

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF AGRICULTURE  
ROYAL GOVERNMENT OF BHUTAN

THE STUDY  
ON  
GROUNDWATER DEVELOPMENT  
IN  
WANGDUEPHODRANG DISTRICT

FINAL REPORT  
VOLUME III: SUPPORTING REPORT

March 1996

PACIFIC CONSULTANTS INTERNATIONAL  
CHUO KAIHATSU CORPORATION

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In this report, project costs are estimated based on July 1995 prices with an exchange rate of  
US\$1.00=Nu.30.85=J.Yen100.00

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VOLUME III: SUPPORTING REPORT

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**TOPOGRAPHIC SURVEY**

**THE STUDY  
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APPENDIX-A TOPOGRAPHIC SURVEY

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## APPENDIX-A TOPOGRAPHIC SURVEY

### A.1 General

During the field survey period, the following topographic survey works were conducted by the Study team.

- Collection of basic topographic data and information on existing bench marks, aerial photos, etc.
- River cross-section surveys at the sites of stream gauge stations and along the Chang Chhu.
- Site survey for the experimental facilities which were constructed in Bajo and Phangyul.
- Plan and profile surveys along the existing irrigation canals in the Study area.
- Plan and profile surveys for the existing urban water supply system in the Wangduephodrang town area.

In addition to the above-mentioned surveys, the photogrammetric mapping was conducted based on the available aerial photos by the Survey of Bhutan under the supervision of the Study team. The topographic drawings prepared in the field survey are listed in Table A.1.1.

### A.2 Topographic Data Collection

#### A.2.1 1:50,000 Scale of Topographic Map

The topographic maps of 1:50,000 scale were collected. The maps were prepared by the Indian government in 1960s based on the aerial photos taken from late 1950s to the beginning of 1960s. Since no update has been made, any objects which have been constructed such as national highways, government office buildings, etc. do not appear on the maps. However the collected maps are considered usable for carrying out field surveys for the Study, since the topography has not changed substantially.

The maps collected covers all of the Study area, but not cover the northern part of the Chang Chhu basin near the border with China, as shown in Fig. A.2.1.

#### A.2.2 Land Use Map

The land use maps prepared by the Land Use Section of MOA were collected covering almost of the whole Dzongkhag area of Wangduephodrang as indicated in Fig. A.2.2. The maps were prepared in 1994 and 1995 based on the image of SPOT satellite.

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### A.2.3 Aerial Photos

Aerial photos covering the whole Study area were collected in the Survey of Bhutan. The photos were taken in late 1950s and printed with the scales of 1:30,000 and 1:35,000.

### A.3 Bench Marks

Only the bench marks established by the Survey of Bhutan in Wangduephodrang town is the one authorized, whose elevation is connected to the national level bench mark networks. Its official elevation is 1,300 m. Based on this bench mark elevation, over 30 bench marks were established along the survey routes in the Study area. The longitude, latitude and measured elevation of such established bench marks are listed below, and their locations are indicated in Fig. A.3.1.

List of Established Bench Marks

| Name of BM | Elevation (m) | Longitude | Latitude  | Name of BM | Elevation (m) | Longitude | Latitude  | Name of BM | Elevation (m) | Longitude | Latitude  |
|------------|---------------|-----------|-----------|------------|---------------|-----------|-----------|------------|---------------|-----------|-----------|
| BM-1       | 1,431.56      | 1082277.4 | 273958.0  | BM BC-2    | 1,423.21      | 1081441.7 | 2739892.5 | BM BC-13   | 1,404.03      | 1081108.2 | 2737976.3 |
| BM-2       | 1,426.78      | 1082012.0 | 2739881.8 | BM BC-3    | 1,416.38      | 1081268.6 | 2739765.4 | BM BC-14   | 1,391.27      | 1080882.9 | 2737792.1 |
| BM-3       | 1,562.43      | 1081045.1 | 2739717.7 | BM BC-4    | 1,414.55      | 1081042.0 | 2739663.6 | BM BC-15   | 1,392.18      | 1079803.5 | 2737364.0 |
| BM-4       | 1,339.07      | 1080869.4 | 2739287.9 | BM BC-5    | 1,413.62      | 1080995.2 | 2739558.4 | BM BC-16   | 1,388.58      | 1079525.8 | 2737105.3 |
| BM-5       | 1,347.68      | 1080388.9 | 2738319.2 | BM BC-6    | 1,412.36      | 1081051.1 | 2739390.3 | BM BC-17   | 1,379.00      | 1079361.1 | 2736827.9 |
| BM-6       | 1,314.07      | 1079909.1 | 2737600.8 | BM BC-7    | 1,411.76      | 1080994.0 | 2739198.2 | BM BC-18   | 1,370.77      | 1079218.0 | 2736122.9 |
| BM-7       | 1,318.65      | 1079296.0 | 2736941.2 | BM BC-8    | 1,409.60      | 1080953.9 | 2739044.0 | BM BC-19   | 1,367.97      | 1079105.5 | 2735670.4 |
| BM-8       | 1,312.50      | 1079014.9 | 2735490.3 | BM BC-9    | 1,411.50      | 1080786.0 | 2738678.9 | BM BC-20   | 1,351.00      | 1079077.7 | 2735433.8 |
| BM-9       | 1,310.22      | 1078632.7 | 2734338.2 | BM BC-10   | 1,411.05      | 1080705.7 | 2738496.8 | BM BC-21   | 1,355.71      | 1078806.8 | 2735011.9 |
| BM-10      | 1,306.60      | 1078608.2 | 2733973.1 | BM BC-11   | 1,407.42      | 1080492.7 | 2738238.3 | BM BC-22   | 1,351.43      | 1078551.9 | 2734543.4 |
| BM BC-1    | 1,423.22      | 1081744.3 | 2739878.6 | BM BC-12   | 1,406.35      | 1080345.0 | 2738134.6 | BM BC-23   | 1,345.50      | 1078336.4 | 2734153.3 |

### A.4 Photogrammetric Mapping

The photogrammetric mapping of 1:10,000 was conducted by the Survey of Bhutan under the supervision of the Study team during the field survey period. In the First Field Survey from February to July 1994, 70 km<sup>2</sup> of mapping was made to cover all of the Study area, and in the Second Field Survey Period from November 1994 to March 1995, 40 km<sup>2</sup> of mapping was made additionally along the Bajo and the Lobeyasa Canals and the southern areas of Rubeyasa sub-area. The mapped areas totaling 110 km<sup>2</sup> are indicated in Fig. A.4.1.

The aerial photos are as follows;

- Specification 1388A shot in 1987 and 1988 with a scale of 1:30,000, and
- Specification 848A shot in 1978 with a scale of 1:35,000.

After the plotting, the field verification was conducted to confirm the details of the plotted maps, and some discrepancies were identified and collected according to the results of such field verification works.

## **A.5 Topographic Surveys**

### **A.5.1 River Cross-section Survey**

#### **(1) Stream Gauging Stations**

Six (6) water level staff gauges and one (1) automatic water level gauge were installed in the Pe Chhu, the Dang Chhu, the Limthi Chhu and the Tabe Rongchhu as shown in Fig. A.5.1. Cross-section surveys were conducted at all the sites where such gauging stations were established to grasp the river sections.

#### **(2) Cross-section Survey for Chang Chhu**

The cross-section surveys were conducted along the Chang Chhu with several hundred meters interval as indicated in Fig. A.5.2. The survey was conducted twice before and after the outburst of Lunana lake to find out the sedimentation effects caused by such extremely large flood which was induced by the outburst. The results are used for estimating the flood water level of the Chang Chhu.

### **A.5.2 Site Survey for Experimental Facilities**

The experimental facilities were planned to be constructed utilizing four (4) kinds of water sources; groundwater, spring, sub-surface water and surface water. The site surveys were carried out for each facility stated above as explained below.

#### **(1) Groundwater Scheme**

The groundwater scheme was planned to be constructed in the RNRRC yard in the Bajo sub-area, consisting of the 50 m deep tubewell operated by a solar power supply system, a water reservoir tank, and distribution pipeline networks. The plan and profile surveys along the pipeline route and the plan table survey at the solar power and tubewell sites were carried out.

#### **(2) Spring Water Scheme**

The plan table survey was conducted for the experimental facilities of the spring water scheme scheduled in the Phangyul sub-area.

#### **(3) Subsurface Water Scheme**

The plan and profile surveys and the plan table surveys were carried out along the delivery pipeline route and at the shallow well site, respectively. The plan of the proposed well site with a scale of 1:500 and the longitudinal profile of delivery pipeline route were prepared for planning and designing of the facilities.

#### **(4) River Water Scheme**

The river water scheme, which are planned to be constructed on the left bank of the Chang Chhu beside the RNRRC yard, consists of the slide type pumping

## APPENDIX A

*The Study on Groundwater Development in Wangduephodrang District of Bhutan*

station, delivery pipeline and the existing reservoir tank. Plan, profile and cross-section surveys were carried out in each respective sites as well as plan table surveys to construct the necessary structures for such experimental facilities.

### A.5.3 Irrigation Canal Route Survey

There are 22 of irrigation canals in the Study area and , the route surveys were carried out for seven (7) canals as shown in Fig. A.5.3. The surveys done consist of plan and profile surveys, and as a result the plan with 1:1,000 scale and the profile with a vertical and a horizontal scales of 1:5,000 and 1:25,000, respectively were prepared. During the survey, inventory survey on the existing canal structure was also conducted.

### A.5.4 Surveys for Urban Water Supply System for Wangduephodrang Town Area

The urban water supply plan is considered to be the most important sector in this study, and various topographic surveys were carried out in the Wangduephodrang town area as well as along the existing conveyance pipeline route as stated below.

#### (1) Existing Conveyance Pipeline and Bajo Canal

The plan, profile and cross-section surveys were carried out along the existing conveyance pipeline route from the Pe Chhu to the water distribution station in the Wangduephodrang town. As a result of these survey, the following drawings were prepared as a result.

- Plans of the conveyance pipeline route in a scale of 1:1,000 (See Fig. A.5.4)
- Longitudinal profiles of the conveyance pipeline route in horizontal and vertical scales of 1:5,000 and 1:200
- Cross-sections with an interval of about 500 m in a scale of 1:200.

#### (2) Distribution Pipelines

In order to grasp the actual routes of the existing distribution networks in the town area as exactly as possible, the plan table surveys were conducted and the plan drawings consisting seven (7) sheets were prepared in a scale of 1:1,000. The routes of such existing pipeline networks are indicated in these maps in detail with their diameters, buried depths and kinds of pipe materials. The longitudinal profiles of major pipeline routes were further prepared based on the leveling survey results. The mapped area of such plan drawings is indicated in Fig. A.5.5.

#### (3) Water Distribution Station

The water distribution station located in the east of the town area has to be improved. Therefore, the plan table survey was, therefore, carried out to facilitate such improvement planning, and the dimensions and sizes of the existing structures

were also measured. The plan drawing of the existing water distribution station is prepared in a scale of 1:200.



**APPENDIX A**  
**TABLES**

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Table A.1.1 List of Topographic Survey Drawings (1/2)

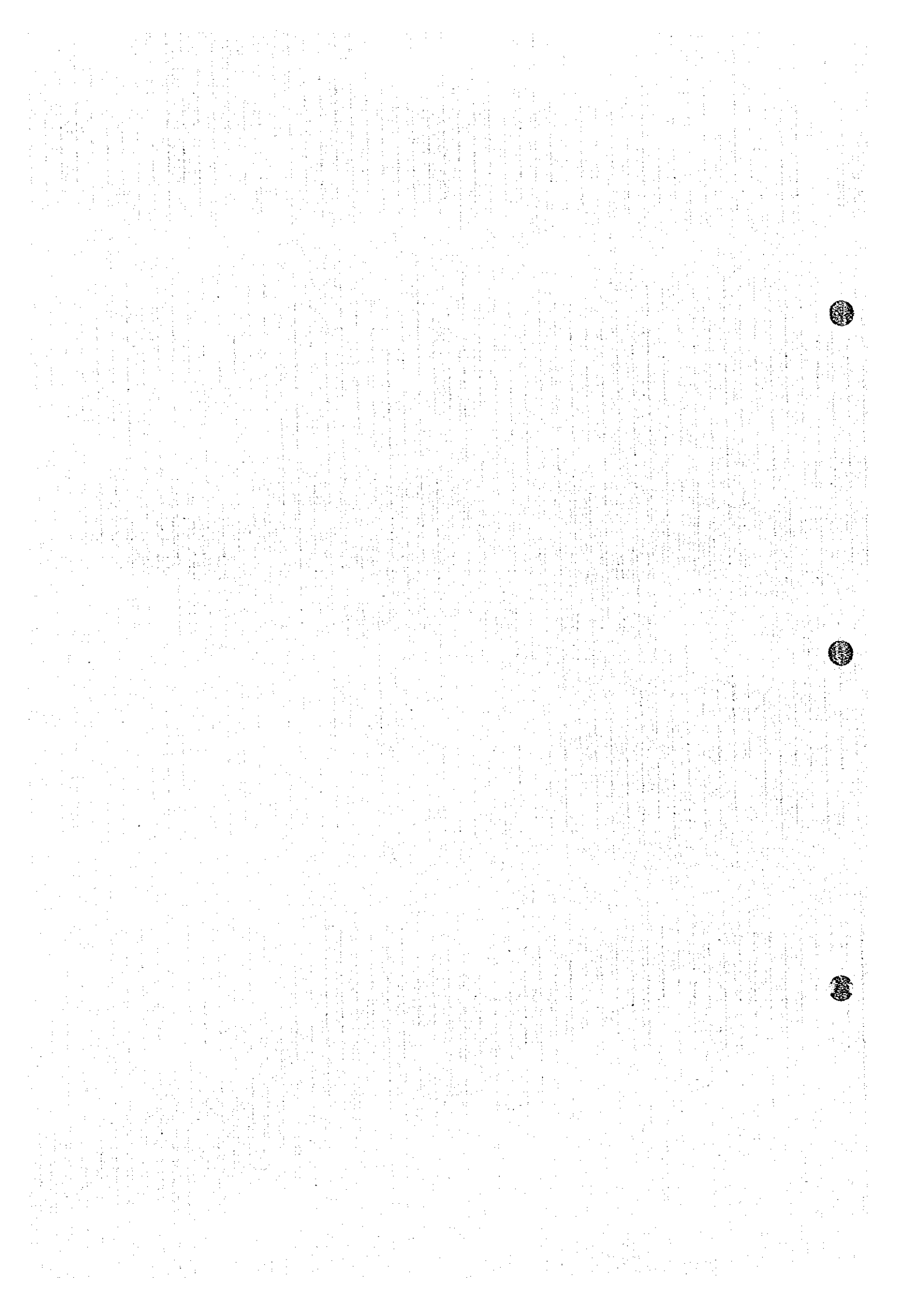
| <u>Titles of Drawings</u>  | <u>No. of Drawings</u> |
|--|------------------------|
| 1. Location Map of Bench Marks   | 1 sheet                |
| 2. River Cross Section Survey  |                        |
| 2.1 Stream Gauging Stations  |                        |
| 2.1.1 Location Map   | 1 sheet                |
| 2.1.2 Cross Section SR1 (Pe Chhu)  | 3 sheets               |
| 2.1.2 Cross Section SR2 (Dang Chhu)  | 1 sheet                |
| 2.1.3 Cross Section SR3 (Dang Chhu)  | 3 sheets               |
| 2.1.4 Cross Section SR4 (Linti Chhu)   | 3 sheets               |
| 2.1.5 Cross Section SR5 (Tabe Rongchhu)  | 3 sheets               |
| 2.1.6 Cross Section SR6 (Tabe Rongchhu)  | 3 sheets               |
| 2.2 Chang Chhu   |                        |
| 2.2.1 Location Map of River Cross-sections   | 1 sheet                |
| 2.2.2 River Cross-sections (Chang Chhu)  | 5 sheets               |
| 3. Topographic Survey for Experimental Facilities  |                        |
| 3.1 Groundwater Scheme   |                        |
| 3.1.1 Plan for General Layout (1:1,000)  | 1 sheet                |
| 3.1.2 Plan for Solar System Layout (1:200)   | 1 sheet                |
| 3.1.3 Longitudinal Profiles of Pipeline  | 4 sheets               |
| 3.2 Spring Water Scheme  |                        |
| 3.2.1 General Plan of the Site   | 1 sheet                |
| 3.2.2 Plan of the Proposed Command Area (1:500)  | 2 sheets               |
| 3.3 Subsurface Water Scheme  |                        |
| 3.3.1 Plan of the Proposed Well Site (1:500) and<br>Longitudnal Profile of Delivery Pipeline                     | 1 sheet                |
| 3.4 River Water Scheme   |                        |
| 3.4.1 Plan of Pumping Station Site (1:500)   | 1 sheet                |
| 3.4.2 Cross-section of River Bank  | 11 sheets              |
| 3.4.3 Depth of the Chang Chhu in front of the Site   | 1 sheet                |
| 3.4.4 Cross-section of the Chang Chhu  | 2 sheets               |
| 3.4.5 Plan of the Route for Delivery Pipeline (1:500) and<br>Longitudinal Profile of the Delivery Pipeline Route | 1 sheet                |
| 4. Irrigation Canals   |                        |
| 4.1 Location Map of the Irrigation Canals Surveyed (1:25,000)  | 1 sheet                |
| 4.2 Plan of the Existing Irrigation Canals (1:1,000)   | 19 sheets              |
| 4.3 Longitudinal Profile of the Existing Irrigation Canals   | 1 sheet                |

**Table A.1.1 List of Topographic Survey Drawings (2/2)**

| <u>Titles of Drawings</u>                                       | <u>No. of Drawings</u> |
|---|------------------------|
| 5. Urban Water Supply System in Wangduephodrang Town            |                        |
| 5.1 Existing Conveyance Pipeline and Canal                      |                        |
| 5.1.1 Guide Map for Plans                                       | 2 sheets               |
| 5.1.2 Plan of Conveyance Pipeline and Canal Route (1:1,000)     | 6 sheets               |
| 5.1.3 Longitudinal Profile of Water Supply in Wangduephodrang   | 1 sheet                |
| 5.1.4 Cross-sections of Conveyance Pipeline and Canal Routes    | 3 sheets               |
| 5.2 Distribution Pipelines                                      |                        |
| 5.2.1 Plan of the Water Supply Service Area (1:1,000)           | 7 sheets               |
| 5.2.2 Routes of the Existing Distribution Pipelines (1:1,000)   | 7 sheets               |
| 5.2.3 Longitudinal Profiles of the Major Distribution Pipelines | 7 sheets               |
| 5.3 Water Distribution Station                                  |                        |
| 5.3.1 Existing Distribution Station (Plan)                      | 1 sheet                |

**APPENDIX A**  
**FIGURES**

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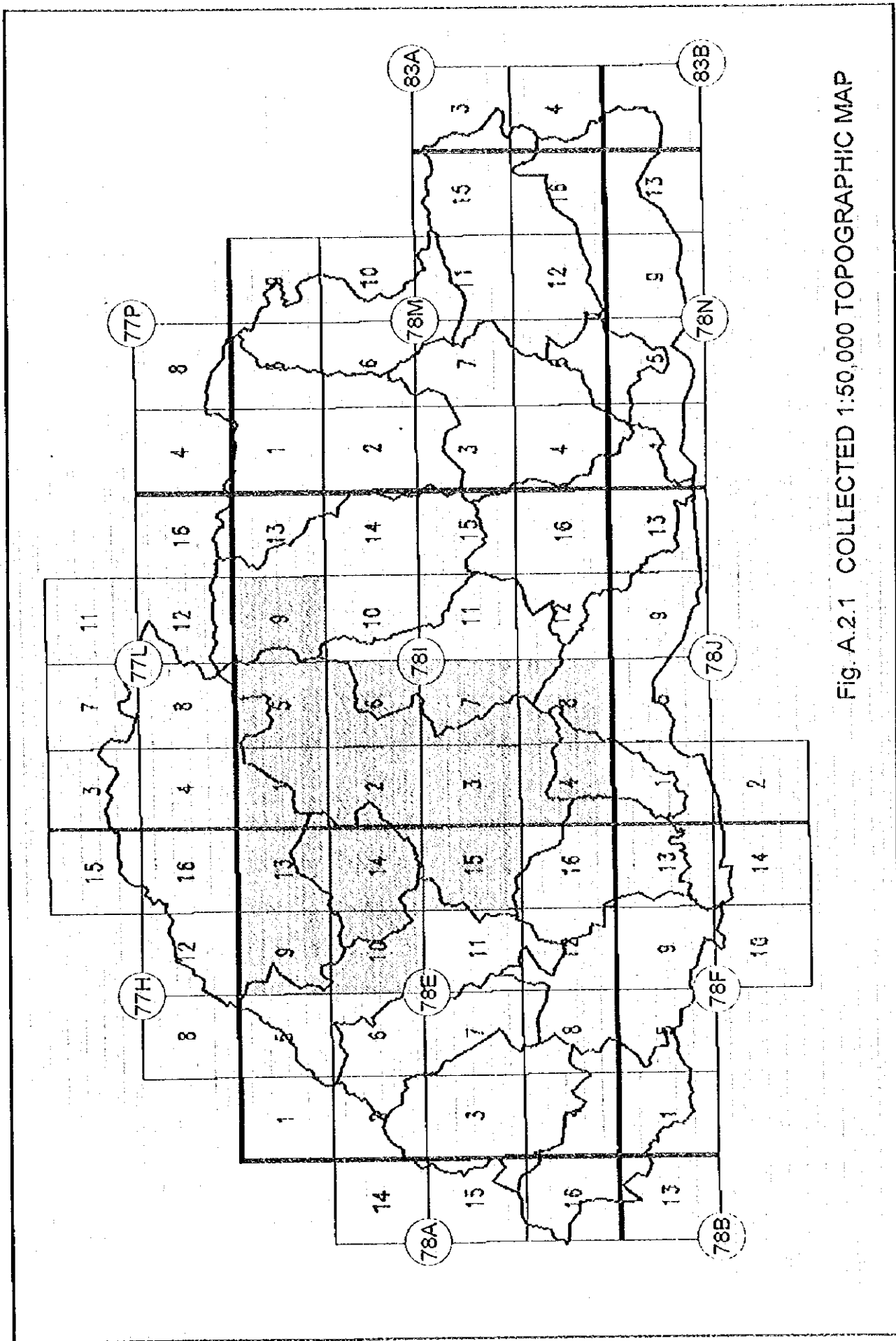


Fig. A.2.1 COLLECTED 1:50,000 TOPOGRAPHIC MAP

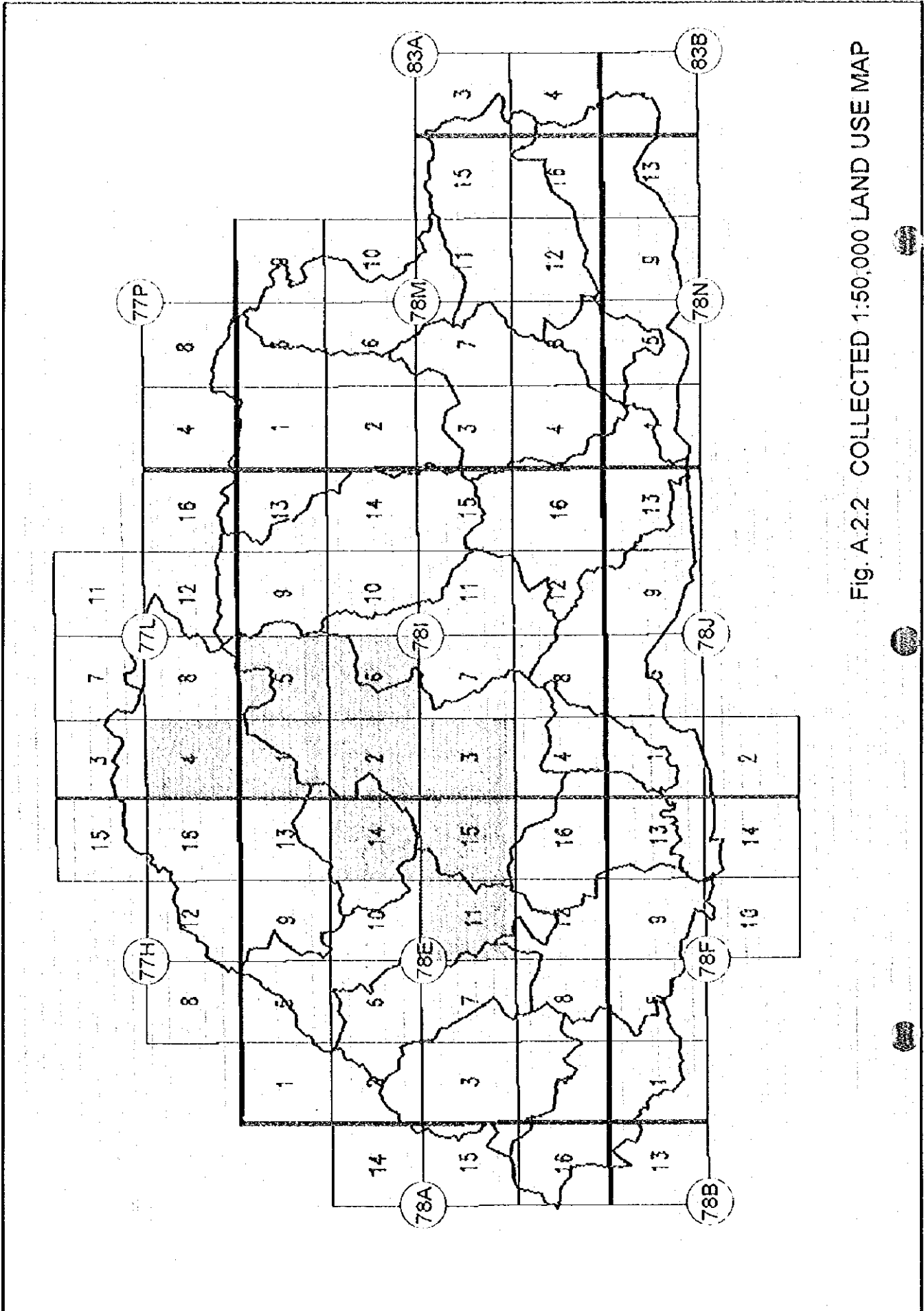
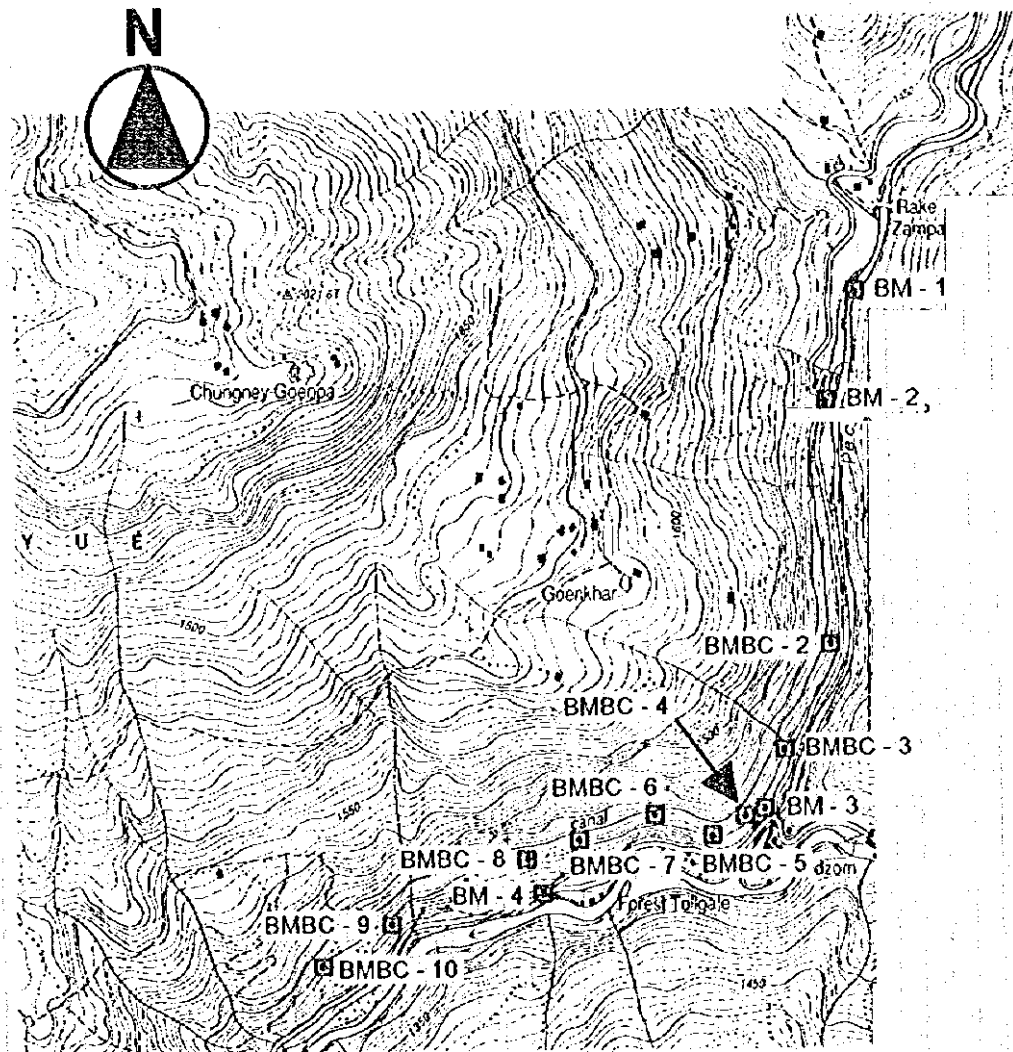


Fig. A.2.2 COLLECTED 1:50,000 LAND USE MAP



List of Established Bench Marks

| Name of BM | Elevation (m) | Longitude | Latitude  | Name of BM | Elevation (m) | Longitude | Latitude  | Name of BM | Elevation (m) | Longitude | Latitude  |
|------------|---------------|-----------|-----------|------------|---------------|-----------|-----------|------------|---------------|-----------|-----------|
| BM-1       | 1,431.56      | 1082277.1 | 2739958.0 | BMBC-2     | 1,423.21      | 1081111.7 | 2739892.5 | BMBC-13    | 1,404.03      | 1080138.2 | 2737976.3 |
| BM-2       | 1,426.78      | 1082012.0 | 2739881.8 | BMBC-3     | 1,416.48      | 1081208.6 | 2739765.4 | BMBC-14    | 1,394.27      | 1080082.9 | 2737792.1 |
| BM-3       | 1,362.43      | 1081045.1 | 2739717.7 | BMBC-4     | 1,414.55      | 1081041.0 | 2739663.6 | BMBC-15    | 1,392.18      | 1079833.5 | 2737361.0 |
| BM-4       | 1,339.07      | 1080869.4 | 2739087.9 | BMBC-5     | 1,413.62      | 1080995.2 | 2739558.4 | BMBC-16    | 1,368.58      | 1079525.8 | 2737165.3 |
| BM-5       | 1,347.68      | 1080768.9 | 2738319.2 | BMBC-6     | 1,412.36      | 1081051.1 | 2739296.3 | BMBC-17    | 1,359.00      | 1079351.1 | 2736827.9 |
| BM-6       | 1,314.07      | 1079999.1 | 2737600.8 | BMBC-7     | 1,411.76      | 1080991.0 | 2739198.2 | BMBC-18    | 1,376.77      | 1079318.0 | 2735122.9 |
| BM-7       | 1,318.65      | 1079296.0 | 2736041.2 | BMBC-8     | 1,409.60      | 1080953.9 | 2739041.0 | BMBC-19    | 1,367.97      | 1079105.5 | 2735670.4 |
| BM-8       | 1,312.56      | 1079014.9 | 2735490.3 | BMBC-9     | 1,412.50      | 1080786.0 | 2738678.9 | BMBC-20    | 1,352.00      | 1079077.7 | 2735437.8 |
| BM-9       | 1,310.22      | 1078632.7 | 2734388.2 | BMBC-10    | 1,411.05      | 1080705.7 | 2738196.8 | BMBC-21    | 1,355.71      | 1078636.8 | 2735011.9 |
| BM-10      | 1,306.60      | 1078608.2 | 2733973.1 | BMBC-11    | 1,407.42      | 1080492.7 | 2738278.3 | BMBC-22    | 1,351.43      | 1078651.9 | 2734545.4 |
| BMBC-1     | 1,423.22      | 1081744.3 | 2739876.6 | BMBC-12    | 1,476.35      | 1080343.0 | 2738131.6 | BMBC-23    | 1,315.50      | 1078736.4 | 2734155.3 |

Fig. A.3.1 LOCATION OF BENCH MARKS (1/2)

### List of Established Bench Marks

| Name of BM | Elevation (m) | Longitude | Latitude  | Name of BM | Elevation (m) | Longitude | Latitude  | Name of BM | Elevation (m) | Longitude | Latitude  |
|------------|---------------|-----------|-----------|------------|---------------|-----------|-----------|------------|---------------|-----------|-----------|
| BM-1       | 1,431.56      | 1082277.1 | 2730058.0 | BM BC-2    | 1,423.21      | 1081444.7 | 2730892.5 | BM BC-13   | 1,404.03      | 1079106.2 | 2737976.3 |
| BM-2       | 1,426.78      | 1082012.0 | 2730841.8 | BM BC-3    | 1,416.26      | 1081208.6 | 2730765.6 | BM BC-14   | 1,394.27      | 1078892.9 | 2737792.1 |
| BM-3       | 1,362.43      | 1081045.1 | 2730717.7 | BM BC-4    | 1,414.55      | 1081042.0 | 2730603.6 | BM BC-15   | 1,392.18      | 1078803.5 | 2737760.0 |
| BM-4       | 1,330.07      | 1080869.4 | 2730679.9 | BM BC-5    | 1,413.62      | 1080955.2 | 2730558.4 | BM BC-16   | 1,398.58      | 1079525.8 | 2737105.3 |
| BM-5       | 1,347.68      | 1080389.9 | 2730319.2 | BM BC-6    | 1,412.36      | 1081051.1 | 2730396.3 | BM BC-17   | 1,379.00      | 1079361.1 | 2736827.9 |
| BM-6       | 1,314.07      | 1079909.1 | 2730600.8 | BM BC-7    | 1,411.76      | 1080941.0 | 2730198.2 | BM BC-18   | 1,379.77      | 1079318.0 | 2736122.9 |
| BM-7       | 1,318.65      | 1079296.0 | 2730941.2 | BM BC-8    | 1,409.60      | 1080953.9 | 2730044.0 | BM BC-19   | 1,367.97      | 1079105.5 | 2735870.4 |
| BM-8       | 1,312.50      | 1079014.9 | 2730490.3 | BM BC-9    | 1,412.50      | 1080786.0 | 2730678.9 | BM BC-20   | 1,359.09      | 1079077.7 | 2735107.8 |
| BM-9       | 1,310.22      | 1078632.7 | 2730338.2 | BM BC-10   | 1,411.05      | 1080705.7 | 2730496.8 | BM BC-21   | 1,355.71      | 1078806.8 | 2735011.9 |
| BM-10      | 1,306.60      | 1078608.2 | 2730973.1 | BM BC-11   | 1,407.42      | 1080492.7 | 2730238.3 | BM BC-22   | 1,354.43      | 1078651.9 | 2734845.4 |
| BM BC-1    | 1,423.22      | 1081744.3 | 2730876.0 | BM BC-12   | 1,406.35      | 1080345.0 | 2730134.6 | BM BC-23   | 1,345.50      | 1078276.4 | 2734155.3 |

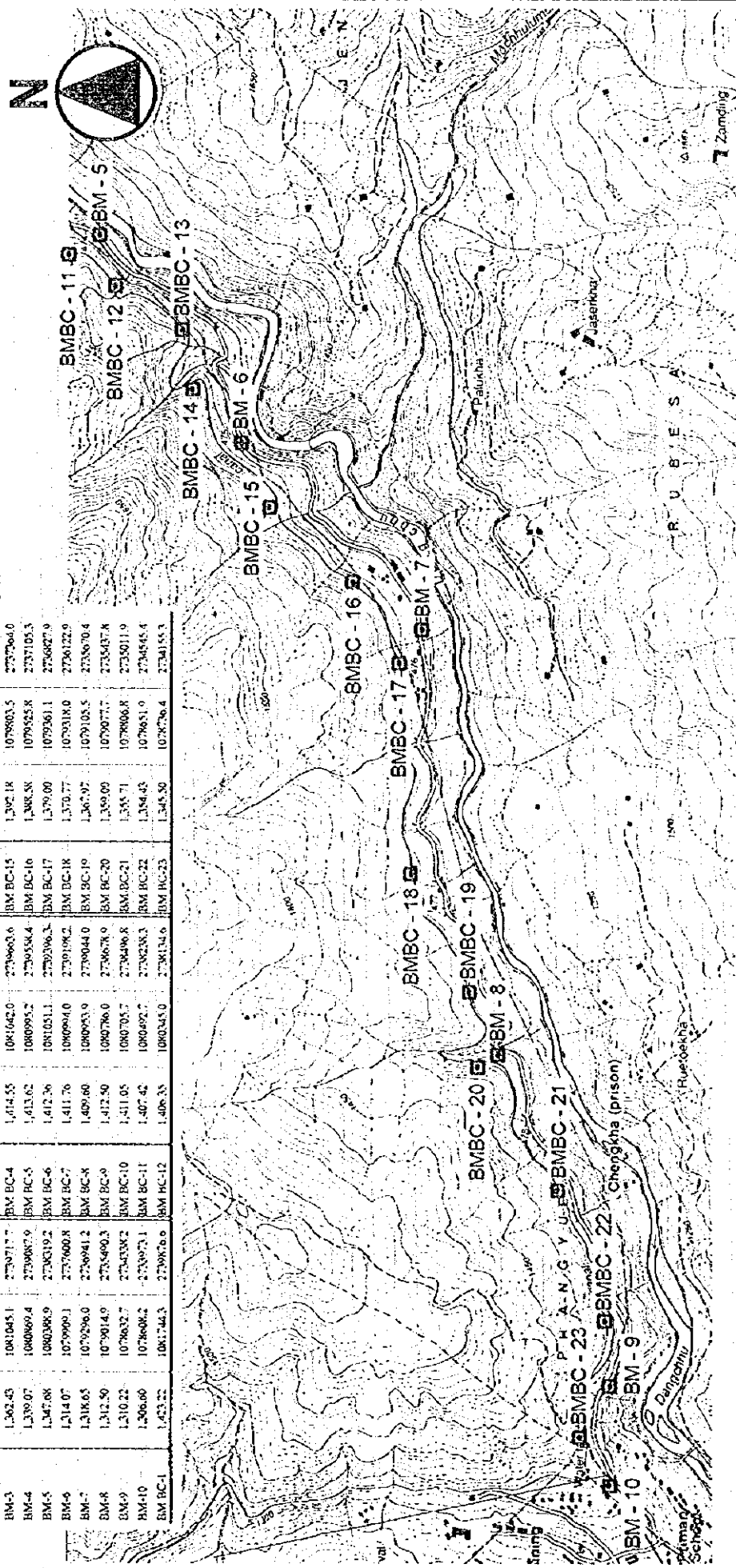


FIG. A.3.1 LOCATION OF BENCH MARKS (2/2)



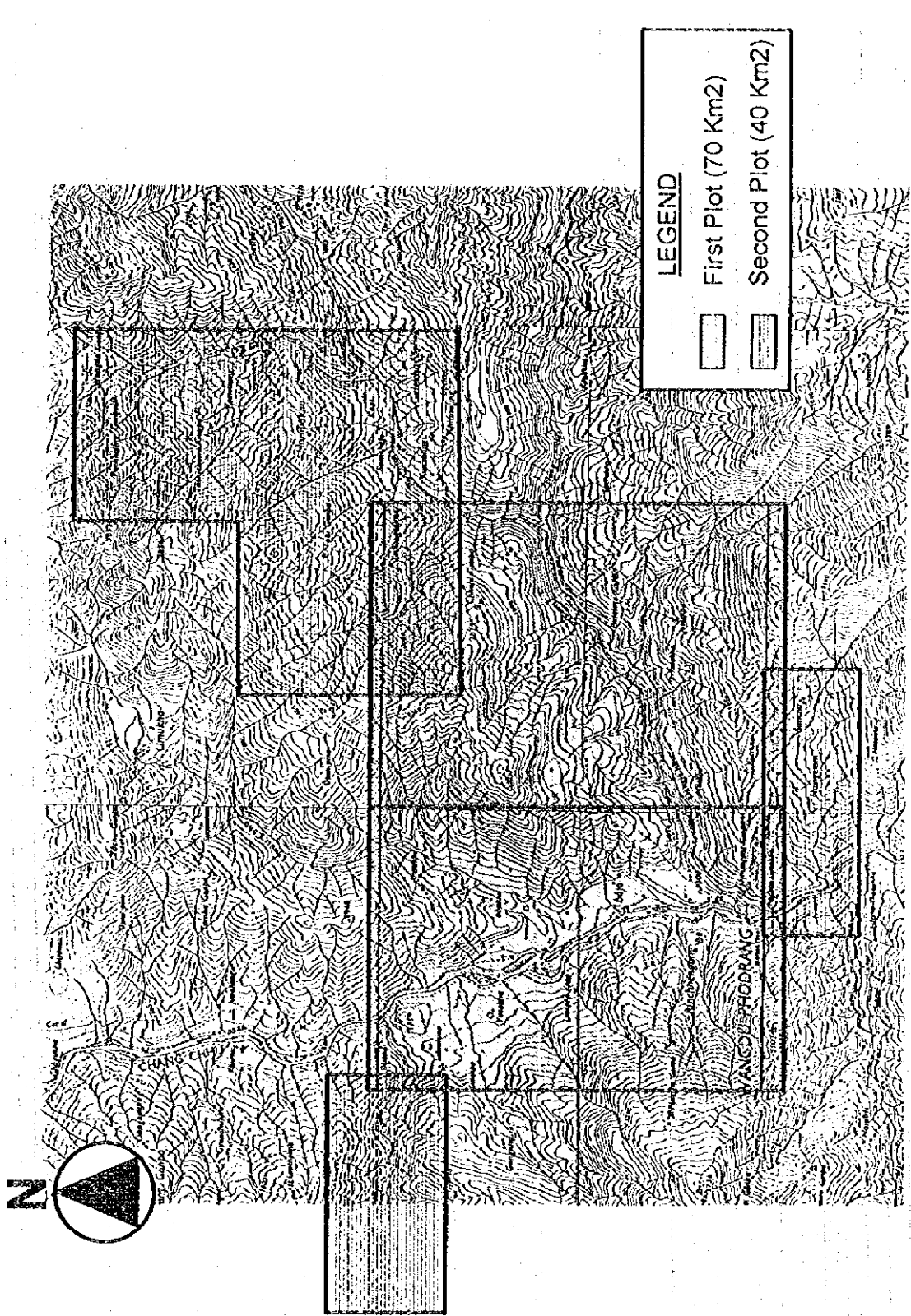


Fig. A.4.1 LOCATION OF PHOTOGRAMMETRIC MAPPING

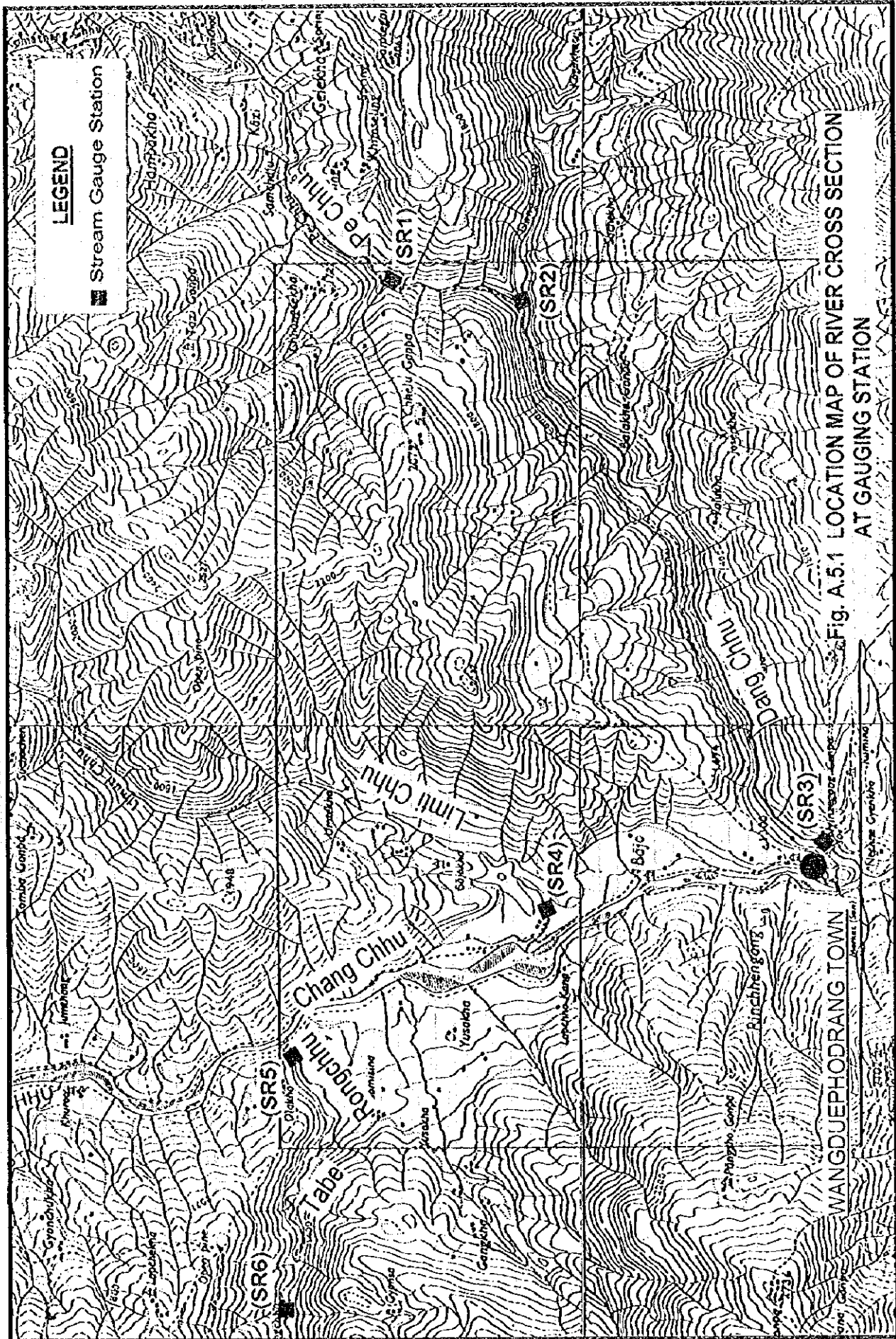


Fig. A.5.1 LOCATION MAP OF RIVER CROSS SECTION AT GAUGING STATION

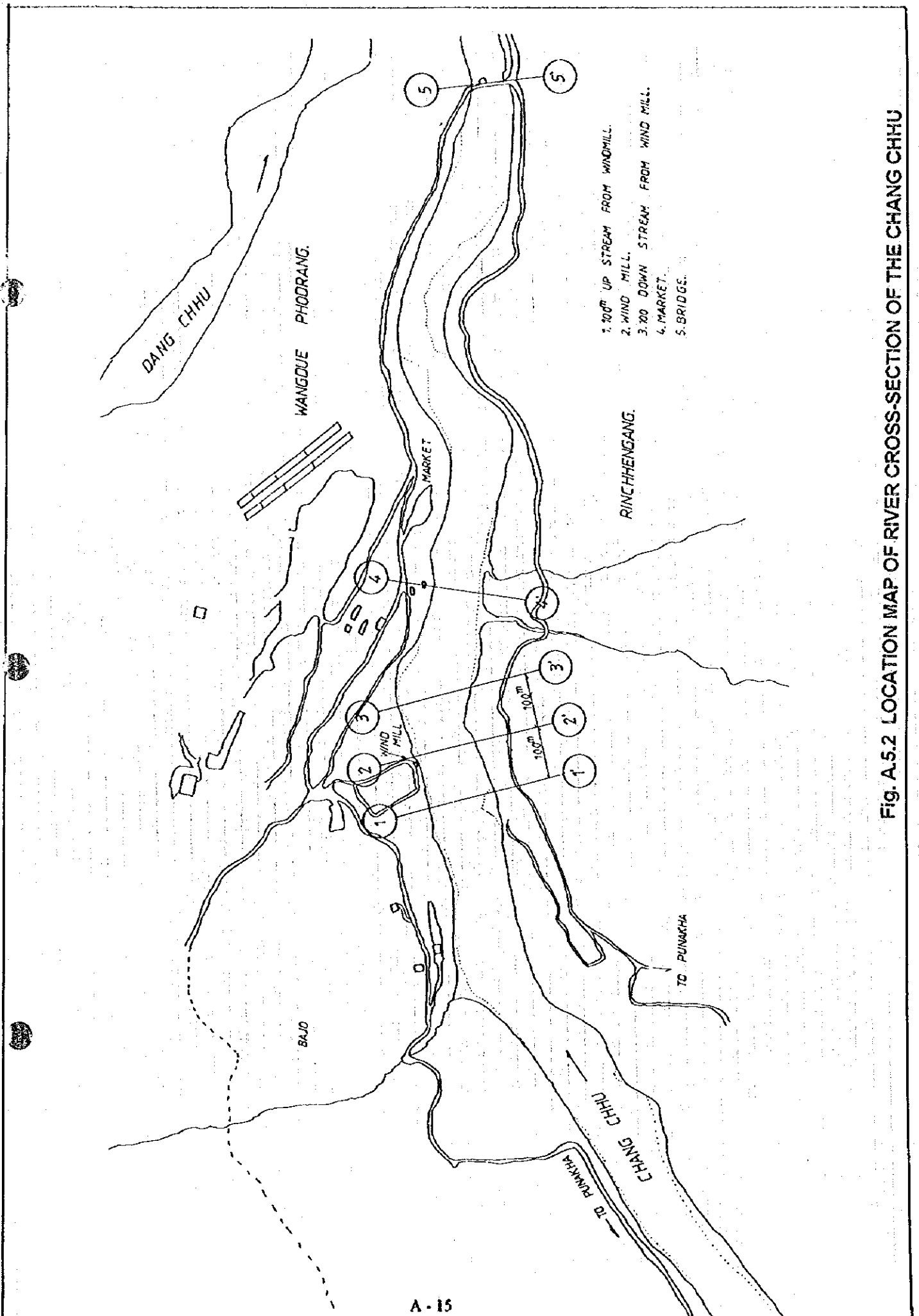


Fig. A.5.2 LOCATION MAP OF RIVER CROSS-SECTION OF THE CHANG CHHU

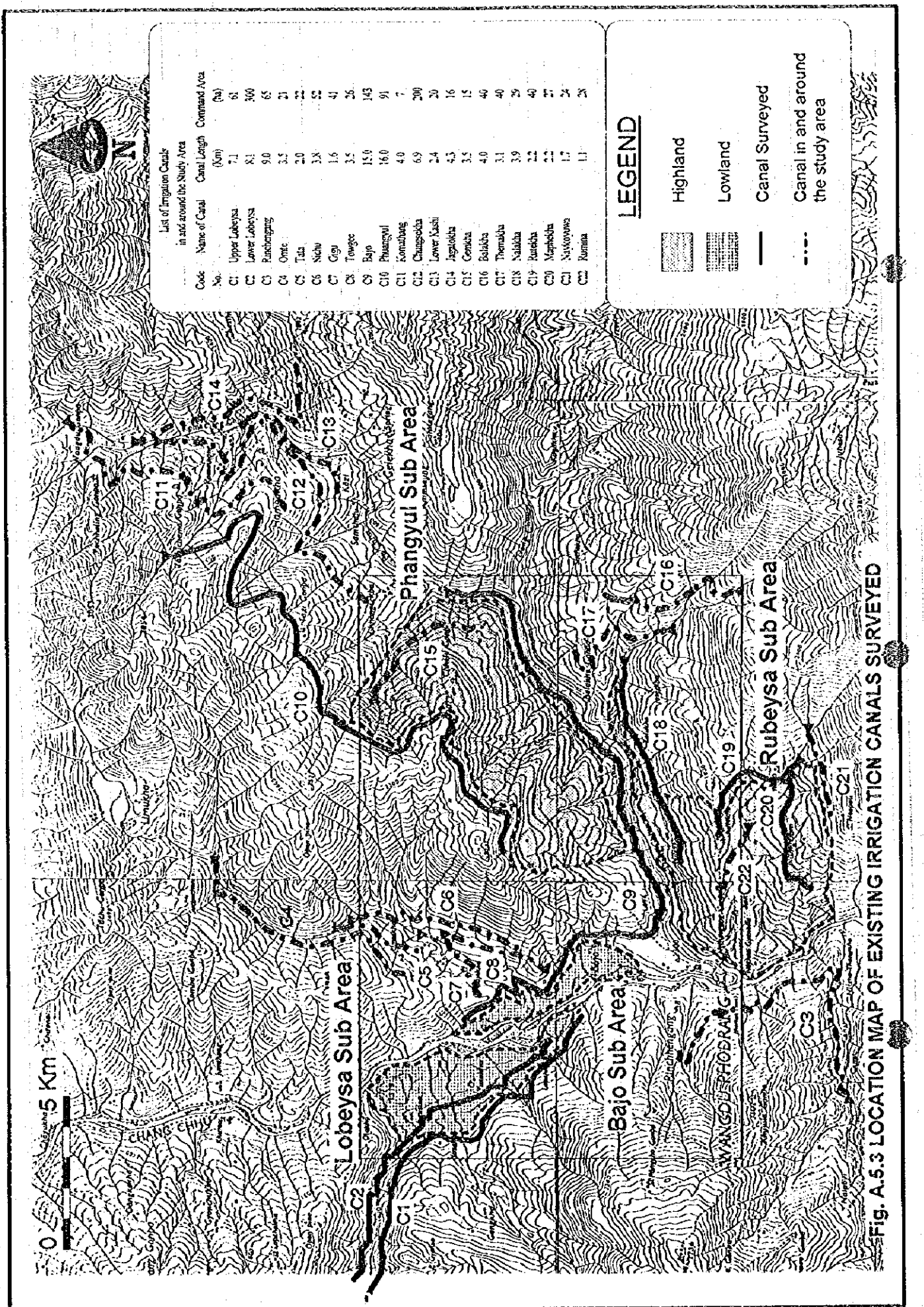


Fig. A.5.3 LOCATION MAP OF EXISTING IRRIGATION CANALS SURVEYED

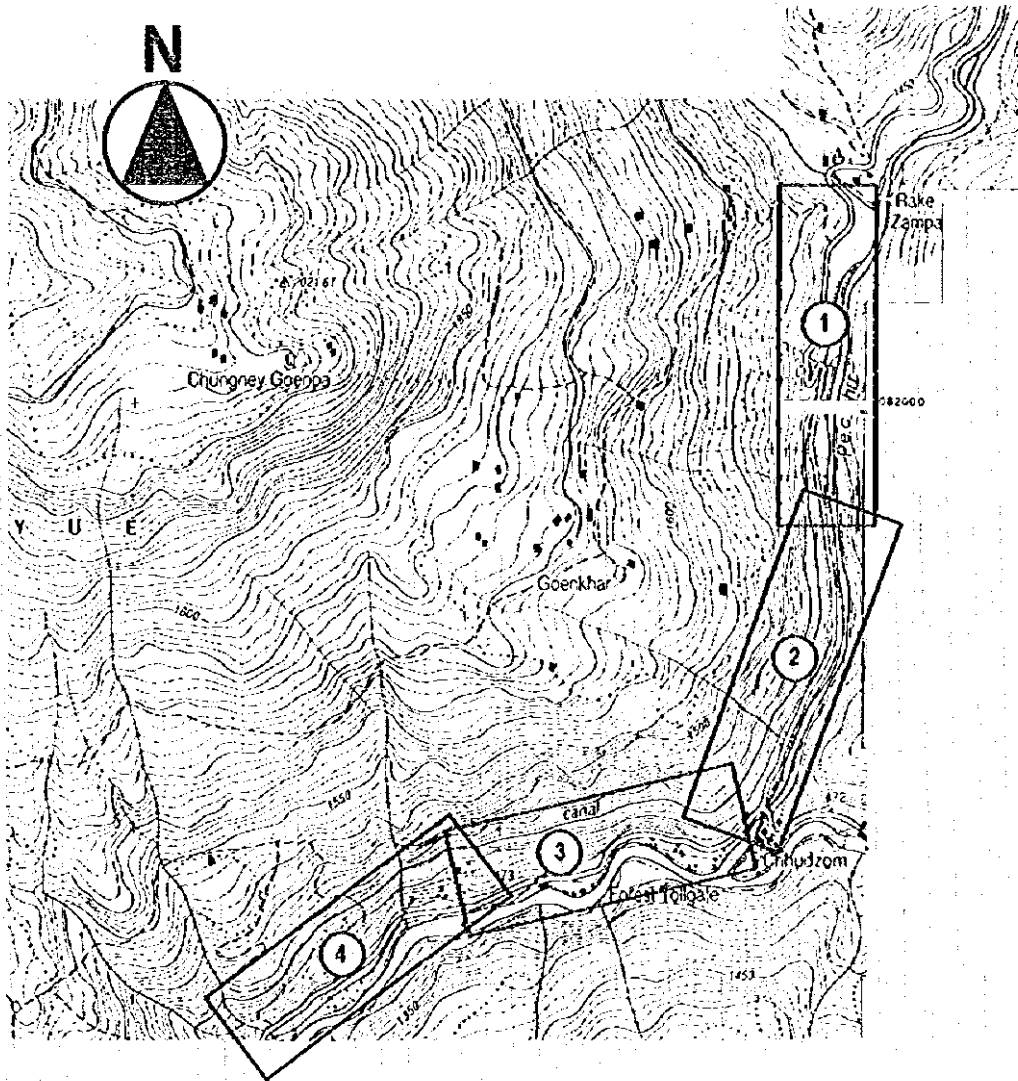


Fig. A.5.4 INDEX MAP FOR PLAN OF CONVEYANCE PIPELINE (1/2)

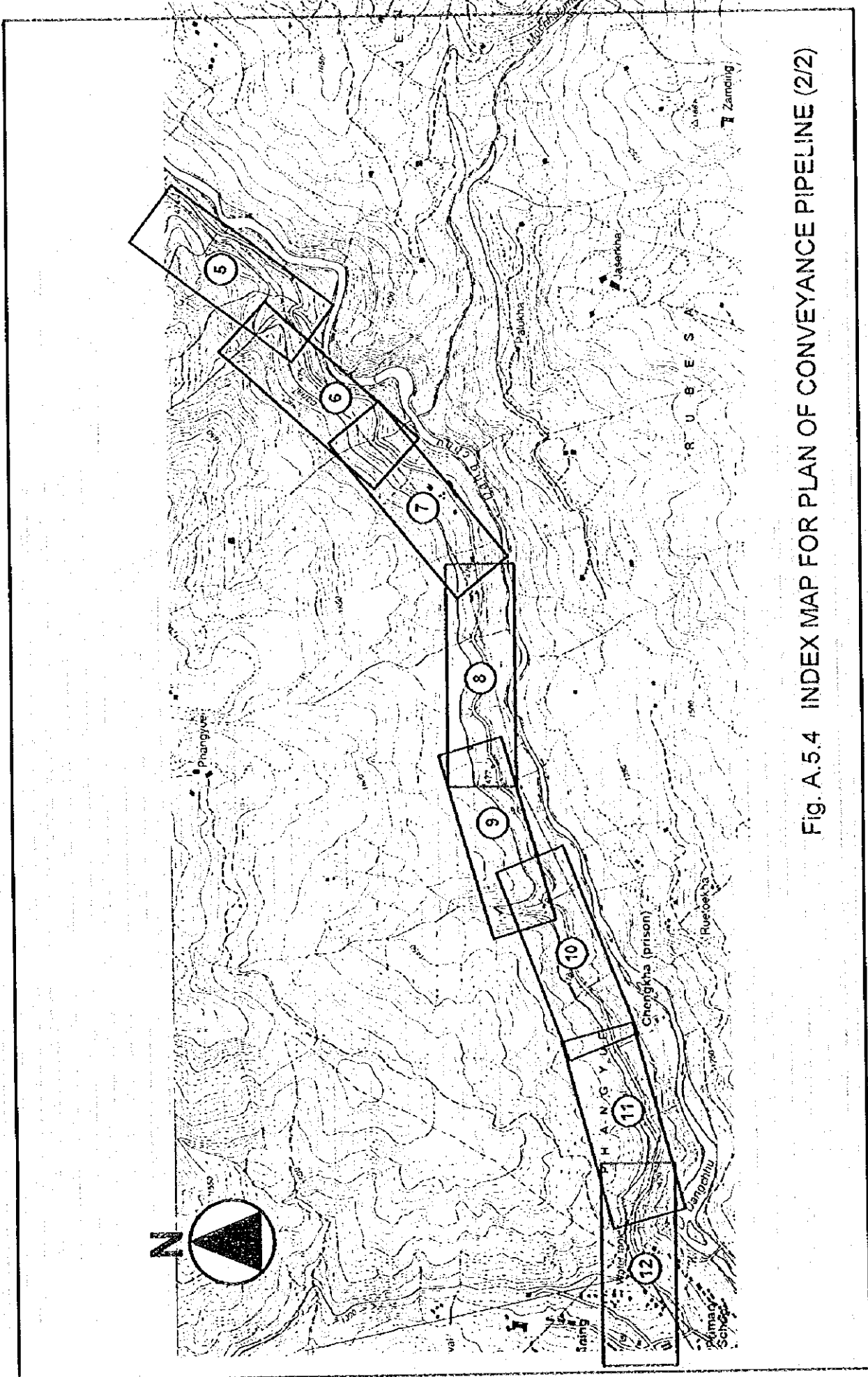


Fig. A.5.4 INDEX MAP FOR PLAN OF CONVEYANCE PIPELINE (2/2)



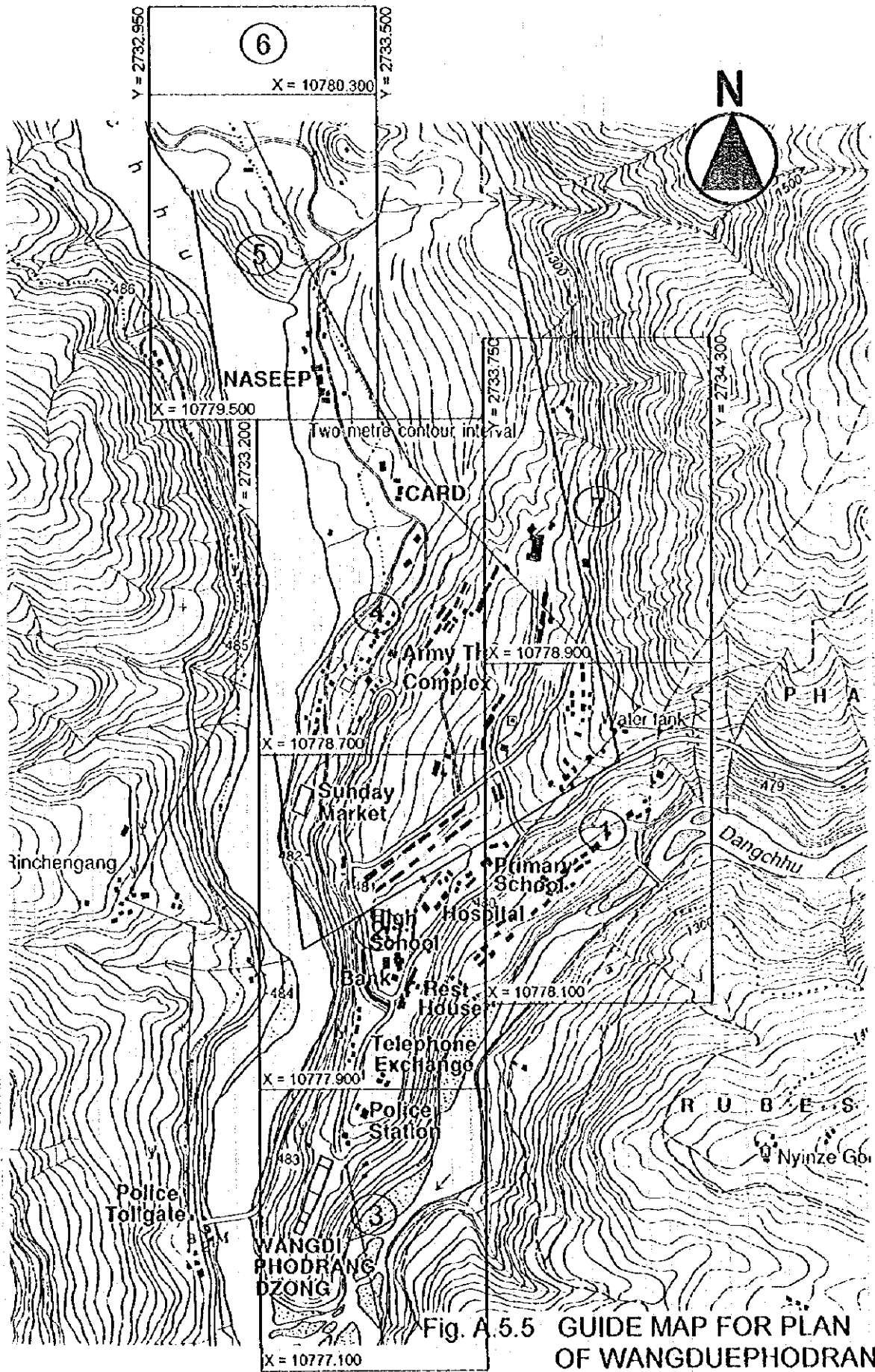


Fig. A.5.5 GUIDE MAP FOR PLAN OF WANGDUEPHODRANG TOWN AREA

**APPENDIX B**  
**SOCIO-ECONOMIC SITUATION**



**THE STUDY  
ON  
GROUNDWATER DEVELOPMENT  
IN  
WANGDUEPHODRANG DISTRICT OF BHUTAN**

**FINAL REPORT**

**VOLUME III: SUPPORTING REPORT**

**APPENDIX-B. SOCIO-ECONOMIC SITUATION**

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## APPENDIX-B SOCIO-ECONOMIC SITUATION

### B.1 General Features of the Kingdom

#### B.1.1 Physical Characteristics

The Kingdom of Bhutan (Druk Yul in Dzongkhag language), which is called Land of Thunder Dragon, lies between latitudes 26° 45' and 28° 10' North and between longitudes 88° 45' and 92° 10' East. The country is relatively compact with a maximum latitudinal distance of 170 Km and a maximum longitudinal distance of 300 Km, and comprises a land area of approximately 46,500 Km<sup>2</sup>. Bhutan is landlocked country situated on the southern slopes of the Eastern Himalayas, bordering the Tibetan Region of China in the north and north-west, and the Indian states of Sikkim, West Bengal and Assam, and Arunachal Pradesh in the west, south and east respectively.

The country is among the most rugged and mountainous in the world, with flat land limited to the broader river valleys, as most of the terrain includes a part of the Himalayan ranges. The land rises from an elevation of about 200 m above sea level in the south to the towering Himalayan mountains more than 7,500 m above sea level in the north. The densely populated central valleys are separated by a 2,000 m above sea level.

The climate is characterised by a dry winter and a wet summer monsoon, and the variations in climate are correspondingly extreme. The southern Bhutan is generally hot and humid, while the high Himalayan mountains in the northern borders of the country are under perpetual snow. The climate can vary considerably between valleys and within valleys depending on levels of altitude. Rainfall, in particular, can differ within relatively short distances due to rain shadow effects. Annual precipitation is concentrated in the monsoon season, from mid-June to September and becomes heavier toward the south, with up to 5,000 mm.

#### B.1.2 Institutional and Legal Framework

##### (1) Structure of the Government

The constitution of Bhutan, the Royal Government of Bhutan (RGOB) is based on an enlightened monarch rules through Lhengyel Shungtshog (Cabinet), Tshogdu (National Assembly) and civil service. However, the structure of RGOB is changing on some organisations in recent years.

##### 1) Monarchy

On December 17, 1907, His Majesty Ugyen Wangchuck (1862-1926) was elected as the first King of Bhutan by popular consensus. Since the establishment of monarchy, there has been four hereditary kings. The third King, His Majesty Jigme Dorji Wangchuck (1928-1972) began a campaign of modernisation and expansion of Bhutan's Government and society based on the accomplishments of his two predecessors in uniting the country under a strong central authority. Hence, the National Assembly consisting of representatives of the people, the monastic order and civil administration were re-established in 1953.

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The present King of Bhutan, His Majesty King Jigme Singye Wangchuck (1955-) acceded to the throne in 1972 on the demise of his father. His Majesty the King is the Head of the Government as well as the State. He is assisted by the Cabinet which consists of His Majesty's Representatives in various Ministries, Ministers and high ranking civil servants.

### **2) National Assembly**

The National Assembly has 150 members of which 105 members are representatives of the people, elected for a term of three years by consensus in each of the Dzongkhags (administrative units). The people's representatives are elected in accordance with the traditional political system at a local level. Twelve monastic representatives are elected by the regional monk bodies, while the remaining 33 members are representatives of the Government and are nominated by His Majesty the King. They include members of the Council of Ministers and the Royal Advisory Council, Secretaries of various Government Departments and several Dzongkhag officers (1994).

The National Assembly meets twice a year, in addition to emergency sessions. The National Assembly enacts legislations and advises the Government on all matters of national importance. Decisions are passed by a simple majority. Any Bhutanese over 25 years of age can be a candidate for membership.

### **3) Royal Advisory Council**

The Royal Advisory Council was formally established in 1965 to advise His Majesty the King and Government Ministers, and to supervise the implementation of programs and policies laid down by the National Assembly. It has a three-year mandate and consists of nine members who must be approved by the National Assembly. Two members are appointed by His Majesty the King, one representative of the state clergy is chosen by the Assembly, and six members are appointed by the National Assembly. The Chairman is nominated by His Majesty the King from among the Councillors.

### **4) Religion and Monk Body**

The Buddhism has a significant influence on the values of the Bhutanese and has shaped the institutions, organisations, arts, drama, architecture, literature and social structure. Bhutan's culture, as in other societies, is continually transforming itself in the face of development.

The importance of religious institutions continue in present day's Bhutan, as signified by the strength of the monk body which currently has a strength of over 4,000 members in Dratshangs or Rabdeys (monasteries) supported by the state. This figure takes count of monks who are part of the formal monastic structure supported by the state, and excludes monks who are not part of the state sponsored Dratshangs. The Rabdeys are based mainly in Dzongs (fort-monasteries).

Each Rabdey is headed by a Lam Neten who is appointed by His Holiness the Je Khempo (Head Abbot), the Head of the Central Monk Body, who is also elected. The present Je Khempo is the 69th incumbent. His Holiness the Je Khempo is the Chairman of 9 member Dratshangs Lhentshog. Monks continue to play an important role in the daily lives of the population in performing religious ceremonies, and in promoting and preserving scholarship. They are also actively involved in the process of development while constantly renewing their relevance to society in times of change.

#### 5) Central Government

Bhutan has been administered by centrally based functional Departments and Ministries. The organisation of central Government consists of seven Ministries, their related Departments and four Commissions, the Royal Bhutan Army, Royal Bhutan Police, Royal Body Guards and several autonomous bodies. The organisation structure of RGOB is shown in the Fig. B.1.1 (1994). The Ministries include:

- a. Ministry of Foreign Affairs,
- b. Ministry of Communications,
- c. Ministry of Trade and Industry,
- d. Ministry of Finance,
- e. Ministry of Social Services,
- f. Ministry of Agriculture, and
- g. Ministry of Home Affairs.

The four Commissions are:

- a. Planning Commission,
- b. Royal Civil Service Commission,
- c. Special Commission for Cultural Affairs, and
- d. Dzongkhag Development Commission.

The Planning Commission is headed by a Minister as its full time head. His Majesty the King is the Chairman of this Commission. The Royal Civil Service Commission which was established in 1982, is responsible for formulating and ensuring implementation of personnel policies in the civil service. The civil service strength was 11,228 as of late 1991.

#### 6) Local Administration

Local administration has been strengthened to meet the requirements of decentralised administration and development. The country is divided into four Zones and 20 Dzongkhags (districts) which were closely divided from 18 Dzongkhags in 1993 (Gasa from Punakha and Trashi Yangtse from Tashigang), on the basis of considering common natural features and geographical proximity. Larger Dzongkhags are sub-divided into Dungkhags (sub-districts). The Dzongkhags, and where they exist Dungkhags, are further sub-divided into 192

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Gewogs (blocks) which were changed from 191 Gewogs in 1993. According to the Land Use Planning project data, the latest number Gewogs is 196.

Dzongkhags are governed by Dzongdags (district administrators) and Dungkhags by Dungsas (sub-district administrators), who are responsible for civil administration and development activities. Each Dzongdas is assisted by a Dzongrab (deputy district administrator) who is responsible for planning and development and civil administration. Gewogs are administered by Gups (in the north) or Mandals (in the south) who are elected by the community. The Gups assist the Dzongdags and Dungsas in collection of taxes, mobilisation of labour for community services and public construction, settlement of disputes and many other local activities, including implementation of some development programmes. In each Dzongkhag, the Dzongda is assisted in his development functions by Dzongkhag Yargay Tshongchung (District Development Committee) which consists of people's representatives and officials.

### **7) Legal and Judiciary**

Bhutan's legal system was previously based on codes laid down by spiritual rulers in the 17th century. The present laws as they exist in Thrimshung Chenmo (Supreme Laws) were legislated by the National Assembly in 1957, under the aegis of His Majesty Jigme Dorji Wangchuck, the third King.

Disputes are usually settled by Gups. Disputes which fail to be resolved out of the court by the Gups go to the Thrimkhangs (District Courts). Each Dzongkhag has a court head by a Thrimpon (district magistrate) and assisted by Ranjams (low officers). A Dzongkhag court has both original and appellate jurisdictions. The judiciary system as a whole had a staffing strength of 200 in late 1991. The next level of jurisdiction is the Thrimkhang Gongma (High Court) in Thimphu.

The High Court was established in 1968 and consists of eight judges excluding the Chief Justice. The judges are assisted by four Ranjam Gongma. All the litigants have access to the supreme court of appeal, i.e. His Majesty the King, if they are not satisfied with the verdict awarded by the High Court. The final appeal is made to His Majesty the King, who then delegates the Royal Advisory Council to investigate and ensure that the courts have dispensed justice in keeping with the law of the country.

### **8) Diplomacy and International Relations**

Bhutan has resident diplomatic representations in India, Bangladesh, Kuwait, New York and Geneva. The Bhutanese Ambassadors in these places are accredited to several other countries. Apart from representatives of international agencies, only India and Bangladesh have resident diplomatic representatives in Thimphu, the capital of Bhutan.

Bhutan became a member of the United Nations in 1971. It is also a member of the Non-aligned Movement, the Colombo Plan, the International Monetary Fund, the World Bank, the Asian Development Bank and South Asian Association for

Regional Co-operation (SAARC). It has signed, ratified or acceded to a number of international conventions.

## (2) Structure of the Ministry of Agriculture

### 1) Organisation

According to the document of the "New Renewable Natural Resources (RNR) Structures and Functions", in keeping with the instructions of RGOB to review the organisational structures and functional activities, with a view to strengthen the Dzongkhag programme planning and implementation capabilities, the Ministry of Agriculture (MOA) had embarked on the process of reorganisation. The MOA has amalgamated the Planning and Policy, and the Administration and Finance functions at the headquarters level in 1990. In 1991/92, further consideration of the Ministry's role in the "Natural Resources Sector Development" led to the formulation of the "Renewable Natural Resources Research Strategy and Plan". As a follow-up to the research and planning exercise, MOA initiated an Extension Review, and Strategy Setting and Planning Exercise in 1992. Finally, MOA was reorganised in November 1993.

With the start of the Seventh Five Year Plan 1992-1997 (7FYP) MOA, guided by PPD, has begun to adopt a wider approach to the development planning process by accepting that the three main activities of MOA, crop, livestock and forestry development, are integral parts of the same development process, at least in Bhutan where the exploitation of any one resource affects the status of the others. The full practical implications of this co-ordinated RNR approach have yet to be worked out, but at least one of them is that at the dzongkhag level the three sectional heads and the field staff in the three sectors should work closely together under the chairmanship of the Dzongdag.

### 2) Functional Structure and Activities

The MOA's basic structure consists of a Policy and Planning Committee, central functional Divisions, and Dzongkhag RNR Divisions. The organisation structure of MOA is shown in the Fig. B.1.2. The co-ordination of the MOA's function at the national level is the responsibility of the Representative of His Majesty the King in MOA, the Deputy Minister and Division Heads. The Policy and Planning Committee, composed of the Deputy Minister and Division Heads, is responsible for overall management of Ministry's activities and for ensuring that the RGOB's policy for the RNR sector is efficiently implemented.

The central functional divisions are as follows (1994):

- a. Research, Extension and Irrigation Division,
- b. Crop and Livestock Services Division,
- c. Forest Services Division,
- d. Planning and Policy Division, and
- e. Administration and Finance Division.

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At the Dzongkhag level, the RNR sector, comprising of Agriculture, Animal Husbandry, Irrigation and Forestry Sections, function under the overall administrative control of the Dzongkhag. The Dzongkhag RNR sector Heads are responsible for co-ordinating the MOA's functions at the Dzongkhag, Gewog and Village levels, and for ensuring that a unified Ministry's presence is felt within each Dzongkhag. On technical matters the RNR sector Heads refer the matter to the respective Technical Divisions of MOA.

### 3) Functions of Irrigation Section

As an operational programme of MOA, the activities of the Irrigation Section within the Research, Extension and Irrigation Division (REID, formerly Department of Agriculture) are decentralised to the Dzongkhag Administration. The construction and maintenance of both major and minor schemes are the responsibility of the concerned Dzongkhag(s). The functions of the various units of the Irrigation Section are as follows:

- a. Irrigation Service Unit: is responsible for technical and professional support services at the central and Dzongkhag level;
- b. Irrigation Training Unit: is responsible for ensuring dissemination and implementation of the National Irrigation Policy, and update the policy manuals to guide the Dzongkhag irrigation staff; and
- c. Construction and Supervision Unit: is responsible for preparation of estimates, evaluation of tender documents, construction supervision, measurement of works, processing of bills and other related works, taken by the different units under MOA.

### 4) Development Plan and Priority

The major objectives of REID during the Seventh Five Years Plan period comprised of the following:

- a. To establish sustainable production systems through increasing soil fertility and improving soil and water conservation;
- b. To increase production of cereals and oilseed crops leading to greater self-sufficiency; and
- c. To increase production of horticultural and grain legume crops, both for export and domestic markets, leading to high incomes, greater economic growth and export revenues.

### 5) Staff and Budget

The total staff and employee of MOA are approximately 2,000 (1994) and a breakdown is as follows:



## NUMBER OF STAFF AND EMPLOYEES OF MOA, 1994

| Sector                                      | Number      |
|---|-------------|
| Her Royal Highness                          | 9           |
| Ministry of Agriculture                     | 4           |
| Natural Resource Training Institute         | 42          |
| Research, Extension and Irrigation Division | approx. 800 |
| Crop and Livestock Services Division        | approx. 360 |
| Forest Services Division                    | approx. 690 |
| Planning and Policy Division                | 21          |
| Administration and Finance Division         | 51          |
| Project Facilitation Office (Khangna)       | 34          |

Source: Administration and Finance Division, MOA

The total budget of MOA for 1993/94 was Nu. 594 million and has increased about 33% from Nu. 446 millions in the previous period.

## BUDGET OF THE MINISTRY OF AGRICULTURE, 1993/94

| Item                | Nu. in million |
|---------------------|----------------|
| RGOB Financing      | 118.818        |
| Current Expenditure | 104.652        |
| Capital Expenditure | 14.166         |
| External Funding    | 474.810        |
| Current Expenditure | 51.045         |
| Capital Expenditure | 423.765        |
| Total               | 593.528        |
| Current Expenditure | 155.697        |
| Capital Expenditure | 437.931        |

Source: Administration and Finance Division, MOA

The budget of the Research, Extension and Irrigation Division for 1995/96 fiscal year is Nu. 334 millions, occupying 6.4% in the total national budget of Nu. 5,212 millions.

## B.2 National Socio-economic Situation

### B.2.1 Population and Settlements

#### (1) Population

Until 1990, there had never been a full population census in Bhutan; the demographic data represent rough estimates, for example, the 1990 total population was estimated as 1.462 million. On the other hand, according to the 7FYP and some other official documents, the 1990 official population of Bhutan has been estimated at 600 thousand. Furthermore, a population data which was prepared by the Land Use Planning project in 1994, the total population of Bhutan is approximately 549 thousand and a breakdown estimated by Dzongkhag is as follows;

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### POPULATION ESTIMATES BY DZONGKHAG

| Dzongkag         | Rural   | Urban  | Total   |
|------------------|---------|--------|---------|
| Thimphu          | 13,225  | 31,000 | 44,225  |
| Paro             | 15,491  | 2,435  | 17,926  |
| Ha               | 7,523   | 250    | 7,773   |
| Chhakha          | 27,870  | 27,000 | 54,870  |
| Samtse           | 66,950  | 4,080  | 71,030  |
| Pinakha          | 13,125  | 1,710  | 14,835  |
| Gasa             | 2,400   | 355    | 2,755   |
| Wangdue-Phedrang | 20,875  | 1,470  | 22,345  |
| Tsirang          | 16,215  | 1,775  | 17,990  |
| Dagana           | 17,045  | 2,135  | 19,180  |
| Bumthang         | 9,992   | 1,615  | 11,607  |
| Trongsa          | 12,117  | 2,135  | 14,252  |
| Zhemgang         | 14,280  | 2,135  | 16,415  |
| Sarpang          | 26,967  | 9,340  | 36,307  |
| Hauentse         | 19,154  | 210    | 19,364  |
| Mongar           | 35,827  | 2,135  | 37,962  |
| Trashigang       | 60,627  | 2,845  | 63,472  |
| Trashiyangtse    | 18,340  | 800    | 19,140  |
| Pemagatshel      | 17,051  | 1,420  | 18,471  |
| Samdrup-Jongkha  | 34,900  | 4,640  | 39,540  |
| Total Bhutan     | 449,974 | 99,485 | 549,459 |

Source: Land Use Planning project, PIDD

The average population density of the country is about 13 persons/Km<sup>2</sup>. However, on cultivated land, the density is high, at places more than 450 persons/Km<sup>2</sup>. The proportion of the population under 15 years old is high with about 40%. As these age groups enter the reproductive period, the growth rate of population is likely to rise above the current 2.5% (7FYP). On the other hand, according to the later official report (1992, Planning Commission), the population growth is estimated at 2% per year, a figure which will rise with the decrease in child mortality, unless efficient family planning programs are implemented. Most recent data on rate of natality and mortality have been decreased, and average rate of natality and maternal mortality, infant mortality and under five mortality in 1991 are 3.83% and 7.7, 142 and 195 per 1,000 live births respectively. Life expectancy at birth has increased year by year and has reached 48.9 years old (7FYP).

#### (2) Settlements

Bhutan is the least populated country in South Asia. However, most of the population is concentrated in the valleys, and large areas in the north of the country are virtually empty except for nomadic herders. The population is distributed in the following areas:

- a. Virtually empty northern region;
- b. Relatively well settled area in the inner Himalayan valleys;
- c. More thinly populated area south of the Black Mountain Range and associated highlands; and
- d. Densely populated southern area.

Although no studies on rural and urban populations have been undertaken, it is estimated that 90% of Bhutan's population lives in rural areas, in an extended family system or maintain strong links with their rural families. It is estimated that village size

varies from 2 houses to 100 houses and the average village consists of about 43 houses. Each house is usually occupied by one household. Assuming that there are 8.5 members per household, the number of households or housing stock can be estimated as approximately 70 thousand (7FYP). However, according to the Land Use Planning project data, the total household is about 80 thousand and average family members are 6.8 which correspond with 7.2 members on rural area and 5.6 members on urban area.

Urban settlements for taxation purposes are classified as having a population between 500 and 25,000. In 1989, 32 urban centres were classified as towns. Thimphu in western Bhutan is the capital with an estimated population of 40,000-50,000 people. The other main urban settlements are Phuntsholing, Gaylegphug and Sandrup Jongkhar. All of these three cities are at the border between India and Bhutan. Towns are developing in all the Dzongkhag (district) headquarters (7FYP).

### (3) Buddhist Culture

The people of Bhutan is Mongoloid origin, with their distinctive language, Buddhist religion and cultural patterns of Tibetan origin inhabit in the northern and central parts. The mongoloid settlers in south-eastern Bhutan termed the Sharchopa's, though of the same origin, have a distinct cultural pattern akin to the Tibet-Burmese. However, they have completely assimilated into the Buddhist derived culture of the northern and central parts. The settlers in south-western part are predominantly Hindus. The bulk of them have immigrated more recently.

In Bhutan, Buddhism plays a central role in people's lives. The basic principles are to give back to nature what has been taken away and to respect all forms of life. Both Buddhist and pre-Buddhist (Bon and Animism) beliefs promote a cautious attitude towards environment. The mountains, rivers, lakes, streams, rocks and soil are believed to be the domain of spirits, so that pollution and disturbance to these sites are believed to be the cause of deaths and diseases.

### (4) Land use

The assessment of land resources and land use has been constrained by lack of recent and detail data with the exception of the Land Use Planning project. This project commenced in mid-1992 with assistance from DANIDA. The project aims to develop an overall land use plan, and has initially developed working land use maps throughout Bhutan. Additional assistance may be forthcoming for a national soil survey. However, the results of the project are not finalised yet and some data is having some doubt.

The Master Plan for Forestry Development (MPFD Draft 1991) has a more recent assessment. The main finding of the MPFD has been that the total forested area is estimated at 56.9% of land area. While a large part of the forest area remains unutilised, forests represent a major source of fuelwood, fodder and construction materials. As livestock graze in forest areas, there is no clear distinction between livestock and forests land uses. Zonal surveys undertaken in 1987/89 have shown that out of total area of land being utilised, more than 50% was accounted for in the others category. This includes, Tsamdok and Sokshin land, i.e. private registered land with forest cover and public land with private grazing rights respectively. Most of temperate

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pasture areas are subject to year round intense grazing without showing signs of overgrazing except close to population centres (7FYP).

### LAND USE IN BHUTAN, 1991

| Item                    | Square Km | Percentage |
|-------------------------|-----------|------------|
| Grass, Water and Alpine | 12,000    | 25.8       |
| Forest                  | 26,500    | 56.9       |
| Cultivated              | 7,500     | 16.1       |
| Un-interpreted          | 500       | 1.2        |
| Total                   | 46,500    | 100        |

Source: Master Plan for Forestry Development, Preliminary data, 1991.

The MPFD has compared land use between the Pre Investment Study in 1957/59 with the most recent assessment and found the following significant changes:

- Agricultural area has increased at the same rate as population growth;
- Degraded forest and other open areas have increased at a more modest rate than increases in agricultural land, but have risen to almost the same total area;
- The area of coniferous forest has remained stable;
- Broad-leaved forest area is the most rapidly decreasing category;
- The main shift in land use has been from broad-leaved forests to arable production and grazing; and
- Estimated decrease in forest cover is 16.8 of the 1958 area and 34.3% over hundreds of years.

### B.2.2 National Economy

#### (1) Outline of National Economy

Bhutan is predominantly an agriculture oriented country, with about 90% of labour force engaged in agricultural sector. The sector contributes about 41% of the Gross Domestic Product (GDP, 1992) and is the backbone of the Bhutanese economy. The Bhutanese people rely on the land for their food and basic necessities, and the rural economy is based on small, primary subsistence-oriented communities.

#### (2) Economic Production

The total estimated GDP in 1992 amounted to Nu. 6,178 million or about US\$ 238 million (US\$ 1 = Nu. 25.92, 1992 annual average) at current price and details are as follows:

#### GROSS DOMESTIC PRODUCT AT CURRENT PRICE, 1992

| Sector      | Nu in million | Percentage (%) |
|-------------|---------------|----------------|
| RNR         | 2,460.50      | 39.8           |
| Agriculture | 1,363.00      | 22.1           |
| Livestock   | 487.40        | 7.9            |
| Forestry    | 610.10        | 9.9            |
| Industry    | 1,786.60      | 28.9           |
| Services    | 1,930.50      | 31.3           |
| Total GDP   | 6,177.60      | 100.0          |

Source: Selected Economic Indicators 1995, RAM

The GDP per capita referred to the total population estimated of 624,240 (based on 600,000 in 1990 and annual population growth rate of 2.0%) is Nu. 9,897 or about US\$ 380 (for reference, it was estimated at US\$ 370 by 1991, 7FYP). This means that Bhutan is not the lowest per capital income in the world which Bhutan have been classified.

### 1) Production by Major Industries

The total production of the six major industries amounted to Nu. 1,304 million in 1994 as compared to only Nu. 534 million in 1990. Of the total sales in 1994, 73.1% represented export to India, 1.0% export to third countries, and rest represented domestic consumption. At about 32% the Bhutan Carbide & Chemicals Ltd. contributed the most, followed by Army Welfare Project, 23% and Bhutan Board Products Ltd., 20%. Other industries were, Penden Cement Authority Ltd., Bhutan Fruit Products Ltd. and Bhutan Polythene Company (RMA, 1995).

### 2) Power

During 1991/92, the Chukha Hydel Project generated 1,554 million units of electricity, out of which 87% or 1,350 million units were exported to India. In 1994, the Chukha Hydro Power Corporation generated revenues of Nu. 568 million, out of which 91% or Nu. 519 million were from export.

#### CHUKHA HYDROPOWER SALES

| Item              | 1990  | 1991  | 1992  | 1993  | 1994  |
|-------------------|-------|-------|-------|-------|-------|
| Total Sales       | 387.8 | 415.1 | 373.9 | 556.1 | 567.8 |
| Export to India   | 374.4 | 397.3 | 355.1 | 537.3 | 519.0 |
| Internal Consump. | 13.4  | 17.9  | 18.8  | 18.8  | 48.8  |

Source: Selected Economic Indicators 1995, RMA

### (3) Economic Growth

During the 1987-1992 period, the annual growth rate of GDP was estimated at 4.0%, a very high rate of growth compared with most developing countries during the same period. The major inputs for GDP growth was not from increases in aid, but was largely based on the expansion of the electricity and mining / manufacturing sectors. The growth rates by sector are summarised as follows:

#### ANNUAL GROWTH RATE OF GDP, 1987-1992

| Sector      | Percentage (%) |
|-------------|----------------|
| RNR         | 1.7            |
| Agriculture | 3.9            |
| Livestock   | 1.8            |
| Forestry    | -2.5           |
| Industry    | 3.4            |
| Services    | 7.7            |
| Total GDP   | 4.0            |

Source: Selected Economic Indicators 1995, RMA

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RNR sector at 1.7% was one of the slowest growing sectors. Even a 3% growth rate is rapid by most standards, and would allow a considerable improvement in average agricultural incomes despite the growth of the rural population. While these estimates were based on limited data, it has been assumed that the growth in the agricultural sector was the result of both increases in area planted and in productivity. The relatively slow growth of the forestry sector, was the consequence of RGOB policy restricting the level of logging to prevent un-sustainable utilisation of the forest resources. This policy resulted in a decline in commercial logging in the early 1980s, when responsibility for logging was handed over to the Bhutan Logging Corporation (a public sector enterprise). The output increased from this sector increased in the mid 1980s, but mainly because of the need to fell trees infested with bark beetle disease (7FYP).

According to the 7FYP, the results of an exploratory GDP projection, in which an overall growth rate of just over 5% p.a. is achieved through continued rapid growth of the manufacturing sector, despite the decline in electricity sector growth. In this scenario, the share of manufacturing in GDP would almost be doubled, to 13.2% by 1997, while the share of electricity would fall to 7.7% from 9.4%. There would be a continued slow decline in the relative importance of the natural resources sectors: the combined share of agriculture and forestry would fall from about 43% to 41% of the total.

### GDP PROJECTIONS 1989-1997

| Sector                      | Average   |            |           | Share(%) |       |
|-----------------------------|-----------|------------|-----------|----------|-------|
|                             | 1989 GDP* | Growth (%) | 1997 GDP* | 1989     | 1997  |
| Agriculture & Livestock     | 1,371.7   | 4.5        | 1,946.4   | 33.0     | 30.9  |
| Forestry                    | 429.1     | 4.8        | 626.3     | 10.3     | 9.9   |
| Mining                      | 35.7      | 7.4        | 63.3      | 0.9      | 1.0   |
| Manufacturing               | 302.5     | 13.4       | 829.0     | 7.2      | 13.2  |
| Electricity                 | 391.0     | 2.7        | 482.5     | 9.4      | 7.7   |
| Construction                | 358.2     | 4.5        | 509.4     | 8.6      | 8.1   |
| Trade, Hotel, etc.          | 268.8     | 2.4        | 325.0     | 6.5      | 5.2   |
| Transport & Communica.      | 235.6     | 6.7        | 396.8     | 5.7      | 6.3   |
| Financial Services          | 306.9     | 5.4        | 468.1     | 7.4      | 7.4   |
| Community Services          |           |            |           |          |       |
| (Govt. Admin. & Defence)    | 525.1     | 4.9        | 771.9     | 12.6     | 12.2  |
| (Less Imputed Bank Charges) | -67.0     | 7.2        | -117.0    | -1.6     | -1.9  |
| Total GDP                   | 4,157.6   | 5.3        | 6,301.7   | 100.0    | 100.0 |

Note: \* 1989 Prices

Source: Seventh Five Year Plan 1992-1997, Planning Commission

#### (4) Foreign Trade

The major export commodities to India were electricity, minerals, especially calcium carbide, cement, timber and wood products, which accounted for 82% of total export amount in 1990. Electricity generated by Chukha Hydro Power Corporation has been occupying first position from 1987 (Nu. 374 million 97% in 1990, Nu. 397 million 96% in 1991 and Nu. 355 million 95% in 1992). The major import commodities from India were varied from consumer goods like a rice, diesel oil, fabrics, etc. to capital goods like truck chassis, petrol, iron rods, etc. From 1987, rice has been the highest imported good.

## MAJOR COMMODITIES TRADED WITH INDIA, 1990

| Commodity           | Nu. in million  | Percentage (%) |
|---------------------|-----------------|----------------|
| <b>I. Export</b>    |                 |                |
| Electricity         | 374.35          | 33.1           |
| Minerals            | 209.04          | 18.5           |
| Cement              | 137.04          | 12.1           |
| Timber              | 107.18          | 9.5            |
| Wood products       | 103.43          | 9.2            |
| Sub-total           | 931.04          | 82.4           |
| <b>Total Export</b> | <b>1,129.57</b> | <b>100.0</b>   |
| <b>II. Import</b>   |                 |                |
| Rice                | 72.92           | 6.4            |
| Diesel oil          | 65.01           | 5.7            |
| Truck chassis       | 54.38           | 4.8            |
| Petrol              | 32.57           | 2.8            |
| Tires and tubes     | 31.70           | 2.8            |
| Sub-total           | 256.58          | 22.4           |
| <b>Total Import</b> | <b>1,142.92</b> | <b>100.0</b>   |

Source: Selected Economic Indicators 1993, RMA

During 1990/91, Bhutan's overall exports increased by 13.3% and imports by 12.7%. Exports to third countries increased by 15.8% and exports to India increased by 13%. On the other hand, imports from third countries grew by only 2.3% whereas imports from India grew by 15%. During 1990/91 marked the second consecutive year during which Bhutan had a balance of payments deficit with India, resulting in a net draw down on Indian Rupee reserves.

#### (5) Balance of Payment

The value of merchandise exports was estimated to have increased by Nu. 261 million during the fiscal year 1993/94. Nevertheless, the decrease in imports of Nu. 407 million has brought about a large trade deficit of Nu. 966 million. The trade balance deficits were accelerated, rising from a deficit of Nu. 217 million in 1990/91 to Nu. 1,634 million in 1992/93, but decelerated in 1993/94.

Further to the trade deficit, the service and transfer payments have been greater than the service and transfer receipts with a deficit of Nu. 455 million. This resulted in a further deterioration of current account balance by deficit of Nu. 1,421 million from deficit of Nu. 1,953 million of the previous period.

Foreign aid has contributed to offset the current account deficits. During 1993/94, Bhutan's Balance of Payments consisting of balance of payments with India and rest of the world had an overall surplus of Nu. 647 million, but it has increased about 70% from the previous year. These years the economic relation with India has been increasing in comparison with the third countries.

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### BALANCE OF PAYMENTS ESTIMATES, 1993/94

(Unit: Nu. in million)

| Item                              | India     | Others   | Total     |
|-----------------------------------|-----------|----------|-----------|
| a) Exports of Goods (Fob)         | 1,825.75  | 272.17   | 2,097.92  |
| b) Imports of Goods (Cif)         | -2,420.06 | 644.02   | -3,064.08 |
| c) Trade Balance (a+b)            | -594.31   | 371.85   | -966.16   |
| d) Service and Transfer Receipts  | 200.26    | 623.76   | 824.02    |
| e) Service and Transfer Payments  | -630.54   | -648.14  | -1,278.68 |
| f) Net Service and Transfer (d+e) | -430.28   | -24.38   | -454.66   |
| g) Current Account Balance (c+f)  | -1,024.59 | -396.23  | -1,420.82 |
| h) Foreign Aid                    | 340.40    | 1,039.71 | 1,380.11  |
| i) Other Loans                    | 563.48    | -71.33   | 492.15    |
| j) Errors and Omissions           | 191.80    | 3.42     | 195.22    |
| k) Overall Balance (g+h+i+j)      | 71.09     | 575.57   | 646.66    |

Source: Selected Economic Indicators 1995, RMA

#### 1) Balance of Payment with India

Bhutan has close economic links with India. Trade with India in 1993/94 amounted to 87% of total export and 79% of total import. The balance of payments deficit with India became more serious from 1989/90.

Merchandise exports have been estimated to have increased by 20% from 1992/93 to Nu. 1,826 million in 1993/94. Most of the increase had come from electricity, calcium carbide, wood products, food products, cardamom, potatoes, etc. At same time, imports also increased by 16% to Nu. 2,420 million which has again resulted in trade deficit of Nu. 594 million. On the other hand, net service and transfer went down by 46%. Combining this, with the trade deficit the current account balance during 1993/94 accounted a large deficit of Nu. 1,025 million.

#### 2) Balance of Payments with Third Countries

Most of the third country exports are to Bangladesh and only a portion of goods are exported to other countries. Export items include oranges, apples, cardamom, coal, boulders, lime stone, cement, HDPE pipes, wood products, dolomite and handicrafts. During 1993/94, exports receipts have increased in Nu. 272 million. The same time, imports, consisting mainly of capital goods, vehicles and other aid-related goods, have been estimated to have remarkably decreased to Nu. 644 million from Nu. 1,385 million of the previous period.

#### (6) International Reserves and External Debt

The total international reserves were stable in these years. The gross international reserves has been increased by US\$ 12.5 million to US\$ 107 million during 1993/94. The growth in reserves was a result of a strong increase in convertible currency reserves. The convertible currency reserves increased by 12% and amounted to US\$ 103 million as on June 30, 1994, as compared to US\$ 92 million of the previous period.



## INTERNATIONAL RESERVES

| Item                                   | 1989/90 | 1990/91 | 1991/92 | 1992/93 | 1993/94 |
|--|---------|---------|---------|---------|---------|
| Indian Rupee (million of Rupee)        | 418.44  | 245.95  | 97.80   | 79.81   | 125.25  |
| Convertible Currency (million of US\$) | 65.00   | 78.78   | 95.96   | 91.86   | 102.93  |
| Total Reserves (Million of US\$)       | 88.98   | 90.39   | 99.74   | 94.40   | 106.92  |

Source: Selected Economic Indicators 1995, RMA

Bhutan has successfully avoided the foreign debt trap into which many countries have fallen. As a result, it has not been forced to mortgage its natural resource base in an unsustainable fashion to pay off outstanding loans.

At the end of June 1992, Bhutan's convertible currency loan outstanding amounted to US\$ 71 million. There was a decline of 12% comparison with the debt outstanding of the previous period. Total repayments during the period amounted to US\$ 4.9 million containing US\$ 3.3 million of principal and US\$ 1.7 million of interest. There was an increase of 12% in total debt service payments during the period. The Indian Rupee debt at the start of 1991/92 of Rs. 980 million rose to 1,266 million due to additional borrowing of Rs. 286 million. Total repayment as at the end of 1992 was Rs. 3.14 million.

## FOREIGN DEBT INDICATORS FOR CONVERTIBLE CURRENCY LOANS

(Unit: US\$ in million)

| Item                              | 1987/88 | 1988/89 | 1989/90 | 1990/91 | 1991/92 |
|-----------------------------------|---------|---------|---------|---------|---------|
| Debt Outstanding (cumulative)     | 41.55   | 72.62   | 73.62   | 79.92   | 70.70   |
| Debt Service Payments             | 0.87    | 4.07    | 6.76    | 4.40    | 4.95    |
| Principal                         | 0.32    | 2.36    | 4.32    | 2.70    | 3.25    |
| Interest                          | 0.55    | 1.71    | 2.44    | 1.70    | 1.70    |
| Debt Service Ratios (in percent)  | 11.10   | 39.80   | 39.23   | 25.88   | 44.78   |
| 1)                                | 7.00    | 16.70   | 14.16   | 8.37    | 24.21   |
| 2)                                | 4.10    | 23.10   | 25.07   | 17.51   | 20.57   |
| Debt Outstanding/GDP (in percent) | 13.90   | 27.00   | 29.18   | 33.69   | 29.50   |

Not 1) Interest payments/convertible currency exports of goods and services.

2) Principal repayments/convertible currency exports of goods and services.

Source: Annual Report 1991-92, RMA

## (7) Foreign Exchange

The expansion of trade with India led to the monetarization of the Bhutanese economy. Since the introduction of the Ngultrum (Bhutanese currency), it has been valued at par with the Indian Rupee and Bhutanese price levels move closely with Indian price levels.

The exchange rate of the Ngultrum against the US\$ and other major currencies experienced a significant change in the beginning of 1991/92 as a consequence of the Reserve Bank of India's move to adjust the external value of the Indian Rupee. As a result of this exercise, the Ngultrum weakened further against the dollar and its average exchange rate against one dollar depreciated to Nu. 31.37 of 1994 average from Nu. 30.49 of 1993 average, experiencing a depreciation of about 2.9% (Fig. B.2.1).

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### EXCHANGE RATES, NGULTRUM / US\$

|                |         |         |         |         |         |
|----------------|---------|---------|---------|---------|---------|
| Calendar Year  | 1990    | 1991    | 1992    | 1993    | 1994    |
| Period Average | 17.5    | 22.74   | 25.92   | 30.49   | 31.37   |
| Fiscal Year    | 1989/90 | 1990/91 | 1991/92 | 1992/93 | 1993/94 |
| Period Average | 16.97   | 18.74   | 25.86   | 27.77   | 28.65   |

Source: Selected Economic Indicators 1995, RMA

The currency equivalents of the Ngultrum against the US\$ in July 1995 is US\$ 1 = Nu. 30.85.

### (8) Financial Investment

The domestic investment by the Bank of Bhutan, Royal Insurance Corporation of Bhutan, Bhutan Development Finance Corporation and Unit Trust of Bhutan, has been increasing remarkably. In comparison with the financial investment in 1987 (Nu. 374.3 million), during these five years that on 1992 raised over 600%. The investment ration toward all economic activity has been increased from 11% of GDP in 1987 to 38% of that in 1992. The RNR sector occupied only 3.4% of all financial investment in 1992.

### FINANCIAL INVESTMENT BY SECTOR

(Unit: Nu. in million)

| Economic Sector           | 1988  | 1989  | 1990  | 1991    | 1992    |
|---------------------------|-------|-------|-------|---------|---------|
| RNR                       | 21.3  | 26.5  | 35.9  | 55.4    | 86.4    |
| Manufacturing             | 119.5 | 147.7 | 220.4 | 307.1   | 452.1   |
| Building and Construction | 240.1 | 272.3 | 294.9 | 344.3   | 473.6   |
| Trade and Commerce        | 78.0  | 127.8 | 181.7 | 254.9   | 328.1   |
| Transport                 | 41.3  | 56.0  | 96.6  | 126.8   | 751.0   |
| Personal and Other Loans  | 93.0  | 167.2 | 166.8 | 249.7   | 281.9   |
| Total                     | 593.2 | 797.5 | 926.3 | 1,338.2 | 2,373.0 |

Source: Selected Economic Indicators 1993, RMA

### (9) National Budget and Balance of Government's Account

The Fiscal Year of RGOB is from 1 July to 30 June. The total national budget of RGOB for 1994/95 was Nu. 5,010 million and the projected budget outlay for 1995/96 jumped to a record value of Nu. 5,212 million.

### NATIONAL BUDGET, 1995/96

| Items               | Nu. in million |
|---------------------|----------------|
| Current Expenditure | 1,872.055      |
| Capital Expenditure | 3,003.517      |
| Repayment of Loan   | 336.022        |
| RGOB                | 2,410.294      |
| External Grant      | 2,535.164      |
| External Loan       | 266.136        |
| Total               | 5,211.594      |

Source: Ministry of Finance, National Budget and Accounts Division

## GOVERNMENT EXPENDITURE (BUDGET), 1991/92

| Item                              | Nu. in million   |
|-----------------------------------|------------------|
| Discretionary Current Expenditure | 669.505          |
| Personal Emoluments               | 325.830          |
| Operating Costs                   | 258.729          |
| Grants and Subventions            | 84.946           |
| Capital Expenditure               | 551.484          |
| Basic                             | 510.854          |
| Public Investment                 | 40.629           |
| Non-Discretionary Expenditure     | 144.633          |
| Retirement Benefits               | 7.861            |
| Dept Service                      | 136.769          |
| Lending                           | 4.614            |
| <b>Total</b>                      | <b>1,370.236</b> |

Source: Seventh Five Year Plan 1992-97, Planning Commission

Revised estimates indicated that the Government's fiscal balance reverted in 1991/92 to a sizeable deficit of Nu. 250 million which corresponded to 5% of GDP, from a small deficit of Nu. 44 million (only about 0.9% of GDP), indicating expansionary fiscal developments in 1991/92. During the period total domestic revenue increased by about 10%, while tax revenues remained constant, current non-tax revenues increased by 17% with maximum contribution from the sale of electricity from the Chukha Hydro Power Corporation.

The Government's current and capital expenditure increased by 6% and 32% respectively. With the grants remaining at the same levels as earlier years and the new revenue measures being still at an early stage, increase in expenditure on developmental activities resulted in a fourfold increase in the budget deficit.

## BALANCE OF GOVERNMENT'S ACCOUNT, 1991/92

| Item                              | Nu. in million |
|-----------------------------------|----------------|
| Revenue                           | 1,148.0        |
| Tax                               | 282.0          |
| Current non-tax                   | 796.0          |
| Other                             | 70.0           |
| Grants                            | 743.0          |
| From India                        | 239.0          |
| Other                             | 504.0          |
| <b>Total Revenue and Grants</b>   | <b>1,891.0</b> |
| Expenditure                       | 2,141.0        |
| Current                           | 1,141.0        |
| Capital                           | 1,000.0        |
| <b>Budget Surplus/Deficit (-)</b> | <b>-250.0</b>  |

Source: Annual Report 1991/92, RMA

## (10) Price Index

During 1991/92, inflation rate as measured by the rate of change of the Consumer Price Index (CPI), accelerated to 16.0% as compared to 13.3% in the previous year. The major factors behind this acceleration was the increase in aggregate demand, increase in food prices, and a strong growth in total liquidity during the year. However, in 1993 and 1994 inflation rates were decelerated to 8.9% and 8.2%, respectively. The average

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increase rates (price index at June) from 1979 to 1994 on food, non-food and total were 8.7%, 11.6% and 9.6%, respectively (Fig. B.2.1).

Because of close trade and monetary links, price developments in Bhutan largely follow those in India; however, price levels in Bhutan tend to be considerably higher than in India due to higher transportation cost and less competitive market.

### PRICE INDEX (AT DECEMBER)

(Unit: Percentage)

| Item     | 1990 | 1991 | 1992 | 1993 | 1994 |
|----------|------|------|------|------|------|
| Food     | 8.1  | 15.1 | 16.3 | 6.3  | 3.7  |
| Non-food | 12.1 | 9.7  | 15.2 | 14.5 | 17.1 |
| Total    | 9.4  | 13.3 | 16.0 | 8.9  | 8.2  |

Source: Selected Economic Indicators 1995, RMA

The average rise rates (price index at the end of year) of foods comparison with the previous year in Thimphu are as follows:

### THIMPHU FOOD PRICE INDEX

(Unit: Percentage)

| Item                | 1990 | 1991 | 1992 | 1993 | 1994 |
|---------------------|------|------|------|------|------|
| Cereals & Pulses    | 0.6  | 3.5  | 0.0  | 2.7  | 2.0  |
| Vegetables & Fruits | 20.2 | 17.8 | 10.3 | 21.5 | 21.8 |
| Other Food          | 7.2  | 4.3  | 11.2 | 2.0  | 4.1  |
| Total Food          | 4.4  | 4.8  | 5.5  | 4.0  | 4.4  |

Source: Selected Economic Indicators 1995, RMA

## (11) Tax System

According to the Royal Monetary Authority, the tax system of RGOB is as follows:

### 1) Direct Taxation

Direct Taxation consists of corporate and personal taxes. Corporate taxes presently yield three times as much as taxes on individuals and trading units. Although RGOB will ensure that the levels of corporate taxation are not so high as to deter domestic and foreign investment, it is expected that corporate tax revenues will increase as manufacturing and other concerns in the public sector expand and the privatisation programme proceeds. Although the number of personal income tax payers is small, the Department of Revenue and Ministry of Finance are studying the possibilities of introducing a more comprehensive personal income tax, which if introduced, would increase tax revenues.

Labour taxes are another form of personal taxation; at present they affect most individuals much more than monetized personal taxes do. Labour tax is particularly important in un-monetized communities, and through their labour village people make an important contribution to their own development. However, labour taxes can be inefficient, since there is a loss of other production which is different for different people and which may exceed the value of the labour contributed. As the economy develops, labour tax will become relatively less important. Already for some labour taxes there is an alternative of cash payment; in future it is likely that more and more people will take this option.

## 2) Indirect Taxation

Indirect taxation accounts for two thirds of domestic tax revenues. However, the yield from indirect taxes is limited by the large number of exemptions to the existing tariffs and duties. Such exemptions have two-undesirable effects: as well as reducing total revenues to Government, they create distortions in the economy, since their effect is to give discriminatory privileges to some participants. During 7FYP the number of exemptions from indirect taxes will be reviewed.

## 3) Actual Tax Payment

Most households pay some kind of taxes. Government servants pay 2% of their salary in income tax. A variety of municipal taxes exist. All households pay Nu. 20-100 annually in urban tax, and business owners pay Nu. 100-400 per year in municipal commercial tax. In brief, taxes are relatively modest, and to a large extent, the above figures represent the households' available income.

## (12) Labour Circumstance

Although significant economic progress has taken place since the 1960s, the majority of the population remain dependent on agriculture from incomes and employment. Employment in the other sectors of the economy continues to be insignificant, as industrial development has been limited. The Government has been responsible for the establishment of several productive enterprises, however the private sector is being encouraged to take over these activities. Unlike many other developing countries, unemployment is not yet a concern.

The shortage of both skilled and unskilled manpower is met mainly through the import of the expatriates. In the case of unskilled labour shortages in the agricultural sector, the problem is compounded by the limited scope for mechanisation due to the mountainous terrain.

## B.2.3 Social Situation and Infrastructure

### (1) Transport Network System

The majority of the people in Bhutan lives at least half a day walking distance from a motor road. Some communities are even more remote, 4-5 days from a motor road. These communities have to rely on mule tracks and foot trails in conjunction with suspension bridges, cantilever bridges and in a few places ropeways to reach the nearest large settlement. Rural communities are responsible for the maintenance of foot trails and bridges on a self-help basis. Suspension bridges provide short-cut links between stretches of foot paths and mule tracks and save much time in reaching one's destination. Thus they increase the accessibility to markets, educational, health, agricultural facilities.

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Only one airport, at Paro, is in regular use. The national airline, Druk Air provides services with two planes to Dhaka, Kathmandu, Delhi, Calcutta and Bangkok. A total of 12,732 passengers were carried by Druk Air in the year 1989/90.

### **(2) Road Network and Condition**

Up until a few decades ago, transport within Bhutan was on foot or on horseback. The construction of a road system started in the late 1960's. Today, there is a network of 2,674 Km of motorable roads. Numerous feeder roads and suspension bridges have also been built. However, transportation in the remote areas is still by walking trails and suspension bridges that can also carry animals. Because of the mountainous terrain, the actual distance on the ground is more than twice as long of direct distance.

The country has a lateral west-east highway from the capital Thimphu to Tashigang (546 Km). The west-east highway is connected to southern Bhutan by three north-south highways: Thimphu - Phuntsholing highway (179 Km), Tongsa - Gaylegphug highway (244 Km) and Tashigang - Sandrup Jongkhar highway (180 Km). Further, new Wangduephodrang - Chirang highway is under construction. The highways have 8 tonnes axle capacity and were built according to Indian Hill Road Standard and Specification by Project Dantak, an organisation of the Government of India.

The motor network is generally limited to providing access between 19 Dzongkhag headquarters excepting Gasa. The major towns and villages are also connected by motor roads. However, the majority of settlements can only be reached by mule tracks and foot trails, as well as cantilever and suspension bridges. Although horses are the main best of burden, yaks and oxen are used for transportation in some parts of Bhutan.

### **(3) Communication Network System**

As of the end of 1990, the number of institutions in the communication sector were as follows: 86 post offices and 25 branch (part time) post offices, 44 civil wireless stations, 8 telegraph offices, 1 weekly newspaper, many institutional bulletins, newsletter and journals, 4 printing presses, 1 broadcasting station, and 2,461 working telephone connections served by 13 telephone exchanges (TFYP).

Telecommunication services consist of telephone, telegraph, telex and civil wireless. However, only the civil wireless service connects all Dzongkhag headquarters in the country. In 1990, an earth satellite station was completed and international telephone lines are available by satellite from Thimphu. In 1993 a modern micro-wave system was linked with all the main centres.

### **(4) Education**

Bhutan's formal education system is as old as Bhutan. Until 1920, it was a purely monastic system. The modern school system began in 1961. In the last ten years the school system and curriculum have been moving toward a more holistic education system. The formal education system consists of one year pre-primary, six years primary, four years secondary, two years senior secondary and three years degree programme.

There were 156 primary schools in 1990 and many new smaller community schools. Enrolment figures for the students in Classes 0-4 is 66%. It was hoped with the expansion of primary education that the disparity between boys (60%) and girls (40%) would be reduced. Despite major efforts, the literacy rate was still quoted as 20% (1990) for adults (Planning Commission).

#### **(5) Health and Sanitation**

Lack of hygiene and poor sanitation cause many infectious diseases. Diarrhoea and respiratory tract infections remain by far the most frequent diseases treated by the health services. Worm infestations are estimated to occur in up to 80% of the population. The majority of the diseases treated are seasonal and there is a marked fluctuation in the out-patient department attendance between summer and winter.

Respiratory diseases are a major cause of morbidity and constitute approximately 20% of all cases in Basic Health Units. After auto respiratory diseases, diarrhoeal disease is the second largest cause of morbidity. Approximately 40% of deaths of children under five are caused by diarrhoea and 15% of all patient seen in health centres in 1989 suffered from diarrhoeal diseases. To reduce the incidence of this disease, access to safe drinking water and sanitary disposal of human excreta is vitally important (7FYP).

The health institutions in July 1991 all over the country were as follows: General Hospital 3, Hospital 18, Hospital beds 944, Basic Health Units 72, Dispensaries 44, etc. (7FYP).

#### **(6) Electricity Supply System**

The theoretical potential for power generation has been estimated as 20,000 MW although the exploitable capacity in Bhutan has been estimated as 6,000 MW. There are present 21 run of the river hydro electricity generation stations, which have a capacity to generate a total of 355 MW: less than 6% of the estimated exploitable capacity. Existing hydro-power generating capacity includes the Chukka Hydro project with an installed capacity of 336 MW, 7 small size hydro-plants ranging from 300 to 1,500 Kw and 12 micro hydels with capacity ranging from 10 to 80 Kw. There are also three plants of 200 Kw capacity, each of which was completed in the 6FYP.

Most of the rural electrification programmes were planned for villages in Southern Bhutan. However, due to the lack of finance and manpower, actual expenditure has been only 36% of the planned outlay as of 1990. The number of villages electrified have increased from 127 in 1986/87 to 171 in 1988/89, and the number of towns electrified has increased from 19 in 1986/87 to 20 in 1988/89. The number of consumers has increased from 11,361 in 1986/87 to 14,092 in 1988/89. Despite the progress mentioned highlighted above, over 90% of the population do not have access to electricity. The eventual goal of providing adequate, reliable and safe electrical energy throughout the country remains to be realised (7FYP).

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### (7) Energy Sources

Firewood accounted for 77% of total energy consumption in 1990; an estimated 1,170,000 m<sup>3</sup> in 1989. This included all users of firewood such as households, commercial establishments for example agro-industries, institutes such as schools, monastic bodies, army, police, etc. As a percentage of the total consumption of firewood, the household sector used 95.0%, Government and commercial establishments 3.4%, the agriculture sector 0.9% and industry used only 0.7%. Annual consumption of firewood for a typical household was estimated at 14 m<sup>3</sup>. Out of this quantity, 7 to 9 m<sup>3</sup> was used in cooking and the rest was used for space heating (7FYP).

### B.2.4 Agriculture

#### (1) Present Situation of Agricultural Sector

The agricultural sector, newly called as the Renewable Natural Resource (RNR) sector that has three sub-sectors: agriculture, livestock and forestry, represents the single largest and most important sector in the Bhutanese economy. However, based on the comparison with share of agricultural labour force (over 90%), agriculture land covers of the country (16%) and its production such as the agricultural GDP (40% of total in 1992), it is clear that productivity of the RNR sector is unsatisfactorily low and rural economy is kept in subsistence level.

Within the RNR sector, five major production systems have been identified. Each of the system contains varying proportions of arable agriculture, animal husbandry and forest use; the predominant type of agriculture practised gives its name to the system. The dryland system includes a proportion of shifting cultivation (tsheri). Rough estimates of the contribution of the five production systems to national production are given in the following:

#### CONTRIBUTION TO NATIONAL PRODUCTION BY PRODUCTION SYSTEM

| Prodc. System              | Agriculture | Livestock | Forestry | Total  | (%)     |
|----------------------------|-------------|-----------|----------|--------|---------|
| Pastoral                   | 14.0        | 126.6     | 70.6     | 211.2  | (8.7)   |
| Wetland                    | 166.1       | 245.8     | 195.0    | 606.9  | (25.1)  |
| Dryland                    | 246.7       | 348.9     | 298.5    | 894.1  | (36.9)  |
| Plantation Crops / Orchard | 217.7       | 65.0      | 34.9     | 317.6  | (13.1)  |
| Forest                     | 1.4         | 190.1     | 199.0    | 390.5  | (16.1)  |
| Total                      | 645.9       | 976.4     | 798.0    | 2420.3 | (100.0) |
| (%)                        | (26.7)      | (40.3)    | (33.0)   |        |         |

Source: Bhutan Research Strategy and Plan, the RNR Sector, 1992

#### (2) Agricultural Land Use

The area under cultivation has been estimated as follows:



## LAND UNDER CULTIVATION, 1991

| Item                   | Hectares       | Percentage (%) |
|------------------------|----------------|----------------|
| Valley Cultivation     | 52,500         | 7.0            |
| Terraced Cultivation   | 235,300        | 31.5           |
| Un-treated Cultivation | 349,700        | 46.8           |
| Shifting Cultivation   | 86,500         | 11.6           |
| Orchards               | 21,400         | 2.8            |
| Habitation             | 2,300          | 0.3            |
| <b>Total</b>           | <b>747,700</b> | <b>100.0</b>   |

Source: Master Plan for Forestry Development, Preliminary data, 1991.

While a large proportion of the country is covered by forest, the area suitable for agricultural production is limited by the topography and low soil fertility in some areas. The river valleys and the flatlands in the southern foothills account for most of the fertile cultivable land whereas the northern alpine belt below the snow line is suitable only for pasture. Land is usually terraced for paddy production, while rainfed crop lands and most of the orchards are not terraced. The most recent estimates suggest that 16% of total land is used for intensive agricultural production, including dryland and irrigated crop production and orchards (7FYP).

### (3) Land Tenure

The RNR sector of all country consists of 65,000 farm households with an average farm size of 1.5 ha. Farm distribution is highly skewed: 45% of farmers with less than 1 ha, cultivating 16% of the total. Conversely 16% of farmers with holding of more than 2.5 ha, hold 42% of the total area. Average farm size is substantially higher in the west. Under existing legislation farm households may only plant an area of up to 10 ha, excluding horticultural crops. Farm size has been decreasing as farms are sub-divided between children, and many small farmers are unable to meet their food requirements. A study in the Punakha-Wangduephodrang area during 1990, showed that 40% of all farmers operated as part owners/tenants. A small number of land less tenants were also identified, accounting for 3-5% of the total. Generally, it is said that there is no landlessness in Bhutan, although the rapidly growing population could lead to the emergence of marginal farmers (7FYP).

### (4) Agro-ecological Zones

Bhutan has extremely diverse agro-climatic conditions due to major differences in altitude and rainfall as well as in slope and soil characteristics. Climatic conditions in the four physiographic regions (the southern foothills, the middle mountains, the high mountains and the Himalaya) range from hot and humid sub-tropical conditions in the south, to the ice and glacial conditions of the high Himalayas in the north (Masterplan for Horticulture Development, 1994).

In an attempt to simplify the diverse climatic conditions and to delineate agricultural areas with similar growing conditions, six agro-ecological zones have been identified based on temperature (determined by altitude) and rainfall. These zones are shown below:

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### AGRO-ECOLOGICAL ZONE

| Zone                    | Altitude<br>(m a.s.l) | Temperature (°C) |      |      | Rainfall<br>(mm) |
|-------------------------|-----------------------|------------------|------|------|------------------|
|                         |                       | Mean             | Max  | Min  |                  |
| Subtropical             |                       |                  |      |      |                  |
| Wet subtropical (WST)   | 150-600 Low           | 23.6             | 34.0 | 11.6 | 2,500-5,500      |
| Humid subtropical (HST) | 600-1,200 Mid         | 19.5             | 33.0 | 4.6  | 1,200-2,500      |
| Dry subtropical (DST)   | 1,200-1,800 Mid       | 17.2             | 28.7 | 3.0  | 850-1,200        |
| Temperate               |                       |                  |      |      |                  |
| Warm temperate (WT)     | 1,800-2,600 High      | 12.5             | 26.3 | 0.1  | 650-850          |
| Cool temperate (CT)     | 2,600-3,600 High      | 9.9              | 22.3 | 0.1  | 650-850          |
| Alpine (AL)             | 3,600-4,600 High      | 5.5              | 12.0 | -0.9 | 650              |

Source: Masterplan for Horticulture Development, MOA, 1994

## (5) Production

### 1) Agricultural Production

A wide range of crops are grown depending on cropping conditions and food self sufficiency requirements. Paddy and maize are the principal cereals grown in all country, on 77% of all cultivable land. Maize covers the largest crop area, but is relatively more important in sub-tropical area of the south. In the temperate area the major crops produced are wheat, buckwheat, potatoes, mustard and barley. Paddy is the principal wet land crop in the monsoon season, and where irrigation water is available wetland winter crops include wheat, mustard and potatoes. Dryland crops in the warm temperate area include wheat, potatoes, mustard.

Oranges, cardamom and other tropical fruits production is concentrated in the south, apples are produced mainly in the temperate area and potatoes are produced in the mid elevation areas. Substantial areas of dryland have been converted to orchard crops in response to the higher profits obtained from horticultural crops. Paddy is the preferred food crop and many farmers would wish to convert dry land to wet land to produce more paddy (7FYP).

### PRODUCTION OF MAJOR CROPS

| Crop       | Area (ha) | Yield (t/ha) | Production (t) |
|------------|-----------|--------------|----------------|
| Maize      | 55,473    | 1.36         | 75,380         |
| Paddy      | 45,086    | 2.39         | 107,877        |
| Millet     | 10,319    | 0.89         | 9,159          |
| Wheat      | 9,568     | 1.12         | 10,747         |
| Orange     | 8,040     | 9.58         | 77,031         |
| Buckwheat  | 7,290     | 0.88         | 6,443          |
| Cardamom   | 6,973     | 0.57         | 3,980          |
| Vegetables | 5,990     | 3.72         | 22,257         |
| Potatoes   | 5,631     | 7.69         | 43,325         |
| Mustard    | 4,782     | 0.77         | 3,686          |
| Barley     | 4,406     | 1.10         | 4,849          |
| Apple      | 1,966     | 4.71         | 9,299          |

Source: Land Use Planning project, PPD

Food grain production has grown slowly and export of cash crops have grown rapidly in recent years. The main cereal crops are paddy, maize, wheat, barley, buckwheat and millet. Bhutan is 66% self-sufficient in all cereals. To meet the remaining food needs, cereals are imported from India (Planning Commission).

## 2) Livestock Production

Cattle are owned by almost every rural household. They are used primarily as draught animals and for the production of dairy products such as milk, butter and cheese for family consumption and sale. While some milk is sold, butter and cheese being less perishable and more easily transportable are one of the main traditional sources of cash income farm produce. Cattle also play an important role as capital in themselves. The livestock population in 1989 were as follows: 303,500 Cattles, 37,100 Yaks, 46,400 Mithuns, 47,800 Sheeps, 32,500 Goats, 63,200 Pigs, 26,100 Houses and 210,700 Poultry (Planning Commission). Mithun is a local name for species *Bos frontalis*.

## (6) Farming System

Traditional labour intensive production methods are used, as there is little scope for mechanisation on steep slopes. Water is not a constraint, but management of water in irrigation systems is inefficient. The crop rotation (Tsheri) is widely practised and has traditionally been based on a long fallow period. In most parts of Bhutan traditional soil conservation techniques have appeared to limit soil erosion to a minimum. In the southern foothills high population pressure and steep slope production are beginning to cause erosion in many parts, as the population are originally from plains of India and are unaccustomed to hill farming.

Livestock is totally integrated in all farming systems. They provide draught power for cultivating the wet-land and much of the dry-land. Manure is collected and spread on fields before ploughing, often in substantial quantities in the central valleys, but less so in the southern areas. Draught animals are critical for crop cultivation, and the manure dose much to maintain the soil structure and soil fertility. Cattle are grazed in the forest areas and fed from crop residues. There are some communities in high altitude areas who are totally dependent on Yak and sheep husbandry.

Bhutanese farmers practice integrated farming including varied proportions of arable agriculture, livestock and use of products. It is estimated that over 70% of the active labour force is engaged in agriculture and related activities.

## (7) Agricultural Institutions and Supporting System

Apart from agricultural producers themselves, MOA has the major responsibility for promotion of agricultural development. The MOA provides support services to farmers through three Divisions of Research, Extension and Irrigation (REID), Crop and Livestock Services, and Forest Services. The principal institutions and supporting systems of REID are as follows:

- a. Agricultural Extension Centre,
- b. Agricultural Research Centre,
- c. Seed and Plant Protection Centre,
- d. Agricultural Training Centre, and
- e. Agricultural Machinery Centre.

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The agriculture support services are considered to be one of the most important and essential services to facilitate the various farming practices. Various kinds of centres and institutes have been established in several places and the services provided in these centres and institutes covers various levels of assistance to the farmers with a wide range of knowledge and know-how having accumulated so far.

### **(8) Agricultural Input Supply**

The present system of input supply is managed by the procurement section of MOA upon the demand of farmers as determined by the dzongkhag agriculture staff. To facilitate timely distribution of inputs, storage facilities are provided at the dzongkhag head quarter. The main objective of efficient supply of input is to increase agricultural productivity and consequently to improve farmer's income from RNR sector. The input supplied includes fertiliser, pest control chemicals, seeds, agricultural tools, etc. As envisaged in RNR concept, input supply is under process of privatisation with a view of ensuring timely supply and minimising other problems in handling, transportation and recovery of cost, etc.

### **(9) Agricultural Marketing**

As most rural settlements are far from markets, there has been little potential for the sale of surplus production of crops and livestock. The isolation of individual holdings and production areas from each other and from main markets makes the development of a market economy slow and difficult. Yet without markets, farmers have no incentive to produce a surplus for sale. Although, the production of cash crops, commercial marketing, and export of horticultural crops have been relatively recent developments, primarily due to the construction of the road network in the 1960's and the development of market services. Prior to these developments, most production was at a subsistence level, and any transaction were generally only under barter arrangements.

For religious and cultural reasons, there is no commercial market for livestock for meat. However, there is commercial value in milk and related dairy products. Yet, in order to increase productivity and to prevent ecological damage, there may be no alternative to the direct culling of animal.

### **(10) Exports and Imports of Agricultural Products**

Bhutan is an agricultural country, yet self-sufficiency of food supply has not been achieved. In terms of basic cereals, self sufficient rate is estimated around 70% in all cereal production, being virtually self deficient in maize, barley, millet and buckwheat, but only 52% self sufficient in rice, 24% in wheat, and 20% in edible oils. To meet the food deficits, cereals and edible oils are imported from India (7FYP).

Because unit production cost are substantially lower in India than in Bhutan, imports of cereals are steadily displacing local produce. Imported cereals are being consumed by farmers, both as a result of greater access to markets and rising cash incomes from the sale of horticultural produce. Horticultural crops: oranges, apples, potatoes, cardamom,

ginger, chillies, vegetables and processed fruit products, are exported to India, Bangladesh, Singapore and Japan and the recent increases in these exports has resulted in a surplus in agricultural trade (7FYP).

Major reasons for the increase in cereals' import are assumed as follows:

- a. Increase in food demand of foreign construction labours for road and other public facilities, and domestic non-agricultural population such as government and private employees;
- b. Increase in rice and wheat demand of rural inhabitants from maize and minor cereals; and
- c. Unstable production of domestic cereals, and no inter-regional and regional marketing channel for domestic cereals.

#### (11) Problems on RNR Sector

The RGOB has recognised the following problems confronting sustainable development on the RNR sector:

- a. Inability to produce enough cereals to meet the consumption needs of the population;
- b. Low productivity of crops;
- c. Inadequate technological support;
- d. Poor water management;
- e. Unbalanced production-mix insufficient to meet the nutritional needs (deficiency in proteins and fat);
- f. Predominance of production for subsistence and less for cash income; and
- g. Scarcity of cultivated land leading to un-sustainable (suicidal) farming practices on steep slopes.

To address these problems under the overall RNR sector framework, RGOB is presently implementing several activities and has planned options to increase agricultural production on a sustainable basis (Planning Commission).

#### B.2.5 Water Resources

With the high precipitation and an altitudinal variation of up to 7,000 m above sea level, the water resources are abundant in Bhutan. The high precipitation results in a rich vegetation, natural and cultivated, and the altitudinal difference give many possibilities for use of the water as a source of energy. Bhutan's water resources are confined in four major river basins: Amo Chhu, Wang Chhu, Sankosh Chhu and Manas Chhu. All four major rivers have their sources in glaciers which cover almost 10% of the country.

Water has traditionally been used for irrigation, and the availability of water resources has determined the sitting of settlements. Irrigation channels, often running over great distances, have been an integral part of agricultural practices and such channels are still built and maintained. The quality of the water in stream is threatened by pollution from towns and other large communities. This pollution is small and mainly caused by organic matter

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which will be oxygenated further downstream, nevertheless this constitutes a health hazard of Bhutan's inhabitants (Planning Commission).

### **B.2.6 Water Supply**

Between 1974 and 1990, a total of 1,387 rural water supply schemes were constructed in rural areas. The 6FYP set a target of constructing 600 new schemes but only 258 were completed as of January 1991. Beneficiary communities contributed labour for the construction and maintenance of water supply schemes. A total of 35,000 households (estimated total household number is 70,000) or 305,000 people would benefit from rural water supply programmes if all of them were functioning. However, many of the older schemes are no longer functioning. Thus, the numbers of households benefiting in 1991 was estimated to be about 26,000 or 225,000 people (7FYP).

A study undertaken in 1989 revealed that 21 of the 24 urban areas studied had a piped water supply and distribution system. At that time 5 urban centres had treatment plants and 4 centres had been provided with treatment plants that were no longer functioning. The survey established that in general the water supplies were sufficient, but that only 5 systems were able to provide a 24 hour service. The distribution systems in Thimphu, Phuntsholing, Paro, Gaylegphug, Tashigang and Samdrup Jongkhar been repaired and extended during the 6FYP (7FYP).

### **B.3 Relative Development Plan**

#### **B.3.1 Background**

Since the 1960s, RGOB has recognised that Bhutan's economic future is linked to its neighbours and to the world economy. Having abandoned a strategy of self-isolation, Bhutan now looks to increasing economic interaction with other countries as an avenue for development. The development of Bhutanese economy is however constrained by several factors (7FYP):

- a. Bhutan is geographically isolated from other countries in the region being a landlocked country, and is distant from the nearest sea port in Calcutta, India. This isolation makes the transport of goods into and from Bhutan costly;
- b. Because of the extremely mountainous terrain, the area of land which is suitable for agricultural production is relatively small. This limits the potential for increasing output from the agricultural sector and increases the risks of environmental degradation;
- c. The population is distributed in remote scattered settlements, to take advantage of the limited land suitable for agricultural production;
- d. The above factors have made the provision of roads and communication networks difficult, and the delivery of health and education services costly;
- e. Unlike most other developing countries, Bhutan has a relatively small population and the supply of manpower is a major constraint. The fairly recent introduction of western education means that there is a shortage of manpower with the necessary skills for a developing economy; and
- f. As most of the population have been subsistence farmers until recently, the level of monetization has remained low. This has restricted the Government's ability to raise

domestic revenues, and Bhutan has relied on external assistance for the funding of development programmes.

His Majesty the King also places much importance on environmentally sound sustainable development. Within the Renewable Natural Resources (RNR) sector the integrated approach to managing the renewable resource base of the country relies heavily on having personnel who have been trained and are capable of implementing the concept of sustainable natural resources management and use.

Bhutan's development is based on co-operation with bilateral and multilateral partners. This international co-operation is essential for the development of the country (Planning Commission).

### **B.3.2 Five Year Plans and Their Emphasis**

The process of social and economic development began late in Bhutan. The Five Year Plans have been the instrument of modern development. The first and second Five Year Plans (1961/67, 1967/72) were totally financed by India and largely implemented with Indian administrative and technical assistance. These plans emphasised the building of basic infrastructure, first and foremost roads, education and human resource training. From the first to the fourth Five Year Plan, there was a shift toward education, health and agriculture. The 4FYP emphasised agriculture, industry and forestry which accounted for 59% of the plan. The 5FYP and 6FYP (1981-1992) marked a further shift toward decentralisation of development planning and a concerted effort toward economic self-reliance. Total expenditure has more than doubled in each successive plan (Planning Commission).

### **B.3.3 Seventh Five Year Plan 1992-1997**

The overall aim of development is to raise the living standards of all the population, with due emphasis given to the quality of life as well as increasing incomes. While this is the usual objective of development as pursued by all developing countries, there are many means of achieving this goal. The RGOB, in consultation with the people and levels of Government, has developed an overall approach based on six principles:

The Seventh Five Year Plan (7FYP) which came into effect in July 1992 has as its main emphasis:

- a. **Self reliance:** Increased self-sufficiency in financial resources. This will mean increasing the efficiency of domestic taxation, but the country will still be heavily dependent on international assistance both from India and other aid partners;
- b. **Human resource development:** High priority to further development of human resources;
- c. **Regionally balanced development:** Pursuing self reliance, by limiting the amount of foreign technical assistance so that it matches the capacity of the institutions to absorb aid without becoming perpetually dependent on outside funds and experts;
- d. **Sustainability:** Sustainability in development will continue to be a high priority both in relation to the capacity to maintain facilities and services, and in relation to the environment;