NO. 15

FEASIBILITY REPORT

ON

BUKIT BAK PILOT PROJECT

FOR

TRIPLE CROP SHIFTING AGRICULTURAL DEVELOPMENT

[redacted]

FEASIBILITY REPORT
ON
BUKIT BAUK PILOT PROJECT
FOR
TRENGGANU TENGAH SWAMP AREA
AGRICULTURAL DEVELOPMENT
MALAYSIA

MAIN REPORT

MARCH 1979

JAPAN INTERNATIONAL COOPERATION AGENCY

No. 13907
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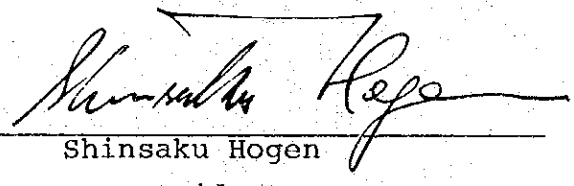
PREFACE

Following a request of the Malaysian Government to the Japanese Government, the Japan International Cooperation Agency (JICA) dispatched a feasibility study team consisting of 17 experts, headed by Mr. Yoshizo Mochizuki of the Taiyo Consultants Co., Ltd., to Malaysia to conduct a field survey on the Bukit Bauk Pilot Project for Trengganu Tengah Swamp Area Agricultural Development, from 4th August to 19th November 1978. The team conducted necessary technical and economic studies in Malaysia and exchanged views with the Malaysian authorities concerned on the proposed project.

After further studies based on the above study and discussions this feasibility report has been formulated.

Agricultural development in a tropical swamp area comparable in scale to this project is rarely found in any other parts of the world. It is therefore my ardent hope that this report will make a valuable contribution to more efficient land utilization and further agricultural development which is a top priority economic policy of the Malaysian Government and serve for furtherance of the friendly relations between Japan and Malaysia. I take this opportunity to express my heartfelt appreciation to the Malaysian authorities concerned for the cooperation extended to the team.

March 1979



Shinsaku Hogen
President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

March 1979

Mr. Shinsaku Hogen
President,
Japan International Cooperation
Agency,
Tokyo

Feasibility Report on Bukit Bauk
Pilot Project for Trengganu
Tengah Swamp Area Agricultural
Development, Malaysia

Dear Sir,

I have the honor to present herewith the Feasibility Report on the captioned project in accordance with the agreement concluded between the Government of Japan and the Government of Malaysia.

The project is aimed at studying the possibility of developing the extensive inland swamp area in Trengganu State for agricultural development.

With the helpful advice and assistance offered by the Advisory Group and the Mayaysian government, we were able to conduct the commissioned field survey successfully for a period of about four months from August to November 1978, during which an interim report containing the basic scheme of the planned agricultural development was presented to the Malaysian government. After our return to Japan, the data collected during the survey were put to a rigid analysis for

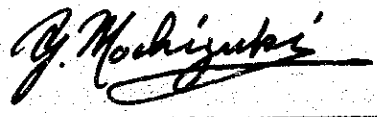
further strict scrutiny of the scheme which is presented in this report.

The project is intended for a comprehensive agricultural development covering stock rearing and fisheries, but its implementation will have to await further studies in certain aspects due to the extreme shortage of data on soils and crops in the said swamp area. Nevertheless, our technical and economic studies led to our conviction that the area having been left intact to date, the project is fully justfiable and will yield a great development effect.

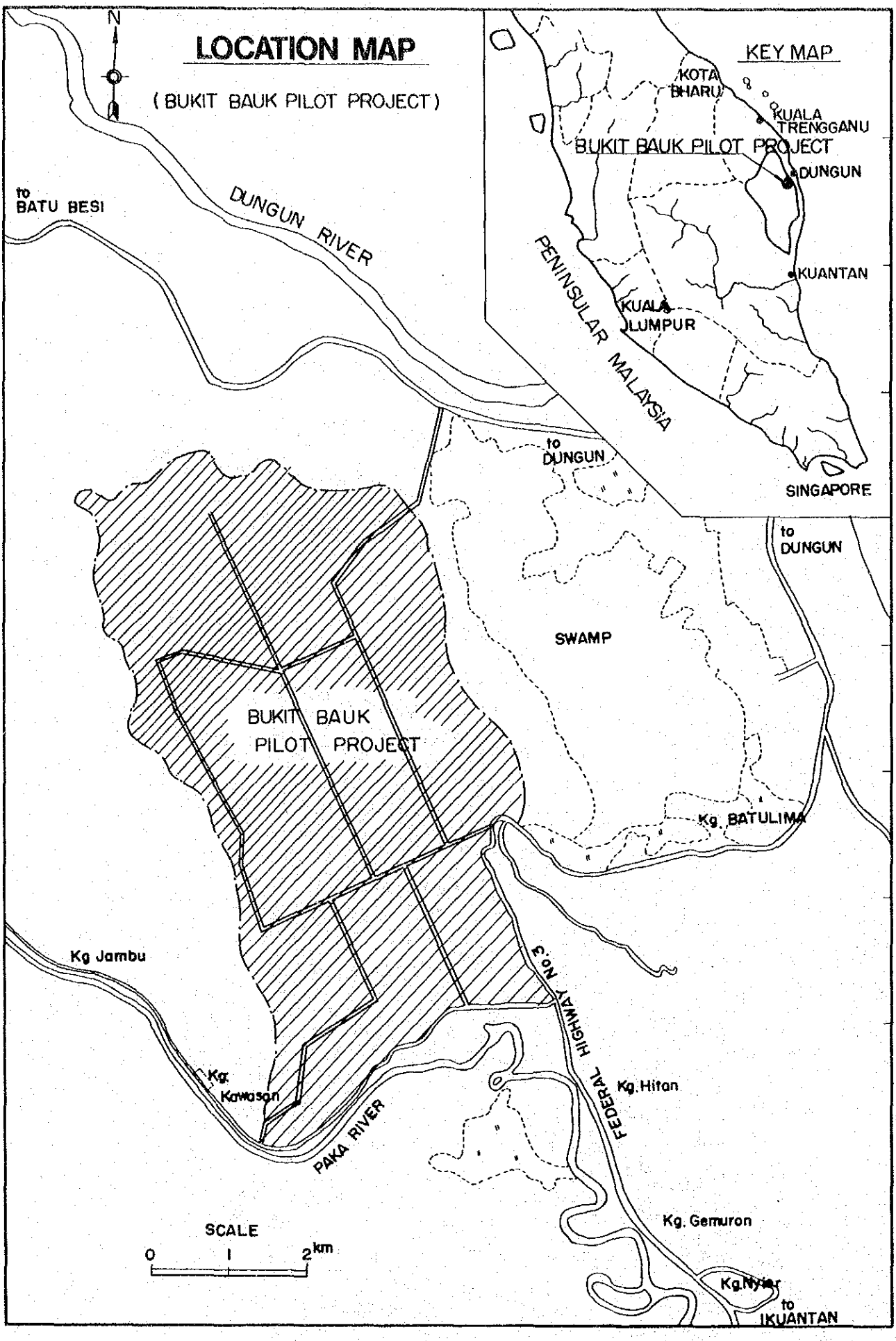
It is therefore our earnest hope that the project will be put into execution at the earliest possible date.

On this occasion, we wish to express our deepest gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Fisheries, The Advisory Group Embassy of Japan, and the Malaysian government for the most helpful and valuable assistance extended to the team throughout the field survey and home office work.

Very truly yours,



Yoshizo Mochizuki
Leader
Feasibility Study Team for the
Trengganu Tengah Swamp Area
Agricultural Development Project


LOCATION MAP
(BUKIT BAUK PILOT PROJECT)
N
KEY MAP
KOTA BHARU
KUALA TRENGGANU
BUKIT BAUK PILOT PROJECT
DUNGUN
KUANTAN
KUALA LUMPUR
PENINSULAR MALAYSIA
SINGAPORE
to BATU BESI
DUNGUN RIVER
to DUNGUN
to DUNGUN
SWAMP
BUKIT BAUK PILOT PROJECT
Kg. BATULIMA
Kg Jambu
Kg. Kawasan
PAKA RIVER
FEDERAL HIGHWAY NO. 3
Kg. Hitan
Kg. Gemuron
Kg. Nyior
to KUANTAN
SCALE
0 1 2 km

S U M M A R Y

1. This is a feasibility report on the Bukit Bauk Area Agricultural Development Project which has been prepared in accordance with the agreement between the Economic Planning Unit of the Malaysian Prime Minister's Department and the Japan International Cooperation Agency, dated August 4, 1978.

A. General Background

2. The objective of the study is to create both agricultural production and employment opportunities through the provision of irrigation and drainage facilities examining ways in which the swamp area could best be utilized in accordance with the Malaysia Agricultural Development Plan. The Bukit Bauk area was selected by the Japanese Preliminary Survey Team in March, 1978 as a possible area for a pilot project as well as a model for overall inland swamp area developments. The Bukit Bauk area is considered to have a relatively higher potential compared to other swamp areas, and is advantageously located near an existing developing area.

3. This feasibility study on the Bukit Bauk Swamp Area Agricultural Development Pilot Project is the result of a strong interest on the part of the Government of Malaysia. As early as 1968, the Government of Malaysia commissioned the Dutch Technical Aid Mission to prepare a regional economic development plan for the State of Trengganu. Later, in 1974, the Government of Malaysia commissioned Hunting Technical Services Limited with the Shankland Cox Partnership, England to prepare a regional planning and development study for Trengganu Tengah. Their study has been used as a planning guide, but a study on inland swamp areas was not carried out because of the lower possibility of development, and the area was classified unsuitable land for agriculture.

4. In 1977, the Government of Malaysia requested the Government of Japan to provide technical expertise under a technical cooperation programme, to study the potential for development and the possibility of effective utilization of the swamp area (approx. 73,000 acres) which extends intermittently from the central to the southern parts of Trengganu State on the east coast of Peninsular Malaysia. In response to the request, the Government of Japan dispatched to Malaysia a Japanese Technical Cooperation Survey Team in June, 1977 and a Japanese Preliminary Survey Team in February and March, 1978. On August 4, 1978, in accordance with the Scope of Works on Feasibility Study for Trengganu Tengah Swamp Area Agricultural Development Project in

Malaysia agreed between the Economic Planning Unit of the Malaysia Prime Minister's Department and the Japan International Cooperation Agency dated August 4, 1978, the Japanese Trengganu Tengah Swamp Area Agricultural Development Survey Team was dispatched to carry out a feasibility study on the Bukit Bauk Pilot Project area.

The objective of this technical cooperation is to formulate on overall agricultural development project leading to irrigation and drainage development of the Bukit Bauk area (comprising about 7,000 acres) in the southern portion of Trengganu Tengah, Dungun District, Trengganu State. It likewise aims to assess the technical feasibility and economic viability of the Pilot Project.

B. Pilot Project Area

5. The Pilot Project area is a swamp surrounded by hills between the Dungun river and the Paka river. The linear distance between the two rivers is about 9 miles. The area is about 5 miles upstream of the estuary of the Dungun river and about 12 miles upstream of the estuary of the Paka river. The area covers 7,006 acres (2,835 ha) and is nearly rectangular piece of land measuring about 5 miles from north to south and about 2.5 miles from east to west. The land is surrounded by hills of less than 500 feet in height on three sides (north, east and west) and is open to the Paka river on the south which has an elevation of about 5 - 10 feet. About two-thirds of the total area (or 4,722 acres) drains into the Paka river through several streams, but most of the area is flooded with water from the Paka river during the monsoon season.

6. The remaining one-third of the area (2,284 acres) lies along the Dungun river and is connected to the Dungun river through two valleys between hills, but it is not affected by the flooding of the Dungun river because of its high elevation. The Pilot Project area is about 240 miles from Kuala Lumpur, and about 6 miles from Kuala Dungun, which is the third largest town in Trengganu State. The area adjoins Federal Highway No.3, which links Kuala Trengganu and Kuantan, and includes a district road which runs through the area in parallel with the Paka river.

C. Proposed Pilot Project

7. The Bukit Bauk Pilot Project for swamp area agricultural development has been given high priority by the Government of Malaysia as mentioned previsouly. Construction of the Pilot Project is divided into two phases. The First Phase is to take 10 years from project commencement and in this

period man and animal power is to be used for farming. In the Second Phase, which follows the First Phase, mechanized farming is to be brought into the Pilot Project.

First Phase

(i) Irrigation and drainage facilities for 5,542 acres (2,243 ha) of arable land including on-farm facilities are to be established. The total length of the main and secondary irrigation canals will be 10.2 miles (16.5 kilometers) and main drainage canals about 3.7 miles (5.9 kilometers), with provision for driving channel lines of 0.143 miles (0.23 kilometers).

(ii) Agricultural development is to be promoted through the setting up of a demonstration farm, marketing facilities, and other agricultural support services.

(iii) Inland fisheries development to ensure a supply protein in the diet of settlers will be achieved through provision of extension services.

(iv) Pumping station will be provided for irrigation.

Second Phase

(v) A flood protection embankment of 3.04 miles (4,898 meters) in length, running on and along the district road will be built. It will be high enough to protect a gross area of 1,616 acres (654 ha) of land against flooding throughout the year.

(vi) One pumping station for irrigation and drainage will be installed.

D. Soil Improvement

8. As the swamp areas have extremely poor drainage conditions and are submerged in many places, their utilization calls for the following three steps which need to be taken before anything else for the purpose of soil improvement.

a. Completion of drainage facilities for drainage of all swamps.

b. Addition of soil improvement materials, appropriate for the proposed crops, such as carbonate precipitate, phosphate, etc.

c. Soil reversing and dressing, or soil dressing after draining and drying where necessary.

9. The depth of drainage canals in peat soil areas should be determined with due consideration of the possible settlement of ground surfaces due to soil shrinkage which could occur with the drainage, drying-up, and decomposition of organic substances. When mechanized farming is to be introduced, the bearing capacity of ground surfaces should be examined carefully and stumps and other obstacles should be removed to permit smooth operation of farm machinery.

E. Agricultural Development

10. Agriculture plays an important role in Malaysian economic and social development. The agricultural sector provides employment for about one-half of the working population. 50% of total exports and 30% of the gross domestic product are derived from the agricultural sector. However, high population growth coupled with the not-so-advanced institutional development support facilities result in under-utilization of existing human and physical resources. Rural development, therefore, provides the key towards developing the Malaysian economy. This means emphasis on increased agricultural productivity, creation of employment opportunities, strengthening of rural institutions for effective delivery of development services to all, and a broad distribution of incremental benefits. The Pilot Project, which will ensure the availability of water in the right quantity at the right time, thus improving the swamp area, will also bring under control the flooding; it will provides roads and power; it will allow cropping flexibility and intensity with more farm land utilized. In short, it is an attempt to introduce a rural development programme.

11. Production can be increased in the following manner;

a. By increasing acreage

b. By increasing yield per unit area

In existing fields, acreage can be increased not so much by acquiring new land but by introducing a new cropping pattern. With this, plus year-round irrigation and flood control, the use of land can be doubled or even trippled. Increasing yield per unit area should be done through infusion of new technologies and management systems which are already well known and being utilized in places with improved agricultural production practices.

12. Swamp utilization will require a huge amount of capital investment because of the natural characteristics, conditions of the swamp areas and their locations. In order to enhance national land use through swamp utilization, it is necessary to study the various swamp conditions including soils, irrigation and drainage, and to make a careful review of the necessity, urgency and justifiability of development from the socio-economic standpoint.

13. Swamps are poorly drained, being submerged constantly in many places, and thus are not favourable for crop cultivation. Paddy is the most suitable crop for cultivation under the existing poor conditions, but if suitable irrigation and drainage facilities are provided, it would be possible to grow other crops also. It is to be noted, however, that the soil conditions in the swamp areas will remain essentially unfavourable for cultivation of deep root crops for a certain period of time after completion of the Pilot Project. According to the study, crops to be grown in swamp areas will be paddy, vegetables, commercial crops and shallow root perennial crops. In order to maximize the profit from minimum land, multiple management by rotation rather than management of a single crop is advantageous as it will make it possible for farmers (settlers) to distribute their family labour force efficiently throughout the year and realize more intensive land use. In paddy field reclamation areas, such combinations as paddy + vegetables, paddy + commercial crops, and paddy + vegetables + commercial crops will yield a greater income than double cropping of paddy which has a rather low profitability. In due consideration of the peat soil in the Pilot Project area, however, for a certain period of time after completion of the Pilot Project, the emphasis will be placed on double cropping of paddy.

F. Agricultural Support Services

14. Irrigation development must be matched by new technologies to maximize return on investment. Since many of the new technologies will be unknown to farmers (settlers) as well as extension agents, a vigorous programme should be launched by the Ministry of Agriculture to introduce these technologies. Extension agents should undergo rigid preparation and training prior to the completion of the Pilot Project. For village farmers (settlers), a demonstration farm would be most appropriate. A demonstration farm should be situated at a strategic place for a fast radiation effect to neighbouring farms and should be properly provided with personnel, facilities and other requirements to ensure success.

15. Since agricultural improvement or rural development is the main target of the Pilot Project, a whole integrated rural development programme should be pursued. The Ministry of Agriculture, the Ministry of Land and Regional Development, the Ministry of Science, Technology and Environment as well as other government agencies to which are assigned the tasks of financing, technological development and transfer, marketing facilities development, rural organizational development, infrastructural development and maintenance, and others, should be coordinated through a special programme for the area.

G. Proposed Settlement

16. The economy of Malaysia is largely agricultural both in domestic and international terms. Therefore, it is quite natural for the government to give maximum efforts to the development of agriculture centering on cash crops, mainly rubber and oil palm of high international marketability. Presently, Malaysia faces the serious domestic problems of unemployment and under-employment. In order to improve the situation, steps must urgently be taken to enlarge the scale of farm management of small farmers to afford more employment opportunities to farm laborers and fishermen who subsist below the poverty line. In Trengganu State alone, an estimated 20,000 people living in poverty are eagerly waiting for the employment situation to improve.

17. In the present situation, Malaysia today faces two contradictory problems in agriculture. While she must encourage farmers to boost production of higher grade food stuffs, she must also extend a helping hand to the unskilled poor. Furthermore, in order to convert swamps into rich farm lands, the nation must introduce advanced techniques for soil improvement, irrigation and drainage and maintain these facilities in proper condition besides maintaining a high degree of farm management.

18. For the proper management of the Pilot Project and the selection of the proposed settlers, the following are essential guidelines.

(i) Select both experienced, seasoned farmers and the unskilled in poverty in an appropriate ratio. If only one of these groups is selected, the problem outlined above will not be solved.

(ii) Divide the settlers into individual management households and joint management households (estate farm system).

(iii) Allocate either a paddy field plus a small acreage of upland field or a fish-culture farm to experienced farmers for individual management.

(iv) Organize stock-rearing, dry field farming and fruit-growing into estate farms and allocate work to unskilled people.

(v) Overall pilot project management should be supervized by a government body who should dispatch specialists to the work site to give technical guidance.

19. The number of households for settlement is planned as follows.

Kind of Farm Household or Estate	Acreage	Unit Acreage 1/ per Household	Number of Households
	(acre)	(acre/household)	(household)
Paddy cultivation household (individual basis)	835	4.85	172
Livestock estate farm	2,158	15	143
Upland crop estate farm	1,874	6	312
Demonstration farm	467	6	78
Total	5,334		705

20. Very careful and detailed study should proceed immediately after commencement of the Pilot Project to determine what kind of farm management pattern is to be introduced for reclaimed land, what kind of ideal rural society is to be developed, and how to improve peat soil areas. To realize concepts for developing an entirely new rural community the study in the Pilot Project will be based on principles to introduce modernized farming with improved production infrastructures and agricultural techniques to facilitate medium-scale farm management and together with the improved rural environment to ultimately develop a model new rural society.

1/: Excluding homesteads

21. Settlement of farmers (settlers) in such swamp areas and expansion of their management activities through the swamp development project will not provide a solution to the existing poverty problems. The success of the Pilot Project depends on whether adequate measures are taken to improve management and distribution channels after settlement. It will only be when such measures are enforced successfully that the settlers will feel assured and be enabled to establish sound management, and this will lead to the solution of the poverty problems and at the same time make the Pilot Project fully justifiable from the viewpoint of the national economy.

H. Cost Estimate

22. The project cost consists of (i) cost for civil works including land reclamation, (ii) cost for storage facilities including project office and its related facilities, and (iii) initial farm investment.

23. The project cost is estimated at M$27,937,000 for the First Phase and M$12,411,000 for the Second Phase. The cost for the engineering services includes the cost required for the detailed design and technical supervision during the construction by foreign experts. The project cost is shown in the table on the next page.

(Unit: M10^3)

Work Item	First Phase			Second Phase			Total Work		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
I. Civil works									
1. Preparation work	-	7	7	-	-	-	-	7	7
2. Embankment	305	214	521	490	340	830	797	554	1,351
3. Irrigation	1,179	689	1,868	-	-	-	1,179	689	1,868
4. Drainage	713	403	1,116	1,390	345	1,735	2,103	748	2,851
5. Roads	1,627	861	2,488	-	-	-	1,627	861	2,488
6. Land reclamation	5,341	4,307	9,648	729	602	1,394	6,133	4,909	11,042
Sub-total	9,167	6,481	15,648	2,672	1,287	3,959	11,839	7,768	19,607
II. Settlement and demonstration farm	2,935	2,157	5,092	1,454	320	1,774	4,389	2,477	6,866
III. Engineering services	605	431	1,036	206	81	287	811	512	1,323
IV. Physical contingency	915	648	1,564	267	128	395	1,183	776	1,959
V. Prices contingency	2,682	1,915	4,597	3,714	2,282	5,996	6,396	4,197	10,593
Total	16,305	11,632	27,937	(8,313)	(4,098)	(12,411)	(24,618)	(15,730)	(40,348)
Unit cost per ha (2,622.0 ha)			M$10,654 (US$5,327)			(M$4,733)			(M$15,387) (US$7,693)
Unit cost per acre (6,480 acres)			M$4,311			(M$1,915)			(M$ 6,226)

I. Project Implementation

24. Successful and efficient project execution presupposes a high degree of coordination at the national (ministerial) and the project level. At the same time there should be adequate delegation of power and responsibility to the executing agency and the project management. With regard to project execution, the Economic Planning Unit (EPU) of the Malaysian Prime Minister's Department will be the principal implementing agency except for the installation of transmission lines, telephone lines, etc., and also agricultural extension, forestry development, fisheries development, marketing and credit, settlement, etc. EPU has always been the executing agency for all foreign and technical assistance and loan project in Malaysia. The Pilot Project will be within the jurisdiction of KETENGAH in Kuala Trenggaunu on behalf of EPU.

25. A central coordinating committee should be established for the proposed Pilot Project prior to the commencement of project implementation. This committee will be composed of representatives similar to the existing steering committee. A local coordinating committee is to be established at the project level to coordinate the various agencies and authorities of the government involved in the Pilot Project. The committee will include state level officers of the agencies.

J. Economic Justification and Financial Analysis

26. Investment in the Pilot Project area is justifiable in terms of the net value that will be added to the national economy, the benefits to farm families (settlers' families), estate farms and other socio-economic benefits though any additional public investment is specially desirable.

27. The economic cost of the Pilot Project is estimated at M$23,340,000 for the first phase at October 1977 prices in which allowance for price escalation is not included. The major tangible benefits to evolve from the Pilot Project will be a substantial paddy, upland crop and livestock production, and the resulting income and employment opportunities for more than 700 settlers' families and seasonal laborers.

28. On the basis of the economic costs and the direct tangible economic benefits from crop and livestock production, the economic internal rate of return (EIRR) for the Pilot Project has been calculated at 16.5%. The EIRR has been calculated on the basic assumption of:

(i) a Pilot Project price of M$528 per ton for an improved variety of paddy based on IBRD projection prices and M$470 per ton for the local variety of paddy, (ii) an average yield of 1.44 tons per crop per acre for improved paddy (monsoon season) and 1.52 tons per crop per acre for improved paddy (off-season), (iii) an agricultural development period of seven years after completion of the Pilot Project in due consideration of swamp area development, (iv) a Pilot Project economic life of 50 years, and (v) a cropping intensity of more than 170%.
Sensitivity tests were conducted for the following cases: i) reduction in improved paddy price from M$528 per ton M$475 per ton, and in local paddy price from M$470 per ton to M$423 per ton, ii) cost overrun of 5%, iii) delay in completion by one year and iv) combination of ii) and iii) above. The results including the least satisfactory case with an EIRR of about 13% are all satisfactory.

29. From the viewpoint of small-scale farmers as individual settlers the majority of these proposed settlers are very poor and are unable to earn sufficient income to support even a low standard of living. Income to farm households includes the net value of crops produced and off-farm income from paddy processing, fishing, water buffalo rearing, etc. By utilizing irrigation facilities efficiently, combined with improved farming practices, a settler managing an average of 5 acres including 0.15 acre of his homestead will be able to create a gross farm income of M$13,171 per annum.

30. As described previously, in the Pilot Project area two kinds of estate farms will be established, namely livestock estate farm and upland crop estate farm. The revenue for these estate farms consists of income from selling the products. Assuming that selling prices of the products are appropriate, the expected annual revenues of respective estate farms are estimated at M$4,434,000 and M$1,206,000 in total after full development.

31. In addition to creating agricultural production which will help achieve self-sufficiency in rice and the crop diversification for the nation, the Pilot Project will have a significant socio-economic impact on employment, environment and other direct benefits as below.

32. The population in the Pilot Project area will benefit directly from the creation of employment opportunities in agriculture, transportation and marketing even during the construction period. Created production will result from the intensive agricultural land use. The agricultural labor requirements will increase gradually in parallel with development, and will reach more than 90 thousand man-days annually at full development. While much of the increased farm labor requirements will come from the seasonal laborers living in the surrounding area who are

under-employed, such laborers will also benefits significantly by the creation of more jobs. Employment opportunities in marketing and transport will also increase significantly as a result of the increased paddy and upland crop production and livestock rearing. It should be noted that immediately after deforestation in the Pilot Project area, employment opportunities will significantly increase.

33. The Pilot Project will enhance the environment of the Pilot Project area by flood protection and improvement of land drainage. Completion of the engineering works will result in improved living conditions, village activities, road systems and fishing areas which will be able to be utilized year round.

34. The Pilot Project will also generate other indirect benefits such as possible expansion of agro-based industries like rice-milling, bran oil extraction, etc. Increased availability of farm by-products such as bran, broken rice and straw will also encourage settlers to provide more adequate sustenance for their draft animals, which in turn will result on more efficient draft cultivation at the initial stage of agricultural development.

35. In the meantime, it is considered the emphasis should be given to the demonstration effect on swamp area agricultural development. As mentioned previously, swamp area agricultural development is one of the most important tasks of Malaysia. Of the potential agricultural land of about 520,000 acres (210,000 ha) in the whole area of Trengganu Tengah, Trengganu State, about 73,000 acres (20,500 ha) or 14% are inland swamp areas which are at present permanently water-logged and generally overlaid with varying depths of peat. Development planning for such swamp areas has already been tried by foreign consultants as well as the Government of Malaysia itself. As for inland swamp areas like the Bukit Bauk area, however, study has never been attempted due to the lower possibility of development.

CONCLUSION AND RECOMMENDATIONS

Conclusion

(1) The Bukit Bauk Pilot Project has a very important significance which is not found in another agricultural projects. It is the first region to be subject to systematic research on swamp peat and its development. The region will provide valuable guidelines for other regions.

(2) This Pilot Project reads the search for new synthetic development of agriculture in swamp areas. It incorporates paddy, upland crops, fruits, beef cattle, water buffalo, and fresh water fishes:
Therefore, at least a demonstration farm should be established in the area to select kinds of crops, to test fertilizers, to control hygiene of livestock, to demonstrate mechanized farming, to conduct experiments in the preservation and processing of agricultural products, and to provide farmers with technical training.

(3) There still are a number of problems yet to be solved in relation to the development of swamp peat on a large scale. The development should be divided into two phases to prevent the Pilot Project from failing as a result of a rapid introduction of modern mechanized farming.

(4) During the First Phase, which would last for 10 years, the present farming methods in Trengganu State which utilize manpower and draft animals would be carried out more intensively. Clearing of land would be temporary without uprooting trees of diameters exceeding 16 inches. Flooded areas will be used for paddy and buffalo grazing. Roads would have two lanes and farm roads not paved.

(5) During the Second Phase, farming would be mechanized by introduction of farming equipment on the basis of the accomplishments of the First Phase. It would be necessary to construct an embankment and install a pumping station for drainage to maximize the effective use of farm mechinery. Two-lane roads would be paved to permit the transportation of of farm machinery.

(6) The Government of Malaysia would be advised to establish a policy to promote agriculture and to aid poorer families. That is, agricultural laborers and fishermen should be employed in agriculture as well as those who have agricultural experience.
Paddy fields should be allotted to each individual with agricultural experience while upland crops, livestock industry and fisheries should be conducted by agricultural laborers under the management of estates with the guidance of technical experts in KETENGAH.

(7) A farmland shortage will be experienced during the Second Phase due to the mechanization of farming. To solve this problem, other swamps must be developed and skilled farmers should be transferred to the new farmlands in order to expand cultivated acreage per farmer in both types of area.

(8) The Bukit Bauk Pilot Project is the first full-scale agricultural project for the development of swamps in Malaysia. Although there are a number of problems from the agricultural technology standpoint, and the Pilot Project is costly in comparison with projects for general agricultural areas, it is feasible economically to accomplish the Pilot Project, which would be beneficial for the long run.
What is gained in the Pilot Project will have a significant influence and provide guidelines to the future development of swamps in Malaysia where there will still be a number of undeveloped swamps.

(9) The construction costs of the First and Second Phases are M$27,937,000 (M$10,654/ha) and M$12,411,000 (M$4,733/ha). The total construction cost is M$40,348,000 (M$15,387/ha). For the time being, only the First Phase is to be carried out. The construction cost of the First Phase of M$27,937,000 consists of foreign currency of M$16,305,000 and local currency of M$11,632,000.

(10) Taking special conditions of the swamps into consideration, it is planned to achieve a specified harvest in the 7th year after completion of the Pilot Project. From 1991 when this harvest is achieved, the annual net benefit will be M$4,608,000. The economic internal rate of return (EIRR) is 16.5%. This figure shows that this plan will pay well economically.

(11) Since the engineering ability of Malaysia is high, the Pilot Project will be conducted by local contractors without using special construction equipment within 5 years.

Recommendations

(12) Implementation of the Bukit Bauk Pilot Project is recommended by the following procedures in order to accomplish the objectives successfully.

To be completed prior to the commencement of construction works

(1) A water level observation station should be built near the Bukit Bauk area on the Paka river. Monitoring of water level should be started as soon as possible by means of an automatic water gauge. Monitored data will not only assist detailed design but also will provide vital information concerning drainage and water-intake for irrigation after completion of the Pilot Project. Although this point is located in a tidal compartment, the analysis of the open sea tides together with that of the water levels of upper streams will provide valuable information.

(2) Prior to the commencement of construction works, about 10 subsidence detectors should be buried in different layers of peat at 50 cm-intervals. The data obtained for each layer will be helpful in the improvement of drainage of mechanized farming.

(3) The topographic maps drawn on a scale of 1:5,000 during the feasibility study period were based on aerial photographs taken more than 10 years ago. Therefore, major routes (main canals and roads) and important areas (demonstration farm, homesteads, etc.) should be properly located before the detailed design.

(4) Prior to the commencement of construction works, a complete detailed design should be prepared by professional consultants. Especially, livestock industry, fresh water fisheries, and grassland developments will require careful attention.
A number of unknown problems might be encountered in the swamp development. Therefore, the detailed design must be based on a careful research, survey and studies by a group of well-experienced technical personnel.

To be completed prior to the completion of the Pilot Project

(5) Soil surveys should be conducted at about 10 locations and continued even during the construction period to detect changes in soils. Since the properties of peat rapidly change as drainage improves, more valuable data are likely to be obtained during the construction period than prior to the commencement of construction works.

A proper soil improvement plan should be drawn up on the basis of the data.

(6) It is recommended that a research organization be established prior to the completion of the Pilot Project. Swamp development is an important task which will draw world-wide attention. A swamp research organization could be established on the basis of the present technical committee. The organization, however, should be staffed with personnel who actually perform survey and should not be for the purpose of discussion.
The system employed by the National Research Institute of Japan could be used as a model.

(7) The selection of settlers should be conducted by committee members who are well informed of the conditions in Trengganu State. Given that the opinions of the consultants are a reference only, success in the Pilot Project and the eradication of proverty seem to be inconsistent with each other. In the selection of settlers, both should be carefully considered, intelligent and hardworking people, even if poor, should be selected.

Necessity of a master plan

(8) Almost no soil study has been conducted for the swamp areas in Trengganu State, of which the total area exceeds 100,000 acres. The total inland swamp areas in Trengganu Tengah Region are said to be 73,000 acres but their distribution is not very clearly known. Therefore, it would first be necessary to conduct a survey to determine the distribution of inland swamps and to classify the region in accordance with soil and topographic characteristics.
The results of the survey should be utilized to determine development priority for each swamp taking the agricultural development plan of the State into consideration. A master plan for implementation of the above procedures would, therefore, be essential.

(9) It is normal practice to implement a Pilot Project after a master plan has been completed. This sequence has been reversed in accordance with KETENGAH's schedule in the case of the Bukit Bauk area since the Pilot Project is essential in the testing of the swamp peat. For the above reasons, the surveys necessary for a master plan should be completed within 1979.

(10) Usually, the master plan is formulated before the Pilot Project. In this case, however, the feasibility of the Bukit Bauk Pilot Project was studied prior to the master plan in a series of schedules in Trengganu Tengah Region. It is the reason why effective investigation results were not necessarily obtained by making a master plan study covering a wide area prior to the Bukit Bauk Pilot Project, since swamp development methods were not established in either investigational aspect or practical aspect. In this connection, as a case study, the Bukit Bauk Pilot Project was first studied.

(11) In the meantime, on the basis of the preliminary survey made in 1978, the following conclusion was obtained, namely, "Almost all swamp areas would require an embankment and pumping stations for the development of the major swamp areas." It was considered that the Bukit Bauk area would include almost all aspects required for swamp development, i.e., both investigational aspect as well as construction aspect. So this area was judged very suitable as a Pilot Project area.

(12) A master plan should be surveyed and studied, and the swamp area developed accordingly. It is recommended those concerned that the best use of the investigation results from the Pilot Project area should be made.

COUNTRY DATA 1978

AREA: *Malaysia (Peninsular Malaysia 50,806; Sarawak 48,050; Sabah 28,725)*		127,581 square miles	
POPULATION			
Malaysia (Peninsular Malaysia 10.84 m, Sarawak 1.16 m, Sabah 0.90 m)		12.90 million	
Peninsular Malaysia; Malays 5.83 m, Chinese 3.79 m, Indians 1.14 m, Others 0.08 m		10.84 million	
Average growth rate, Malaysia 1976-80 (% per annum)		2.7%	
NATIONAL PRODUCT (constant 1970 prices)		*% growth*	*% of GNP*
Gross National Product		+7.2	100%
		($21,558 m)	
Consumption expenditure:	Public	+9.0	20%
	Private	+8.5	56%
Fixed capital formation:	Public	+3.7	9%
	Private	+9.0	13%
Exports of goods and services		+3.2	41%
Imports of goods and services		+9.3	36%
NATIONAL INCOME AND SAVINGS			
National income (Public sector 22%, Private sector 78%)		$32,138 million	
Per capita income		$ 2,490	
National savings		$ 9,324 million	
Per capita savings		$ 723	
DOMESTIC PRODUCT (constant 1970 prices)		*% growth*	*% of GDP*
Gross Domestic Product		+7.0	100%
		($22,195 m)	
Agriculture (Rubber 9%, Palm oil 6% of GDP)		+1.5	25%
Manufacturing		+11.5	19%
Construction		+10.5	4%
Wholesale and retail trade		+6.2	12%
Banking, insurance, real estate and business services		+7.2	8%
Government services (public administration, defence, health, education)		+9.2	14%
FEDERAL GOVERNMENT FINANCE			
Revenue		$8,220 million	
Operating expenditure		$8,100 million	
Development expenditure		$3,600 million	
Domestic debt		$1,765 million	
Foreign debt (debt servicing ratio 4.3%)		$ 565 million	
BALANCE OF PAYMENTS AND EXTERNAL RESERVES (net)			
Current account		+$ 296 million	
Capital account		+$2,019 million	
Basic balance		+$2,315 million	
Net external reserves (6-1/3 months of estimated 1978 retained imports at end August 1978)		+$6,890 million	
Net change in external reserves		+$ 150 million	
INTERNATIONAL TRADE			
Total exports (Rubber 50%, Palm oil 68%, Tin 36% of World total in 1977)		$16,216 million	
Total imports (Food 16%, Petroleum 10%, Machinery and transport equipment 36%)		$13,123 million	
Trade balance		$ 3,093 million	
MONEY AND BANKING			
Money supply (Currency 49%, Demand deposits 51%)		$ 7,377 million	
Quasi money		$10,134 million	
Private sector liquidity		$17,511 million	
Commercial banks' prime lending rate (w.e.f. June 2, 1977)		7-1/2% per annum	
Malaysian Ringgit (one) = 0.34 SDRs, US$0.43, £0.22 (end August 1978)			
(Before Ringgit was floated on June 20, 1973 – US$0.40, £0.16)			
PRICES (Peninsular Malaysia)		*Index*	*% change*
Consumer Price Index, 1967 = 100		162.5	+5.0
of which: Food (weight = 46.8%)		177.6	+4.9
Export Price Index, 1970 = 100		196.6	+5.4
Import Price Index, 1970 = 100		217.2	+7.0
EMPLOYMENT		*Thousand*	
Labour force		4,790	
Employed (Agriculture 45%, Manufacturing 12%, Government 15%)		4,486	
Unemployment rate		6.3%	

ABBREVIATIONS AND DEFINITION OF TERMS

km	kilometer	ha	hectare
cm	centimeter	kl	kilometer
t	ton	m^3/sec	cubic meter per second
g	gram	l/sec/ha	liter per second per ha
m^2	square meter	l/ha	liter per hectare
m^3	cubic meter	hr(s)	hour(s)
l	liter	mm/day	millimeter per day
l/sec	liter per second	%	percent
t/ha	ton per hectare	ft	foot
kg/ha	kilogram per hectare	Fig.	Figure
t/hr	ton per hour	U.S.$	U.S. Dollar
$mile^2$	square mile	M$	Malaysian Dollar
°C	degree Centigrade	M$/ha	Malaysian Dollar per ha
°F	degree Fahrenheit	U.S.$/ha	U.S. Dollar per hectare
m	meter	$M\$10^3$	M$1,000
mm	millimeter	U.S. $10^3	U.S. $1,000
kg	kilogram	M$/kati	Malaysian Dollar per kati
km^2	square kilometer	inch/month	inch per month
L	length	ft^3/sec	Cubic feet per second
Q	quantity	N	Nitrogen
ø	diameter	P	Phosphorous
H	head	K	Potassium
KW	kilowatt	wt.	weight

GDP	Gross Domestic Product
GNP	Gross National Product
c.i.f.	cost, insurance, freight
f.o.b.	free on board
TOL	Temporary Occupation License
IBRD	International Bank for Reconstrcution and Development
FAO	Food and Agriculture Organization of the United Nations
KETENGAH	Trengganu Tengah Development Authority
EPU	Economic Planning Unit
MARDI	Malaysia Agricultural Research Development Institute
DID	Drainage and Irrigation Department

FAMA	Federal Agricultural Marketing Authority
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FELDA	Federal Land Development Authority
KADA	Kamubu Agricultural Development Authority
MAJUIKAN	Fisheries Development Authority
RISDA	Rubber Industry Smallholders Development Authority

CONVERSION TABLE OF MEASURES

(1) Gantang = I Imperial gallon = 4.546 ℓ or
= 2.54 Kg

(2) Kati = 1.33 pounds = 0.606 Kg

(3) Picul = 133 pounds = 60.55 Kg

CURRENT EQUIVALENT

MS$1.00 = US$0.45

Feasibility Report on Bukit Bauk Pilot Project
for Trengganu Tengah Swamp Area Agricultural Development

C O N T E N T S

Attached:

STUDY REPORT

APPENDIX

List of Tables and Figures

List of Drawings

I. INTRODUCTION

I. INTRODUCTION

1. This is a final feasibility report on the Bukit Bauk Swamp Area Agricultural Development Pilot Project which has been prepared in accordance with the agreement between the Economic Planning Unit of the Malaysian Prime Minister's Department and the Japan International Cooperation Agency dated August 4, 1978.

General Background

2. Trengganu Tengah is a regional development area on the east coast of Peninsular Malaysia. It comprises 1.1 million acres (440,000 ha) of which 520,000 acres (210,000 ha) are considered to be land with some potential for agriculture. Of this potential agricultural land, about 73,000 acres (29,500 ha) or 14% are inland swamp areas which are at present permanently water-logged and generally overlaid with varying depths of peat. The objective of the study is to create both agricultural production and employment opportunities through the provision of irrigation and drainage facilities with pumping stations, examining means by which the swamp area could best utilized in accordance with the Malaysia Agricultural Development Plan.

3. Under the present development programme, most of the better classes of agricultural land have already been developed or earmarked for specific projects. Utilization of the intervening swamp areas is expected to create further employment opportunities in the region and better usage of the infrastructure which is presently being provided. Further, it is considered that the identification of uses for this class of land will provide guidelines for swamp utilization in other parts of the country. Since much of the inland swamp areas are located in the eastern part of the country, development of inland swamp areas in this region has been given high priority by the Government of Malaysia.

4. The Bukit Bauk area has been selected by the Japanese preliminary survey team as a possible area for a Pilot Project as well as a model for the overall inland swamp area development. The Bukit Bauk area is considered to have a relatively higher potential various other swamp areas, and to be advantageously located near an existing developing area.

Historical Background for the Pilot Project

5. This feasibility study on the Bukit Bauk Swamp Area Agricultural Development Pilot Project is the result of a strong interest on the part of the Government of Malaysia. As early as 1968, the Government of Malaysia commissioned the Dutch Technical Aid Mission organized by the Netherlands Engineering Consultants - NEDECO, The Hague, and International Land Development Consultants - ILACO N.Y. Arnhem to prepare a regional economic development plan for the State of Trengganu. In 1974, the Government of Malaysia commissioned Hunting Technical Services Limited with the Shankland Cox Partnership, England to prepare a regional planning and development study for Trengganu Tengah. Their study has been used as a planning guide, but study on inland swamp areas, especially on the Bukit Bauk area was not carried out due to the lower possibility for development.

6. In 1977, the Government of Malaysia requested the Government of Japan to provide technical expertise under a technical cooperation programme to study the potential for development and the possibility of effective utilization of the swamp areas (approx. 73,000 acres) which extend intermittently from the central to the southern parts of the State of Trengganu on the east coast of Peninsular Malaysia. In response to the request, the Japanese Technical Cooperation Survey Team was dispatched to Malaysia in June, 1977. Furthermore, in February and March, 1978, the Japanese Preliminary Survey Team was dispatched to carry out a preliminary survey for the inland swamp area agricultural development. In accordance with the Scope of Works on the Feasibility Study for the Trengganu Tengah Agricultural Development Project of Malaysia agreed between the Economic Planning Unit of the Malaysian Prime Minister's Department and the Japan International cooperation Agency dated August 4, 1978, the Japanese Trengganu Tengah Swamp Area Agricultural Development Survey Team was dispatched to carry out the feasibility study on the Bukit Bauk Pilot Project area in August, 1978. The following is an abstract from the Scope of Works.

Objective

7. The objective of this technical cooperation is to formulate an overall agricultural development project plan which would lead to irrigation and drainage development of the Bukit Bauk area (comprising about 7,000 acres which is nearly equal to about 2,835 ha) in the southern portion of Trengganu Tengah, Dungun District, Trengganu State. It likewise aims to assess the technical feasibility and economic viability of such a Pilot Project.

8. Experienced Japanese experts will be engaged from the Japan International Cooperation Agency (JICA) to carry out a feasibility study for the proposed Pilot Project in close cooperation with KETENGAH, on behalf of the Government of Malaysia. The Japanese experts will consists of a Team Leader/ Irrigation Engineer, and an Irrigation Engineer, a Soil Scientist, an Agro-Economist, a Forestry Expert, a Fisheries Expert and others.

Scope

9. The main components of the Pilot Project formulation include:

1) Feasibility study in BUKIT BAUK AREA

(1) Field work:

a) Field investigation
b) Supplemental data collection
c) Topographic survey
d) Bench mark survey for the production of topographic maps at a scale of 1:5,000
e) Soil, geology and canal alignment survey
f) Irrigation and drainage survey
g) Surveys on agriculture and agro-economy
h) Surveys on regional economy and institutions
i) Selection and delineation of the project area and the basis of review of data and information obtainable from reconnaissance survey

(2) Work to be undertaken in Japan:

Based on the results of the field survey in the BUKIT BAUK AREA, the work to be undertaken in Japan will comprise study on the following items:

a) Determination of definite layout of the project
b) Drawing of topographic maps at a scale of 1:5,000 including aerial triangulation, plotting and drawing, checking and correction of existing topographic maps, and detailed drawing and printing
c) Preparation of basic designs of the project
d) Preparation of an implementation schedule for the project
e) Estimation of the costs and benefits of the project, and
f) Economic evaluation

2) Master plan study

(1) Field work:

a) Field investigation
b) Supplemental data collection
c) Soil, geological and hydrological survey
d) Plan formation for irrigation, drainage and water management scheme
e) Agricultural survey
f) Agro-economic survey
g) Socio-economic survey
h) Forestry survey
i) Livestock farming survey
j) Aquaculture (freshwater pisciculture) survey

(2) Work to be undertaken in Japan:

a) Formulation of a long-term estimate of population, the demand-supply situation of foods, agricultural structure and distribution channels to enable determination of the kinds and yields of crops to be grown, taking Trengganu State as a single economic unit
b) Clarification of soil conditions in swamp areas based on the results of soil surveys to enable selection of suitable crops
c) Clarification of drainage potential of each swamp area through hydrological analysis
d) Study on socio-economic conditions in each swamp area
e) Calculation of project cost for each type of swamp
f) An overall evaluation of each swamp to enable determination of the sequence of development on the basis of Items b) - e) above.
g) Implementation of a model farm management plan in a selected area to enable planning of future courses of agricultural development in Trengganu Tengah
h) Preparation of a master plan incorporating the results of Items a) - g)

10. The results of the study are compiled into the present Feasibility Report on the Bukit Bauk Swamp Area Agricultural Development Pilot Project, consisting of the following volumes.

- Main Report
- Study Report
- Appendix

Acknowledgements

11. Greatful recognition is made for the cooperation and assistance during the field survey, the collection of data and information and the execution of the survey provided to the survey team by officials of the Government of Malaysia, the State Government of Trengganu and the Trengganu Tengah Development Authority, other governmental authorities concerned, private organization and individuals. Thanks are due to all of them.

II. BACKGROUND

II. BACKGROUND

A. Agricultural Sector

12. Malaysia is an agricultural country. 50% of the total employment, 50% of the total amount of exports and 30% of the total domestic production depend on agriculture. Rubber accounts for 22.2% of exports, palm oil 15.2% and timber 11.0%. On the other hand, poverty rate among the agricultural population is 63%, twice as high as the average of other industries, which is 30%. Except for those who are engaged in the production of oil palm, whose poverty rate is rather low 9%, 78% of those who raise paddy and agricultural laborers suffer from poverty.

13. Although the Government of Malaysia has established a policy to promote poverty eradication, to increase farmers' income and to create employment opportunities, it does not seem to agree with the present agricultural production systems, under the management of estates centered around oil palm and rubber, which can be quickly converted into money. The fact that farmers do not have a strong desire to manage better, and poor agricultural technologies prevent the policy from being effective. It should be noticed that fertilizers and irrigation were only recently introduced.

14. If the present conditions continue, agricultural modernization in Malaysia will be left behind and earning differentials between city laborers and farmers will widen. To prevent the problem, a number of realistic projects should be carried out as soon as possible to promote agricultural modernization. On the other hand, there soon will be no land which permits a large scale development for agricultural purposes, and then the use of swamps will be benefitial. For the sake of the development of agricultural technologies for swamps, the importance of the Bukit Bauk Pilot Project should be re-emphasized.

15. In due consideration of agriculture in Malaysia, especially in Trengganu State, it should not be forgotten to modernize agriculture to keep pace with global trade in the future as well as poverty eradication among the agricultural population of the country. Those who are concerned with the Bukit Bauk Pilot Project should fully understand the importance of the two objectives.

B. Special Characteristics of the Pilot Project

16. Not just EPU and KETENGAH but the staff of the Government of Malaysia as well should be aware that the Bukit Bauk Pilot Project is important not just to Trengganu State and Malaysia but also to other tropical countries who will be required to develop their swamps.

17. A report prepared by Hunting Technical Services Ltd., England, in 1974, states that swamps are unsuitable for agricultural use as follows:

> "Sub-class 3d:
> Soils which are water-logged throughout the year are generally included in this sub-class. Drainage of these areas such as inland swamps can be costly."

> "Sub-class 4d:
> Deep peat which has not been drained belongs to this category. Very little examination has been carried out in these areas and most of the information are based on the work of the Dutch Team."

18. It was a well known fact that the development of swamps is costly with many unknown technical problems. However, the Pilot Project should be seen from a national standpoint instead of just cost standpoint.

19. One feature of the Bukit Bauk Pilot Project is that it is concerned with the integral agricultural development. A similar project in another country is usually concerned with the improvement of single work such as paddy only or upland crops, whereas the Bukit Bauk Pilot Project involves paddy, upland crops, fruits, beef cattle, buffaloes, small livestock and fresh water fishes.

C. Importance on Peat Swamp Area Development

20. It is said that more than 121 million ha of peat are distributed throughout the world with more than 90% in those countries in frigid and subfrigid zones in latitude 45°N or higher. Various countries, such as the Union of Soviet Socialist Republics, Germany, the United State of America, Canada, Great Britain and Japan have conducted an extensive study on peat to use for agricultural purposes. Peat does not necessarily yield less agricultural products than other types of soil if weather conditions remain the same. There are some cases with a higher yield due to much quantity of organic substances in peat. Since peat is usually found in low swamp areas and along rivers, it is necessary to provide proper drainage and flood protection to improve yield.

21. Although the percentage of peat in the tropical regions is rather small in comparison with the peat of the world, peat is widespread in the regions as well. A number of peat swamps are found in Indonesia and Malaysia. There are 2 million acres of peat in the Peninsular Malaysia. While grass peat is found in the northern hemisphere, woody peat is widespread throughout the tropical rain forests in the tropical zone.

22. Almost no research has been conducted on peat and its utilization by the countries in the tropical regions. At the same time, present situation does not allow peat swamps left developed. It is essential to develop them promptly if limited natural resources are to be used effectively. Therefore, it is significant that the Government of Malaysia has started a systematic survey and research on peat swamps before any other government in the tropical region. The findings will provide important guidelines to other tropical countries.

23. It is a fact that the Bukit Bauk Pilot Project is costly in comparison with other agricultural projects, and it is understandable. A common agricultural project in Malaysia is usually involves isolated work such as the construction of irrigation facilities or the reclamation of hilly areas for oil palm farmlands, or the construction of irrigation facilities such as canals and pumping station for paddy fields. Oil palm farms do not require drainage facilities, uprooting or clearing, since it is sufficient to cut down trees and burn them. On the other hand, the development of swamps will require drainage facilities, uprooting and clearing in addition to cutting in order to use them as paddy and upland crop farm fields.

24. Although the Pilot Project is costly, its expected effects in terms of economy well justify the cost. Further, it should be taken into consideration that the Pilot Project includes the construction of roads and drainage facilities which are usually classified under the category of public works.