

CHAPTER 2 CONTENTS OF THE PROJECT

Chapter 2. Contents of the Project

2.1 Basic Concept of the Project

For the basic design of the Project, the policies described below are adopted as the basic policies.

(1) Design Policies regarding Natural Conditions

1) Temperature and Solar Radiation

The roofs of the existing facilities are made up of roof tiles on top of corrugated metal sheets and have no suspended ceiling below. As a result, the temperature inside the classrooms on the north side becomes high due to radiant heat from the roof which is exposed to strong solar radiation, disrupting pupils' study in these classrooms. In view of this fact, the planned new facilities will have a suspended ceiling made of a heat insulation material to prevent radiant heat from the roof.

2) Rainfall

Measures vis-à-vis downpours (a high rain intensity can last for 2 to 3 hours) and a high humidity level are required. The areas around Zomba and Domasi are high rainfall areas. The annual rainfall in an ordinary year is approximately 1,300 mm which drops to approximately 800 mm in a dry year. Some 90% of the annual rainfall occurs in the rainy season from December to April. The planned measure to deal with heavy rain during the rainy season is the introduction of long eaves while ensuring good natural ventilation.

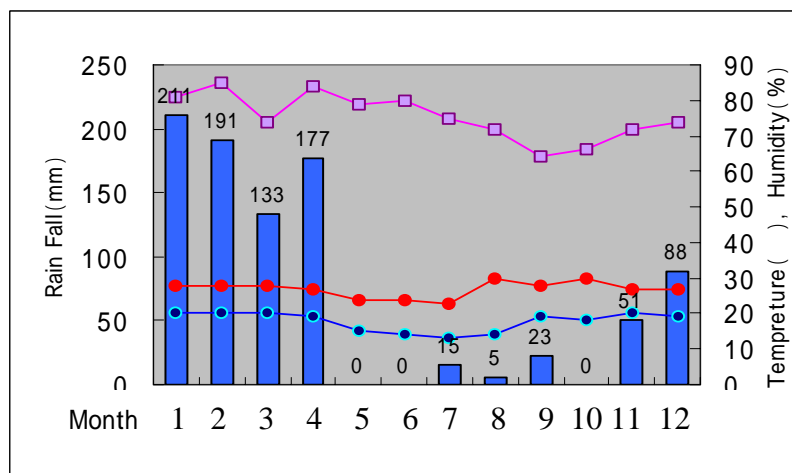


Figure 2-1 Weather Condition in Zomba (2000)

3) Earthquakes

No earthquake causing damage to buildings has been recorded around Zomba or Domasi in the past although no accurate earthquake records are available at Design Department of MoTW. As seismic stress is not considered for the structural design of local buildings, seismic force is not considered under the Project.

(2) Design Policies regarding Social Conditions

1) Consideration of Users

Given the character of the demonstration school, the planned facilities are expected to attract people with various background from the local community. In view of possible visits by disabled persons, a toilet for the disabled will be added to the ordinary toilets together with the elimination of differences in levels to create a barrier free zone. As female pupils dislike being seen entering the toilet facilities, various measures, including the introduction of a screened entrance, will be employed to protect their privacy.

2) Conservation of Surrounding Environment

The surrounding area of the DCE is predominantly a natural setting with trees and a few scattered private houses. The existing facilities on the campus are also surrounded by greenery. Special consideration, including the avoidance of areas with many trees, will be paid to the layout plan for the new facilities for the purpose of preserving nature as much as possible.

(3) Design Policies regarding Construction Conditions

1) Building Restrictions and Related Laws and Regulations

There are no independent design standards in Malawi and BS or SABS (South Africa) are referred to for building and fire services-related regulations. For building design purposes, the standards of the country of origin of building materials are used while structural standards in the country in which an engineer studied are referred to for structural design purposes. Either BS or Japanese standards will, therefore, be used for the Project depending on their appropriateness. The Fire Services Act in Malawi stipulates that the locations of indoor fireplugs (hose reels at 30 m intervals), fire extinguishers (powder/aqueous) and fire alarm bells, etc. should be decided in accordance with checking of the drawings by the City Planning Office. The relevant aspect of the draft plan for the Project will, therefore, be discussed with the City Planning Office for its approval.

2) Environmental Regulations and Environmental Impacts Assessment

While the environmental regulations in Malawi follow the Blue Book of the EU, effluent standards and others are not clearly defined. For the design of the Project, the Japanese standards for BOD, COD, residual solid matters, temperature and pH, etc. will be referred to so that the design for the Project reflects these standards.

3) Use of Locally Procurable Materials

Most construction materials are procurable locally although many are originally imported from South Africa and other countries. Locally produced construction materials are limited to gravel, sand, cement, fresh concrete, some secondary concrete products (blocks and floor slabs) and bricks. Other construction materials are imported from South Africa and other countries for selling in the local market. Building services and electrical materials are mostly made in South Africa. The construction materials to be used for the

Project will be selected from locally procurable materials, which are durable with few complications or difficulties in regard to maintenance.

4) Use of Local Construction Methods and Local Workers

A bricked wall structure is commonly used in Malawi. The interior of such walls is lined with mortar with a paint finish. The roof is commonly made of either roof tiles or iron sheets. Similar construction methods will, therefore, be adopted for the Project. Even though plastering and some finishing work require skilled workers, minimum work involving skilled workers will be planned so that local workers can be used to work with familiar local construction methods.

(4) Design Policies regarding Use of Local Contractor

The business scale of local construction companies in Malawi is quite small as the lack of market stimulation measures has kept these companies less competitive in the market. As a result, they are only capable of constructing small facilities. Major construction work in Malawi involves either foreign aid or investment by a foreign private company. The principal contractor for such work is a construction company of either the donor country or a neighbouring country, such as South Africa or Zambia. Given the fact that the technical capability of local construction companies is still in the process of development, the planning priority is given to the use of local construction methods with which a local construction company acting as the sub-contractor for the Project is familiar.

(5) Design Policies regarding Operation and Maintenance Capability of Implementation Body

1) Easy to Operate and Maintain Equipment and Systems

It is assumed that the current technical staff of the DCE will be responsible for the technical maintenance of the new facilities after the completion of the Project. The systems adopted by the existing facilities are simple and none of them has any complicated control devices. In consideration of the technical level of the existing technical staff, the building service equipment and systems for the new facilities will be the same or similar to the existing equipment and systems in view of easy operation and maintenance.

2) Reduction of Running and Maintenance Costs

The following measures are planned to save resources as well as energy in order to make it easier to secure the required operation and maintenance budget for a long period of time.

When only part of a facility is in use, system operation to serve only the area in use will be possible.

Priority is given to the selection of simple equipment and systems which are popularly used in Malawi and which match the technical level of the maintenance staff of the university to enable adequate inspection by the said staff.

(6) Design Policies regarding Facility Grades

As all of the planned facilities are essential for a qualitative improvement of secondary education, the minimum specifications and scale are adopted to materialise as many facilities as possible. Materials, which can be procured in the local market, will be given selection priority to match the existing facilities and to achieve similar grades to the existing facilities.

(7) Design Policy regarding Construction Schedule

Given the anticipated scale of the facilities, completion of the construction work in some 12 months is judged to be possible provided that locally procurable materials and common construction methods in Malawi are used. The procurement and installation of the equipment will be completed within the same period.

(8) Design Policies regarding Cost Reduction

- 1) A work supervision method which can be adapted to local engineers and workers will be examined by adopting the standard design for secondary schools, which is adopted by the World Bank, and commonly used materials and construction methods. In doing so, it is attempted to make the direct construction cost of the Project nearer the local unit cost.
- 2) As seismic force is not considered for structural design in Malawi, the existing facilities of the DCE employ a wall structure. The amounts of reinforcing bars and concrete to be used under the Project will be reduced as much as possible by employing the same type of structure where possible.
- 3) In principle, wooden furniture will be manufactured in Malawi in order to minimise the number of items to be imported.

(9) Design Policies regarding Equipment Selection

The original request was not accompanied by a clearly specified equipment list and the subsequent study found many discrepancies in terms of the possession and use of educational equipment by educational facilities similar to those requested. In the case of laboratory equipment, selection will be based on the equipment list for the SEP of the World Bank. The principal considerations for equipment selection are (i) a high potential of use in view of the current situation of secondary schools in Malawi and (ii) ease of handling by teachers. The basic principles for equipment selection are listed below.

1) Equipment Selection Criteria

Selection of the minimum range of equipment featuring equipment which is required to implement the curriculum, easy to use by ordinary teachers and frequently used reflected upon the actual teaching condition.

Exclusion of equipment which can be easily procured at low cost within the scope of the Project

Exclusion of equipment of which the maintenance or for which obtaining consumables is difficult from the scope of the Project

2) Equipment Grade

Good durability

Grade which can be maintained by a local agent

Easy maintenance

3) Quantity of Equipment

Sufficient but not excessive quantity required for learning by pupils

Avoidance of duplication between different subjects but sufficient quantity for common use

2.2 Basic Design of the Requested Japanese Assistance

2.2.1 Confirmation of Contents of the Request

The contents of the request and their purposes and confirmed items during the Basic Design Study, are described below.

(1) Demonstration Secondary School

As there is no demonstration secondary school in Malawi at present, the first such school will be necessary to be established at the DCE, which commands the status of a key institution for the training of secondary school teachers in the country, for the purposes of developing training opportunities for students and teaching methods and of contributing to the qualitative improvement of secondary school teachers through research work. The envisaged school will have such facilities as administrative rooms, classrooms, science and biology laboratories, HE and handicrafts workshops, a library and an assembly hall, etc. A range of equipment will be provided for these facilities, including equipment for scientific experiments for the science and biology laboratories, cooking and dress-making equipment for the HE workshop, drawing, woodworking and metalworking equipment for the handicrafts workshop, such office equipment as a copier and OHP and suitable furniture for each room.

Staff housing is one of the requirements for a new school in Malawi and staff housing for 20 teachers and 6 administrative staff members is additionally requested. Given the lower salary level for teachers at the DCE at present than those of other colleges/universities, the lack of staff housing will jeopardise the recruitment of new staff for the new school.

(2) Female Hostels

The PIF, which is the higher plan for the Project, calls for the rectification of gender and social gaps in secondary education to achieve equal opportunities for all. The accommodation capacity of the existing DCE hostels is 390 for male students and 150 for female students. The shortage of female hostels has restricted the enrolment of female students at the DCE. It is, therefore, necessary to increase the capacity of the female hostels to 270, which is half of total 540 students. New female hostels will, therefore, be constructed under the Project to meet the shortage. Items of furniture, including beds, study desks and chairs, will be provided as equipment required for the lives of students and self-study after school hours.

(3) Computer Room

The new national curriculum introduced in 2000 incorporates computer lessons in secondary education. Practical training using computers is necessary for such subjects as humanities and mathematics. Actually there are 5 computers donated by USAID at DCE however, these computers are used for teaching material development or preparation of tests by teachers and students are restricted to use them. A computer workshop that 20 students can make a practice will, therefore, be introduced. The necessary furniture includes computer desks and chairs, the sizes of which should be appropriate for the size of the computer room. As the model and specifications of computer soon be out of dated, 20 computers will be prepared by the DCE

(4) Gymnasium

Physical education at secondary schools commenced in 2000 under the new curriculum. The DCE is the only institution in Malawi which implements the curriculum for the training of secondary school PE teachers. Currently the practice of PE is introduced in curriculum 11 hours per week. The construction of the gymnasium will avoid direct sun, which is strong throughout the year, and will enable PE on the many rainy days during the rainy season. A range of PE equipment, including volleyballs and basketballs, and fitness equipment were requested for this gymnasium.

(5) Water Supply Facilities

In regard to the development of a water supply system on the DCE campus, test drilling has been conducted in the past to provide a stable supply of water but has been unable to find a suitable water source. As a result, low-pressure water supply is currently provided during restricted hours. As the question of a stable water supply has become a serious issue which determines the length of teaching hours and even the continuity of teacher training, further test drilling will be conducted with a view to introducing a water supply system of an adequate size to ensure the smooth management of the new school.

(6) Additional Request of Equipment

In addition to the above contents of the original request, an additional request was made during the field survey period as shown below. The survey on the existing equipment found that this additional request involved basic equipment and that it had mainly been made to preserve the quantity of existing equipment. Most of the items can be procured locally at a low price and their absence will not disrupt the practical teaching in place. Nevertheless, it was decided to examine their necessity as part of the analysis of the requested items in Japan. Meanwhile, the introduction of a HE workshop, handicrafts workshop, AV centre, special classroom for the visually impaired, recreation room and sports ground to the demonstration secondary school was additionally requested following the revision of the curriculum in 2000. It was, therefore, decided to examine their necessity as part of the analysis of the requested items in Japan although their relevance did not appear to be high in view of the current curriculum requirements and ability of the teaching staff, etc.

Table 2-1 Additional request during the field survey

Requested item	Contents	Reason of request
• Domasi College of Education		
Computer	Ten (10) for teacher	for administration
Existing Lab .(Chemical)	Glass utensil, Burner, etc.	The number is not enough Out of order
Existing Lab .(Physics)	Video Camera, Computer, Balance, etc.	The number is not enough for practice
Existing Lab .(Biology)	Glass utensil, etc.	Same above
Existing Lab .(Home Economics)	Electrical sawing machine, Iron, Spoon, etc	Same above
• Demonstration Secondary School		
Home Economics Lab.	Construction of Laboratories	Need for new curriculum of year 2000
Craft Work Shop	Same above	Need for practice
Computer and Computer Lab.	Construction of Computer Lab. 20 computers for students	Same above
Audio Visual Centre	Construction of AV centre	Same above
Special Classroom for the visually impaired	Same above	Same above
Recreation Room	Same above	Same above
Sports Ground	Preparation of sports ground	Same above

2.2.2 Examination of Contents of the Request

2.2.2.1 Scope of Assistance for Facilities

(1) Relevance of Demonstration Secondary School

1) Status of Demonstration Secondary School

The following purposes of establishing the demonstration secondary school were confirmed through consultations with the DCE during the Basic Design Study period.

By establishing a demonstration secondary school on the campus of the DCE, students of the DCE will be able to familiarise themselves with the proceedings of classroom lessons, classroom management and communication by means of actual daily practice. In addition, the mutual complementation of the lessons at the DCE and educational practice at the school will enhance the feedback effect for students.

The presence of a demonstration secondary school on the campus will allow the DCE to gather vital information to develop a teaching method, an educational method specific to each subject and a curriculum. At present, the MIE situated next to the DCE develops the curriculum and teaching instructions with the help of the DCE. The development of an educational method specific to each subject and curriculum which are more closely linked to the reality of the educational front line will be possible as the MIE will be able to routinely gather detailed information from the school.

As activities to achieve the above purposes can be routinely conducted, it will be easier for the teachers and students of the DCE to share accumulated information and experience originally obtained from the demonstration secondary school. Moreover, as some of the teaching practice for DCE students can take place at this new school, reduction of the travelling and accommodation expenses for students will be possible in addition to diversion of the savings to other educational purposes. While there are three CDSS in the catchment area of the DCE and one conventional secondary school near Zomba (16 km from Domasi), upgrading of one of these schools to a demonstration school would make it necessary for the DCE to provide a means of transportation for students because of the poor state of telecommunications and transport to any one of these schools. Given the severe financial state of the DCE, however, the use of any of these schools as a demonstration school is not feasible.

The proximity of the DCE and the demonstration school when the latter is established is expected to maximise the educational effects on the students of the DCE through daily activities and, therefore, the establishment of a new demonstration secondary school on the campus of the DCE is judged to be highly relevant.

2) Scale of Demonstration Secondary School

The requirements for the inauguration of a new secondary school in Malawi set forth by the MoEST Science and Culture (MoEST) specify three types of schools, i.e. two classes per grade (320 students in total), three classes per grade (460 students in total) and four classes per grade (double shifts). The minimum requirements are set for

laboratories, teachers' rooms and other facilities. As the minimum requirement for teachers is the same for schools with one class per grade and schools with two classes per grade, all secondary schools have at least two classes per grade because of the inefficiency of schools with one class per grade. The basic number of students per class is set at 40.

Based on the analysis results of the contents of the request, it has been decided that the new school will have two classes per grade (40 students/class x 2 classes/grade x 4 grades = 320 students) with a minimum number of staff members. This decision took the eligible number of children in the catchment area into consideration to ensure the viability of the new school. At present, the new school is due to open in 2005 and the DCE should introduce the necessary measures to allow the transfer of second (F2) through fourth (F4) grade students in addition to the enrolment of first grade (F1) students at the time of the school's opening to avoid empty classrooms.

3) School Catchment Area and Estimated Number of School-Age Children

The MoEST sets forth an area with a 10 km radius as the catchment area for a secondary school and, therefore, it can be assumed that children in the Songani zone and Nsondale zone will be admitted to the new demonstration secondary school. As of 2002, nine primary schools in the Songani zone (one of which is an incomplete school with only students up to the sixth grade) and two primary schools in the Nsondale zone have 507 eighth grade primary school students (see Table 2-2). Assuming that the ratio of primary school students progressing to secondary education is 53.8%*, the catchment area of the new demonstration secondary school will have 272 children who could enrol in the first grade (F1) at the beginning of the 2003 school year. Given the average ratios of F2, F3 and F4 secondary school students to F1 students of 97.8%, 63.3% and 54.1%* respectively, there will be 148 children in the catchment area who could enrol in F4 at the new school.

* These figures are calculated from the Education Basic Statistics Malawi, 1998, 1999 and 2000.

Table 2-2 Primary schools within catchments area

Primary School	Distance (Km)	Zone	Year	2002 Number of Enrollement			2002 STD8			2003F1 Estimated Number of Students
				M	F	Total	M	F	Total	
Malemia	1.2	Songani	8	347	428	775	23	24	47	25.3
Domasi Govt.	0.5	Songani	8	607	659	1,266	41	43	84	45.2
Domasi Domo	0.0	Songani	8	287	354	641	25	35	60	32.3
Mchengawedi	4.0	Songani	8	523	586	1,109	12	13	25	13.5
Mapalo	3.0	Songani	8	260	283	543	9	21	30	16.1
Songani	5.0	Songani	8	744	878	1,622	57	69	126	67.8
Mwanje	6.0	Songani	5	166	211	377	0	0	0	0.0
Domasi CCAP	10.0	Songani	8	344	305	649	25	20	45	24.2
Lifani	4.5	Songani	8	280	321	601	32	38	70	37.7
Matandani	2.5	Nsondole	8	175	232	407	11	9	20	10.8
Kanjedza	3.0	Nsondole	6(?)	138	108	246	0	0	0	0.0
				3,871	4,365	8,236	235	272	507	272

Source: Songani, Statistic of Songani Zone 2002 September, Nsondole Planning Section, South Eastern Division

When applying the annual population growth rate of 1.9% in the last 10 years (1998 national census data), the eligible number of children for the new school in the catchment area in 2005 is estimated to be 283 for F1*, 277 for F2, 179 for F3 and 153 for F4. Of these, 80 from each group will enrol at the new school. As the catchment area currently has three CDSS and four private schools but no ordinary day secondary school, there should be a sufficient number of children of appropriate age in the catchment area.

Note: The relevant age is 15 – 18 for F1 to F4. (In Japan, the student age for each grade is based on the age when leaving school. In Malawi, it is based on the age of enrolment at the school. Therefore, the age range is 14 – 17).

Table2-3 Number of students subject to enrolment

	STD 8			F1(53.8% of STD 8)			F2 (97.8% of F1)			F3 (63.3% of F1)			F4 (54.1% of F1)		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
2002	235	272	507												
2003				126.4	146.3	272.8	123.6	143.1	266.8	80.0	92.6	172.7	68.4	79.2	147.6
2004				128.8	149.1	277.9	126.0	145.8	271.8	81.6	94.4	175.9	69.7	80.7	150.4
2005				131.3	151.9	283.2	128.4	148.6	277.0	83.1	96.2	179.3	71.0	82.2	153.2

Source: Zomba Education Office

As of February, 2003, the school fee is MK 1,500/year for state schools, including CDSS. In comparison, the school fee for private schools varies from MK 1,500 to MK 15,000/year. While it is believed that the new school will not face any difficulties attracting students, special attention should be paid to its possibly adverse impacts on the local community in general and private schools in particular.

Table2-4 Number of secondary school and students within area of demonstration secondary school

	Secondary School	Zone	Male	Female	Total
CDSS	NSONDOLE	Nsondole	174	82	256
	KATAMBA	Nsondole	239	108	347
	SONGANI	Songani	227	107	334
	Sub-total		640	297	937
Private School	Yankho	Songani	N.A.	N.A.	60
	Domasi Private	Songani	N.A.	N.A.	320
	Mapalo Private	Songani	N.A.	N.A.	200
	Mlauli	Songani	N.A.	N.A.	350
	Sub-total		N.A.	N.A.	930
Total					1,867

Source: CDSS, South Eastern Education Division Summary Statistic Oct., 2000

Private school, Songani Primary School Teachers (Hearing from PEA of Songani Zone) 2003 February

4) Required Number of Teachers

According to the minimum staff requirements for secondary schools set forth by the MoEST following the streamlining of secondary education institutions and the introduction of the new curriculum, the minimum number of teachers is 16 for schools with two classes per grade and 24 for schools with three classes per grade. The new curriculum introduced in 2000 demands the gradual introduction of practical teaching facilities for science, humanities and language subjects taught at secondary schools. With such facilities in mind, the minimum requirement for teachers is 18, consisting of one principal, one vice-principal, four department heads and 12 ordinary teachers. As it is desirable for schools to have some teachers which specialise in certain subjects to ensure

the smooth progress of teaching, the planned number of teachers of 20 for the new schools, including two specialist teachers, is judged to be appropriate.

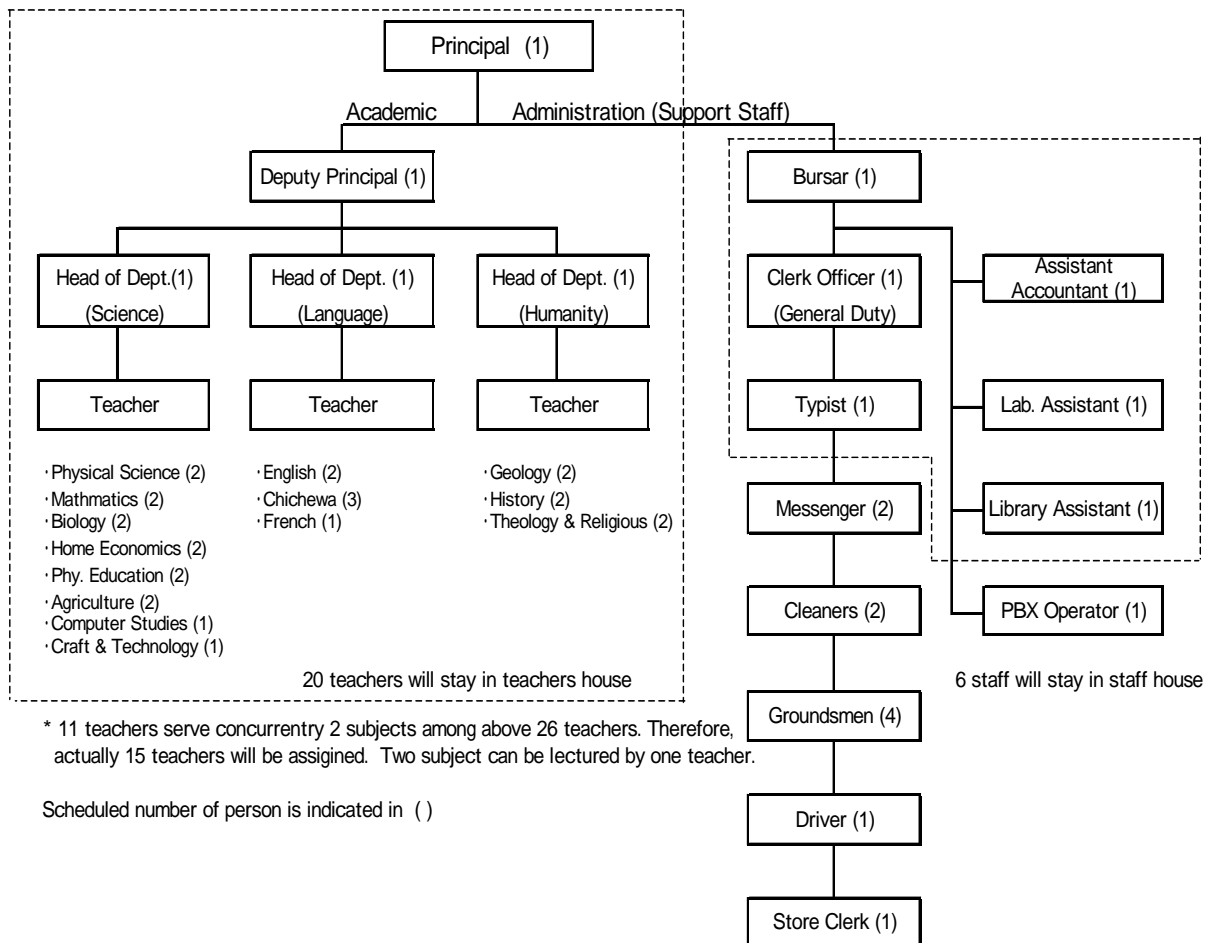


Figure 2-2 Organization of demonstration secondary school

5) Components of Demonstration Secondary School

A demonstration secondary school is required to well perform its intended functions in accordance with the relevant national policies, including the standards/requirements set forth by the MoEST for all secondary schools. To be more precise, teaching must be in line with the new curriculum introduced in 2000. Following analysis of the contents of the request, it has been decided to include workshops for HE and handicrafts, both optional subjects, because of the strong need for these facilities at a secondary school.

In regard to the necessary rooms, the following rooms are included in the Project as essential components in view of their compatibility with the government policy, their necessity based on the curriculum and their versatile usability at the school.

- Administration Block
- Classrooms (40 students x 8)
- Toilets
- Laboratories (Science; Biology)

- Workshops (Home Economy; Handicrafts)
- Library
- Multi-purpose Hall
- Storage

It has been decided to omit some of the requested rooms from the Project as their relevance is judged to be low due to the reasons summarized below. These rooms are a Social study laboratory, Computer room, AV centre, Special classroom for the visually impaired, Sports ground and Recreation room.

Social Studies Workshop

Social studies is a compulsory subject which is taught at all secondary schools. At present, this subject is taught in ordinary classrooms. Despite expectations for proper preparation and the use of teaching materials which reflect the real social conditions surrounding the students, such teaching materials are not sufficiently available for social studies which are considered to be a subject to materialise the linkage of students with society as upheld by the PIF. In this context, a social study workshop appears useful for teaching on life skills which is also a compulsory subject. If there is a room where the products of joint work in social studies lessons can be displayed as parts of teaching materials, such a room can be regarded as a resource centre for students to share information and experiences. However, the function of such a resource centre of the joint production of teaching materials for social studies, such as illustrated environmental information or information on the local community, etc., can be conducted in the handicrafts workshop or multi-purpose hall. Accordingly, it has been decided that no special social studies workshop will be introduced as a component of the Project.

Computer Room

The PIF calls for the introduction of computer education in secondary education to train human resources that will constitute the driving force of the future of Malawi. However, computers rapidly become outdated, making their renewal every few years necessary. In addition, the employment of a computer engineer for maintenance purposes is necessary. As there is no plan to employ such an engineer for the demonstration secondary school, computer maintenance is not guaranteed. Moreover, there is no plan under the Project to provide computers for the computer training room of the DCE. Neither is the provision of computers for the demonstration secondary school planned under the Project. As the DCE has no plan to procure computers for this secondary school at its own expense, a computer room is not included in the Project because of its irrelevance as a project component.

AV Centre

At present, such AV teaching materials as educational video programmes are prepared by the AV Centre of the Malawi Institute of Education and there is no plan for the demonstration secondary school to prepare their own AV teaching materials. Even the higher plan does not specify AV education at secondary schools and the activities of an AV centre have little relevance to the curriculum. Accordingly, the inclusion of an AV centre as a component of the Project has no relevance to education at the demonstration secondary school.

Special Classroom for Visually Impaired

Approximately 0.1% of primary school students have some kind of visual impairment (Education Basic Statistics Malawi 2000). Corresponding data for secondary school students is currently unavailable. Standard secondary school facilities do not include special facilities for the visually impaired and there is no relevant standard. At present, there are no special teachers for such children and it is necessary for the Government of Malawi to train such teachers first. The requested facility has, therefore, little relevance to the Project and has been omitted from the scope of the Project.

Sports Ground

There is a sports ground on the planned site for the demonstration secondary school which is currently used by the demonstration primary school albeit infrequently. As the DCE has its own sports ground, the sports ground used by the primary school can be shared by the secondary school. It is, therefore, judged that the inclusion of a sports ground in the Project is unnecessary.

Recreation Room

A recreation room has little relevance to the higher plan. As the planned demonstration secondary school is not a boarding school, there is little necessity for a room for the recreational activities of students. Moreover, this type of room is not included in the standard components for secondary schools set forth by the MoEST. As group/joint activities based on the curriculum can be conducted in the multi-purpose hall, it is judged that the introduction of a recreation room has no relevance to the Project.

The required components for the demonstration secondary school are listed below.

Table 2-5 Necessary rooms for the demonstration secondary school

Requested room	Consistency with a national policy	Necessity from a curriculum	Multi-usability	Judge & Comment
<The component which should be included in this Project>				
Administration Block	○	-	-	○ Necessary for school operation
Classrooms (2 rooms x 4 grades = 8 Classrooms)	○	-	-	○ Necessary for teaching
WC	○	-	-	○ Necessary for school operation
Laboratory	Science	○	○	○ Necessary for Curriculum practice
	Biology	○	○	○ Same above
	Home Economics	○	○	○ Same above
Craft Workshop	×	○	○	○ Same above
Library	○	-	-	○ Necessary for self study of students
Assembly hall	○	-	○	○ Convert as a multi purpose hall
Storage	○	-	-	○ Necessary for school operation
Teacher's Houses	○	-	-	○ Necessary for secure and install teachers

Requested room	Consistency with a national policy	Necessity from a curriculum	Multi-usability	Judge & Comment	
<The component which should be excluded from this Project>					
Social Study Laboratory	×	○	×	×	Craft workshop and multi purpose hall can be used.
Computer Room	×	○	×	×	Depend on the availability of computers
Audio-Visual Center	×	×	×	×	Not included as a component of secondary school of MoEST
Special Classroom for the visually impaired	○	×	×	×	Not included as a component of secondary school of MoEST
Sports Ground	○	-	-	×	Existing ground at DCE can be used
Recreation Room	×	-	-	×	Not related to curriculum

The examination results of each component are described next.

6) Laboratories and Workshops

Science and Biology Laboratories

The curriculum for secondary education combines physics and chemistry as natural science subjects under the single subject of “science”. Science and biology are both compulsory subjects and most secondary schools have corresponding laboratories. In terms of the syllabus for secondary education, laboratory exercises or experiments are regarded as part of learning through experience to improve the quality of secondary education. It is judged that these two laboratories are essential for the demonstration school in view of the actual contents of the curriculum.

At many secondary schools in Malawi, laboratories are used for not only experiments but also for lectures although the intensity of their use for lectures varies from one school to another. The use of the requested laboratories for lectures is, therefore, considered in the project design. It has been substantiated that the frequency of laboratory use for actual experiments depends on the ability of individual teachers. The provision of an assistant to improve the efficiency of teaching in the laboratories is desirable.

The integrated science is core subject in the new curriculum and other subjects related to the science and biology are majored in by most of the students.

Laboratory tables will be arranged in each of the science and biology laboratories to serve a class size of 40 students. Based on a rate of one table per five students, eight tables for students and one table for the teacher, totalling nine tables, are planned for each laboratory. Each laboratory table will be equipped with water supply and drainage systems, a gas tap for a burner and a electrical power point. In addition, a range of equipment for use for experiments specified in the curriculum is planned.

The science laboratory will be located next to the biology laboratory so that these two laboratories can share an equipment storage room and a preparation room.

HE Workshop

In 2002, seven out of 18 conventional secondary schools in the South Eastern Division offered HE as an optional subject and approximately two-thirds of the students in F1 through F3 took this optional subject regardless of gender. The

standard requirements for secondary schools set forth by the MoEST include a HE workshop. In consideration of these facts, it is judged that the introduction of a HE workshop is relevant to the Project.

HE is an optional subject and it is assumed that two-thirds of the class size, which is the Handicrafts Workshop average ratio of students opting to take an optional subject, is used as the planning basis (up to 30 students) for this workshop. In the curriculum, HE is further divided into cooking and dress-making courses and the plan should allow the simultaneous use of this single workshop for cooking and dress-making. Each work table will serve five students. A total of seven tables, consisting of six tables for students and one table for the teacher, is planned. Each table will be equipped with water supply and drainage systems and a electrical power point for cooking purposes. In addition, cookers, etc. for cooking practice and sewing machines, etc. for dress-making practice are planned under the equipment component of the Project. Baths, etc. for baby care practice will not be introduced because of their little use. In addition, a range of equipment for use for experiments specified in the curriculum is planned.

The HE laboratory will be located next to the workshop so that these two laboratories can share an equipment storage room and a preparation room.

Handicrafts Workshop

The current curriculum includes technical drawing, metalwork, art and woodwork as optional subjects for junior secondary education and crafts design and technology as an optional subject for senior secondary education. However, few secondary schools offer crafts design and technical drawing, etc. as optional subjects. Even though teaching on handicrafts requires suitable equipment, this subject is a popular optional subject at schools possessing such equipment. It is not unusual for an entire class to select this subject. The decision on which subject is taught in Malawi currently depends on the availability of suitable facilities and teachers and it is essential for the demonstration secondary school to have suitable facilities and teachers. As a subject for junior secondary education, handicrafts existed prior to the introduction of the new curriculum in 2000 while craft design and technology in senior secondary education combines the three components of handicrafts in junior secondary education. As such, this subject is not new and there are teachers capable of teaching the various components of this subject. It is, therefore, judged that the inclusion of a handicrafts workshop in the Project is appropriate.

Work tables and chairs to serve a class of 40 students are planned for the handicrafts workshop. Each table will seat five students and nine tables, consisting of eight tables for students and one table for the teacher, are planned. Each table will be equipped with a power point. The basic range of training equipment is planned, including drawing equipment, pottery equipment, woodwork equipment and metalwork equipment.

7) Library

One of the problems of secondary education in Malawi is the serious shortage of textbooks with a student to textbook ratio of more than 10 to 1 for many subjects. While the PIF, which is the higher plan, calls for the distribution of an adequate quantity of textbooks and supplementary teaching materials to each secondary school, the reality is that not all students are provided with a textbook in the classroom. As it is necessary for

students to read textbooks in the library after lessons, a library is an important facility. The standard requirements for secondary schools set forth by the MoEST include a library, which is also necessary for students to read supplementary teaching materials. The field survey found that most day secondary schools have a library. Students use the library on a daily basis during intervals or after school hours. Although the number of books in the library varies from one school to another, it is the policy of the MoEST to provide textbooks and supplementary teaching materials for the demonstration secondary school as a matter of priority based on the PIF. Accordingly, a library is judged to be a relevant component of the Project.

Having adopted the relevant standard set by the MoEST, the size of the library is planned based on its assumed use by 50 persons, consisting of a class of 40 students and 10 school staff members. The open stacking system will be employed so that students can freely search the books. This system will secure a wide space in general. The MoEST standard for the size of a stack room is approximately 40 m². Sufficient reading space, including space for open shelves, will be provided. Reading tables and individual booths for personal learning will be introduced. The adoption of the standard space for shelves set forth by the MoEST will make it possible to store the number of books required of an ordinary secondary school. Textbooks, reference books and other books for the library will be provided by the Malawi side.

8) Multi-Purpose Hall

The DCE currently has a multi-purpose hall which is used for various purposes, including student meetings, college events and gymnastics practice using mats, etc. The hall has an auxiliary kitchen for students and functions as a canteen. The hall also has a small space which functions as a cafeteria and an outdoor space for eating and drinking. As the DCE is a boarding college, all of the students have their meals in this multi-purpose hall every day.

As the demonstration secondary school will be established on the campus of the DCE, use of the DCE's multi-purpose hall for the school's own purposes may be imagined. In reality, however, such use would be quite difficult given the intensive use of the DCE's multi-purpose hall as described above. Moreover, the field survey found that the primary school on the DCE campus has never shared the DCE's facilities from the time when it was a demonstration primary school for the teacher training college for primary school teachers, i.e. the predecessor of the DCE. It has been pointed out that the planned demonstration secondary school cannot expect to share the DCE's facilities because of various reasons except in special cases. Furthermore, the secondary school and the DCE are separate bodies from the viewpoint of the educational/school communities linked to them. People related to the secondary school are parents and people of the local community. It is reported that, unlike a college or university, the scale of commitment by these people affects not only school management but also the academic performance of the students. The availability of a space to hold the school's own events and meetings, etc. should, therefore, prove to be instrumental in developing a stronger commitment by parents and local people to the demonstration secondary school.

Activities at Multi-Purpose Hall

Ordinary secondary schools in Malawi have a multi-purpose hall as a facility component at which the activities listed in Table 2-6 take place.

While the frequency of various meetings varies from one school to another, the frequency of meetings involving staff members of local schools to be held at this

demonstration secondary school is expected to be higher than other secondary schools because of its status as a model school.

Table 2-6 Activities at multi-purpose hall of secondary school

	Type of Activity	Participants	Frequency
1	Morning assembly	All teachers and students	Every week (twice/week in some cases)
2	Entrance ceremonies and graduation ceremonies	All teachers and students	Once/year
3	Student meetings	Single class or all students of one grade (50 – 100)	20 – 30 times/year
4	Parent meetings, etc.	People related to the school (40 – 50)	3 – 5 times/year
5	Community meetings	People of the local community (30 – 40)	2 – 3 times/year
6	Teacher training events	Teachers of local secondary schools (40 – 50)	5 – 6 times/year
7	Study meetings for local schools	Community representatives and teachers (40 – 50)	3 – 5 times/year

Source: Survey data

Position of Proposed School in Cluster System

Active use of the cluster system is a government policy in Malawi to improve the quality of education. Under this system, 8 – 10 schools form a cluster and these schools jointly conduct staff training (on not only the teaching of individual subjects but also on leadership and management skills, etc.) and share textbooks, information and experience, centering on a core school. The core school is selected based on such criteria as the size (larger than the others), location (good physical access from satellite schools) and high level of the principal's leadership or commitment. At present, conventional secondary schools act as core school. As the catchment area of the demonstration secondary school has only CDSS and private schools (there is no conventional school), this new school could become the core school in the area, suggesting that meetings, including those which involve the local community, may well frequently be held at the school.

Given the fact that the active involvement of local people in school management and the training of teachers as well as representatives of the local community greatly contribute to a qualitative improvement of education, the introduction of a multi-purpose hall to facilitate the necessary activities to improve education is a government policy. The multi-purpose hall of the demonstration secondary school will, therefore, have a larger floor space than ordinary classrooms for the display of textbooks, books and reference materials, etc. so that it can function as a resource centre for satellite schools in the cluster system and the local community.

Based on the above argument, the introduction of a multi-purpose hall at the demonstration school is judged to be both necessary and relevant.

The scale of Multi-Purpose Hall

Morning assembly will be held in the courtyard or another suitable place. As such other events as the entrance ceremony, graduation ceremony and national tests only take place once a year, these will be held in the existing DCE hall. Therefore the size of the multi-purpose hall under the Project is planned to be large enough to accommodate the activities of students of one grade instead of 340 (320 students and 20 teachers) which has been requested.

- Grade Meetings

The new curriculum for secondary schools introduced in 2000 adopts an approach of enhancing academic ability as well as daily life skills through enquiring study, experiments and observation. The availability of a place to hold presentation

meetings for each grade or joint work by students of the same grade relating to social studies, science studies or life skills can contribute to the exchange of opinions between students and also to active class management. As the demonstration secondary school will have two classes (80 students) per grade, the multi-purpose hall will have a sufficient floor area to accommodate some 100 seats, consisting of 80 seats for students of one grade and seats for school staff and external personnel.

The floor space of the multi-purpose hall of the demonstration secondary school should be large enough to seat some 100 people (80 students of one grade, school staff and others) in view of its use by each grade. This translates to space equivalent to two classrooms. It is also planned to provide a range of equipment, such as tables, chairs, speaker system, OHP and screen, to assist meetings held in the hall.

- **PTA/School Community Meetings**

For non-boarding secondary education, the active involvement of the PTA/school community (parents and people belonging to the local community) in school management can enhance the morale of school staff and also create an environment in which the positive learning of students is encouraged. Efforts have commenced to formulate a school management plan on the individual school basis and to implement, monitor and evaluate such a plan. PTA/school community meetings require a floor area which is large enough to allow 40 – 50 participants (consisting of two representative parents for each class, i.e. 24 in total, such community representatives as traditional community leaders and representatives of the private sector and neighbouring primary schools, etc., staff members of the demonstration secondary school and some staff members of the DCE, etc.) to sit in a circle.

- **Training Under Cluster System**

The Government of Malawi is attempting to improve the quality of education by conducting training on teaching and school management (leadership and management, etc.) utilising the cluster system. One cluster contains 8 – 10 secondary schools and core subjects are taught by 2 – 4 teachers depending on the school size. Training under the cluster system can, therefore, expect some 30 participants. Moreover, the participation of DCE staff and students in such training as trainers or participants will be effective for curriculum development. The multi-purpose hall should, therefore, have sufficient floor space to seat some 40- 50 people facing each other and also to allow the freedom of movement of these people.

(2) Staff Housing

Twenty houses for teachers and six houses for administrative staff were originally requested for the reason that staff housing is essential to recruit excellent teachers. According to the minimum requirement of the MoEST the staff accommodation has to be attached to the new establishment of schools. For the staff house usually consists of three bedrooms, a living room, a bedroom with a bathtub (equipped with a water heater to provide hot water) and toilet.

The necessity for and relevance of introducing staff housing as part of the new secondary school are explained next.

1) Government Policy

The PFI which provides the framework for the education sector in Malawi calls for “the introduction of and compliance to officially determined minimum standards to

upgrade human as well as physical resources and also to secure the quality of education at both public and private schools” for secondary education. When the establishment of a new secondary school is planned, an application for registration approval is made to the MoEST via the divisional education office which checks the contents of such application in view of the actual conditions of education in the area in accordance with the Minimum Requirement for Opening Secondary School set forth by the MoEST. These standards include the introduction of staff housing as listed below.

Table 2-7 Minimum required number of staff house based on the Minimum Requirement by MoEST

	Number of student (Number of class room)	Number of teacher	Minimum number of staff house
1	960 students (40 students/class × 4grades × 6classes : 3classes, 2sift)	29	26
2	480 students (40 students/class × 4grades × 3classes)	24	16
3	320 students (40 students/class × 4grades × 2 classes)	16 (18)*	14

Source: Document by MoEST

*in case reflected the new curriculum

2) Incentives for Teacher Recruitment

- Physical Situation (Secondary School in Local Area)

Full-time teachers and other school staff not residing in staff housing on the DCE campus live in such neighbouring towns as Zomba and Mataware. Domasi is located some 16 km from Zomba and Mataware and the DCE operates a bus service for its staff because of the insufficient public bus transport outside Domasi. Many teachers often arrange their teaching schedule for their own convenience. According to the students, it is not unusual for part-time teachers commuting to the DCE to cancel or to arrive late for their lessons. The campus is surrounded by rural scenery and there are hardly any houses which are suitable for renting.

- Financial Situation (Low Level of Remuneration)

While the salaries of secondary school staff nearly doubled in 2000 as a result of the introduction of a housing allowance, the salary scale for the grade to which many teachers belong is still low. As there is hardly any prospect for promotion or a pay rise, secondary schools are not particularly attractive places of employment. Accordingly, there has been a steady flow of teachers seeking employment in the private sector. The initial salary in the banking sector for a university (college) graduate (equivalent to POC) is MK 37,000 which is almost three times higher than the salary for most secondary school teachers. In this context, the availability of staff housing is a strong incentive for the recruitment and long service of capable teachers.

3) Difficulty of Ensuring Long Service of Teachers in Rural Areas

While there is a teacher surplus in urban areas, there is a teacher shortage in rural areas. The assignment of a female teacher to a rural area after marriage is practically impossible unless her spouse teaches at the same school.

In 1989, the Government of Malawi introduced a policy of assigning teachers to their hometowns. The result was a high teacher to student ratio in the central and southern areas because of the smaller number of teachers originating from these areas. Below is the teacher to student ratio at non-boarding conventional schools (type of school which resembles the characteristics of the proposed demonstration secondary school) in the South Eastern Division in which Domasi is located. It can be seen that the

ratio at schools in Zomba Rural is higher than the ratio at schools in Zomba Urban, indicating the difficulty of achieving an appropriate level of teacher assignment. Meanwhile, there appears to be a concentration of students at non-boarding conventional secondary schools in urban areas.

Table2-8 Non boarding conventional secondary school in the south eastern division

	2000			2002			2000 2002		
	Number of Student	Number of Teacher	Percentage	Number of Student	Number of Teacher	Percentage	Fluctuation (person)		
	ENROLMENT	TEACHER	STR	ENROLMENT	TEACHER	STR	Stu	Tea	
CHIMWALIRA	218	7	31.1	225	8	28.1	7	1	Zomba R
CHINGALE	259	9	28.8	170	9	18.9	-89	0	Zomba U
LIKANGALA	479	24	20.0	609	27	22.6	130	3	Zomba U
LIWONDE	326	10	32.6	271	12	22.6	-55	2	Machinga
MAJUNI	378	9	42.0	308	7	44.0	-70	-2	Machinga
MALOMBE	334	5	66.8	228	4	57.0	-106	-1	Machinga
MPIRI	325	8	40.6	301	7	43.0	-24	-1	Mangochi
PUTEYA	342	9	38.0	336	12	28.0	-6	3	Mangochi
Total(Mean)	2,661	81	37.5	2,448	86	33.0	-213	5	

Source: Data from Southern Eastern Division

4) Positive Contribution of Good Community Relationship to School Operation

Under the present system, secondary school teachers are recruited at the central level and are then assigned nationwide. Therefore, many teachers do not have a prior relationship with the school to which they are assigned and also with the local community. Staff housing is a necessary facility for teachers to build a close relationship with the local community.

5) Fiscal Conditions

The fiscal situation in Malawi is quite severe due to declining domestic revenue, decrease of financial aid by donors and high inflation. Even though the education sector is a priority sector, the actual disbursement is 20% lower than the approved budget. Despite the serious teacher shortage for both primary and secondary education and the general shortage of personnel observed at the MoEST and in Domasi (staffing level at 40% of full capacity), the development budget is insufficient. Accordingly, it will be extremely difficult to secure the necessary teachers if staff housing is not included in the Project for its arrangement by the Government of Malawi. The inadequate recruitment of teachers will certainly disrupt the operation of the new school. Moreover, if school staff members rent houses outside the campus, relying on the housing allowance introduced in 2000, the budget of the MoEST will be further squeezed.

The minimum requirement for staff accommodation set by the MoEST for the establishment of a secondary school is 14 houses for teachers for a school of 320 students. The planned 14 houses include a house for the principal. Many administrative staff members live in such neighbouring towns as Zomba and Matawara and there is a university bus service to these towns. Accordingly, no houses for administrative staff members are included in the Project. Neither is any furniture for the teachers' houses included in the Project. The planned floor area is 90 m² for the principal's house and 72 m² for houses for other staff members. These figures are judged to be appropriate from the viewpoints of comfort and cost.

(3) Female Hostels

1) Relevance of Female Hostels

In the PIF which provides the framework for the education sector, the Government of Malawi upholds equal educational opportunity for both sexes as a priority issue and calls for the improvement of female hostels to achieve such opportunity. At present, the DCE has 390 spaces in male hostels and 150 spaces in female hostels. The male to female ratio is 13 to 5. The limited availability of female hostels has restricted the enrolment of females at the DCE, resulting in 125 female students in the 2002 school year compared to 367 male students. The reasons for the 25 vacancies at the female hostels are listed below.

- Temporary absence or dropping out due to ill health
- Temporary absence or dropping out due to pregnancy and childcare
- Transfer to another educational institution
- Dropping out due to poor academic performance (less than 50% of full marks for each year)

The DCE plans to strike a balance between male and female students by admitting a number of female students corresponding to the number of vacancies at female hostels, including vacancies for female students arising due to the reasons listed above.

For admission to the DCE, an applicant firstly undergoes examination of the application form to verify the eligibility of the applicant. If the applicant is found to be eligible, he/she is qualified to take an aptitude test (equivalent to an entrance examination).

There are about 260 numbers (average) of females who passed the aptitude test from 1998 to 2002 as shown in table 2-9. But the females who are rejected, are about 200 by the reason of shortage of hostels for females. This means that there is a sufficient demand for hostels without special measures, such as lowering of the pass level, and the construction of additional female hostels is judged to be relevant to the Project.

Table 2-9 Number of female applicants for aptitude test and number of those passing the test (person)

Year	No. of Applicants	No. of Eligible Persons	No. of Those Taking the Test	No. of Those Passing the Test	No. of Those Allowed to Enrol	No. of Those Rejected
2002	310	304	304	303	47	257
2001	343	340	340	340	105	235
2000	241	237	237	236	44	193
1999	221	214	214	213	32	182
1998	209	203	203	203	59	144

Source: Statistics of DCE

2) Current Situation of Use of Female Hostels

Each double bedroom in the female hostels currently has study desks and built-in lockers in addition to two beds. Self-learning after school hours, including in the evening, is conducted in these bedrooms. Some boarders complain about a lack of privacy due to

the small room size. Showers and toilets are provided at the end of each building and some students take a shower during the lunch break. Shower rooms are equipped with a water heater as the Domasi area can be cold in the morning and evening during the rainy season. In addition, there is a laundry and an outside drying space which are frequently used. The maintenance, including cleaning of the hostels are well managed by matron for both of male and female hostel, which appears to be good.

3) Scale of Female Hostel

At present, the total accommodation capacity of hostels is 390 students for male, 150 for female and 540 students in total. To accommodate 270 female students which is half of current number of total students, it requires extra accommodation for 120 female students (270 – 150). Based on this calculation, additional hostel space for 120 female students is included in the Project as the minimum requirement although the original request by the Malawi side was for 144 female students.

Actually 70% of university students are female teachers in active service but the present rooms are still small. In view of protecting their privacy, double occupancy rooms with a span of 3.6 m (existing rooms is 3.0m) are planned under the Project to improve the present room space of the female hostel.

(4) Computer Room

1) Relevance of Computer Room

The PIF calls for the introduction of computer education in secondary education to foster people who are computer literate to be the driving forcing of Malawi's future although no secondary school has introduced a computer workshop as yet. However, the call by the PIF for the introduction of computer education in secondary education is based on the necessity for the gradual development of such education in view of the future needs of society. Today, computers are used on a daily basis by company offices as well as public offices. At most schools, computers are commonly used for administration purposes. Under these circumstances, there is an increasing need for computer education as part of secondary education, making the training of teachers for computer education essential. The introduction of a computer room at the DCE is, therefore, judged to be relevant to the Project.

2) Present Situation of Computer Use

Computers provided by the USAID in 2001 are used for the preparation of teaching materials and test papers by teachers and for administrative purposes, including the preparation of documents. The operating system for Windows 98 and MS Office is installed. All 39 teachers are capable of using basic software. At present, the computer room (PC laboratory) has five DOS-V computers although two of these have some problems. There are two printers, i.e. one laser printer and one HP printer. MaC machines are not used and have been removed. The air-conditioning unit (wind-through type) of this room is out of order.

3) Training Plan in Computer Room

The planned use of the computer room of the DCE is outlined below.

The computer room will be used for two courses, i.e. the mathematics group and the humanities group.

In the case of the mathematics group, the students of each year will be divided into three groups while the students of the humanities group of each year will be divided into six groups.

The mathematics group students and the humanities group students will use the computer room for three periods and two periods a week respectively.

The weekly schedule of use for the computer room is shown in table 2-10 below.

Table 2-10 Weekly schedule of use for the computer room

hour	1	2	3	4	5	6	7	8	9
MONDAY	Yr 2 Group 1M	Yr 2 Group 1M		Yr 3 Group 1M	Yr 3 Group 1M	Yr 3 Group 1H	Yr 3 Group 1H	Yr 3 Group 3H	Yr 3 Group 3H
TUESDAY	Yr 2 Group 2H	Yr 2 Group 2H	Yr 2 Group 1H	Yr 2 Group 1H	Yr 2 Group 2M	Yr 2 Group 2M		Yr 3 Group 3H	Yr 3 Group 3H
WEDNESDAY	Yr 2 Group 3M	Yr 2 Group 3M	Yr 3 Group 2M	Yr 3 Group 2M	Yr 2 Group 4H	Yr 2 Group 4H	Yr 3 Group 3M	Yr 3 Group 3M	
THURSDAY	Yr 2 Group 4H	Yr 2 Group 4H	Yr 2 Group 5H	Yr 2 Group 5H	Yr 3 Group 5H	Yr 3 Group 5H	Yr 2 Group 2M	Yr 2 Group 3M	Yr 2 Group 1M
FRIDAY	Yr 3 Group 6H	Yr 3 Group 6H	Yr 2 Group 6H	Yr 2 Group 6H	Yr 3 Group 2M	Yr 3 Group 3M	Yr 3 Group 1M	Yr 2 Group 3H	Yr 2 Group 3H

Notes: H: Humanities group

M: Mathematics group

Source: DCE

The number of students using the computer room per period is calculated in the following manner.

The mathematics group of the Faculty of Science has 60 students/year while the humanities group of the Faculty of Humanities has 90 students/year, all of which use the computer room as part of the curriculum. The maximum number of students using the computer room in one period is, therefore, 20.

Mathematics group: 60 students/year → three groups of 20 students each

Humanities group : 90 students/year → six groups of 15 students each

The planned contents of the student training in the computer room are basic computer operation, document preparation, spreadsheets and statistical processing, etc. using MS Office which is the basic software bundle in use. Computers are used on a regular basis in Malawi at many private companies and public offices and also for administrative work at many schools. These offices mainly use computers for administrative work, spreadsheets and database creation using MS Office and, therefore, basic training will be provided in the computer room to enable students to perform these tasks. The more advanced use of computers will be left to specialist higher education and/or practice after graduation. As teachers of the mathematics group are expected to teach basic operation, including the use of software, there is no plan to practice higher grade software or to provide more advanced training. In regard to computer maintenance, the DCE is expected to recruit a system engineer at its own expense. The DCE currently

intends to exclusively use the computers for the education of students and does not plan to allow public access.

4) Scale of Computer Room

Computer room is used by up to 20 students will be considered. A preparation room will be introduced next to the computer room for the storage of spare parts. Twenty computer tables and 20 chairs for students and a table and chair for the teacher will be provided under the equipment plan. Cabinets will also be provided under the equipment plan for the preparation room for the storage of spare parts.

Air-conditioning is essential for a computer room in view of better computer maintenance, including protection from dust and temperature and humidity control. Air-conditioning will, therefore, be installed. The air-conditioning specifications will be those of a simple room cooler which can be easily maintained by a local engineer and the installation work will be included in the building service work.

(5) Gymnasium

1) Relevance of Gymnasium

The PIF adopts a policy of introducing new teaching methods to achieve the basic target of developing healthy human resources for the future of Malawi. The new curriculum which was introduced in 2000 includes PE (physical education) in secondary education based on this PIF policy. The syllabus for PE includes actual exercises in addition to the theory of PE. These sporting exercises listed in the PE curriculum are such ball games as volleyball, basketball and gymnastics using a box and mattress, etc. The DCE is the only institution in Malawi training PE teachers for secondary education. In Domasi, the climate during the rainy season is particularly unsuitable for outdoor exercises as the temperature increases above 30°C during the day. The strong solar radiation throughout the year is another reason to avoid outdoor exercises. The introduction of a gymnasium is, therefore, judged to be relevant to allow actual exercises to be conducted during the rainy season.

2) Current Situation of PE

PE as part of secondary education commenced in Malawi in 2000. At present, the DCE is the only institution which trains PE teachers in terms of both theory and practice as neither Chancellor College of the University of Malawi nor Mzuzu University has a comparable course. PE teacher training at the DCE includes such sports as basketball, volleyball and hockey in addition to football and netball which are the main sports in Malawi. Tennis, table tennis and badminton are taught in an informal manner. Athletics and gymnastics using a box and mattress (but not bars) are also taught.

The existing range of equipment includes volleyballs, basketballs, rackets and nets for tennis and badminton, air pumps, hurdles and poles for pole jumping. The hand-made hurdles and poles are not approved products for official competition but are good enough for use for educational purposes. Volleyballs and basketballs, etc. are donated by the CIDA (of Canada) every year. The DCE has a fitness room which is equipped with running machines, weight training machines and barbells, etc. The subjects featured in PE are dietetics, sports science, anatomy, health education, teaching method, micro-

teaching (teaching exercises between students) and actual exercises. The DCE has three PE teachers and the first class of 25 students graduated last year.

3) Gymnasium Utilisation Plan

The planned use of the gymnasium for physical exercises is shown below based on the curriculum and lesson schedule. The use of this gymnasium by students of the demonstration secondary school for physical exercise also planned.

Table 2-12 Weekly schedule of use for the gymnasium

	7:30-8:30	8:30-9:30	9:30-10:30	10:30-11:30	11:30-12:30	13:30-14:30	14:30-15:30	15:30-16:30	16:30-17:30	17:30-18:30	18:30-19:30
Monday		▨		▨	■	■				▨	▨
Tuesday	■		▨		▨		▨		■		
Wednesday					■		■	■			
Thursday		■		▨		▨					
Friday			▨	■	■			■			
Saturday	▨	▨									
Sunday							▨	▨	▨	▨	▨

■	Domasi College of Education Physical Education Lessons (including practical lessons and theory&practical lessons)	11hours/week
▨	Demonstration Secondary School Physical Education Lessons (each form year has 2 hours physical education classes per week)	8hours/week
▨	Recreation for lecturers and students activities for Sports Clubs	10hours/week
▨	Recreation over the weekends and students activities for Sports Clubs	7hours/week
Total hours		<u>36hours/week</u>

PE is a compulsory subject in the curriculum and the above table suggests the use of a gymnasium for an average of five hours a day. At present, most secondary schools do not conduct PE but it is planned to use the gymnasium of the DCE for the physical exercise of students of the demonstration secondary school. The types of activities to be conducted in the gymnasium are basketball, volleyball, table tennis, badminton and box and mattress exercises. As this gymnasium will be the only facility of its kind in the area, its active use by the local community for sporting events is anticipated.

4) Scale of Gymnasium

The floor area of the gymnasium will be large enough to provide two volleyball courts and one basketball court. While the ceiling height will be high enough to allow these sports to take place, the overall height of the building will be kept to a minimum. External walls will be introduced to prevent rain from entering the area and balls from flying out of the area. Existing equipment such as balls, rackets, etc. are still able to use also every year volley balls and basket balls etc. are donated by CIDA. Therefore, basket ball nets, volleyball nets and posts, etc. are included in the equipment plan which are necessary for the use of gymnasium.

(6) Water Supply Plan

1) Background

For the purpose of stability of water supply to the campus, DCE has conducted a trial borehole making, however it could not have enough volume of water and it couldn't be a source of water supply. Therefore, present water supply is still not in good condition. The investigation and another trial borehole making are carried out which prospect the better water supply conditions by the Basic Design Study of the Project.

The drilling survey which was conducted as part of the Basic Design Study involved horizontal as well as vertical electrical prospecting as described below to check for water veins.

- **Horizontal Prospecting**

The field survey found outcrops of rock everywhere on and around the DCE campus. As the geological line runs northeast to southwest, traverse lines were set at a right angle to the geological line as much as possible. The prospecting depth was set at 40 m.

- **Vertical Prospecting**

Vertical prospecting was conducted at six sites where a water vein could be found based on the horizontal prospecting results. The prospecting depth was set at approximately 80 m. A site of approximately 50 m along the main road from the main entrance of the DCE campus was found to be the most promising for the discovery of a water vein as a result of this vertical prospecting. This grassland site adjacent to the primary school was determined to be the drilling point.

Drilling was conducted at this point to 61 m below the ground with a bore diameter of 200 mm. A PVC casing was inserted to a depth of 60 m and rose 1 m above the ground. Of this 60 m, 30 m was made up of slot pipes (screens).

The pumping test results suggest that a stable pumping volume from this borehole would be approximately 6 litres/min which is similar to the pumping volume of the existing borehole on the DCE campus. This water volume is insufficient to meet the daily water demand of the campus. Accordingly, this borehole can only be considered a supplementary water supply source however, based on the result of the water quality test which was conducted during the site survey, common germs and colon bacillus were detected. Therefore the use of borehole water will be limited to use a laundry, sprinkle, mopping, etc. and it is not able to use a drinking or washing hands such as relating human sanitation.

2) Survey on Existing Boreholes Near Domasi

The results of the field survey on existing boreholes near Domasi College of Education are given below.

Table 2-13 The results of the field survey on existing boreholes near DCE

Borehole Number		BH-10	BH-32	BH-14
Well Number		L273	Q409	E140
Name of village		Mtwiche	Chemisala	Malemia
Depth of well (m)		30.5	36.6	30.5
Water level (GL-m)		6.40	19.80	4.3
Drawable quantity (L/min)		Very little	19.8	15.6
Soil Condition	Surface (m~m)	0~0	0~15.2	-
	Weathering Rock (m~m)	0~30.5	15.2~36.6	-
Digged time		02/07/1956	03/11/1969	03/04/1958
Installation time of Hand pump		26/10/94	5/11/94	26/10/94
Others		Pump was broken in January 2003 Located at hillside	Still working Located at flat ground	Pump was broken 3 years ago Located at flat ground

Source: Document by Ministry of Water Resources and the site survey

When a borehole is situated on flat ground covered by a thick weathered rock layer, the available water volume is sufficient for the use of a manual pump. However, it is generally difficult to secure a sufficient volume of water when a borehole is situated on a hillside with a shallow weathered rock layer as in the case of the survey point this time.

Consequently, for the project the installation of new boreholes are given up and plan to get water with the Domasi Water Supply Project, a sufficient municipal supply of water to the new as well as existing facilities is anticipated. It describes below.

3) Water Supply Plan by the Domasi Water Supply Project

Given the fact that the Domasi Water Supply Project is in progress with the assistance of the African Development Bank and it covers DCE, with scheduled completion by the end of the year 2003,

The outline of the Domasi Water Supply Project is as follows.

- Water Intake for Water Supply (GH = 873 m)

The intake point is located at the confluence between Lusanya River, a tributary of Domasi River, and Mkanya River. The river flow measured during the dry season is 23 litres/sec and it is planned to take 8.7 litres/sec (752 m²/day) for public water supply. At present, the screen at this intake is frequently troubled by the inflow of gravel and mud during the rainy season but major improvement is expected to take place through the construction of a new weir, etc.

- Treatment Work

The river water guided through the intake is led to a sedimentation basin and is then filtered and sterilised before storage in a water tank (capacity: 1,000 m³; TWL: 790 m).

The water distribution plan at the present stage is shown Figure2-3.

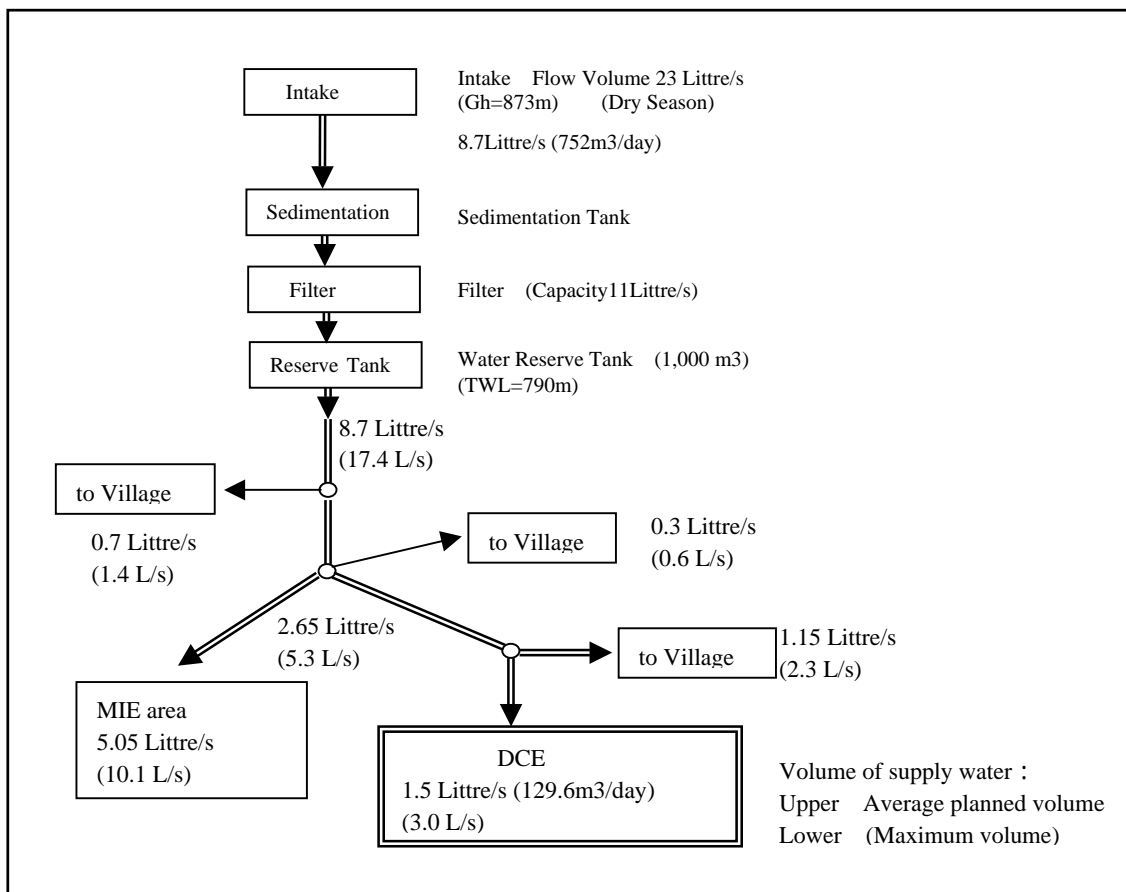


Figure2-3 Water distribution plan by the Domasi Water Supply Project

The monthly water supply volume in 2002 did not show any many fluctuations between the rainy season and the dry season as the daily supply volume was of 400 – 600 m³ was fairly constant. After the completion of the Project, the water supply volume is expected to generally improve by some 50%. The current plan anticipates the distribution of 1.5 litres/sec (approximately 130 m³/day) of water to the DCE as the design mean water supply volume. As the pipe diameter under the Project is designed to be double the present requirement, the water supply volume to the DCE can be doubled if necessary. This means that there will be a sufficient water supply capacity to meet the water demand of the existing facilities.

The field survey found that there are two water supply routes to the DCE campus, i.e. one for educational facilities and one for staff housing. The water consumption before and after the Project is outlined in table 2-14 below.

Table2-14 Water consumption before and after the project

Area	Existing facilities		After the project (After improvement)	
College	84m ³ /day	~ 119 m ³ /day	103 m ³ /day	~ 147 m ³ /day
Staff house	18 m ³ /day	~ 26 m ³ /day	24 m ³ /day	~ 35 m ³ /day
Total	102 m ³ /day	~ 146 m ³ /day	127 m ³ /day	~ 182 m ³ /day
Volume of water supply			129 m ³ /day	~ 259 m ³ /day

Source: Calculation by the consultant

As the completion of the construction work of this Grant Aid Project is scheduled at the beginning of year 2005, the field survey results show that the water supply under

the Domasi Water Supply Project will be completed as originally scheduled by the end of year 2003, the volume of municipal water supply to the campus of the DCE will be 129 – 259 m³/day which should be sufficient to meet the expected water demand of 127 – 182 m³/day of the planned facilities under the Project. As the enough volume of water will be available for the entire campus, including the improvement of the water supply system for the existing facilities on the campus.

In this connection, the time of completion of the Domasi Water Supply Project should be kept and managed internally by the Malawian side and the connection work to the planned facilities and existing facilities of DCE shall be done by the Malawian side to ensure the water supply in the Project.

(7) Drainage Plan

At present, waste water from the campus is centrally treated at an oxidization pond located at the side of the grounds in the southern part of the campus. This pond is full of ditch reeds and requires cleaning and sludge removal. In addition, there is leakage from the drainage pipeline leading to the pond, making the repair and cleaning of this pipeline necessary.

The introduction of a system whereby treated water from a septic tank attached to each new facility is conveyed to the existing oxidization pond via the existing drainage pipeline will be examined under the Project.

As the water supply and drainage systems for the planned facilities under the Project are within the scope of the building service work. However, repair of the drainage pipeline and cleaning of the oxidization pond will be conducted by the Malawi side as apart of maintenance work of existing facilities , therefore, these repair and cleaning are not included in the Project.

Although adoption of the BOD standard of BS is recommended as part of the installation standards for sanitary facilities, there is no regulatory standard at present. Similarly, there is no standard regarding the distance between a borehole and waste water treatment facilities. A distance of 30 m, which is the standard distance used in Japan is, therefore, adopted for the Project.

2.2.2.2 Examination of Scope of Assistance Regarding Equipment

(1) Availability and Situation of Use of Educational Equipment

The existing laboratories at the DCE have a basic range of equipment, including microscopes, oscilloscopes and optical measuring instruments. However, the interview survey conducted as part of the Basic Design Study found that the use of simple equipment is much more frequent than that of complicated equipment because of the shortage of science teachers, unfamiliarity with equipment methods and other reasons, suggesting a situation where not all equipment is fully utilised.

(2) Examination of Requested Equipment

The original request for equipment mainly featured equipment for the laboratories and workshops of the demonstration secondary school. A request was also made for a copier for the office, furniture for various rooms, a speaker system and a screen, etc. for the multi-purpose hall and PE equipment. When examining the standard laboratory equipment for secondary schools, it was found that the equipment listed for the World Bank's SEP, managed by the EDMU, is used as the standard equipment for secondary schools by the MoEST.

Table2-15 Contents of the requested equipment

Facility	Requested Equipment
< Demonstration Secondary School >	
Head Teacher's Office	Cabinets, Desk, Chair, 2 Computers, Fax machines, Carpet, Copy machine, Air conditioner
Deputy Head Teacher's Office	Same above
Secretary's Office	Computer, Desk, Chair, Carpet
Staff Room	Notice board, Lockers, Cabinets, Notice board, Desk, Chair
Store Room	Cabinets for documents
Library	Bookshelves, tables, Chairs, Books, Ceiling fans
Physical Science Laboratory	Lab table for 40persons, Side table, Water supply , Gas supply, shelves, Blackboard, Draft chamber, OHP, Screen, Standard Lab. equipment
Biology Laboratory	Lab table for 40persons, Side table, Water supply , Gas supply, shelves, Blackboard, Draft chamber, OHP, Screen, Standard Lab. equipment
Human Ecology Laboratory	Lab table for 30persons, Cooking equipment, Refrigerator, Freezer, Blackboard, Screen, Standard Lab. equipment
Workshop	Work bench, Clumps, Electrical drilling machine, Rulers, Roughing planes, Ripsaws, Hammers, Drawing boards, T-square, Compass, Measures
Class Room	Desks, Chairs
Assembly Hall	Public address system, Roll-up screen, chairs
Staff Houses	
< Female Hostel >	
	Study desks, Chairs, Beds, Lockers
< Gymnasium >	
	Fitness equipment, Volley ball equipment, Basket ball equipment
< Computer Room >	
	Desks, Chairs, 20 Computers

The absence of a detailed equipment list in the original request led to consultations between the two sides and it was agreed that the World Bank's SEP equipment list would be used as the basis for equipment selection. However, the said list featuring equipment supply for 20 target secondary schools covers as many as 40 plus items, containing many reagents, etc. which are considered to be unnecessary in view of the actual teaching secondary schools in Malawi at present. Because of this, the types and quantities of equipment were examined with the main focus on simple equipment and apparatus for ease of handling by teachers for basic experiments. In the case of HE equipment, a standard range of equipment was examined based on the list prepared by the Malawi side.

Each requested equipment is classified in one of the following three categories and items have been selected for each category. The equipment has been selected based on the principle of selecting items which can be easily procured at low cost and excluding those which are difficult to maintain or for which obtaining consumables in Malawi is difficult from the Project.

Equipment required to implement the curriculum (laboratory equipment and workshop equipment, etc.)

The demonstration secondary school, computer room and gymnasium are facilities required to implement the curriculum. Equipment required to conduct activities specified by the curriculum using such facilities are included.

Equipment required to maintain the functions of educational facilities (study desks and chairs, etc.)

This equipment, etc. is required for the operation of various rooms and common fixtures and fittings other than equipment directly related to educational activities are omitted pursuant to the Undertakings of Each Government attached to the Minutes of Discussions for the Basic Design Study.

Equipment required for school operation (copier and speaker system, etc.)

This equipment, etc. is required to support school activities, including various types of meetings. Staplers and files, etc. used for administrative work will be provided by the Malawi side as they can be easily obtained at low cost in Malawi.

1) Equipment Required to Implement the Curriculum

Certain types of laboratory equipment are required for the teaching of science and biology under the curriculum for secondary education. Science is divided into integrated science and physics. Meanwhile, HE and handicrafts require workshop equipment. The equipment required for HE is further divided into that for cooking and that for dress-making. Numbers for each equipment have been determined by the number of group based on a rate of one table per five students. However, reagents and consumable equipment are not included because which can be easily procured at low cost and be equipped as a routine supply by DCE.

The selected items based on the curriculum are listed below.

Table 2-16 Equipment required to implement the curriculum

Use purpose on the Curriculum	Main Equipment Examined
< Science Laboratory >	
Laboratory experiments and exercises in general	Laboratory tables (for 40 students; water supply, drainage and gas supply work is included in the building service work)
Physics and chemistry in general	Glass apparatus, etc.
Scientific measuring	Voltmeters, ammeters, balances and spring balances, etc.
Electricity	Switches and variable resistors, etc.
Matter and combinations	Glass apparatus, etc.
Elements	Periodic table of elements
Dynamics	Pulleys and others
Others (magnetic force, mechanism and heat, etc.)	magnets, etc.
< Biology Laboratory >	
Living things in general (observation)	Glass apparatus, gas burners and microscopes, etc.
Observation	Magnifiers and measuring tapes, etc.
Plant growth	Glass apparatus, etc.
Interaction between plants and nature	Thermometers and others
Photosynthesis	Microscopes and others
Breathing	Mirrors and others

Use purpose on the Curriculum	Main Equipment Examined
Others (environment, human body and animals, etc.)	Anatomical models and human skeletal model, etc.
< HE Workshop >	
HE work tables	Work tables (for 30 students; water supply, drainage and gas supply work is included in the building services work)
Cooking	Electric heaters and refrigerators, etc.
Textiles/clothing	Sewing tools and sewing machines, etc.
< Handicrafts Workshop >	
Handicraft work tables	Work tables, etc.
Drawing	Drawing tools, etc.
Metalwork	Metalworking tools (drills and files, etc.)
Woodwork	Woodworking tools (saws and planes, etc.)
Pottery	Pottery tools

2) Minimum Range of Equipment Required for Use of Facilities

These are mainly furniture and fixtures. In accordance with the “necessary measures undertaken by each government” attached to the appendix-1 of Minutes of Discussions of the Basic Design, general furniture is to be provided by the government of the recipient country (Malawi). The possibility of providing nets and other items for ball games to be used in the planned gymnasium has also been examined. The existing equipment for physical education in the gymnasium has been found to be still usable. The main items of selected equipment are listed below.

Table 2-17 Minimum range of equipment required for use of facilities

Facility	Main Equipment Examined
< Demonstration Secondary School >	
Administration Rooms	Desks/chairs; conference desks/chairs; desks/chairs for the principal and vice-principal; sofa sets; shelves (H: 1,200 mm); stools (for waiting guests)
Classrooms	Students’ desks/chairs; teachers’ desks/chairs; blackboards; notice boards
Laboratories (Science and Biology)	Laboratory chairs; cabinets; blackboards; notice boards
Workshops (HE and Handicrafts)	Workshop chairs; cabinets; blackboards; notice boards
Library	Reading desks (large and small); chairs; bookshelves; cabinets; counter; notice board
Multi-Purpose Hall	Conference tables; collapsible chairs; blackboard; notice board
Preparation Rooms and Warehouse	Storage shelves

3) Minimum Range of Equipment Required for School Operation

The types of equipment required for school operation include office equipment and water supply and drainage equipment. In accordance with the equipment selection criteria of the exclusion of equipment which can be easily procured at low cost within the scope of the Project, staplers, punches, files and other common office items are to be prepared by the Malawi side. Water supply and drainage are included in the plumbing work of the facility construction. Only a copier to copy documents and test papers, etc. has been examined. In relation to the multi-purpose hall, equipment which may be required for meetings or training involving many people has also been examined. The main selected equipment is listed below.

Table 2-18 Minimum range of equipment required for school operation

Facility	Main Equipment Examined
< Demonstration Secondary School >	
Office Equipment	Copier
Multi-Purpose Hall	Loudspeaker; OHP; screen

(3) Examination of Requested Additional Equipment for Existing Facilities

The supplementary request for additional equipment for the existing facilities was examined.

Examination of the request has found that the reasons for the request are a numerical shortage and out of order, etc. and that “a shortage” to continue existing activities is not a viable reason for their relevance to Japan’s grant aid, and the requested equipment was judged to be unnecessary to support activities relating to such project components as the demonstration secondary school, female students’ dormitory, computer room and gymnasium. In short, the requested additional equipment for the existing facilities is not related to the project components and does not constitute a numerical addition to the existing equipment or meet the objectives of the Project. For these reasons, the requested additional equipment is not included in the scope of the Project.

2.2.3 Design Policy

(1) Contents of MoEST Standards

In Malawi, the MoEST has prepared the Standards for Secondary Education Facilities with the assistance of the World Bank. These standards constitute the Standard Design adopted by the MoEST and are applied to secondary school construction work by the MoEST. In reality, however, secondary schools which are constructed with the number of classrooms immediately required are not particularly unusual among CDSS because of insufficient funding and other reasons. The said Standard Design has been adopted by the ongoing SEP of the World Bank and the ADF-III of the AfDB where the room configuration is almost identical despite slightly different room sizes.

Table 2-19 Secondary school facilities based on MoEST standards (with World Bank assistance)

Facility	Required Floor Area (Effective)	Auxiliary Room(s)	Remarks
1. Administration Building	9.2 m x 25.4 m = 233.68 m ²	Incorporates the principal's office, deputy principal's office, administration office, first aid room, reception, storage room, toilets and accounting office	
2. Classroom	9.0 m x 7.2 m = 64.80 m ² Capacity: 40 students/classroom	Preparation room (serving two classrooms) 2.6 m x 5.4 m = 14.04 m ²	The preparation room is sandwiched by two classrooms to form a unit.
3. Laboratory	10.8 m x 9.2 m = 99.36 m ² Capacity: 40 students/laboratory Compulsory subject: general science Optional subject: physics; chemistry; biology	Preparation room and equipment storage (serving two laboratories) 3.3 m x 6.4 m = 21.12 m ²	The preparation room is sandwiched by two classrooms to form a unit; physics and chemistry may share the same laboratory.
4. HE Workshop	10.8 m x 9.2 m = 99.36 m ²	Preparation room and equipment storage 3.3 m x 6.4 m = 21.12 m ²	For cooking, dress-making and home-making practice
5. Library	7.2 m x 19.8 m = 142.56 m ² Stack room: 4.5 m x 9.0 m = 40.5 m ²	Incorporates a counter, office, stack room and reading room	-
6. Multi-Purpose Hall	25.2 m x 20 m = 504 m ²	Stage and storage room, etc. 5.2 m x 21.6 m = 112.32 m ²	Used for morning assembly, dining, meetings and ceremonies
7. Warehouse	9.7 m x 7.6 m = 73.72 m ²		
8. Toilets	Boys: 7 urinals 4 bowls Girls: 7 booths Staff: one each for male and female staff	-	Separate building
9. Sports Ground	Depending on the site conditions	-	For netball, basketball and football, etc.
10. Staff Housing	For ordinary teachers: 89.3 m ² For principal: 119.3 m ²	Three bedrooms, living room, dining room, kitchen, storage room, garage and bathroom	(Required regardless of a school being a boarding school or not)

In the case of a boarding secondary school, the following facilities are added.

Facility	Required Floor Area (Effective)	Auxiliary Room(s)	Remarks
1. Hostels (for male and female)	9.7 m x 27.3 m = 264.81 m ² (one building contains 12 bedrooms)	Each bedroom has study desks and lockers; toilets, showers and laundry, etc. are common use	Each room has two beds; one room is used as a sick bay (for isolation)
2. Kitchen	20 m x 24 m = 480 m ²	Workshop, storage room, refrigerator, food preparation room, kiosk, changing room and toilets, etc.	The standard plan is adopted for a university/college kitchen.

The field survey in Malawi confirmed the configuration and size of the rooms of similar facilities by means of actual surveying and also by checking collected drawings as shown in the table below. For the facility plan under the Project, it has been decided to proceed with the design of the facilities based on the MoEST Standards while referring to the room sizes of similar facilities given above.

Table 2-20 Comparison of room sizes of various secondary education facilities

• Classrooms

School	Floor Area	Capacity	Remarks
Mulunguzi Secondary School	61.2 m ²	40 students	Each classroom is accompanied with a courtyard (44.5 m ²).
Secondary School of World Bank Standard Design	64.8 m ²	40 students	A storage room (6.6 m ²) and office (7.1 m ²) are located between two classrooms.
Secondary School of AfDB Standard Design	62.3 m ²	40 students	Each classroom is accompanied by a preparation/storage room (9.9 m ²)

• Laboratories

Type of School	Floor Area	Sink	Remarks
World Bank Standard Design	99.7 m ²	16 (1)*	A storage room (9.7 m ²) and preparation/washing room (13.0 m ²) are located between two laboratories; the chemistry laboratory has a built-in draft chamber
AfDB Standard Design	85.5 m ²	10 (2)*	A storage room, dark room and preparation room (46.6 m ² in total) are located between two laboratories

* The figure in brackets indicates the number of sinks for teachers.

• Staff Housing

School	Total Floor Area	Living/Dining	Kitchen	Storage	Bath room	Toilet	Bed room 1	Bed room 2	Bed room 3	Corridor	Conde
DCE (for Ordinary Teacher)	96.5 m ²	O	O	O	O	O	O	O	O	O	O
Mulunguzi Secondary School	84.0 m ²	O	O	O	O	O	O	O	O	O	O
World Bank Standard Design (for Ordinary Teacher)	89.3 m ²	O	O	O	O	O	O	O	O	O	O
AfDB Standard Design (for Ordinary Teacher)	96.5 m ²	Same plan as for DCE									

(2) Examination of Facility Size

The required size of each room planned under the Project has been examined based on the situation of activities at the DCE, the expected number of students at the demonstration secondary school (40 students x 2 classes/grade x 4 grades = 320 students) and the standards described earlier. The resulting facility plan is shown in the table below.

Table 2-21 Examination of facility size

(m²)

Priority	Requested Section	Names of Room	No. of Prsn	No. of Rms	Floor Area (m ²)	Total Floor Area	Request	Standard Plan	Basis of floor area calculation
1-1	Demonstration Secondary School								
	Administration Area	Head Teacher's room	1	1	19.80	19.80	12.4	19.4	based on standard plan
		Deputy Head Teacher's room	1	1	16.30	16.30	12.4	13.0	same above
		Secretary	1	1	10.00	10.00	9.3	-	based on furniture arrangement
		Teacher's room	18	1	71.25	71.25	56.0	53.5	for 20 teachers, including function of reception and emergency room
		Staff room		1	20.00	20.00		19.4	for 6 staffs
		Burser	-	-	-	-	12.4	13.0	included in staff room
		Reception	-	-	-	-	-	5.3	included in staff room
		Emergency room	-	-	-	-	-	12.0	
		Kitchen		1	6.50	6.50	12.0	5.0	based on standard plan
		Storage		1	8.50	8.50	6.0	6.3	keep maintenance tools
		WC(M), WC(F)		2	4.90	9.80	18.0	13.0	based on standard calculation
		Corridor, Hall		1	27.85	27.85	55.5	36.1	minimum requirement is planned
		Sub-total					190.00	194.0	196.0
	Classrooms	Classroom	40	8	75.00	600.00	640.0	518.4	for 40 students / class room, including observation area
	Laboratories / Workshop	Science Laboratory	40	1	114.00	114.00	120.0	99.7	for 40 students / class room, including observation area, based on arrangement of furniture
		Biology Laboratory	40	1	114.00	114.00	85.0	99.7	same above
		Home Economics Laboratory	30	1	114.00	114.00	-	99.7	for 30 students / class room, including observation area, based on arrangement of furniture
		Craft Workshop	40	1	114.00	114.00	-	-	for 40 students / class room, including observation area, based on arrangement of furniture
		Preparation room		2	14.30	28.60	-	46.1	Store the equipment for lab. One preparation room is shared by two laboratories.
		Storage		2	14.30	28.60	-	57.9	Store the equipment for lab. One storage room is shared by two laboratories.
		Sub-total					1,113.20	845.0	921.5
	Public Area	Library	50	1	190.00	190.00	166.0	183.1	for 50 persons, based on furniture arrangement, open shelf system is adopted
		Multi-purpose Hall	100	1	112.50	112.50	457.0	504.0	for 80 students/1grade + 20 staff = 100 persons
		Preparation room		1	15.00	15.00			for preparation of equipment and teaching tools
		Storage		1	22.50	22.50			to store desks and chairs, storage is shared by multipurpose hall and library
		Sub-total					302.50		
Common Space	WC(M), WC(F)		2	29.10	58.20	58.0	48.0	based on standard calculation	
	Hall, Corridor		1	572.10	572.10	160.0	244.2	minimum requirement is planned	
	Sub-total					630.30			
Total					2,236	1,880	2,097		
1-2	Staff Houses	Head Teacher's House		1	90.00	90.00	-	131.3	No garage is planned
		Teacher's House		13	78.50	1,020.50	-	1,205.2	based on minimum requirement
	Total					1,111	-	1,337	

Priority	Requested Section	Names of Room	No. of Prsn	No. of Rms	Floor Area (m ²)	Total Floor Area	Request	Standard Plan	Basis of floor area calculation
2	Female Hostel	Bed room	2	60	12.96	777.60	748.8	-	based on furniture arrangement, two students share one room, space where each students can keep privacy is planned
		WC, Shower		6	21.60	129.60	261.0	-	based on existing hostel
		Laundry		6	19.44	116.64	108.9	-	based on existing hostel
		Corridor		6	38.40	230.40	560.3	-	minimum requirement is planned
		Covered Walkway		1	190.00	190.00	-	-	minimum requirement is planned
			1	(165.00)	(165.00)		-		
	Total					1,444	1,679	-	including the space of corridor
3	Computer Laboratory	PC room	20	1	54.00	54.00	160.0	-	for 20 students, based on furniture arrangement
		Preparation room		1	18.00	18.00	43.0	-	keep spare parts, maintenance equipment
		Corridor		1	25.00	25.00			minimum requirement is planned
		Covered Walkway		1	(72.5)	(72.5)	-	-	minimum requirement is planned based on existing facilities
		Total				97	203	-	
4	Gymnasium	Gymnasium		1	875.00	875.00	875.0	-	for two valley ball coats and one basket ball coat are planned
		Change room (M)		1	25.00	25.00	25.0	-	change clothes
		Change room (F)		1	25.00	25.00	25.0	-	change clothes
		Storage		1	25.00	25.00	35.0	-	store sports equipment
		Staff room					25.0		use existing facility
							30.0		
		Covered Walkway		1	(186.00)	(186.00)	-	-	minimum requirement is planned based on existing facilities
		Total				950	1,015	-	
	Ground Total					5,838	4,777	3,433	(area of connection corridors to existing facilities of 424 m ² is not included)
						6,262			(area of connection corridors to existing facilities of 424 m ² is included)

2.2.4 Basic Plan of Facility

(1) Layout Plan

1) Location and Site of Planned Construction Site

The DCE is located 16 km north of Zomba, an old capital, and there is a good paved access road from the national motorway M4 eastwards to the main entrance of the campus. The campus has an area of some 48 ha. The site is gently sloping from the main entrance to Domasi River at the southern edge and various facilities are distributed among rich greenery.

2) Examination of Layout Plan

The basic policies for the layout plan are to clarify the multiple functions required of college facilities together with zoning of the existing facilities and to make the new facilities capable of effectively using the existing infrastructure. A site survey was conducted (i) for the purpose of giving priority to vacant sites where the construction of new facilities is feasible in view of the shape of the project site and (ii) to verify the locations of existing infrastructure buried in the ground using existing drawings. Based on the site survey results, it was judged that sites suitable for the new facilities are to the east of the main approach, to the southeast of the existing staff housing and to the north of the existing basketball and tennis courts.

The DCE and PIU in Blantyre were firstly approached to check the possibility of extension to the east of the campus as indicated in the drawing attached to the request but no clear answer was given regarding the feasible area for extension. It was explained that a long stretch of farmland to the east of the campus is owned by the MoEST. However, this site to the east of the campus is cultivated land (maize and vegetables) with infrequent hamlets along the road and the construction of new facilities on this site will require major extension of the service lines because of its long distance from the existing infrastructure. Because of such implications, it is judged that this site to the east of the campus is unsuitable as the project site.

The following conclusions have been reached regarding the desirable location of each component of the Project.

Demonstration Secondary School

As described earlier, the candidate site is next to the existing primary school to create “a primary and secondary schools zone” because of the unclear site boundary for the option of extending the campus to the east of the existing college buildings.

Staff Housing

One house for the Principal and 13 houses for teachers are planned based on the examination results of the necessity for and relevance of staff housing. The new staff housing will be located to the south of the existing staff housing area under the pretext of “a housing zone”.

Female Hostels

The planned construction site of the new female hostels was to the east of the existing female hostels and the request suggested a six-story building. However, the proposed site is partially sloping with an unclear boundary. In addition, the area to the east of the existing fence is farmland incorporating densely built private houses. Accordingly, the creation of “a female hostel zone” to the west of the existing female hostels is considered.

Computer Room

Given the types of activities of the existing facilities, the requested location appears to be the most functional site. This site is, therefore, considered as the project site for the computer room.

Gymnasium

Extension from the existing PE facilities is considered to create “a PE zone” adjacent to the outdoor basketball and tennis courts.

The candidate sites for each of the facilities and the resulting functional zones are shown below.

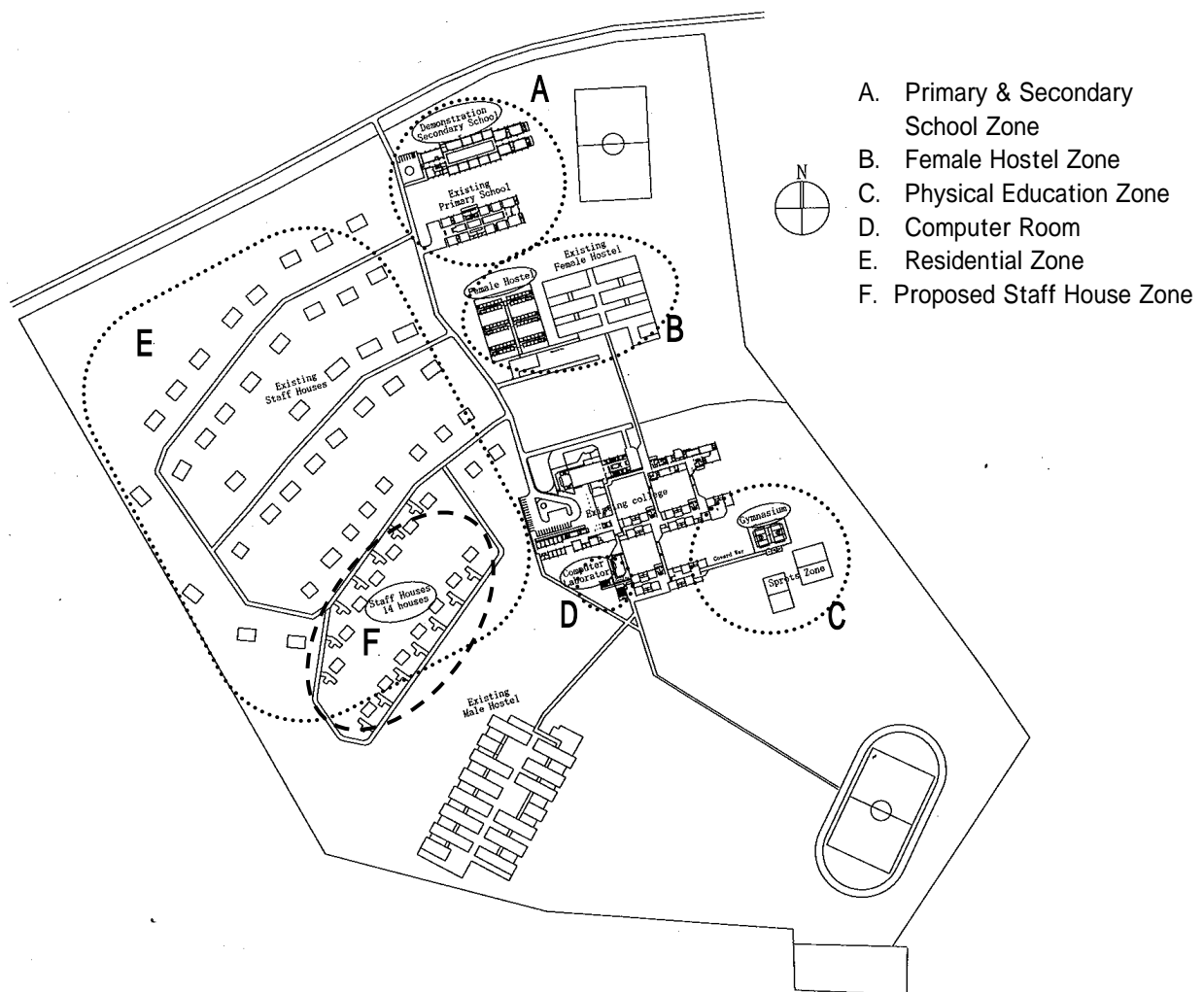


Figure 2-4 Layout plan of the planned facilities

(2) Plan

1) Demonstration Secondary School

The demonstration secondary school is planned based on the following design principles.

The school will be located to the north of the existing primary school near the main gate as this site can create “an educational practice zone” on land of a fair size and with easy access to the existing utility service routes.

A single story building is planned in view of achieving harmony with the existing facilities on the campus and reducing the construction cost.

The building will have an east-west axis with major openings to the north and south to avoid an excessive rise of the indoor temperature due to direct sunlight in the morning and evening. The building will be parallel with the primary school building for harmony.

The middle corridor will have skylights as in the case of the existing facilities to create a bright space with a feeling of openness.

A compact design consisting of “a management and common use area” and “a classroom and laboratory area” will be adopted to create a building with clearly defined zones and short lines of flow.

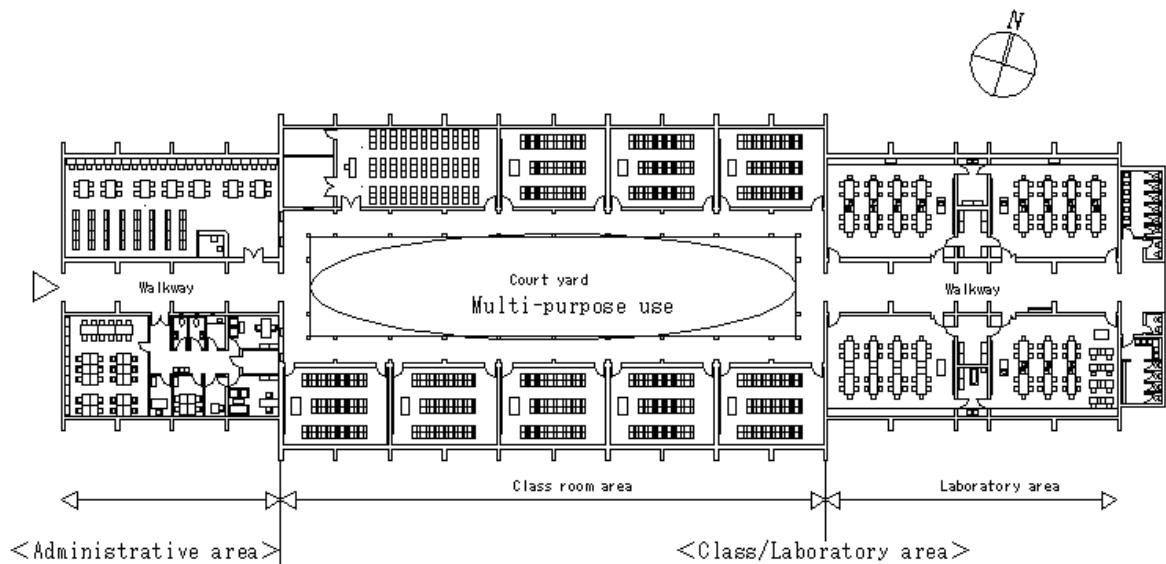


Figure 2-5 Study plan of demonstration secondary school

2) Staff Housing

There are 43 staff houses on the campus at present and 13 new houses for the principal and teachers of the demonstration secondary school are planned under the Project based on the following design principles.

The design of the new houses will take the natural environment of the area into consideration while referring to the design of the existing houses as well as similar facilities.

A conde will be introduced in accordance with the local custom as an outdoor space for conversation with neighbours and housework.

The house plan will take the fact that a Malawi family tends to have many children (5 – 7) into consideration.

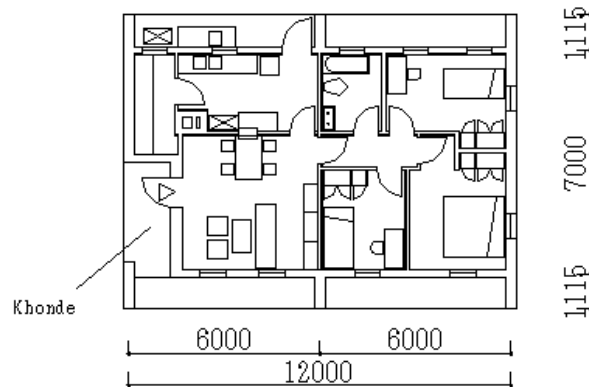


Figure 2-6 Study plan of staff house

3) Female Hostels

Sixty double rooms are planned in parallel with the existing female hostels.

The planned site is sufficiently large enough for the construction of single story hostels, the cost of which is lower than two story buildings. In addition, a single story design will allow lighting through the courtyard and, therefore, the construction of single story hostels is planned.

Using a slope corridor to connect with the existing female hostels.

The planned room size is 3.6 m x 3.6 m (existing hostels: 3.0 m x 3.5 m) to secure a 1.8 m wide space (existing hostels: 1.2 m) between two beds in view of better privacy.

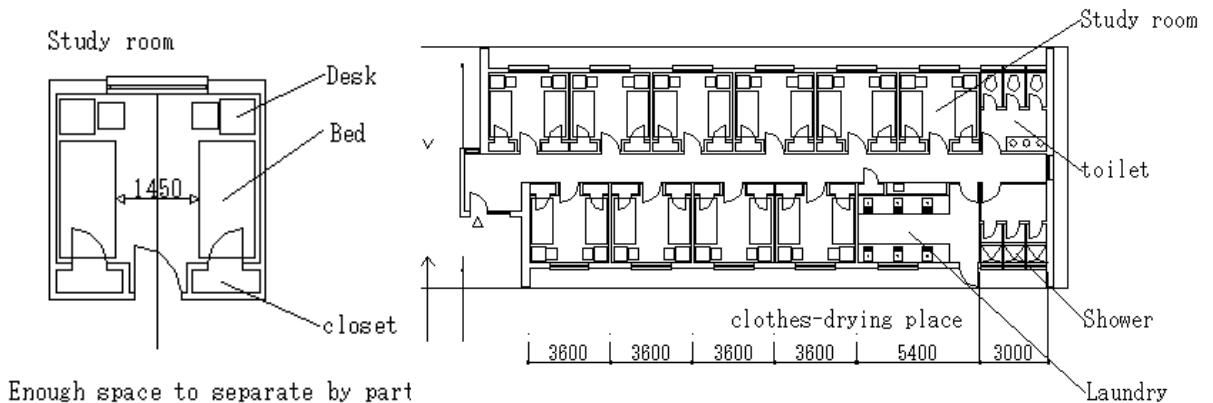


Figure 2-7 Study plan of female hostel

4) Computer Room

The computer room is planned based on the following design principles for the purpose of teaching information processing skills to DCE students.

Contrary to the almost square shape shown on the drawing attached to the request, a rectangular shape is planned in view of the better layout of the computer tables and a more economical structural span.

Air conditioner is planned to close windows in order to prevent humidity and dust from entering the room.

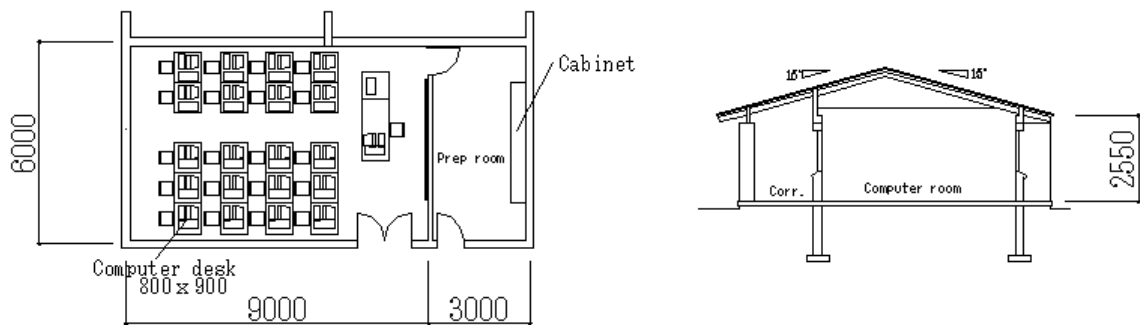


Figure 2-8 Study plan of computer room

5) Gymnasium

A gymnasium equipped with a simple roof and auxiliary rooms are planned based on the following design principles to enable sports and PE on rainy or extremely hot days.

The basic floor area should be sufficiently large to accommodate one basketball court and two supplementary volleyball courts.

The ceiling height should be at least the 7 m required for basketball and the required ceiling height for official volleyball games (12.5 m) is not considered as the planned volleyball courts in the gymnasium will be for practice purposes only.

The floor finish will be a mortar finish or similar for practice courts instead of the wooden floor required for official games.

The auxiliary rooms will consist of a changing room, toilet and equipment storage as these constitute the minimum requirements.

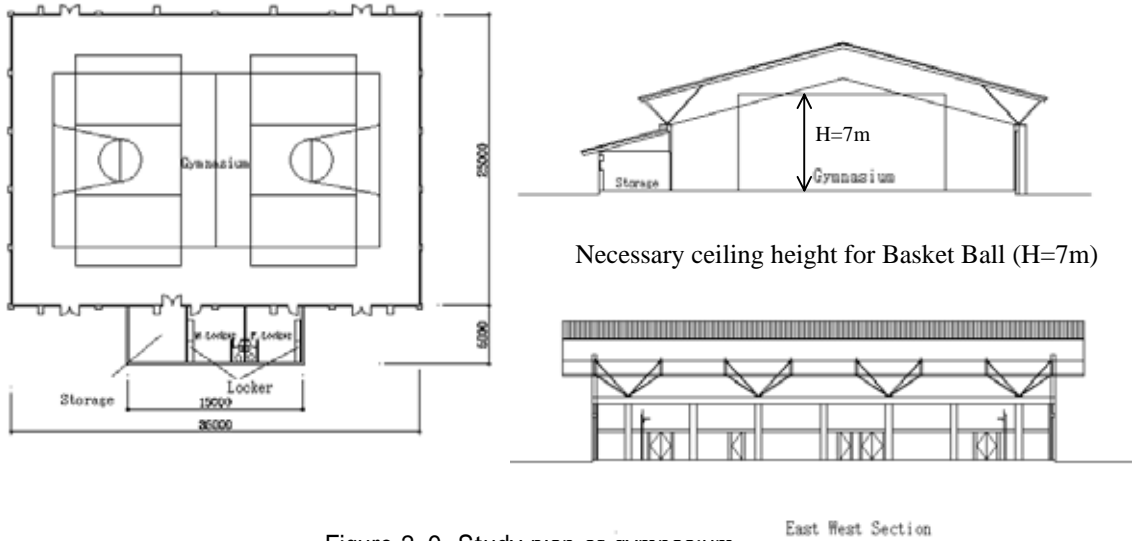


Figure 2-9 Study plan of gymnasium

6) Examination of Sizes of Various Rooms

The required floor area for different types of classrooms is examined in the following manner taking the furniture layout to accommodate 40 students and extra space for observing students (20 students per unit) into consideration.

Ordinary Classrooms

The MoEST Standard Design sets the floor area for ordinary classrooms at 64 m². A 1.5 m wide zone along the wall will be introduced under the Project at the back of the classroom to allow some 20 observing students to stand or to pass each other. The resulting classroom size planned in this manner is 70 m² (7 m x 10 m).

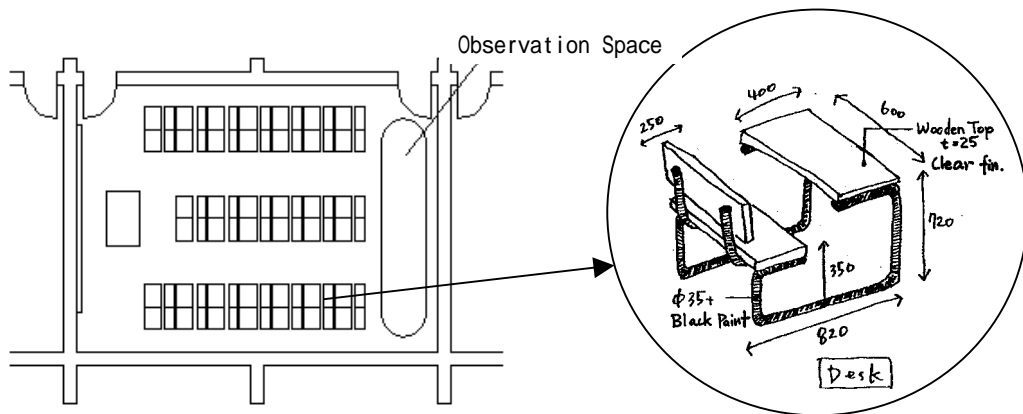


Figure 2-10 Layout plan of Ordinary Classroom

Science and Biology Laboratories

In view of the MoEST Standard Design floor area for this type of room of 112 m², the planned floor area for the science and biology laboratories is 114 m² to incorporate space for some 20 observers on the corridor side.

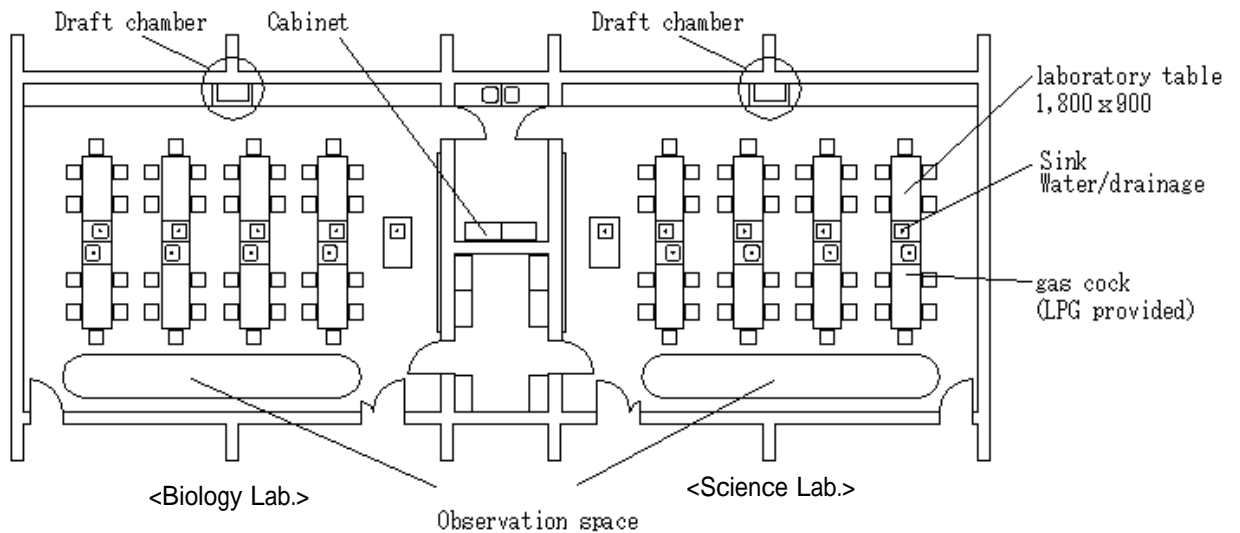


Figure 2-11 Layout plan of laboratories

Handicrafts and HE Workshops

- a. Same as in the case of the laboratories, the planned floor size for the handicrafts workshops is 114 m² each to accommodate 40 students and 20 observing students.
- b. In the case of the HE workshop, one room should be sufficient for cooking and dress-making practice to take place and the planned floor area is 114 m² which incorporates space for some 10 observing students.

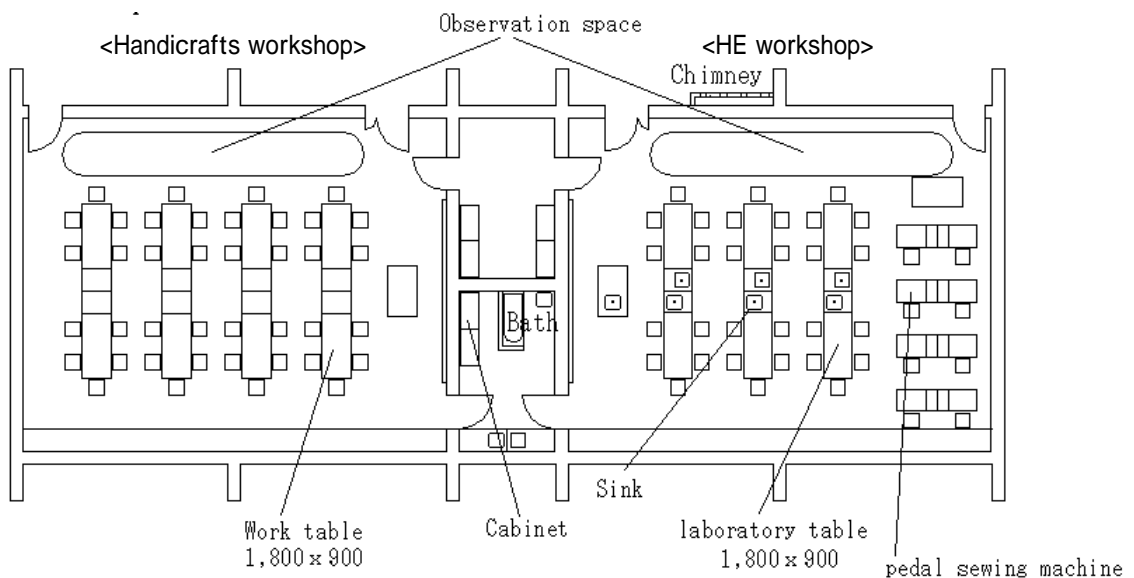


Figure 2-12 Layout plan of handicrafts and HE workshops

Layout of Administration Rooms

Based on the MoEST Standard Design, the administration building is planned to accommodate the principal, deputy principal, administrative staff and 20 teachers.

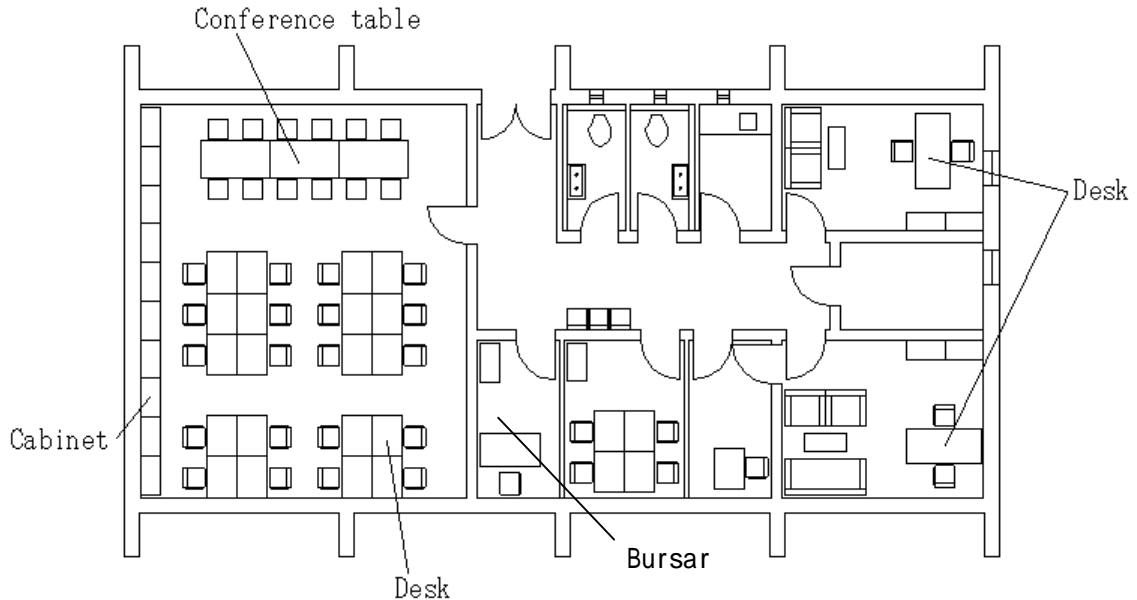


Figure 2-13 Layout plan of administration rooms

Layout of Multipurpose Hall

The planned size should be capable of accommodating the following activities.
 Presentation of students' achievements in such subjects as social studies, science and life skills, etc. at meetings attended by the entire students of one grade and joint work: 80 students of one grade and 20 staff members, totalling 100 participants

PTA/school community meetings: 40 – 50 participants

Training under the cluster system: 40 – 50 participants

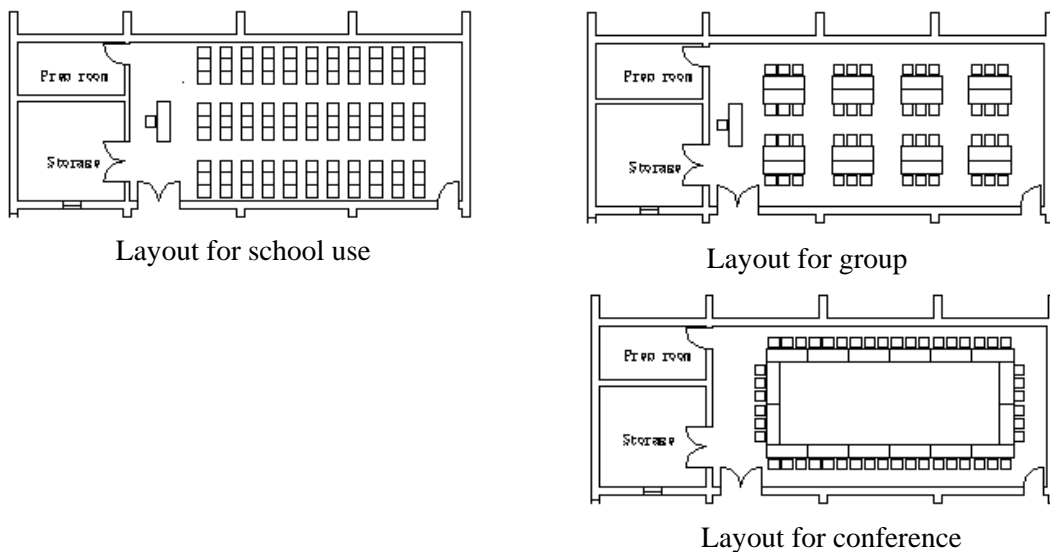


Figure 2-14 Layout plan of multipurpose hall

In regard to the bedroom size for the female hostels, three options, i.e. ① present size, ② twin bedroom with space to protect privacy and ③ single room, were examined and Option ② was selected to provide a reasonable distance between the beds to protect privacy.

Table 2-22 Examination of bedroom size for female hostels

	Option 1	Option 2	Option 3
Function	Twin bedroom of the present size	Twin bedroom with extra space for privacy	Single room
Room Span	2.92 m	3.60 m	2.1 m
Floor Area	10.35 m ² /room 60 rooms + utilities = 1,131 m ² ; + connecting corridors = 1,453 m ²	12.96 m ² /room 60 rooms + utilities = 1,413 m ² ; + connecting corridors = 1,569 m ²	7.56 m ² /room 120 rooms + utilities = 1,562 m ² ; + connecting corridors = 1,718 m ²
Advantages	Lower cost	Protection of everyday privacy with the use of a curtain, etc.	Protection of privacy
Disadvantages	No privacy	Incomplete protection of privacy	High cost (due to more doors and walls, etc.)

(3) Cross-Sectional Plan

As the planned site for the demonstration secondary school is large enough even after securing a some 40 m distance between the new school building and the existing primary school building, a single story secondary school building is planned. A single story building is judged to be a rational choice from the viewpoints of the structure, construction schedule, cost and harmony with the existing buildings nearby.

In regard to the female hostels, a sufficient space can be secured to build new single story hostels parallel to the existing single story female hostels. The choice of single story buildings is rational from the viewpoints of the lines of the daily flow of boarders, brightness of the middle corridors, structure, construction schedule, cost and harmony with the existing buildings nearby.

Other new facilities, such as staff housing, a computer room and gymnasium are also planned to be single story buildings to ensure their harmony with the existing facilities as well as the surrounding nature.

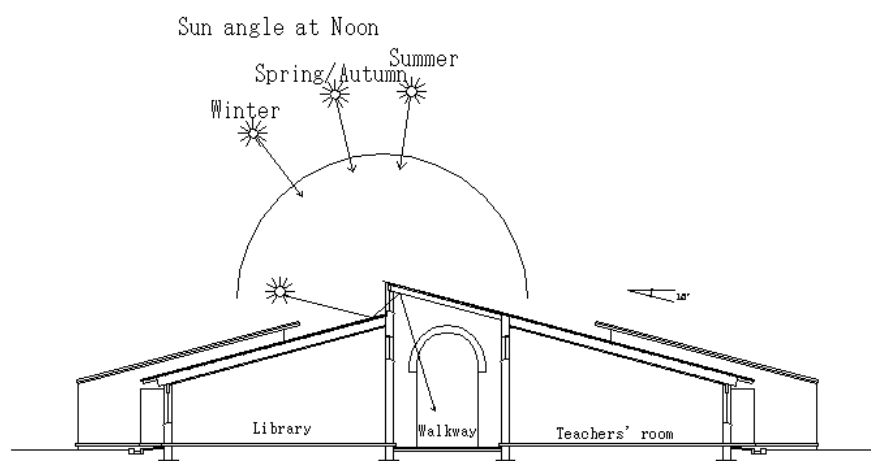


Figure 2-15 Section plan of demonstration secondary school

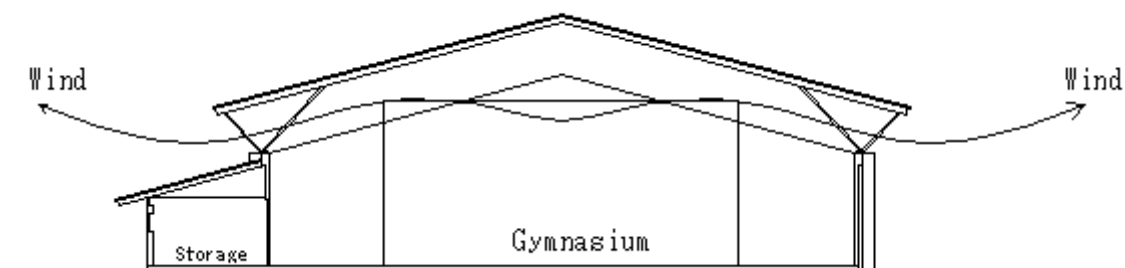


Figure 2-16 Section plan of gymnasium

(4) Structural Plan

1) Design Policies

As there are no laws, regulations and standards relating to structural design in Malawi, each designer applies the standards adopted by the educational institution at which he studied. Accordingly, BS, South African standards, US standards and German standards, etc. are used and facilities constructed with donor assistance are designed based on the standards used by each donor. In view of this situation, the following standards are referred to for the design of the planned facilities under the Project.

- Building Standards Law and its Enforcement Regulations in Japan
- Explanation of Technical Standards for Building Structures, 2001 Edition
- Calculation Standards for Reinforced Concrete Structures and Explanation (Architectural Institute of Japan -AIJ)
- Design Standards for Wooden Structures and Explanation (AIJ)
- Design Standards for Steel Structures and Explanation (AIJ)
- Design Standards for Building Foundation Structure
- British Standards (BS)
- South African Bureau of Standards (SABS)
- Uniform Building Code (UBC)

2) Setting Up of General Conditions

- Wind Force : Strong wind blows immediately before rain and local structural calculations use 40 m/sec as the reference wind velocity.
- Earthquakes : Earthquakes which can actually be felt are extremely rare and no accurate earthquake records are available. As a result, seismic stress is not considered in the structural calculation.
- Salt Damage : No salt damage has been reported as such damage is not a common occurrence. While no salt damage occurs around the project site, fish in Lake Chilwa to the east of Domasi, which has no outflowing river and where the water level rises in the rainy season, are said to differ from fish in rivers due to the presence of a minute quantity of salt in the lake water.

3) Examination of Bearing Capacity of Soil

A local subcontractor conducted test drilling to some 2 m below the ground, i.e. the foundation level, at the four planned construction sites on the campus to visually check the soil and to collect soil samples for analysis at the University of Malawi. The results are shown in Table 2-23.

Table 2-23 Ground survey results

Site	Planned Facility	Depth	Soil Type	Long-Term Bearing Capacity
1	Demonstration Secondary School	GL -2.0 m (spring water detected)	Sandy soil with silt	3.9 tons/m ²
2	Female Hostels	GL -2.1 m	Sandy soil with gravel	12.6 tons/m ²
3	Gymnasium	GL -2.1 m	Sandy soil with silt and gravel	15.0 tons/m ²
4	Staff Housing	GL -2.2 m	Sandy soil with silt and gravel	18.3 tons/m ²

The long-term bearing capacity of the soil is approximately 4 tons/m² at Site 1 and 18.3 tons/m² at Site 4 based on one-third of Terzaghi's ultimate bearing capacity. The sandy soil with silt at Site 1 necessitates either deeper foundations or wider continuous footings because of the small bearing capacity. The bearing capacity at Site 2 through Site 4 is sufficient to allow the use of independent footings or continuous footings.

Accordingly, spread foundations (continuous footings) are selected for the Project and the foundation size is calculated for each planned facility based on the load supported by the walls. Prior to building work, a plate bearing test will be conducted at the bottom level of the foundations at each site to confirm the bearing strength employed.

4) Main Structure and Design Load

The main structures to be used for this project are shown in the table below. All of columns material is brick, beam material is wood, wall material is brick and roof structure is wood except gymnasium, which are most commonly used in Malawi. Although the structural modules will be streamlined as much as possible to produce a stable and economical structure.

The external forces to be considered are the dead load, live load and wind load. The reference wind velocity to determine the wind load is 40 m/sec. The different loads used for the structural design are listed in Table 2-24.

Table 2-24 Main structure and Design loads (N/mm²)

	Columns	Beam	Wall	Roof	Dead load	Live load
Class room	Brick + RC	Wood	Brick	Wood	3,000	3,000
Female Hostel	Brick + RC	Wood	Brick	Wood	3,000	1,500
Gymnasium	RC	Steel Truss	Brick	Steel Truss	3,000	3,000
Staff house	Brick	Wood	Brick	Wood	3,000	1,500

In regard to structural materials, those, which are locally procurable, will be given priority. The site survey did not find any salt damage to the buildings. However, as

the material salt content was found to exceed 0.04% (NaCl) for coarse or fine aggregate and/or 200 ppm in the mixing water prior to concrete work, a rust prevention agent is used.

The structural design is based on the materials and design strength listed below.

Table 2-25 Construction materials to be used

Item	Description
Design Strength	21 N/mm ²
Cement	Normal Portland cement
Mixing Agent	Not used in the case of mixing on site
Concrete Aggregate	Crusher run
Fine Aggregate	River sand or mountain sand
Reinforcing Bars (Irregular)	D10 – D16 ASTM Grade 40 (or equivalent) D19 – D25 ASTM Grade 60 (or equivalent)
Structural Steel	BS4360 General 43 (or equivalent)
Bolts	BS4604 General Grade (or equivalent)
Wood	Sawn timber: hemlock spruce, JAS E90 (or equivalent) Glue-laminated timber: hemlock spruce, JAS E75-F255 (or equivalent)
Bricks	

(4) Building Services Plan

1) Plumbing Work

Water Supply Facilities

The existing water supply route consists of branching out from the municipal water main which runs along the front road at the northwestern corner of the campus for gravity feeding to an elevated RC water tank (25 tons) via a meter. The water is then fed to a stop valve located to the west of the existing primary school via the north side of the staff housing area on the campus from branching out to each facility. The existing female hostels with a relatively high water consumption level have previously suffered a severe water shortage as reduction of the river water volume during the dry season led to an insufficient water supply to the elevated RC water tank. An additional elevated steel water tank for exclusive water supply to the female hostels was subsequently installed to the south of the primary school, mitigating the water shortage at the female hostels.

The staff houses receive gravity water supply from the elevated water tank for communal water supply which is located at the back of the Post Office along the M4 and each house has its own water meter.

The planned water supply under the Project is branching out between the meter for the existing service pipe (100 A) and the elevated RC water tank to supply water to a new elevated steel water tank at the side of the secondary school. The new secondary school and new female hostels will receive water supply from this new elevated water tank. Water supply to the gymnasium will branch out from an existing college facility as few utensils using water are installed in this building. In regard to the new staff houses, the Malawi side will be responsible for the laying of a service pipe from the municipal water main to meters at individual houses while the work to install the water meter and

indoor piping at each house is included in the scope of the Project. The planned water consumption of each new facility is shown in the table below.

Figure 2-26 Planned water consumption of each new facility per day

1) Water consumption at campus per day

Facility	Item	Calculation	Water consumption (L/day)	
			Max/day	Average / day
Primary school	Staff	21 persons × 60 L/M• day =	1,260	882
	Student	640 persons × 30 L/M• day =	19,200	13,440
	Sub total		20,460	14,322
Existing facilities of DCE	Staff	163 persons × 60 L/M• day =	9,780	6,846
	Student	540 persons × 30 L/M• day =	16,200	11,340
	Kitchen	703 meal × 1 time × 10 L/meal =	7,030	4,921
	Sub total		33,010	23,107
Existing hostel	Student	540 persons × 110 L/M• day =	59,400	41,580
	Sub total		59,400	41,580
Water consumption of existing campus			112,870	79,009
Secondary school	Staff	26 persons × 60 L/M• day =	1,560	1,092
	Student	320 persons × 30 L/M• day =	9,600	6,720
	Sub total		11,160	7,812
Female hostel	Student	120 persons × 110 L/M• day =	13,200	9,240
	Sub total		13,200	9,240
Water consumption of secondary school and female hostel			24,360	17,052
Water consumption of whole academic facilities(existing + new facilities)			137,230	96,061

2) Water consumption at staff houses per day

Facility	Item	Calculation	Water consumption (L/day)	
			Max/day	Average / day
Existing facilities	Staff families	176 persons × 150 L/M• day =	26,400	18,480
New facilities	Staff families	56 persons × 150 L/M• day =	8,400	5,880
Water consumption of staff house (existing + new facilities)			34,800	24,360

Necessary water volume for whole campus

	Water consumption (L/day)	
	Max/day	Average / day
Actual	139,270	97,489
After completion of the project	172,030	120,421

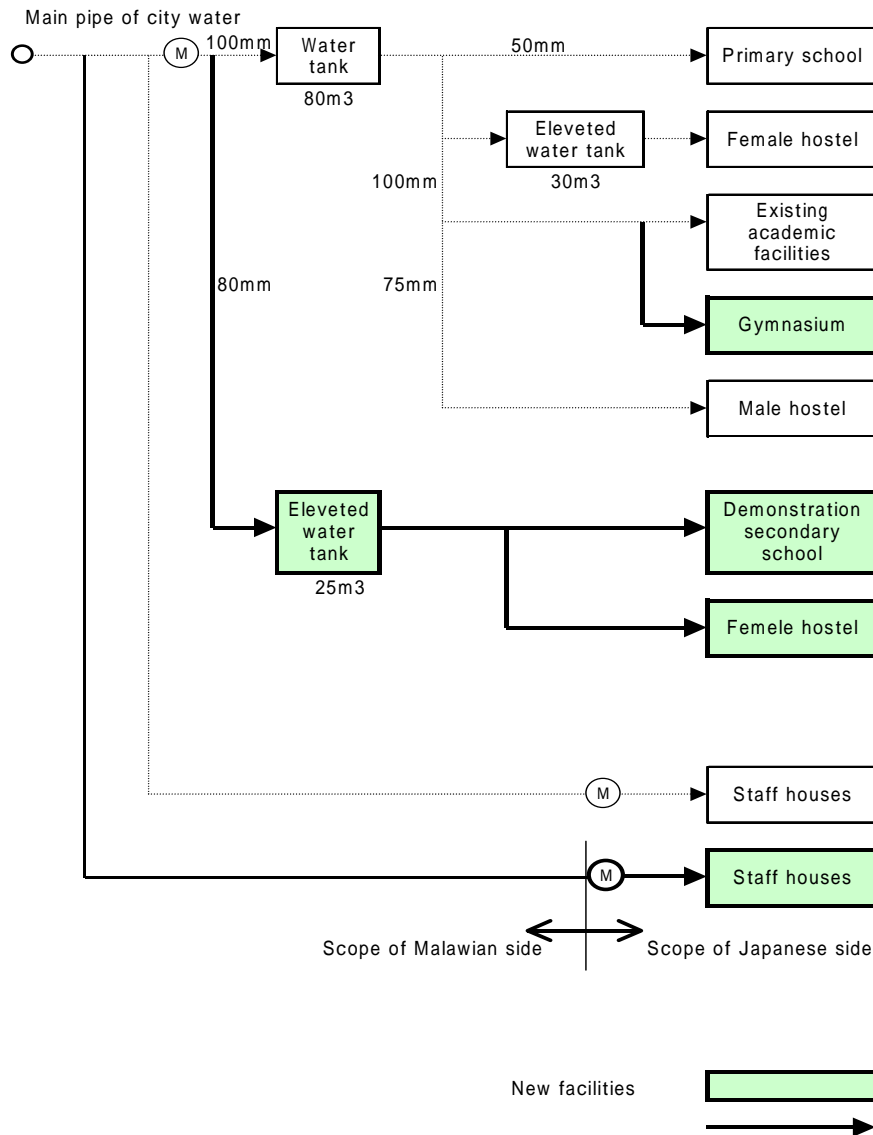


Figure 2-17 Flowchart of water supply

<Water quality test>

The water quality test laboratory of the University of Malawi was subcontracted to conduct a water quality test to determine whether groundwater from a borehole would be suitable for drinking purposes or not. For comparison purposes, the quality of municipal water was also tested. The test results are shown in the table below. The Project plans the use of municipal water for drinking purposes as groundwater which is unsuitable for drinking based on the test results. Therefore, the borehole is not use on the project..

Table 2-27 Result of water quality test

Item	New Borehole			Existing Borehole			City Water			W H O	Japan
Na	mg/L	22.8 ±0.6		15.9 ±0.2			2.3 ±0.3			-	200
K	mg/L	4 ±0.0		17 ±0.0			0.6 ±0.0			-	} total 300
Mg	mg/L	6.21 ±0.01		7.01 ±0.07			0.39 ±0.03			-	
Ca	mg/L	16.35 ±0.10		13.02 ±0.04			0.59 ±0.03			-	
Fe	mg/L	4.82 ±0.00	×	2.34 ±0.07		×	<0.03			-	0.3
Cu	mg/L	<0.02		<0.02			<0.02			2.0	1.0
Zn	mg/L	0.01 ±0.00		0.01 ±0.00			0.66 ±0.00			-	1.0
Pb	mg/L	<0.05		<0.05			<0.05			0.01	0.05
Mn	mg/L	0.27 ±0.01		0.07 ±0.01			0.07 ±0.01			0.5	0.05

Item	New Borehole			Existing Borehole			City Water			W H O	Japan		
	Dilution	No.	piece/mL	Dilution	No.	piece/mL	Dilution	No.	piece/mL				
Common Germs	10 ⁰	1	25	×	10 ⁰	1	9	×	10 ⁰	1	3	0	100
		2	378			2	8			2	0		
		3	84			3	8			3	9		
	10 ⁻¹	1	210		10 ⁻¹	1	10		10 ⁻¹	1	0		
		2	360			2	20			2	0		
		3	120			3	10			3	10		
	10 ⁻²	1	100		10 ⁻²	1	0		10 ⁻²	1	0		
		2	300			2	0			2	0		
		3	0			3	0			3	0		
Colon Bacilli	10 ⁰	1	65	×	10 ⁰	1	8	×	10 ⁰	1	0	0	0
		2	260			2	20			2	1		
		3	75			3	16			3	3		
	10 ⁻¹	1	19		10 ⁻¹	1	10		10 ⁻¹	1	0		
		2	46			2	20			2	0		
		3	7			3	10			3	0		
	10 ⁻²	1	1		10 ⁻²	1	0		10 ⁻²	1	0		
		2	2			2	0			2	0		
		3	1			3	0			3	0		

Sewerage Facilities

The original design for the campus facilities (1985) planned the installation of a septic tank at each building/house for subsequent infiltration. Because of the rise of the groundwater table during the rainy season, however, it was decided to construct an oxidization pond at the side of the sports ground in the southern part of the campus for centralised treatment. This pond is currently full of ditch reed, requiring cleaning as well as sludge removal. In addition, there is leakage from the pipeline. The planned method under the Project is the introduction of a septic tank for each facility and channelling to the existing oxidization pond.

In regard to the drainage of rainwater, storm ditches will be introduced below the eaves of each planned facility for their connection to the existing drainage ditches on the campus.

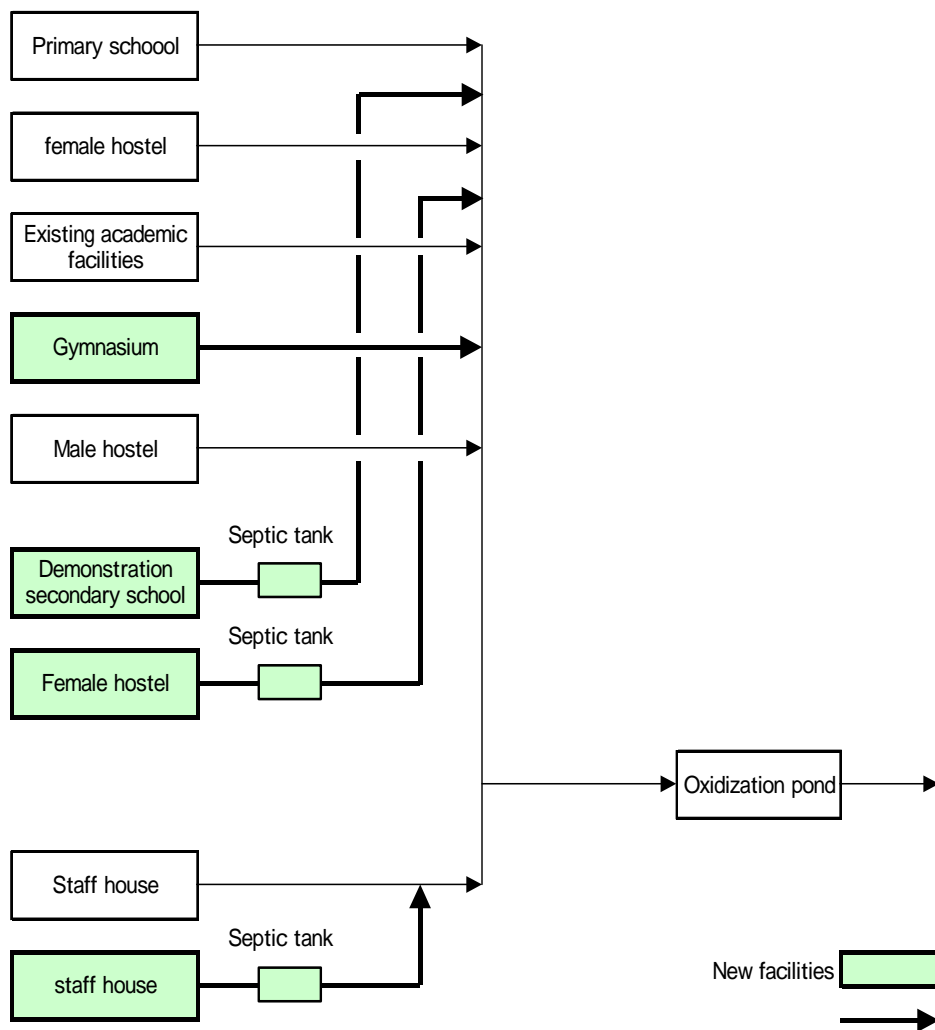


Figure 2-18 Flowchart of Sewerage

Sanitation Facilities

The cistern system which is commonly used in Malawi will be used for the flushing of bowls and urinals. Each toilet area will be provided with washbasins and mirrors, etc. For students of the demonstration secondary school, western type water closets and stainless steel continual urinals (serving 6 – 9 students) with a high tank will be installed as these are commonly used at school facilities. A sink(s) will be installed in each laboratory or workshop.

Calculation of Required Number of Toilets

The required number of toilets and washbasins was calculated using the calculation standards of the Society of Heating, Air-Conditioning and Sanitary Engineers (SHASE) of Japan. Toilets at schools are heavily used during breaks between lessons. Level 2 of the following table is applicable to Malawi based on the length of each lesson of 50 minutes and the maximum waiting time for toilet use during breaks of 60 seconds.

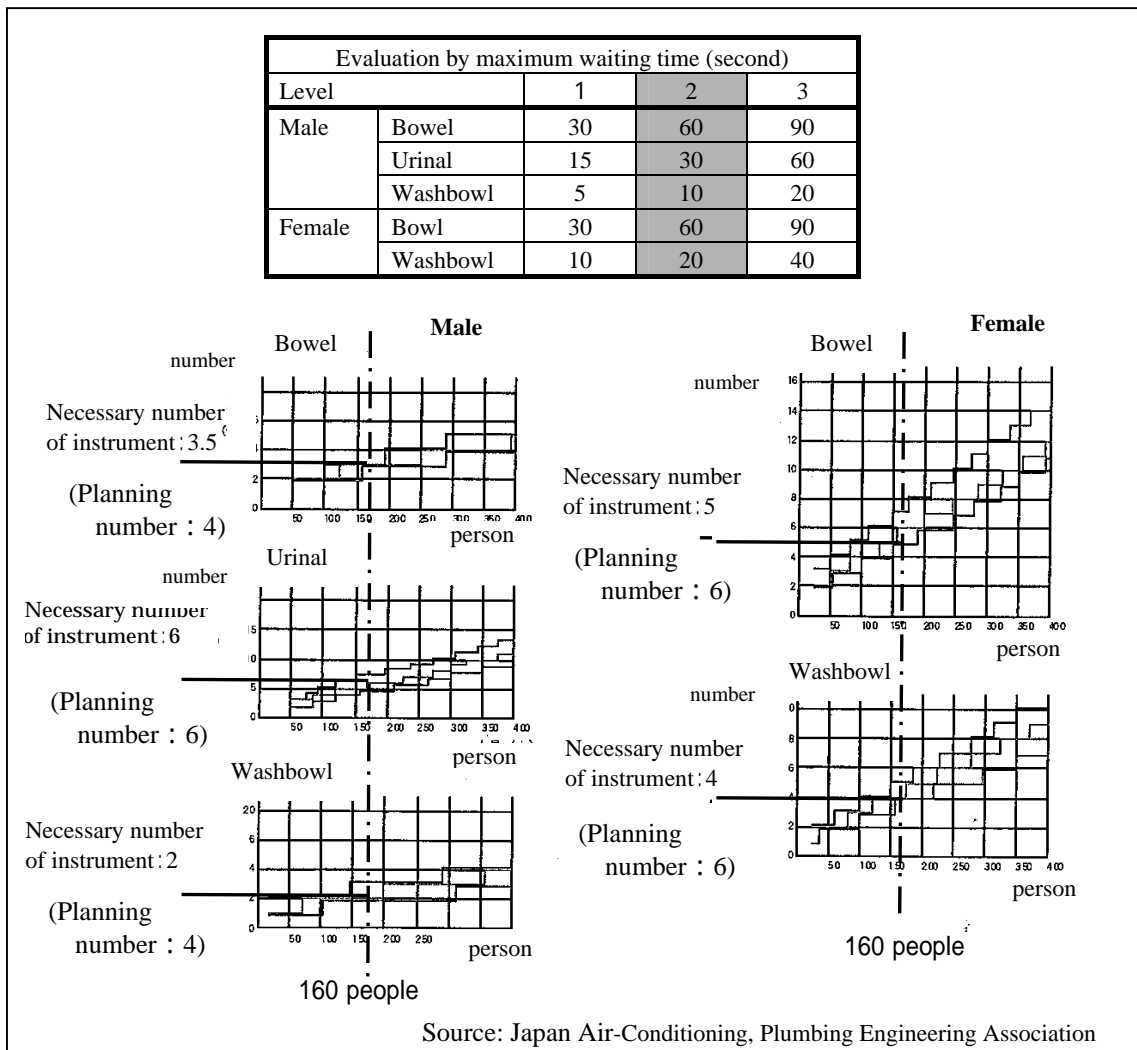


Figure2-19 Calculation method of numbers of sanitary fixtures

Fire Extinguishing System

Fire plugs (with a 100 feet long hose reel) will be installed near the entrance of each facility along the indoor corridors. These will be directly connected to the water supply line and no fire pumps will be installed. In addition, dry chemical fire extinguishers will be provided at specified locations in the laboratories where fire is used, those are science laboratory, biology laboratory and H.E.

Standard for the installation of fireplugs does not exist in Malawi, however, before start the construction work it is necessary to confirm by the City Planning with concerned drawings.

Gas Pipelines

Each laboratory table in the science and biology laboratories will be equipped with a gas cock to allow the use of a gas burner. Meanwhile, each laboratory table and the draft chamber in the science laboratory will be served by propane gas piping. The gas cylinders will be placed outside in view of safety and a central supply system will be established to supply gas to each laboratory table and the draft chamber.

3) Electrical Installations

Existing Power Receiving and Transforming Systems

At present, a special high voltage distribution line (11 kV) runs underground from the western side of the main entrance to a transformer (11 kV/400 V, 200 kVA) located halfway (some 100 m from the main entrance) along the premises road. Electricity is then distributed to each campus facility from the low voltage secondary side via a distribution panel located to the north of the hall. Each staff house is independently equipped with a watt-hour meter.

The field survey found that the capacity of the existing transformer and the average electric power used at present are 200 kVA and less than 100 kVA respectively. As the total power demand of the planned facilities under the Project is approximately 33 kVA based on the calculations shown below (Table 2-28), the excess capacity of the existing transformer can meet the power demand of the new facilities. Accordingly, no new transformer will be installed.

Table2-28 Calculation of electrical power consumption

	Area (m ²)	Lighting Load (VA)		Outlet Load (VA)		Sub Total (VA)
		(VA/m ²)	(VA)	(VA/m ²)	(VA)	
1. Demo. Sec. School	2,236	3.5	8,000	1.8	4,000	12,000
2. Staff Housing	1,111	5.5	6,000	1.8	2,000	8,000
3. Female Hostel	1,444	11.0	16,000	3.0	4,000	20,000
4. Computer Room	97	40.0	4,000	80.0	8,000	12,000
5. Gymnasium	950	2.5	2,400	0.6	600	3,000
Total	5,838		42,000		13,000	55,000

$$55,000 \times \text{demand} \quad 0.6 \quad = \quad 33,000$$

Total power consumption : 33KVA

In regard to the supply of power to the planned facilities other than staff housing, power supply will be made through new service connections beyond the watt-hour meter at the existing distribution panel and, therefore, the work to provide these new connections will be included in the Project. However, in the case of the extension of power supply to the staff housing, an individual watt-hour meter will be installed in each house and the Malawi side will be responsible for extension of the service line from the transformer to the individual watt-hour meters. The cost of extension, etc. will be based on the electrical installation standards in Malawi described below.

Table 2-29 Outline of electric service line extension work

Item	Outline
Electrical Installation Standards	No Malawi standards; BS, IEE (Institute of Electrical Engineers) and CAWS (Central Africa Wiring Standards) are used
Rated Voltage and Power	High voltage side: 11 kV; 33 k V; 66 kV; 132 kV Low voltage side: 3 ϕ 4 W 400 W/AC 230 V, 50 Hz
Demarcation Point of Responsibility	ESCOM is responsible up to the watt-hour meter while the user is responsible for the rest of the work. In the case of low voltage supply or a transformer capacity of less than 400 kVA: ESCOM is responsible up to the watt-hour meter installed on the low voltage distribution panel (installed on the MSB in the case of existing facilities) while the user is responsible for the rest of the work.

Item	Outline
	In the case of a transformer capacity of 400 kVA or higher: ESCOM is responsible up to the power receiving and transforming facilities (high voltage distribution panel, transformer and high voltage watt-hour meter) while the user is responsible for work on the secondary side.
Cost of Extension	Transformer: some MK 250,000 for 100 kVA or some MK 316,000 for 200 kVA Cables: some MK 600/m for 33 kV overhead aluminium cable of 100 m ² Work period: to be completed within six months of application

Source: ESCOM (Electricity Supply Corporation of Malawi)

Trunk Power Equipment

Power will be distributed from the low voltage distribution panel for the existing transformer to the lighting distribution panel and power control panel at each planned facility via buried cable. As the connecting corridors for the existing facilities have pits for power distribution, these pits will be used where possible for part of the new distribution routes. Beyond the panels mentioned above, the wiring system will use conduits. No alarm panel indicating abnormalities of the power receiving and transforming equipment, generating unit and plumbing systems will be installed under the Project.

Table 2-30 Power system for trunk and branch circuit

	Power supply method
Trunk lighting and power circuit	Three phase four wire; 400/230V
Receptacles for lighting	Single phase two wire; 230V
Power for plumbing system	Single phase two wire; 230V

Lighting Facilities

Necessary number of lighting fixtures in the room shall be decided by the required luminous intensity in the room. Luminous intensity in the classrooms in the practice secondary school is to be 300lx for reading book in considering rainy days. Computer room luminous intensity is 500lx for matching to the brightness of the monitor screen. Luminous intensity of Corridor and toilets are standardised as 100lx. To save energy, switching will, in principle, be conducted in-situ, i.e. in the same room, by means of adopting the fine zoning of areas for lighting. Corridors, etc. will allow zonal switching while the outdoor and security lights will use an automatic switching system. The power outlets will be ordinary BS outlets. The light sources will be mainly fluorescent lamps of a size which can be locally purchased for easy maintenance.

Table 2-31 Planned luminous intensity for main rooms

Facility	Planned luminous intensity
Rooms for demonstration secondary school	300Lx
Dormitory rooms for female hostel	100Lx
Computer room	500Lx
Gymnasium	100Lx
Corridor, Toilets	100Lx

Fire Alarm

A manual fire alarm will be installed at strategic points to enable the safe evacuation of anyone inside a building by the early detection and warning of a fire by an alarm.

Standard for the installation of fire alarm system is not existing in Malawi, however, before start the construction work it is necessary to confirm by the City Planning with concerned drawings.

4) Telephone System

There is a telephone exchange of the telephone corporation on the right-hand side of a bridge over Domasi River some 500 m east of the DCE along the road running to the south of the campus in the direction of the MIE. This exchange provides 10 lines for the DCE (three are connected to a switchboard) and some 25 lines for individual households. A switchboard (10/100 lines) made by Alcatel is installed at the PBX in the administration office to serve extension and there are some 30 unused extension lines.

Under the Project, the installation of a telephone is planned in the administration office of the demonstration secondary school, the hall of the new female hostels and the gymnasium, etc. As the hitherto unused extension lines of the existing PBX will be used to provide new telephone lines to these locations, no new PBX will be installed. Wiring will be conducted through the existing pits and the ground.

As the use of the Internet in the computer room is not planned, no telephone extension will be made to the computer room.

Table 2-32 Planned facility equipment

	AC/Vent Works			Water/Drainage/Gas Works				Electrical Works		
	A/C	Ceiling Fan	Ventilation	Water/Drainage	Hand Basin	Fire Exter	Gas	Outlet	Tel.wire	Lux
A. Demonstration Secondary School										
Administration Block										
Head teacher's room	-		-	-	-	-	-			300
Deputy head teacher's room	-		-	-	-	-	-			300
Secretary room	-	-	-	-	-	-	-			300
Staff room	-	-	-	-	-	-	-			300
Teacher's room	-	-	-	-	-	-	-			300
Kitchen	-	-	-	-	-	-	-	-	-	100
Storage	-	-	-	-	-	-	-	-	-	100
WC	-	-	-	-	-	-	-	-	-	100
Corridor, Hall	-	-	-	-	-	-	-	-	-	100
Academic Block										
Class room	-	-	-	-	-	-	-	-	-	300
Science laboratory	-	-	-	-	-	-	-	-	-	300
Biology laboratory	-	-	-	-	-	-	-	-	-	300
Home Economics Lab.	-	-	-	-	-	-	-	-	-	300
Craft workshop	-	-	-	-	-	-	-	-	-	300
Preparation room	-	-	-	-	-	-	-	-	-	100
Storage	-	-	-	-	-	-	-	-	-	100
Public Block										
Library	-	-	-	-	-	-	-	-	-	300
Multipurpose hall	-	-	-	-	-	-	-	-	-	300
Preparation room	-	-	-	-	-	-	-	-	-	100
Storage	-	-	-	-	-	-	-	-	-	100
Common space										
WC	-	-	-	-	-	-	-	-	-	100
Entrance, Corridor	-	-	-	-	-	-	-	-	-	100
B. Staff House										
Living/Dining	-	-	-	-	-	-	-	-	-	300
Bed room 1,2,3	-	-	-	-	-	-	-	-	-	300
Kitchen	-	-	-	-	-	-	-	-	-	100
WC	-	-	-	-	-	-	-	-	-	100
Storage	-	-	-	-	-	-	-	-	-	100
C. Female Hostel										
Study room	-	-	-	-	-	-	-	-	-	100
WC + Shower room	-	-	-	-	-	-	-	-	-	100
Laundry	-	-	-	-	-	-	-	-	-	100
Corridor	-	-	-	-	-	-	-	-	-	100
D. Computer Room										
Computer room	-	-	-	-	-	-	-	-	-	500
Preparation room	-	-	-	-	-	-	-	-	-	100
Corridor	-	-	-	-	-	-	-	-	-	100
E. Gymnasium										
Gymnasium	-	-	-	-	-	-	-	-	-	100
Male locker room	-	-	-	-	-	-	-	-	-	100
Female locker room	-	-	-	-	-	-	-	-	-	100
Storage	-	-	-	-	-	-	-	-	-	100

Legend: ○ equipped - non-equipped lux: planned luminous intensity

(5) Construction Materials Plan

The construction materials are selected based on the following principles

- Selection of locally established materials and finishing methods to suit the local climate
- Selection of materials and construction methods which are easy to maintain to reduce the construction cost

- Local procurement of construction materials as much as possible to facilitate repair and maintenance without external assistance and to reduce the construction cost
- Use of materials in line with the standard designs of the MoEST, World Bank and other donors

The main materials to be used are outlined next.

Roofing Materials

- The common roofing method in Malawi is the laying of cooling tiles above galvanised corrugated sheet metal and this method was employed for all of the existing facilities of the DCE. With the passing of time, however, the cooling tiles often slip and, therefore, corrugated coloured sheet metal and its improved type have often been used recently. In the case of secondary schools built under the World Bank Project, corrugated coloured sheet metal is used and a ceiling is only provided for laboratories. As a result, ordinary classrooms without a ceiling experience a sharp rise of the room temperature due to radiant heat. In view of this, highly durable improved corrugated coloured sheet metal will be used for the Project and ceilings will be introduced to improve insulation in order to prevent radiant heat.

External Walls

- Fair face brickwork which is common in Malawi will be employed for the external walls as in the case of the existing facilities.

Doors and Windows

- The windows will be steel top-hinged outswinging windows which are common in Malawi and windows where is necessary of security will be provided with security grills. The opening area of the windows will be determined to secure an adequate luminous intensity while preventing the intrusion of low sunlight in the morning and evening to prevent a rise of the indoor temperature.
- The interior doors will have a steel frame and wood panels which are common in Malawi.

Interior Finish

- The floors will be mortar with a trowel finish on RC slabs to ensure durability.
- In principle, the interior walls will be mortar with a paint finish on brick walls in accordance with the common method in Malawi and the brick walls will be partially exposed for variation.
- In principle, the ceilings will be made of softboard with a paint finish which is the common method for schools and other buildings in Malawi. As the roof of the existing facilities are made of cooling tiles placed on corrugated sheet metal without a ceiling, teaching in the classrooms on the north side is sometimes disrupted by a rise of the

room temperature. A ceiling will, therefore, be introduced for those rooms which may suffer from a high temperature due to radiant heat.

The planned specifications for the new facilities and those of the existing facilities are compared below.

Table 2-33 Comparison between local and selected method for the project

	Local method	Selected method	Reason for selection
Exterior : Roof	Metal roof (Roof tile)	Metal roof	Dual roof for weather proof and heat absorption and cost performance
Wall	Fair faced brick Brick + Mortar + Paint	Fair faced brick	Common use in local. Easy maintenance and crack proof
Fittings	Steel Wooden	Exterior : Steel Interior : Wooden + Steel frame	Common use in local. Stronger than aluminium and cost performance.
Interior : Floor	Mortar trowel	Mortar trowel	Common use in local and cost performance.
Wall	Mortar + Paint	Mortar + Paint Partially brick face	Common use in local and cost performance.
Ceiling	Soft Board + Paint or no ceiling	Soft Board + Paint	Common use in local and heat absorption.

2) Planned Main Finishing Materials for Each Facility

The planned main finishing materials are described below. The principal policy is the use of materials, including imported materials, which can be easily procured locally and which are easy to maintain for all of the planned facilities.

Table 2-34 Finishing plan for exterior

Roof	Eave	Sash	Column• Beam• Wall
Galvanized steel roof	CSA board t6 + AEP	Steel	Fair faced brick

Table 2-35 Finishing plan for interior

	Story	Floor	Skirt• Base	Wall	Ceiling	Fitting
Demonstration Secondary School	1	Mortar trowel	Mortar + AEP	Mortar t10 + AEP	Soft Board t6 + AEP	Steel frame + Wooden door t40
Staff House	1	Same above	Same above	Same above	Same above	Same above
Female Hostel	1	Same above	Same above	Same above	Same above	Same above
Computer Room	1	Same above	Same above	Same above	Same above	Same above
Gymnasium	1	Same above	Same above	Same above	No ceiling	Same above

(6) Consideration of Gender and the Disabled

In addition to the introduction of toilets for the disabled, a user friendly structure will be considered for all of the facilities. One concrete measure to be adopted by the facilities plan is elimination of any differences in level to achieve barrier-free facilities.

2.2.5 Basic Plan of Equipment

(1) General

As the request for equipment submitted by the Malawi side did not contain a detailed list of equipment, the three categories of equipment described below were introduced to examine the necessary equipment. The standard list of equipment for the syllabus and the World Bank project were referred to for examination of the necessary laboratory equipment.

1) Equipment Required for Implementation of Curriculum

- Equipment for the science and biology laboratories
- Equipment for the HE and handicrafts workshops

2) Furniture Required for Functioning of Educational Facilities

- Desks, tables, chairs, cabinets and others for the classrooms and offices of the demonstration secondary school and reading tables and stacking shelves, etc. for the school library
- Beds, study desks, chairs and lockers, etc. for the bedrooms in the female hostels
- Desks, chairs and cabinets for the computer room
- Blackboards, notice boards and others

3) Equipment Required for School Operation

- Speaker system, OHP and screen for the multi-purpose hall
- Office equipment, including a copier
- Ballgame nets and others for the gymnasium

(2) Examination of Curriculum and Equipment

Examination of the curriculum and syllabus prepared by the MoEST found that the equipment listed in the table below is also required. Based on this list, equipment with versatile use which does not require many consumables is selected for the Project. Although the DCE and the demonstration secondary school are separate bodies for operational purposes, it is assumed that the range of equipment of the DCE's laboratories will be commonly used to avoid the supply of duplicated equipment under the Project.

Table 2-36 Examination of curriculum and equipment

a. Integrated Science (Physics and Chemistry)

Teaching Contents Under the Curriculum	Equipment	Purpose of Use
Water and solutions	Glass apparatus, such as beakers and flasks, test-tube racks, washing bottles and balances, etc. as auxiliary apparatus for experiments	Used for experiments to separate mixed solutions through distillation and other purposes
Scientific experiment techniques	Thermometers, stopwatches and magnifying glasses	Used to teach basic techniques for experiments
Concept of dynamics	Spring balances and bar magnets, etc.	Used for basic experiments on dynamics
Work and energy	Thermometers, etc.	Used for teaching on heat capacity
Energy and machinery	Pulleys and ropes, etc.	Used for teaching on mechanical enlargement ratio
Concept of electrical current	Ammeters, voltmeters, switches, transistors, etc.	Used for basic experiments on electrical circuits
Concepts of light and reflection	Plane mirrors and others	Used for teaching on the relationship between focal distance and image
Concept of matter	Glass apparatus, including test-tubes, etc.	Used for experiments on chemical reactions

b. Natural Science

Teaching Contents Under the Curriculum	Equipment	Purpose of Use
Scientific research techniques	Glass apparatus, including test-tubes, beakers and flasks,, and thermometers, etc.	Used for teaching on the safe use of laboratory experiment apparatus
Exercises on dynamics	Spring balances, etc.	Used for teaching on forces acting on material bodies
Exercises on electricity	Ammeters, voltmeters, variable resistors and knife switches, etc.	Exercises on series and parallel circuits, etc.
Exercises on magnetism	Bar magnets, iron powders and bearing magnets, etc.	Used for teaching on magnetic force and fields
Moleculars, compounds and structures	Gas burners, evaporating dishes, beakers, filter paper, pokers and steel tripods, etc.	Used for teaching on the differences between chemical compounds and mixtures and their properties
Exercises on chemical reactions	Glass apparatus, including test-tubes, combustion spoons, etc.	Used for teaching on the differences between physical and chemical changes
Force and machinery	Slopes and pulleys, etc.	Used for teaching on the advantages of machinery, etc.
Specific gravity of matter	Graduated measuring cylinders, etc.	Used for exercises on the measurement of specific gravity
Heat capacity and heat conduction	Thermometers and alcohol lamps, etc.	Used for basic experiments on heat
Properties of light	Plane mirrors, lenses and prisms, etc.	Used for basic experiments on light

c. Biology

Teaching Contents Under the Curriculum	Equipment	Purpose of Use
Laboratory research techniques	Glass apparatus, including beakers, alcohol lamps, microscopes, slide glass and dissecting tools, etc.	Used for teaching on the proper and safe use of laboratory apparatus/tools
Living things in daily life	Microscopes and preparations, etc.	Used for the definition and observation of living things
Digestion by mammals	Test-tubes, etc.	Used for teaching on chemical digestive processes
Interaction between organisms and the	Thermometers and others	Used for teaching on the constituents of the natural world

natural world		
Photosynthesis	Microscopes and glass apparatus, including test-tubes	Used for teaching on the photosynthesis process and for observation of stomata
Nutrition of humans	Glass apparatus, including test-tubes	Used for teaching on the nutrition of food
Breathing mechanism	Glass apparatus, including flasks	Used for experiments to measure water vapour and CO ₂ in the air
Functions of eyes and ears	Anatomical models of the eye and ear and other items	Used for teaching on the mechanism of the eye and ear

d. HE Laboratory

Teaching Contents Under the Curriculum	Equipment	Purpose of Use
< Cooking >		
Grains	Electric cookers and kitchen scales, etc.	Used for teaching on the nutritional value of grains
Fresh meat and meat products	Electric hot plates and others	Used for teaching on how to cook meat and eggs
Milk and dairy products	Oven toasters, etc.	Used for teaching on milk and dairy products
Fruit and vegetables	Electric cookers and kitchen scales, etc.	Used for teaching on how to cook fruit and vegetables
< Dress-Making >		
Materials and composition of clothes	Pedal-operated sewing machines	Used for teaching on the basics of dress-making
Handling of needles	Sewing kits	Used for teaching on how to sew manually
Stitching exercises	Pedal-operated sewing machines	Used for teaching on the stitching process
Finishing	Electric irons and ironing boards, etc.	Used for teaching on the finishing method

e. Handicrafts Course

Teaching Contents Under the Curriculum	Equipment	Purpose of Use
Technical drawing <ul style="list-style-type: none"> • Drawing of straight lines • Drawing of curved lines 	Drawing boards, T squares, drawing equipment and others	Learning how to draw lines
Crafts design and technology <ul style="list-style-type: none"> • Characteristics of materials • Design practice 	Craft design kit	Learning of design
Woodworking <ul style="list-style-type: none"> • Characteristics of wood • Woodworking practice 	Drilling machines, rulers, handsaws and chisels, etc.	Woodworking practice
Metalworking <ul style="list-style-type: none"> • Characteristics of metal • Metalworking practice 	Drills, hammers and anvils, etc.	Metalworking practice

In addition, the possible inclusion of the equipment listed below is examined as office equipment, equipment for meetings and training and sports equipment for the gymnasium, etc. which are required for the proper operation of the school.

f. Equipment for School Operation

Type of School Operation	Equipment Required	Purpose of Use
School administration • Office work and tests	Copier	Office work, including the preparation of circulars and test papers
Multi-purpose hall • Meetings and training • Training and conferences	Speaker system (microphone, amplifier and speaker) OHP and screen	• Used for meetings or training involving 50 – 100 people • As above
Sports equipment and others • Equipment for the gymnasium • Blackboards and notice boards	Ballgame nets and poles Blackboards and notice boards	• Required for ballgame practice • Required for classrooms and laboratories, etc.

(3) List of Main Equipment

The equipment to be provided under the Project is selected based on the above examination results. The type and purpose of use of each main equipment are shown in the table below. A more comprehensive list of the planned equipment is given in the Equipment List in 2.3.

While the planned quantity is based on the introduction of eight laboratory tables (five students each) for a class of 40 students, the introduction of six tables is planned for cooking. The quantity of each type of equipment is based on the number of these tables. No extra set for demonstration by the teacher is considered as demonstrations are planned to be conducted using a laboratory table for students.

Table 2-37 List of planned main equipment
< A. Equipment for Laboratories >

Code	Name of Equipment	Main Specifications	Q'ty	Purpose of Use
Integrated Science				
16	Measuring cylinder, graduated	100x1ml, 250x2ml	16	For measuring volume
21	Spring balance	10x0.1N, 1x0.01N	8	Experiment for the force
27	Voltmeter	For DC -5 ~ +15V	8	For electric circuit
36	Table balance	Cap.200g, with weight	8	For basic weighing skill
Physical Science				
12	Beaker	Capacity 100ml, 300ml	16	For chemical reaction
19	Optical lens set	Bi-concave, bi-convex, etc.	8	Experiment for optics
24	Burner	For LPG	8	Experiment for distillation
28	Tripod stand	For burner, spirit lamp	16	For heating experiment
Biology				
10	Specimen, prepared	Blood types, cells, etc.	1	Construction of tissues
20	Student microscope	40 ~ 400x, monocular	8	For biological observation
21	Dissecting tool set	Dish, scissors, etc.	8	Observation of a living body
22	Models	Eye model, ear model	1	Learning for human body
25	Pressure sterilizer	Pressure type, 10L	1	For sterilizing glassware

< B. Equipment for Practicing >

Code	Name of Equipment	Main Specifications	Q'ty	Purpose of Use
Home Economics (Cookery)				
1	Electric cooker	Double stove, 2kWx2	6	For practicing cookery
3	Kitchen scale	Top-pan, capacity 2kg	6	For weighing of food
5	Upright fridge	350L, with freezer	1	For preserving food
Home Economics (Clothing)				
8	Treadle sawing machine	Vocational type	8	Experiment for sawing
10	Electric iron	With steaming, 1000W	4	For finishing, etc.
11	Dressmaking set	Scissors, thimble, etc.	8	For cutting texture
Workshop				
1	Portable electric drill machine	For iron/wood, with bits	8	For metal/wooden work
2	Upright electric drill machine	Table-top, 13mm boring	4	For wooden work
9	Hammer	Claw hammer, mallet	8	For metal/wooden work
10	Portable drawing board	900x600, with T-square	20	Learning of drawing techs

< C. Equipment for Administration Block >

Code	Name of Equipment	Main Specifications	Q'ty	Purpose of Use
1	Photocopier	15cpm or more, max.A3	1	Copying of material

< D. Equipment for Assembly Room >

Code	Name of Equipment	Main Specifications	Q'ty	Purpose of Use
1	Public address set	Microphone, speaker, etc.	1	For public addressing
3	OHP	Halogen lamp, 400W	1	For projection of document

< E. Equipment for Gymnasium >

Code	Name of Equipment	Main Specifications	Q'ty	Purpose of Use
1	Goods for volleyball	Supporting rods, net	2	For physical training
2	Goods for basketball	Movable goal post	1	For physical training

(4) Furniture

The standard school furniture is determined by the EDMU/PIU and the World Bank and AfDB have adopted specifications which are based on such standard furniture. This standard range and specifications of school furniture are also adopted for the Project, taking interchangeability with existing furniture and convenience for repair into consideration. Most such furniture is imported from South Africa although local secondary schools with a small number of classrooms (CDSS) sometimes use local products.

The classroom furniture consists of single seat desks and chairs for 40 students, a teacher's desk and chair and a blackboard. Two furniture sizes will be introduced for students to serve the two lower grades and two higher grades in view of the physical growth of the students between these grades. The office furniture includes desks, chairs and cabinets for the principal's office, teachers' room and preparation rooms, etc. Furniture for staff housing is not included in the Project as it should be provided by the Malawi side.

Table 2-38 List of planned furniture

Facilities	Name of Furniture	Specifications	Q'ty
<Demonstration Secondary School>			
Administration	Office Desk	900x700x740mm, wooden	25
	Office Chair	Revolving chair	25
	Folding Table	1800x900x740mm, wooden	3
	Wooden Chair	480x520x450mm, without armrest	12
	Desk for Principal/Vice Principal	1800x900x740mm, wooden	2
	Office Chair	Revolving chair	2
	Sofa	1800x700x700mm, artifitial leather	2
	Arm Chair	700x700x700mm, artifitial leather	2
	Center Table	1200x600x450mm, wooden	2
	Stool	500x500x400mm, artifitial leather	2
	Cabinet	900x450x1200mm, wooden	17
	Stool for waiting	1500x520x540mm, wooden	1
Class Room	Desk for Student	700x450x740mm, wooden	320
	Wooden Chair	480x520x450mm, without armrest	320
	Desk for Teacher	1200x600x740mm, wooden	8
	Wooden Chair	480x520x450mm, without armrest	8
Laboratories (Biology, Science)	Experimental Table	1800x900x800mm, with double sink, water tap, gas cock	16
	Experimental Table for Teacher	1800x900x800mm, with single sink, water tap, gas cock	2
	Stool	400x400x700mm, wooden	82
	Cabinet	1200x450x1800mm, wooden	2
	Cabinet	900x450x1800mm, wooden	6
	Side Experimental Table	3000x600x800mm, with single sink, water tap, gas cock	9
	Draft Chanbaer	1200x1250x750mm, with water tap, gas cock	2
Home Economics Craft Workshop	Experimental Table	1800x900x800mm, with double sink, water tap, gas cock	6
	Experimental Table for Teacher	1800x900x800mm, with single sink, water tap, gas cock	1
	Stool	400x400x700mm, wooden	31
	Cabinet	1200x450x1800mm, wooden	2
	Cabinet	900x450x1800mm, wooden	6
	Side Experimental Table	3000x600x800mm, with single sink, water tap, gas cock	8
	Experimental Table	1800x900x800mm, wooden	8
	Experimental Table for Teacher	1800x900x800mm, wooden	1
	Stool	400x400x450mm, wooden	41
Library	Library Desk (large)	1800x1000x740mm, wooden	7
	Library Desk (small)	800x600x740mm, wooden	23
	Wooden Chair	480x520x450mm, without armrest	51
	Book Shelf	900x450x1800mm, both sides shelves, wooden	32
	Cabinet	900x450x1800mm, wooden	4
	Reception Counter	600x5000mm, L-shaped, wooden	1
	Office Chair	Revolving chair	2
Multipurpose	Folding Table	1800x600x740mm, wooden	16
	Folding Chair	Steel, artifitial leather	100
<Gymnasium>			
Locker Room	Locker	3,600x450x1800mm, wooden	2

Facilities	Name of Furniture	Specifications	Q'ty
<Female Hostel>			
Study Room	Bed	950x2050x450mm, wooden	120
	Side Desk	750x600x740mm, wooden	120
	Wooden Chair	480x520x450mm, without armrest	120
	Locker	450x900x1800mm, wooden	120
<Computer Room>			
Compute Room	PC Desk	900x900x740mmm, wooden, with cable holes	20
	PC Desk for Teacher	1800x900x740mmm, wooden, with cable holes	1
	Office Chair	Revolving chair	21
Preparation	Cabinet	900x450x1800mm, wooden	4

(5) Procurement Plan

In regard to educational equipment, while general-purpose office equipment, etc. can be procured locally, the import of science equipment, etc. from a third country is assumed because of the absence of local products.

The SEP of the World Bank plans to provide more than 400 items as required equipment, etc. for new secondary schools (320 students) and the main items are listed in the Appendix. The international tender for the planned equipment resulted in only one bidder from Malawi. The other bidders were two UK companies, two South African companies and one Indian company. The local bidder was a section of a company of which the main business is the supply of pharmaceuticals and medical equipment. This company acts as an agent for Philip Harris and Fisher Scientific of the UK. The science equipment used by the DCE is made by Philip Harris of the UK.

In regard to the procurement of furniture, import from South Africa is a common practice if the quantity is large. For example, the SEP of the World Bank imports furniture from South Africa. However, as wooden furniture can be procured in Malawi, the main sources for furniture supply under the Project are planned to be Malawi for wooden furniture and South Africa for mass-produced steel and other types of furniture.

2.3 Basic Design Drawings / Equipment List

(1) Architectural Drawings

1. Site Plan
2. Demonstration Secondary School
- 3-1. Staff Houses
- 3-2. Head Teacher's House
4. Female Hostel
5. Computer Room
6. Gymnasium
7. Water Supply Plan
8. Drainage Plan
9. Electrical Connection Plan

(2) Equipment List

1. Integrated Science
2. Physical Science
3. Biology
4. Home Economics
5. Workshop
6. Administration Block
7. Class Room
8. Library
9. Multi Purpose Hall
10. Female Hostel
11. Computer Room
12. Gymnasium