

**IRRIGATION DEPARTMENT
MINISTRY OF AGRICULTURE AND IRRIGATION
THE REPUBLIC OF THE UNION OF MYANMAR**

GUIDELINES FOR LAND CONSOLIDATION IN MYANMAR

prepared based on

**LESSONS LEARNT FROM A PILOT FARMLAND CONSOLIDATION
PROJECT IN ZABU THIRI TOWNSHIP, NAY PYI TAW CITY**

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**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
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PREFACE

This Guidelines has been prepared based on the lessons learned from a pilot farmland consolidation project implemented under ‘the Preparatory Survey for the Project for Rehabilitation of Irrigation Systems’. The pilot project had been carried out from April 2013 to May 2014 in Zabu Thiri Township, Nay Pyi Taw City, and it covered an area of 338 acre (137 ha) with 138 farmers.

Subjects incorporated in this Guidelines are fully based on the experiences of the pilot farmland consolidation project including a series of stakeholder meeting, consensus building by all the concerned beneficiary farmers on such issues as project implementation, non-substitute plot reallocation, establishment of farmer organization, technical design, construction schedule, construction cost, environmental and social consideration, etc.

Being humble enough for over generalization, experiences in the pilot farmland consolidation project are illustrated as much as possible corresponding to the general description of the subjects to indicate how practically farmland consolidation works are to be put into implementation. Though ideas in this Guidelines should not be over generalized, they are expected to be tools of practical application to further extend farmland consolidation project to places where there is a due need as well as potential.

Primary users of this Guidelines are to be the Government officers concerned, i.e., the officers of the Irrigation Department, Agricultural Mechanization Department, Cooperative Department, Settlement and Land Record Department, and General Administration Office. The readers are expected to utilize this Guidelines in respect of each condition, but also to try out the disciplines asserted throughout the text in practice.

We wish to take this opportunity to express our sincere gratitude to all the stakeholders and also the concerned officers who have well contributed to the implementation of the pilot project. We also wish to express our deep gratitude to the concerned government offices both at the Headquarters as well as at district/township level for the leading role of facilitating the process of the relevant works. We hope this Guidelines will serve as a means of successfully implementing future farmland consolidation projects in Myanmar.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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ACRONYMS AND ABBREVIATIONS

AMD	Agriculture Mechanization Department
CARTC	Central Agriculture Research and Training Centre
CD	Cooperative Department
DAP	Department of Agricultural Planning
DAR	Department of Agriculture Research
DOA	Department of Agriculture
GAO	General Administration Office
DOA	Department of Agriculture
GOJ	Government of Japan
GOM	Government of Myanmar
ID	Irrigation Department
JICA	Japan International Cooperation Agency
JIID	The Japanese Institute of Irrigation and Drainage
MC	Ministry of Cooperatives
MOAI	Ministry of Agriculture and Irrigation
MOF	Ministry of Forestry
MOLF	Ministry of Livestock and Fisheries
PAPs	Project Affected Persons
SLRD	Settlement and Land Records Department
TS	Township (the smallest administrative unit where government institutions are placed)
WRUD	Water Resources Utilization Department
YAU	Yezin Agriculture University

FARMLAND TERMS IN MYANMAR

Le	Paddy land or wet land which can be used as paddy land
Yar	Upland
Kaing	Farmlands which appear in the flood lands in Ayeyarwady River as the water recedes
Kyun	Farmlands which appear on the alluvial sandbars in Ayeyarwady River as the water recedes

UNIT CONVERSION

Rice (1) basket	16 pyi 75 pounds 34.0136 kilograms
Rice (1) pyi	4.6875 pounds 2.1258 kilograms
1 pyi	8 nohzibu
1 basket	16 pyi
1 lb (pound)	0.453 592 kg
1 kilogram	2.205 pounds
1 ton (long ton)	2240 pounds
1 metric ton	1000 kilograms 2204.623 pounds
1 kg	0.6124 viss
1 pond	0.4536 kg
1 kg	2.2046 ponds
1 Gallon	4.5461 litre

1 litre	0.2200 Gallon
1 inch (in.)	2.54 cm
1 feet (ft.)	30.5 cm
1 meter	3.279 feets
1 kilometer	0.621 mile
1 mile	1.601 kilometer
1 acre (ac)	0.40468 ha
1 hectare (ha)	2.471 ac
1 ac-ft	1233.4 cum
1 square kilometer	0.386 sq.mile

CURRENCY EQUIVALENTS (AS AT JUNE 2014)

1 US\$	=	101.68 Japanese Yen (TTB)
1 Kyat	=	0.106 Yen
1 US\$	=	959 Myanmar Kyats
1 lakh	=	100,000 Kyats

MYANMAR FINANCIAL YEAR

April 1 to March 31

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CHAPTER 1 INTRODUCTION TO THE GUIDELINES

1.1 Scope covered by the Guidelines

The Guidelines cover issues of paddy field consolidation in agricultural land consolidation, specifying survey works, planning and designing works, implementation procedure and methods, etc. required for the project preparation of land consolidation. The users for the Guidelines are primarily government officers involved in the land consolidation works; namely, officers in Irrigation Department (ID), Agriculture Mechanization Department (AMD), Settlement and Land Record Department (SLRD), Cooperative Department (CD), and General Administration Office (GAO).

Land consolidation projects comprise comprehensive land re-adjustment works and other land improvement works. The land readjustment works include rearrangement of farmland, so that agriculture mechanization can easily be introduced. Improvements include reshaping of irregularly scattered paddy plots, and land re-plotting. Furthermore, the readjustment works include construction of agricultural infrastructure such as farm road, irrigation canal, and drainage canal, and also securing of necessary land for those facilities provided through the reallocation of land.

Land consolidation projects can thus be defined as integrated and comprehensive agriculture development project covering not only land readjustment works and all other related works in the project areas but also the establishment of irrigation/drainage canals, farm roads, and all associated structures. The Guidelines, therefore, in describing the general principles applicable to land consolidation works, should not bind every individual project uniformly, but should be practically applied to the works in order to meet local requirements.

1.2 Basic Concept of the Guidelines

The main objectives of land consolidation projects are to increase agricultural productivity and to contribute to preserving a favorable rural environment through comprehensive consolidation of agricultural land together with the establishment of agricultural infrastructure. Land consolidation works should therefore be planned in due consideration of the following;

- 1) Land consolidation projects should satisfy forecasted agricultural requirements and allow establishment of effective and rationalized farming with high productivity of land and labor,
- 2) The projects should contribute to the establishment of a favorable rural environment as part of the consolidation works by constructing/upgrading farm roads, irrigation canals, drainage canals, and other relevant facilities, and
- 3) At the same time, the projects should be so planned, designed and implemented as to meet internationally recognized guidelines for environmental and social impact assessment, and this guidelines refers to the 'JICA Guidelines for Environmental and Social Considerations (April 2004)'.

Land consolidation results in rearrangement of farmland, establishment of irrigation and drainage canals, farm road construction, soil improvement in cases, and consolidation of farm plots with the aim of ensuring highly productive conditions for effective mechanized farming and rationalized water management to meet future agricultural requirement. Land consolidation works will thereby improve and consolidate overall farm conditions, including related land-use-right and farmers' interests.

Land consolidation aims at thorough consolidation of farmland conditions including transfer of land-use-right, and therefore once the consolidation works are implemented, further revision or change on the farmlands becomes impossible. Consequently, especially in view of investment, land consolidation works must be well planned and designed in order to provide better long-term changes

in farming conditions. With this, a variety of land consolidation contents should be examined in order to ensure the most effective and rational agricultural condition covering not only short-term but also future long-term development.

1.3 Compensation Principles

Land consolidation will enhance agriculture production by means of uniformly leveled farmlands equipped with agricultural infrastructure such as irrigation and drainage canals and farm roads as aforementioned. However, necessary lands to be occupied by the infrastructure shall be availed out of the farmland presently owned by the beneficiary farmers. It means that the beneficiary farmers shall surrender a part of their farm land, in which no compensation can be made on conditions that the following are met;

- 1) It has been confirmed that the productivity of the project area will increase more than the rate of the area to be discounted to the total area for securing the land necessary for the construction of agricultural infrastructure. Further, the lands shall be reallocated to each landowner with the discount of equal rate less than, in principle, 10% from each of their original areas before the land consolidation.
- 2) The areas to be reallocated to the landowners upon completion of the land consolidation project should be equivalent to the areas they used to own before the land consolidation excluding the area acquired for the agriculture infrastructure construction, e.g. construction of farm roads, irrigation canals and drainage canals.
- 3) Sufficient discussions among the concerned stakeholders including the whole beneficiary farmers on the project implementation have been carried out, and the contents of the project, policy for compensations and supports have been agreed upon among the concerned beneficiary farmers.
- 4) A complaint handling mechanism in order to deal with claims from not only the beneficiary farmers but also nearby inhabitants during and after the implementation period has been established prior to the project commencement.

Upon applying this Guidelines, it has to be confirmed that all the above conditions from 1) to 4) are fulfilled; otherwise, the following compensations or supports against the effects shall be undertaken by the responsible organizations according to the contents of dissatisfaction;

- 1) On the loss of land (jointly contributed land), which is eliminated from the original farmland for the sake of agriculture infrastructure construction, provision of alternative land or compensation with the value for the reacquisition of equivalent land shall be arranged,
- 2) On the land to be lost apart from the ones contributed for the sake of agriculture infrastructure construction, provision of alternative land or compensation with the value for the reacquisition of equivalent land shall be arranged,
- 3) On the loss of income generation opportunity incurred by the temporal seizure of the land for land consolidation work, compensation for the loss of the opportunity and/or supports to livelihood recovery shall be provided, and
- 4) On structures such as houses and trees existing on the land for the project, compensation with the value for the requisition and/or supports for reconstruction in case removing and reconstructing the structures shall be arranged. Note that these measures can be effective only on the structures existent before the cut-off date of the project.

CHAPTER 2 RATIONALE OF LAND CONSOLIDATION PROJECT

2.1 Background

Paddy field was firstly developed in the areas where water was naturally available as a form of swamps or basins fed by local river systems. With the progress of technical improvement of construction works, terrace paddy fields were established around the paddy fields initially developed. Construction of ridge helped keep irrigation water in paddy field for a better plant growth, while topography forced paddy fields in irregular shape and small plot size.

Before the technical development of farmland consolidation, human and/or animal power was the main workforce of farming practices, which used to be applied to irregular and small shaped paddy fields. After the industrial development, demand of food production has increased and new technology was required for efficient use of existing farmlands. Firstly, separation of canal functions into irrigation and drainage came up for effective farmland utilization, and then farm mechanization followed it for the purpose of accelerating farming practices.

Farmland consolidation is a new technology development that ensures high productivity of agriculture, introduction of mechanized farming, and rationalized water utilization. Farmland consolidation consists of several works such as enlargement and rearrangement of farmland plots, improvement/upgrading of irrigation and drainage canals, and farm road construction. The works will therefore result in improving and consolidating overall farm conditions, including related farmland-use-rights.

Furthermore, each and every farm plot will be once accumulated and re-plotted in a rectangular shape by the works; this is why each of the beneficially farmers will have to reallocate their farmland upon mutual agreement among them. Reallocation works of farm plots are very important since farmland is the principal asset for every farmer; their farm plots have to be exchanged and sometimes combined towards achieving highly productive farmland as a whole. Thus, the reallocation plan should be carefully examined, wherein full consensus from all the beneficiaries should be obtained before the commencement of the construction works.

2.2 Experiences in Japan

In the late 19th century, primitive farmland consolidation was executed in Ishikawa prefecture in Japan so as to improve canal function by separating irrigation and drainage with the establishment of rectangular shaped farmlands. At that time, farm mechanization was too early to be introduced. After the Second World War, development of farm machinery gained progress, especially for paddy farming, and thus farm mechanization, coupled with farmland consolidation, was widely introduced in Japan under the national and/or regional farmland development projects.

In 1961, the Agricultural Basic Law was established and the national farmland consolidation project was institutionalized in 1963, which targeted the farmland areas over 3,000 ha. Such projects having less than 3,000 ha were covered by regional project schemes. The farmland consolidation implemented since the late 19th century focused on animal-power plowing and separation of irrigation and drainage functions, while farmland consolidation done in the 1960s and onwards has mainly focused on farm mechanization with larger rectangular plots.

Farm machinery development for paddy farming had started with tractor utilization, replacing hand-tractor use that was quite popular during the initial stage of farm mechanization after the draft-cattle era. After the introduction of farm tractor for plowing works, combine-harvester and transplanting machine were also introduced in Japan, and farmland consolidation materialized the effective use of these newly developed farm machineries all over the country.

This development had assisted not only the increase of work productivity for farming practices, but

also the mobilization of work-labor forces from the agriculture sector to the second and/or the third industry sectors, which then had contributed to and supported the high economic growth in Japan from the 1960s to 1980s. Yet, mobilization of the workforce from agriculture sector resulted in an unforeseen result. Young generation in rural area tried to find their jobs in manufacture and/or service industries flourished in urban areas, and then, successors of agriculture sector had decreased during the same period.

In 1988, new direction on farmland consolidation was institutionalized aiming at a one-hectare farm-plot development instead of previous 0.3 ha (30a) farm plot formation. A large farm plot development project entails an improvement of irrigation and drainage systems and systematic farm management, and it helps increase work productivities and also improves cropping patterns by enabling double and even triple cropping. The establishment of farming business companies has also increased along with the favorable farming conditions taking place.

There were some historical examples of farmland consolidation in Japan. Figure 2.2.1 and Figure 2.2.2 show initial farmland consolidation in Japan, which aimed at improving farming condition suitable for draft cattle and horse plowing. Separation of irrigation canals and drainage canals was mainly conducted during this period, and rectangular farm plot was firstly introduced for the sake of systematic plowing and farming. Many projects were executed in northern parts of Japan, where the areas are well-known for the production of high quality rice today.

Figure 2.2.3 shows an example of farmland consolidation in recent years in Japan, which area is located at Nemoto, Ibaraki prefecture in Japan. Nemoto area once had a farmland consolidation project from 1956 to 1959, undertaking an enlargement of the farmland size from primitive irregular and scattered small plots to 0.2 ha rectangular plots, and irrigation and drainage conditions were also improved. After four decades, agriculture sector in this area faced the aging problem of farmers, malfunction of drainage canals, and high production cost due to still small farm management size.

Under the latest consolidation project, drainage condition was improved and the average farm plot size was enlarged to as big as 1ha or larger. The beneficiary farmers organized a farming cooperative to cultivate over half of the project area (111ha) by renting under-utilized farmlands from aged farmers. They enjoy the scale merit by farmland consolidation, e.g., the unit farming time was reduced to about half of the previous one and the cost of farming per unit area was reduced by about 20% (see Figure 2.2.4). Improved farming condition enabled farmers to cultivate several crops by changing the

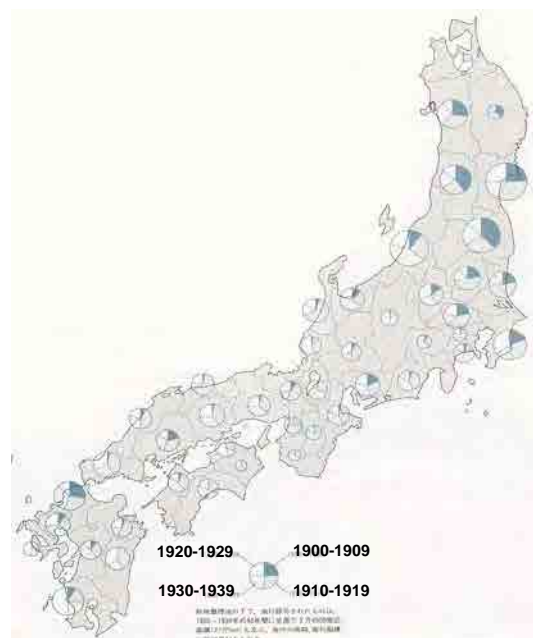


Figure 2.2.1 Farmland Consolidation in 1900 – 1939

Source: Japanese Institute of Irrigation and Drainage (JIID)



Figure 2.2.2 Farming Practice in 1900 – 1939 in Japan

Source: Japanese Institute of Irrigation and Drainage (JIID)

cropping pattern: previously only a single cropping of paddy and now paddy, soybean, and barley.



Figure 2.2.3 Farm Plot Size Enlargement from 0.2ha (left) to over 1ha (right) in Ibaraki, Japan

Source: Nemoto Regional Farmland Consolidation Project, Ibaraki, Japan

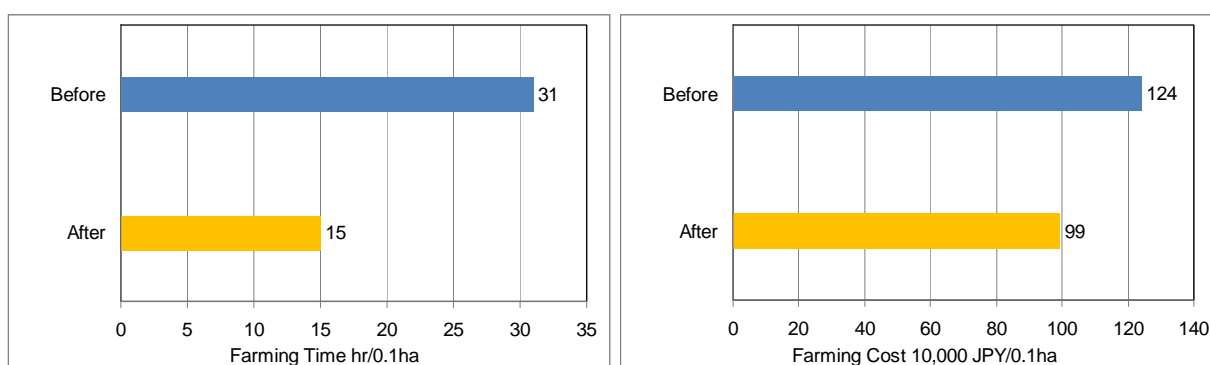


Figure 2.2.4 Decrease of Farming Time and Farming Cost with the Consolidation Project

Source: Nemoto Regional Farmland Consolidation Project, Ibaraki, Japan

2.3 Legal Framework

As aforementioned, farmland consolidation projects were commenced in the late 19th century in Japan, and some legal bases have supported them. Those legal bases consist of the rights indicated below, and following discussions summarize the present condition in Myanmar and also requirements to proceed land consolidation projects further:

- ✓ Existence of beneficiaries' farmland ownership or otherwise the right to use the farmland,
- ✓ Purchase and selling right of the farmland (or right of using the farmland) by beneficiaries,
- ✓ Existence of water users association, and
- ✓ Law and regulation on cooperative activities.

2.3.1 Required Legal Frame

1) Landownership or Farmland-Use-Right

Landownership can ensure the legal title-deed of ownership of the farmland. While creating rectangular-shaped farmland, farmland consolidation involves re-plotting of farmland. If this ownership is uncertain, farmland cannot be reallocated to farmers. In Myanmar, landownership belongs to the government while individual farmers have the farmland-use-right, legally entitled right to use the farmland, and such farmland-use-right was firstly recorded more than a hundred years ago. In Japan, on the other hand, law of landownership was established from the period of 1873 to 1879.

Then, a new farmland law in Myanmar was enacted on March 30, 2012 where a right to use farmland

by farmers was secured. The Chapter III 'Rights of Person who has the Right to Use the Farmland' of the Law stipulates that the person who has the right to use the farmland shall have the following rights; 1) right to have the farmland in possession, right to use the farmland, right to enjoy the benefit which arises from this right; and 2) right to sell, mortgage, lease, exchange and gift the whole or part of the right to use the farmland. There is therefore no obstacle in the legal right concerning the farmland towards implementing land consolidation projects.

2) Purchase and Selling Right

Farmland consolidation often requires a sell-and-buy process in order to adjust small plot by rounding off/up fractions of farmlands. Recent farmland consolidation project in Japan aims at creating 1 ha plots and that of Myanmar targets 1-acre plot (0.4 ha). There should be fractions of farmlands, which are quite less than 1 ha in Japan or 1 acre in Myanmar. Such land can be sold or bought by other farmers through negotiation between the farmers. Without having this purchase and selling right, area adjustment does not proceed as expected.

In Myanmar, the aforementioned Farmland Law enacted on March 30, 2012 secures the farmers to exercise the right to sell, mortgage, lease, exchange and gift the whole or part of the farmland use right. With this provision enacted, farmers in Myanmar are now entitled to sell or purchase their right to use the farmland whereby area adjustment associated with land consolidation can be arranged. In Japan, on the other hand, buying-and-selling right was legalized in the period of 1873 to 1879 when the law of land ownership was established.

3) Water Users Association

Since farmland consolidation aims at developing irrigated farming with an effective use of farmland, the establishment of irrigation/drainage system in the project area is necessary. The operation and maintenance of irrigation systems require cooperative works such as dredging and re-sectioning of canals, and therefore an organization shall be established to undertake such tasks as a water users association. Furthermore, given legal status, the association can possess common properties such as farm roads, and irrigation and drainage canals. In Japan, the Law of Water User's Association was established in 1908, soon after the establishment of the law of land ownership right.

In Myanmar, this area is still behind as compared to other countries. No water users association has been established in the irrigation systems under the Irrigation Department. It is noted that Water Resources Utilization Department has established water users groups in charge of collecting pump operation fee only for the pump irrigation systems. However, this group is not composed of all the beneficiary farmers, nor legally entitled, but only of farmer representative and government officers. It means that this water users group cannot be comparable with the water users association discussed here. It is therefore advised for the Myanmar government to take necessary actions in this area.

4) Law and Regulation on Cooperative Activities

In Myanmar, no water users association has been established as above-mentioned, nor has any legal framework been established providing necessary legal status to such organization. Therefore, farmers in the pilot project area implemented in 2013-2014 under a JICA assistance have established farmer organization and obtained legal status under the 'Co-operative Society Law, 1992'¹ only as an available option. In Japan, on the other hand, water users association is established under respective

¹ In Myanmar, as of May 2014, the Co-operative Society Law is the only legal framework in establishing farmer organization. In some countries e.g. Japan, there are legally entitled 2 kinds of organization; cooperative union and water users association. The former undertakes all sort of agriculture improvement activities while the latter's activities center on the O&M and management of irrigation facilities including land consolidation project.

legal framework, different from those of cooperatives.

Therefore, it is recommended that the Myanmar government should embark on this area in that necessary legal framework concerning water users association should be prepared for and enacted, and accordingly respective association should be established. Such legally entitled association should be in charge of dealing with not only irrigation development/ rehabilitation projects but also land consolidation projects.

2.3.2 Future Directions and Future Prospection

Taking into account some experiences on farmland consolidation in Japan as well as above discussions, table below summarizes required legal frameworks linked with the current government direction and future prospect in Myanmar. Many of the necessary legal frameworks concerning land use right have been prepared by the Settlement and Land Record Department (SLRD), and enacted as ‘The Farmland Law (March 30, 2013)’, while necessary actions with respect to farmers association should come in at an earliest time:

Table 2.3.1 Required Legal Framework and Current Direction/Future Prospect

No.	Legal Framework Required	Current Direction and Future Prospect in Myanmar
1	Existence of beneficiaries' land ownership (farmland-use-right in Myanmar)	<ul style="list-style-type: none"> ✓ SLRD under MOAI is now preparing for and delivering a farmland-use-right certificate to farmers. ✓ It certifies the right to use the present farmland. ✓ Investigation and confirmation of the present farmland-use-right is a very difficult task since it has not been updated approximately for the last 30 years. ✓ It will be extended to the whole country.
2	Purchase and selling right of land (right to use the farmland in Myanmar) by beneficiaries	<ul style="list-style-type: none"> ✓ SLRD under MOAI is now preparing for and delivering a farmland-use-right certificate to farmers, which indicates that the farmland owner can sell and buy the right to use farmland. ✓ It certifies the selling and buying land-use-right of the farmland. ✓ Investigation and confirmation of the present farmland-use-right is a very difficult task since it has not been updated approximately for the last 30 years. ✓ It will be extended to the whole country.
3	Existence of water users association	<ul style="list-style-type: none"> ✓ In Myanmar, there has not been legalized water users association to date. ✓ It is however recommended that water users association should be established under the auspices of ID/WRUD with newly arranged legal status deferent from those provisioned in the cooperative law. ✓ With a legal status, such association can own farm road and irrigation/ drainage canals, which are no longer under ID, as common properties. ✓ Given the legal status, the water users association can request rehabilitation of agricultural facilities to the ID by utilizing government budget.
4	Law and regulation on cooperative activities	<ul style="list-style-type: none"> ✓ Cooperative Department is willing to establish and expand cooperative groups in the whole country. ✓ Yet, the Cooperative Department considers that irrigation management may be out of their scope. ✓ ID plans to establish water users association for the purpose of collecting irrigation fees from the beneficiaries, yet still under discussion only. ✓ In future, it is therefore recommended that water users association which is in charge of not only collectively managing irrigation activities but also responsible for respective land consolidation activities shall be established with legal status.

Source: JICA Survey Team based on experiences conducted in Japan

CHAPTER 3 CONSENSUS BUILDING FOR LAND CONSOLIDATION

3.1 Implementation Structure

To implement farmland consolidation works in Myanmar, ID (Irrigation Department), SLRD (Settlement and Land Record Department), AMD (Agriculture Mechanization Department) and DOA (Department of Agriculture) which are under MOAI, and GAO (General Administration Office), CD (Cooperative Department) and also the Management Committee of Farmers Organization concerned should be involved as the project implementer, facilitator for establishment of farmer organization, the office in charge of registering the farmer organization, the office in registering farmland-use-right, etc. The relationship among the organizations is shown in Figure 3.1.1 with the farmer organization at the center, and major responsibilities by each organization are summarized below:

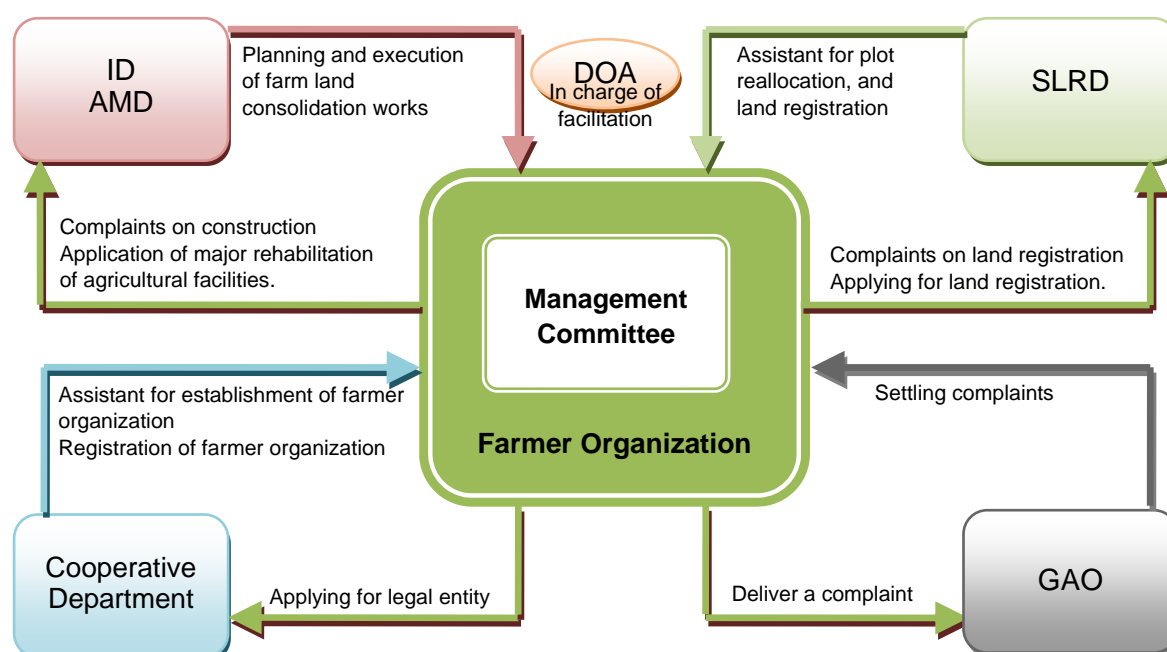


Figure 3.1.1 Implementation Structure of Land Consolidation Project

Source: JICA Survey Team, 2014

- 1) ID (Irrigation Department): Planning and designing of farm land consolidation project together with AMD, and execution of farmland consolidation works for the parts of farm roads, irrigation and drainage canals,
- 2) AMD (Agriculture Mechanization Department): Planning and designing of farm land consolidation project together with ID, and land leveling by using farm machineries (in general, tractors 70HP and 90HP), making plot boundary levees within one-acre standard plot, and first-time harrowing and ploughing for the preparation of cultivation,
- 3) SLRD (Settlement and Land Record Department): Assistance to farmer origination to establish farm plot reallocation plan, conduct of the farmland area survey upon completion of consolidation works, and issuing of registration for the right of cultivating farmland.
- 4) DOA (Department of Agriculture): Facilitation and coordination in respective necessary tasks which have to be done between beneficiaries and concerned government departments,
- 5) CD (Cooperative Department): Assistance to farmers in establishing farmer organization, acceptance of application of registration and issuing of the registration certificate,
- 6) GAO (General Administration Office): Responsible office for coordination between farmer organization and concerned government departments, and consultation to solve complaints/ grievances from concerned farmers, and

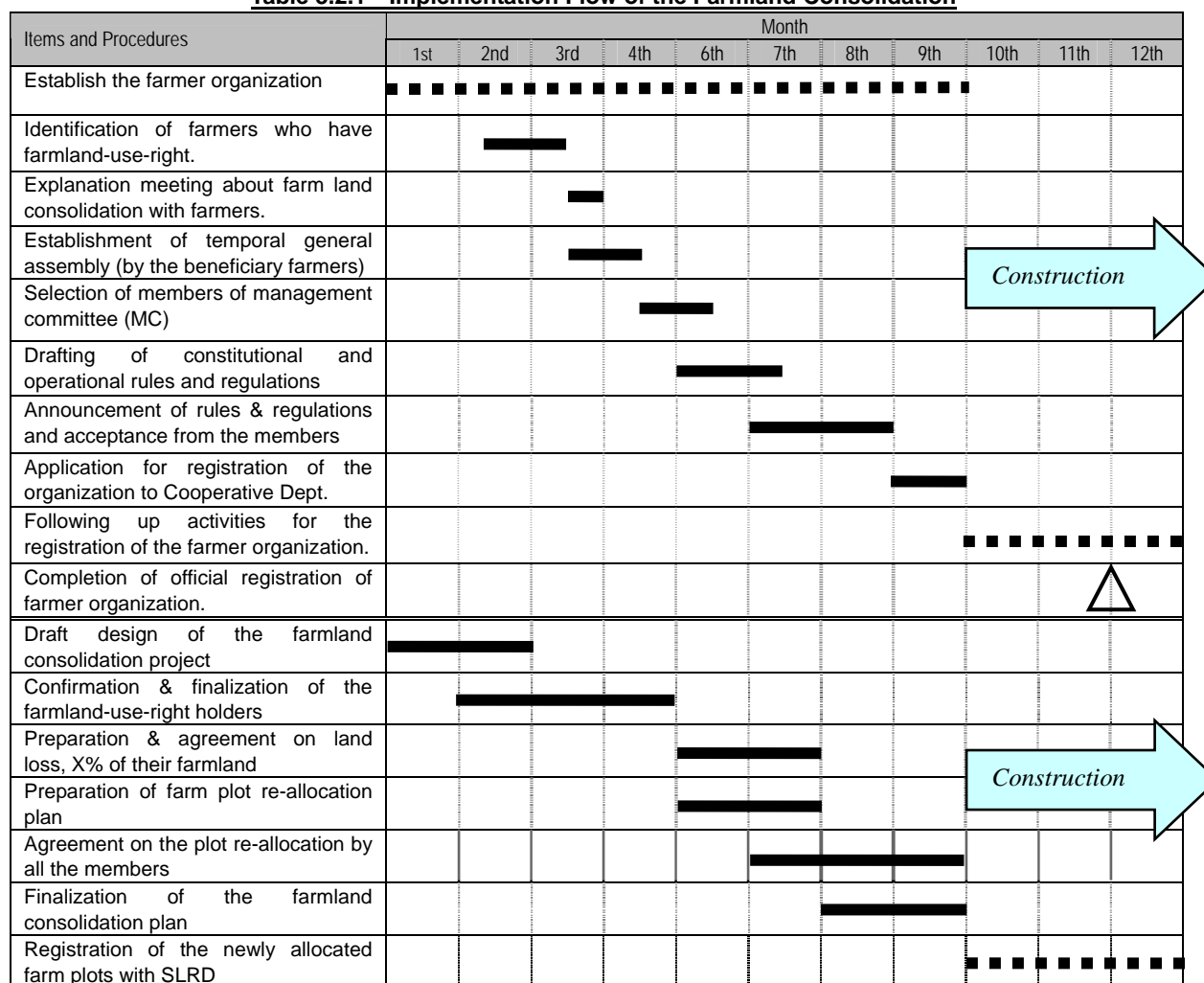
7) Management Committee: Responsible body established under the farmer organization in coordinating and negotiating respective issues with each of the government organizations noted in above 1) to 4).

Upon completion of the farm land consolidation works, farmer organization established will take responsibility of daily O&M of farm road, and irrigation and drainage canals. Furthermore, if a farmer or organization itself has complaints/ grievances, the management committee under the farmer organization takes the responsibility to solve them. If the committee cannot solve the complaints/ grievances, the committee will deliver the claim to the respective government offices.

3.2 Implementation Flow

A typical work flow of farmland consolidation is presented below, which is mainly composed of 2 parts: 1) establishment of farmer organization, and 2) designing of farmland consolidation project, including plot re-allocation arrangement. Since the farmer organization should be in charge of obtaining consensus and agreement from the colleague farmer members on the consolidation project, the organization needs to be established fairly before the commencement of the physical construction works by securing enough lead time.

Table 3.2.1 Implementation Flow of the Farmland Consolidation



Source: JICA Survey Team based on an experience from a pilot consolidation project supported by JICA (2013-2014)

With referring to the example of a pilot farmland consolidation project carried out under a JICA assisted pilot program in 2013-2014, approximately nine months should be allocated for settling all the preparatory works required before the commencement of the construction works including engineering

design of the project, estimation of and agreement on the loss of farmland for the construction of farm road and canals, establishment of plot re-allocation plan, and agreement thereon, and the establishment of the farmer organization. Note that updating of the farmland-use-right, i.e. identifying the current rightful cultivator, may need much longer time than primarily estimated since such updating has not been made for decades.

It is pointed out that till the time all the concerned farmers have agreed upon the plot re-allocation plan, no construction work shall be commenced. However, such arrangement, obtaining prior agreement, has not been made in the past projects in the country, and the backward measure gave a lot of burden to the SLRD for the land registration. For upcoming consolidation projects, therefore, the agreement should be reached unanimously prior to the commencement of the construction works.

Figure 3.2.1 shows the flow of the major activities applied under a typical farmland consolidation project in corresponding to the implementation schedule indicated in Table 3.2.1. As aforementioned, major activities pertaining to the beneficiary farmers are to be conducted and tackled by the farmer themselves, meaning by the farmer organization established fairly before the commencement of physical construction. There should be at least four times general assembly, or general stakeholder, meetings where all the concerned farmers together with government officials are to attend prior to the commencement of the construction.

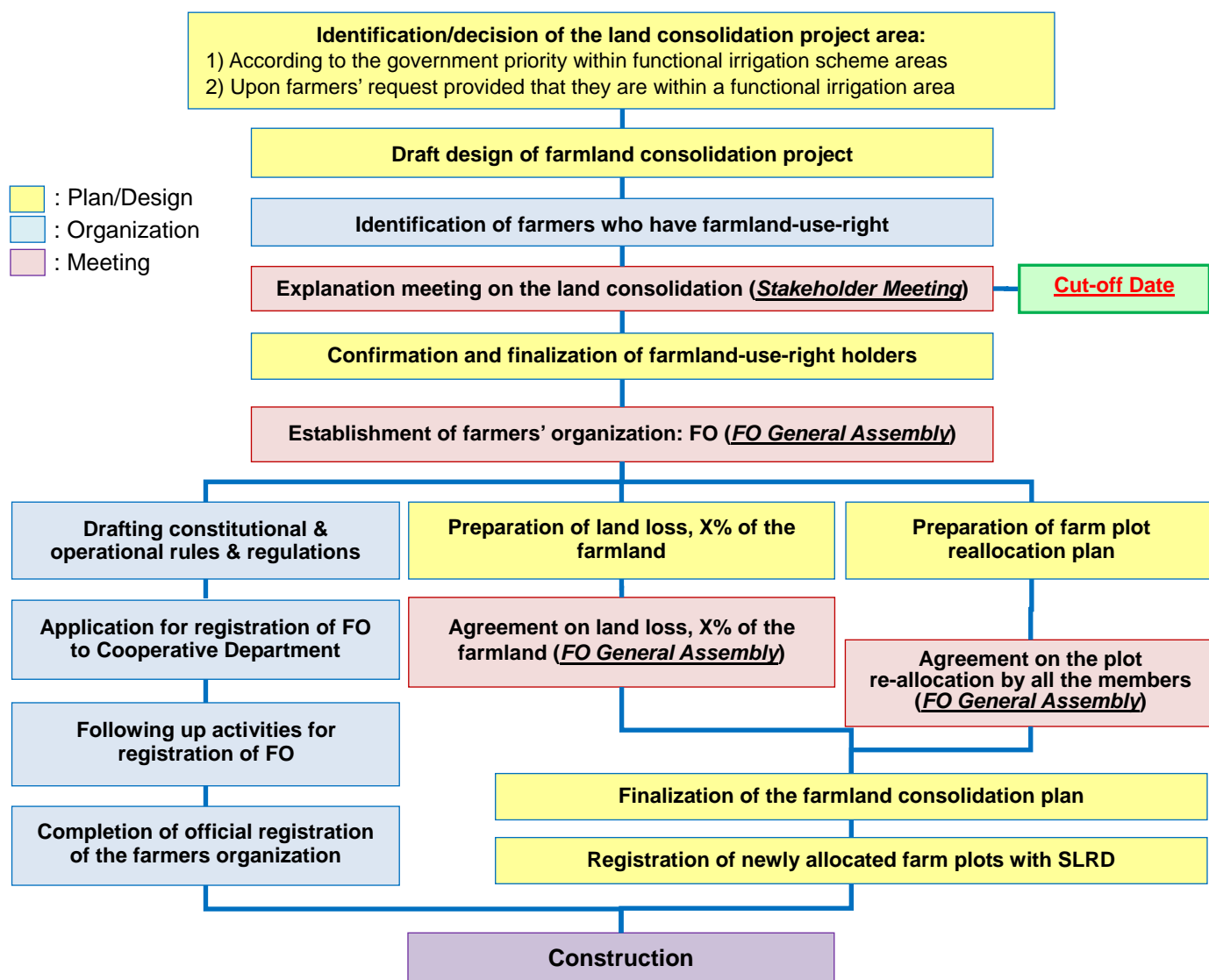


Figure 3.2.1 Implementation Flow of Land Consolidation Project

Source: JICA Survey Team, 2014

3.3 Confirmation of Farmland-Use-Right Holders

To confirm all the farmland-use-right holders in a project area, the beneficiary farmers of the project, is a quite important pre-requisite to proceed to the following steps. The right of using farm land is stipulated by a law, “the Farm Land Law, March 2012”. SLRD under MOAI is in charge of enforcing the law and keeps records for the land use. Every SLRD township office has a list showing the name of farmland-use-right holder, acreage of each plot, block number and plot number with a cadastral map. Based on the record, beneficiary farmers and also the farmland they own can be identified (see Box 3.1 as an example). To refer to the registration record, however, some attention should be paid as noted below:

- ✓ Farm plot owners which are mentioned in the registration list are sometimes different from the present cultivator. When there is a change in farmland-use-right holder, the original farmer shall submit an application of changing owner of the farmland-use-right to SLRD. When the SLRD receives the application, the staff in charge shall update the farm plot registration record. However, the farm plot registration book has seldom been updated almost more than 20 years, showing still the old right holder’s name.
- ✓ Address and contact number of farmland-use-right holders are not indicated in the record, accordingly which village they live in is not known. Though most of the farmers live in nearby villages from the project site, some farmers may live in a far place, or town, city, etc. This situation makes difficult to contact respective beneficiary farmers, whereby it takes much time to obtain agreement on the project implementation, non-substitute re-plotting wherein they shall surrender a part of their land for the construction of, e.g., irrigation canal, and rearrangement of newly allocated plots.

In case that the right holder is not updated, SLRD shall communicate both the old right holder and the present cultivator preferably including the village chairperson, and shall update the record accordingly. Further, through the process of implementing the project, there is a series of meetings which are usually arranged through village representatives, e.g., village chairperson. Likewise, follow-up meetings are usually held at the village level. With a help of the concerned village chairpersons and village leaders, the list of the right holders’ registration shall be rearranged according to the village where they live (see an example shown below).

Box 3.1: Example of Identifying the Farms and Farmers

For a pilot farmland consolidation project implemented in 2013-2014 JICA team checked the number of farmers and each acreage of the farmlands based on the registration records kept by SLRD Zabu Thiri Township Office, Nay Pyi Taw Council Region. The SLRD record indicated total 153 farmers with a total farmland area of 346 acre within the target project area as below:

Title	Number of beneficiably
Number of beneficiaries	153 farmers
Total farm plot acreage	346 acre (140ha)



Box 3.2: Example of Updating the Right Holders

In fact, it took five months for a pilot consolidation project carried out in 2013-2014 to complete the updating and rearrangement of the registration. There were lot number of farmers not yet updated according to the present status, and also it took time to locate absentee farmers who live in far places, and so did to explain the project and obtain his/her consent on the project implementation. Village chairperson was the best informant to solve this issue. Under the pilot consolidation project, the SLRD has renewed the certificate of farmland-use- right for all the farmers concerned upon completion of the update.

Table 3.3.1 Example of Rearranged Right Holders' List

No.	Village Tract	Village	Name	Farmland Owned						Total Area
				Farmland 1			Farmland 2			
				Block	Plot	Acre	Block	Plot	Acre	
1	XXX	xx	ZZZZ	1654	23	0.38	1654	24	3.97	5.35
2				1654	28	2.71				
3	zz	ZZZ	YYY	1660	18/2	2.1	1654	25	1.02	3.12
4										
5										
6				1660	56/2	1.67				1.67
7										

3.4 First Stakeholder Meeting: Introduction of the Project

With preliminary design of a land consolidation project completed, there should be a participatory stakeholder meeting where all the concerned parties should be invited; namely, the potential beneficiary farmers, and officers from ID, SLRD, DOA, AMD, Cooperative Department, and General Administration Office. This participatory meeting is the first opportunity to officially inform the project to the respective beneficiary farmers. The date of this first meeting should therefore be the CUT-OFF date of the project, which is set to protect any fraudulent claims for the project implementation.

It is noted that this first stakeholder meeting shall be convened upon completion of the preliminary design as well as preliminary identification of the beneficiary farmers. It shall not wait till the time all the beneficiaries have been duly confirmed. This is because finalization of the beneficiaries needs much longer time due to the farmland-use-right registration record rarely updated more than 20 years, absentee farmers whose whereabouts is not known, etc. Therefore, with reference to the available registration record and collaboration from the respective village chairpersons who know the farmers cultivating the area, potential beneficiary farmers whoever is thought so shall be convened to this first stakeholder meeting while continuing the finalization of the due beneficiaries.

At this first stakeholder meeting, officers from AMD and ID should explain the project including the rationale, objective, benefits accrued, preliminary design of the land consolidation, content of the construction works, construction schedule, role and duties of the beneficiary farmers including the establishment of farmer organization, etc. Three major points are

Box 3.3: An Example of the First Stakeholder Meeting

At the pilot farmland consolidation project carried out in 2013-2014 near Nay Pay Taw, first farmer meeting, the stakeholder meeting, was held on 20th July 2013 for the purpose of explaining the project objective and contents of the land consolidation works.

Total 83 farmers participated while the rest 55 farmers were absent at the meeting. However, follow-up house-to-house visit and a series of small group meetings at village level had finally covered all the concerned 138 farmers within 2 weeks, and they all have given agreement on the project implementation.

Date	20 th , Jul, 2013 (Sat)
Objectives	To understand the project objective, To know the contents of the consolidation works, and To obtain agreement on the project implementation.
Place	Monastery in Shar Taw Village
Participant	83 farmers ID: Township Officer, Zabu Thiri Township DOA District Officer SLRD, Township officer, Zabu Thiri Township Cooperative Department, Regional officer JICA Survey Team



Left: participant farmers to the stakeholder meeting where ID and SLRD officers explain the project. Right: a farmer has agreed the project implementation, and is giving his signature.

exampled below:

- ✓ What and how will be changed by farmland consolidation project?
The works accompany rearrangement and consolidation of farmland plots, improvement/upgrading or new construction of irrigation and drainage canals, and construction of farm road. It should also be explained that there should be a part of farmland they should lose without compensation, so-called non-substitute re-plotting, for the construction of irrigation/drainage canals and farm road, and the construction will not start until all the concerned beneficiary farmers have agreed upon the project.
- ✓ Why farmland consolidation is necessary?
Given the present condition, many farmers are dependent on animal power and manual labor for their farm work and can hardly manage irrigation water according to the crop requirement. With farmland consolidation project implemented where farm road and irrigation/drainage canals are to be established, farmers can easily and effectively introduce agriculture machinery and control irrigation water, whereby the crop yields will be increased more than that of present condition.
- ✓ Why farmer organization needs to be established?
Coordination in farm plot reallocation is essential for farm land consolidation and farmers themselves have to take charge of daily management and operation of farm road, irrigation canal, and drainage canals. Farmer organization on behalf of individual farmers will take the responsibility of these tasks. Farmer organization will be officially registered with the Cooperative Department; therefore the organization with legal entity can apply government assistances for the maintenance of farm road, irrigation and drainage canals as need arises.

All the concerned farmers are supposed to attend the stakeholder meeting since the project affects the present status of farmlands in terms of shape, location, and also the area acreage, for which a part of the farmland shall be sacrificed without compensation due to the construction of farm road, and irrigation and drainage canals. However, some farmers may not be able to participate in the meeting due to some reasons. Thus, additional explanation meetings should be held for such absentee farmers, which can be organized at the respective village level.

Assistances and coordination from the concerned government offices as well as beneficiary farmers in preparing and holding the stakeholder meeting are very much required. For example, AMD/ID should inform the meeting to the respective administrative body, e.g. township General Administration Office, SLRD and DOA, and respective village representatives, e.g. village chairperson, 10 HHs leaders¹ and alike. AMD/ID should organize the additional explanation meetings in their villages for those who had not attended the stakeholder meeting.

Table 3.4.1 can be used for the registration of the participant farmers and also to obtain agreement on the implementation of the land consolidation project. After having understood the contents of project, they are asked one by one if they agree on the implementation of the land consolidation project. If they agree, they can put a circle on the symbol “√”. There may be some farmers who do not agree or otherwise reserve the decision at this moment (see examples in Box 3.4).

Table 3.4.1 Example of Attendant List for Stakeholder Meeting and Agreement

No	Village Tract	Village	Farmer Name	Acreage	Agreement		Signature of Agreement
1					√	X	
2					√	X	

¹ In Myanmar, there is village chairperson as the representative designated at the level of village, the smallest administrative unit. Aside from the chairperson, a representative is nominated among 10 households as well as among 100 households. They are called 10 households leader and 100 households leader respectively.

No	Village Tract	Village	Farmer Name	Acreage	Agreement		Signature of Agreement
3					√	X	
4					√	X	
5					√	X	
6					√	X	
7					√	X	

In most cases, difficulty for those farmers to agree may be concerned with; 1) surrender of a part of their farmland for the non-substitute re-plotting, and 2) location of newly allocated farm plot after consolidation works. For the first issue, non-substitute re-plotting wherein the beneficiaries shall surrender a part of their farmlands, though the final ratio of the land to be surrendered may not be available at this stage, it can be said to be a range of 5% to maximum 10% of the currently owned area acreage. In any case, no more than 10% sacrifice will be applied or project design shall be changed e.g. reducing the width of farm road, bank width of irrigation canals, etc., so that the ratio can be kept less than 10%. At the same time, it can be explained that there will be crop yield increase more than that once produced out of the land to be lost according to experiences already implemented (refer to later section).

For the second issue, location of newly allocated farm plot, respective concerned farmers shall discuss and negotiate each other preferably at the presence of management committee of the farmer organization to be established. The basic point is that the one who can settle his/her claim pertaining to the location of new farm plot is the colleague farmer. Therefore, there has to be some compromise which in fact applies to the both farmers, colleague farmers each other.

It shall also be explained that there will be four opportunities including this stakeholder meeting where the farmers should express their opinions whether they agree/accept or not; namely,

- 1) the stakeholder meeting (this meeting) where they express the opinion on the project implementation,
- 2) meeting for establishing a farmer organization including the management committee to be in charge of soliciting agreement/consensus from member farmers on the respective issues, and of operation and maintenance for the facilities to be constructed such as farm road, irrigation and drainage canals,
- 3) meeting for agreement on the non-substitute re-plotting for which the farmers have to surrender a part of their farmlands for the purpose of construction of farm road, and irrigation and drainage canals, and
- 4) meeting for agreement on the farm plot reallocation arrangement.

In each of the three opportunities, they have the right to express their opinion and the project thus proceeds step by step upon each of the agreements unanimously by all the concerned farmers. In fact, there may be some farmers who can hardly be convinced for the project implementation. In this case,

Box 3.4: Examples of Farmer Claims

In the pilot farmland consolidation project carried out in 2013-2014 near Nay Pay Taw, there were mainly three difficulties raised by concerned farmers.

For the first issue, there were farmers located at the most upstream part of the project area where they were able to carry out irrigated agriculture taking irrigation water from a canal running beside though it was unofficial. Since they were enjoying irrigated agriculture, they were reluctant to accept the land consolidation project. Through repeated negotiations, they finally agreed on and accepted the project.

Second, during the final confirmation of the farm plots, some farmers started expressing another plot to be allocated for him/her despite the fact that they had once already agreed on the re-plotting plan before the commencement of the construction. In this case, concerned farmers were requested to amicably settle the issue at the presence of SLRD officers and management committee members of the farmer organization.

For the third issue, there was one house established after the project had been announced, namely, after the CUT-OFF date. This case was beyond what the beneficiary farmers could settle mutually, and therefore forwarded to the township General Administration Office. Then, the owner had finally agreed to remove the house for the sake of the collective benefit accrued from the project.

not only the concerned government officers but also his/her colleague farmers shall try to convince such farmers for the sake of collective benefit; till then no further step shall proceed.

3.5 Establishing Farmer Organization: Second Stakeholder Meeting

Farmers are to be convened once again for the purpose of establishing a farmer organization. Main support from the respective government offices to the farmers should be to facilitate them to form the farmer organization by themselves. This organization is meant to not only undertake the O&M of facilities such as farm road and canals but also play a central role of obtaining consensus from all the farmers for the consolidation project. Difficult part pertaining to the land consolidation is concerned mainly with 2 issues; namely, 1) consensus building on surrendering a part of their farmland (non-substitute re-plotting), and 2) agreement on farmland re-plotting.

With the consolidation work implemented, farmers are to lose a part of their farmland for the sake of construction of farm road and irrigation/ drainage canals, share of which ranges from 5 – 10 % in most cases. The farmers are also meant to move their original farm plots to a newly arranged area in many cases. If a farmer has 2 – 3 plots apart each other within the consolidation area, it is better to collect all the pieces of plot into one merged area. In fact, it takes time to obtain such agreement on this loss of a part of farmland and also on the arrangement of plot re-allocation from all the concerned farmers.

For any upcoming land consolidation projects, these agreements should be reached unanimously prior to the commencement of the consolidation works. Then, the farmer organization, or precisely the management committee, shall be in charge of obtaining the agreements from all the farmers supported by SLRD, ID/AMD and Cooperative Department. This is because the farmer themselves know the best of their colleague farmers. Government officers should play a role of facilitating them to form the organization as well as supporting the process of obtaining the agreements by farmer themselves.

During the first stakeholder meeting with all the concerned farmers, ID and AMD are to thoroughly explain why land consolidation project should be introduced to their area and then can briefly explain why farmer organization should be established in relation to the project implementation. Following up the explanation made during the first stakeholder meeting, the Cooperative Department shall now thoroughly explain the purpose, advantages and benefits of establishing the farmer organization and the way of how to register to be a legal entity during this second stakeholder meeting.

After the farmers have learned the project and the roles of farmer organization, next step is to let them select the members of management committee of the farmer organization. Note that at least one or two farmers from each of the villages concerned should be included to represent his/her village. Duties and responsibilities of the management committee should be explained to and shared by all the attendees. Name list of the committee members, allocation of respective positions to the members, and explanation on the responsibilities by position should be shared among the participants.

3.5.1 Structure of Farmer Organization

The basic structure of the organization can be as follows, and the establishment should be supported by ID/AMD and the Cooperative Department. The highest organ in the organization is the general assembly, which shall be composed of all the member farmers concerned. This is the supreme organ in the organization especially vested in the decision making power. All the plans shall be forwarded to the general assembly and the decision shall be made in this assembly, meaning all the important decision, like agreement on the plot re-allocation, shall be made by all the members themselves.

Under the general assembly, there should be the management committee. The members of the management committee shall, of course, be selected by the general assembly as aforementioned by all the participants to the first farmer meeting. The members of the committee can be composed of; 1)

chairperson, 2) secretary, 3) auditors, and 4) members coming from all the concerned villages for the land consolidation project. It should be noted that all the concerned villages should send at least one – two members to the management committee, meaning that all the villages can be represented at the level of management committee.

In above regard, the management committee is therefore in charge of execution or day-to-day management of the issues decided by the general assembly. Further, under land consolidation project, there should be 3 special roles vested in the committee; namely, 1) obtaining consensus from all the famers on the loss of a part of their farmland, 2) planning of the plot re-allocation and obtaining agreement on the plan from all the farmers, and 3) acceptance and mediation of grievances arising through the process from the member farmers. SLRD shall assist the management committee to obtain the consensus/ agreement while the General Administration Office should assist the committee when they are to solve problems.

The management committee should, thus, be the one discharging the central role in obtaining the agreements from all the famers on the issues of losing a part of their farmland and the plan of plot reallocation. The committee shall also be in charge of mediating relevant farmers who insist specific location for their plots over the same area each other. In addition, the committee should fix the price per acre to be prepared for the cases in that farmers owning small pieces of land hope to sell them to other farmers in the process of finalizing the plot reallocation. This fixing price can be applied only during the consensus making on the plot reallocation, but not at a later stage after the consolidation works have been completed.

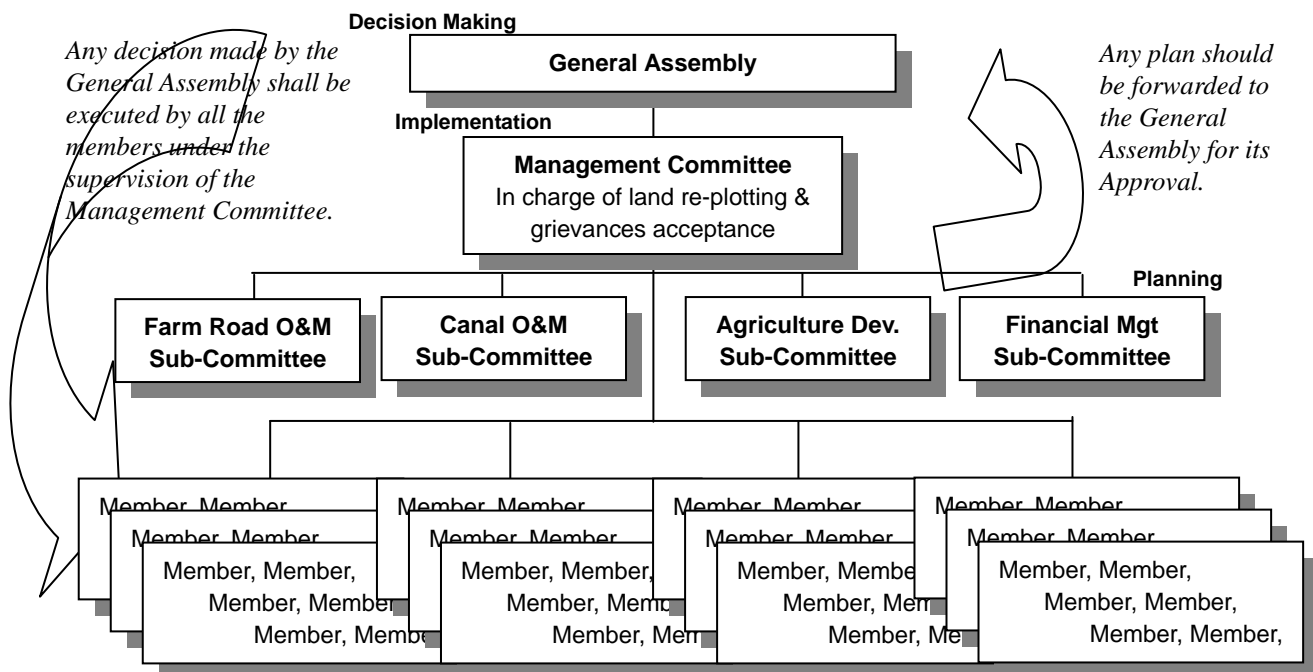


Figure 3.5.1 Internal Organizational Set-up for the Farmer Organization

Source JICA Survey Team, 2014

The farmer organization, upon consensus by the general assembly, can form some sub-committees in charge of planning composed of volunteer farmers or elected persons within the organization, usually placed under the management committee as a line structure. These sub-committees can be led by the members of the management committee. The basic role of the sub-committees is to prepare for a plan e.g. maintenance schedule of farm road and canals, bulk purchase of farm input, collection of some fund required for maintenance, etc., and forward such plans to the general assembly for the decision making.

3.5.2 Registration of Farmer Organization

In Myanmar as of May 2014, legally entitled farmers organization can only be the ‘primary cooperative society (or their association as syndicate or union)’ registered with the Cooperative Department². Therefore, to register a farmer organization as legal entity in Myanmar, one possible option, or the only realistic option at this moment, for farmers organization to obtain a legal status is to register it as a primary cooperative society (hereinafter referred to simply as farmer organization).

In fact, there are differences between cooperative society and such organization in charge of managing irrigation facilities as well as dealing with land consolidation. Cooperative society, by its nature, can be formed of common interest basis ‘voluntarily’ while the latter’s membership is a ‘must’ though formed on basis of common interest, which is in this case land consolidation. In this regard, it is recommended that relevant legal framework for the latter organization, e.g. water users association, be prepared and enacted, and accordingly rightful organization can be established in undertaking land consolidation and also irrigation development/ rehabilitation.

By obtaining legal entity, there are advantages accrued for the farmer organization, e.g., access to agricultural loans as organization, procurement of agricultural machineries by installment, etc. There is one more advantage with the legal right. As expected, there will be agricultural infrastructure within the consolidation project area such as farm road and irrigation/drainage canals. The infrastructure, upon completion of the consolidation works, shall be registered as collective property of the organization, not belonging to individual farmer. Such common property owned by a legal entity can receive government support upon request, e.g. rehabilitation of farm road, irrigation canal, etc., provided that such work goes beyond the capacity of the farmer organization.

The principle in terms of operation, maintenance and rehabilitation is that as far as the farmer organization can manage the required works, they should undertake the works collectively by themselves. Collective actions by the organization should at first be sought in carrying out such works. Of course, the organization can anytime request technical assistances from the respective government offices such as ID and/or AMD. Then, when the required works fall beyond the organization’s capacity, for example in financial terms, the legally established organization can have an opportunity of receiving the government supports.

There are preparation steps to register the organization as a legal entity, and it takes time if the management committee members try on their own. Assistances from the Cooperative Department should be given in the registration process. For example, a responsible officer from the township office should assist the management committee in preparing for necessary documents for the registration such as documenting brief history of the organization, purpose and roles of the organization, biographies of the member representatives, etc. It may take about two months for successful registration as legal entity; preparation in the first month and waiting for the approval from the headquarters of Cooperative Department in the second month.

3.6 Establishment of Farm Plot Reallocation Plan

3.6.1 Agreement on the Loss of Farmland: Third Stakeholder Meeting

Before the commencement of consolidation works, farm plot reallocation plan should be established and agreed by all the concerned farmers. To prepare for the plot reallocation plan, ID shall provide information to the management committee about the acreages to be occupied by new farm road,

² In fact, Water Resources Utilization Department (WRUD) under MOAI has established water users group mainly for the purpose of collecting irrigation service fee for pumping irrigation schemes; however, this organization can not be legalized yet due to lack of relevant law. The water users group as of now can only be established according to the WRUD’s internal regulation.

irrigation canals and drainage canals to be constructed under the farmland consolidation works. Given this acreages, the management committee shall estimate how much percentage of the members' farm lands should be surrendered as exemplified below:

- ✓ Total farmland area identified by registration record: 1,000 acres
- ✓ Land occupied by farm road(s) 23 acres
- ✓ Land occupied by irrigation canal(s) and drainage canal(s) 43 acres
- ✓ Land occupied by ancillary facilities, e.g., weirs, drops, etc. 1 acres
- ✓ Percentage of land to be lost: $(23+43+1) / 1,000 = 6.7\%$

To make the farmers easily understand why such land loss should be required with the land consolidation works, an example showing an overview of before- and after-project can be presented to the farmers (see Figure 3.6.1). Before farm land consolidation project is commenced, there are no farm road, irrigation canal and drainage canal in almost all the current farmlands. After the implementation of farmland consolidation, however, new agricultural infrastructure such as farm road, irrigation canal and drainage canal will show up. To construct such infrastructure, thus, each farmer has to lose his/her equal share of their farmlands.

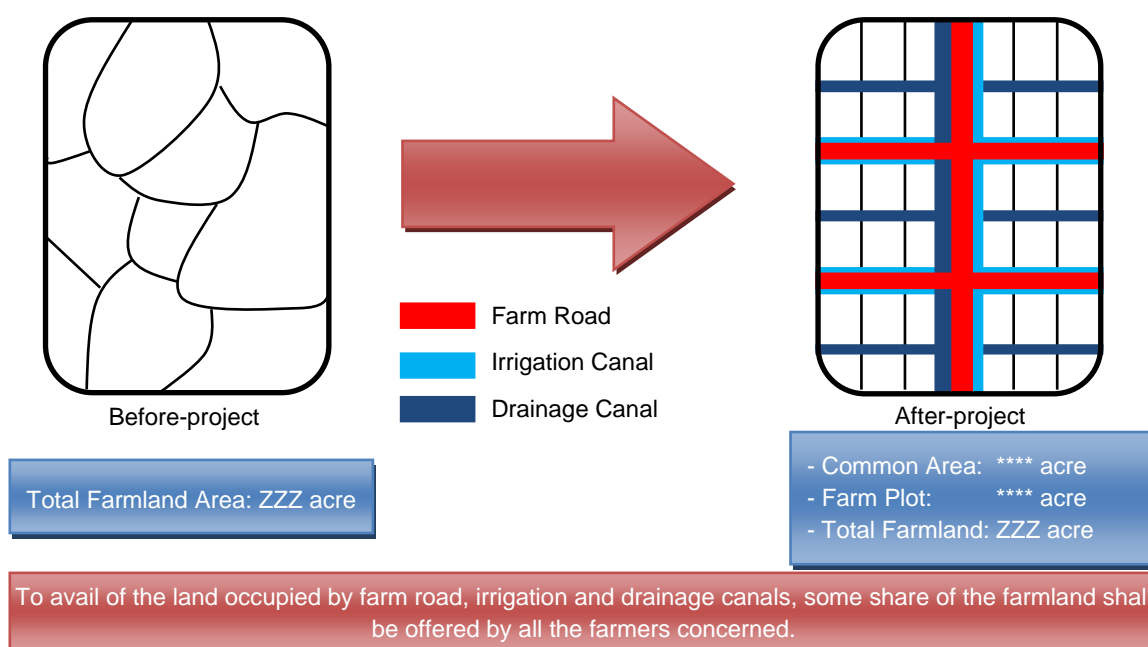


Figure 3.6.1 Explanation on Reduction of Farmland by Construction of Agricultural Infrastructure

Source JICA Study Team, 2014

The loss of the land ranges from 5% to a maximum 10% in most cases based on the projects so far implemented. It is noted that the maximum of the land loss should NOT BE MORE THAN 10 PERCENT; or the potential beneficiary farmers would very much hesitate to embark on the land consolidation project. Likewise, without showing the benefit accrued from the consolidated farmlands, they may hardly accept the project implementation. In this regard, there should be an example shown to the farmers where more benefit than that from the land to be lost can accrue with a land consolidation project (see Box 3.5 as an example).

There is also a safeguard policy for compensation according to the “JICA Guidelines for Environmental and Social Consideration (April, 2010) as well as World Bank Safeguard Policy OP/BP 4.12. The safeguard policies state that compensation must be based on the full replacement cost as much as possible (note that the cost here means the pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected

land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes). On this policy, the benefit accrued from the land consolidation project should be more than that the farmers are supposed to lose.

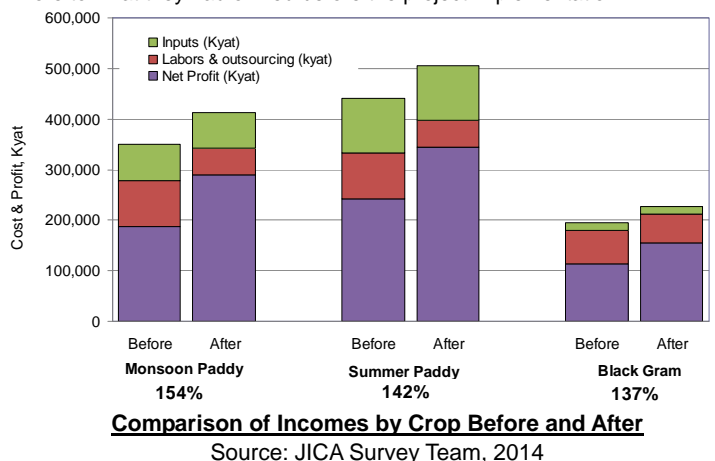
The percentage of the land to be lost, 6.7% in the above example, shall apply uniformly to all the farm lands that the beneficiary farmers own. The area to be lost shall be precisely calculated by each of the farmers, and summarized according to the following sheet (see Table 3.6.1). The sheet shows the farmer name with their village name, and the presently owned area, the percentage of reduction uniformly applied, and the area after the reduction has been made.

Box 3.5: Example of Benefit with Land Consolidation

A farm land consolidation project had been implemented in 2013-2014 near Nay Pyi Taw supported by JICA. Beforehand the project implementation, JICA team carried out a production survey in the neighboring fields where land consolidation works had already been introduced 2-3 years ago.

The survey covered 10 sample farmers and identified that the benefit comes mainly from; 1) production increase of crops enhanced by irrigation and drainage canals, and 2) cost reduction of transporting harvested crops from the fields to outside with the former the major one.

As summarized below, monsoon paddy's net income has marked such increment of 154%, summer paddy by 142% and black gram by 137%. This net income increase surpasses the loss of the land, 7.7 %, much more to what they had owned before the project implementation.



There should be a general assembly meeting where all the concerned farmers are to attend, and the management committee is to show the completed sheet indicating the original area acreage and the reduced acreage with the consolidation works completed. The management committee shall request the farmers of accepting the loss of land **WITHOUT ANY COMPENSATION** as a pre-requisite of implementing the consolidation works. It may take time for all the farmers to accept the reduction, and likewise the committee needs to explain the benefit from the consolidation works many times.

Table 3.6.1 Calculation of Reduction of Farm Plot Acreage by Farmer

No	Village Tract	Village	Farmer's Name	Farm Plot Acreage			Agreement (Signature)
				Original (acre)	Reduction (6.7 %*)	Remaining (acre)	
1	XX	ZZ	XX YYY	5.4	0.362	5.038	
2							
3	ZZ	XX	XX ZZ	4.3	0.288	4.012	
N-1							
N							

Note: 6.7% is an example shown in the above practice.

In such a case where unanimous agreement on the land reduction has not been achieved during the assembly meeting, a series of ground-working; namely, house-to-house visit, should be followed till the moment all the farmers have accepted the reduction of land. The house-to-house visit shall be conducted by such committee members who come from the respective village. The house-to-house visit shall also cover the absentee farmers to the general assembly, so that all the farmers have to be contacted, consulted and agree on the reduction with his/her signature on the right column of the sheet.

3.6.2 Agreement on the Farm Plot (Field Lot) Reallocation Plan: Fourth Stakeholder Meeting

With the consolidation works completed, all the plots are to be arranged in a rectangular shape. In Myanmar, the smallest unit of farm plot with the consolidation work done can be one-acre area, i.e. 360ft x 120ft rectangular-shaped farmland. In preparing a farm plot reallocation plan as draft form, following basic approach should be undertaken;

- ✓ Allocate a newly constructed plot area, whether whole one-acre area or a part of it, to the original farmer who used to cultivate in that same area as much as possible; namely, keep the same location of their farm lands wherever possible, and
- ✓ If a farmer has more than one farm plot scattered in the project area, collect all the pieces of lands he/she owns, and allocate a newly constructed plot area, whether whole one-acre area or a part of it depending upon the total farm acreage, equal to the accumulated farm areas.

There may be many pieces of farmlands less than the smallest unit of one-acre land, owned by individual farmers. To accommodate these smaller farm plots, following measures can be taken according to the farmers' preference;

- ✓ Make a ridge, which height is about 20 - 30 cm, to divide the one-acre farm plot into several smaller plots where respective concerned farmers are allocated each smaller unit of farmland according to the original area they had owned, and to know the exact position of each small plot, put such numbers as F3/1, F3/2, F3/3 for farmer-1, farmer-2 and farmer-3 respectively within the one-acre plot 'F3',
- ✓ On condition that all the farmers who have smaller farm plot agree to work collectively, mostly applied in a case of relatives each other, the one acre farm plot can be cultivated by the collective work, and the harvest should be shared according to the size of original farmland, and
- ✓ If a farmer has very small piece of farmland, an arrangement of selling out the small farmland to the neighboring farmer(s) can be made. In this case, a fixed unit price shall be applied to all those farmers who want to sell out.

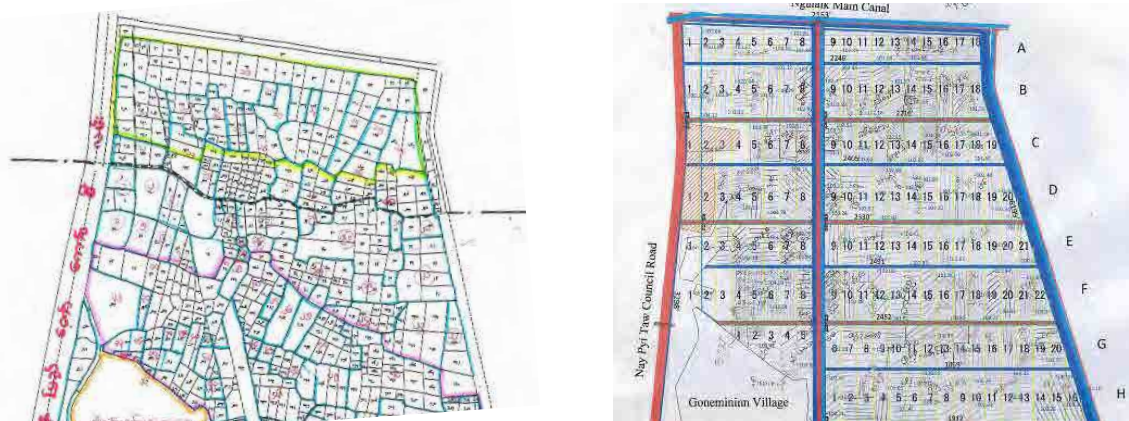
At the beginning of the general assembly where the farm plot reallocation is to be discussed, above measures should be explained to the participant farmers. With these measures in mind, the management committee shall show a draft farm plot reallocation plan prepared beforehand the assembly. An example of the draft farm plot reallocation plan is presented below; left map shows the original farm plots while the right one shows the arrangement of consolidated farm plots by one-acre rectangular plot as the standard. The table below comparatively indicates original farm plots and newly allocated ones by consolidation works.

The draft form of plot reallocation plan is prepared based on the original plot registration record with maps owned by SLRD and the land consolidation design drawings. The plan shall be prepared by the management committee of the farmer organization. In fact, there must be a difficulty for the committee members to prepare the draft plan by themselves. In this case, SLRD should assist the management committee to finish up the plan.

The draft farm plot reallocation plan is presented by the management committee during the general assembly meeting convened for a specific purpose of soliciting agreement on the plot reallocation from all the concerned farmers. In fact, there should be some farmers who do not want to accept the location newly allocated for his/her plot. In this case, discussion between the concerned farmers should take place mediated by the management committee together with SLRD officials.

There may be absentee farmers to the general assembly meeting. Also, there could be farmers who

have not yet come to the acceptance of newly allocated location till the end of the assembly meeting. In these cases, groundwork meeting where only the concerned farmers are to be convened or house-to-house visit shall be conducted by the management committee. These practices shall be carried out until all the farmers come to the agreement on the farm plot reallocation plan, thus the plan is finalized.



စဉ်	ကျေးရွာအုပ်စု	ကျေးရွာ	တောင်သူအမည်	စီမံကိန်းအကောင်အထည်ဖော်မီ					စုစုပေါင်း	စီမံကိန်းအကောင်အထည်ဖော်ပြီး					စုစုပေါင်း	သဘောတူညီချက် လက်မှတ်
				1	2	3	4	5-စန./စီ		1	2	3	4	5-စန./စီ		
				တွင်း	တွင်း	တွင်း	တွင်း	တွင်း		တွင်း	တွင်း	တွင်း	တွင်း	တွင်း		
				နှစ်ပင်	နှစ်ပင်	နှစ်ပင်	နှစ်ပင်	နှစ်ပင်		နှစ်ပင်	နှစ်ပင်	နှစ်ပင်	နှစ်ပင်	နှစ်ပင်		
				ဧက	ဧက	ဧက	ဧက	ဧက		ဧက	ဧက	ဧက	ဧက	ဧက		
၁	အောင်ဇွေ	အောင်ဇွေ		1654	1654				4.35	C-11	C-11/2				4.00	
				23	24						၆၂၆.၂၅					
				0.38	3.97						0.35	3.65				
၂	အောင်ဇွေ	အောင်ဇွေ		1654					2.71	C-15-16	C-17/8				2.49	
				28							၂၁					
				2.71							2.49					

No	Village Tract	Village	Name	Before					Total	After					Total	Signature
				1	2	3	4	5		1	2	3	4	5		
				Block	Block	Block	Block	Block		Block	Block	Block	Block	Block		
				Plot	Plot	Plot	Plot	Plot		Plot	Plot	Plot	Plot	Plot		
				Acre	Acre	Acre	Acre	Acre		Acre	Acre	Acre	Acre	Acre		

Figure 3.6.2 Example of Draft Farmland Plot Reallocation

Note: the total acreage after the project implementation is less than that of original plot due to loss of land for the construction of farm road, irrigation and drainage canals.

3.7 Registration of Reallocated Farm Plots

After farm land consolidation works have been completed, registration of farm land will be carried out. Note that registration of farm land means the registration of the right to use farmland for agriculture purposes since the land itself belongs to the state in Myanmar. The process of registration should be as follows:

- ✓ Upon completion of the consolidation works, concerned township SLRD prepares a cadastral map showing all the consolidated farm plots with block and farm plot numbers,
- ✓ With reference to the above map together with the agreed plot reallocation map (see right inset of Figure 3.6.2), the management committee confirms to the respective farmers whose plots will be moved from the original position to the newly allocated location,
- ✓ Upon confirmation by the farmers with the management committee, the township SLRD now goes to the farm plot he/she wants to register, and confirms the farmer’s rightful will to have the

plot registered, and

- ✓ The farmer submits an official document required for the registration, upon which the SLRD office issues a certificate of farmland-use-right for the subject farm plot.

During the preparation of the registration, some farmers may come to an idea of selling out their farm plot to the farmer(s) who has the neighboring plot especially in case that he/she owns very small plot e.g. less than 0.25 acre. There may be other cases that a farmer wants to purchase his/her neighboring plots. There could, therefore, be transaction of farm plots taking place during the time of preparing the registration. This transaction may take place even during the finalization of farm plot reallocation.

Though the transaction of farm plots, transaction of the right to use farmland in essence, is a private business deal, there should be a fixed unit price applied only to the deals conducted during the preparation of registration. If such deal takes place with different negotiable prices, it may take long time to settle by all the respective farmers. To facilitate the process of registration, there should therefore be a fixed price applied during this preparation stage for the registration.

The price should refer to the current prevalent transaction price in and around the area (see Box 3.6 as an example). The fixed unit price should firstly be drafted by the management committee with SLRD officers, and presented to the general assembly convened for the agreement on farm plot reallocation plan. The fixed price should be discussed by all the participant farmers and agreed upon.

Box 3.6: An Example of Fixed Price

Under a pilot farm land consolidation project supported by JICA and implemented in 2013-2014, unit price of trading the right to use farmland was set before carrying out the farm plot registration. SLRD Zabu Thiri township officer and management committee held a meeting and set the draft unit price at 3 million kyat per acre.

After setting the draft unit price, general assembly was convened where the draft fixed unit price was discussed among the participant farmers. As a result of general assembly, the unit price of trading farmer's farmland-use-right was set at 3 million kyat per acre as proposed by the management committee, and this fixed price was applied during the preparation stage of registration conducted in March-April, 2014.

CHAPTER 4 TECHNICAL GUIDELINE FOR FARMLAND CONSOLIDATION

Technical guideline discussed in this chapter is developed with reference to the 'Engineering Manual for Irrigation & Drainage, Land Consolidation' compiled in 1987 by Japanese Institute of Irrigation and Drainage. The guideline helps engineers to carry out land consolidation works of paddy fields in plain area with gentle slope, and the land consolidation can rationalize the farmland use and enhance agricultural productivity.

This technical part of the guideline is composed of three major components: preparatory works, planning and design, and construction. The preparatory works aim at identifying current status in physical conditions of farmlands, farming practices, farmland use rights, and other social and economic conditions. Planning and design can provide project beneficiaries with tangible information and image on the land consolidation; project cost should be estimated at this stage. Project implementation in the construction stage materializes improvement of farmland utilization and cost performance in farming.

4.1 Procedure of Land Consolidation Works

Farmland consolidation requires mutual understanding and collaboration between the implementing organization and beneficiary farmers from the initial stage of planning. An appropriate relationship among them shall be kept until the completion of the project. Better circumstances between these stakeholders will in fact enhance farming activities. Therefore, participatory approach is essential for implementing the project. Such participatory approach can strengthen the basic elements of the project such as investigation, planning, design, and construction works.

The standard procedure for land consolidation before the commencement of construction is: 1) detailed topographic survey, 2) field lots planning, 3) design of paddy field and elevation, 4) design of roads, irrigation and drainage canals and other related structures, 5) calculation of earthmoving volume, 6) determination of construction methods, 7) determination of construction period, 8) preparation of construction specification, 9) estimation of construction cost, and 10) overall coordination plan, as detailed in the following:

- 1) **Detailed topographic survey:** Identification of the targeted farm lots and calculation of earthmoving volume on a map with a scale of 1/1,000 to 1/5,000, depending on the size of the target area.
- 2) **Field lots planning:** A plan of the field lots and irrigation canal networks shall be prepared in consideration with the current arrangement of the cultivation lots.
- 3) **Design of paddy field and elevation:** A tentative elevation should firstly be obtained by the geometric mean of the area including the level of each existing lot. The designed paddy-field elevation is calculated by balancing the cut and fill volumes in the target paddy field.
- 4) **Roads, irrigation and drainage canals and other related structures:** It is recommended that the structure be standardized as much as possible and that prefabricated structure be utilized to improve quality, shorten construction period, and save manpower for construction.
- 5) **Calculation of earthmoving volume:** earthmoving volume is calculated on the basis of the elevations of the present and design paddy field. It is recommended that the calculation of earth moving volume be carried out accurately and speedily by spreadsheet software.
- 6) **Selection of construction method:** The construction method should be determined to suit the construction procedure, available construction equipment, and materials.
- 7) **Determination of construction period:** Construction period should be determined in accordance with the meteorological (rainfall) condition, cropping season, etc. The

construction is recommended to be done during the off-crop season, whereby no compensation is required.

- 8) **Preparation of specification:** Except for general specification, specification should be prepared for particular items to ensure proper execution of works. A clause should be incorporated in the general specification that an agreement should be reached between interested parties before the commencement of construction to avoid any conflict of interests.
- 9) **Estimation of construction cost:** based on the design quantities, cost estimation shall be carried out. In Myanmar, since most construction works are carried out by direct force account by utilizing the machineries and operators owned by AMD and ID, major components of the construction costs are diesel, lubricant, construction materials such as cement and bricks for constructing structures, and labors.
- 10) **Overall coordination plan:** since land consolidation project involves many stakeholders such as AMD, ID, SLRD, DOA, Cooperative Department, General Administration Office, and the beneficiary farmers, an overall coordination plan shall be prepared showing which stakeholder undertakes which parts of the necessary works with time frame.

In Myanmar, as far as designing including necessary surveys and construction are concerned, AMD and ID should undertake major responsibilities. For example, with the cadastral maps provided by SLRD, AMD should carry out topographic survey to check elevation and shape by each paddy field and prepare for a general plan, i.e. farm plot rearrangement plan, of the subject land consolidation project. ID, then, should design agricultural infrastructure such as farm roads, irrigation and drainage canals including layout plan as well as those structural details.

As for construction, implementation concerning farm plot consolidation should be undertaken by AMD such as removal of existing levees, ploughing and harrowing, renewal of levees, and then the leveling of the consolidated farm plots while ID should undertake the construction of agricultural infrastructure. ID will therefore construct main farm roads, branch farm roads, irrigation canals and drainage canals including both main and secondary ones.

4.2 Step 1: Preparatory Works

Preparatory works start from preliminary investigation, which is the first step in identifying the status-quo of the project area. Firstly, necessity of the project should be evaluated from the results of the preliminary investigation and the national/regional development plan. A detailed investigation plan should be formulated based on the results of the preliminary investigation. It is noted that planning and design can run parallel to the investigation, and any new problems encountered during the planning and design may be explored and investigated as required.

4.2.1 Preliminary Investigation

The preliminary investigation should be carried out to evaluate the viability of various works such as rearrangement of farmland blocks/lots, farm road construction, irrigation/drainage improvement, and soil improvement (subsurface-drainage, soil dressing, etc.), and also to prepare for detailed investigations by identifying the status-quo and development potential of the project areas. Items to be clarified during the preliminary investigation are as follows:

- ✓ General conditions of meteorology (especially rainfall), soils, geology and topography,
- ✓ Farm road width and routes, size, shape and distribution of farm plots; surface drainage conditions and needs for improvement; status and condition of farmland; and status of land improvement,

- ✓ Water utilization (irrigation/drainage conditions, and conditions of major irrigation/ drainage facilities),
- ✓ Socioeconomic conditions and farm management conditions in the target and surrounding areas, and
- ✓ Future development plans and agro-related projects prepared by the government.

4.2.2 Detailed Investigations

Firstly, the survey items and locations for the detailed investigation are identified based on the results of the preliminary field survey, existing data, available maps, and local opinions. The results of the detailed investigations are to be utilized for planning and designing of the land consolidation works, and also for planning cropping pattern, irrigation water requirements, etc. If the need for any revision arises during the investigation, such revision should be included in the scope of the succeeding investigations.

1) Survey on Natural Conditions

Natural conditions mean the meteorology and hydrology of the proposed project area. The purpose of this survey is to design capacities of irrigation and drainage canals. The meteorological data needs to cover more than 10 years. For large project areas, the targeted area should be divided into several blocks for effective planning and designing. If irrigation supply and unit drainage requirement have already been designed by another irrigation project which covers the target project area, this survey can be skipped.

2) Preparation of Topographical Maps

First of all, availability of existing topographical maps of the project area should be checked. Topographical maps should cover the project area and its periphery with a certain scale required for planning and designing works. If maps on a scale of 1/1,000 to 1/5,000 are available, these maps should be utilized. If they are not available, topographical maps on a scale of 1/1,000 to 1/5,000 should be prepared at the initial stage of the preparation works. In addition, maps on a scale of 1/2,500 to 1/10,000 should also be availed for planning farmland blocks, road networks, irrigation/drainage systems, etc.

Topographical maps should be prepared to cover land re-adjustment area with a margin of 200 m to 500 m in width around irrigation/drainage facilities and road construction sites. If link roads are to be constructed to connect the community link roads in the target area with the road outside the project area (such as highways or council roads), or if canals are proposed to link the main irrigation/drainage canals, maps should cover a margin of 200 m to 500 m in width around these facilities.

3) Surface Geology

Surface geology influences planning and design of irrigation/drainage canals as well as farmland rearrangement plan mainly due to different preference of each farmer. The geological conditions of the field surface should be surveyed to develop surface geological maps of the project area by analyzing the data collected, field reconnaissance, and test pits and augur sampling. The topographical classification and the surface soil conditions may be illustrated in the maps.

4) Soils and Bearing Capacity

The physical characteristics of the soils in the project area should be studied based on existing data/information and field investigations to determine the necessity for sub-surface drainage, soil improvement and topsoil treatment, and also for evaluating ground bearing capacity. The survey of bearing capacity is important to know the traffic-ability of the heavy machineries to be introduced to

the fields. Cone penetration test is recommended to be carried out simultaneously with the soil profile survey.

5) Soil Profile Survey

To know the soil profile, test pit shall be conducted. The test pit points should be selected at the rate of one pit per 25 ha on the topographical maps with a scale of 1/5,000 to 1/10,000. In principle, the depth of pits should be down to one meter below the surface, but when the field conditions are particularly sloping, with considerable cut and blank, pit depth could be down to 50 cm below the paddy field surface after cutting and filling.

6) Groundwater Table

Groundwater-table survey of paddy fields and peripheral areas is required to determine an appropriate drainage improvement method, and indicate necessary changes in water requirement as a result of execution of land consolidation works. The groundwater-table survey should be done using observation wells (strainer pipes), existing wells, and drainage water level in the canals. The groundwater table in the off-irrigation period can often be assessed from the position of gray layers and acidic spots found during the soil profile survey.

Gray layers are commonly observed below the constant groundwater level, assuming identical soil colors like grayish green or bluish green. Fields where the topsoil consists entirely of gray layer or where the gray layer develops immediately below the topsoil are classified as ill-drained fields, while those in which gray layers are observed approximately 80 cm below the field surface are classified as medium-drained fields. If the gray layers develop under the thin top soils, and groundwater level is high, sub-surface drainage must be carefully studied.

7) Irrigation

For land consolidation projects, in which the terminal irrigation and drainage systems are to be improved, status-quo of irrigation water distribution, water consumption (water duty), normal drainage mechanism, and irrigation/drainage facilities should be identified. With topographical maps as a basis, field investigations and interview surveys should be made, which covers the location and type of intake facilities, and the name, route, command blocks and areas of irrigation canals so as to develop maps of the irrigation system and schematic diagrams on a scale of 1/2,500 – 1/5,000.

After the implementation of land consolidation works, former ill-drained paddy fields sometimes become well-drained fields with a resultant change in unit water requirement. Consequently, if changes are expected in soil permeability and groundwater table upon the completion of construction works, an in-depth survey of water requirement should be done in the areas where topographical and soil conditions are similar to the project area so as to obtain data for estimating the unit water requirement after the project.

Reuse of irrigation water is practiced in various forms for securing additional irrigation water in some project areas. Implementation of land consolidation works will, however, completely separate irrigation canals from drainage canals, except on some sloping land where these canals are combined into one. Under such conditions, specific facilities or special planning is required for successful re-use of irrigation water after the completion of the project.

8) Drainage

A survey of the present drainage system should be carried out, covering topography, acreage of commanded and catchment area, drainage conditions of canals, inlets, etc. and the relationship between drainage canals and their outfalls. Drainage system maps and a schematic diagram on a scale

of 1/2,500 – 1/5,000 should be developed.

9) Socio-economic Conditions

A socio-economic survey should be undertaken in the project area. The following items should be investigated and analyzed for project formulation, subject to changes or variation to suite the scale, local conditions of the project area:

- ✓ Local economy (i.e. economy of the administrative area of the project),
- ✓ Working population by industry,
- ✓ Relationship to other development plans,
- ✓ Conversion of agricultural land for other purposes,
- ✓ Land designated for agriculture,
- ✓ Number of farm households by farmland size,
- ✓ Number of farm households by major crop,
- ✓ Trends and changes in number of farm households, and
- ✓ Trends in conversion of land by land categories.

10) Farm Management and Crop Husbandry

A clear understanding of problems in farm management and crop husbandry will contribute to better planning and designing of the project. The surveys should cover the following items: present land use, farmer organization, major crops and related cropping patterns, mechanization of farm works and availability of transportation facilities, crop yields and crop damage with its causes, production costs of major crops and farm income, farm landholdings and distribution, and farm labor availability.

11) Farmers' Opinions

Farmers' opinions help examine the future farming plans and their views on the proposed land consolidation project. The survey is conducted through interviews and/or questionnaires, taking account the following items: views on agricultural modernization and planned measures for land consolidation, as well as criteria for introduction of agricultural machineries and facilities, establishment of farmer organization, field lot size, scale and structures of canals, and farm roads, etc.

4.3 Step 2: Planning and Designing

4.3.1 Planning

A step by step process will help to make the detailed land consolidation plan. Land consolidation contains many components and differs depending on the land and water conditions of each project site. Thus, it is necessary to examine the project components through a detailed study on each project. To select the most feasible plan, several alternative plans need to be prepared.

Due to the difference in local conditions, the above planning procedures cannot always be practiced. For example, in a project area without sufficient water supply, the irrigation plan takes priority over other components since the enough quantity and timely supplied water will govern the agricultural land use. In general, various plans should be formulated based on the present condition of the target project area.

4.3.2 Selection of Project Area

For the selection of the project area, a comprehensive study is required and covers the following issues. Also, it should be done in consideration with the regional development plans and relations with the

surrounding area. Without a thorough coordination, the project area would have to be altered in the implementation stage. In these works, attention should be paid to avoiding irregular boundaries between the project area and its surrounding areas as outlined in the following:

- ✓ Distribution in land conditions, such as topography, and terrestrial objects like mountains, river, road, railways, etc.,
- ✓ Boundaries between respective water user's association,
- ✓ Boundaries between respective cities, towns, district, townships, and villages,
- ✓ Irrigation and drainage systems,
- ✓ Designated boundaries on land use (industrial use, urbanization use, etc.),
- ✓ Existing development project (completed, on-going, and under planning),
- ✓ Intentions of farmers concerned, and
- ✓ Possibility of collecting fragmented lots (reallocation of plots, including on absentee owner's farmlands).

For selection of the project area, careful attention needs to be paid to neighboring areas for avoiding unexpected defects of roads, canals and others in their functional connection. When examining the boundary of land consolidation of beneficial areas, the beneficial area should be determined through a well-balanced coordination with the regional development plan, especially when the land consolidation area is included in a vast agricultural tract.

When a land consolidation plan is made in vast area, it is advisable to prepare an overall basic design and establishment of the overall land consolidation plan for the whole project area, and then, based on the basic design, detailed planning should be done in respective area. For detached farming blocks when exist, each block can be integrated into one project area if the block has a consistently close relationship with the main project area.

4.3.3 Farm Management Plan

The farm management plan provides a basis for the water requirement and farming benefit after the completion of the project. Thus, it should consider proposed crops, cropping area, cropping patterns, scale of farming units, scale of farming facilities, farmer organization, and the relevant communities, etc. Since the farm management plan requires a long-term consideration, the future situation of farm management for the long-term development period and the necessary countermeasures should also be studied in advance.

4.3.4 Land Readjustment Plan

1) Land Readjustment Plan and Definition of Farmland Blocks

The land readjustment plan generates a visible design in shape and size of farm lots equipped with well aligned irrigation/drainage canals and farm road. In this process, the farmland can be roughly divided into field lots, field blocks and farm blocks with their shapes and sizes having a functional relationship with each other as follows:

- 1) Field lots: Field lots are the smallest units of farmland divided by boundary levees. The shape and size of the field lots shall be arranged in such a manner as to allow an efficient farm management with a use of farm machinery along with adequate irrigation/drainage; namely, 1 acre (360 ft x 120 ft) field lot is applied in most cases.
- 2) Field block: Field blocks are larger units of farmland which enables the adequate water management for enhanced paddy cropping. They are usually divided by permanent structures

like small irrigation canals or road where irrigation canals are commonly laid along the roads. In general, one field block consists of 10 to 15 lots.

- 3) Farm blocks: Farm blocks are rectangular in shape surrounded by farm road on all four sides, and are adopted as the unit for farm management, cultivation and land use to ensure uniform water management within the blocks. In general, one farm block consists of two field blocks extending along both sides of the small drainage canals.

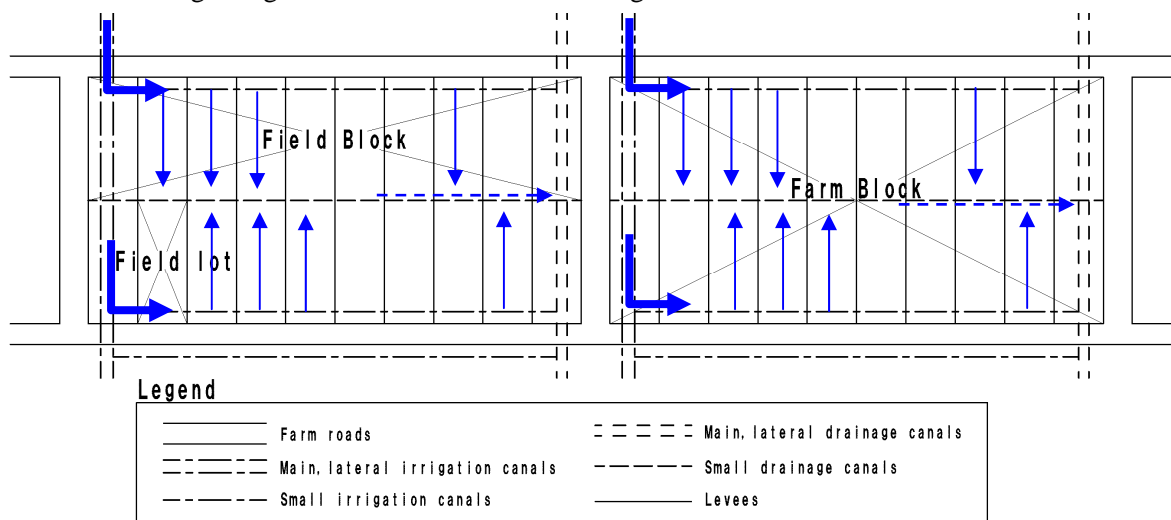


Figure 4.3.1 Relations among Field Lots, Field Blocks, and Farm Blocks

(Source: Japanese Institute of Irrigation and Drainage)

2) Layout of Irrigation/Drainage Canals, Farm Roads, and Farmland Blocks

Layout of irrigation/drainage canals, farm roads and farmland blocks is the basic frame of the project. Layout of irrigation/drainage canals and farm roads in the project area should be made taking into consideration topography, ground slope, and existing irrigation networks in and around the project areas. Studies shall also be made for determining field blocks and field lots in a detailed step by step approach paying close attention to the following points:

- 1) Layout of irrigation/drainage canals, farm roads and farmland blocks shall be made so as to enable easy access to field lots from relevant farmers' villages, and to enhance the capability of independent irrigation/drainage operation for each field lot or field block;
- 2) In principle, irrigation and drainage shall be separated; to this end, the layout of the main and lateral irrigation canals and the main and lateral drainage canals shall be organized as to make the separation possible;
- 3) Farm roads shall be planned along the main/lateral irrigation/drainage canals and farm ditches where possible; and
- 4) When a farmland block formation is to be undertaken, the shapes and layout of field blocks shall be determined in relation with the irrigation/drainage canals and farm roads.

3) Shapes and Areas of Field Blocks

Recommended shapes and areas of field blocks are as follows: the longer side of field block shall be within the range of 1,200 ft to 1,800 ft as an allowable length for farm ditches while the shorter side shall be within the range of 120 ft to 360 ft in consideration of distance from farm drains for smooth surface drainage. As a result, the recommendable field blocks shall be within the range of 120 ft x 1,200 ft (3 acre) as the smallest unit to 360 ft x 1,800 ft (15 acre) as the largest unit.

4) Shapes and Areas of Field Lots

In principle, the shape of field lots shall be rectangular, where angled or curved border lines may be applied in sloping land areas. In determining shapes and areas of field lots, such factors shall be examined; 1) working efficiency of farm machinery and 2) convenience of irrigation/drainage water control at on-farm level, 3) convenience of irrigation/drainage management at block level. The general shapes and areas of the standard field lots are as follows:

Table 4.3.1 Shapes and Areas of Standard Farm Land Lots

Category	Field Condition	Width (ft)	Length (ft)	Acreage
Field lot	Paddy Field	360	120	1.0
Field block	Paddy Field	360	1,200 – 1,800	10 - 15
Farm block	Paddy Field	360 - 720	1,200 – 1,800	20 - 30

Source: Japanese Institute of Irrigation and Drainage

5) Treatment of Field Lots under Special Conditions

Sometimes, design engineers may face difficulty of keeping the standard shapes and areas of field lots. In such a case, careful consideration is required as follows:

- 1) Field lots with irregular shapes affected by existing national or township roads, railways, boundaries with neighboring land, etc., shall be adjusted to the recommended shapes and size of the areas, or work efficiency of farm machinery would be reduced.
- 2) In sloping land of more than 1/20, the longer side shall be laid along the topographical contour lines, and
- 3) Where off-season cropping is practiced, upland cropping may play an important role in farm management. In such areas, the longer side should be kept less than 360 feet, taking into account the labor work for carrying harvests, surface drainage and so on.

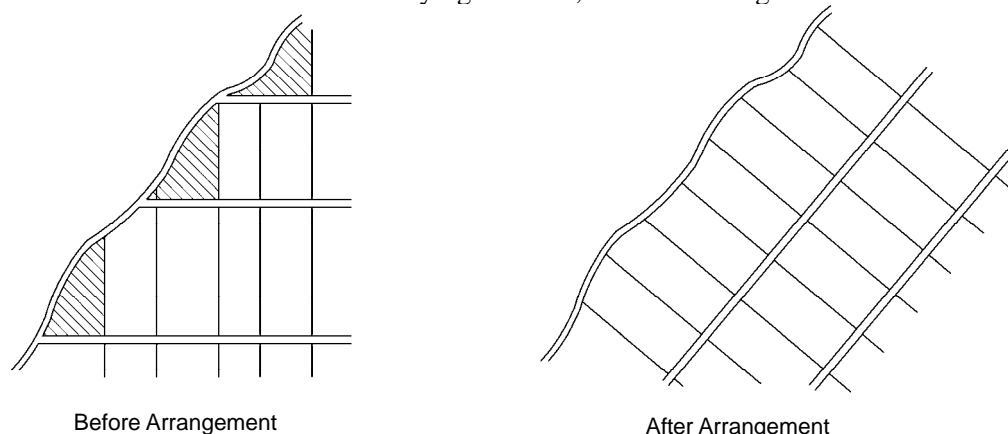


Figure 4.3.2 Example of Field Lot Arrangement in case of Irregular Shape

(Source: Japanese Institute of Irrigation and Drainage)

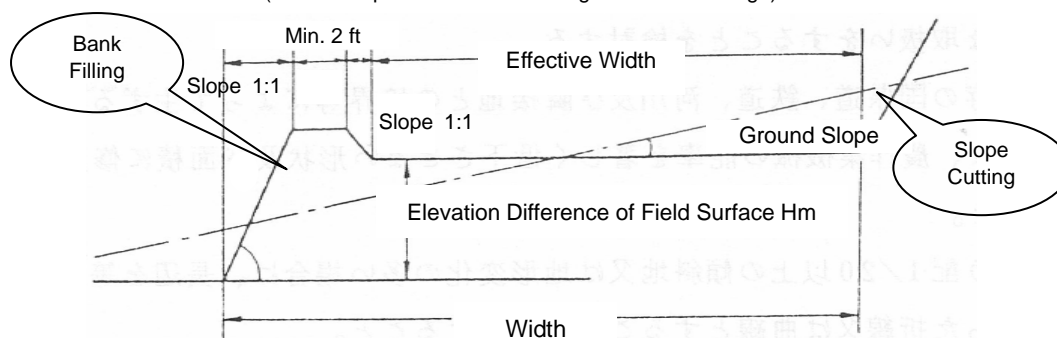


Figure 4.3.3 Example of Cross Section of Shorter Side: Cutting and Filling of Slope

(Source: Japanese Institute of Irrigation and Drainage)

4.3.5 Irrigation Planning

1) Irrigation Water Requirement

In order to carry out proper water management at each lot of paddy-field, it is important to secure a sufficient amount of irrigation water corresponding to the growing stage of the crops. Aiming at a stable water supply, the design irrigation-water-requirements are determined considering two major factors: 1) the total water requirements throughout the irrigation period and seasonal water requirements to meet the demands from the proposed cropping patterns, and 2) the peak water requirements based on the comparative study of water demands in puddling period and other cultivation periods.

2) Irrigation Canal

In principle, irrigation and drainage canals shall be separated from each other in the flat lands and very gently sloped land so as to allow free and independent operation of the system. For considerably steep land (e.g. over 1/50), however, irrigation-cum-drainage canals may be applied, requiring a careful study to judge. For the irrigation canals, lined open-canals are preferred, and the cross-section shall have an enough capacity to discharge the peak water requirement.

Concerning the relationship in elevation between canals and field surface, it is advisable to arrange the elevation of the canal bottom within a range from -5 cm to + 10 cm to the field surface. When the bottom elevation of the canals is much higher than the field surface elevation, not only smooth access of the farming machines to the fields is hindered, but a scouring protection facility needs to be installed at the inlet of each field lot.

Open-type earth-canals are preferred for farm ditches. The foundation and materials should, however, be resistant against scouring. It is not recommended that the farm ditch extends too long. The total extension of farm ditch shall be in a range of 300-600 m (1,000 ft - 2,000 ft) at the maximum with the same size of cross-section from the upstream to the downstream end.

3) Inlets

One or several inlets will be provided alongside the small farm ditches at intervals of less than 50 m for each field lot. In principle, the inlet is located on the upstream side, if only one is installed. The inlet section for open canals is designed according to the water amount to be taken in with a width of 50 cm (1 ft 8 in) at the maximum. If the water amount requires provision of wider inlets, two or more inlets shall be installed. The inlet elevation shall be within a range of 0 cm to 10 cm (4 inch) above the field surface. The structure of the inlet can preferably be a permanent concrete equipped with stop log.

4) Boundary Levee

Boundary levee consisting of earth embankment shall be provided at borders of all field lots. As a general understanding, the boundary levee, installed as earth structure, shall be embanked with borrowed material out of the field soils nearby. Being often obstacles in the field for smooth mechanized farming, boundary ridges comprising concrete block and plastic plate may be applied. This exercise is only due to the fact that earth boundary levee may be prone to water leakage due to unfavorable soil properties. The boundary levees should be installed with sufficient hardness and strength against leakage.

4.3.6 Drainage Planning

1) Design of Drainage Discharge

The design drainage-discharge in a field lot for flood control shall be designed, taking into

consideration the following cases;

- ✓ In terminal field lots, the farm drains or lateral drainage canals in some areas shall have the capacity to drain daily rainfall within a day for paddy monoculture, while draining 4-hour rainfall within 4 hour period for off-season cropping and the rotation paddy and other crops.
- ✓ For the downstream portions of the flat land requiring provision of sluices, the design drainage discharge shall be estimated taking into account the allowable inundation depth. This should save the construction cost of sluices.

2) Drainage Canals

Open canals shall be used for drainage canals. Following two kinds of canal sections shall be used to meet the conditions of the groundwater table, namely: 1) under low groundwater table, section should be allowed to drain the maximum drainage discharge of surface water, and 2) under a high groundwater table, the section should be designed with careful consideration of underground drainage in addition to the aforesaid capacity. Embankment protection works, when necessary, shall be designed considering the level of the flooding taking place once or twice a year.

3) Outlets

Outlets will be provided on the side along the drains of field lots more than one in an interval of 50 m. When only one outlet is provided, it should be installed downstream of the field lots. The section of outlets, in principle, shall have 50 cm in width at maximum. If the drainage capacity requires more than 50 cm in width at one outlet, the number of the outlets should be increased. The bottom elevation of the outlets shall be 5.0 cm to 20.0 cm below the field surface. The outlets shall have a structure to secure easy operation of opening and closing with drop-works provided at the drain side.

4) Gates and Weirs

Gates and weirs should be provided along the course of the drainage canals according to the necessity. Check gates, for example, will be provided along the drainage canals, if necessary, so as to control irrigation water (seepage) and the groundwater tables during the irrigation period. One or two check gates shall be installed for one field block. The check gates are closed before puddling, and thereafter, opening/closing operation shall be practiced to meet the requirements of intermittent drainage. The check gates shall, of course, be left opened during the non-irrigation period.

In the paddy fields of flat land and gently sloped land, sluice gates shall be provided to mitigate the flushing of flood water, for minimizing the sections of the lateral and the main drainage canals and/or the capacities of pumping facilities, and for preventing the area outside project in the downstream from flooding. These gates are installed at the terminal of each field block where the drains join the lateral drainage canals (around the lateral farm roads) so as to periodically function concurrently as water level control weir.

Weirs for reuse of irrigation water may be required. The weirs of this kind shall be installed for reusing the irrigation water in the sloped land through diverting drainage water into irrigation water. In the steep-sloped land, these weirs, in general, are installed at the terminals of the dual-purpose drainage canals, at the lateral canals of each field block, or several field blocks to be connected with the drainage canal for allowing the water flow through irrigation canals in the downstream.

4.3.7 Road Planning

1) Preparation for Farm Road Planning

For farm road planning under land consolidation project, road width and grade should differ according

to the type and function of the farm road. There are three types of farm roads by its type and function:

- ✓ **Main farm roads:** The farm roads linking villages, villages with farming areas, community roads with farming area, and farming areas with facilities for production, processing, marketing, etc.
- ✓ **Longitudinal lateral farm roads:** The farm roads running along the short side of field lots and linking the main farm roads with field lots.
- ✓ **Cross lateral farm roads:** The farm roads serving as link roads of longitudinal lateral farm roads.

2) Farm Road Width

Road width will be designed based mainly on the required function, ensuring traffic safety. The total width is composed of effective width, shoulder width, and other width requirements. The width of roads should be economical, considering the expected types of vehicle passing the road, traffic frequency, area of the land rendered for road construction, construction cost, O/M cost, and future widening plan, etc.

The main road width shall be determined in consideration with clearance, width of allowance between vehicles with a passing margin of 0.5 m, outer side margin of 0.3 m, and 0.5 to 0.7 m allowance for road shoulders. The effective width of the main farm-road can therefore be within the range of 5.0 m to 6.0 m, considering the size of trucks (2.4 m wide) or tractors (2.4 m wide) expected to pass. On lateral farm roads, the effective width should be within the range of 3.0 m to 4.0 m or a combined total width of 3.5 m.

3) Elevation of Road Surface

Elevation of road surface affects accessibility of farm machineries to farm land. Also, it should avoid flood influence during rainy season. This is why the road needs to keep certain height from farmland surface, but not too high. The elevation of the farm road surface from the farmland surface shall be more than 60 cm for the main farm roads, and more than 30 cm for lateral farm roads. Some extra filling will be required for the areas where soft foundation exists.

4) Longitudinal Slope

As a general understanding, the maximum longitudinal slope for the main farm roads should be around 8 percent, except for particular cases that may require up to 12 percent. When extending the longitudinal slope by more than 8 percent, the length should be within 100 m and a portion with less than 2.5 % slope should be provided for more than 30 m in length. For the longitudinal lateral farm roads along the field lots, appropriate longitudinal slopes shall be given so as to meet the requirements of field lot layout, elevation gaps, etc., enabling the smooth access of farm machineries from roads to field lots.

5) Cross Grade

Road slope-out from the center towards the road edges facilitates surface drainage. In principle, the cross grade slope should range from 3.0 to 6.0% for sand or gravel roads, and 1.5 to 2.0% for concrete paved roads or asphalt paved roads. The cross grade of farm roads needs to be only slightly elevated at the central portion of the road. The smaller cross grade will be advantageous for vehicles traveling, although the larger grade will be convenient for surface drainage. The road embankment slope shall be 1:1.0 under the condition of embankment height less than 3 ft.

6) Road Bed Materials

Quality of road bed will affect the life span of road function. If it is available in the project area, quality coarse-earth-material should be used for the road bed construction. When the specified quantity is unavailable in the project area, materials shall be borrowed from designated borrow sites outside project area. Generally, embankment materials for the road construction are obtained from a borrow pit for the main roads and the excavated materials for lateral roads.

7) Mode of Pavement

Mode of pavement shall be designed in the view of construction cost, type of road and traffic volume. Gravel pavement is, in most cases, employed for farm roads. Out of commonly applied thickness of 15 cm (6in) to 30 cm (1ft), the gravel layer thickness for farm roads shall be modified depending on the strength of earth materials, conditions during rainy season, etc. Note that gravel layer is not required where suitable quality materials are not available or for the lateral-farm-road with minimal traffic.

8) Road Crossings

If a large volume of traffic is expected, it should be considered to provide road crossings with corner cuttings. Corner cutting should be restricted, where possible, to prevent rectangular field lots from turning into irregular shaped lots. The corner cuttings shall have a cutting of 1.5 m to 2.0 m in length, taking into consideration the total width of tractor or combine to be introduced.

9) Access Roads

For field lots, one access road is recommended to be constructed on the side where the inlet is installed to the field lot; namely, upstream side. Where two adjacent field lots have a surface elevation difference of less than 30 cm (1 ft) and are under the same land holding right, only one access road can be provided to serve both lots. This access road is constructed on the left side where the inlet is installed to the field lots to allow operation of farm machineries in a clockwise rotation. The typical width of such access roads shall be 4.0 m, except for the cases where a 6.0 m (20ft) width for one access road serves two field lots. The slope for these access roads shall be less than 2.5 percent.

10) Road Bridges

As a general understanding, the width of road bridges will be same as that of the road concerned. The design vehicle load for the bridges will be 6 ton to 14 ton with an effective width of more than 4.0 m (13 ft). About 0.25 m (10 inch) shoulders shall be provided on main farm road bridges. The bridges with less than 15 m (50 ft) in length can be given the same width as that of the relevant roads. The handrails can be low in height so that the farm machinery is able to pass smoothly with loads.

4.3.8 Effective Soil Layer Treatment Plan

If a lack of soil fertility is expected at effective soil layer by implementing land consolidation, effective soil layer improvement may be employed. Firstly, the thickness of effective soil layer will be identified based on observation of soil layer where paddy roots can extend. As to identify effective soil layer with an engineering viewpoint, effective soil layer is the one which does not correspond to any of the following indices more than 10 cm (4 inch) in thickness.

- ✓ containing coarse sand by more than 40% in weight,
- ✓ containing gravel by more than 50% in weight,
- ✓ containing coarse sand and gravel mixture by more than 55% in total weight,
- ✓ hardness measured by more than 24 mm,
- ✓ containing peat or black mud layers, and

- ✓ phosphoric acid absorption coefficient rate more than 2,000 (mg/100g).

The following methods may have to be employed to maintain the effective soil layers in implementation of the land consolidation works. The actual method shall be chosen based on the results of the soil survey conducted prior to the commencement of the construction works.

1) Surface Soil Improvement through Fertilizing Management Practice

When land consolidation works do not include surface-soil handling practice, the decrease of surface soil fertility may be expected. If an area, where the soil cutting is conducted, shows considerably high coefficients in phosphoric-acid absorption due to a lack of nitrogen, then, more fertilizer needs to be applied than usual application. In contrast, fertilizer restriction/reduction may be necessary in the areas where the soil filling has been conducted and also the soil contains an excessive amount of nitrogen.

2) Surface Soil Handling

Surface soils, which have long been cultivated by farmers, affect the yield of paddy. Thus, surface soil handling is usually recommended except for some cases. Detailed studies shall be conducted on the following respective cases: namely, the surface soil handling 1) required, 2) difficult, and 3) not required.

- ✓ **Cases requiring surface soil handling:** the farmlands that have considerably thin effective soil-layer and extend over sand-and-gravel type sub-soils. Such farmland cannot maintain the soil surface layer with certain thickness more than 30 cm (1 ft).
- ✓ **Cases where surface soil handling presents difficulties:** the farmlands where land consolidation works are implemented for ill-drained, weak-foundation or ill-drained paddy fields, as well as paddy fields in steep slope areas.
- ✓ **Cases where surface soil handling is not required:** the farmlands which have a surface soil layer more than 30 cm (1 ft) in thickness even after the land consolidation has been completed, or where sub-soil can easily be turned into better quality soils with reasonable and well-balanced fertilization. Land consolidation in this area is conducted within 5.0 cm (2 inch) of cutting and filling practice.

3) Soil Dressing

Soil dressing shall be carried out for maintaining the effective soil layers and favorable physical and chemical properties of soil. The soil dressing for improving the physical soil properties such as permeability and bearing capacity will produce favorable effects right upon the completion of the consolidation works, while the improving of chemical properties will respond gradually. The dressing materials should be well mixed with plowing layer soil except for areas where field elevation increases.

River or swamp sediments can be used as dressing material for supplying organic matters to the soil. When implementing such works, careful attention should be paid to the drying-up of the sediments for promoting the decomposition of organic matters. In this process, the nitrogen content applied to the soils should not be excessive.

4) Soil Permeability

From the viewpoint of large-size-machinery workability and rotational cropping, relatively high permeability of soils is recommended, although from an economic viewpoint and for successful paddy growth, too high permeability is not favorable during the irrigation period due to the increase in percolation. In a view of paddy growth and farm management, the optimum percolation amount is

usually around 20 mm/day (8 in), which can be secured by such soils with a permeability of about 2 to 5×10^{-5} cm/sec.

Increase in permeability can be managed by water management and/or crop planting. This method shall make better use of evaporation from field surfaces and accelerate dry-up of the fields, so that the soil permeability can be improved through the creation of many cracks in the target soils. There are two ways to accelerate the creation of cracks in the soils: 1) direct seeding on dried paddy fields, and 2) rotation of paddy and other crops. If these methods cannot provide a favorable effect on developing the cracks deeper in the soils, drain provision and/or mechanical crushing of sub-soil may be required to secure water-seepage routes in the subsoil layers.

Heavy construction machinery is usually used for earthworks of land consolidation. Such earthworks result in well-compacted farmland and thus decrease permeability of a soil layer just below the surface soil and the plowing layers. The major factors in decreasing soil permeability are to crush porosity in soil structure. The reduced permeability, however, can be recovered to the original level with heavy cracks that can be generated by intensive intermittent drainage. Furthermore, the reduced permeability can be recovered year by year through re-development of the soil structure through the repeated non-irrigation periods.

5) Bearing Capacity

For operation of farm machinery, enough bearing capacities are required for the soil, on which the machineries are to run. Bearing capacity shall be measured by static penetration test with cone penetrometer (cone area: 6.45 sq.cm, coned angle: 30 degree), and the penetration resistance shall be expressed in cone index. Measurements after the completion of construction works shall be carried out at more than five points in every field lot, so as to obtain the average values of more than three measurements by depth and the cone index for the measuring point.

The bearing capacity for traveling of farming machines in the field differs by kind and type of machineries in the field, including the type of wheels, type of attachments and working conditions. For the bearing capacity required for plowing and harvesting, the target value of cone index should be more than 4.0 kg/cm^2 on an average of four-point measurements at every 5.0 cm (2 inch) in the depth from 0 cm to 15.0 cm (6 inch) below the field surface, and more than 2.0 at the minimum (see table below).

Table 4.3.2 Relationship of Major Machine Workability and Cone Indices

Workability	Tractors (plowing)		Combine (harvesting)
	Rubber Wheel	Girdle Cover	
Easy	more than 4	more than 3	more than 3
Slightly difficult	3-4	2-3	1-2
Difficult	2-3	1-2	1-2
Impossible	2 and below	1 and below	1 and below

Source: Japanese Institute of Irrigation and Drainage

Concerning the limit on machine workability for puddling, the target value of cone index should be at least 2.0 on an average of four-point measurements at every 5.0 cm (2 inch) at a depth from right below the plowing layer to approximately 15.0 cm (6 inch) below the field surface. These cone indexes are required for the machine workability for puddling in completely irrigated fields.

6) Land Leveling Preciseness

Land leveling works on the paddy fields aim to keep water distribution effectively over a field lot. The preciseness of the field leveling shall be expressed by the errors to the average elevation, resulting from the leveling survey of a sectioned 10 m square area. From the viewpoint of effective water ponding for paddy cultivation, the error of every survey point from the average elevation should be

within the allowable range from +5.0 cm to -5.0 cm.

When cutting-and-filling works are implemented in a unit field lot, particular attention shall be paid to subsoil-leveling-works to prevent the paddy field from an uneven settlement between cutting and filling portions. The uneven level of subsoil will sometimes cause uneven water distribution over the fields that will result in unbalanced growth of paddy plants. The surface of subsoil layers shall be as level as possible and the surface of subsoil layers in cut portions should be slightly lower than that in the embanked portions.

4.4 Step 3: Construction

4.4.1 Construction Procedure

Construction procedure commonly applied is: 1) setting up of topographic survey pegs, 2) temporary works including removal of obstructions, 3) excavation of drainage canals, 4) construction of structures, 5) removal of surface soil when required, 6) construction of sub-base (foundation) of paddy field, 7) removal of miscellaneous matters produced, 8) construction of road, 9) bringing back of removed surface soil, 10) construction of irrigation and drainage canals, 11) construction of boundary levees, 12) land leveling/grading of paddy field, 13) finishing works, and 14) removal of temporary structures.

Procedure for construction of field plots, roads, irrigation and drainage canals, as well as related facilities should be carefully timed to suit the overall construction schedule of the works. This is required especially in the course of coping with shortage of soils and disposing of residual soils, etc. For facilities construction, the site should be thoroughly drained by constructing drainage canals or temporary drainage ditches. When a main drainage canal is constructed, the excavation should be executed first.

4.4.2 Temporary Works

Of temporary works, it is important that temporary drainage canals are provided to keep the site dry prior to and during the works in order to achieve a high working efficiency and good quality of works. Public facilities and private properties as well as various rights located in or attached to the construction site should be identified first, and the issues of removal and compensation, if applicable, should be discussed with the persons concerned before the commencement of works.

4.4.3 Earth Moving: Surface Soil Handling

Two methods of surface-soil handling can be considered, depending on the natural topography of the project area: 1) temporary stockpile method, and 2) rotational earth moving method.

1) Temporary Stockpile Method

Under the temporary stockpile method, the excavated materials are temporarily stockpiled in a certain area and then brought back to the original position after the completion of other earth moving works. In a relatively flat area where differences in design elevation are less than 0.5 m from the original ground elevation, an original lot can be used as the temporary stockpile to which soils from other lots are to be brought. This procedure must not disturb the following foundation works, and therefore the preferable location for the temporary stockpile is at the center or corner of the subject field lot.

Aside from the temporally stockpile being designated within the original lot, temporary stockpile may also be located in adjoining lots which have a field elevation similar to the design elevation of the subject lot. The most common method of the stockpiling for this is to deposit half of the excavated materials in the adjoining upstream field lot while the rest in the adjoining downstream field lot (see

left figure below). This surface-soil handling method presents the shortest hauling distance and it is efficient the most.

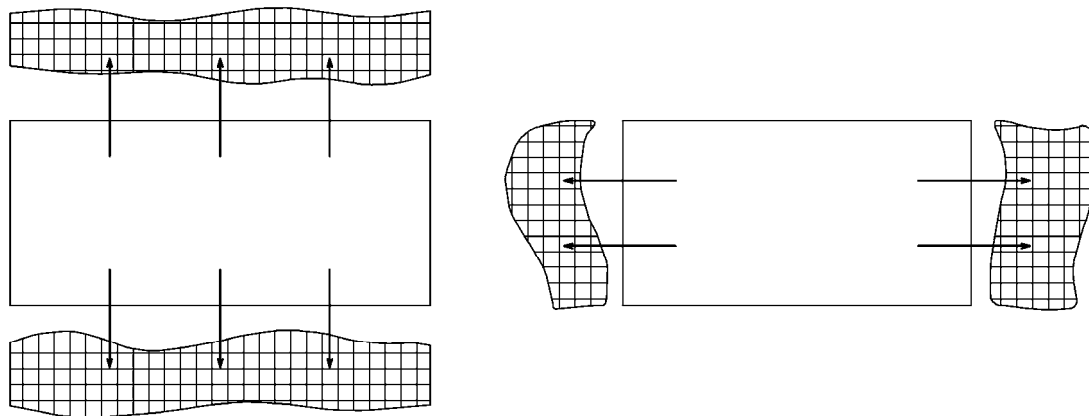


Figure 4.4.1 Example of Temporally Stockpile Method to Adjoining Lots

(Source: Japanese Institute of Irrigation and Drainage)

On the other hand, when elevation differences of the upper and lower adjoining field lots are more than 0.5 m from the design field elevation of the subject lot, it is difficult to bring the temporarily deposited soils back to the original field lot. In this case, the excavated materials should preferably be deposited in the nearest adjacent lots located in right and left side from the subject lot, which could have a smaller elevation difference than those lots located in upstream and downstream sides (see right figure above).

2) Rotational Earth Moving Method

Rotational earth moving method may be employed in original farms lots with an elevation difference of less than 0.5 m from the design field elevation or in farm blocks where the balance of earthwork can be handled within the block. The lot or block should not be interrupted by roads and canals. The works are executed by such procedure: 1) surface soil from ‘B’ block is stockpiled in ‘A’ block, 2) foundation works are carried out in the block ‘B’, 3) surface soil from ‘C’ block is laid on ‘B’ block, 4) similarly, the surface soil from ‘D’ block is laid on ‘C’ block upon completion of the foundation work at ‘C’ block, and 5) same procedure continues, and finally the surface soil from ‘B’ block deposited at ‘A’ block is laid on ‘J’ block.

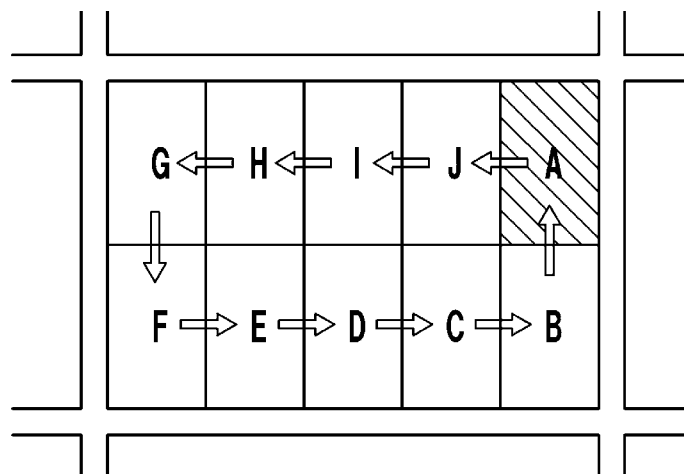


Figure 4.4.2 Example of Rotational Surface Soil Moving Sequence

(Source: Japanese Institute of Irrigation and Drainage)

4.4.4 Cutting and Filling

Cutting and filling should be carefully performed to avoid differential settlement in the banked portions. Filling materials should be spread in layers with some extra filling on the banked portions to be able to keep the designed elevation even after settlement. In this regard, it is necessary that each layer of filling should be spread with a thickness of 20 to 30 cm and compacted thoroughly. When the filling height is considerably high, materials at the foot of boundary levees especially on sloping lands should be firmly compacted by a crawler tractor or alike. Without such treatment, land settlement or slope failure may occur.

If a drainage canal is to be constructed along the short side of a field lot or a farm block at a banked portion, the drainage canal should be excavated after the filling has been firmly compacted during the foundation works. Existing drainage canals, when existed, should be filled after water has been removed and flow is stopped. There may further be depressions, ponds and swamps in the construction site; in these cases, they should be filled with coarse materials by utilizing excavated materials from existing roads, and/or subsoil produced at early stage of earth moving, for example.

Gravels and boulders in the subsoil, or excavated from existing roads, should be buried below the foundation as deep as possible. Remaining gravels and boulders found within the foundation should be removed and utilized for farm road construction, and canal embankment, if possible. Large stones which are difficult to dispose of should be buried below the layer where agriculture machineries are to cultivate; say deeper than 15 to 20 cm from the ground surface.

4.4.5 Land Leveling and Grading

Land leveling and grading are conducted to level uneven surface of land consolidation areas. The degree of precision is indicated by the difference in undulation based on the average elevations of five points each from two or three rows of leveling survey line over a field lot. The tolerance allowed in land leveling should be plus or minus 5 cm for paddy fields in consideration of equal water distribution, introduction of farm machineries, etc. During the final leveling work, excavated materials from irrigation and drainage canals and from boundary levees may be used to make up the difference in the land leveling.

To ensure favorable results in the case of works involving a large volume of cutting and filling, rough leveling should be made, before going into the final leveling, to allow the ground to settle for one or two months. In addition, a margin of plus or minus 10 cm may be adopted in leveling areas located near drainage during the rough leveling stage. As it would be impractical to re-arrange subsoil surfaces after they have been covered with surface soil, more cutting rather than filling should be conducted to level the ground during such rough leveling work.

To facilitate surface drainage, it is necessary to differentiate the irrigation side and the drainage side of field lot. Either side should be at the same elevation, or the drainage side should be at a slightly lower level. In a flat area, earth materials for road construction are generally taken from the irrigation side, resulting in deposit of residual soil on the drainage side. As this could easily lead to poor surface drainage, the above condition shall be carefully ensured. In addition, when the irrigation side is banked, while the drainage side is cut, extra filling is required on the embanked portion.

If the degree of land leveling is more than the allowable tolerance of plus or minus 5 cm due to soft foundation, for example, the following two conditions should be satisfied. Firstly, the number of surveyed points exceeding the standard of plus/minus 5 cm should be less than 20 percent. Secondly, the survey stations exceeding the standard should not be located adjacent to each other. If the field cannot be leveled, land leveling by ponding may be introduced through puddling by swamp bulldozer or a tractor-drawn implement.

4.4.6 Selection of Construction Machinery

The type and number of construction machineries should be decided based on the design of the land consolidation works, construction schedule, most suitable and economic combination of machineries for the construction works, etc. The machineries should be selected as to suit soil characteristics, to fully utilize machinery capacity to ensure economical construction cost, and to meet the construction schedule for satisfactory completion of the project.

The bearing-capacity characteristics of soil will vary considerably depending on soil properties and travelling frequency of the machineries. Machineries with appropriate contact pressure must therefore be selected through the assessment of foundation conditions prior to the commencement of construction works. Foundations of paddy fields are generally soft and the workability on them can be affected easily by rainfall. Therefore, a combination of ordinary and swamp-type machinery may be employed especially for poor drainage areas.

Types of work contents are divided into 5 categories; namely, 1) ploughing and harrowing, 2) farm road, 3) drainage canal, 4) irrigation canal, and 5) farmland leveling. Earthwork is the major work in the farmland consolidation works and construction of structure is not so big compared to earth work. Therefore, construction machineries are mainly used for earthwork and structures are mainly constructed by man power.

To complete the construction works in three months from April to June, which is the off-crop season in most areas, enough number of construction machineries has to be procured. For example, Table 4.4.1 shows standard Operation Schedule of farmland consolidation works and Table 4.4.2 shows the standard quantity of heavy machineries. Note that the tables are prepared on basis of an area of 100 ha as standard.

Table 4.4.1 Standard Operation Schedule by Machinery (100ha)

Month		1st			2nd			3rd			Date
		10	20	30	40	50	60	70	80	90	
AMD	Removal of Levee	■									6
	Ploughing and Harrowing		■	■	■	■					34
	Renewal of Levee					■					6
	Leveling (Rough)						■	■	■		22
	Leveling (Final)								■	■	22
	Sum										90
ID	Main Farm Road	■									10
	Branch Farm Road		■	■	■						25
	Filling Gravels on Farm Road					■	■				11
	Irrigation Canal						■	■	■		22
	Drainage Canal								■	■	22
	Sum										90

Source: JICA Survey Team (2014), based on experiences by AMD and ID

Table 4.4.2 Standard Required Machinery (100ha)

Item		QTY	Major Function
AMD	90 HP Tractor	7	Leveling (Rough, Final)
	75 HP Tractor	8	Ploughing and Harrowing
	7 disc harrower	5	Harrowing
	4 disc plougher	5	Removal and making Levee, Ploughing,
	22 disc harrower	3	Harrowing
	Laser leveler unit	1	Farm plot Leveling (Rough, Final)
	10 ft. rear blade leveler set	5	Farm plot Leveling (Rough, Final)

	Item	QTY	Major Function
	Front blade leveler set	2	Farm plot Leveling (Rough)
	Total station	1	Farm plot Leveling (Rough, Final)
	Level instrument	1	Farm plot Leveling (Rough, Final)
ID	Dozer Class II	3	Dozing and compacting soils on Farm road, irrigation and drainage canals
	Dozer Class III	1	Dozing and compacting soils on Farm road, irrigation and drainage canals
	Hydraulic Excavator (1m3)	5	Earth works for farm road, irrigation canal and drainage canals, and Construction of structures.
	Mini Backhoe (0.23m3)	5	Earth works of lateral irrigation canal and drainage canal
	Dump Truck (10m3)	14	Transport of materials and aggregates such as sand, cement, cement brick, etc. from stock yard in ID Regional Office, then to the site.
	Vibration Roller	1	Earth works for compaction of farm road.
	Water Bowser (1,200m3)	1	Transport of water for adjusting water content prepared for soil compaction
	Low bed Semi-Trailer Truck	1	Transport of heavy machineries

Source: JICA Survey Team (2014), based on experiences by AMD and ID

4.5 Standard Construction Cost

Based on a pilot farmland consolidation project implemented in early 2014 in Zabu Thiri Township, Nay Pyi Taw city, standard cost of farmland consolidation required for 100ha is estimated at around 426 million Kyats. Note that necessary machineries are all provided by ID, so that the cost is estimated under direct-force account construction. The cost of diesel, lubricant and grease comes to 140 million Kyats (33%); the construction materials need approximately 190 million Kyats (44%); ploughing, harrowing and ground leveling cost together arrives at 18 million Kyats (4%); and labor cost comes to 79 million Kyats (19%). Table 4.5.1 shows the standard construction cost by major category required for 100 ha of farm land consolidation project and the break down of the cost in Table 4.5.2:

Table 4.5.1 Standard Construction Cost (100ha)

Number	Item	Cost (Kyat)	Percentage
1	Diesel, Lubricant, Grease	139,878,043	33 %
2	Construction Materials	189,631,364	44 %
3	Ploughing, Harrowing, Ground Leveling	17,796,429	4 %
4	Labor	78,924,643	19 %
Total		426,230,478	100 %

Source: JICA Survey Team (2014), based on a pilot farmland consolidation project implemented in early 2014 in Zabu Thiri Township, Nay Pyi Taw city

Table 4.5.2 Breakdown of Standard Construction Cost (100ha)

Category	Item	Quantity	Unit	Unit Cost	Cost
1	High Speed Diesel	29,706.54	Gal	4,400	130,708,757
	Lubricant	587.86	Gal	15,000	8,817,857
	Grease	117.14	Gal	3,000	351,429
	Sub Total				139,878,043
2	Sand	347.71	Sud	39,350	13,682,442
	Chipping	78.84	Sud	124,920	9,849,166
	Brick	394,398.24	Nos	91	35,890,239
	6" - 9" Stone	170.00	Sud	90,170	15,329,222
	Kanker	2,885.17	Sud	15,000	43,277,550
	Lime	360.20	Cft	2,500	900,499
	Hard Wood	12.31	Ton	820,000	10,091,857
	Jungle Wood	0.14	Ton	470,000	67,143
	Binding Wire	1.79	Viss	3,060	5,464
	Wire-Nail	43.93	Viss	3,200	140,571
	5/8" M.S Rod	0.33	Ton	800,000	262,857
	Small Bamboo	1,826.43	Nos	300	547,929
	Glue	76.43	Bott	500	38,214
	Brush	147.86	Nos	1,500	221,786
	Thatch	3,546.43	Nos	120	425,571

Category	Item	Quantity	Unit	Unit Cost	Cost
	Hnee (Bamboo Thread)	59.11	Viss	1,200	70,929
	Control Bar & Gate Leaf	2.21	Nos	1,000,000	2,214,286
	1' Φ PVC Pipe	18.75	Rft	31,875	597,656
	8" Φ PVC Pipe	72.14	Rft	7,775	560,911
	1'-6"Φ RCC Pipe	182.14	Nos	56,700	10,327,500
	Cement	3,730.71	Bag	6,800	25,368,857
	Temporary hut	0.71	Nos	5,175,000	3,696,429
	Spare parts for heavy machine	247.14	Acre	60,000	14,828,571
	Field use materials	247.14	Acre	5,000	1,235,714
		Sub Total			
3	Plowing Cost	247.14	Acre	40,000	9,885,714
	Harrowing Cost	247.14	Acre	20,000	4,942,857
	Ground Leveling	593.57	Nos	5,000	2,967,857
		Sub Total			
4	Smith	5.00	Rft	5,000	25,000
	Carpenter	325.00	Suds	5,000	1,625,000
	Mason	2,940.71	Suds	5,000	14,703,571
	Worker	15,200.71	Suds	3,500	53,202,500
	Trollergyi	139.29	Nos	30,000	4,178,571
	Labor transportation	247.14	Time	21,000	5,190,000
		Sub Total			
Grand Total					426,230,478

Source: JICA Survey Team (2014), based on a pilot farmland consolidation project implemented in early 2014 in Zabu Thiri Township, Nay Pyi Taw city

CHAPTER 5 ENVIRONMENTAL AND SOCIAL CONSIDERATION

Prior to the implementation of land consolidation project, environmental and social impact shall be assessed. This assessment shall include; 1) consideration of alternative options, 2) identification of environmentally important parameters and examination of them, 3) proposing of mitigation measures if negative impacts are expected, and 4) establishment of monitoring plan. Since the legal/regulative procedure for the Environmental Impact Assessment (EIA) is still in progress in Myanmar as of May 2014, following discussions refer to the “JICA Guidelines for Environmental and Social Consideration (April, 2010).”

5.1 Environmental and Social Issues to Examine

In examining the environmental and social impacts associated with the land consolidation, such issues/areas shall be covered: 1) natural and social condition, 2) the county’s legal/regulative framework for environmental impact assessment, 3) scoping of environmental parameters which are to be affected by the project, 4) assessment on the parameters, 5) mitigation measures or alternative option(s) against negative environmental and social impact, 6) establishment of environmental management and monitoring plans, 7) stakeholder meetings, etc.

Further, a simplified Resettlement Action Plan, so-called RAP, shall also be prepared. Resettlement in this context does not mean the resettlement of people, but the loss of beneficiaries’ farmland. Land consolidation project usually entails the establishment of farm road, and irrigation and drainage canals. Thus, the beneficiary farmers need to surrender part of their farmland for such agricultural infrastructure.

The RAP shall include: 1) the scale of the land to be lost, 2) census survey for all the population to be affected, 3) household economic survey covering at least 20% of the population to be affected, 4) compensation measures and/or recovery plan for the land loss, 5) procedure of accepting claims from stakeholders, 6) institutional setup for responding to the claims, 7) establishment of monitoring plan, and 8) stakeholder meetings. Note that the compensation for the land loss is not usually done by a form of direct financial compensation, but by providing more productive land equipped with the agricultural infrastructure.

5.2 Environmental and Social Consideration in Land Consolidation Project

5.2.1 Consideration of Alternative Options

As the first step of environmental and social impact examination, alternative options(s) should be explored. Aside from the planed farmland consolidation project, two options can be considered: development of new farmland, and implementation of no project (zero option). Table 5.2.1 below shows the typical issues/areas in assessing the options as examples: 1) the site, 2) resettlement and land acquisition, 3) access, 4) effect of the project, and 5) project cost.

In most cases, farmland consolidation at the current farmland can be recommended as shown in the example. Concerning a new farmland development (Option 2), it may not be possible to secure area(s) nearby to replace the current farmland. If the Option 2 is selected, new farmland would be located far from the current farmland, and the beneficiary farmers need to move to such a far place.

Table 5.2.1 Example of Examining Alternative Options for Farmland Consolidation Project

Environmental Items	Option 0 (no project)	Option 1 Farmland Consolidation	Option 2 New Farm Development
Farmland consolidation site	-	Same site as current farmland	New farmland should be prepared
Resettlement and land acquisition (land recovery)	-	X Some land areas are required for construction of farm road and	XXX Full scale land acquisition is required.

Environmental Items	Option 0 (no project)	Option 1 Farmland Consolidation	Option 2 New Farm Development
		irrigation and drainage canals.	
Access	-	++ Through the establishment of new farm road into the farmland area, better access is expected.	XXX New farm has to be developed probably at a far place from the present farmland.
Effect of project	-	+++ New farm road and the irrigation system will increase agricultural production.	XX New land may not be as fertile as the present one, resulting in lower yields of crops.
Project cost	Zero	Medium	Very High
Selection	-	Selected	-

X : small-scale negative impact, XX: middle-scale negative impact, XXX: large-scale negative impact

+ : small-scale positive impact, ++: middle-scale positive impact, +++: large-scale positive impact

Source: JICA Survey Team (2014)

5.2.2 Scoping and TOR Required for Land Consolidation Project

Scoping shall be conducted at an early stage of the environmental and social examination. The scoping is to identify: 1) the important parameters to be considered in the environmental and social examination; 2) the appropriate time and spacing required for the environmental study; and 3) the information necessary to decide whether the project should be implemented, modified or otherwise cancelled. Thus, through the scoping, environmental parameters, on which negative impacts likely take place, will be identified.

An example of scoping matrix is presented in the following Table 5.2.2, in which the environmental parameters to be examined are based on the JICA Guidelines. Note that the following scoping shall be taken only as example and actual scoping shall be conducted according to various extents of the environmental and social impacts by each consolidation project. The evaluation shall be conducted by each of the parameters separately at the stage of construction and operation with the following four levels:

- A+/-: Significant positive/negative impact is expected,
- B+/-: Positive/negative impact is expected to some extent,
- C+/-: Extent of the positive/negative impact is unknown (a further examination is needed, and the impact could be clarified as the study progresses), and
- D: No impact is expected.

With respect to land consolidation project, negative impact may be incurred on such parameters, but not limited to, air pollution (during construction), water pollution (during construction), waste (during construction), noise and vibration (during construction), topography and geographical features (during construction & operation), land loss (during construction & operation), water usage or water rights and rights of common (during construction), misdistribution of benefit and damage (during construction & operation), working environment (during construction), and accidents (during construction).

On the other hand, upon completion of the land consolidation project, positive impacts can also be made on such parameters: livelihood for the local economy, land use and regional resources, water usage or water rights, rights of common, social organization like a decision making organization, landscape, and working environment for the beneficiary farmers. Land consolidation project provides the beneficiaries with agricultural infrastructure such as farm road, irrigation and drainage canals, and also facilitates farm mechanization, which altogether increase the agricultural production.

Table 5.2.2 Example of Scoping Matrix for Farmland Consolidation Project

Environmental Parameters	Evaluation (example)		Reasons
	Construction Stage	Operational Stage	
1. Air pollution	B ⁻	D	Due to the farmland consolidation works, air quality deterioration such as dust generation and gas emission from heavy machines may be expected.
2. Water pollution	B ⁻	D	Oil leakage from heavy machines, vehicles, etc. may be expected during the construction phase.
3. Waste	B ⁻	D	Some construction waste including soils to be moved may be dumped during farmland consolidation works.
4. Soil contamination/ salinization			
5. Noise and vibration	B ⁻	D	Noise and vibration from heavy machines seem to annoy residents living nearby during the construction.
6. Ground subsidence			
7. Offensive odor			
8. Protected area			
9. Ecosystem			
10. Hydrological situation			
11. Topography and geographical features	B ⁻	B ⁻	Due to the re-shaping of existing farmland and new farm road and irrigation & drainage canals, topographical features will be changed.
12. Involuntary resettlement			
13. Land loss	B ⁻	B ⁻	Some parts of farmland area will be changed to farm road, and irrigation and drainage canals due to the farmland consolidation work.
14. The poor			
15. Indigenous and ethnic people			
16. Employment			
17. Livelihood for local economy	D	A ⁺	There is a high expectation for increasing local economy thanks to the established road/canals upon completion of the farmland consolidation.
18. Land use and regional resources	D	A ⁺	After the completion of works, farmers can use their own farmland equipped with farm road, irrigation and drainage canals more efficiently.
19. Water usage or water rights and rights of common		A ⁺	After completion of the works; however, every farmer can use irrigation water more efficiently than before.
20. Existing social infrastructures and services			
21. Social organization such as a decision making organization	D	A ⁺	In line with the consolidation works, a new farmer organization will be established and they will be in charge of O&M of road and canals.
22. Misdistribution of benefit and damage	B ⁻	B ⁻	During the process of farmland re-plotting, some misdistribution of farmland re-plotting may take place, giving a larger portion to some farmers if not well monitored.
23. Social institutions			
24. Cultural heritage			
25. Landscape			

Environmental Parameters	Evaluation (example)		Reasons
	Construction Stage	Operational Stage	
26. Gender			
27. Children's rights			
28. Hazards (Risk), Infectious diseases.			
29. Working environment. (Including working safety)	B ⁻	A ⁺ (for farmers)	Working environmental safety measures should be enforced during the farmland consolidation works. Upon completion, the working environment for the farmers will be upgraded thanks to the farm road and canals established.
30. Accidents	B ⁻	D	During farmland consolidation works, there is a possibility that accident may be increased due to traffic increase for the consolidation works.
31. Global warming			

Source: referred to JICA Guidelines for Environmental and Social Consideration (April 2010)

Through the scoping, those parameters ranked at A⁻, B⁻, and C⁻ have been identified, which are expected to have a negative impact or otherwise unknown impact. To further examine the parameters in order to know what extent the impact is to take place and what measures can be undertaken, terms of reference (TOR) should be prepared to specify the study contents and study methods by each of the parameters. An example of TOR is presented below:

Table 5.2.3 Example of TOR for the Environmental Parameters Identified by Scoping

Environmental parameters (negative impact expected)	Study Contents	Study Method
1. Air pollution	<ul style="list-style-type: none"> Study the influence to social institutes under the farmland consolidation phase. 	<ul style="list-style-type: none"> Examine the location of hospital, school, residential area, farmland consolidation work period and site.
2. Water pollution	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
13. Land loss	<ul style="list-style-type: none"> Study the area to be changed to farm road and canals by referring to the design drawings. 	<ul style="list-style-type: none"> Examine the area of right of farm road, irrigation canal and drainage canal.
29. Working environment. (Include working safety)	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
30. Accidents	<ul style="list-style-type: none"> Study the heavy machines which are planned to use. 	<ul style="list-style-type: none"> Examine what kind of and how many heavy machines are used under the project, and check the route(s) of bringing them in relation to residential areas.

Source: JICA Survey Team (2014)

5.2.3 Environmental and Social Impact Evaluation

Following the TOR established above, environmental and social examination shall be conducted with reference to map(s) of farmland consolidation, plan and design of the farmland consolidation, interviews to concerned organizations such as Irrigation Department, Department of Agriculture and relevant Township Office, census survey results covering all the affected households, and household economic survey results covering at least 20% of the affected households.

The results out of the environmental and social examination can be summarized in an evaluation matrix prepared in comparison with the scoping results. An example is presented below (see Table 5.2.4); and the following result shall be taken only as example. Actual evaluation shall, of course, be made according to various extents of the environmental and social impacts by each consolidation

project.

In the evaluation matrix, all the environmental parameters identified during the scoping stage are once again listed with the scoping results, to which evaluation results through the environmental and social examination are comparatively shown. Then, there will be some environmental parameters, which have been changed through the environmental and social examination. For these parameters, the reason why it has been changed must be elaborated.

Table 5.2.4 Example of Impact Evaluation as Compared to the Scoping Results

Environmental Parameters	Evaluation at Scoping		Evaluation based on the result of environmental and social examination		Reasons
	Construction Stage	Operation Stage	Construction Stage	Operation Stage	
1. Air pollution	B ⁻	D	B ⁻	D	
2. Water pollution	B ⁻	D	B ⁻	D	
3. Waste	B ⁻	D	D	D	Some amount of excavated soils seems to be discharged; however, almost all of soils can be reused.
4. Soil contamination/ salinization					
5. Noise and vibration	B ⁻	D	B ⁻	D	
6. Ground subsidence					
7. Offensive odor					
8. Protected area					
9. Ecosystem					
10. Hydrological situation					
11. Topography and geographical features	B ⁻	B ⁻	D	D	The features will be changed, however the scale of changes is very small, therefore no negative impact.
12. Involuntary resettlement					
13. Land loss	B ⁻	B ⁻	B ⁻	B ⁻	A portion of farmland will be changed to farm road, and irrigation & drainage canals.
14. The poor					
15. The indigenous and ethnic people					
16. Employment					
17. Livelihood for local economy					
18. Land use and regional resources					
19. Water usage or water rights and rights of common	B ⁻	A ⁺	D	A ⁺	Farmland consolidation work will be done in May and June. During that time, farmers do not cultivate crops, therefore, no negative impact.
20. Existing social infrastructures and services					
21. Social organization such as a decision making organization	D	A ⁺	D	A ⁺	
22. Misdistribution of benefit and damage	B ⁻	B ⁻	B ⁻	B ⁻	

Environmental Parameters	Evaluation at Scoping		Evaluation based on the result of environmental and social examination		Reasons
	Construction Stage	Operation Stage	Construction Stage	Operation Stage	
23. Social institutions					
24. Cultural heritage					
25. Landscape					
26. Gender					
27. Children's rights					
28. Hazards (Risk), Infectious diseases.					
29. Working Environment. (Include working safety)	B ⁻	A ⁺ (for farmers)	B ⁻	A ⁺ (for farmers)	Safe working environment should be secured during farmland consolidation working phase.
30. Accidents	B ⁻	D	B ⁻	D	During the works, there is a possibility that an accident may take place due to an increase of traffic.
31. Global warming					

Source: JICA Survey Team (2013)

5.2.4 Mitigation Measures

Above impact evaluation identifies environmental parameters adversely affected by the implementation of the farmland consolidation project. Though the negative impacts are generally limited to only construction stage except for the land loss, mitigation measures should always be established prior to the commencement of the work. The measures should be elaborated by each of the parameters negatively affected with proper information who implements and who monitors. Such impacts can be minimized by mitigation measures as shown in the following table as example (note that measures on land loss are discussed in the following chapter).

Table 5.2.5 Example of Mitigation Measures against Environmental Parameters Negatively Affected

Environmental parameters	Proposed environmental management plan		Implementing organization	Monitoring /responsible organization
	Farmland consolidation phase	Operation phase		
Air Pollution	<ul style="list-style-type: none"> To prevent air pollution, carry out regular check-up and maintenance for the vehicles/ machineries. Spray water in and around the work sites in order to prevent dust arise. Monitor the complaints from the relevant inhabitants who live in near the work site. 	-	ID (CON4)	ID (CON4)
Water Pollution	<ul style="list-style-type: none"> To prevent water pollution, prepare a sedimentation basin at a lower part of the field. When the sedimentation basin becomes full, the sediment should be removed, brought back to, and spread over the farm area after having been dried. 	-	ID (CON4)	ID (CON4)
Noise and Vibration	<ul style="list-style-type: none"> Carry out regular check-up and maintenance of heavy machineries in order to prevent big noise and vibration. Do not carry on the work near the residential area at night time, e.g. from 18:00 to 8:00. Monitor the complaints from the relevant inhabitants. 	-	ID (CON4)	ID (CON4)
Land Loss	Note: this issue is elaborated in the following chapter		ID (CON4)	Management Committee (SLRD)
Working Environment (Include working safety)/ Accident	<ul style="list-style-type: none"> Carry out safety check when bringing the heavy machineries into the field and bringing out after the farmland consolidation works. Carry out safety check every day when the refueling car accesses into the field. To inform the consolidation works to the inhabitants near the site; put up a sign board for the work. 	-	ID (CON4)	ID (CON4)

Environmental parameters	Proposed environmental management plan		Implementing organization	Monitoring /responsible organization
	Farmland consolidation phase	Operation phase		
	<ul style="list-style-type: none"> Instruct all the drivers/operators on compliance with prescribed routes, speed, working hours, etc. 			

Source: JICA Survey Team (2014)

5.2.5 Environmental Monitoring Plan

After having designed the mitigation measures, monitoring plan should be formulated. Typical environmental parameters adversely affected by the farmland consolidation project are air pollution, water pollution, noise/vibration, working environment and accident. Thus, those items shall at least be monitored (note that the issue of land loss is discussed in the following chapter). Tables below indicate a recommended monitoring plan with relevant monitoring forms, which should/can be modified according to the site-specific condition.

Table 5.2.6 Recommended Monitoring Plan (Construction Stage)

Environmental Parameter	Survey Point	Monitoring Item	Frequency	Responsible Organization
Air Pollution	Residential areas near the consolidation site.	Monitor the complaints from the relevant inhabitants near the site.	Once per week	ID (CON4)
	Maintenance of heavy machineries	Check the heavy machineries whether trouble/damage has happened to the machines or not. If a trouble is found, it should be repaired.	Every day	ID (CON4)
	Water spray	Spray water during the consolidation works to prevent the dust arising.	Every day	ID (CON4)
Water Pollution	Sedimentation basin	Monitor the quantities of sediment. If the sedimentation basin becomes full, the sediment should be removed, and brought back/ spread over the farmland.	After rainfall in the field.	ID (CON4)
Noise and Vibration	Residential areas near the consolidation site.	Monitor the complaints from the inhabitants near the site.	Once per week	ID (CON4)
	Maintenance of heavy machineries	Check the heavy machineries whether trouble or damage is happening to the machines. If a trouble is found, it should be repaired.	Every day	ID (CON4)
	Time of consolidation works	Do not continue the work near the residential area at night time, from 18:00 to 8:00.	Every day	ID (CON4)
Land Loss	To be discussed in the next chapter	-	-	-
Working Environment (Including working safely) / Accident	Consolidation area and around the residential area	Check the management/ operation of machineries, vehicle routes and speed.	Every day	ID (CON4)
	Maintenance of heavy machineries	Check the heavy machineries whether trouble or damage takes place to the machines. If a trouble is found, it should be repaired.	Every day	ID (CON4)
	Access of machineries into the field.	Conduct safety check during the carrying in and out the heavy machineries.	First and end time of the works	ID (CON4)
		Conduct safety check when the refueling car accesses to the field.	Every day	ID (CON4)
	Installation of project sign board	Install a sign board which explains the farmland consolidation works.	Prior to commencement of the works	ID (CON4)

Source: JICA Survey Team (2013)

Table 5.2.7 Recommended Monitoring Forms (Construction Stage)

1) Grievances from the habitant near the site.

Environmental Parameter	Monitoring Results	Measures Taken	Monitoring Date
Air Pollution			Once per week
Noise, and Vibration			Once per week

2) Maintenance of heavy machines

Type of Machine	Kinds of Damages	Measures Taken	Monitoring Date
Crawler Tractor			Every day
Hydraulic Excavator			Every day
Dump Truck			Every day
Vibromax			Every day
Mini Backhoe			Every day

3) Natural Environment

Environmental Parameter	% of Sediment in Basin	Measures Taken	Monitoring Date
Water pollution If the percentage of the sediment exceeds 70%, the sediment should be removed.			After the rainfall in the field.

4) Working Environment (Include working safety)/ Accident

Environmental parameter	Monitoring Results	Measures Taken	Monitoring Date
Safety check of carrying the heavy machineries into the field.			At the beginning of the consolidation works.
Safety check of refueling cars accessing into the field.			Every day.
Safety check of carrying-out the heavy machineries from the field.			Upon completion of the consolidation works.
Checking the heavy machineries keeping correct routes and speed.			Every day
Do not operate the heavy machineries from 18:00 to 8:00 in the field.			Every day
Installation of project sign board around the field.			Prior to commencement of the consolidation works.

Source: JICA Survey Team (2014)

5.3 Preparation of Resettlement Action Plan (RAP): Land Acquisition**5.3.1 Needs of Land Acquisition, and Compensation Measures**

Land consolidation project develops farm road, irrigation and drainage network to the adjacent area of the farmland. By making use of these facilities, especially irrigation and drainage facilities, farmers can enhance their agricultural production. However, the area for the new farm road, irrigation and drainage canals shall be generated using the beneficially farmers' farmland. Therefore, the beneficiaries of the project are also PAPs (project affected peoples) who are supposed to surrender a part of their farmland.

In the case of Japan, land consolidation projects do not make any compensation for the loss of the land. There is a pre-condition that the one who applies the project should be the farmers, or the representatives of the farmers. It is a pre-condition that the farmers who want their lands to be consolidated must have agreed to surrender a part of their farmland before the application is submitted. Under this concept, no compensation is arranged in Japan.

Likewise, direct compensation should not be made for the loss of lands in the case of Myanmar too. If direct compensation is made, principle of public equity may rather be hindered. Since the beneficiary

farmers already enjoy the benefit of land consolidation on their private properties, which is to be funded from the government coffers or by donor(s), further investment for the compensation using the public funding is rather unfair for the sake of public.

With above in mind, no direct compensation should be arranged under land consolidation projects, provided that there are such conditions met; 1) loss of the land should be less than 10%, 2) the loss of the land can be recovered by more productive farmland equipped with agricultural infrastructure upon the consolidation, 3) procedure of handling claims is established, and of course 4) all the concerned farmers have agreed upon the project including the policies and procedures taken for compensation.

Further, the JICA Guideline specifies that ‘compensation must be based on the full replacement cost as much as possible (see Box 5.1).’ In line with this principle, the value of the land as well as the increase of the crop production with the project should be more than those having been generated from the original farmland; otherwise, land consolidation project should not be implemented.

Box 5.1: JICA Policies for Involuntary Resettlement:

There are policies that the JICA upholds for involuntary resettlement, which are further complemented by World Bank OP 4.12. Of the policies, relevant ones to the land consolidation work are as follows:

- ✓ People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
- ✓ Compensation must be based on the full replacement cost as much as possible (Note that the cost here means the pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes).
- ✓ In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
- ✓ Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
- ✓ Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

5.3.2 Identification of the PAPs and the Scale of Land Acquisition

To identify all the PAPs and the project beneficiaries, as well as the scale of land acquisition, registration data of the land-use-right shall firstly be collected from the SLRD. Also, a census survey should be carried out covering all the beneficiary farmers in the target land consolidation area. As shown in the following table as example, the PAPs shall be identified by some categories, such as number of household units, number of the affected population, and legal status of the land/tillage right:

Table 5.3.1 Example of Project Affected Units (PAUs) and Affected Persons (PAPs)

Type of loss	No. of PAUs			No. of PAPs		
	Legal	Illegal	Total	Legal	Illegal	Total
Required for farm plot re-allocation.						
1 HH (Farm user on government land)						
2 HH (Farm user on private land)	XXX	X	XXXX	XXXX	X	XXXX
3 HH (Tenants)						
4 CBEs (Farm user on government land)						
5 CBEs (Farm user on private land)	XX		XX	XXX		XXX
6 CBEs (Tenants)						
7 Community owned structures						
Grand Total (1 – 9)	T		TT	T		TT

Note: No. of PAUs can be obtained at the office of Settlement and Land Records Department, No. of PAPs should be from the census survey, HH: Household, CBEs: Commercial and Business Enterprises

Based on the registration data for the land-use-right and the result of census survey, total land area for the consolidation project shall be estimated. At the same time, the area to be occupied by road and irrigation canals shall be computed with reference to the design drawings. Both estimates can be summarized as in the following table, from which we can know how much percentage of the land shall be surrendered for the construction of road and canals out of the total farmland.

Table 5.3.2 Example of Farmland Consolidation Area and Area to be Lost

Area	Total Farmland	Area to be lost by farm road and canal construction	Total Household
Acre	xxxx	zz (z %)	XX
Hector	XXXX	ZZ (Z %)	ditto

Source: Settlement and Land Records Department (MOAI) for the farmland area. Design drawings for the area to be lost by farm road and irrigation canal.

The ratio of the farmland to be surrendered for the construction of farm road and canals is usually in a range of 5%-10%; in general, the smaller the project area is, the bigger the land loss is. If the ratio is more than 10%, it would be difficult to obtain the consensus of the concerned farmers on the consolidation project. In such case, the design of farm road and canals shall be modified as to minimize the land area to be occupied or otherwise enlarging of the whole project area may be considered.

5.3.3 Agreement on Land Acquisition

Having identified the percentage of the land to be lost, all the beneficiary farmers shall agree on the arrangement that they surrender a part of their farmland for the construction of farm road and canals. Following table can be used to show how much area shall be surrendered by each of the farmers and to know if he/she has agreed or not. The table shall accompany a map showing the original land plot and designed land-consolidation map where new plot number is indicated.

Table 5.3.3 Recommended Monitoring Format (Responsible organization: Farmer Organization)

Village Name	Farmer Name	Original Farmland (acre)	Z % of Farmland (acre)	Remaining Farmland (acre)	Original Location	New Location	Sign, Date

Source: JICA Survey Team (2014)

To obtain the agreement from the beneficiary farmers, a farmer organization or management committee should take charge because the farmer themselves knows the best of their colleagues than the government officers. Government officers should play a role of facilitating the farmers to form the farmer organization as well as supporting the process of obtaining the agreement by farmer themselves. Government officers should not enforce the authoritative power in the process of obtaining agreement.

5.3.4 Monitoring Issues

The monitoring of land-surrender shall be carried out throughout the process of plot re-allocation in order to ensure that the plot re-allocation be conducted in accordance with the voluntary agreement and also referring to the plot re-allocation plan agreed. The monitoring activities should be carried out by the management committee of the farmer organization, and closely supervised by Cooperative Department and the SLRD. It is expected that the likelihood of complaints could be timely detected by the management committee, and issues arisen should be tried to solve by the committee calling upon concerned farmers and also supported by Cooperative Department.

5.4 Handling of Complaints

There should be an institutional arrangement of handling complaints/grievances which may arise during and after the project implementation. When a farmer has some complaints associated with the land consolidation work, the management committee, representatives of the farmer organization, shall

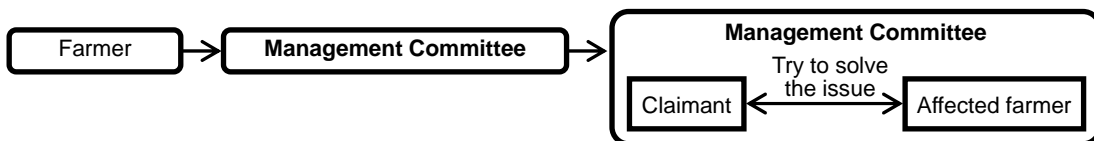
receive the complaints first. Then, the committee shall demarcate the complaints into such categories as: 1) those associated with plot re-allocation, 2) those associated with construction, 3) those associated with land registration, and 4) others.

For the first category, complaints concerning plot re-allocation, the management committee calls upon the concerned farmers, the one who made the complaint and the other who is affected by the claim, and tries to mitigate the issue. Most expected complaint is that the affected farmer does not prefer the location to which the farm plot is to be moved. To solve this issue, the committee should be in the position of mediating the concerned farmers, and the farmer themselves should reach the agreement. The project implementer should wait for the unanimous agreement for the plot re-allocation.

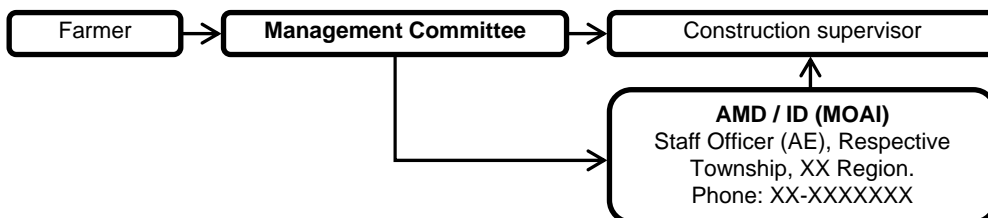
On the 2nd issue concerning construction, the management committee shall deliver the complaint to the construction supervisor at the site. If the complaint is not taken up by the site supervisor, the committee shall deliver the issue to the ID officer in the respective township office. The committee shall discuss the issue with the ID officer, and the feedback/mitigation measures will be instructed by the officer to the construction site.

Concerning the 3rd issue, land registration, the management committee shall go, together with the claimant, to the township officer of the SLRD in charge of the registration of land cultivation deed. The committee shall assist the member farmers to have the registration process done smoothly or assist in solving any problems associated with the land registration. For other complaints, the committee may try to solve it with the claimant or otherwise they may have to go to General Administration Office of the respective township.

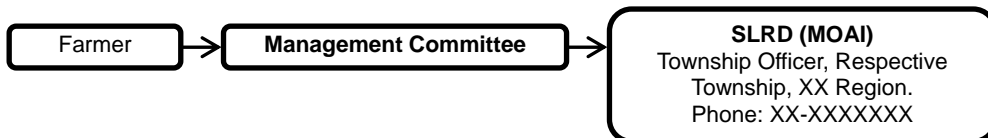
a) Complaints concerning plot re-allocation



b) Complaints concerning construction



c) Complaints concerning land registration



d) Complaints concerning other matters



Figure 5.4.1 Example Flow of Compliant Handling

Source: JICA Survey Team, 2014

5.5 Consultation Meetings

Throughout the environmental and social examination and also preparation of the RAP, a series of consultation meetings should be held with the beneficiary farmers who are also the PAPs. In principle,

four types of consultation meetings should be held as shown below:

Table 5.5.1 Example of Typical Consultation Meetings

Meeting	Contents	Organizer
Explanation of the project, at the commencement of project	<ul style="list-style-type: none"> ✓ To explain the project concept and preliminary plan & design ✓ To explain the necessity of establishing the farmer organization 	ID, SLRD, (CD)
Establishment of the farmer organization	<ul style="list-style-type: none"> ✓ To explain the roles and regulations for farmer organization ✓ To select farmer representatives who are the members of the management committee 	CD, (SLRD)
Presentation of and agreement on the land loss to be occupied by farm road and canals, with finalized farmland consolidation design, implementation schedule	<ul style="list-style-type: none"> ✓ To explain the necessity of surrendering a part of their farmland for the construction of farm road and canals ✓ To obtain consensus for surrendering the part of the farmland. ✓ To show the finalized design and schedule of the farmland consolidation project 	ID, (SLRD, CD)
Presentation of and agreement on the farm plot re-allocation plan, followed by ground negotiation	<ul style="list-style-type: none"> ✓ To show the plot re-allocation plan ✓ To facilitate ground negotiation among concerned farmers on the plot re-allocation ✓ To obtain agreement on the plot re-allocation plan among all the concerned member farmers 	SLRD, (ID, CD) Management Committee

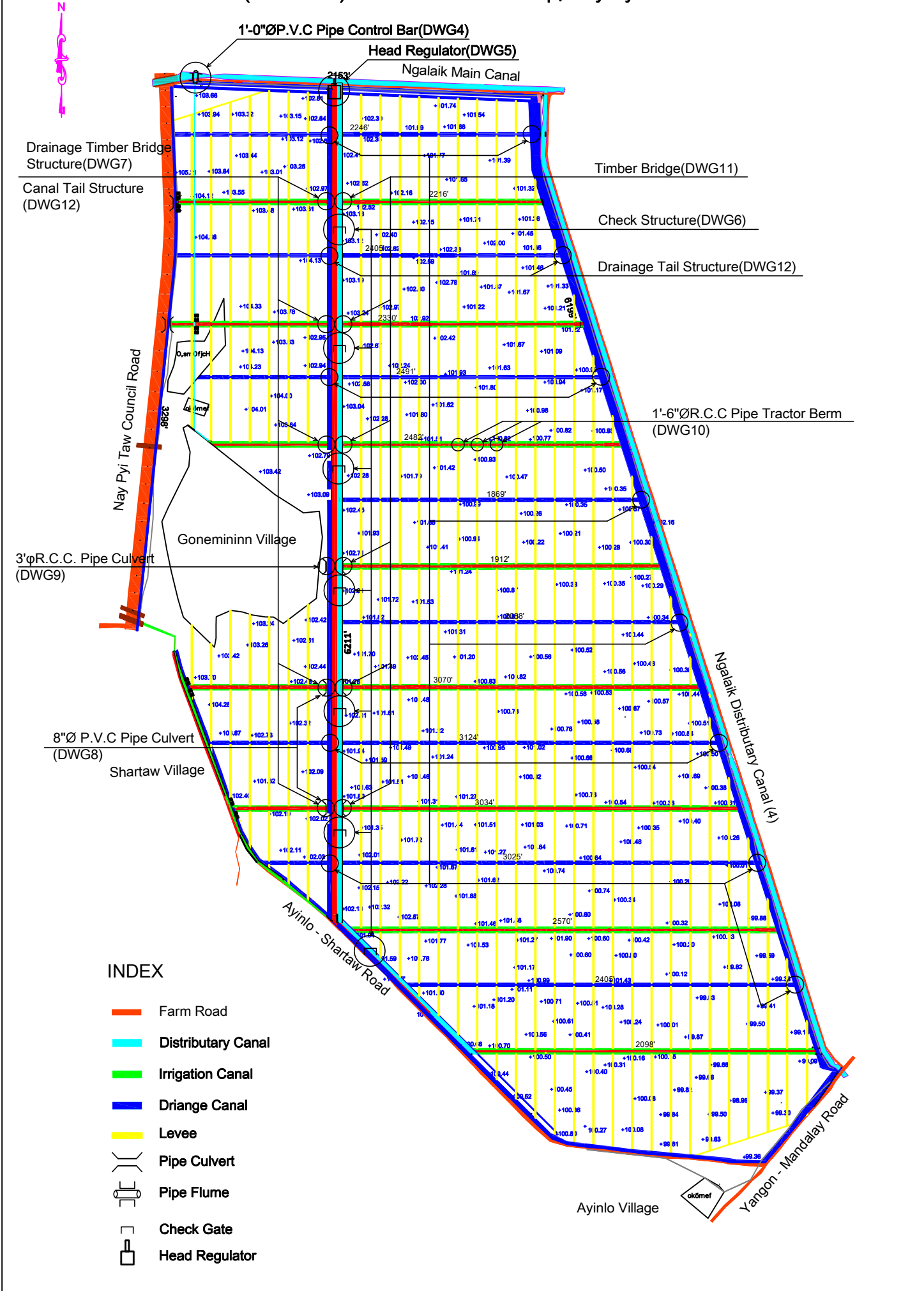
Note: ID (Irrigation Department), SLRD (Settlement and Land Record Department), and CD (Cooperative Department)

Source: JICA Survey Team based on an experience from a pilot consolidation project supported by JICA (2013-2014)





DRAWINGS

- DWG 1. Example of Farmland Consolidation Project Plan (342 acres) in Zabu Thiri Township, Nay Pyi Taw
- DWG 2. Standard Alignment
- DWG 3. Main Farm Road, Branch Farm Road, Water Flow
- DWG 4. 1'-0"Ø P.V.C Pipe Control Bar
- DWG 5. Head Regulator
- DWG 6. Check Structure
- DWG 7. Drainage Timber ridge Structure
- DWG 8. 8"Ø P.V.C Pipe Culvert
- DWG 9. 3'Ø R.C.C Pipe Culvert
- DWG 10. 1'-6"Ø R.C.C Pipe Tractor Berm
- DWG 11. Timber Bridge
- DWG 12. Tail Structure

DWG1. EXAMPLE OF FARMLAND CONSOLIDATION PROJECT PLAN (342 acres) in Zabu Thiri Township, Nay Pyi Taw

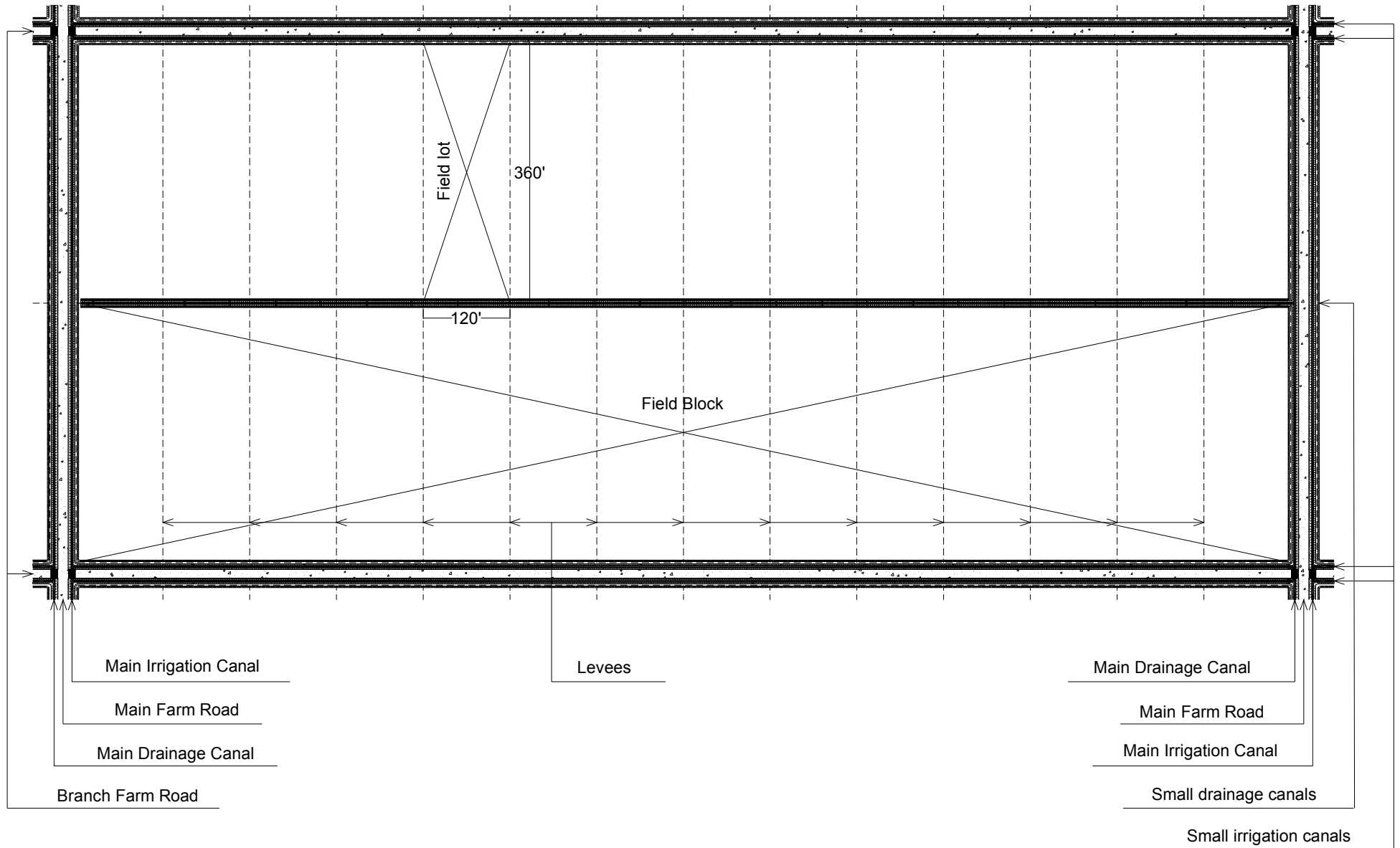


INDEX

- Farm Road
- Distributary Canal
- Irrigation Canal
- Drainage Canal
- Levee
-  Pipe Culvert
-  Pipe Flume
-  Check Gate
-  Head Regulator

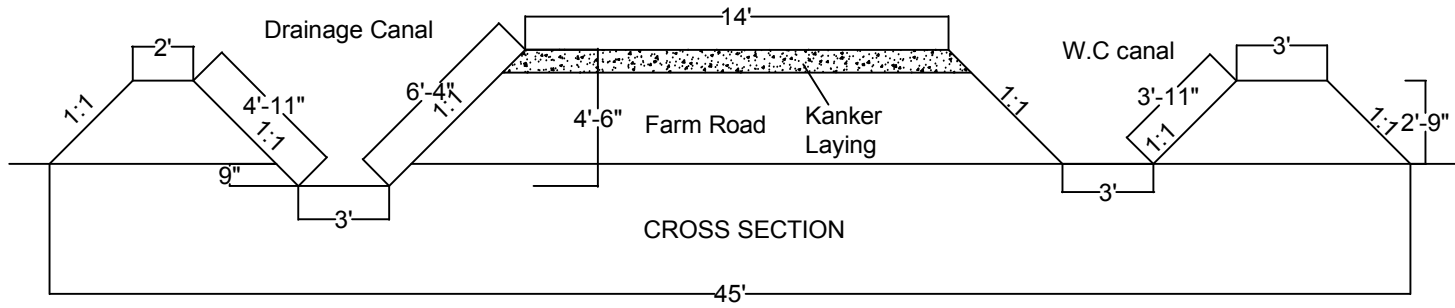
DWG2 .STANDARD ALIGNMENT

Farm Block

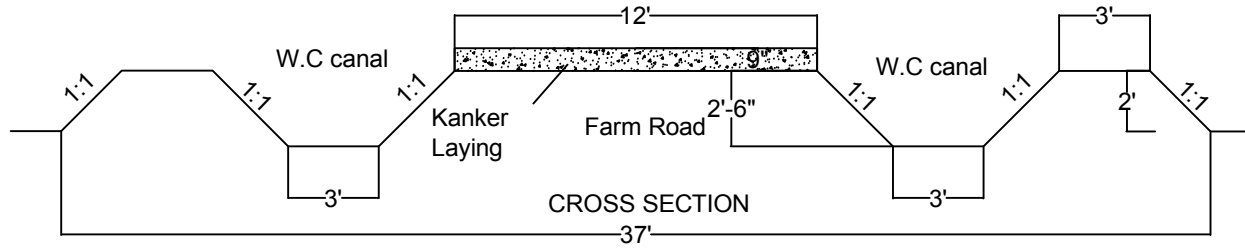


DWG3. MAIN FARM ROAD, BRANCH FARM ROAD, WATER FLOW

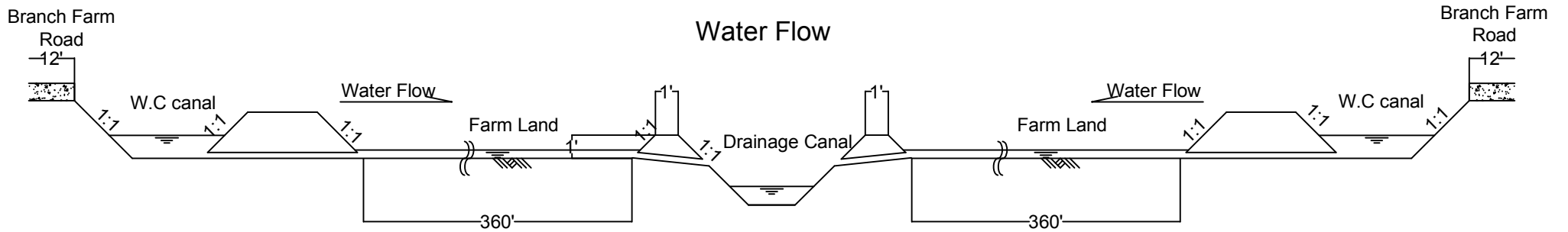
Main Farm Road



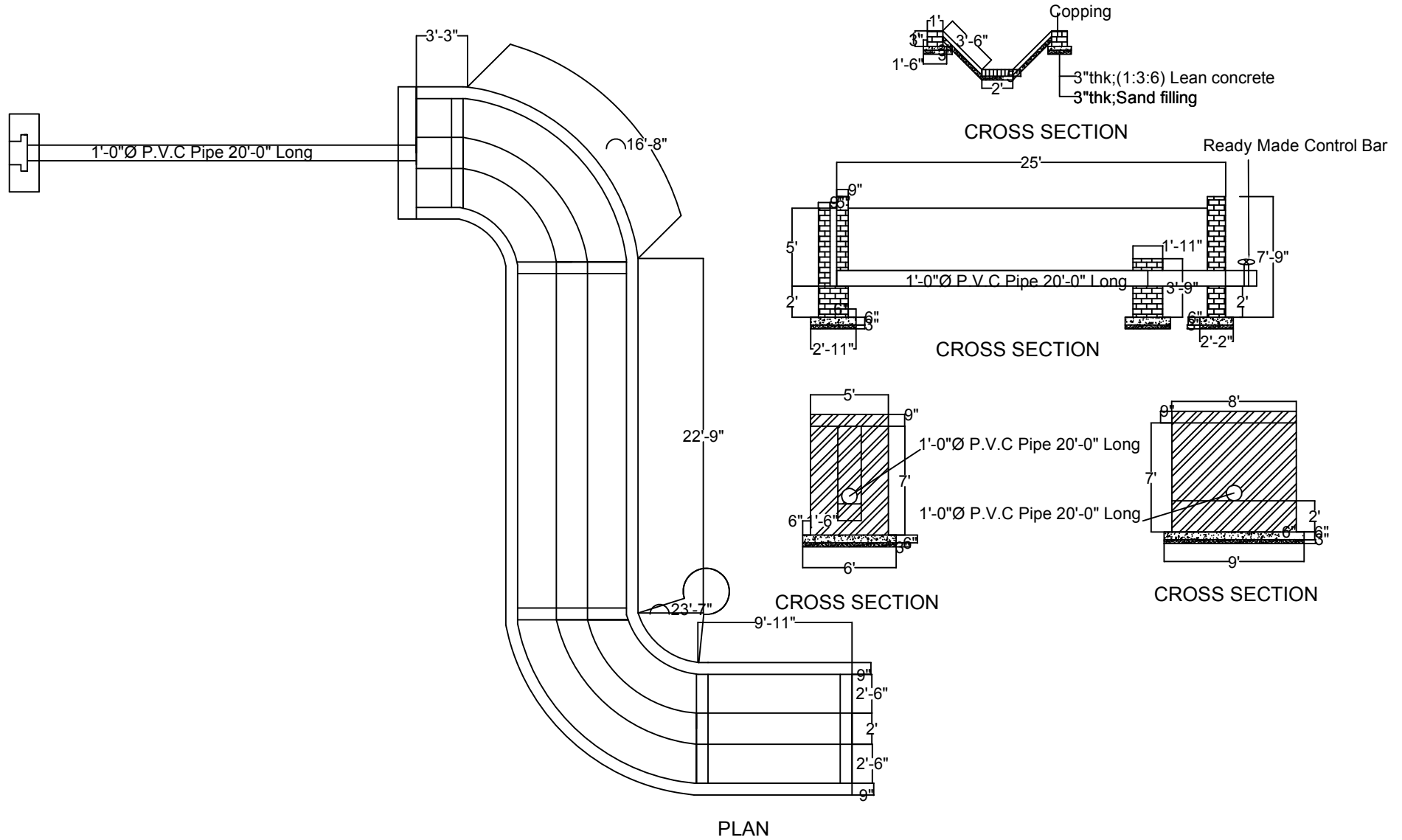
Branch Farm Road



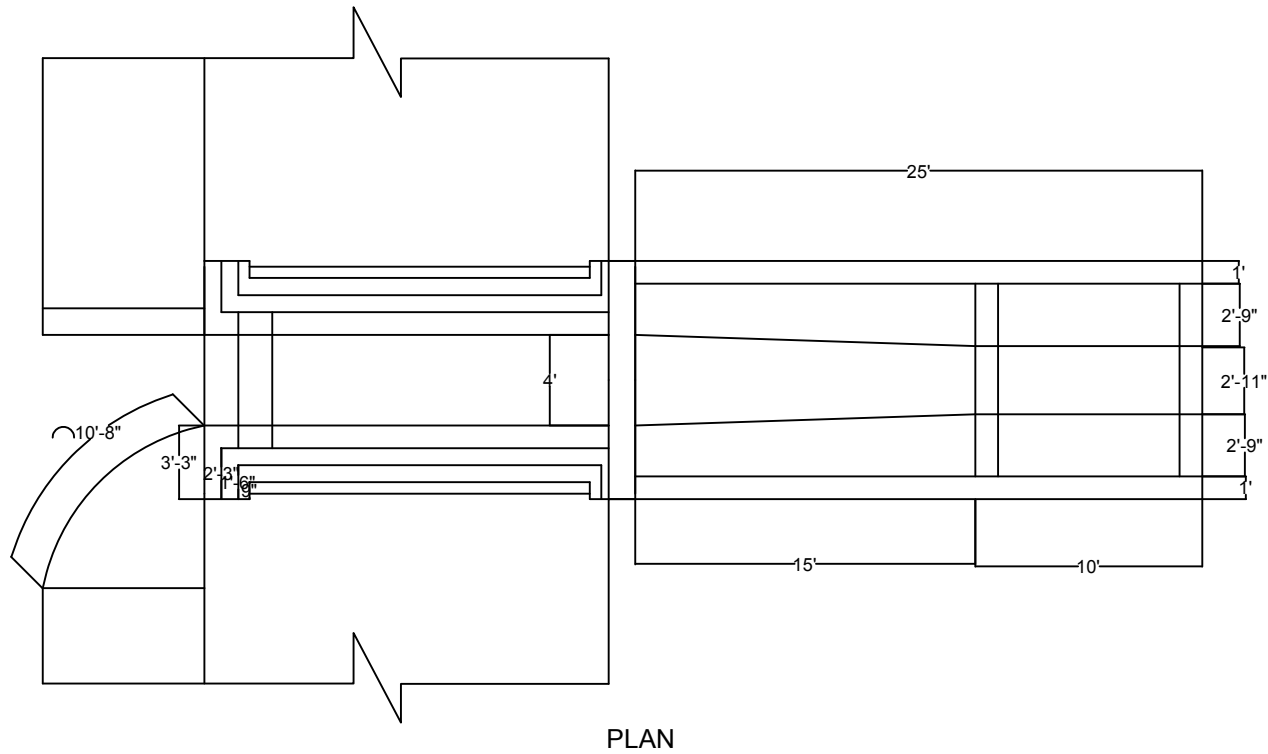
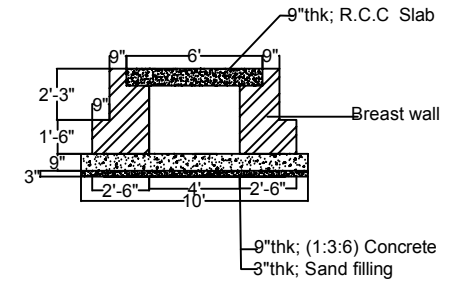
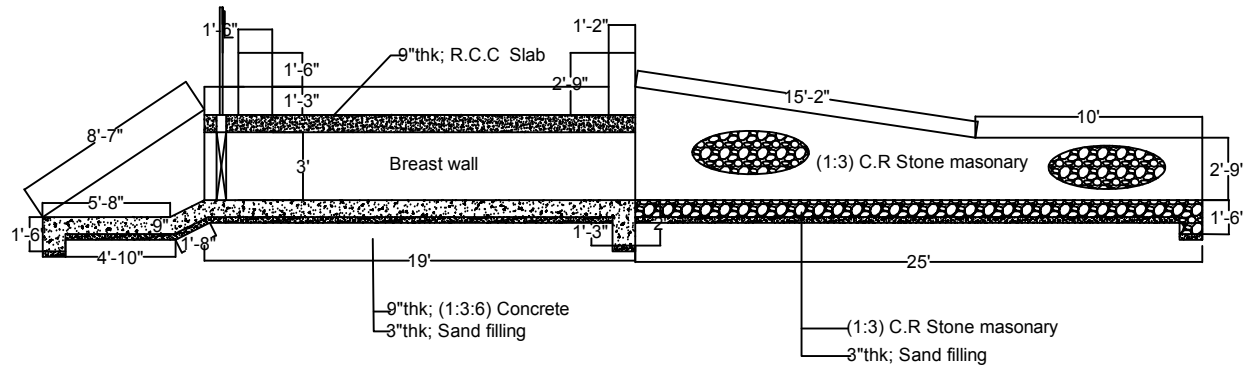
Water Flow



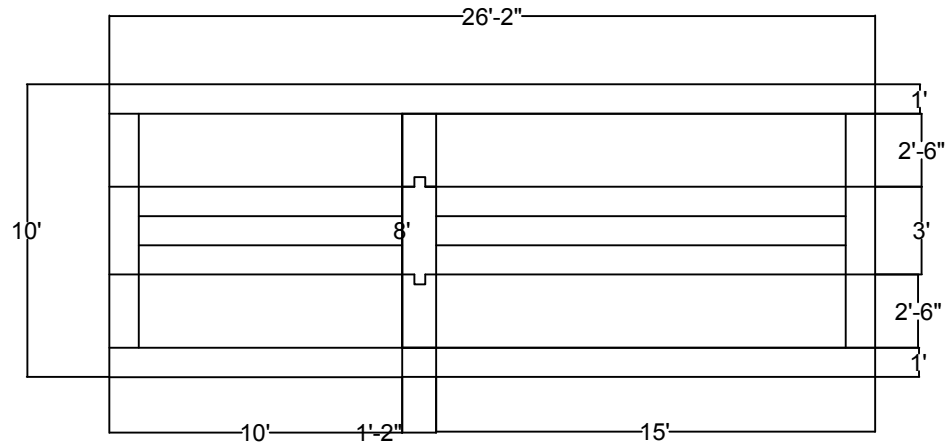
DWG4. 1'-0"Ø P.V.C PIPE CONTROL BAR



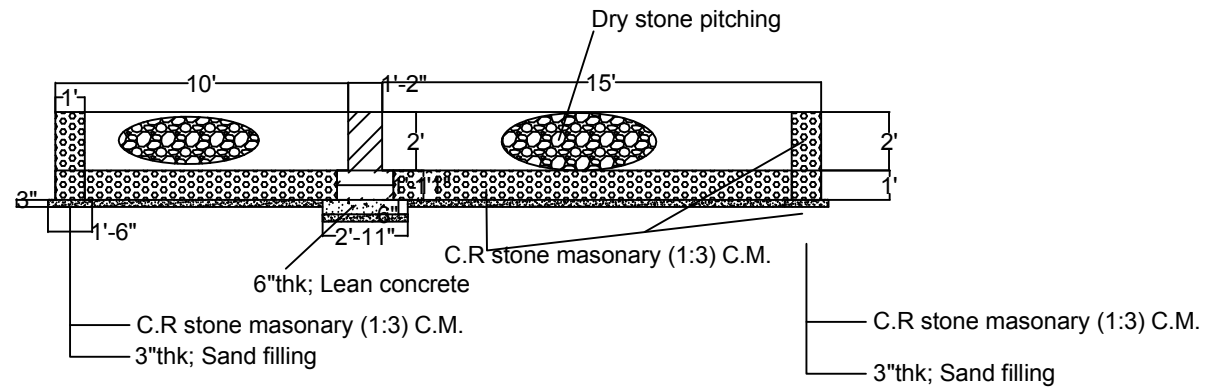
DWG5. HEAD REGULATOR (H/R)



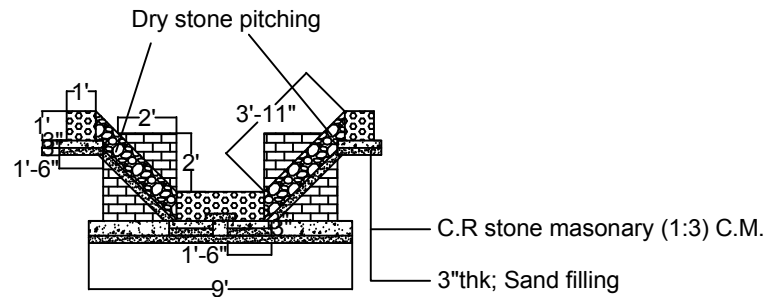
DWG6.CHECK STRUCTURE



Plan

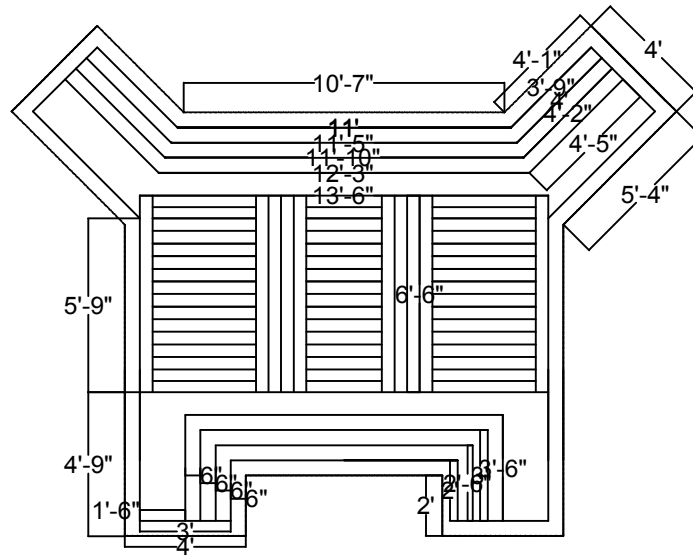


Cross Section

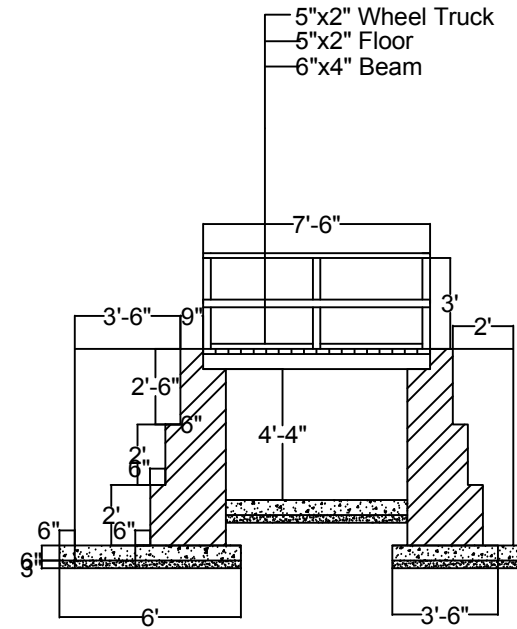


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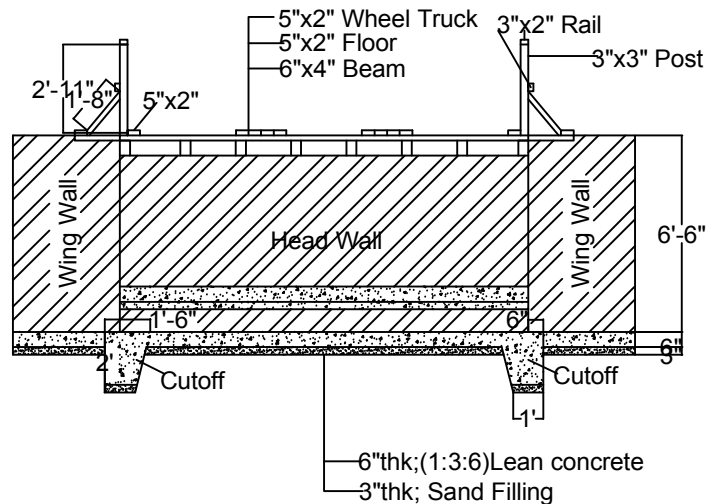
DWG7. DRAINAGE TIMBER BRIDGE STRUCTURE



PLAN

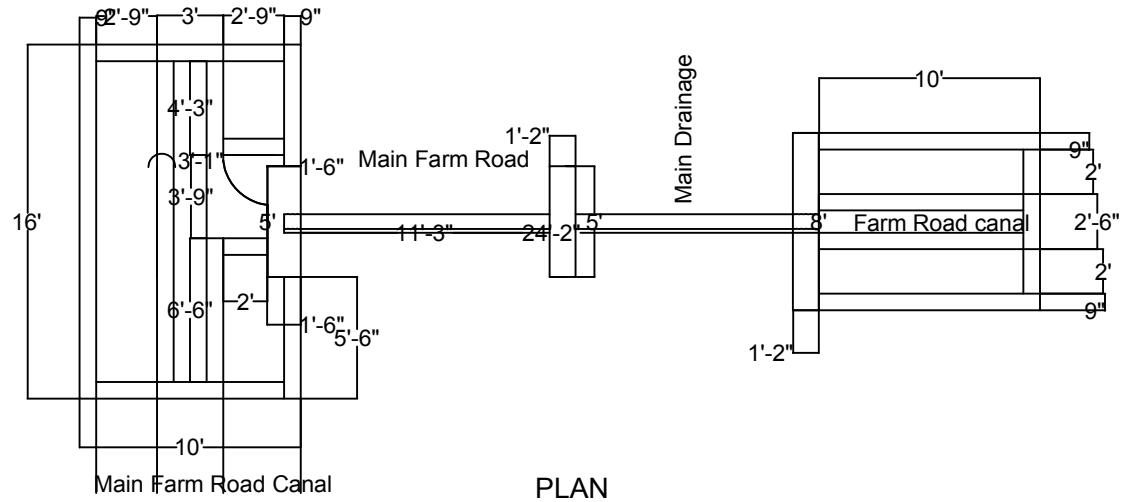


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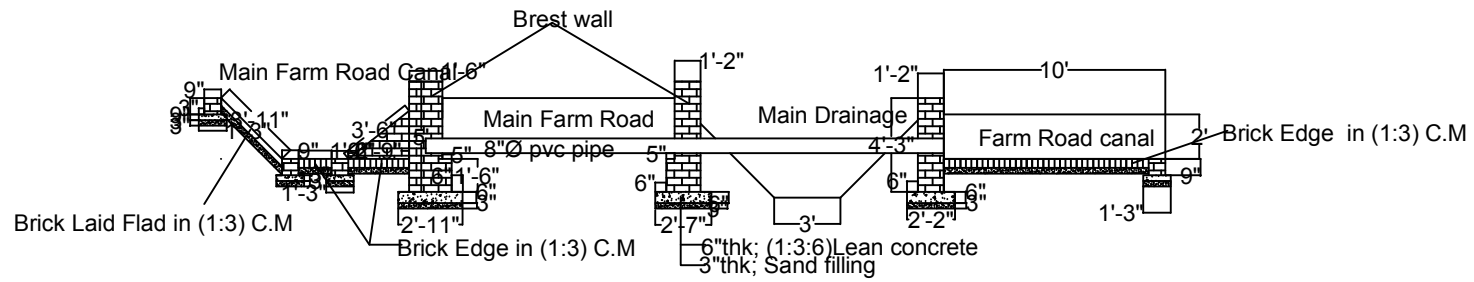


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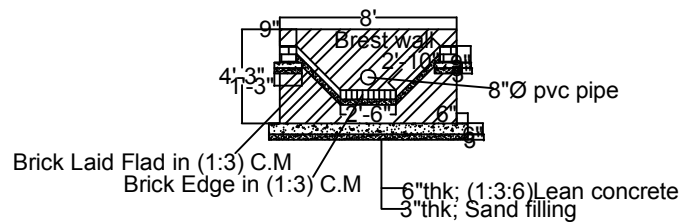
DWG8. 8"Ø P.V.C PIPE CULVERT



PLAN

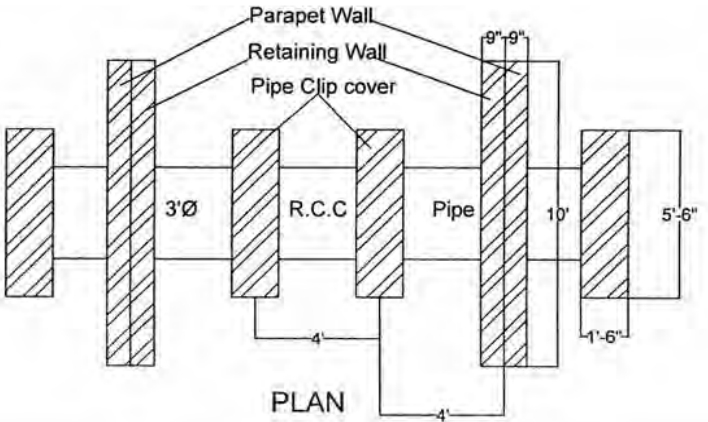
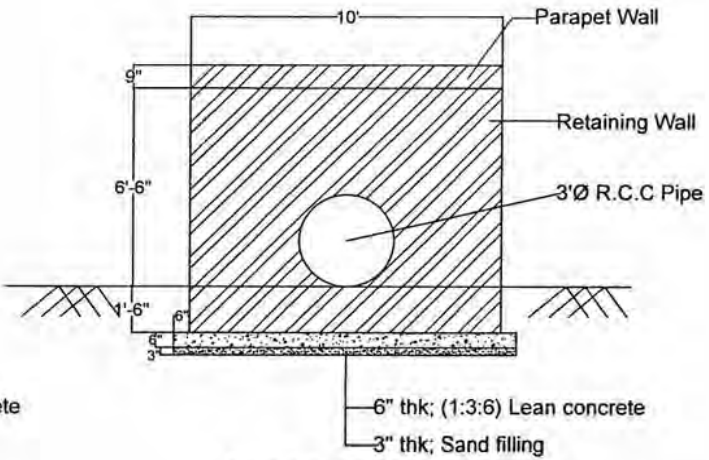
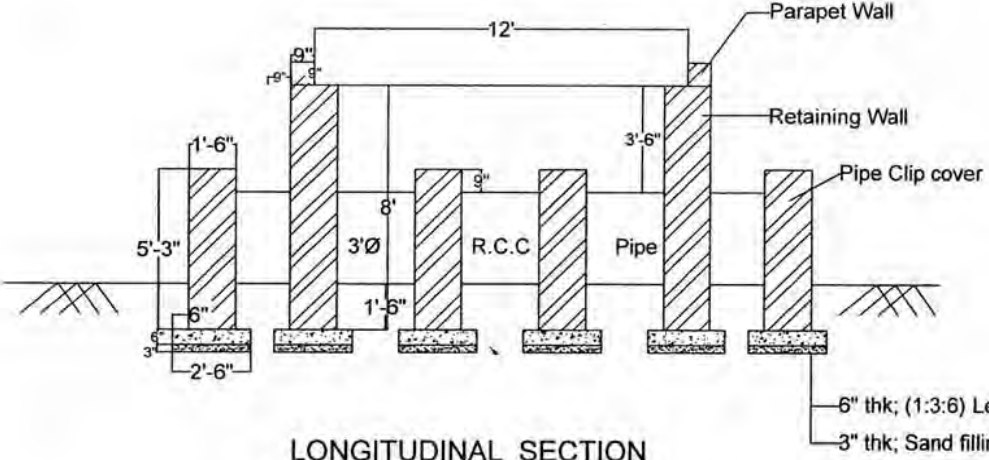


LONGITUDINAL SECTION

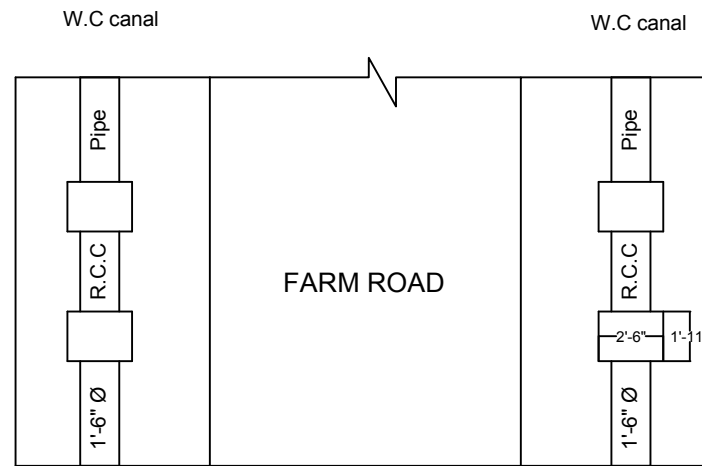
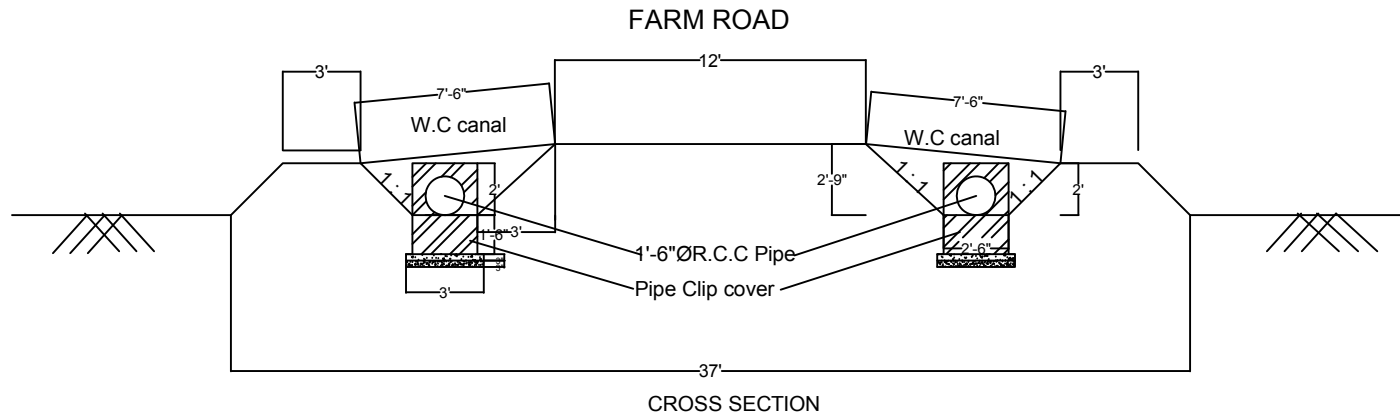


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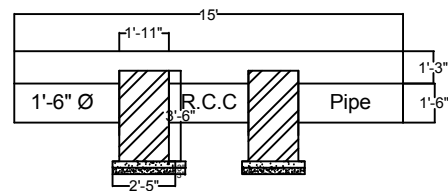
DWG9. 3' Ø R.C.C PIPE CULVERT



DWG10. 1'-6"ØR.C.C Pipe TRACTOR BERM

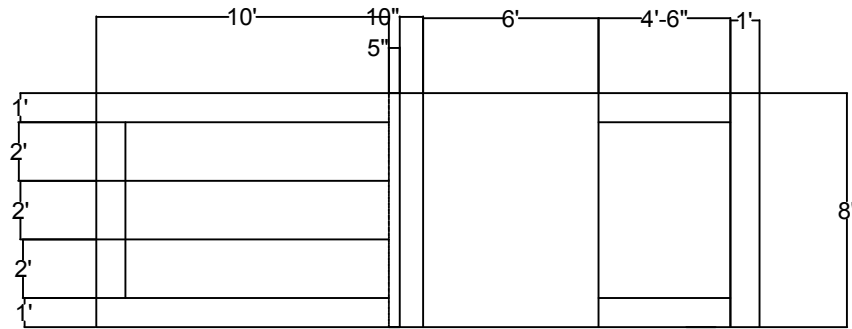


PLAN

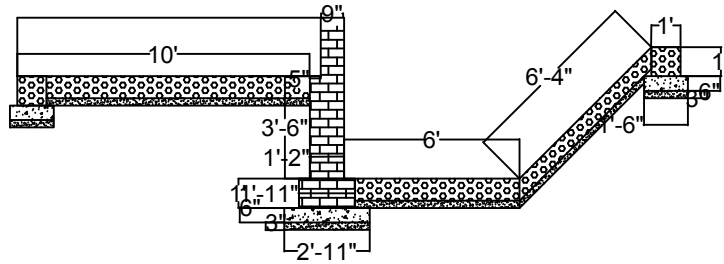


DWG12. TAIL STRUCTURE

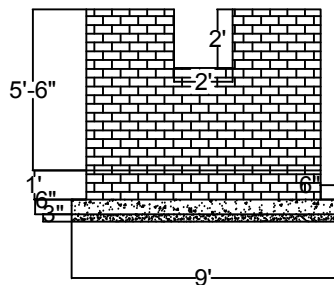
Canal Tail Structure



PLAN

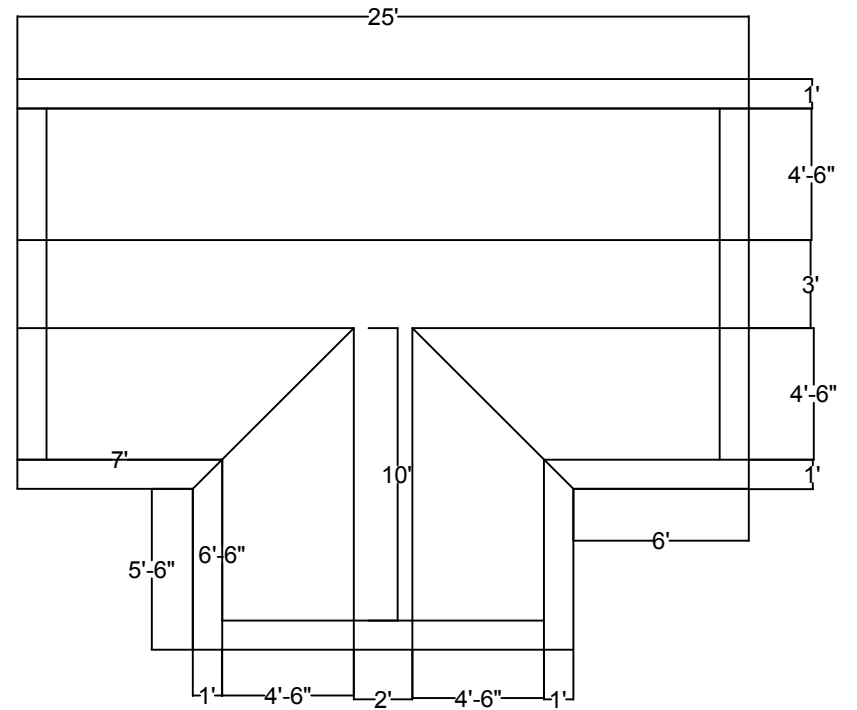


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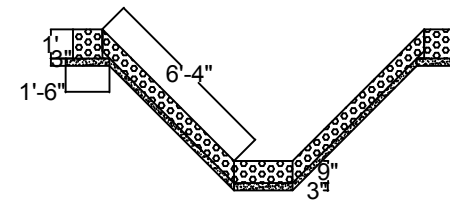


CROSS SECTION

Drainage Tail Structure



PLAN



CROSS SECTION