

REPUBLIC OF INDONESIA  
MINISTRY OF PUBLIC WORKS AND ELECTRIC POWER

INCEPTION REPORT  
ON  
MASTER PLAN STUDY FOR  
OVERALL ULAR RIVER IMPROVEMENT PROJECT

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## PREFACE

This report has been prepared for carrying out the study of the master plan for the Overall Ular River Improvement Project in accordance with the Scope of Work which was submitted to the Government of Indonesia by the Japan International Cooperation Agency.

The Project aims at the implementation of the flood control works of the Ular River and, at the same time, the improvement works of the irrigation and drainage systems and extension works of irrigated paddy field which may be contemplated in relation to the flood control.

The objective of the present study is to formulate a master plan for the above-mentioned Project and to indicate the priority order of the individual projects to be included in the Master Plan. The study will be completed in two years of 1976 and 1977.

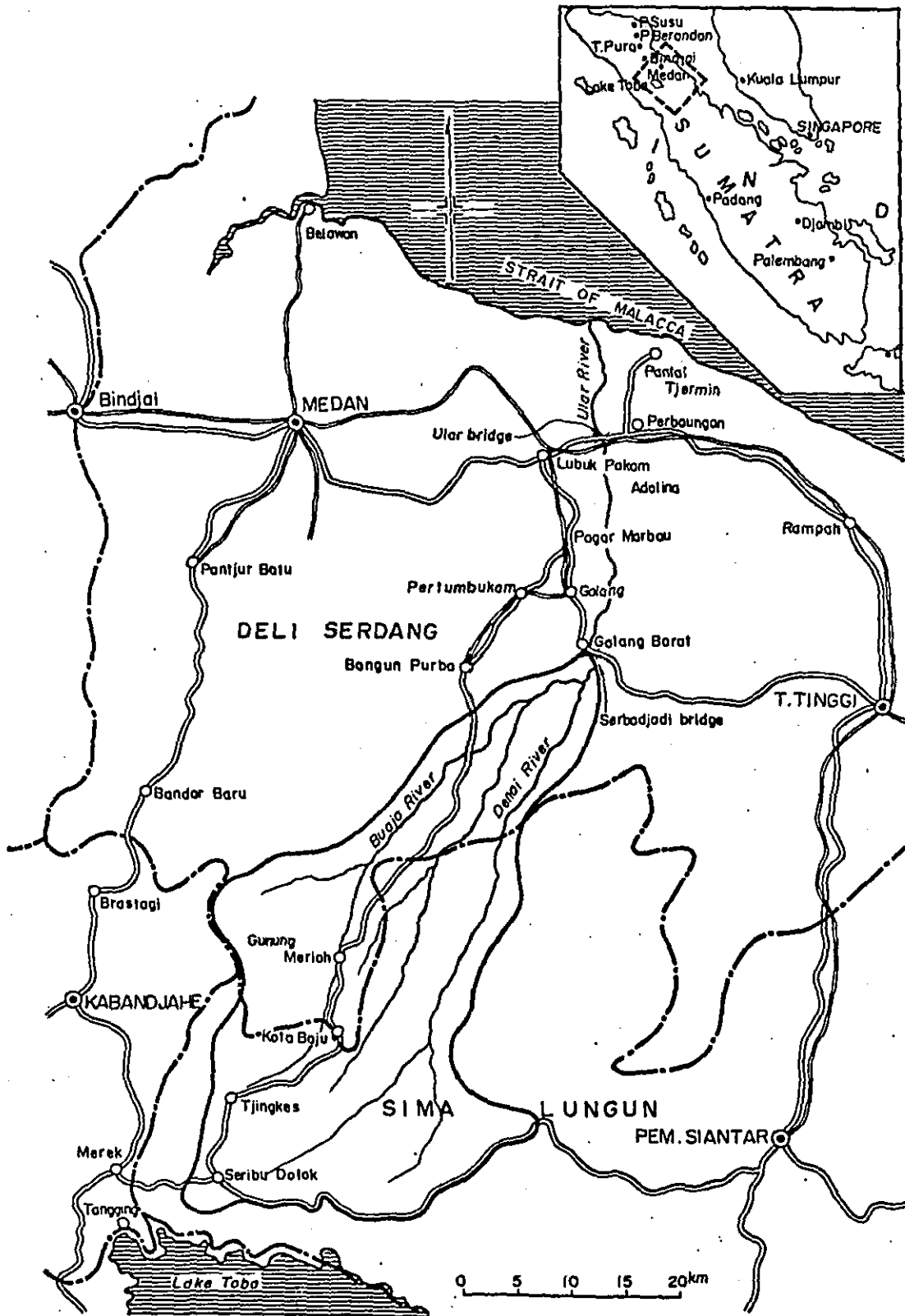
October 1976



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Leader of the Japanese Master  
Plan Study Team for the Overall  
Ular River Improvement Project

# Ular River Basin



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## I. BACKGROUND OF THE STUDY.

The Ular River originates in the Bukit Barisan mountains, that is, the somma of Lake Toba runs almost to the north and pours into the Malacca Strait at a point about 30 km in the southeast of Medan, the capital of North Sumatra Province. The river has a catchment area of about 1,000 km<sup>2</sup> and a length of about 115 km. The hilly land of the upper basin is formed of andestic or liparitic effusive rocks accompanied with pre-tertiary sedimentary rocks. The downstream plain is composed of alluvium.

The river basin stretches over both Kabupaten of Deli/Serdang and Simalungun. The flat area surrounding the lower reaches has well-developed plantations of palmoil, rubber, tobacco, etc. and well-cultivated paddy field. This area is among the best agricultural production zones in Indonesia. Furthermore, the national railway and the national highway run through this area.

The climate of this area belongs to the tropical one, the mean annual rainfall is about 1,800 mm in the downstream area and that in the mountainous area is about twice as much as the former. Water level of the river usually continues to be high in the rainy season from September to January and high run-off discharges due to squally rainfall are frequently superposed on it. Almost in every rainy season, flooding has repeatedly occurred due to breaches of the dikes, and caused great damages to farm land, the railway, the highway and other public facilities as well as inhabitants.

With the view to preventing these disasters emergently, a flood control project was planned over a stretch of 11 km upstream from the Perbaungan highway bridge in view of the fact that very frequent breaches of the dikes occurred on this stretch. This project was started in 1971 as Ular River Urgent Flood Control Project with the aid of a loan from the Overseas Economic Cooperation Fund, Japan, estimating the temporary design discharge at 600 m<sup>3</sup>/s. The emergency works were finished in March, 1976 and are producing the expected effect in their own way.

However, in view of the fact that the above-mentioned works are the emergent ones, the Government of Indonesia has intended to formulate a master plan which contains not only flood-control measures but also improvement and development of the irrigation and drainage in the downstream plain area, and requested to the Government of Japan to extend a technical aid in conducting the study for making the Overall Ular River Improvement Plan. In response to the request, the Japan International Cooperation Agency dispatched a Preliminary Study Team to Indonesia in March 1976, and it was decided to carry out the present study in cooperation with the Indonesian counterparting.

## II. OBJECTIVE OF THE STUDY.

The present study aims at the formulation of a master plan for the Overall Ular River Improvement Project which will be composed of the flood control project in consideration of sand control and the irrigation project related to the former. The master plan will contain the following.

- a. Plan for flood control in consideration of the regulation of flood discharge and sand efflux by means of dam and the improvement of river channel considering a retarding effect, if any.
- b. Plan for improvement of irrigation and drainage.
- c. Plan for extension of paddy field.
- d. Study of possible exploitation of water utilization by dam.

Based on the master plan, the priority order of the individual projects shall be studied from the viewpoint of engineering and economy. The area for the study shall cover a region from the river-head to the rivermouth including the area to be affected by the flooding of the Ular River.

## III. PLAN OF APPROACH.

The activities to be taken in the present study shall be divided into two parts: (1) main works for carrying out the study and (2) transfer of knowledge to the counterparts during the study.

### 1. Main works.

#### (1) General.

As a first step, some candidate plans for flood control will be formulated paying attention to the maximum discharge in the past and taking into consideration the construction costs of the flood control works. Next, a master plan for the Overall River Improvement Project which will consist of the flood control works and the related irrigation and drainage works will be formulated in consideration of benefit-cost evaluation. Finally, the priority order of the individual projects included in the master plan will be studied from the viewpoint of engineering as well as economy.

Those studies will be made both in the field and in the Study Team's Home Office on the basis of the aerial photographs to be newly taken on a scale of 1/25,000, the topographic maps covering an area of 100 km<sup>2</sup> including the confluence of the Denai and the Buaya and the cross-sectional and longitudinal profiles of the Ular River. Those profiles will be prepared by the Government of Indonesia, and the photographs and the maps will be prepared by the JICA before the commencement of the present study.



(2) Collection of data.

The following data will be prepared by the JICA prior to the commencement of the study. Other necessary data will be collected in the field. All the data will be evaluated by the Study Team before using.

- a. Data collected by the Preliminary Study Team.
- b. Aerial photographs of the whole river basin which are taken on a scale of 1/25,000.
- c. 1/10,000 topographic maps covering an area of 100 km<sup>2</sup> including the confluence of the Denai and the Buaya.
- d. Results of the longitudinal leveling of the river and the leveling on the roads. The pegs set at intervals of 2 km for carrying out the leveling will be remained on the sites and the locations of them will be marked on the aerial photographs mentioned above.
- e. Data on the relation between the tidal level and elevation of the bench marks included in the data mentioned in the above items c and d.

(3) Surveying and measurement.

Field surveying and measurement necessary for the study will be carried out by the Government of Indonesia and the arrangement of equipment will be made by the JICA as described in Chapter X. The Study Team will work out the plans for the surveying and measurement.

(4) Flood control plan.

- a. The basic point of location where the basic flood hydrograph is to be set for planning the flood control will be settled near the Serbajadi Bridge located approximately 35 km upstream from the rivermouth. Flood hydrographs at the basic point of location will be studied based on the existing data on hydrology.
- b. The basic flood discharge will be allocated to dam and river channel in case that dam is effective for flood control and irrigation.
- c. Dam, if effective, will primarily be planned in consideration of regulation of flood and checking or regulation of sand efflux, and based on this plan, exploitation of water to be utilized for irrigation will further be studied. For the purpose of regulation of flood, it will be most effective if the dam sites are located as much downstream as possible. Therefore, dam sites will be searched by giving priority to an area near the confluence of the Denai and the Buaya.
- d. An area prospective for the retardation of flood will be searched in the field study and the effect will be studied if a candidate area has been found.
- e. The improvement of the river channel will be planned within the range of stretch from the river mouth to near the Serbajadi Bridge.

(5) Irrigation and drainage plan.

Based on the established plan for flood control, related plans for improvement of irrigation and drainage and extension of paddy field will be formulated.

(6) Water requirement study.

Water requirement for irrigation will be studied. As for the other water utilization, potentiality of exploitation by dam will be studied.

(7) Benefits.

The benefits of the present project will be divided into two parts; benefits due to prevention of flood disaster and benefits due to related projects.

The former benefits are those which will be brought by the effect of flood-disaster prevention by means of one or combined works of dam, sand control and river channel improvement taking account of retardation of flood. The latter benefits are those which will be brought by the improvement of irrigation and drainage and the extension of paddy field on the basis of the implementation of flood control works.

(8) Economic evaluation.

Economic present costs and economic present benefits will be calculated for each alternative plan in order to compare the economic relative merits of them. The economic evaluation will be made on the basis of the study of the net present values, the benefit-cost ratios and the internal rates of return.

2. Transfer of knowledge.

Knowledge will be transferred to the Indonesian counterparts through the actual study work to be done in cooperation with both the teams in the Study Team's home office as well as in the field.

IV. STUDY IN THE FIELD.

(1) Reconnaissance.

Reconnaissance and hearing at site will be made as much as possible to grasp the actual circumstances.

(2) Collection of data.

Necessary data will be collected in Jakarta, Bogor and Bandung as well as in the field.

(3) Hydrologic measurement.

The following supplementary measurement will be carried out at need.

- i) Measurement of discharge and suspended load.
- ii) Sampling of bed materials and mechanical analysis of them.
- iii) Surveying necessary for the above measurements.

(4) Survey of the past floods.

Survey will be conducted of the causes, the inundation depth and the damages due to the major floods in the past, and leveling at major points in the inundated area will also be carried out.

(5) Survey of the flood control facilities.

Survey will be conducted of the structure and location of the existing facilities for flood control.

(6) Field survey of suitable sites for dams.

In order to select suitable site for dams, general reconnaissance and geological survey will be carried out. If boring for selected dam sites is urgently required, the boring test will be carried out by the Government of Indonesia. For the selected dam sites, cross-section surveying will be conducted. Along with the selection of the dam sites, reconnaissance for borrow area available for the construction will be carried out.

(7) Survey of water requirement for irrigation.

The survey of the existing conditions of cropping pattern, irrigation area and water management, and the measurements of existing canal discharge and plot water requirement in depth at the main parts will be carried out in order to assume the water requirement for irrigation.

(8) Field survey of retarding area.

There is an area which seems to have a retarding effect for flood discharge. Survey will be conducted of the topography, the river channel and the land utilization in this area.

(9) Field survey of land erosion.

Field inspection of land erosion will be conducted as far as possible with a view to grasping the topography, the covering of vegetation and the geology of the upper basin which is regarded as the source of supply of sand.

(10) Field survey for irrigation plan.

Survey will be conducted of the topography, climate, hydrology, irrigation system and soil in the project area in order to study the

improvement of irrigation and the extension of paddy field. Leveling at major points will be carried out.

(11) Field survey for drainage plan.

Survey will be conducted of the existing drainage systems and facilities, and necessary data for planning will be collected.

(12) Field survey for benefit estimation.

Survey will be conducted of the population, the general economy, the general properties, the agricultural products, the public facilities, the traffic of highway and railway in the project area, and the damages due to floods.

(13) Field survey for the estimation of the construction costs.

Survey will be conducted of the unit costs of the individual construction works and necessary unit prices.

V. STUDY IN THE HOME OFFICE.

(1) Determination of the basic flood hydrograph and the allocation of discharge.

a. Run-off analysis.

The mechanism of run-off will be studied by use of the record at the recording rainfall gaging stations (about 6 stations) installed in the basin, the record at the recording gaging stations installed on the Ular River and the stage-discharge curves.

b. Study of the basic flood hydrograph and the allocation of discharge.

The flood hydrograph at the basic point for design will be studied based upon the record of the peak discharge and hydrograph observed at the point. Some flood hydrographs will be taken as the candidate basic flood hydrographs and the allocation of discharge to dam and river channel will be studied for each flood hydrograph taking into consideration the construction costs of the flood control works.

(2) Planning of dam.

After the selection of dam site, a dam plan will be studied for the purpose of flood control and irrigation on the basis of the field study and rough reservoir operation.

(3) Study of retarding effect.

The retarding effect of the candidate area chosen by the aerial-photograph study and the field inspection will be studied within the framework of the river channel design.

(4) Planning of river channel.

The carrying capacity of the existing river channel will first be studied and then channel improvement plans will be worked out based on the discharge allocated to the channel.

(5) Study of land erosion and sand control.

Study will be made on the amount of sediment transportation at the upper end of the expected reservoir or at the point of Serbajadi Bridge.

(6) Planning of irrigation.

On the premise that the river improvement works are implemented, plans for the improvement of irrigation and the extension of paddy field will be studied together with a study of the future farm management system to be proposed.

(7) Planning of drainage.

Drainage plans in the project area will be studied based on the study of the existing drainage systems and facilities on the premise of the implementation of the river improvement works.

(8) Estimation of construction costs.

The construction costs and the maintenance costs will be estimated of the individual projects worked out by the studies mentioned above.

(9) Estimation of benefits.

The project benefits will be estimated based on the following.

- a. Effect of reduction in flood damages due to the flood control works. This will be estimated in consideration of damaged area, degree of inundation, and products and properties contained in that area.
- b. Increase in agricultural products due to the improvement works of irrigation and drainage and the extension of paddy field.
- c. Other benefits. Benefits other than those mentioned in the items a and b will be incorporated in the project benefits, if they are countable in monetary term.

(10) Economic evaluation.

Economic evaluation of the candidate master plans will be made by examining the net present value, the benefit-cost ratio and the internal

rate of return on the basis of the economic present costs and the economic present benefits.

- (11) Determination of the master plan and study of the priority order of the individual projects.

A master plan will be chosen from among the candidate master plans based upon the results of the above-mentioned economic evaluation. Economic and engineering judgement will be made regarding to the priority order of the individual projects included in the master plan. The study works will be conducted as shown in ANNEX attached herewith.

#### VI. TRANSFER OF KNOWLEDGE.

1. Transfer of knowledge in the field.

The Indonesia counterparts will join the Japanese Study Team in making the necessary studies in the field and knowledge will be transferred to them through the actual study work.

2. Transfer of knowledge in the Study Team's Home Office.

The Indonesian counterparts will join the Japanese Study Team in formulating the project plan in the Team's Home Office and knowledge will be transferred through the actual study work. For this purpose, the JICA will arrange a special budget for the counterparting in Japan.

#### VII. WORK SCHEDULE.

The Ular River master plan study will be carried out based on the work schedule shown in Fig. 1.

The two months beginning around the end of October will be spent for the study in Indonesia. At the beginning of this period, the Inception Report will be discussed in Jakarta and submitted to the Government of Indonesia.

In the field, data collection and basic studies will be carried out after the reconnaissance for about one week. In the Study Team's home office, two months and a half will be spent for making the plan for the project and the Interim Report will be prepared in Japan.

The Interim Report will be submitted to the Government of Indonesia in March 1977 and discussions will be made during about 10 days. After having received the comments on the Interim Report, the Draft Final Report will be prepared in Japan in the following four months and submitted to the Government of Indonesia for discussion. After having received the comments on the report, the Final Report will be prepared in Japan and sent to the Government of Indonesia in December 1977. The reporting schedule is described in Chapter IX of this report.

## VIII. ORGANIZATION FOR THE STUDY.

For carrying out the study, the JICA and the Government of Indonesia will establish the organization shown in Fig. 2 in accordance with the Scope of Work submitted to the Government of Indonesia.

The Study Team consists of the members mentioned below.

|                                  |                       |
|----------------------------------|-----------------------|
| Team leader                      | Dr. Seichi Sato       |
| Co-leader                        | Mr. Kiyomi Kasama     |
| River engineer                   | Mr. Shoji Kawabata    |
| Hydrologist                      | Mr. Noboru Jitsuhiro  |
| Sabo engineer                    | Mr. Masahiro Kimura   |
| Dam engineer                     | Mr. Jiro Shimoyama    |
| Geologist                        | Mr. Hisashi Sasaki    |
| Irrigation and drainage engineer | Mr. Takeshi Nomoto    |
| Agronomist                       | Mr. Kenjiro Onaka     |
| Agroeconomist                    | Mr. Masashi Shono     |
| Surveyor                         | Mr. Masaru Yonai      |
| Project economist                | Dr. Kinichi Ohno      |
| Measurement and Liaison          | Mr. Yoshiaki Ishizuka |

## IX. REPORTING.

### (1) Inception Report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Inception Report (in English) upon discussion with the Government of Indonesia at the commencement of the field study.

### (2) Interim Report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Interim Report (in English) together with the economic and technical priority order of the individual projects within 6 months after the commencement of the field study. The Government of Indonesia will provide its comments to the JICA within 30 days after the receipt of the Interim Report.

### (3) Draft Final Report.

The JICA will prepare and submit to the Government of Indonesia 20 copies of Draft Final Report (in English) within 4 months after the receipt of the comments on the Interim Report. The Government of Indonesia will provide its comments to the JICA within 30 days after the receipt of the Draft Final Report.

(4) Final Report.

The JICA will prepare and submit to the Government of Indonesia 30 copies of Final Report within 60 days after the receipt of the comments on the Draft Final Report.

X. ARRANGEMENT OF THE EQUIPMENT FOR THE FIELD STUDY.

The following equipment will be arranged by the JICA for the field study. A proper measure will be taken by the Government of Indonesia in carrying them in and out of Indonesia.

| <u>Items</u>                          | <u>Specification</u>    | <u>Quantity</u> | <u>Remark</u> |
|---------------------------------------|-------------------------|-----------------|---------------|
| (1) Electro-optical<br>Distance meter | SOKKISHA: SDM 1-C       | 1 set           |               |
| (2) Transit with tripod               | SOKKISHA: TM-10C        | 1 set           |               |
| (3) Level with tripod                 | SOKKISHA: B-2           | 1 set           |               |
| (4) Level with tripod                 | ZUIHO: Z-TL Tilting     | 1 set           |               |
| (5) Hand level                        |                         | 2 pcs           |               |
| (6) Binocular                         | NIKON J-B7              | 1 pc            |               |
| (7) Mirror stereoscope                | TOPCON III type         | 2 pcs           |               |
| (8) Pocket stereoscope                | TOPCON II type          | 2 pcs           |               |
| (9) Handy talky<br>for surveying      | HITACHI CH-1330         | 2 pcs           |               |
| (10) Calculator                       | Pocket-type             | 10 pcs          |               |
| (11) Current meter                    | CM-1B type              | 2 set           |               |
| (12) Silt sampler                     | ASAHISOKKI: Price type  | 1 set           |               |
| (13) Stop watch                       |                         | 2 pcs           |               |
| (14) Hand auger                       | S-15-1A                 | 1 set           |               |
| (15) PH meter                         | HM-1F                   | 1 set           |               |
| (16) Pedometer                        |                         | 1 pc            |               |
| (17) Altimeter                        | Tomen 3B-21             | 1 pc            |               |
| (18) Planimeter                       |                         | 4 pcs           |               |
| (19) Curvimeter                       |                         | 3 pcs           |               |
| (20) Sieve                            | SS-85                   | 1 set           |               |
| (21) Leveling staff                   | MIKASA: 3m, two-folding | 2 pcs           | Expendables   |
| (22) Leveling staff                   | 5m, telescopic          | 5 pcs           | "             |
| (23) Esron tape                       | 50 m                    | 4 pcs           | "             |
| (24) Esron tape                       | 30 m                    | 1 pc            | "             |



|  |                    |        |   |
|--|--------------------|--------|---|
| (25) Esron rope                            | 100 m              | 2 pcs  | " |
| (26) Esron rope                            | 50 m               | 1 pc   | " |
| (27) Pole                                  | 2 m                | 6 pcs  | " |
| (28) Boring spade                          | S-F-54             | 1 set  | " |
| (29) Standard soil color chart             | S-F-462            | 1 set  | " |
| (30) Soil tester                           | S-F-300            | 1 set  | " |
| (31) Auger boring past-hall                | SS-24 with one rod | 1 pc   | " |
| (32) Screw point for swedish sounding test | SS-156             | 2 pcs  | " |
| (33) Beaker                                | 1000 cc with cap   | 5 pcs  | " |
| (34) Volumetric cylinder                   | 1000 cc            | 2 pcs  | " |
| (35) Evaporation dish                      | φ10 cm             | 10 pcs | " |

#### XI. ARRANGEMENT BY THE GOVERNMENT OF INDONESIA.

In carrying out the field study, the Government of Indonesia will cooperate with the Study Team by:

- (1) Providing the data and information for the study.
- (2) Assuring the security of the field study team.
- (3) Exemption from taxes and duties for the Study Team and the equipment to be carried into Indonesia for the study.
- (4) Permission for taking all data and materials concerned out of Indonesia by the Study Team.
- (5) Providing the suitable office space in Medan with office equipment necessary for the study.
- (6) Providing 7 vehicles with drivers and their maintenance.
- (7) Making arrangements for accomodations and field office required for the study, when necessary.
- (8) Providing one Indonesian counterpart for each Japanese expert.
- (9) Providing 6 surveying teams, each of which will consist of one surveyor, one assistant and four laborers.
- (10) Providing 2 measurement teams, each of which will consist of one engineer, three assistants and three laborers for supplementary measurement including laboratory test.
- (11) Arranging transportation for the above items (9) and (10).
- (12) Providing 2 boats with engines for surveying.
- (13) Carrying out necessary soil samplings and laboratory tests.
- (14) Carrying out machine boring of digging test pits for geological survey at expected dam sites.
- (15) Providing such necessary materials wooden stakes of about 150 pcs, paint and pegs for surveying.

FIG. I (1) WORK SCHEDULE OF THE ULAR RIVER MASTER PLAN STUDY

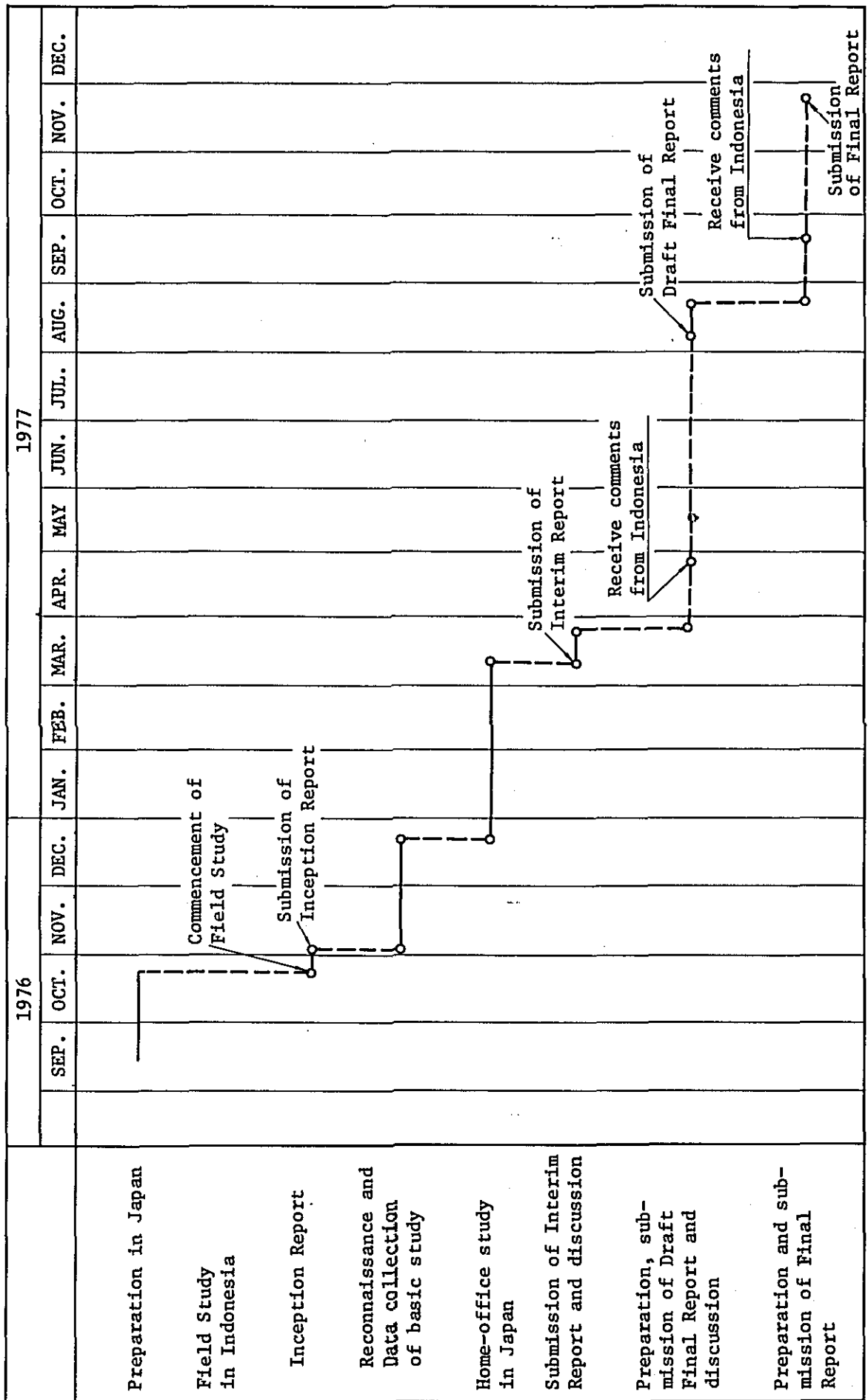


Fig. I (2) WORK SCHEDULE FOR EACH ITEM OF THE ULAR RIVER MASTER PLAN STUDY

|                                | 1976                 |             |                   |                                |      |      |           |                              |                       |                        |                                  |                          | 1977                     |                            |      |      |  |  |  |  |  |  |  |  |
|--------------------------------|----------------------|-------------|-------------------|--------------------------------|------|------|-----------|------------------------------|-----------------------|------------------------|----------------------------------|--------------------------|--------------------------|----------------------------|------|------|--|--|--|--|--|--|--|--|
|                                | SEP.                 | OCT.        | NOV.              | DEC.                           | JAN. | FEB. | MAR.      | APR.                         | MAY                   | JUN.                   | JUL.                             | AUG.                     | SEP.                     | OCT.                       | NOV. | DEC. |  |  |  |  |  |  |  |  |
| General                        | Preparation in Japan | Field Study | Home Office Study | Submission of Inception Report |      |      | Reviewing | Submission of Interim Report | Compiling of Printing | Submission of Comments | Submission of Draft Final Report | Re-compiling of Printing | Comments of Final Report | Submission of Final Report |      |      |  |  |  |  |  |  |  |  |
| River planning                 | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Hydrological study             | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Dam planning                   | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Geological study               | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Sand control study             | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Irrigation & drainage planning | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Agronomic study                | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Agroeconomic study             | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Project economic study         | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Surveying                      | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |
| Measurement & Liaison          | ---                  | ---         | ---               | ---                            | ---  | ---  | ---       | ---                          | ---                   | ---                    | ---                              | ---                      | ---                      | ---                        | ---  | ---  |  |  |  |  |  |  |  |  |

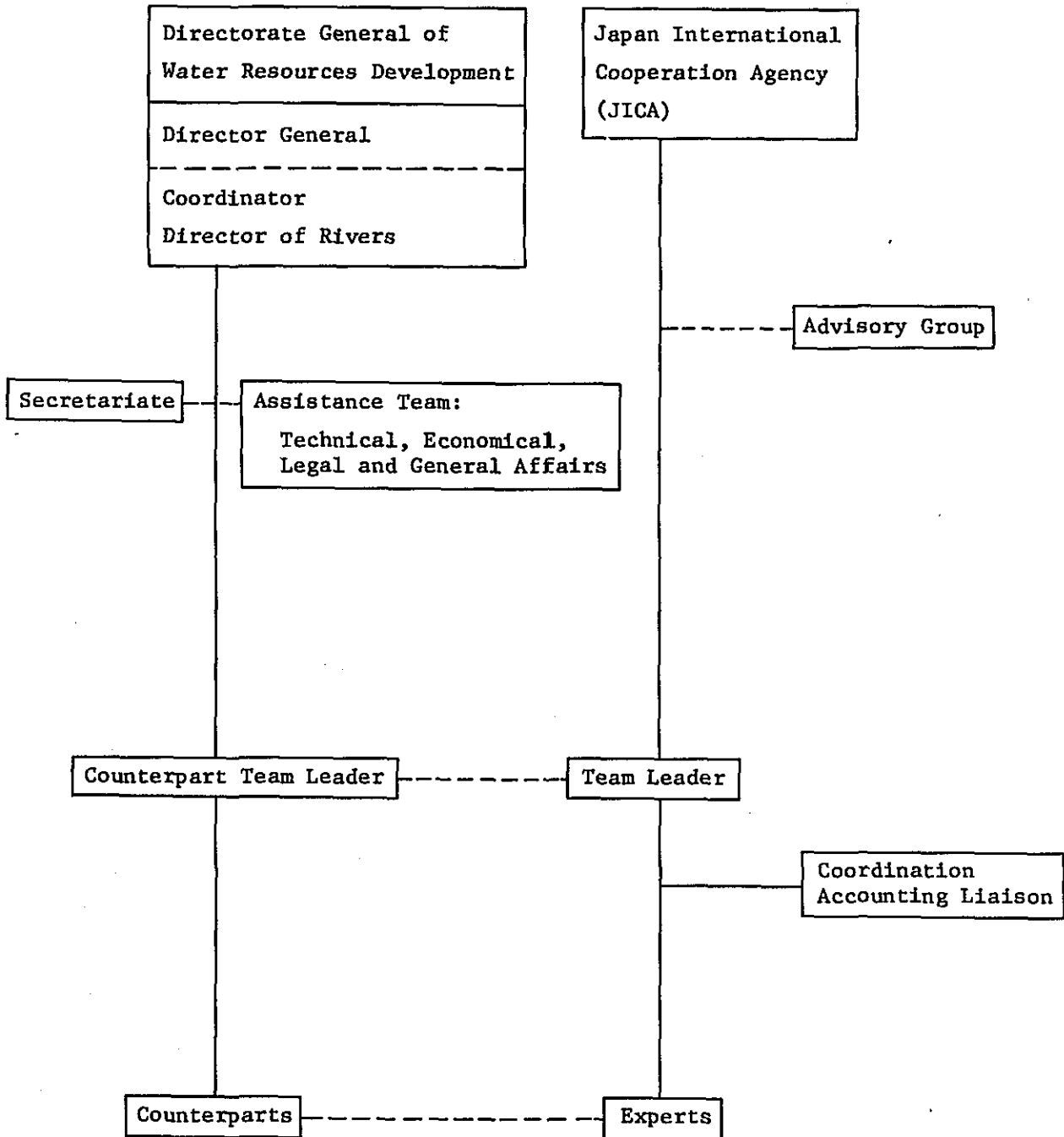
Note: ——— Work in Indonesia  
 - - - - - Work in Japan

Fig. 1 (3) ASSIGNMENT SCHEDULE FOR THE ULAR RIVER MASTER PLAN STUDY

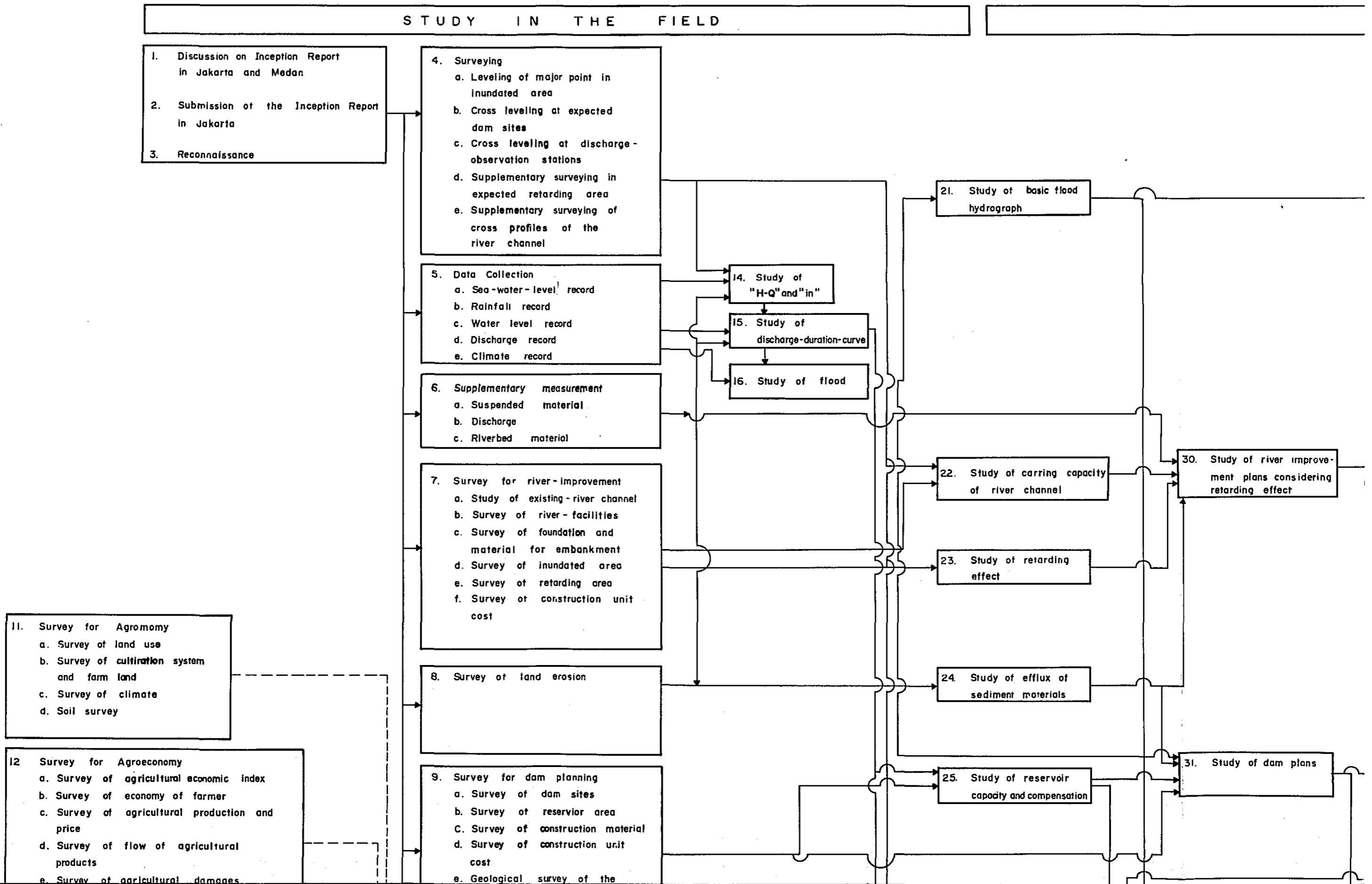
— in Indonesia  
 --- in Japan

|                                |                  | 1977 |      |      |      |      |      |      |      |     |      |      |      |      |      |      |      |
|--------------------------------|------------------|------|------|------|------|------|------|------|------|-----|------|------|------|------|------|------|------|
|                                |                  | 1976 |      |      |      |      |      |      |      |     |      |      |      |      |      |      |      |
|                                |                  | SEP. | OCT. | NOV. | DEC. | JAN. | FEB. | MAR. | APR. | MAY | JUN. | JUL. | AUG. | SEP. | OCT. | NOV. | DEC. |
| Team Leader                    | Dr. S. Sato      |      |      | —    |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Co-Leader                      | Mr. K. Kasama    |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| River Egnineer                 | Mr. S. Kawabata  |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Hydrologist                    | Mr. N. Jitsuhiro |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Sabo Egnineer                  | Mr. M. Kimura    |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Dam Egnineer                   | Mr. J. Shimoyama |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Geologist                      | Mr. H. Sasaki    |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Irrigation & Drainage Engineer | Mr. T. Nomoto    |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Agronomist                     | Mr. K. Onaka     |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Agroeconomist                  | Mr. M. Shono     |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Surveying Engineer             | Mr. M. Yonai     |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Project Economist              | Dr. K. Ohno      |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |
| Measurement and Liaison        | Mr. Y. Ishizuka  |      | —    |      |      |      |      | —    |      |     |      |      | —    |      |      |      |      |

FIG. 2 ORGANIZATION CHART

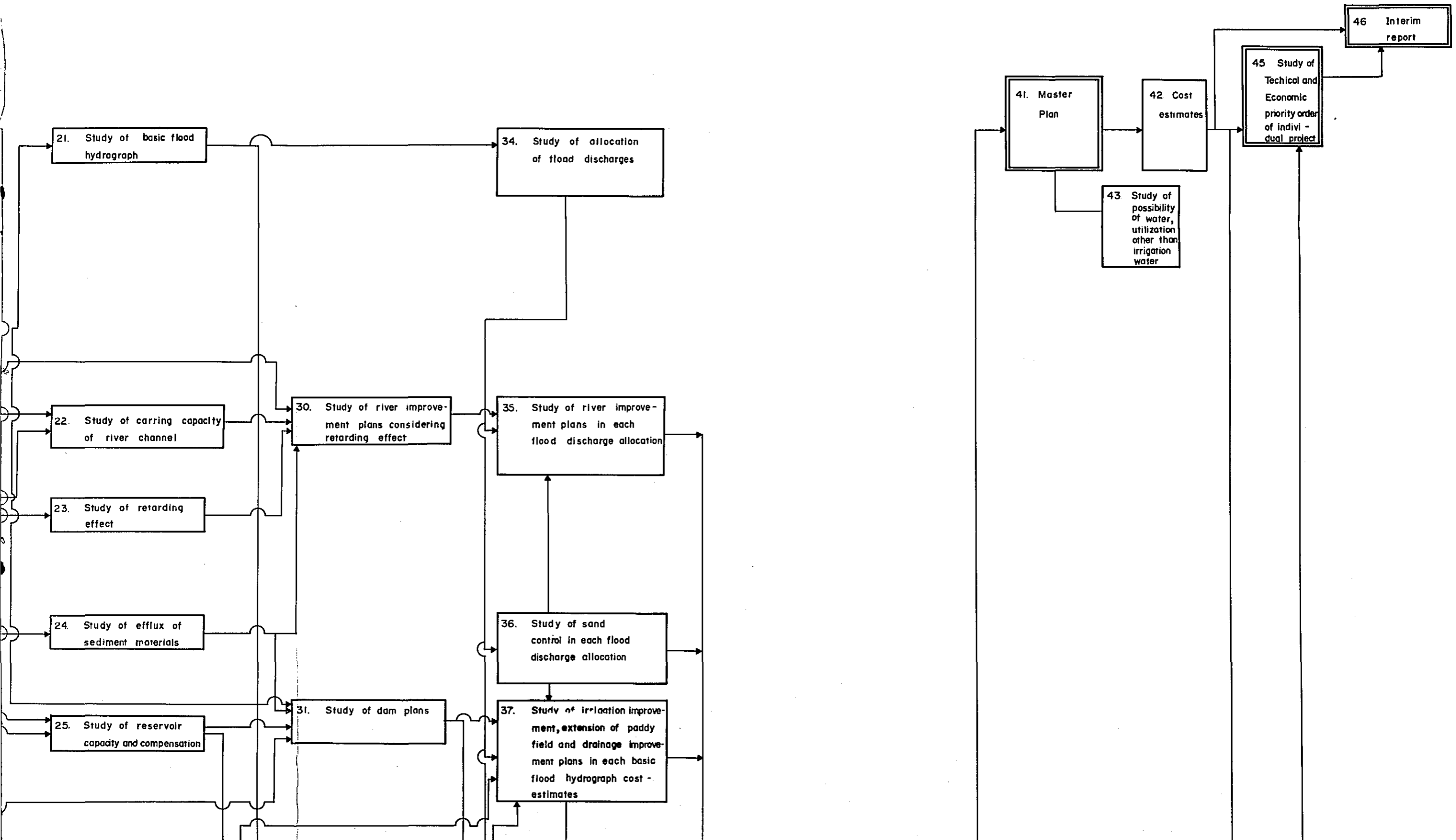


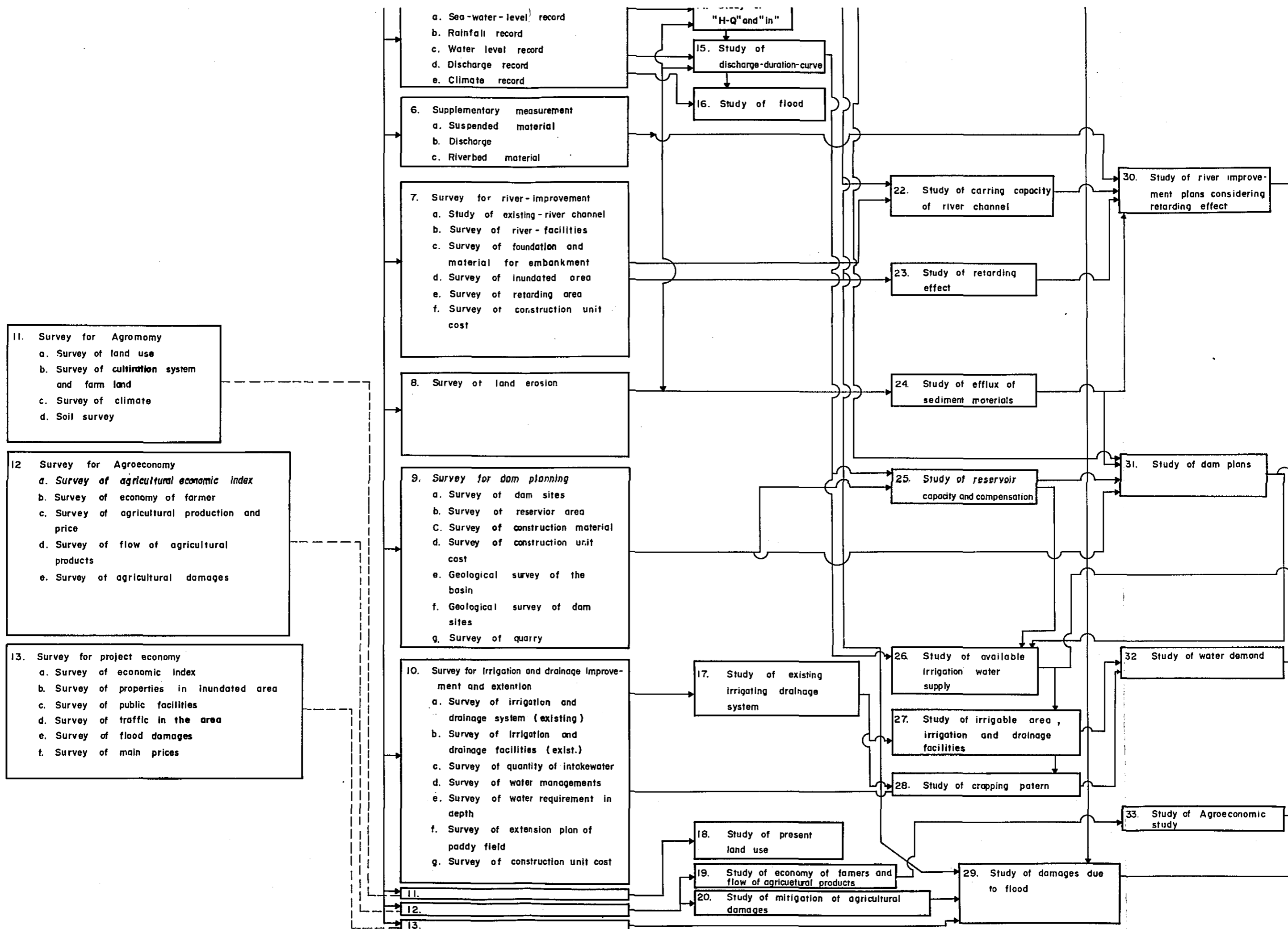
STUDY IN THE FIELD



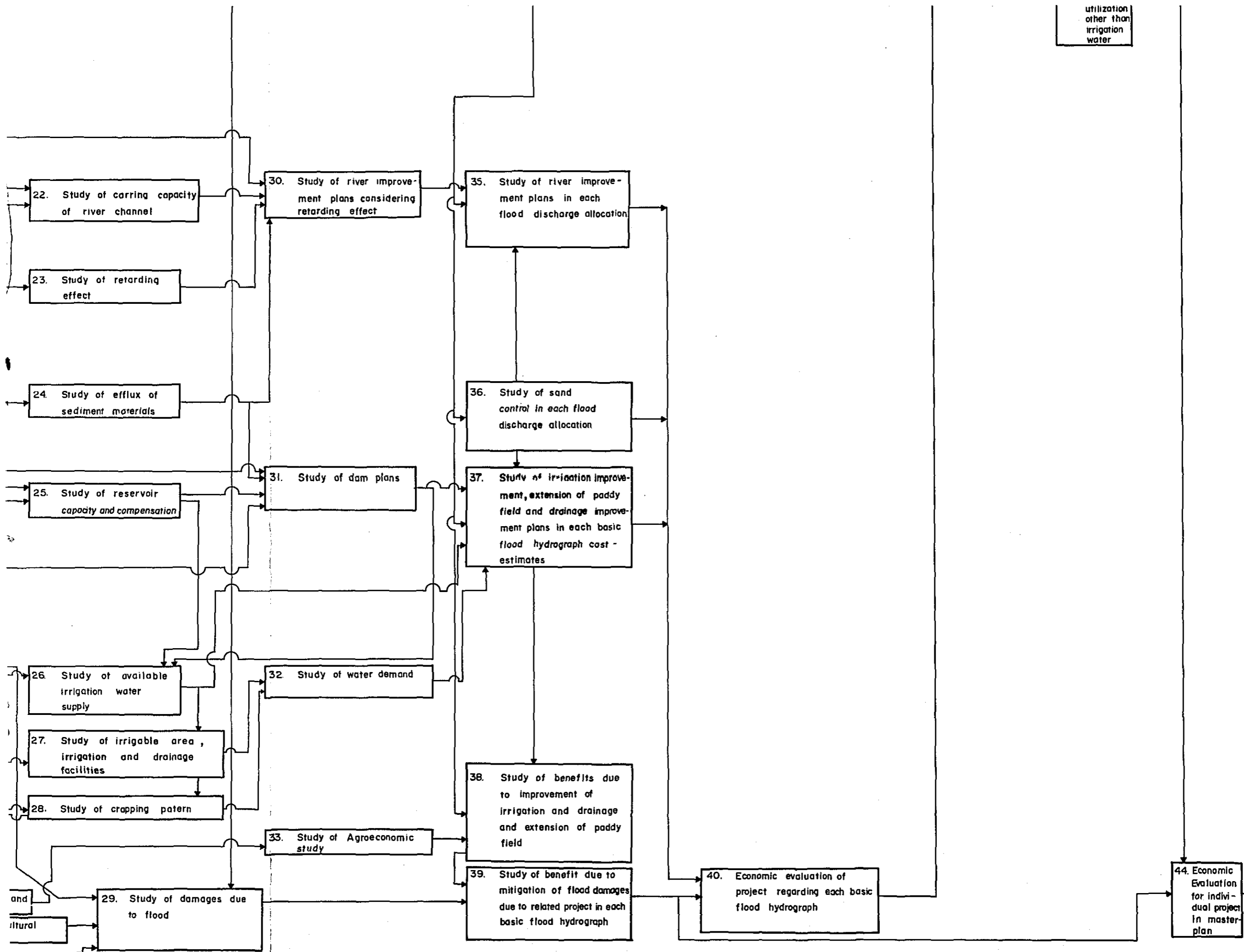
MASTER PLAN STUDY ON OVERALL ULLAR RIVER IMPROVEMENT PROJECT  
 UP TO INTERIM REPORT )

STUDY IN THE HOME - OFFICE









utilization other than irrigation water