Kingdom of Bhutan
National Land Commission Secretariat

PREPARATORY SURVEY
FOR
THE PROJECT
FOR
THE DEVELOPMENT OF DIGITAL TOPOGRAPHIC MAP
IN
THE KINGDOM OF BHUTAN

FINAL REPORT

AUGUST 2021

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

AERO ASAHI CORPORATION
YACHIYO ENGINEERING CO., LTD.

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Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey for the Project for the Development of Digital Topographic Map in the Kingdom of Bhutan and entrust the survey to a joint venture which consists of AERO ASAHI CORPORATION and YACHIYO ENGINEERING CO., LTD.

The survey team held a series of discussions with the officials concerned of the Royal Government of Bhutan from November 2020 to May 2021. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the Project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Royal Government of Bhutan for their close cooperation extended to the survey team.

August, 2021

Kiyoshi AMADA
Director General,
Infrastructure Management Department
Japan International Cooperation Agency

Summary

1. Background and Outline of the Project

In recent years, global climate change has caused glacial lake outburst flood in the Kingdom of Bhutan (hereinafter referred to as “Bhutan”), resulting in increased numbers of meteorological disasters such as flood disaster, flash flood, cyclones, and seasonal storms. Not only have the storm disasters that occurred between 2011 and 2013 destroyed many houses, floods/flash floods that have caused the greatest damages in terms of total number of deaths, have occurred 26 times (according to local media) between 2015 and 2019. Natural disasters are becoming a great risk for the safety and everyday lives of people in Bhutan. Also, climate change has led to issues such as rapid water depletion, and water resource management for water shortage needed to meet the demands for the increase of drinkable water due to rapid population increase in the urban areas.

Such issues led to the Government of Bhutan (hereinafter referred to as “GOB”) to set “Climate and Disaster Resilient Development” and “Sustainable Water” as urgent goals. These goals were based on 12th Five Year Plan (hereinafter referred to as “FYP”) and the government organizations are working to strengthen the disaster prevention measures and water resource conservation, and such. For instance, the Department of Human Settlement (DHS) under the Ministry of Works and Human Settlement (MoWHS) is creating flood hazard maps, National Land Commission (NLC) is implementing the national land use zoning based on the information on land use regulations for disaster risk management, and National Center for Hydrology and Meteorology (NCHM) is creating a water source inventory.

On the other hand, most of the analysis towards policy planning will require reliable geospatial information as a basis. The topographic map that covers the whole country was created in 1960 with a scale of 1/50,000. However, since the information have been outdated and unreliable, and have not been suitable for the measurement and the analysis, it has made difficult for GOB to prepare the policies. In order to solve these issues, GOB has decided to create 1/25,000 of geospatial information for the whole country by June of 2023 for the 12th FYP. Through a technical cooperation project from 2015 to 2017 called “Project on Development of National Geo-Spatial Data in Bhutan”, (hereinafter referred to as “the Previous Project”) for capacity building for creating topographic map and map symbol specification, Japan has assisted in the creation of 1/25,000 accurate digital topographic map for the southern region of Bhutan, a relatively flat area where agricultural land maintenance and infrastructure maintenance are prioritized as a policy for economic development of Bhutan, but a same scale map covering the remaining northern and central areas has not yet been created. The remaining areas include the residential areas of the capital, and many locations of past disaster areas, even though disaster prevention is an urgent issue waiting to be solved. Also, for planning disaster prevention for urban areas, a topographic map with precise representation of land-use is needed, but a map in the scale of 1/5,000 as large-scale topographic map is not yet created. Rapid creation of digital topographic map is in demand, so that GOB can utilize it for planning and analysis of disaster prevention and water resource management, which GOB must act urgently.

Under these circumstances, GOB requested Government of Japan (hereinafter referred to as "GOJ") for grant aid assistance for the project to develop digital topographic map (hereinafter referred to as "the Project") in northern and central regions of Bhutan that targets urgent areas including residential areas and past disaster areas with a map scale of 1/25,000 and urban areas with a map scale of 1/5,000.

2. Outline of the Preparatory Survey and Contents of the Project

At the request of GOB, the Japan International Cooperation Agency (JICA) has decided to conduct a survey for the project for the development of digital topographic map in Bhutan. The 1st survey was conducted in December 2020, and the 2nd survey was conducted in April and May 2021. In the outline design of the Project, the optimal plan was formulated as a result of discussions with the Bhutan side on various aspects such as technical aspects, cost aspects, maintenance capability, etc. The basic policy is to define map areas so that the maps to be created can be used as basic data in the preparation of various development plans required for "disaster risk management" and "water resource management," the issues that need to be addressed urgently in Bhutan, and to design a project to ensure wide use of its outputs in Bhutan. The outline of the Project is shown in the table below.

Outline of the Project

Overall Goal	Contributing to reduce the vulnerability against deteriorating living environment
Project Objective	Maintaining the geospatial information for policy making towards the disaster prevention countermeasure and natural resource management by developing the digital topographic map of northern and central region (1/25,000 scale) and major cities (1/5,000 scale)
Project Site	Northern and Central Regions of Bhutan
Products	➢ Digital Topographic Map - 1/25,000 Digital Topographic Map (includes 10m mesh DEM) Mapping Areas: Approx. 17,271 km^2 (Northern and Central Regions of Bhutan) - 1/5,000 Digital Topographic Map (includes 5m mesh DEM) Mapping Area: Approx. 500 km^2 (Major urban areas) ➢ Satellite Image - Ground Sample Distance 1.5 m class Satellite Images Procurement areas: Approx. 17,686 km^2 - Ground Sample Distance 0.5 m class Satellite Images Procurement areas: Approx. 1,066 km^2
Consulting Service	➢ Detailed Design ➢ Support of Tender ➢ Supervision of Procurement

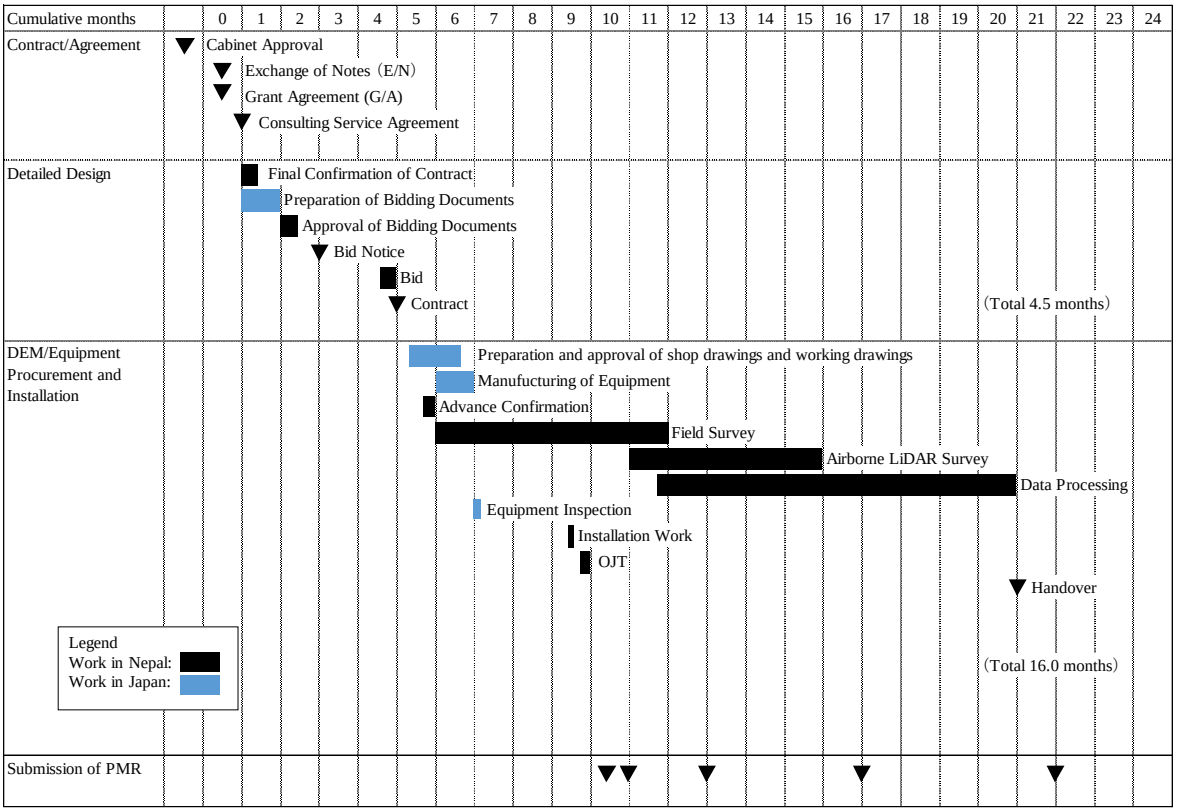
Source：JICA Survey Team

3. Implementation Schedule and Cost Estimation

Based on the Guidelines of Japan's Grant Aid, the Project implementation schedule is as shown in the table below. The required period for the Project is approximately 4.5 months for the implementation design stage and approximately 19 months for the implementation of the digital topographic mapping and equipment procurement, for a total of approximately 23.5 months.

The Project cost to be borne by Bhutan side is 204 million yen, and the cost to be borne by Japanese side is confidential until all the contracts of the Project are concluded.

Project Implementation Schedule



Source: JICA Project Team

5. Project Evaluation

(1) Relevance

GOB sets “Climate and Disaster Resilient Development” and “Sustainable Water” as an urgent goal, and is working toward strengthening disaster prevention measures and water resource conservation. Analysis towards policy planning requires reliable geospatial information as basis. As for central and northern areas, creating topographic maps for urgent areas including residential areas of the capital, and many locations of past disaster areas, will contribute to to the planning and analysis of disaster prevention countermeasure and water resource management, which need be addressed urgently by GOB. If the area that had been developed in the Previous Project in southern Bhutan is added to the area to be developed in the Project, the coverage of the 1/25,000 digital topographic maps will reach approx. 80 % of the entire Bhutan. In addition, the mapping of populated areas shall be prioritized. Therefore, many Bhutanese shall benefit from the implementation of the Project.

GOB has set the targets of creating 1/25,000 digital topographic maps of the entire country and 1/5,000 digital topographic maps covering 3,435 km^2 mainly in urban areas in the 12th FYP. The implementation of the Project will contribute to the achievement of these targets of the development plan of Bhutan. For these reasons, the relevance of the Project can be concluded.

(2) Effectiveness

The implementation of the Project is expected to create the effects shown in the table below. The

actual indicator values in 2019, before the implementation of this outline design survey, are used as the reference values. The indicator values to be achieved three years after the completion of the Project are used as the target values.

Quantitative Effects obtained by Implementation of the Project

Indicator	Reference value (actual value in 2020)	Target value (in 2026) 3 years after completion
The number of Dzongkhag where digital topographic map is used for flood hazard assessment	0 cases	3 cases
The number of downloads of digital topographic maps from NLCS's website	4 times	137 times

Source: JICA Project Team

The implementation of the Project is expected to produce the following qualitative effects.

- Improvement of capability for disaster management by efficient preparation of disaster risk analysis map and city planning map
- Effective selection of the construction site and promotion of prompt construction for dam and irrigation system by identification of catchment area using the latest digital topographic map and digital elevation model

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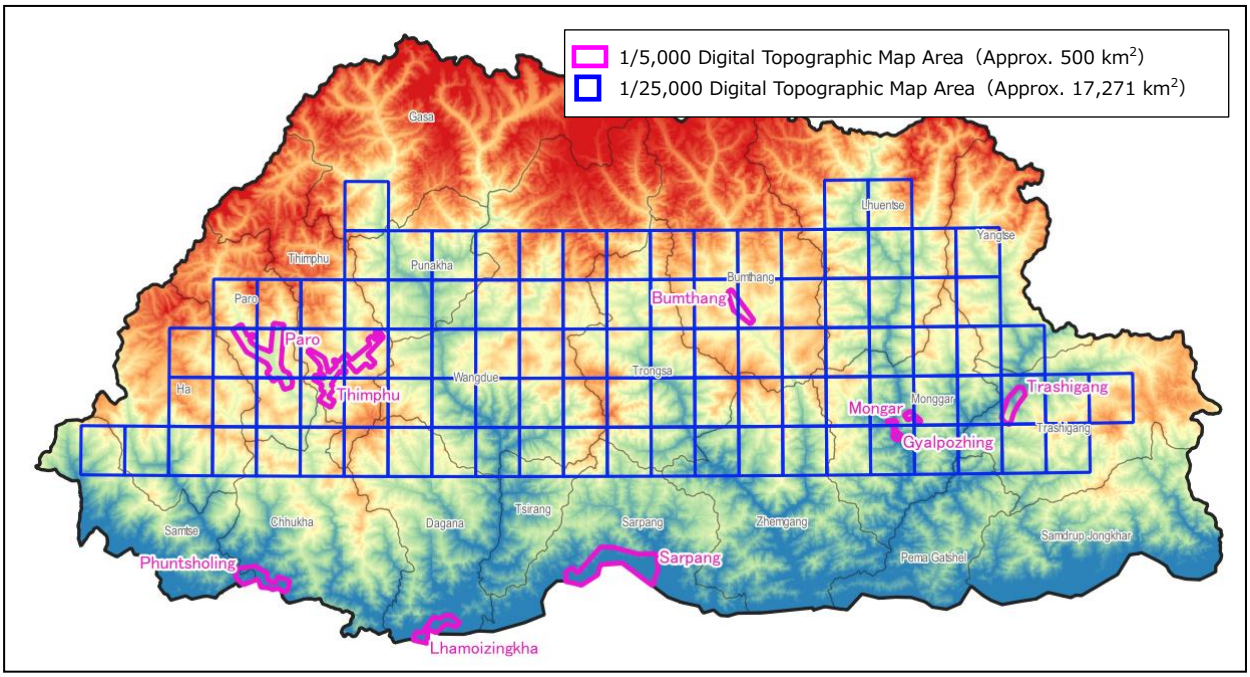
1 USD (US Dollar) = 106.16 JPY (Japanese Yen)

1 BTN (Bhutan Ngultrum) = 1.58688 JPY

Location Map



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Abbreviations

A/P	Authorization to Pay
B/A	Banking Arrangement
BTN	Bhutan Ngultrum
CGISC	Centre for Geographic Information System Coordination
DAC	Development Assistance Committee
DEM	Digital Elevation Model
E/N	Exchange of Note
FEMD	Flood Engineering Management Division
G/A	Grant Agreement
GI	Geo-Information
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Flood
GNHC	Gross National Happiness Committee
GNSS	Global Navigation Satellite System
ICIMOD	International Centre for Integrated Mountain Development
JICA	Japan International Cooperation Agency
MoAF	Ministry of Agriculture and Forest
MoWHS	Ministry of Works and Human Settlement
NCHM	National Center Hydrology and Meteorology
NKRA	National Key Result Areas
NLCS	National Land Commission Secretariat
NSDI	National Spatial Data Infrastructure
RPC	Rational Polynomial Coefficients

Chapter 1 Background of the Project

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1-1 Background and Outline of Grant Aid Assistance

In recent years, global climate change has caused glacial lake outburst flood in Bhutan, resulting in increased numbers of meteorological disasters such as flood disaster, flash flood, cyclones, and seasonal storms. Not only have the storm disasters that occurred between 2011 and 2013 destroyed many houses, floods/flash floods that have caused the greatest damages in terms of total number of deaths, have occurred 26 times between 2015 and 2019. Natural disasters are becoming a great risk for the safety and everyday lives of people in Bhutan. Also, climate change has led to issues such as rapid water depletion, and water resource management for water shortage needed to meet the demands for the increase of drinkable water due to rapid population increase in the urban areas.

Such issues led to GOB to set "Climate and Disaster Resilient Development" and "Sustainable Water" as urgent goals. These goals were based on 12th FYP and the government organizations are working to strengthen the disaster prevention measures and water resource conservation, and such. For instance, the Department of Human Settlement (DHS) under the Ministry of Works and Human Settlement (MoWHS) is creating flood hazard maps, National Land Commission (NLC) is implementing the national land use zoning based on the information on land use regulations for disaster risk management, and National Center for Hydrology and Meteorology (NCHM) is creating a water source inventory.

On the other hand, most of the analysis towards policy planning will require reliable geospatial information as a basis. The topographic map that covers the whole country was created in 1960 with a scale of 1/50,000. However, since the information have been outdated and unreliable, and have not been suitable for the measurement and the analysis, it has made difficult for GOB to prepare the policies. In order to solve these issues, GOB has decided to create 1/25,000 of geospatial information for the whole country by June of 2023 for the 12th FYP. Through a technical cooperation project from 2015 to 2017 called "Project on Development of National Geo-Spatial Data in Bhutan", for capacity building for creating topographic map and map symbol specification, Japan has assisted in the creation of 1/25,000 accurate digital topographic map for the southern region of Bhutan, a relatively flat area where agricultural land maintenance and infrastructure maintenance are prioritized as a policy for economic development of Bhutan, but a same scale map covering the remaining northern and central areas has not yet been created. The remaining areas include the residential areas of the capital, and many locations of past disaster areas, even though disaster prevention is an urgent issue waiting to be solved. Also, for planning disaster prevention for urban areas, a topographic map with precise representation of land-use is needed, but a map in the scale of 1/5,000 as large-scale topographic map is not yet created. Rapid creation of digital topographic map is in demand, so that GOB can utilize it for planning and analysis of disaster prevention and water resource management, which GOB must act urgently.

Under these circumstances, GOB requested GOJ for grant aid assistance for the project to develop

digital topographic map in northern and central regions of Bhutan that targets urgent areas including residential areas and past disaster areas with a map scale of 1/25,000, and urban areas with a map scale of 1/5,000. The purpose of the preparatory survey (hereinafter referred to as "the Survey") was to confirm the necessity and appropriateness of the request, to make an appropriate outline design as a grant aid project, to formulate a project plan, and to estimate the outline project cost. The contents of the request are shown in Table 1-1.

Table 1-1 Contents of the Request

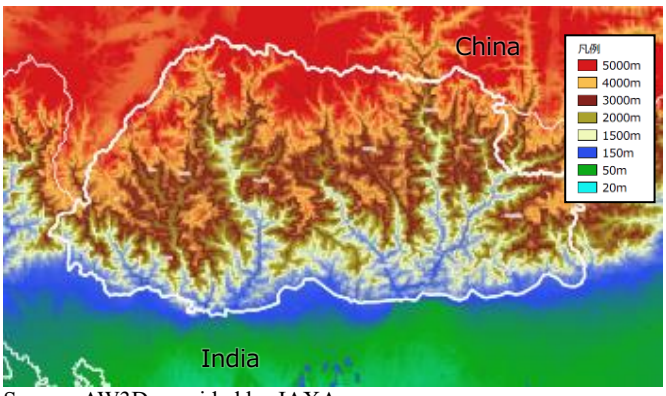
Year of request	2018
Objective	1/25000 Digital Topographic Mapping of Northern and Central Regions of Bhutan(approx. 27,800km^2)
Contents of the Request	● 1/25,000 Digital Topographic Map ● Ground Sample Distance 1.5m class Satellite Image ● Maintenance of Digital Topographic Map

Source: JICA Survey Team

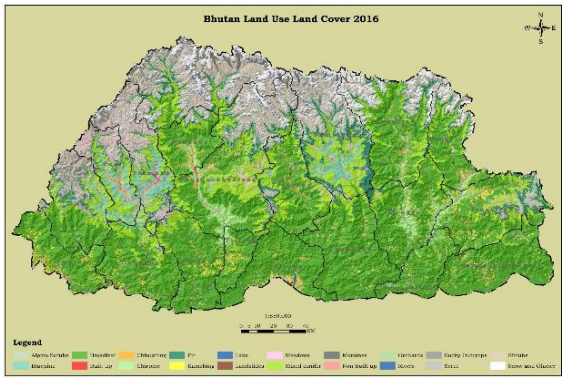
1-2 Natural Conditions

(1) Topography

Bhutan is a landlocked country located on the southern slopes of the eastern Himalayas. The land area is approximately 38,394 km^2, and the elevation ranges from about 150 m in the southern Indian border area to about 7,500 m in the northern Chinese border area, with a huge difference in elevation in the north-south direction. The active uplifting caused by the Himalayan orogenic movements during the Tertiary and Quaternary periods and the resulting river erosion formed a steep mountainous terrain. Most of the country is mountainous, with only a few plains in the border region with India in the southern part of the country, which lies on the northern edge of the Assam plains. Because of these topographical features, approximately 71% of the country is covered by forests. Other land cover includes 13% shrubland (including 3% alpine shrubs), 5% glacier and year-round snow, 4% rocky, 3% meadows, 3% cultivated agricultural land, and less than 1% water bodies and built-up areas. Figure 1-1 shows the color elevation map and land use/land cover maps of Bhutan.



Source: AW3D provided by JAXA
Color Elevation Map



Source: Land Use and Land Cover of Bhutan 2016 (MoAF)
Land Use/Land Cover Map

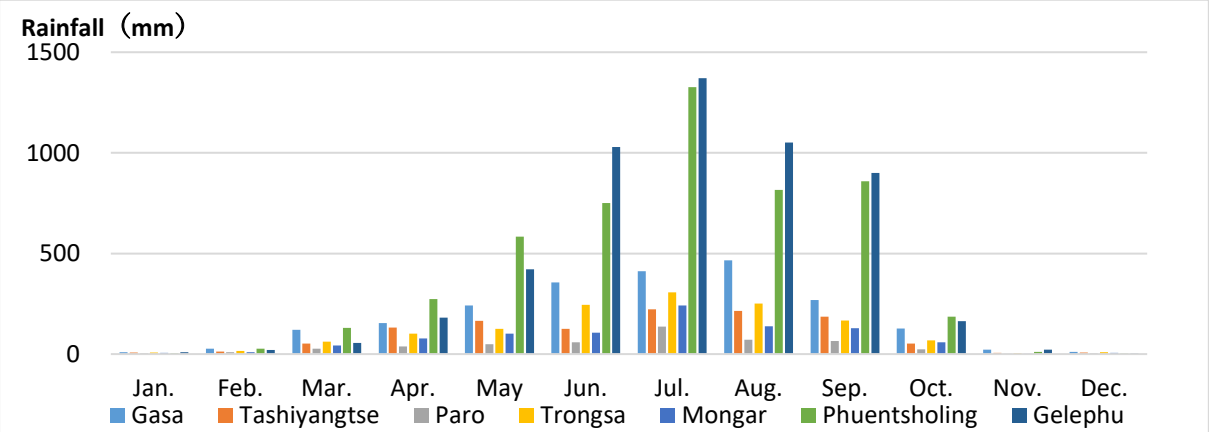
Figure 1-1 Color Elevation Map and Land Use/Land Cover Map of Bhutan

(2) Climate

Bhutan has a wide variety of climates due to the topographical features such as the large differences in elevation from north to south and the many river valleys, and the climate is classified into the major categories as follows.

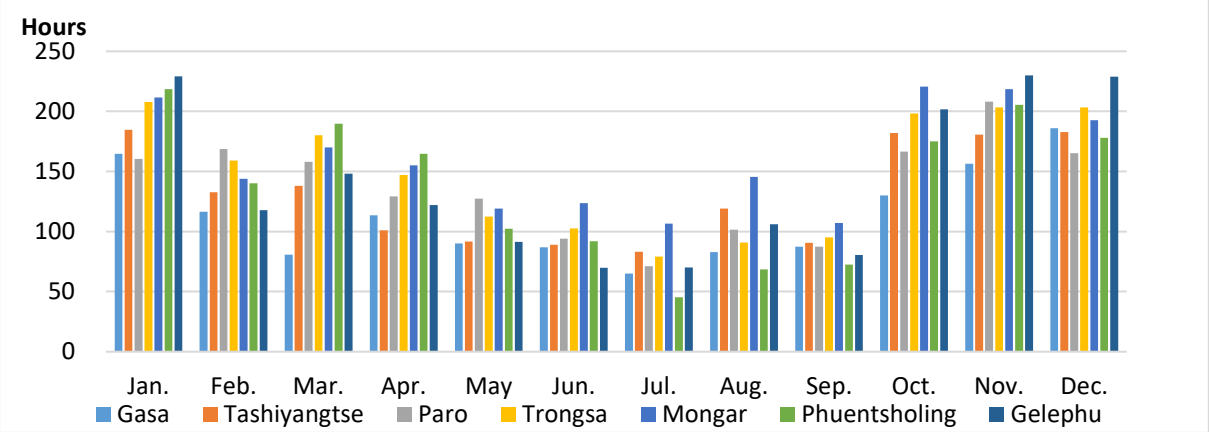
- Alpine climate in the northern Himalayas (over 4,000 m above sea level)
- Monsoon climate in the central mountainous region (2,000-4,000 m above sea level)
- Subtropical climate in the southern hilly areas and lowlands (150-2,000 m above sea level)

Figure 1-2 and Figure 1-3 show the average monthly rainfall and sunshine hours for each cities from 2015 to 2019. From these figures, June - September is classified as the rainy season and October - May as the dry season. Whereas, the monsoon climate zone in the central part of the country, including the capital city Thimphu, has four seasons similar to Japan. The southern cities of Phuntsholing and Gelephu, which are adjacent to the Indian border, have subtropical climates and much more rainfall during the rainy season (June - September) than the northern and central region, so the risk of flooding is also relatively high. As the area of 1/5,000 digital topographic map includes these two cities, it is necessary to pay attention to the period of carrying out the field work.



* The data from 2016 to 2019 is for Phuntsholing
Source: NCHM

Figure 1-2 Average Monthly Rainfall from 2015 to 2019



* The data from 2017 to 2019 is for Gasa (2018-2019 on January and February), and Phuntsholing (2018-2019 on January and March, and 2019 on February)
Source: NCHM

Figure 1-3 Average Monthly Sunshine from 2015 to 2019

1-3 Environmental and Social Considerations

The Project is a digital topographic mapping project using satellite images and does not involve construction work, so there is no effect given to the natural and social environment around the Project site.

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

The objective of the Project is to maintain the geospatial information for policy making towards the disaster prevention countermeasure and natural resource management by developing the digital topographic map of northern and central region (1/25,000 scale) and major cities (1/5,000 scale), thereby contributing to reduce the vulnerability against deteriorating living environment.

The above goals are consistent with the development issues and policies of Bhutan and "The Country Assistance Policy for Bhutan" prepared in 2015 by GOJ for development cooperation with the Kingdom of Bhutan. Therefore, the necessity for implementation of the Project is high.

The outline of the Project confirmed with the Bhutan side in the Survey is shown in Table 2-1. As the technology for the development and maintenance of digital topographic maps and for their publication and distribution will be transferred to National Land Commission Secretariat (hereinafter referred to as "NLCS") in the technical cooperation project, "Project for Promotion of Utilization of Geospatial Information through Development of National Spatial Data Infrastructure (hereinafter referred to as 'the TCP')," to be implemented concurrently with the Project, the Project shall not have a soft component as technical assistance. As the sum of the areas of digital topographic map to be developed in the Project and the TCP is smaller than the target mapping area mentioned in the 12th FYP, GOB will have to make self-help efforts in the mapping, including the formulation of an implementation plan by NLCS, after the completion of the Project.

Table 2-1 Outline of the Project

Overall Goal	Contributing to reduce the vulnerability against deteriorating living environment
Project Objective	Maintaining the geospatial information for policy making towards the disaster prevention countermeasure and natural resource management by developing the digital topographic map of northern and central region (1/25,000 scale) and major cities (1/5,000 scale)
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Consulting Service	➢ Detailed Design ➢ Support of Tender ➢ Supervision of Procurement

Source：JICA Survey Team

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

The purpose of the Project is to create 1/25,000 digital topographic maps of northern and central regions of Bhutan and 1/5,000 digital topographic maps of major urban areas. The basic policy is to define map areas so that the maps to be created can be used as basic data in the preparation of various development plans required for "disaster risk management" and "water resource management," the issues that need to be addressed urgently in Bhutan, and to design a project to ensure wide use of its outputs in Bhutan.

i) A priority order for mapping area shall be established among the mapping purposes based on the contribution of each purpose to the mitigation of the vulnerability of social and economic infrastructure of Bhutan, and mapping areas shall be selected based on the priority order.

ii) Stereo plotting of satellite images shall be used for data acquisition. The Ground Sample Distance (GSD) of the images shall be the size enough to satisfy the required specifications of the digital topographic maps to be created, *i.e.*, approx. 1.5 m for the 1/25,000 maps and approx. 0.5 m for the 1/5,000 maps.

iii) The map symbol specifications and product specifications established in the Previous Project shall be followed in the 1/25,000 digital topographic mapping in the Project, in principle.

iv) The map symbol specifications and product specifications for the 1/5,000 digital topographic maps shall be developed in the discussions between the Bhutanese and Japanese sides based on the draft specifications used in the pilot project by NLCS.

v) Data formats appropriate to use on GIS and as printed maps shall be determined.

(2) Policy on Natural Conditions

1) Meteorological Conditions

Bhutan has a rainy season between June and September and a dry season between October and May. A satellite image covers a wider area than an aerial photograph. As a satellite is orbiting the earth, the chance of capturing an image of a specific area from it is limited. For these reasons, meteorological conditions have a larger impact on the quality of satellite imagery than aerial photography. The comparison of the average monthly sunshine duration in the five years between 2015 and 2019 collected in this survey has revealed that the durations in April and following months are shorter than the duration in March in certain areas (see Figure 1-3). This finding suggests that the best periods of taking satellite image are between October and March.

2) Natural Disasters

As most of the land of Bhutan is in precipitous mountainous areas, disasters, including landslides, slope failures, rock falls, and floods/flash floods, occur in the country. Most of these disasters occur in the rainy season. Therefore, field work such as control point surveying and field identification are at risk of being involved in natural disasters, and considering the rainy season, the best time for field work is between October and March.

(3) Policy on Social Conditions

1) Transportation

The road network in Bhutan has many topographical constraints, and the main trunk roads consists of the National Highway No. 1 (Northern East-West Corridor) that connects Thimphu and Trashigang through Punakha, Trongsa, and Mongar and secondary roads that branch to the north and south from the highway. While the length of paved roads has been on the increase, most of the roads are one-lane roads. Therefore, long travel time needs to be considered in planning the field work.

2) Security

Few cases of kidnappings occurred near the border with India in Sarpang Dzongkhag, southern Bhutan until 2015. The entry of persons involved in JICA projects in certain areas in Bhutan is prohibited or restricted. This security situation shall be considered in the planning of the field work, including the control point surveying and field identification, for the 1/5,000 digital topographic mapping.

(4) Policy on Surveying Works

1) Field work

The field work shall consist of the control point survey and field identification. The Contractor shall be responsible for the work. The staff of NLCS shall accompany the Contractor to the worksites as assistants of the Contractor and explain the work to relevant organizations and residents near the sites. The Contractor and NLCS collect information together at the sites.

As for selecting pricking points for control point survey. NLCS shall acquire permission to enter private land for the GNSS observation and preserve pricking points, while the Contractor shall select the points and conduct the observation at the points. The permission of residents shall be obtained for the entry into private land for the field identification and the observation at pricking points. Permanent structures shall be selected as pricking points, if possible, to secure the ease of conservation and safety of the points for the observation work. When moving to and from the existing control points and pricking points, and when moving during the field identification, in principle, the Contractor shall travel together with NLCS staff, give full consideration to the road conditions, and pay sufficient attention not to be involved in traffic accidents.

2) Policy on Use of Local Contractors

The interview at NLCS has revealed that local survey companies in Bhutan are small and cannot implement a public survey in compliance with the Survey Act. Therefore, in principle, the field work in the Project shall not be subcontracted to local contractors. Instead, the Contractor shall implement it with the assistance of NLCS to ensure safety management, schedule control, and quality control.

3) Policy on Transfer of Data out of Bhutan

NLCS has agreed with JICA Survey Team on the transfer of the data collected in the field work out of Bhutan on the condition, "Data shall be transferred through JICA." As this agreement will allow the data transfer from Bhutan, in principle, it will be possible to implement the work in Japan.

(5) Policy on Operation and Maintenance

The digital topographic maps (1/25,000 and 1/5,000) to be created in the Project will be used for disaster risk management and water resource management in Bhutan. NLCS will have to update the digital topographic maps regularly or as required, including corrections for changes over time, to keep the data fresh. NLCS will also have to plan for development of 1/25,000 digital topographic maps of the unmapped areas to achieve the goal of the 12th FYP of fulfilling completion of the entire territory's 1/25,000 topographic mapping.

As the technology required for the creation and updating of digital topographic maps was transferred to NLCS in the Previous Project and will also be transferred to NLCS during TCP which will be implemented concurrently with the Project, the Project shall not have a soft component for the provision of technical assistance. Therefore, a system shall be developed in the Project to enable the staff of NLCS who have learned the basic and advanced mapping technology in the TCP to maintain the digital topographic maps after the completion of the Project using the equipment owned by NLCS and provided in the TCP. As an efficient map maintenance method and a cooperation system with other relevant organizations are planned to be established in the TCP, a map maintenance plan shall be prepared under consultancy of the TCP.

(6) Policy on Procurement of Satellite Image

Satellite images shall be procured in the Project. The images that satisfy the specifications shown in Table 2-2 shall be procured for the creation of the digital topographic map and Digital Elevation Model (DEM).

Table 2-2 Specifications of Satellite Image Required for Digital Topographic Mapping

Item	Description
GSD	・ For 1/25,000 digital topographic mapping: equivalent to GSD of 1.5 m ・ For 1/5,000 digital topographic mapping: equivalent to GSD of 0.5 m
Image Quality	・ Pan-sharpened images captured as stereo pairs ・ Images captured in good meteorological conditions with few shadows of topography and features ・ Clear images that allow interpretation of shapes, positions, and attributes of features required for the creation of digital topographic map and DEM

Item	Description
Positional Accuracy	・ Images that ensure the satisfaction of the standards for positional accuracy required of digital topographic maps at given scales
License	・ License from the supplier for the use of images by a sufficient number of end-users
Miscellaneous	・ Images shall have appropriate overlaps to enable connection of the digital topographic map to be developed in the Project with adjacent areas such as existing maps and unmapped area. ・ When it is unavoidable to use satellite images (archives) that have been taken in the past, secure changes on the required quality of the created topographic maps (deliverables of the Project) shall be considered.

Source: JICA Survey Team

The satellite images to be procured in the Project will be used for creating 1/25,000 and 1/5,000 digital topographic map and DEM. Organizations that are registered as the end-users in the Project shall be allowed to use the procured images and create other products, including orthophoto, from them. An operation and maintenance plan shall be formulated for the use of these deliverables by relevant organizations and the citizens of Bhutan. The following points shall be noted in the plan formulation.

- Procure satellite images after securing a necessary and sufficient number of their end-users,
- Accurately understand the coverage of license for each deliverable created from satellite images, and obtain the appropriate license from the distributor at the time of procurement.

(7) Policy on the Cost for the Prevention of COVID-19 Infection

Due to the recent spread of COVID-19, measures to control the pandemic are taken in various countries (including countries of transit and project implementation), and quarantine and other measures are being taken when entering the country.

Therefore, the cost for COVID-19 prevention (labor cost, direct expense, and overhead) required for the travel to and work in Bhutan by the Consultant and Contractor staff for the Project shall be included in the Project cost.

2-2-2 Basic Plan

2-2-2-1 Digital Topographic Mapping Areas

(1) 1/25,000 Digital Topographic Mapping Area

In contrast to the originally envisaged area of 18,900 km^2, GOB requested that the entire 27,800 km^2 area not yet covered by the 1/25,000 digital topographic map be covered, excluding the 11,000 km^2 area in southern Bhutan that had already been covered by the Previous Project. JICA Survey Team proposed that the Bhutan side specify the areas that urgently need topographic maps, and the NLCS, the executing agency, eventually requested to cover an area of about 19,853 km^2. Based on the request, JICA Survey Team clarified criteria and priority areas for the selection of the map areas and examined the relevance of the mapping in the Project.

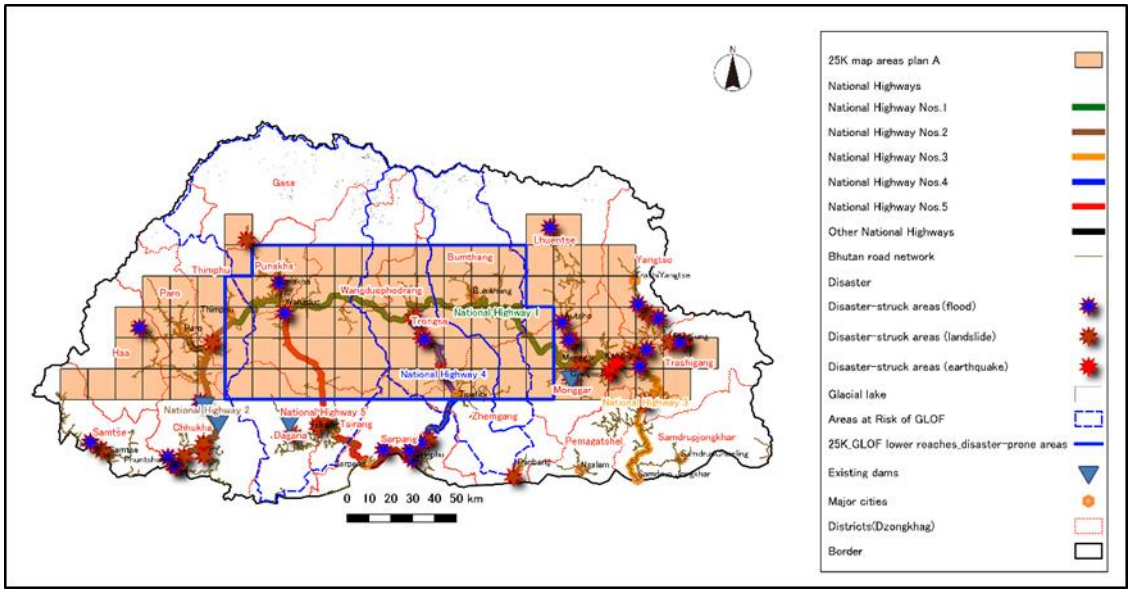
Various development plans, including disaster prevention plans, urban development plans,

infrastructure development plans, and agricultural land development plans are required for achieving National Key Result Areas (NKRA) of the 12th FYP, “climate and disaster resilient development” and “water security”. Areas essential for these development plans were defined as proposed map areas. In order to select the proposed areas, target items requiring digital topographic maps were classified as shown in Table 2-3. For each classified item, the map sheets including the item was selected. Then, areas of relatively low urgency were excluded from the selection, and the 1:25,000 digital topographic mapping area (total 101 sheets, 17,271 km^2) was finalized. Figure 2-1 shows the development area.

Table 2-3 Classification of Proposed Map Areas

No.	Items that require digital topographic map	Purpose
1	Residential Areas	Disaster Risk Management
2	Major Trunk Roads (National Highways No. 1 - 5)	Disaster Risk Management
3	Past Disaster Areas (floods, landslides, etc.)	Disaster Risk Management
4	Areas at Risk of Glacial Lak Outburst Flood (GLOF)	Disaster Risk Management/Water Resource Management
5	Existing and Planned Dam Sites (for power generation)	Disaster Risk Management/Water Resource Management

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2-1 1/25,000 Digital Topographic Mapping Areas in the Project

(2) 1/5,000 Digital Topographic Mapping Area

The 1/5,000 digital topographic maps are expected to be used for disaster risk reduction and management and water resource management as same as the 1/25,000 maps. They are also expected to be used for more detailed development planning, including urban planning and planning of the development of infrastructure, including public facilities.

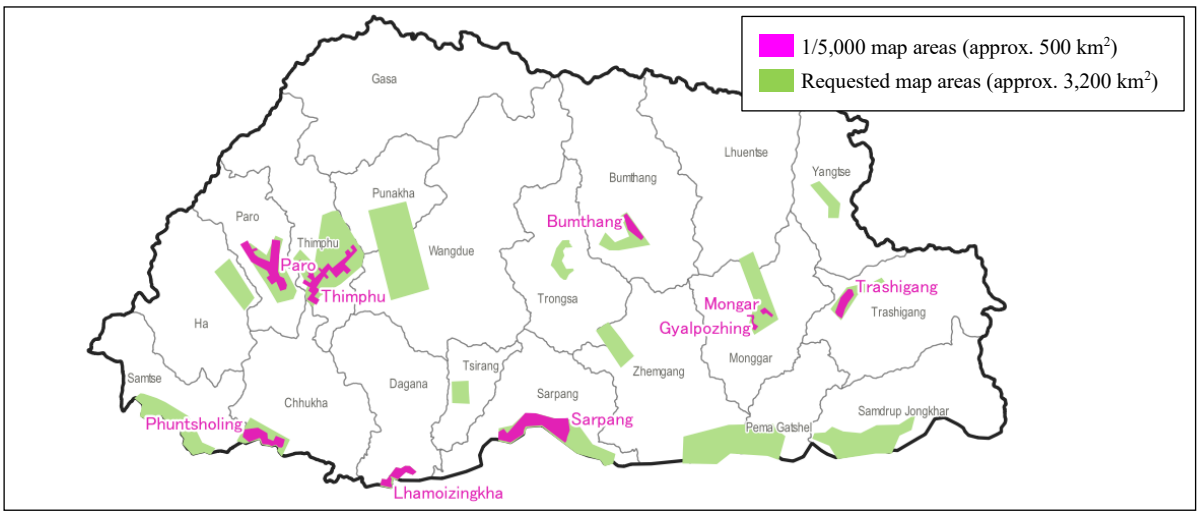
NLCS requested assistance in 1/5,000 digital topographic mapping of an area of approx. 3,200 km^2, equivalent to what is mentioned in the 12th FYP, to GOJ. As there was an area difference between this area and the mapping area of 500 km^2 of the plan of the Japanese side, the Survey team requested NLCS to set a priority order among the proposed cities and re-examine the mapping areas. In response to the request of the team, the NLCS proposed the results of a re-examination of the areas to be developed.

The two parties agreed that the area of the 1/5,000 digital topographic mapping in the Project should be 500 km^2 as originally planned based on the discussions. The priorities were determined by the Bhutan side in consideration of the importance and future development prospects in the region, based on population, key industries, and the potential development scale in domestic trade. Table 2-4 shows the priority ranks of the proposed cities. Figure 2-2 shows the areas of which 1/5,000 digital topographic maps shall be created in the Project. Priority "A" is planned to be developed in the Project.

Table 2-4 Proposed Cities for 1/5,000 Digital Topographic Map

No.	City	Dzongkhag	Thromde Rank	Priority Rank
1	Bumthang	Bumthang	Dzongkhag Thromde	A
2	Phuntsholing	Chukha	Dzongkhag Thromde	A
3	Autsho	Lhuentse	Yenlag Thromde	C
4	Mongar	Mongar	Dzongkhag Thromde	A
5	Gyalpozhing	Mongar	Yenlag Thromde	A
6	Paro	Paro	Dzongkhag Thromde	A
7	Nganglam	Pemagatshel	Regional Hub	C
8	Punakha	Punakha	Dzongkhag Thromde	*1
9	Samdrup Jongkhar	Samdrup Jongkhar	Dzongkhag Thromde	C
10	Samdrup Choling	Samdrup Jongkhar	Yenlag Thromde	C
11	Dewatang	Samdrup Jongkhar	Dzongkhag Thromde	C
12	Samtse	Samtse	Dzongkhag Thromde	*1
13	Gelephu	Sarpang	Gyelyong Thromde	A*2
14	Sarpang	Sarpang	Yenlag Thromde	A
15	Lhamoizingkha	Dagana	Yenlag Thromde	A
16	Thimphu	Thimphu	Dzongkhag Thromde	A
17	Trashigang	Trashigang	Dzongkhag Thromde	A
18	Kanglung	Trashigang	Regional Hub	A*3
19	Rangjung	Trashigang	Yenlag Thromde	C
20	Trashiyangtse	Trashiyangtse	Dzongkhag Thromde	B
21	Tsirang	Tsirang	Dzongkhag Thromde	B
22	Wangdue Phodrang	Wangdue Phodrang	Dzongkhag Thromde	*1
23	Tingtibi	Zhemgang	Yenlag Thromde	B
24	Panbang	Zhemgang	Yenlag Thromde	C

*1 Cities in which the pilot project was implemented.
*2 The Mapping Area of "Sarpang" includes "Gelephu".
*3 The Mapping Area of "Trashigang" includes "Kanglung".
Source: NLCS



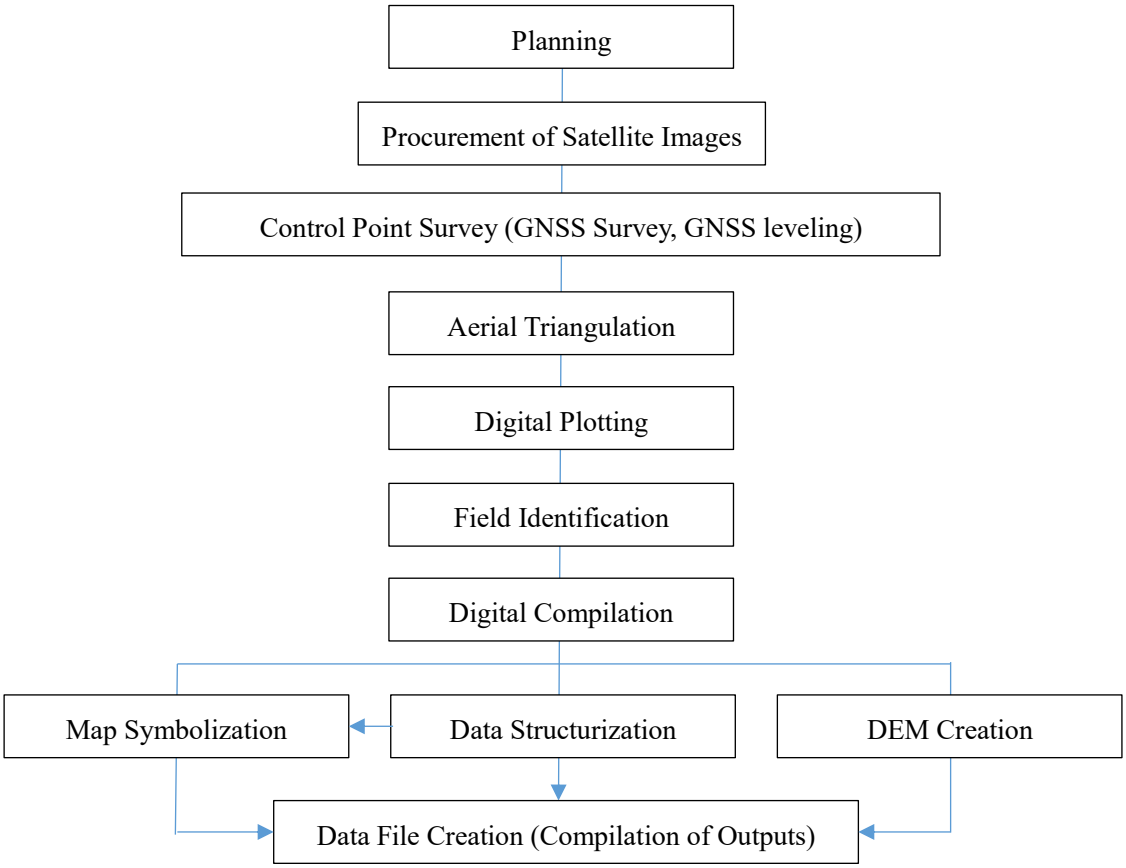
Source: JICA Survey Team

Figure 2-2 Cities and Areas of which 1/5,000 Digital Topographic Map are to be created

2-2-2-2 Plan for Designing Digital Topographic Map

(1) Workflow

Figure 2-3 shows the workflow of the digital topographic mapping in the Project. The same workflow shall be used for both 1/25,000 and 1/5,000 mapping.



Source: JICA Survey Team

Figure 2-3 Workflow of Digital Topographic Mapping

(2) Conditions for Digital Topographic Mapping

1) Applicable Standards

The "Survey Manual" prepared by NLCS as the guidelines for surveying in Bhutan and "Survey Regulation" prepared in the Previous Project as the regulations for surveying shall be used as standards in the surveying and digital topographic mapping in the Project. Regarding "Survey Regulation", survey work types, work processes, and accuracy standard are described in accordance with Japan's regulation for surveying ("Standards for Operating Specifications for Public Surveying", "Work Specifications for National Base Mapping (Draft)").

For matters not mentioned in the "Survey Manual" and "Survey Regulation", relevant provisions of the Japan's "Standards for Operating Specifications for Public Surveying (Notifications No. 413 of 2008 and No. 461 of March 2020 (partial revision) of the Ministry of Land,

Infrastructure, Transport, and Tourism)" (hereinafter referred to as "the Standard"), "Explanation and Use of the Standards for Operating Specifications for Public Surveying", and JICA's "Work Specifications for National Base Mapping (Draft)" shall apply.

2) Survey Standards and Measurement Unit

The survey standards in Bhutan are shown in Table 2-5. The "DRUKREF 03" geodetic system used for Bhutan is based on ITRF2000 as the geodetic coordinate system, GRS80 as the reference ellipsoid, and DrukGeoid 2015 as the geoid model. Transverse Mercator projection is adopted as the projected coordinate system. The digital topographic maps to be developed in the Project shall also apply this survey standards. The unit of distance shall be metric, commonly used in Bhutan.

Table 2-5 Surveying Standards of Bhutan

Item	Definitions
Geodetic Datum	Name: DRUKREF 03 Geodetic Coordinate System: ITRF2000 Reference Ellipsoid: GRS80 - Semi-major axis: 6,378,137 m - Semi-minor axis: 6,356,752.31414035 m - Flattening: 1/298.2572221 Geoid: DrukGeoid 2015
Projected Coordinate System	Projection: Transverse Mercator - False Easting: 250,000 m - False Northing: 0 m - Central Meridian: 90° - Latitude of Origin: 0° - Scale factor: 1.0
Unit of Distance	Meters (m)

Source: NLCS

3) Specifications for Digital Topographic Mapping

Table 2-6 shows the specifications to be satisfied by the digital topographic mapping in the Project.

Table 2-6 Specifications for Digital Topographic Mapping

Item		Specifications
Digital Topographic Map (1/25,000)	Mapping area	Northern and Central Regions of Bhutan
	Size of mapping area	Approx. 17,271 km^2
	Map symbol specifications	In accordance with "Map symbols regulation for 1/25,000 Scale Digital Topographic Maps".
	Product specifications	In accordance with "Data Product Specification for Fundamental Geospatial Data (Scale 1/25,000) Prototype Ver.0".
	File formats	ESRI file geodatabase, MXD, and PDF*
	Map sheet size	7.5' x 7.5' grid
	DEM	10 m x 10 m grid (to be created automatically from contour data)
Digital Topographic Map (1/5,000)	Mapping area	Major urban areas
	Size of mapping area	Approx. 500 km^2
	Map symbol specifications	New specifications shall be prepared referred to the specifications for the 1/25,000 maps.
	Product specifications	New specifications shall be prepared referred to the specifications for the 1/25,000 maps.
	File formats	ESRI file geodatabase, MXD, and PDF*

Item		Specifications
	Map sheet size	2,462 m × 2,770 m-grid (Provisional, instructed by NLCS)
	DEM	5 m x 5 m grid (to be created automatically from data of contours and breaklines)
Satellite image (GSD 1.5 m class)	Area to be covered by procured images	Approx. 17,686 km^2
	GSD	1.5 m-equivalent
	Image capturing	October 2021 – March 2022
	Product type	Stereo-pair, pan-sharpened
	Cloud cover	5 % or less and without a cloud interfering with the plotting
	Number of end-users	Unlimited in Bhutan
	License, etc.	・Multi-license for free use and distribution of deliverables (in prints and data), including digital topographic map and DEM, only in Bhutan ・Image quality and positional accuracy shall be appropriate for digital topographic mapping.
Satellite image (GSD 0.5 m class)	Area to be covered by procured images	Approx. 1,066 km^2
	GSD	0.5 m-equivalent
	Image capturing	October 2021 – March 2022
	Product type	Stereo-pair, pan-sharpened
	Cloud cover	5 % or less and without a cloud interfering with the plotting
	Number of end-users	Unlimited in Bhutan
	License, etc.	・Multi-license for free use and distribution of deliverables (in prints and data), including digital topographic map and DEM, in Bhutan ・Image quality and positional accuracy shall be appropriate for digital topographic mapping.

* MXD and PDF refer to symbolized data represented as a map, including marginal information, etc. and can be used as a paper map by printing.

Source: JICA Survey Team

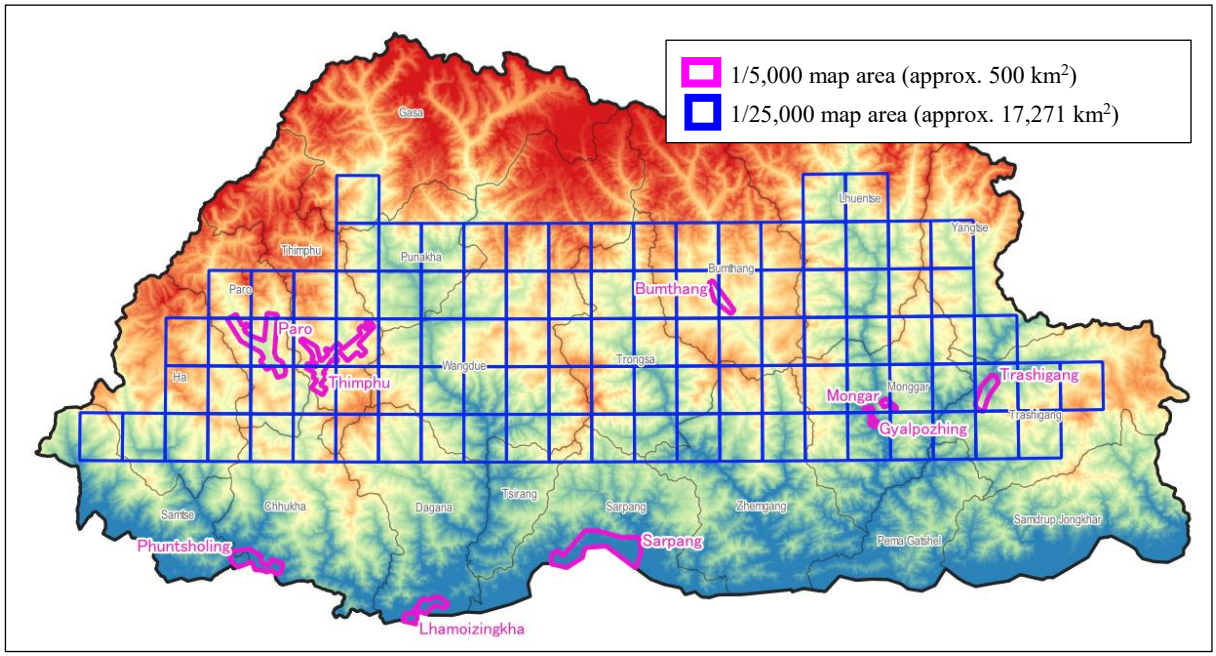
4) Project Site (Target Mapping Areas)

As described in the previous section, the area covered with the 1/25,000 digital topographic map is approximately 17,271 km^2 in northern and central regions of Bhutan, and that by the 1/5,000 map is approximately 500 km^2 in nine urban areas in Bhutan. Table 2-7 shows the conditions used for selecting the mapping areas at both scales. JICA Survey Team studied the needs presented by NLCS and the conditions in the table deliberately and selected the areas that satisfied the needs and conditions. Figure 2-4 shows the areas to be developed in the Project.

Table 2-7 Conditions for Selecting Mapping Areas

Scale	Selection Conditions
1/25,000	・ Mapping by map sheet area (all features in the map sheet area shall be plotted.) ・ An area in which an urgent need for the mapping is recognized for its contribution to the promotion of disaster risk management and water resource management
1/5,000	・ The cities with the highest priority shown in Table 2-4 as priority A are the target areas for development. (mapping is done on a map sheet by map sheet basis, but does not require plotting that covers all features in the map sheet area) ・ Areas, mostly in urban areas, in which the priority for the use of the maps for the preparation of various development plans, etc. is high

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2-4 Digital Topographic Mapping Areas

5) Warranty Period

The warranty period of the digital topographic maps shall be one year from the handing over of the Project deliverables (digital topographic maps produced in the Project). The warranty shall cover cases in which the Project deliverables do not satisfy the specifications. The Contractor shall correct the defects. Although the warranty will not cover changes that have occurred in topography and features after the satellite images were taken, in principle, only for infrastructure structures, including roads and power transmission lines that are under construction at the time of image taking, the Contractor shall reflect these on maps based on the reference materials provided by NLCS.

The inspection before the expiration of the warranty period was not originally planned to be implemented because all the deliverables of the Project will be data, which will not degrade over time. However, reviewing the condition of the effectiveness of the Project such as by checking for operational issues considering the situation of the budget and securing of personnel of the executing agency, and checking the status of IT environment for the utilization of digital topographic map, is also an important part of the inspection in addition with checking the defect correction done by the Contractor during the warranty period. Therefore, the necessity of carrying out the inspection shall be reconsidered before signing the consulting agreement.

(3) Plan for Digital Topographic Mapping

The Contractor shall implement the processes 1) to 10) of the digital topographic mapping in Japan and Bhutan, which are based on 1) Applicable standard in (2) Conditions for digital topographic mapping. Also, the map symbol specifications and product specifications for 1/25,000 digital topographic map conform to “Map symbols regulation for 1: 25,000 Scale Digital Topographic Maps”

and “Data Product Specification for Fundamental Geospatial Data (Scale 1/25,000) Prototype Ver.0”, established in the Previous Project. As for 1/5,000 digital topographic map, map symbol specifications and product specifications (the features to be acquired are already determined in the Survey) shall be determined during the detailed design stage.

1) Procurement of Satellite Image (Work in Japan)

The Contractor shall procure satellite images that satisfy the specifications provided in Table 2-6 and cover the entire project site (approx. 17,271 km^2 for the 1/25,000 mapping and approx. 500 km^2 for the 1/5,000 mapping) shown in Figure 2-4.

Because of the need to maintain consistency with terrain and planimetric features outside the mapping area, satellite imagery shall be purchased by extending 500 meters from the mapping area, satellite images extending 500m from the mapping area shall be purchased. Also, as a purchasing condition, minimum purchasing area and minimum purchasing width per 1 area is decided by the distributors. Since the digital mapping areas of each cities for the 1/5000 scale digital topographic map are narrow as shown in Figure 2-4, the purchasing area of the images will be about twice the area of the mapping area. Table 2-8 shows the quantity and use of the satellite images to be procured in the Project.

Table 2-8 Quantity and Use of Products to be Procured

No.	Product	Quantity	Use
1	Satellite Image (GSD 1.5 m class)	1 set	Satellite images for 1/25,000 digital topographic mapping area to be covered with procured images: approx. 17,686 km^2
2	Satellite Image (GSD 0.5 m class)	1 set	Satellite images for 1/5,000 digital topographic mapping area to be covered with procured images: approx. 1,066 km^2

Source: JICA Survey Team

2) Control Point Survey (Work in Bhutan)

The control point survey is carried out for an aerial triangulation of satellite images to create the stereoscopic images for the creation of the topographic maps. As a general rule, the positions of clear features on the satellite images will be confirmed on sites, and the pricking work will be performed to clearly indicate the positions on the satellite image, and the monumentation will not be performed. Control point surveys are classified into the following GNSS survey (determination of horizontal position) and GNSS leveling (determination of ground height).

・ **GNSS Survey**

In order to create topographic maps from satellite images, reference points are required for making the aerial triangulation. The control point survey is the work of observing the pricking points based on the existing triangulation points and permanent reference points for obtaining the coordinates. It is planned that 23 control points in the area of 1/25,000 digital topographic mapping, while 46 points in the area of 1/5,000 mapping will be established. The GNSS survey to set up the control points is planned to be carried out by the Contractor with the NLCS.

・ **GNSS Leveling**

To ensure the height accuracy of the 1/5,000 digital topographic maps, 30 elevation reference points shall be established in addition to the ground control points mentioned in the preceding paragraph. Taking into consideration of the precipitous topography in the mapping areas, the GNSS leveling shall be used for its efficiency in obtaining height data. The GNSS Leveling shall be carried out using two or more existing benchmarks and/or triangulation stations as given points near height reference points using GNSS receivers. In practice of GNSS leveling works, to acquire the heights of reference points by setting the GNSS receivers at the existing benchmarks and/or the triangulation stations and the reference points and heights shall be measured by conducting simultaneous static GNSS observation.

3) Aerial Triangulation (Work in Japan)

The satellite image product include an exterior orientation model called a rational polynomial coefficient (RPC) model derived from the satellite orbit information, etc. This RPC model is similar to the exterior orientation elements in the aerial photogrammetry and it is a file containing rational polynomial coefficients that link the satellite images to the ground surface. An RPC model is required for measuring three-dimensional coordinates of a feature on a satellite image (stereo plotting) in the digital plotting. However, as the accuracy of the model is not sufficient for creating topographic map in the Project, aerial triangulation is performed with the ground control points mentioned above in 2) and tie points (points observed on the image at the same location in multiple overlapping and adjacent satellite images) using specifically designed software to improve the accuracy of the model for the creation of 1/25,000 and 1/5,000 digital topographic maps. The results of the process shall be recorded on the quality control sheet, and the adjusted RPC models shall be used in the next process, digital plotting.

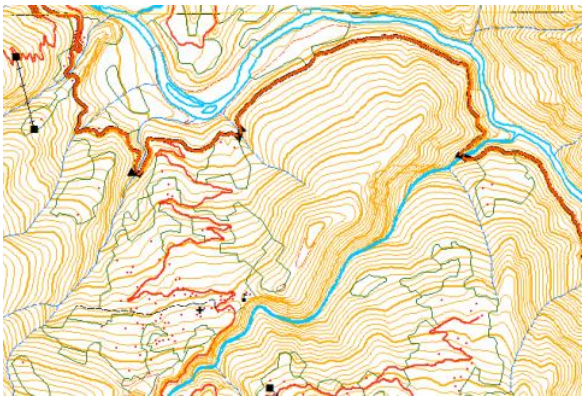
4) Digital Plotting (Work in Japan)

An RPC model created in the aerial triangulation and a pair of satellite images shall be set in a digital plotter as shown in Figure 2-5 to perform the digital plotting stereoscopically (Figure 2-6). The first step to follow in the Project is to obtain the features described in the map symbol specifications by interpreting the satellite images. Features that need to be confirmed in the field, such as those that are difficult to interpret due to the shade of trees, or difficult to judge, will be identified during the digital plotting and organized as subjects of the field identification.

After the digital plotting, shapes of features and connection between features shall be inspected and corrected, and output maps and satellite images shall be compared visually to confirm whether all features have been plotted. In addition, items needed to be identified in the field found in the inspection shall be added to the subjects of the field identification as mentioned in the preceding paragraph. After inspection and correction, administrative boundary data and annotations shall be added to the data as required to create manuscript data. The subjects of the field identification shall be added to the manuscript data to create manuscripts for the field identification.

Source: JICA Survey Team

Figure 2-5 Equipment for Digital Plotting (Digital Stereo Plotter)



Source: "Project on Development of National Geo-Spatial Data in Bhutan" Final Report, JICA (2017)

Figure 2-6 Sample of Digital plotting Output

5) Field Identification (Work in Bhutan)

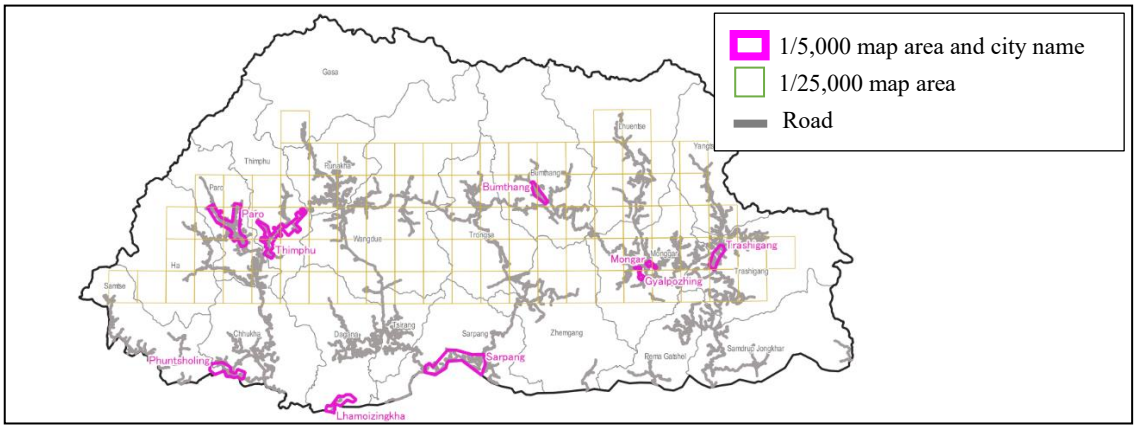
The work described in Table 2-9 shall be conducted in Bhutan with the manuscripts for the field identification created in the digital plotting.

Table 2-9 Main Subjects of Field Identification

Subject	Description
Annotation/attribute information	・ Items, including place names, rivers, and mountains, to be indicated on maps ・ Attributes of structures (positions and names of health, educational, administrative, and other public facilities)
Undefined objects identified in digital plotting	・ Features difficult to interpret on satellite images ・ Features required to confirm in the field
Collection of reference information	・ Collection of information, including reference materials and data, at relevant organizations and local administrative offices

Source: JICA Survey Team

The 1/25,000 mapping area covers a large area of northern and central Bhutan. Since there is only one road connecting the east and west (see Figure 2-7), it is necessary to pay attention to the access to the site, and consideration is given to the efficiency of movement and work, such as dividing the survey area into certain blocks and forming appropriate groups. These shall be included in the plan for the field identification.



Source: JICA Survey Team

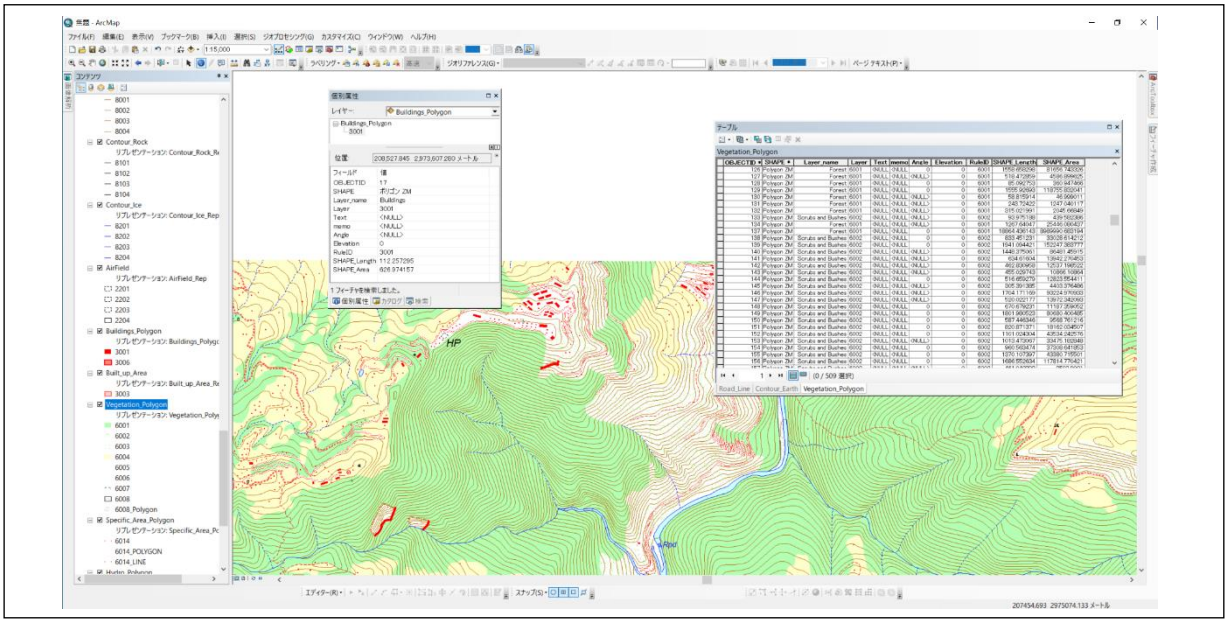
Figure 2-7 Road Network in Bhutan

6) Digital Compilation (Work in Japan)

The results of the field identification shall be used for the addition and correction of the digital plotting data. The annotation and attribute data shall be processed in the compilation process as required for improving the efficiency of the following data structurization process. The rules provided in the specifications shall be followed in the joining between stereo models, between adjacent map sheets, and between the existing data and the data to be created in the Project. The compiled data shall be inspected visually on printed maps or on a monitor screen together with an inspection program. An inspection program will be used to detect logical inconsistencies in the compiled data.

7) Data Structurization (Work in Japan)

In the data structurization, the compiled topographic map data shall be converted into structured data that can be used in GIS software. To do so, the compiled data shall be classified into point, line, and polygon data, the classified data shall be given topological relations, and attribute information shall also be added to the database. Figure 2-8 shows an example of GIS-structured data. The product specifications shall be followed in the structurization.



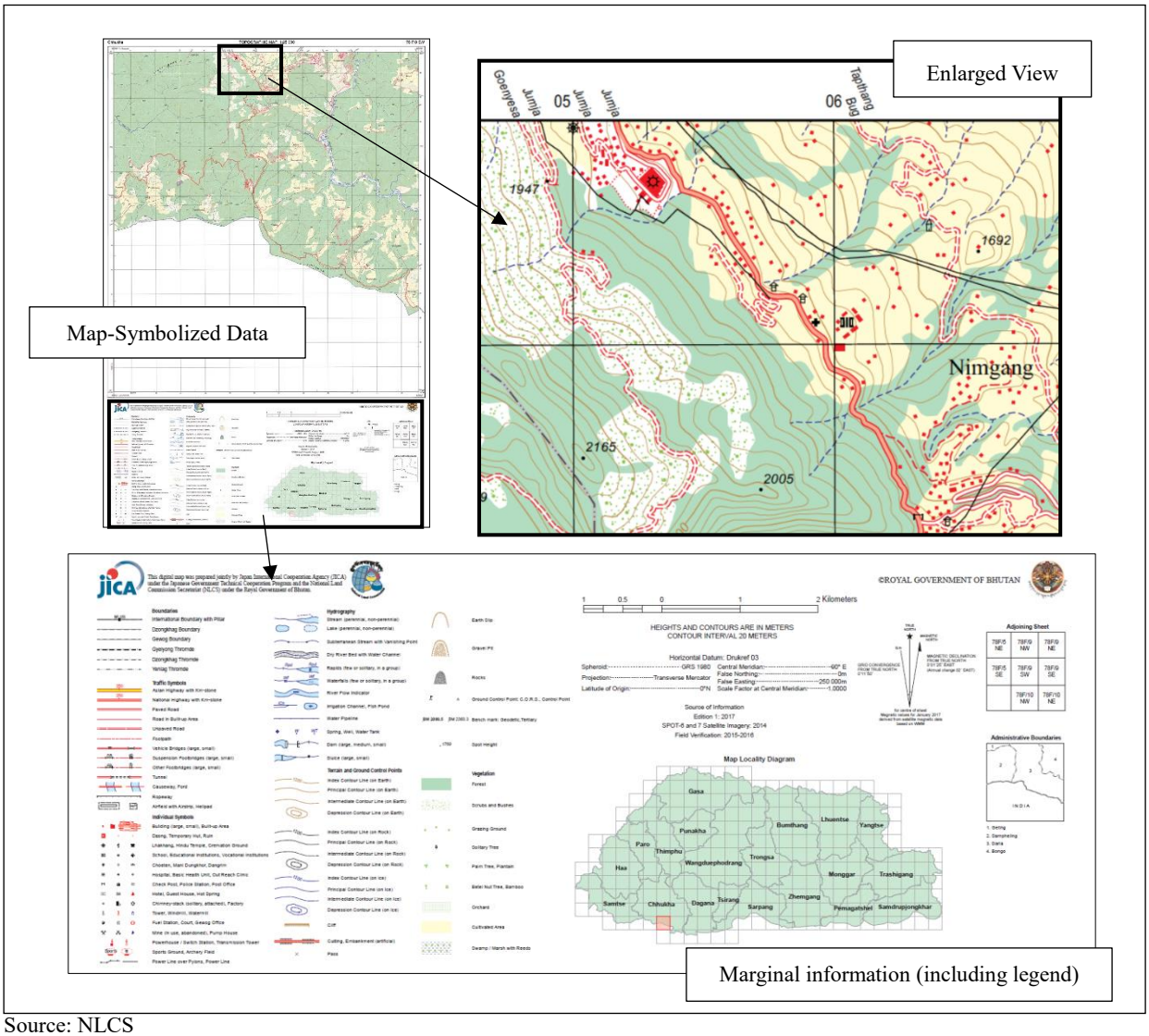
Source: NLCS

Figure 2-8 Example of Structured Data

8) Map Symbolization (Work in Japan)

Map-symbolized data shall be created from the compiled or GIS-structured data. The map-symbolized data shall be easily identifiable on topographic maps and able to be used on printed maps. Figure 2-9 shows an example of a set of map-symbolized data. In the map symbolization, the legibility of the data on a topographic map shall be improved by giving map symbols to all features in accordance with the map symbol specifications, determining an order of feature representation in accordance with the specifications, positioning annotation data, such as place names and names of public facilities, appropriately, and adjusting positions of symbols. Then, ancillary information such

as azimuth, scale, map name, number, legend, grid coordinate values, etc. (called "marginal information") is placed on the outside of neatline as appropriate, and the appearance of the map is adjusted so that each map sheet becomes a single topographic map.



Source: NLCS

Figure 2-9 Examples of Map-Symbolized data (Map sheet "78 F/9 SW" of southern Bhutan)

9) Creation of Digital Elevation Model (DEM) (Work in Japan)

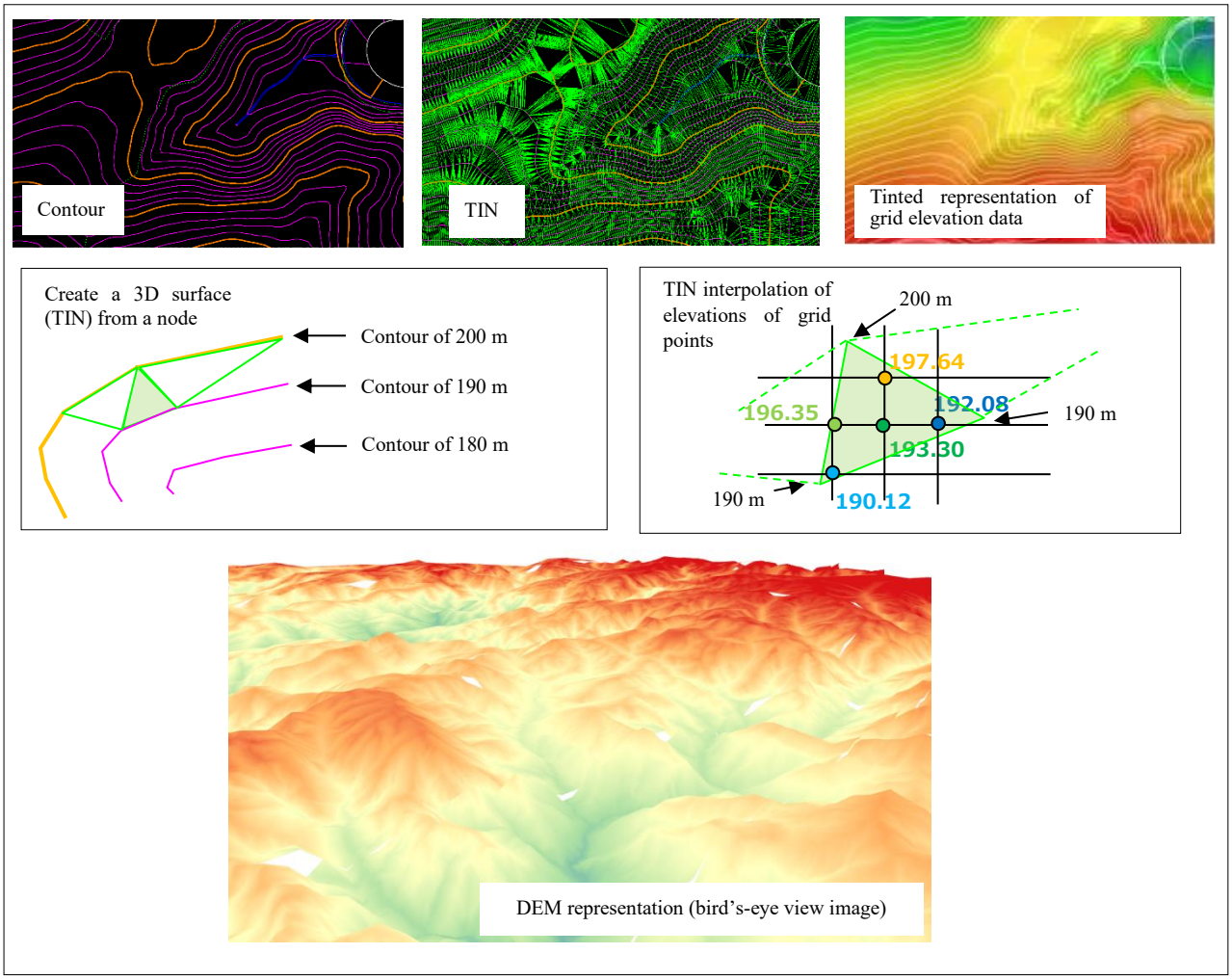
Table 2-10 explains the method for creating DEM at each scale. Figure 2-10 shows an example of a created DEM.

Table 2-10 DEM Creation Methods

Scale	Creation Method
1/25,000	・ Automatic DEM generation using contour lines and spot elevations obtained in the digital plotting shall be used. (Contour line method) ・ Grid size: 10 m x 10 m ・ Accuracy (RMSE): Less than ±5.0m

Scale	Creation Method
1/5,000	・ Automatic DEM generation using breaklines obtained in the digital plotting in addition to the contour line methods shall be used. ・ Breaklines shall be obtained at the following locations: ✓ Top and bottom edges of embankment or retaining wall with large height differences, ✓ Edges of elevated roads and edges of roads on overhead crossings, ✓ Ridges, valleys, and major shorelines, ✓ Terrain feature lines representing continuous changes of topographic gradients, ✓ Other terrain features required for representing terrain explicitly ・ Grid size: 5 m x 5 m ・ Accuracy (RMSE): Less than ±1.67 m

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2-10 Example of DEM

10) Data File Creation (Work in Japan)

Digital topographic map data file shall be created from the GIS-structured data and map-symbolized data and the created file shall be stored in electromagnetic recording media (hard disks [HDDs], Blu-ray Discs [BDs], DVDs, etc.). A data file shall be created for each map sheet area. The data formats shown in Table 2-11 shall be used. Metadata describing the location, contents, quality, etc. of each file (map sheet) shall be created.

Table 2-11 File Formats of Digital Topographic Map

Scale	Creation Method
GIS-Structured Data	・ ESRI file geodatabase format
Map-Symbolized Data	・ PDF format ・ MXD format ※ An MXD file in which representation on print before the conversion to a PDF is configured shall also be delivered to the Bhutan side, in principle, for the data updating in the data maintenance. The use of a file format other than MXD shall be allowed only when the representation of map-symbolized data that meets the specification can be configured in such a file.

Source: JICA Survey Team

11) Consultation Meetings

Consultation meetings with the executing agency shall be held four times, one at the commencement of the Project, two times during the implementation, and one at the delivery of the Project deliverables.

Table 2-12 Main Contents of Consultation Meetings

Classification	Location	Content
Commencement of the Project	Japan and Bhutan (Remotely)	Introduction of participants, explanation of work plan
Mid-period	Bhutan	Delivery of the satellite image, Meeting before the start of the control point survey
Mid-period	Bhutan	Reporting work progress, Meeting before the start of field identification
Handing over of the deliverables	Bhutan	Handing over of the Project deliverables

Source: JICA Survey Team

(4) Clarifying Scope of Copyright and Ensuring Visibility of Japan's Assistance

While the copyright of the digital topographic maps (GIS-structured data [File Geodatabase format], map-symbolized data [MXD format, PDF format], digital elevation model) to be created in the Project shall belong to GOB or NLCS, GOJ shall have the right to use them. A note mentioning that the digital topographic maps were created with the Grant Aid of Japan and the logo of Japan's Grant Aid shall be included in the file explaining the map specifications that is to be distributed with the maps to outside users such as relevant institutions and people of Bhutan, to enhance the visibility of Japan's assistance to Bhutan.

2-2-3 Outline Design Drawings

The outline design drawings of the Project (Digital Topographic Mapping Area and Control Point Distribution Map) are shown in Figure 2-11 and Figure 2-12.

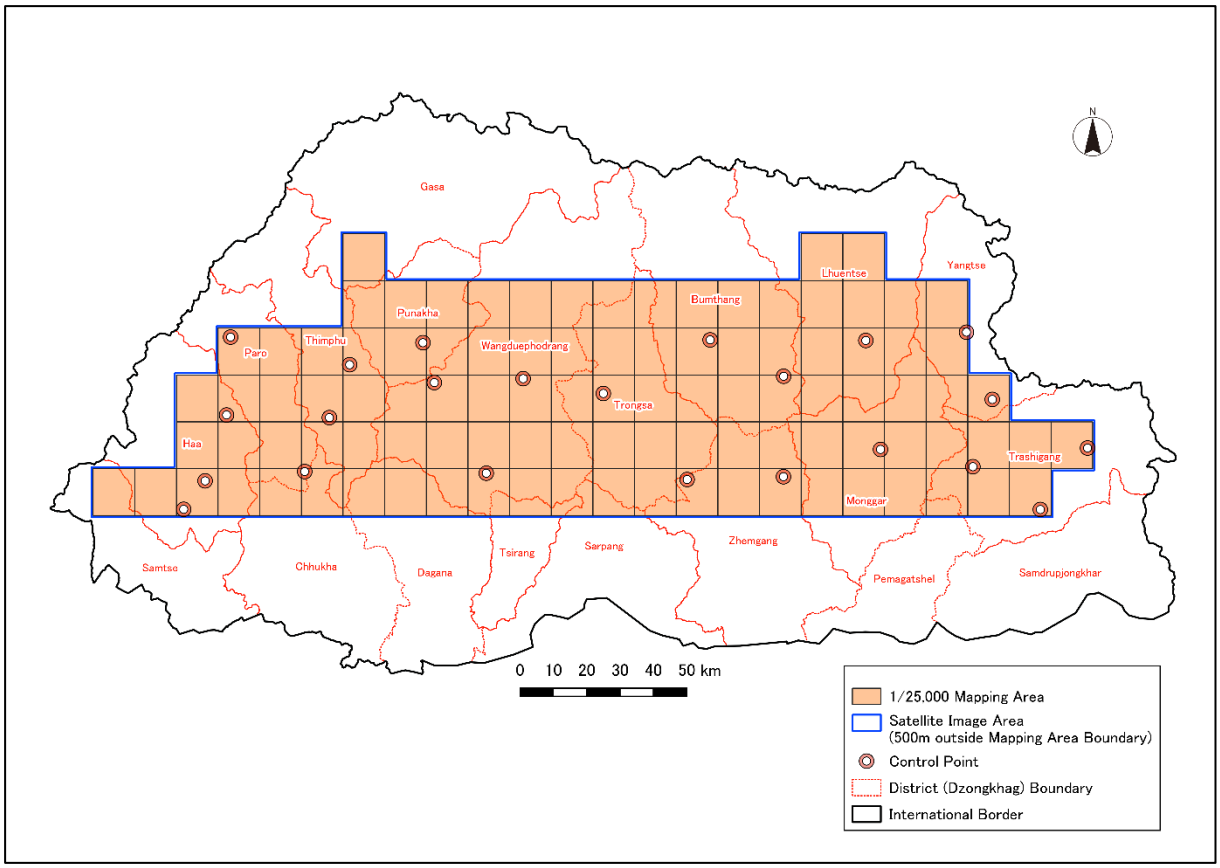


Figure 2-11 1/25,000 Digital Topographic Mapping Area and Control Point Distribution Map

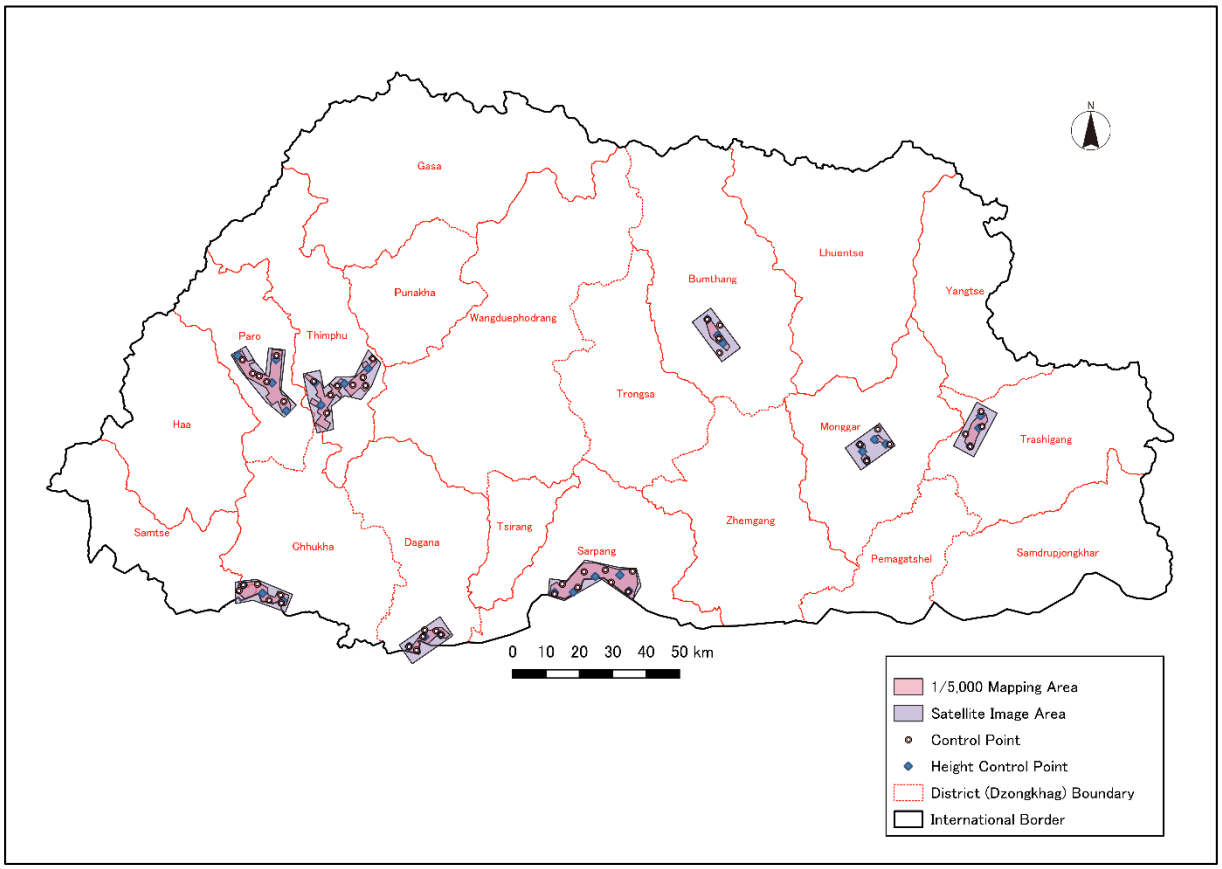


Figure 2-12 1/5,000 Digital Topographic Mapping Area and Control Point Distribution Map

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Project shall be implemented within the framework of Japanese Grant Aid Scheme. Therefore, it shall be implemented after the approval of GOJ and the conclusion of the Exchange of Notes (E/N) and Grant Agreement (G/A) between GOB and GOJ. The basic issues and the matters requiring special considerations for the implementation of the Project are mentioned in the following.

(1) Implementing Agency

NLCS and GNHC shall be the implementing and responsible agencies of GOB of the Project, respectively. NLCS shall implement the Project. During the implementation, NLCS shall maintain close communication and hold detailed discussions with the Japanese Consultant and Contractor to assist the Contractor in the field work in Bhutan for the digital topographic mapping, inspect the final products, and distribute and maintain the digital topographic maps, and shall appoint persons in charge of the Project.

(2) Consultant

A Japanese consultant shall conclude a design and supervision agreement with NLCS, implement the detailed design, and supervise the Project implementation for the smooth implementation of the Project. The Consultant shall also prepare the tender documents and assist the executing agency, NLCS, in the tender process.

The Consultant shall dispatch a supervising engineer to Bhutan at the commencement and completion of the digital topographic mapping by the Contractor. The Consultant shall also dispatch an inspection engineer to Bhutan to assist NLCS in the confirmation of the final products of the 1/5,000 digital topographic maps because NLCS does not have sufficient experience in creating them. The Consultant shall instruct and manage the Contractor from Japan by confirming the progress of each work process and state of quality control at an appropriate time to manage and control the schedule, quality, and safety of the work.

(3) Japanese Contractor

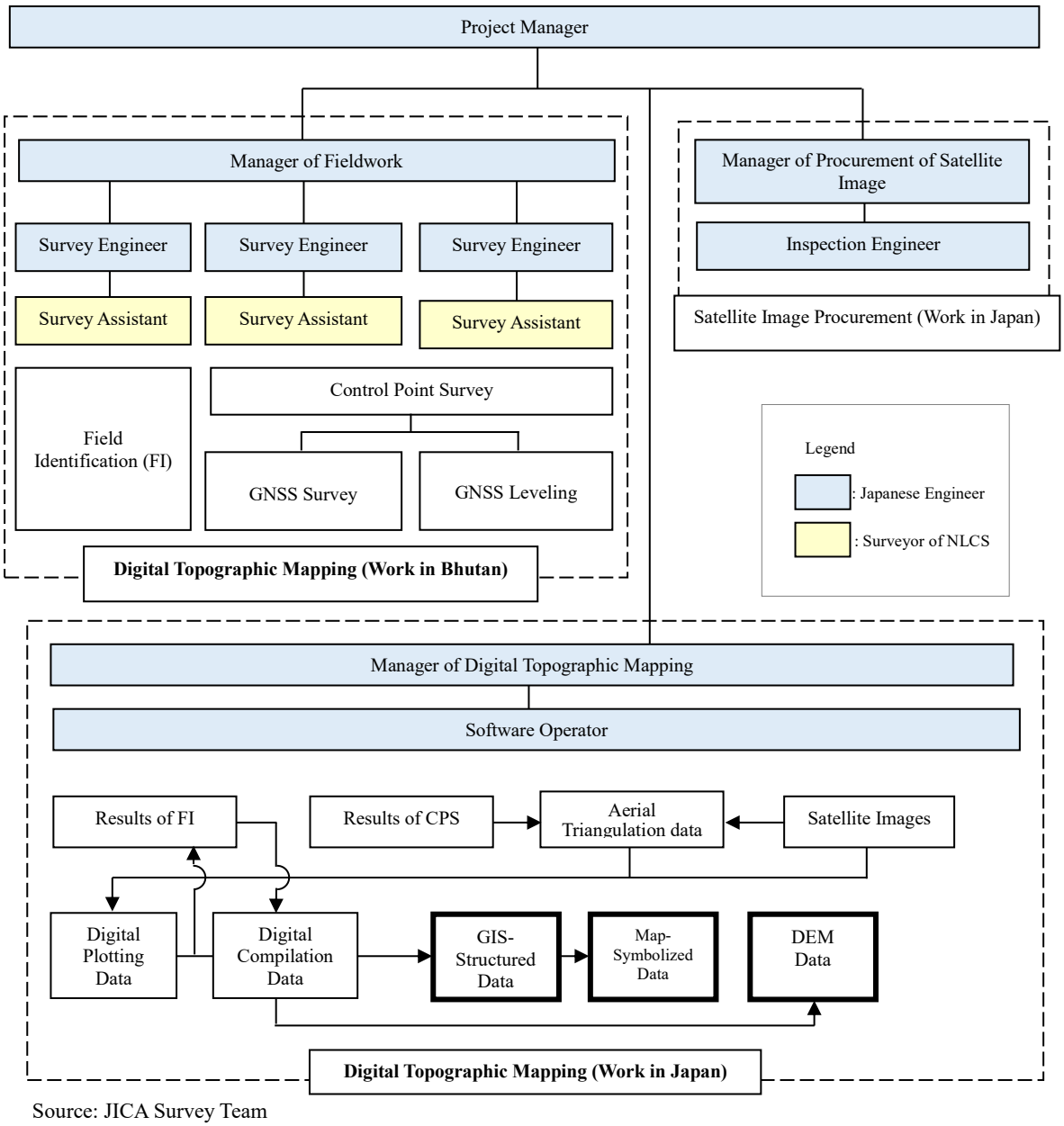
In accordance with the framework of Japan's grant aid scheme, the Japanese Contractor that will be selected by the Bhutan side in competitive tender will procure satellite images and create digital topographic maps as the contractor of the Project. Also, the Contractor shall correct any defects found during the one-year warranty period after the handing over of the Project deliverables. Therefore, the Contractor must establish a means of communication with NLCS to be used after the delivery of the Project deliverables.

(4) Necessity for Dispatch of Engineers

In the Project, 1/25,000 and 1/5,000 digital topographic maps shall be created from satellite images with photogrammetry technology. If specific equipment and software and a sufficient number of expert engineers are available, topographic maps can be created anywhere. Meanwhile, among the topographic

mapping processes, the control point survey and field identification must be conducted in the field. Although there are several local survey companies in Bhutan, they are small-scale and do not have experience in creating national base maps. Therefore, Japanese engineers or engineers of third countries employed by the Contractor shall be dispatched to Bhutan to conduct the field work, including the control point survey, field identification and the quality control for the field work.

All the processes except the control point survey and field identification mentioned above are office work. There is no survey companies capable of conducting mapping of the scale of the Project in Bhutan. Therefore, the work other than control point survey and field identification shall be implemented in Japan. The quality and schedule of the entire process up to the creation of the deliverable products shall be controlled consistently under the management of Japanese engineers of the Contractor. Figure 2-13 shows the organizational structure of the Contractor for the implementation of the Project.

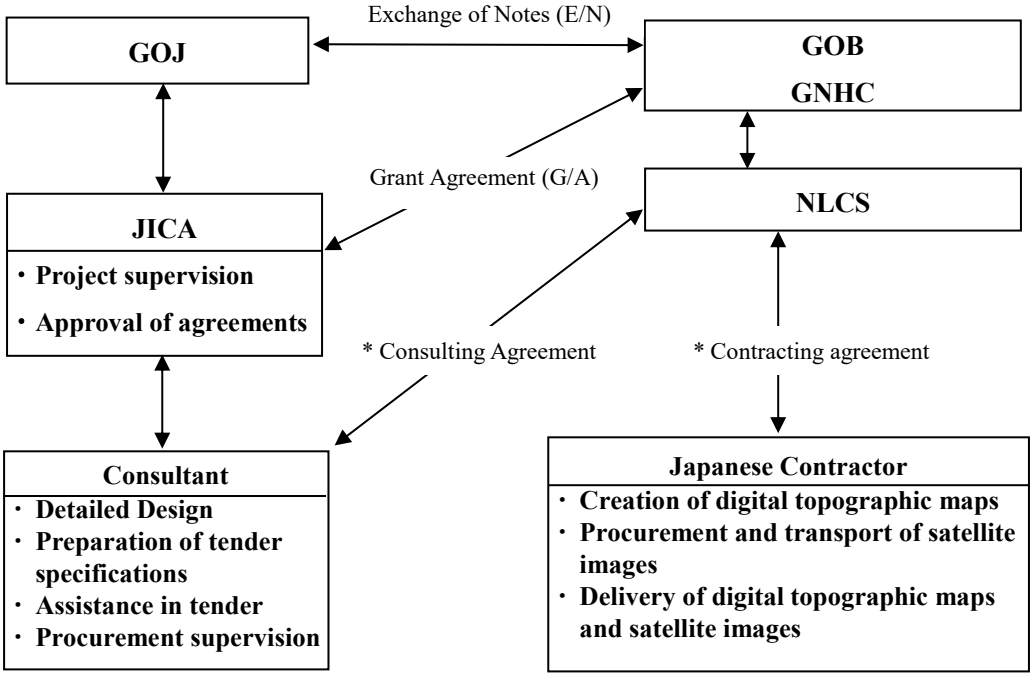


Source: JICA Survey Team

Figure 2-13 Organizational Structure for Digital Topographic Mapping

(5) Overall Relationship among Relevant Organizations in Project Implementation

Figure 2-14 shows the relationships between the parties involved in the Project.



* JICA's approval is required for the conclusion of the consulting and contracting agreements.
Source: JICA Survey Team

Figure 2-14 Relationships between Parties Involved in this Project

2-2-4-2 Implementation Conditions

(1) Responses to COVID-19 Countermeasures

As of April 2021, GOB requests persons arriving in Bhutan from abroad to self-quarantine for 21 days after the entry. The Contractor shall consider this restriction when planning the dispatch of the Project staff to Bhutan. The Contractor must also note that a COVID-19 countermeasure taken at points of entry in Japan requires persons arriving in Japan from abroad to stay in places designated by the directors of Quarantine Stations for 14 days.

(2) Tax exemption procedure

Table 2-13 shows the information of taxes, tax exemption/refund, and its procedures for the Project.

Table 2-13 Taxes and Levies regarding the Project

Taxes and Levies related to the Project*	How to exempt/ refund	Law/ Regulation	Rate / Calculation	Remarks
Corporate tax for Japanese /third countries nationals	Exempt (Advance)	45.2 b), Part I Corporate Income Tax, Income Tax Act of Bhutan 2001	3% (of the contract value) for contractors and consultants	Corporate Taxes for any third countries companies under Tax Exempted Agreement Projects are not be levied. However the any Third Country Companies, which are not under tax exempted agreement projects, have to pay 3% Corporate Income Tax from their contract value.
Corporate tax for Bhutanese nationals	Not Exempted	2.1, Income Tax Act of Bhutan 2001	30% (from the assessed Net Profit)	The Bhutanese private companies and corporate offices need to declare and pay the Corporate Income Tax, even if they are engaged in project under the tax exemption agreement like grant aid or technical cooperation.
Personal income tax for Japanese/third country's staff	Exempt (Advance)	14, Part III Personal Income Tax, Income Tax Act of Bhutan 2001	Rate shall be set depends on the annual income (Income: Nu.) as below. 1. Income < 300,000: 0% 2. 300,000> Income < 400,000: 10% 3. 400,000> Income < 650,000: Nu.10,000 +15% 4. 650,000> Income <1,000,000: Nu.47,500 +20% 5. 1,000,000> Income <1,500,000: Nu.117,500 +25% 6. 1,500,000> Income: Nu.242,499 +30%	Employees of companies, which are engaged in project under the tax exemption agreement like grant aid or technical cooperation, are exempted. However the employees of Japanese Nationals and/or third countries nationals, who are not under tax exempted agreement projects, have to pay the specific amount (see the left).
Personal income tax for Bhutanese staff	Not Exempted	Ditto	Ditto	The Bhutanese, even those employed by the Japanese companies engaged in project under the tax exemption agreement like grant aid or technical cooperation, need to declare the income tax. Employers usually withhold the tax and deposit to the Ministry of Finance, or employees can declare to the government.

Taxes and Levies related to the Project*	How to exempt/ refund	Law/ Regulation	Rate / Calculation	Remarks
Sales Tax and Import duty (in case of air transportation)	Exempt (Advance)	3.1 Part I, Sales tax, custom and excise act of the Kingdom of Bhutan 2000	10%: Sales tax 20%: Import duty (for Satellite images) However, Sales Tax shall not be levied on goods imported into Bhutan in accordance with bilateral or multilateral trade agreement signed by GOB.	Equipment dispatched by Air: No need for an import license Application for Customs Duty Exemption Organization in charge：Execution agency (NLCS) - invoice should be addressed to NLCS Documents Needed: - Copies of invoice - packing list - permit/approval letter from relevant agency if restricted - applications form for Import Duty Exemption Certificates, - Project related documents, approval from JICA and government for the projects(A copy of the Grant Agreement concluded between RGOB and JICA) Duration：7 working days/ 3 working days if documents are complete [Procedure to apply for Sales Tax, Customs Duty and Green Tax Exemption on goods (if necessary)] ① The Contractor exports the satellite image from Japan to Bhutan and NLCS receives the import documents (ex. Copies of invoice, Packing list, etc.). ② NLCS as the Exempted Party submits the above Documents Needed to DRC HQ and requests him to issue Exemption Certificate for the import material. ③ DRC HQ reviews the documents and issues the exemption certificate to the Exempted Party (NLCS) if all the conditions and requirement are fulfilled.
Japanese consumption tax on Japanese procured items (Services and goods consumed in Japan)	Not Exempted	Consumption Tax Law-Article 4, Article 29 Local Tax Law-Article 72 of 83	7.8%：Consumption Tax 2.2%：Local Consumption Tax	Tax exemption is not available for the following services and goods procured in Japan. -Air ticket (Tokyo-Paro round trip) -Tender announcement on newspaper -PCR test

Taxes and Levies related to the Project*	How to exempt/ refund	Law/ Regulation	Rate / Calculation	Remarks
Japanese consumption tax on goods procured in Japan (goods exported to Bhutan)	Exempt (Refund)	Article 7 of the Consumption Tax Act	7.8%: Consumption Tax 2.2%: Local Consumption Tax	■Procedure for refunding consumption tax on the purchase of satellite images to be exported Within two months from the day after the last day of the taxation period, submit the following required documents to the tax office and apply for a refund. -Final tax return for consumption tax and local consumption tax for the taxable period -Statement of purchase deduction tax (for corporations) -Calculation of taxable sales ratio, deductible purchase tax amount, etc.
Tax deduction at source (TDS) for Rental car charge	Not Exempted	TDS guidelines	2 %	TDS Exemption for private businesses and individual is not possible.
Sales Tax and Custom Duty (for fuel/gasoline)	Not Exempted	-	Bhutan Sales Tax: 5% Custom Duty: 20%	If the grant aid project requires huge amount of fuel as construction of roads, bridges, large infrastructures, above tax will be exempted with the MOU signed between JICA and the Director General's office, DRC. However, the exemption will not be applicable for the conveyance or transportation of the project staffs.

Source: JICA Survey Team

2-2-4-3 Scope of Works

Table 2-14 shows the work and cost demarcation of the Project between Japan and Bhutan. The JICA Survey Team will confirm with NLCS that the Bhutanese items will be implemented at an appropriate time and necessary budget for that will be secured.

Table 2-14 The Work and Cost Demarcation of the Project

(1) Before the Tender

No.	Undertaking	To be covered by			Notes
		Japan	Bhutan		
			GNHC	NLCS	
1	To open Grant bank account (Banking Arrangement, "B/A")		●		Complete within 1 month after the signing of G/A
2	To issue Authorization to Pay ("A/P") to a bank in Japan (the Agent bank) for the payment to the consultant.		●		Complete within 1 month after the signing of the consulting service agreement
3	To bear the following commissions to a bank in Japan for the banking services based upon the B/A (regarding the payment to consultant)				
	(1) Advising commission of A/P			●	For the consulting services
	(2) Payment commission for A/P			●	Advance payment for consulting services
4	To submit Project Monitoring Report (reflecting the result of Detail Design)			●	Reflect the result of the Detail Design

Remark: ● denotes the side responsible for the work, GNHC: Gross National Happiness Committee, NLSC: National Land Commission Secretariat

(2) During the Project Implementation

No.	Undertaking	To be covered by			Notes
		Japan	Bhutan		
			GNHC	NLCS	
1	To issue A /P to a bank in Japan (the Agent bank) for the payment to the contractor.		●		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A (regarding the payment to contractor)				
	(1) Advising commission of A/P			●	For the works undertaken by the Contractor
	(2) Payment commission for A/P			●	For the contract for consulting service and Contractor's works
3	Procurement of Digital Topographic Map and Satellite Image	●			
4	To transport of the Satellite Image				
	(1) Transportation by air for the Satellite Image to Paro airport	●			
	(2) Inland transportation to the Project site (NLCS Headquarters)	●			
5	To ensure prompt custom clearance and to assist the contractor about the inland transportation in Bhutan			●	
6	To accord Japanese persons and/or persons from third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the Bhutan and stay therein for the performance of their work			●	

No.	Undertaking	To be covered by			Notes
		Japan	Bhutan		
			GNHC	NLCS	
7	To ensure that custom duties, internal taxes and other fiscal levies, as shown below, which may be imposed in the county of the Recipient (Bhutan) with respect to the purchase of the products and/or the services be exempted / be borne by its designated authority without using the Grant. 1) Corporate tax for Japanese/third countries' companies (Exempt/Advance) 2) Personal income tax for Japanese/third countries' staff (Exempt/Advance) 3) Sales tax and import duty (in case of air transportation) (Exempt/Advance) 4) Japanese consumption tax on goods procured in Japan (goods exported to Bhutan) (Exempt/Refund) On the other hand, the tax deduction at source (TDS) for rental car charge will be applied and the tax is not exempted.			●	
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project including, but not limited to, personal expense of NLCS's employee.			●	Control Point Survey, Field Identification, and Final Inspection are applicable.
9	To provide the security at the Project site during the implementation of the following works.				
	(1) Control Point Survey for producing Digital Topographic Map (2) Field Identification for producing Digital Topographic Map	●		●	
10	To provide with the facilities for distribution of electricity and other incidental facilities necessary for the implementation of the Project, when necessary.			●	
11	To give the permission for contractor to bring out the products from Bhutan for necessary processing.			●	
12	To Submit the following Project Monitoring Reports				
	(1) Project Monitoring Report after each work under the contract(s) such as shipping, delivery, installation, and operational training			●	
	(2) Project Monitoring Report (final)			●	
13	To organize NLCS' internal team to check the Products for quality control and bear relevant expenses			●	
14	To submit a report concerning the completion of the Project			●	

Remark: ● denotes the side responsible for the work

(3) After the Project

No.	Undertaking	To be covered by			Notes
		Japan	Bhutan		
			GNHC	NLCS	
1	To organize NLCS' internal team to support the user of the Products and bear relevant expenses			●	
2	To organize NLCS's internal team to update the Products and bear relevant expenses			●	
3	To encourage the related authorities for the utilization of the Products			●	

Remark: ● denotes the side responsible for the work
Source: JICA Survey Team

2-2-4-4 Consultant Supervision

(1) Basic Policy on Supervision

The Consultant has the obligation to organize a project team in charge of the Project affairs and to smoothly execute the detail design and the supervision work in accordance with the contents of the Guideline of Japan's grant aid and the outline design. As for supervision work, the Consultant shall strive to control the schedule, quality, and safety of the work as planned by supervising the progress in each process of the digital topographic mapping and by performing quality control such as verifying the quality control sheets prepared by the Contractor at the completion of each process and assisting NLCS to conduct the final inspection.

(2) Process Management

The Consultant will compare the progress of the work with the implementation schedule decided by the Contractor in the contract every month or every week in order to adhere to the delivery deadline given in the contract. In cases where delays are predicted, the procurement agent will warn the Contractor and demand the submission and implementation of a plan of countermeasures. Comparison of the planned schedule and actual progress will mainly be based on the following items:

(a) Confirmation of the commencement of the work,
(b) Confirmation of procured satellite images,
(c) Confirmation of the quantity of completed work in each process of the digital topographic mapping, and
(d) Supervision of work processes based on the implementation schedule.

(3) Safety Control

The Consultant shall have a thorough consultation with the safety manager of the Contractor to prevent industrial accidents, injuries to third-party persons, and accidents involving them at worksites during the field work. The following are the points of note in the safety management at worksites.

(a) Establishment of work safety management regulations and appointment of safety managers,
(b) Planning driving routes of project vehicles and ensuring safe driving,
(c) Measures to provide welfare to workers and encourage them to take holidays, and
(d) Security measures during the stay in Bhutan.

(4) Organizational Structure for Supervision

After the conclusion of the contracting agreement between the Client and the Contractor, the Consultant shall confirm and approve the specifications for the procurement of satellite images and field work planned by the Contractor and instruct the Contractor to commence the Project activities.

During satellite image procurement, field work, and digital topographic mapping, the Contractor

shall confirm the progress and schedule of the work appropriately and the Consultant shall supervise the work following the processes shown in Figure 2-3. As all the work except the control point survey and field identification is to be implemented in Japan, the Consultant shall not have a supervisor permanently stationed in Bhutan during the Project but assign an engineer in Japan on a spot basis to supervise the Project implementation. In addition, the final inspection before delivery of the digital topographic maps, NLCS shall conduct the visual inspection of obtained features and map representation in the products, while for the 1/5,000 digital topographic maps, the technology transfer for quality evaluation by TCP is planned but it will not be assured that NLCS has sufficient capacity to implement it. Therefore, the Consultant shall dispatch an inspection engineer to Bhutan to assist NLCS in the final inspection and verify the quality of created 1/5,000 digital topographic maps. The Consultant shall supervise the implementation of the Project with the persons shown in Table 2-15.

Table 2-15 Persons in Charge of Supervision of Project Implementation of Consultant

Person	Place of Work (Country)	Responsibility
Chief Consultant/Project Supervising Engineer 1 (Acceptance inspection, delivery, etc.)	Bhutan/Japan	Overall project supervision, General meetings at the commencement of the Project work and the work in Bhutan, acceptance inspection and delivery of project deliverables, etc.
Inspection Engineer 1 (Procurement of satellite images)	Japan	Ordering of satellite images (preparation of specifications, drawings, etc.) and confirmation of the procurement order, Verification of the inspection results of the procured satellite images
Inspection Engineer 2 (Digital topographic mapping)	Japan	Confirmation and approval of the specifications of entire digital topographic mapping, Confirmation of the progress in each process in the digital topographic mapping and verification of the survey deliverables (quality control sheets, etc.)
Inspection Engineer 3 (Result verification)	Bhutan/Japan	Inspection of the results (deliverables) of the 1/25,000 and 1/5,000 digital topographic mapping

Source: JICA Survey Team

2-2-4-5 Quality Control Plan

The Consultant shall perform the quality control (supervision) of the digital topographic maps to confirm whether they have the accuracy and functions compliant with the specifications. As the digital topographic maps to be created in the Project shall be survey results that should be used widely as national basic data and the quality must be controlled appropriately. Therefore, the Contractor shall perform the quality control in accordance with “The Standards for Operating Specifications for Public Surveying” of Japan. The quality control to be conducted by the Contractor is shown in detail in the Standard, and the inspection results for each work shall be organized in quality control sheets in accordance with the Standard. The Consultant shall confirm quality control sheets prepared by the Contractor to verify whether the Contractor has performed the work appropriately. When quality assurance is at risk as a result of verification, the Consultant shall immediately instruct the Contractor to take necessary measures, including conducting a re-survey. The Consultant shall report the

verification results to the Client immediately for approval.

The Contractor shall evaluate the quality of the final deliverables (results) in comparison with the product specifications and the Consultant and Client shall inspect the deliverables (results). Table 2-16 shows the responsibilities of the Client, Contractor, and Consultant in the quality control at different stages of the Project.

Table 2-16 Responsibilities in Quality Control at Different Stages

No.	Stage	Contractor	Consultant	Client
1	After conclusion of contracting agreement	Preparation of the specifications for the procurement of satellite images and implementation plan for digital topographic mapping	Verification and approval of the documents prepared by the Contractor	Confirmation of the approval by the Consultant
2	At the completion of the procurement of satellite images	Inspection of satellite images and preparation of and quality control sheets - Quality control sheets	- Verification and approval of the quality control sheets prepared by the Contractor (all sheets) - Visual inspection of procured images based on the quality control sheets	Ditto
3	At the completion of the aerial triangulation	Inspection of the results of the control point survey (GNSS observation of 69 points and GNSS leveling of 30 points) and the aerial triangulation and preparation of quality control sheets - Description of ground control points - Quality control sheets for the establishing of the ground control point - Quality control sheets for the aerial triangulation - Other relevant materials	Verification and approval of the quality control sheets and others prepared by the Contractor (all sheets)	Ditto
4	During the digital plotting and digital compilation (five times)	Inspection the results and preparation of quality control sheets - Quality control sheets for the digital plotting, - Quality control sheets for the digital compilation - Other relevant materials	Verification and approval of the quality control sheets prepared by the Contractor (all sheets)	Ditto

No.	Stage	Contractor	Consultant	Client
5	At the completion of the data structurization, map symbolization, and digital elevation model creation (four times)	・Inspection of DEM data - Quality control sheets ・Quality evaluation based on the product specifications - Data files of the digital topographic map, - DEM data files, - Quality evaluation sheets, - Metadata, - Other relevant materials	- Verification and approval of the quality control sheets prepared by the Contractor (all sheets) - Final inspection of the data (1/25,000 digital topographic map and DEM) - Final inspection of the map and data (1/5,000 digital topographic map and DEM, *Assistance to the final inspection by the Client) - Verification and approval of the quality evaluation by the Contractor	- Final Inspection (visual inspection) of 1/25,000 digital topographic map - Final inspection of the map and data (1/5,000 digital topographic map and DEM)
6	After the completion of the data file creation	Preparation of a survey report, compilation of the results, and delivery of the Project deliverables including survey report to the Client	- Verification and approval of the survey report and project completion report prepared by the Contractor - Attendance as witness at the acceptance inspection and delivery of the Project deliverables	- Confirmation of the verification results - Acceptance inspection of the Project deliverables after the delivery

Source: JICA Survey Team

2-2-4-6 Procurement Plan

(1) Country of Procurement and Country of Origin

The Equipment in the Project will basically be procured from Japan. Table 2-17 shows Equipment Procurement Sources.

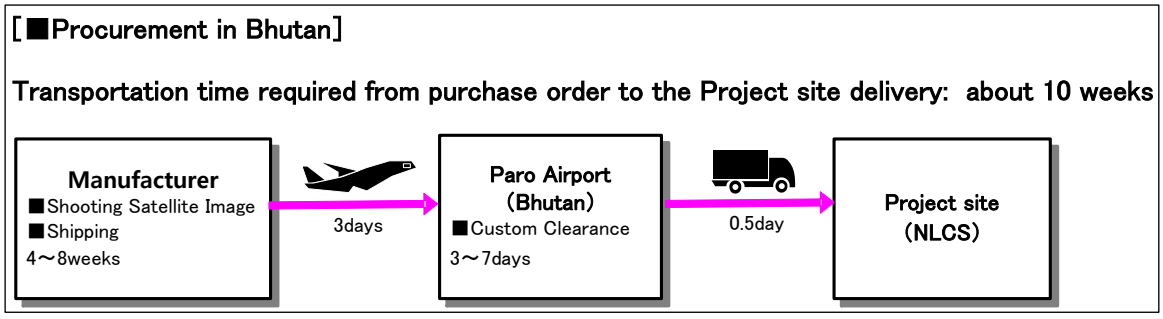
Table 2-17 Equipment Procurement Sources

No.	Item	Qty	Country of Procurement	Country of Origin
1	Satellite Image （GSD 1.5 m class）	1 set	Japan	France
2	Satellite Image （GSD 0.5 m class）	1 set	Japan	USA

Source: JICA Survey Team

(2) Equipment Transportation Plan

The transportation plan for the Equipment (Satellite Image) of the Project is shown in Figure 2-15.



Source: JICA Survey Team

Figure 2-15 Equipment Transportation Plan

Since the satellite images to be procured is a data, if the file size is small, it can be delivered by distributing it to the FTP server owned by the purchaser via the Internet. However, the total file size of satellite images procured in the Project is estimated to be approximately 100GB, in order to avoid the risk of transfer failure due to Internet network errors, etc., the satellite images will be saved on a recording medium such as a hard disk and it will be sent from Japan to Bhutan by air.

2-2-4-7 Operational Guidance Plan

NLCS is capable of and has experience in procuring satellite images and creating digital topographic maps, which are to be implemented in the Project. The technology for using such images and creating such maps shall also be transferred to NLCS during TCP. Therefore, initial operational guidance shall not be provided in the Project.

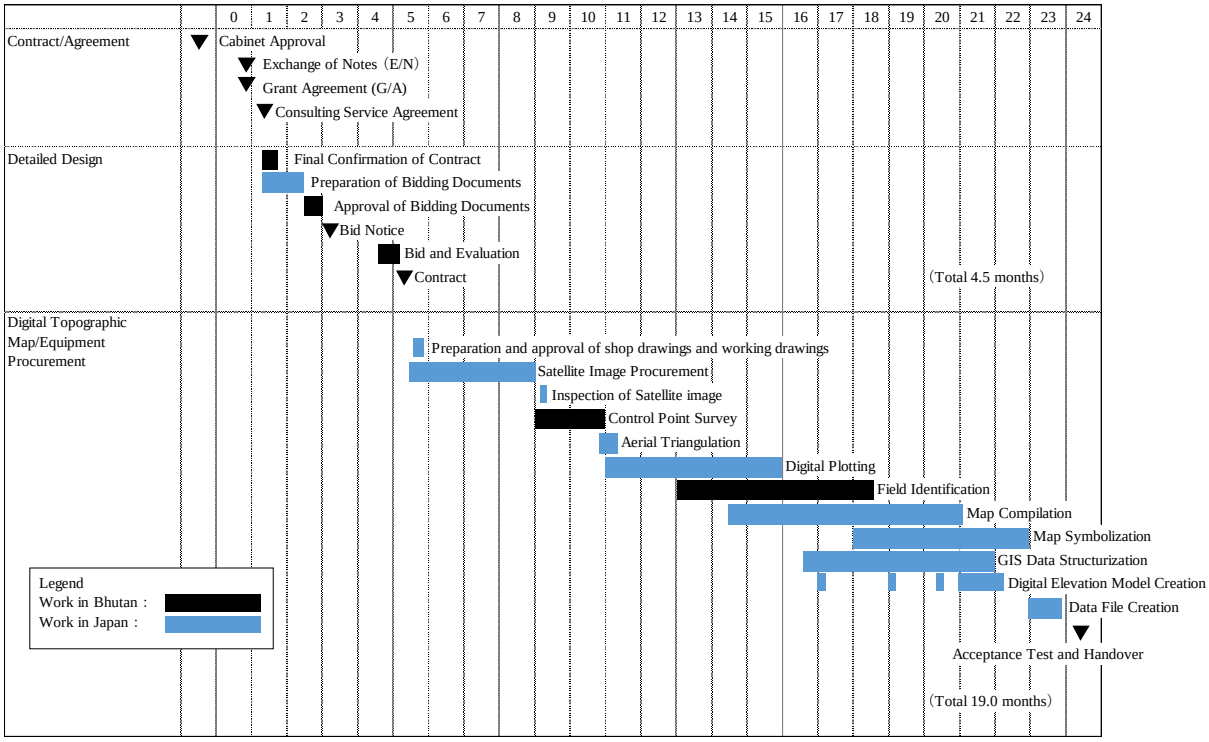
2-2-4-8 Soft Component (Technical Assistance) Plan

As mentioned in 2-2-4-7, the technology for creating and updating digital topographic maps shall be transferred to NLCS during TCP, therefore the Project shall not have a soft component.

2-2-4-9 Implementation Schedule

Based on Procurement Guidelines for the Japanese Grants (Type I), the Project implementation schedule is as shown in Table 2-18. The required period for the Project is approximately 4.5 months for the implementation design stage and approximately 19 months for the digital topographic mapping and equipment procurement, for a total of approximately 23.5 months.

Table 2-18 Project Implementation Schedule



Source: JICA Survey Team

2-3 Security Plan

(1) Security situation in the Project Site

In Bhutan's major cities, the northern and central regions, which are the Project sites, there are fewer violent crimes such as robbery compared to neighboring countries, and security situation are generally good.

(2) Security Measures in the Project Site

A part of the control point survey and the field identification are planned to be carried out locally during the rainy season. There are many mountainous areas in the northern and central regions of Bhutan, and landslides occur frequently from June to July. During the rainy season, it is possible that public roads will be blocked by landslides and construction work. Therefore, when local operations are carried out in the rainy season, the Contractor ask the road conditions to the Department of Roads of MoWHS, which manages roads in Bhutan and grasps the road blockage status due to road construction and landslides in advance, and adjust the work plan if necessary.

2-4 Obligations of Recipient Country

When the Project is implemented, the Japanese side will be responsible for the satellite image procurement. The Japanese side is mainly responsible for the digital topographic mapping. Then the Bhutan side is also responsible for the assistance of the control point survey and the field identification, executing the final inspection of the digital topographic maps and bear the cost (personnel costs for NLCS staff, accommodation costs, etc.). The main items to be done by the Bhutan side are as follows:

(1) Payment for the following commissions to a bank in Japan for banking services based on B/A

NLCS will bear the following fees arising during the Project.

- Advising commission of A/P
- Payment Commission for the consulting service agreement and the contract

(2) Transporting, Custom Clearance and Tax exemption procedure of the Satellite Image

The satellite images will be transported from Japan to Bhutan by air, and after customs clearance at Paro Airport, they will be transported to the NLCS headquarters, which is the Project site. The required transportation period is about 10 days including customs clearance, NLCS will carry out procedures related to customs clearance and tax exemption for the satellite image.

(3) Providing convenience for project personnel (Japanese / third country) to enter and stay in Bhutan

It is assumed that Japanese or third country engineers will be engaged in the work in Bhutan for

the control point survey, field identification, etc. of the digital topographic mapping of the Project. For this reason, NLCS will carry out the necessary procedures and obtain permits (entry permit, residence permit) for the entry and stay of these parties.

(4) Securing personnel and costs for Control Point Survey, Field Identification, and Final Inspection for Digital Topographic Mapping

NLCS will hold a meeting with the Contractor and the Consultant about the implementation schedule, process, and work content of control point survey, field identification, and final inspection in the digital topographic mapping, at the time of concluding the contract to carry out the digital topographic mapping smoothly and secure necessary budget and personnel for the work.

(5) Permission for the Contractor to bring out the products from Bhutan

In the digital topographic mapping, the Contractor will carry out the work of aerial triangulation, digital mapping, digital compilation, map symbolization, data structurization, digital elevation model creation, and data file creation in Japan. An acquisition of the permission to bring necessary satellite images and data obtained in the field work (control point survey and field identification) from Bhutan to Japan shall be necessary.

(6) Appropriate operation and maintenance of Digital Topographic Map and Satellite Image

The following technology transfer will be implemented to NLCS by TCP that will be implemented in parallel with the Project:

- Technical support aimed at further improving the technical level of topographic map creation and building National Spatial Data Infrastructure (NSDI) in Bhutan
- Technology transfer related to standardization of geospatial information, specification formulation, metadata, product specification creation, work method establishment, quality / accuracy control, etc. will be carried out.

Therefore, the operation and maintenance plan for digital topographic maps and the satellite images procured in the Project will be developed based on the policy formulated in that project.

2-5 Project Operation Plan

(1) Organizational Structure for Project Operation and Maintenance

The digital topographic maps to be created in the Project are expected to be used widely in the planning of disaster risk reduction measures and infrastructure development by various Bhutanese organizations. NLCS shall need to manage the Project deliverables to make them known and used widely in Bhutan and update and maintain them to ensure the sustainability of the topographic maps after the

completion of the Project.

JICA Survey Team has confirmed that the Department of Survey and Mapping shall be responsible for the creation, distribution, and maintenance of the digital topographic map. The team assumes that the Topographical Survey Division and Geoinformatics Division handle the practical matters concerning the updating/maintenance and distribution/publication release of the map data respectively. The TCP is designed to have the technology transfer for the establishment of procedures for map data maintenance, including the intervals and methods of data updating and cooperation with relevant organizations for the updating. In order to establish this procedure-based approach to data operation and maintenance within the NLCS, the team recommends NLCS to establish a new division/section responsible for the data distribution and maintenance or clarify the maintenance tasks within the roles and authorities of existing division/sections, ensure appropriate staffing and establish a system to secure allocation of the required budget.

(2) Updating and Maintenance of Digital Topographic Map

Digital topographic maps need to be updated as required for maintaining information on them. Although it is not necessary to update maps regularly, it is recommended to update a map whenever large-scale infrastructure has been constructed in a map area. In addition, urban areas have many increases and decreases in buildings and facilities, so they should be updated at least once every 10 years. As the policy of NLCS on the updating of digital topographic maps is related to the establishment of procedures mentioned above in (1), a plan for the data distribution and maintenance, including the establishment of the structure, shall be developed in the activities of the TCP. As NLCS has the equipment required for updating digital topographic maps, including that provided in the Previous Project, it shall now focus on human resource development through the technology transfer in the TCP.

(3) Utilization Plan of Digital Topographic Map

Based on the Survey result such as needs of existing 1/25,000 and 1/50,000 scales topographic maps and requests to NLCS, collected from the relevant organizations, Table 2-19 shows the concrete measures for promoting utilization of geospatial information provided by NLCS including digital topographic maps in the scale of both 1/25,000 and 1/5,000 developed in the Project.

Table 2-19 Measures for promoting utilization of geospatial information such as topographic maps

No.	Measures for utilization	Relation to GI Policy and GI Rules & Regulations
1	Immediate recovery of Geo Portal	* GI Policy asks the concerned agency to integrate metadata and data, and to ensure accessible through common portal. * GI Rules and Regulations defines Geoportal to act as single and seamless point of access to Geo-information for all GIS users as well as policy makers in the country
2	Introduction of topographic maps, etc., in the Web site of NLCS	* No description on this measure, but preparing for the case that Geo Portal cannot be recovered promptly, it is important to provide necessary information through web site.

No.	Measures for utilization	Relation to GI Policy and GI Rules & Regulations
3	Development of brochure showing information such as contents, access and prices of products provided by NLCS	* No description on this measure, but it is important to promote utilization of topographic maps using paper media including distribution in the seminar and workshops.
4	Holding of lectures and seminars on how to use topographic maps in GIS	* GI Rules & Regulations asks office of CGISC to coordinate and conduct GIS Expo / Conference / Workshops / Seminars.
5	Expansion of online data provision	* GI Policy asks the concerned agency to integrate metadata and data, and to ensure accessible through common portal. * GI Rules & Regulations describes that Geoportal shall have the provision for online data requisition and delivery.
6	Moderation of conditions on the use of topographic maps and development of secondary use of them	* Annexure I and II of GI Rules & Regulations show the formats of 'Usage Agreement for Spatial Data' and 'DATA REQUISITION FORM', respectively.

Source: JICA Survey Team

The measures listed in Table 2-19 are almost included in GI Policy and GI Rules & Regulations, excluding 'No.6 Moderation of conditions on the use of topographic maps and development of secondary use of them', and NLCS has already agreed with them. NLCS also agrees with the review of 'Usage Agreement for Spatial Data', and some user organizations have request to NLCS on the development of regulation on secondary use of geospatial data. Therefore, it is important to discuss No.6.

The measures No.2 - 4 and No.6 excluding No.1 "Immediate recovery of Geo Portal" are expected to be implemented in this grant aid project or the ongoing technical cooperation project in which NLCS is involved as counterpart organization.

Regarding No.1 "Immediate recovery of Geo Portal", Geo Portal was established through the support by International Centre for Integrated Mountain Development (ICIMOD) of which Bhutan is the member country, and might cost much for its recovery. Geo Portal is, however, one of bases of GI Policy, and is related to the measure No.5, consequently the measure No.1 is the important issue to be solved promptly.

Table 2-20 shows the activities and their outcomes of the measures for promoting utilization excluding No.1.

Table 2-20 Activities and their outcomes for promoting utilization of geospatial information such as topographic maps

No.	Measures for utilization	Activities	Outcomes
2	Introduction of topographic maps, etc., in the Web site of NLCS	Creating a website for 1/25,000 and 1/5,000 digital topographic map including the following information ・Written description and graphics of the topographic map (showing a part of a topographic map) ・Index map of available topographic maps using administrative boundaries, main roads, and rivers as background ・Simple ways of using the data ・How to get maps and their prices	Websites introducing topographic map

No.	Measures for utilization	Activities	Outcomes
3	Preparation of brochure showing information such as contents, access and prices of products provided by NLCS	・A4 sized (front and back) colored brochure including the same information as No.2 website	Brochure of topographic maps
4	Holding lectures and seminars on how to use topographic maps in GIS	・Regularly holding free seminars on “how to use topographic maps in GIS”, in NLCS and provinces that are covered or partly covered by topographic maps. ・To request institution with experience in using digital topographic maps to send instructors ・Making lecture materials available online afterward	Increase in the number of users who can handle topographic maps
5	Expansion of online data provision	・To develop a system that allows users to download data from Geo Portal. Since a system for collecting money must be constructed for paid distribution service, an online service for free distribution should begin first. ・If restoration of Geo Portal in short period of time is difficult, a download feature for free distribution for users should be added on a different platform such as on websites introduced in No.2 of the same table.	Realization of providing data online
6	Moderation of conditions on the use of topographic maps and preparation of terms of use for secondary use	・In order to use topographic map, regardless of whether the map is analogue or digital, an application form and a letter of agreement must be submitted. Therefore, these steps will be simplified through online services. ・Creating regulations for secondary use	・Simplified procedure for obtaining topographic map ・Clarification of regulations for secondary use

Source: JICA Survey Team

2-6 Project Cost Estimation

2-6-1 Initial Cost Estimation

(1) Estimation of Cost Borne by the Government of Japan

This section is closed due to confidentiality.

(2) Estimation of Cost Borne by the Government of Bhutan

The estimated initial cost of the Project to be borne by Bhutan side is shown in Table 2-21 and Table 2-22.

Table 2-21 Budget Estimation of Tasks Undertaken by GNHC

No.	Item	Estimated Cost (BTN)	Remark
Before the Tender			
1	To open Grant bank account (Banking Arrangement, “B/A”)	0	Complete within 1 month after the signing of G/A

No.	Item	Estimated Cost (BTN)	Remark
2	To issue Authorization to Pay ("A/P") to a bank in Japan (the Agent bank) for the payment to the consultant.	0	Complete within 1 month after the signing of the consulting service agreement
During Implementation of the Project			
1	To issue A /P to a bank in Japan (the Agent bank) for the payment to the contractor.	0	Complete before the 1st payment to the contract
	Total	**0**	

Source: JICA Survey Team

Table 2-22 Budget Estimation of Tasks Undertaken by NLCS

No.	Item	Estimated Cost (BTN)	Remark
Before the Tender			
1	To bear the following commissions to a bank in Japan for the banking services based upon the B/A (regarding the payment to consultant)		
	(1) Advising commission of A/P	3,150	For the consulting services 5,000 JPY/time x 1＝5,000JPY＝3,150 BTN
	(2) Payment commission for A/P	509,175	Secure the budget for the consulting service agreement and the contracts before the tender.
2	To submit Project Monitoring Report (reflecting the result of Detail Design)	0	
During Implementation of the Project			
1	To bear the following commissions to a bank in Japan for the banking services based upon the B/A (regarding the payment to contractor)		
	(1) Advising commission of A/P	3,150	For the contract 5,000 JPY/time x 1＝5,000JPY＝3,150 BTN
	(2) Payment commission for A/P	-	Including above "Before the Tender 2(2)"
2	To ensure prompt custom clearance and to assist the contractor about the inland transportation in Bhutan	0	
3	To accord Japanese persons and/or persons from third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the Bhutan and stay therein for the performance of their work	0	
4	To ensure that custom duties, internal taxes and other fiscal levies, as shown below, which may be imposed in the county of the Recipient (Bhutan) with respect to the purchase of the products and/or the services be exempted / be borne by its designated authority without using the Grant. 1) Corporate tax for Japanese/third countries' companies (Exempt/Advance) 2) Personal income tax for Japanese/third countries' staff (Exempt/Advance) 3) Sales tax and import duty (in case of air transportation) (Exempt/Advance) 4) Japanese consumption tax on goods procured in Japan (goods exported to Bhutan) (Exempt/Refund) On the other hand, the tax deduction at source (TDS) for rental car charge will be applied and the tax is not exempted.	0	

No.	Item	Estimated Cost (BTN)	Remark
5	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project including, but not limited to, personal expense of NLCS's employee.		
	(1) Control Point Survey - 2 teams x 49 days - NLCS assign his staff 1person for each team	122,500	■ Labor cost: 2 staff x 49 days x 1,250BTN/day＝122,500BTN ■ Transportation and accommodation cost: Whenever it is necessary to arrange transportation and accommodation, the vehicle and/or the guest house will be arranged by NLCS
	(2) Field Identification - 5 teams - NLCS assign his staff 1person for each team - Team 1 x 87 days, Team 2 x 87 days, Team 3 x 130 days, Team 4 x 65 days, Team 5 x 85 days	567,500	■Labor cost: (2 staff x 87 days + 1 staff x 130 days + 1 staff x 65 days + 1 staff x 85 days) x 1,250BTN/day＝567,500BTN ■ Transportation and accommodation cost: Whenever it is necessary to arrange transportation and accommodation, the vehicle and/or the guest house will be arranged by NLCS
	(3) Final Inspection - 2 teams - NLCS assign his staff 1person for each team - Team 1 x 34 days, Team 2 x 20 days	81,000	■Labor cost: (1 staff x 34 days + 1 staff x 20 days) x 1,500BTN/day＝81,000BTN ■ Transportation and accommodation cost: Whenever it is necessary to arrange transportation and accommodation, the vehicle and/or the guest house will be arranged by NLCS
6	To provide the security at the Project site during the implementation of the following works. (1) Control Point Survey for producing Digital Topographic Map (2) Field Identification for producing Digital Topographic Map	0	
7	To provide with the facilities for distribution of electricity and other incidental facilities necessary for the implementation of the Project, when necessary.	0	
8	To give the permission for contractor to bring out the products from Bhutan for necessary processing.	0	
9	To submit the Project Monitoring Report after each work under the contract(s) such as shipping, delivery, installation, and operational training To submit Project Monitoring Report (final)	0	
10	To organize NLCS' internal team to check the Products for quality control and bear relevant expenses	0	
11	To submit a report concerning the completion of the Project	0	
After the Project			
1	To organize NLCS' internal team to support the user of the Products and bear relevant expenses	0	
2	To organize NLCS's internal team to update the Products and bear relevant expenses	0	
3	To encourage the related authorities for the utilization of the Products	0	
	Total	**1,286,475**	

Source: JICA Survey Team

(3) Estimation Conditions

(a) Estimation date: December 2020
(b) Exchange rates: 1 USD = 106.16 JPY
1 BTN = 1.58688 JPY

2-6-2 Operation and Maintenance Costs

The digital topographic maps to be developed in the Project should be updated as required for maintaining information on them. In particular, it is recommended to be updated when major infrastructure has been constructed in a map area. Also, urban areas have many increases/decreases in buildings and facilities, so they should be updated once every 5 to 10 years. Therefore, it is recommended to accumulate a certain amount of the costs for updating in each fiscal year.

Based on the above, the estimated cost of updating 10 sheets (about 1,700 km^2) of 1/25,000 digital topographic maps and 100 km^2 of 1/5,000 digital topographic maps once every five years is shown in Table 2-23. As NLCS plans to update the topographic maps with the existing staff, it is assumed that there will be no increase in the labor cost for updating and that only the purchasing cost of the latest satellite images will be applicable.

Table 2-23 Operation and Maintenance Costs for Updating Digital Topographic Map (Only Additional Costs)

Item	Subjects	Costs (BTN)	Remarks
Material Cost	Satellite Image (GSD 1.5 m class)	4,396,552	Unit price x Area = 4,080 Yen/km^2 x 1,710 km^2 = 6,976,800 Yen = 4,396,552 BTN
	Satellite Image (GSD 0.5 m class)	2,066,949	Unit price x Area = 32,800 Yen/km^2 x 100 km^2 = 3,280,000 Yen = 2,066,949 BTN
Total		6,463,501	-
Annual Cost		1,292,700	-

* 1 BTN = 1.58688Yen
Source: JICA survey team

As shown in Table 2-23, the material cost for updating the topographic maps every five years is approximately 6.5 million BTN, which is approximately 1.3 million BTN in annual cost. This cost is equivalent to less than 1% of the annual budget of the NLCS, and can be secured by GOB.

Chapter 3 Project Evaluation

Chapter 3 Project Evaluation

3-1 Precondition

The implementation of the Project shall require timely and strict performance of the obligations described in Table 2-14 in Section 2-2-4-3 by the Bhutan side.

3-2 Necessary Inputs by Recipient Country

(1) Establishment of Operation and Maintenance System (with budget and personnel)

The Bhutan side shall continue to maintain an operation and maintenance system in order to realize and sustain the effects of the Project, and will secure the necessary budget, personnel, and systems to continue to maintain and update the digital topographic maps after the Project is completed.

Therefore, after the completion of the Project, NLCS needs to allocate personnel appropriately to continue and expand the skills to be acquired through the technology transfer and other activities related to digital topographic mapping and maintenance management, which were already conducted in the Previous Project and are planned to be conducted in the TCP, which is to be implemented concurrently with the Project.

(2) Dissemination and Promotion of Use of Data Utilization and Extension to New Users

The Bhutan side shall endeavor to expand and promote the use of the digital topographic maps created in the Project and find new users among government organizations and the public by implementing the measures provided in the plan for map use mentioned in the previous chapter.

3-3 Important Assumptions

The important assumptions to realize and sustain the Project effects are as follows:

- The conditions of public safety and political situation shall not drastically deteriorate

3-4 Project Evaluation

The Project is evaluated by focusing on relevance and effectiveness based on the five evaluation criteria of the Development Assistance Committee (DAC).

3-4-1 Relevance

(1) Beneficiaries

The 1/25,000 digital topographic maps of northern and central Bhutan and 1/5,000 digital

topographic maps of major urban areas shall be created in the Project. If the area that had been developed in the Previous Project in southern Bhutan is added to the area to be developed in the Project, the coverage of the 1/25,000 digital topographic maps will reach approx. 80 % of the entire Bhutan. In addition, the mapping of populated areas shall be prioritized. Therefore, many Bhutanese shall benefit from the implementation of the Project.

(2) Urgency

Various analyses for planning development projects such as disaster risk management and water resource management require reliable geospatial information as a basis. The northern and central regions of Bhutan include residential areas of the capital and past disaster areas, which urgent actions for disaster prevention are in need. Also, for planning disaster prevention for urban areas, a topographic map with precise representation of land-use is needed, but a large scale map of 1/5,000 for topographic map has not yet been created. Therefore, GOB to act urgently toward creating and analyzing plans for disaster prevention and water resource maintenance, rapid creation of digital topographic map in northern and central regions of Bhutan that targets urgent areas including residential areas and past disaster areas with a map in the scale of 1/25,000 and urban areas with a map in the scale of 1/5,000 is in demand.

(3) Contribution to the Achievement of Overall Goal

GOB has set the targets of creating 1/25,000 digital topographic maps of the entire country and 1/5,000 digital topographic maps of an area of 3,435 km^2 mainly in urban areas in the 12th FYP. The implementation of the Project will contribute to the achievement of these targets of the development plan of Bhutan.

(4) Consistency with Japan's Assistance Policies/Strategies

"The Country Assistance Policy for Bhutan" prepared in 2015 by GOJ puts emphasis on reducing vulnerabilities of Bhutan, and will assist Bhutan's efforts to tackle environmental issues and climate change through the improvement of living environment and with measures against climate change and disasters. Therefore, the Project fits with Japan's assistance policies/strategies.

3-4-2 Effectiveness

The expected (1) quantitative and (2) qualitative effects of the implementation of the Project are analyzed to evaluate its effectiveness.

(1) Quantitative Effects

The implementation of the Project is expected to create the effects shown in Table 3-1. The actual indicator values in 2019, before the implementation of this outline design survey, are used as the reference values. The indicator values to be achieved three years after the completion of the Project are

used as the target values.

Table 3-1 Quantitative Effects from Project Implementation

Indicator	Reference value (actual value in 2020)	Target value (in 2026) 3 years after completion
The number of Dzongkhag where digital topographic map is used for flood hazard assessment	0 cases	3 cases
The number of downloads of digital topographic maps from NLCS's website	4 times	137 times

Source: JICA Survey Team

- The number of Dzongkhag where digital topographic map is used for flood hazard assessment

  The Flood Engineering Management Division, Department of Engineering Services, Ministry of Works and Human Settlement (FEMD) has been assigned the responsibility of preparing and updating flood hazard zonation maps in the National Integrated Water Resources Management Plan 2016 supported by GOJ. FEMD has already conducted flood hazard assessments, including flood hazard maps, for 19 provinces. Since the 12th FYP states that three flood hazard assessments will be conducted, it is assumed that the number of assessments will be the same in the upcoming 13th Plan, therefore, the target is set to three.

- The number of downloads of digital topographic maps from NLCS's website

  The annual number of downloads of the Fundamental Geospatial Data in Japan is about 6 million times. The number of downloads of digital topographic maps in Bhutan is assumed to be proportional to the coverage area of topographic maps, population, national income per capita, and IT competitiveness, and the target value is set at 137 calculated based on these ratios.

(2) Qualitative Effects

The implementation of the Project is expected to produce the following qualitative effects.

- Improvement of capability for disaster management by efficient preparation of disaster risk analysis map and city planning map
- Effective selection of the construction site and promotion of prompt construction for dam and irrigation system by identification of catchment area using the latest digital topographic map and digital elevation model

3-4-3 Efficiency

For the Project, digital topographic map is created by procuring satellite images. If there is a delay in taking the satellite image, the entire work schedule will be affected. Therefore, the satellite image is planned to be taken between October and March, a period with good weather conditions. Also, since mapping areas include steep mountainous terrain that might become a problem during field

identification, efficient work will be expected by assigning NLCS staff, who have experienced “field identification” during technical transfer in the Previous Project, as an assistance.

3-4-4 Impact

Digital topographic map of northern and central region (1/25,000 scale), and major cities (1/5,000 scale) will be developed in the Project. By maintaining the geospatial information for policy making towards the disaster prevention countermeasures and natural resource management, the reduction of vulnerability against deteriorating living environment can be expected.

3-4-5 Sustainability

Since GOB is promoting the cross-sectional use of geospatial information owned by institutions other than NLCS, building of NSDI is one of the prioritized areas in the 12th FYP. Japan is implementing the TCP in parallel with the Project, and will assist the capacity building of geospatial information sector of Bhutan through the reconstruction of NSDI strategy, creation of NSDI operation and maintenance plan, efficient maintenance method for 1/25,000 digital topographic map, and technical transfer of 1/5000 large scale digital topographic mapping. Therefore, the Project sustainability can be concluded as high.

Appendices

Appendices

1 Member List of the Study Team A1-1
2 Study Schedule A2-1
3 List of Parties Concerned in the Recipient Country A3-1
4 Minutes of Discussions A4-1

Appendix 1

Member List of the Study Team

1 Member List of the Study Team

(JICA)

Name	Position	Organization
SUGITA Shigehiko	Leader	Japan International Cooperation Agency (Director, Team 1 Urban and Regional Development Group, Infrastructure Management Department)
YAGI Toshiharu	Planning	Japan International Cooperation Agency (Deputy Director, Team 1 Urban and Regional Development Group, Infrastructure Management Department)
SAKABE Shinichi	———	Japan International Cooperation Agency (Senior Advisor, Urban and Regional Development Group, Infrastructure Management Department)
WATANABE Kozo	———	Japan International Cooperation Agency Bhutan Office (Chief Representative)
TANAKA Mariko	———	Japan International Cooperation Agency Bhutan Office (Representative)
KAWAI Masayoshi	———	Japan International Cooperation Agency Bhutan Office (Project Formulation Advisor)
SUBBA Krishna	———	Japan International Cooperation Agency Bhutan Office (Deputy Chief Program Officer)

(Consultant)

Name	Position	Organization
IKEDA Takao	Chief Consultant/ Preparation of Specifications 1	Aero Asahi Corporation
HARADA Takashi	Deputy Chief Consultant / Preparation of Specifications 2	Aero Asahi Corporation
HOSHINO Jun	Topographic Mapping Plan	Aero Asahi Corporation
MARUYAMA Hiromichi	Quality Control Plan/ Maintenance and Utilization Plan	Aero Asahi Corporation (Infrastructure Development Institute-Japan)
IKEDA Yosuke	Procurement Plan/Cost Estimation 1	Yachiyo Engineering Co., Ltd.
TOMIZAWA Shinjiro	Procurement Plan/Cost Estimation 2	Aero Asahi Corporation

Appendix 2 Study Schedule

2 Study Schedule

PREPARATORY SURVEY FOR THE PROJECT FOR THE DEVELOPMENT OF DIGITAL TOPOGRAPHIC MAP IN THE KINGDOM OF BHUTAN
Schedule for the 1st Survey

No.	Date	Day	Survey Content						
			JICA Mr. Shigehiko Sugita JICA Mr. Toshiharu Yagi	AAC Mr. Takao Ikeda	AAC Mr. Takashi Harada	AAC Mr. Hiromichi Maruyama (Infrastructure Development Institute-Japan)	AAC Mr. Jun Hoshino	YEC Mr. Yosuke Ikeda	AAC Mr. Shinjiro Tomizawa
Person in charge			Leader, Planning	Chief Consultant/Consultation of Topographic Map Specifications 1	Co-Chief Consultant/Consultation of Topographic Map Specifications 2	Quality Control Planning/ Maintenance and Utilization Planning	Topographic Map Development Planning	Procurement Planning/ Cost Estimation 1	Procurement Planning/ Cost Estimation 2
Number of days			4	14	13	13	8	12	14
1	8-Dec	Tue	・Meeting with NLCS (Kick Off Meeting, Explanation of JICA's policy, ICR and draft of M/D etc.)	・Meeting with NLCS (Kick Off Meeting, Explanation of JICA's policy, ICR and draft of M/D etc.)	・Meeting with NLCS (Kick Off Meeting, Explanation of JICA's policy, ICR and draft of M/D etc.)	・Meeting with NLCS (Kick Off Meeting, Explanation of JICA's policy, ICR and draft of M/D etc.)	・Meeting with NLCS (Kick Off Meeting, Explanation of JICA's policy, ICR and draft of M/D etc.)	・Meeting with NLCS (Kick Off Meeting, Explanation of JICA's policy, ICR and draft of M/D etc.)	・Meeting with NLCS (Kick Off Meeting, Explanation of JICA's policy, ICR and draft of M/D etc.)
2	9-Dec	Wed		・Meeting with NLCS (Explanation of ICR)	・Meeting with NLCS (Explanation of ICR)	・Meeting with NLCS (Explanation of ICR)		・Meeting with NLCS (Explanation of ICR) ・Getting on the information sheet on tax exemption in Bhutan	・Meeting with NLCS (Explanation of ICR) ・Getting on the information sheet on tax exemption in Bhutan
3	10-Dec	Thu		・Survey on Satellite Image Procurement (Sales Agent in Japan)				・Survey of Satellite Image Procurement (Sales Agent in Japan)	・Survey of Satellite Image Procurement (Sales Agent in Japan)
4	11-Dec	Fri		・Meeting with NLCS (Questionnaire – Question and Answer)	・Meeting with NLCS (Questionnaire – Question and Answer)	・Meeting with NLCS (Questionnaire – Question and Answer)		・Survey of Satellite Image Procurement (Sales Agent in Japan) ・Meeting with NLCS (Questionnaire – Question and Answer)	・Survey of Satellite Image Procurement (Sales Agent in Japan) ・Meeting with NLCS (Questionnaire – Question and Answer)
5	12-Dec	Sat	–	–	–	–	–	–	–
6	13-Dec	Sun	–	–	–	–	–	–	–
7	14-Dec	Mon		・Internal Meeting	・Internal Meeting	・Hearing with DRE ・Receipt of questionnaire from MoWHS	・Internal Meeting	・Internal Meeting ・Update Tax Exemption Information Sheet (Tax Law Check)	・Internal Meeting
8	15-Dec	Tue		・Meeting with NLCS (1/5000 specification discussion)	・Meeting with NLCS (1/5000 specification discussion)	・Hearing with NCHM ・Meeting with NLCS (1/5000 specification discussion) ・Hearing with DDM	・Meeting with NLCS (1/5000 specification discussion)	・Request for quotation of rental-car and hotel ・Update of Tax Exemption Information Sheet (Tax Law Confirmation)	・Meeting with NLCS (1/5000 specification discussion) ・Request for quotation of rental-car and hotel
9	16-Dec	Wed	・Internal Meeting (Interim reports and discussions on each issue)	・Internal Meeting (Interim reports and discussions on each issue)	・Internal Meeting (Interim reports and discussions on each issue)	・Internal Meeting (Interim reports and discussions on each issue)		・Internal Meeting (Interim reports and discussions on each issue) ・Update of Tax Exemption Information Sheet (Tax Law Confirmation)	・Internal Meeting (Interim reports and discussions on each issue)
10	17-Dec	Thu		・Internal Meeting	・Internal Meeting	・Internal Meeting ・Summarize the questionnaire	・Internal Meeting	・Internal Meeting	・Internal Meeting
11	18-Dec	Fri		・Meeting with NLCS (Q&A based on questionnaire, discussion of topographic maps and DEM specifications, etc.)	・Meeting with NLCS (Q&A based on questionnaire, discussion of topographic maps and DEM specifications, etc.)	・Meeting with NLCS (Q&A based on questionnaire, discussion of topographic maps and DEM specifications, etc.)	・Meeting with NLCS (Q&A based on questionnaire, discussion of topographic maps and DEM specifications, etc.)		・Meeting with NLCS (Q&A based on questionnaire, discussion of topographic maps and DEM specifications, etc.)
12	19-Dec	Sat	–	–	–	–	–	–	–
13	20-Dec	Sun	–	–	–	–	–	–	–
14	21-Dec	Mon		・Internal Meeting	・Internal Meeting	・Hearting with Thimphu Thromde ・Internal Meeting	・Internal Meeting	・Internal Meeting	・Internal Meeting
15	22-Dec	Tue	・Meeting with NLCS (Discussion on M/D and Q&A)	・Meeting with NLCS (Discussion on M/D and Q&A)	・Meeting with NLCS (Discussion on M/D and Q&A)	・Hearting with DoR			・Meeting with NLCS (Discussion on M/D and Q&A)
16	23-Dec	Wed		・Internal Meeting	・Internal Meeting	・Internal Meeting	・Internal Meeting	・Internal Meeting ・Request for quotation for local car rental and hotel	・Internal Meeting
17	24-Dec	Thu		・Internal Meeting	・Internal Meeting	・Hearing with WFP ・Hearing with DHS ・Internal Meeting	・Internal Meeting	・Internal Meeting	・Internal Meeting
18	25-Dec	Fri	・Meeting with NLCS (Survey Report, Q&A and discussion on M/D)	・Meeting with NLCS (Survey Report, Q&A and discussion on M/D)	・Meeting with NLCS (Survey Report, Q&A and discussion on M/D)	・Meeting with NLCS (Survey Report, Q&A and discussion on M/D)		・Meeting with NLCS (Survey Report, Q&A and discussion on M/D)	・Meeting with NLCS (Survey Report, Q&A and discussion on M/D)

PREPARATORY SURVEY FOR THE PROJECT FOR THE DEVELOPMENT OF DIGITAL TOPOGRAPHIC MAP IN THE KINGDOM OF BHUTAN
Schedule for the 2nd Survey

No.	Date	Day	Survey Content					
			JICA Mr. Shigehiko Sugita, Mr. Toshiharu Yagi	AAC Mr. Takao Ikeda	AAC Mr. Takashi Harada	AAC Mr. Hiromichi Maruyama (Infrastructure Development Institute-Japan)	YEC Mr. Yosuke Ikeda	AAC Mr. Shinjiro Tomizawa
Person in charge			Leader, Planning	Chief Consultant/Consultation of Topographic Map Specifications 1	Co-Chief Consultant/Consultation of Topographic Map Specifications 2	Quality Control Planning/ Maintenance and Utilization Planning	Procurement Planning/ Cost Estimation 1	Procurement Planning/ Cost Estimation 2
Number of days			6	6	6	2	4	6
1	26-Apr	Mon	・JICA Study Team Preliminary Meeting	・JICA Study Team Preliminary Meeting	・JICA Study Team Preliminary Meeting			・JICA Study Team Preliminary Meeting
2	27-Apr	Tue	・Meeting with NLCS (Explanation of the key points of M/D and the Draft Final Report, discussion of the questionnaire, etc.)	・Meeting with NLCS (Explanation of the key points of M/D and the Draft Final Report, discussion of the questionnaire, etc.)	・Meeting with NLCS (Explanation of the key points of M/D and the Draft Final Report, discussion of the questionnaire, etc.)			・Meeting with NLCS (Explanation of the key points of M/D and the Draft Final Report, discussion of the questionnaire, etc.)
3	28-Apr	Wed	・Internal Meeting ・Sorting Information and Data	・Internal Meeting ・Sorting Information and Data	・Internal Meeting ・Sorting Information and Data		・Internal Meeting ・Sorting Information and Data	・Internal Meeting ・Sorting Information and Data
4	29-Apr	Thu	—	—	—	—	—	—
5	30-Apr	Fri	・Meeting with NLCS Explanation of the Draft Final Report and discussion of the questionnaire, etc.	・Meeting with NLCS Explanation of the Draft Final Report and discussion of the questionnaire, etc.	・Meeting with NLCS Explanation of the Draft Final Report and discussion of the questionnaire, etc.	・Meeting with NLCS Explanation of the Draft Final Report and discussion of the questionnaire, etc.	・Meeting with NLCS Explanation of the Draft Final Report and discussion of the questionnaire, etc.	・Meeting with NLCS Explanation of the Draft Final Report and discussion of the questionnaire, etc.
6	1-May	Sat	—	—	—	—	—	—
7	2-May	Sun	—	—	—	—	—	—
8	3-May	Mon	—	—	—	—	—	—
9	4-May	Tue	—	—	—	—	—	—
10	5-May	Wed	—	—	—	—	—	—
11	6-May	Thu	・Internal Meeting ・Sorting Information and Data	・Internal Meeting ・Sorting Information and Data	・Internal Meeting ・Sorting Information and Data		・Internal Meeting ・Sorting Information and Data	・Internal Meeting ・Sorting Information and Data
12	7-May	Fri	・Meeting with NLCS Discussion on M/D and questionnaire	・Meeting with NLCS Discussion on M/D and questionnaire	・Meeting with NLCS Discussion on M/D and questionnaire	・Meeting with NLCS Discussion on M/D and questionnaire	・Meeting with NLCS Discussion on M/D and questionnaire	・Meeting with NLCS Discussion on M/D and questionnaire

Appendix 3

List of Parties Concerned in the Recipient Country

3 List of Parties Concerned in the Recipient Country

Name	Position
NLCS (National Land Commission Secretariat)	
Tenzin Namgay	Director, Department of Survey & Mapping
Tashi	Chief Survey Engineer, Topographical Survey Division
Biswanath Pradhan	Chief Survey Engineer, Topographical Survey Division
Kinga Loday	Deputy Chief Survey Engineer, Topographical Survey Division
Chokila	Deputy Chief Survey Engineer, Topographical Survey Division
Lobzang Tobgye	Deputy Chief Survey Engineer, Topographical Survey Division
Binay Tamang	Chief Survey Engineer, Geoinformatics Division
Sonam Yangdon	Deputy Chief Survey Engineer, Geoinformatics Division
Samdrup Dorji	Deputy Chief Survey Engineer, CGISC (Center for GIS Coordination)
Lhakpa Wangmo Thingh Tamang	Survey Engineer, CGISC (Center for GIS Coordination)
GHNC (Gross National Happiness Commission)	
Sonam Yarphel	Deputy Chief Program Officer
DDM (Department of Disaster Management, Ministry of Home and Cultural Affairs)	
Sonam Tshewang	Executive Engineer, Rehabilitation and Reconstruction Division
DHS (Department of Human Settlement, Ministry of Works and Human Settlement)	
Bhawana Chettri	Chief Urban Planner, Survey&GIS division
Daza Daza	Surver Engineer, Survey&GIS division
DoR (Department of Road, Ministry of Works and Human Settlement)	
Yeshey Penjor	Executive Engineer, RMM & GIS Section, Maintenance Division
MoEA (Ministry of Economic Affairs)	
Choten Duba	Executive engineer, Alternate Energy Division, Department of Renewable Energy
NCHM (National Centre for Hydrology and Meteorology)	
Phuntsho Tshering	Executive Geologist, Cryosphere Services Division
Thimphu Thromde	
Sonam Zangmo	Senior GIS Officer, Urban Planning and Development Division
WFP (World Food Programme)	
Laksiri Nanayakkara	Emergency Preparedness and Response Officer

Appendix 4　Minutes of Discussion

(1) 1st Field Survey　25th December 2020

(2) 2nd Field Survey　12th May 2021

4. Minutes of Discussions(M/D)

(1) 1st Survey (from December 8th to 25th, 2020)

Minutes of Discussions
on
the Preparatory Survey
for
the Project for Making Digital Topographic Map
in
the Kingdom of Bhutan

In response to the request from the Government of the Kingdom of Bhutan (hereinafter referred to as "Bhutan"), Japan International Cooperation Agency (hereinafter referred to as "JICA") have conducted the Preparatory Survey for the Project for Making Digital Topographic Map (hereinafter referred to as "the Project"). JICA and the officials of the Government of Bhutan held a series of discussions and conducted necessary surveys for Outline Design from December 8th to 25th, 2020.

In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Bhutan and Tokyo, December 25th, 2020

Mr. SUGITA Shigehiko	Mr. Tenzin Namgay
Director of Team 1 (Leader of Preparatory Survey Team)	Director
Urban and Regional Development Group, Infrastructure Management Department	Department of Survey and Mapping
Japan International Cooperation Agency	National Land Commission Secretariat
Japan	Bhutan

ATTACHMENT

1. Objective of the Project
The objective of the Project is to prepare digital topographic map of midland of Bhutan (1/25,000 scale) and major cities (1/5,000 scale) by putting the geospatial information so as to be the base for the disaster prevention countermeasure and natural resource management thereby contributing to reduce the vulnerability of infrastructure.

2. Title of the Project
The title of the Project is "the Project for Making Digital Topographic Map.

3. Project site
Both sides tentatively confirmed that the Project site is in Bhutan, which is shown in Annex 1.
However, both sides agreed to continue to discuss the purpose of use of the Product and the details of structure and land features to be reflected in the Product. Through further discussion, both parties will finalize the Project site by January 15th, 2021 for estimate.

4. Responsible authority for the Project
The National Land Commission Secretariat is the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and accordingly as scheduled. The organization charts are shown in Annex 2.

5. Items requested by the Government of Bhutan

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Bhutan are as follows:

1) Products
- Digital Topographic Map
  - 1/25,000 Digital Topographic Map (Approx. 18,900km2) including Digital Elevation Model (DEM)
  - 1/5,000 Digital Topographic Map (Approx. 500km2) including Digital Elevation Model (DEM)
- Satellite Image
  - Ground Sampling Distance (GSD) 0.5 m class Satellite image
  - GSD 1.5 m class Satellite image

2) Consulting Services
- Detailed Design of the Project
- Support of Tender
- Supervision of Procurement

5-2. JICA will assess the feasibility of the above requested items through the Preparatory Survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Bhutan side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as "the Grant") as described in Annex 3 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires the Bhutan side to submit the Project Monitoring Report, the form of which is attached as Annex 4.

6-2. The Bhutan side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.

The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey

7-1. JICA will proceed with further surveys in Bhutan and remotely from Japan until April, 2021.

7-2. JICA will prepare a Draft Preparatory Survey Report in English and dispatch a mission to Bhutan in order to explain its contents in April, 2021.

7-3. If the contents of the Draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Bhutan side, JICA will finalize the Preparatory Survey Report and send it to Bhutan around July.

7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Bhutan side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

8-2. The Project is categorized as "C" from the following considerations:

Not located in a sensitive area, nor has its sensitive characteristics, nor falls into sensitive sectors under the Guidelines, and its potential adverse impacts on the environment are not likely to be significant.

9. Other Relevant Issues

9-1. Specification of Digital Topographic Map

<1/25,000 scale>

Both sides confirmed that the 1/25,000 digital topographic map shall have the same map symbol specification and product specification as the past technical cooperation project called "the Project for Development of National Geo-Spatial Data in Bhutan" conducted by JICA from 2015 to 2017. Both sides also confirmed that the file format shall be File Geodatabase, MXD, and PDF and the file sheet size shall be 7.5-minutes grid.

<1/5,000 scale>

It was confirmed that the Bhutan side has created the specification for 1/5,000 digital topographic map, so JICA requested the Bhutan side to provide the 1/5,000 map symbol specification of Bhutan by January 3rd, 2021. Referring to the

specification, both sides will further discuss and decide the specification for 1/5,000 digital topographic map by January 15th, 2021.

9-2. Specification of Satellite Image

JICA received the information from the Bhutan side that WWF Bhutan's satellite images for base mapping for defining the HCV (High Conservation Values) zones which may cover partially the Project area. Considering the fact, JICA requested the Bhutan side to provide all of the satellite images and accompanied data by January 8th, 2021. Then, JICA will carefully assess whether or not the images provided by WWF Bhutan can be utilized for the Project by January 13th from each and every aspect, including technical matters and license issues.

If the satellite images are adequate to prepare a digital topographic map for the Project, both sides can consider utilizing the images and reflect the cost estimate. On the other hand, in case all the images and accompanied data are not shared by January 8th, 2021 or those are technically inadequate for digital map production, both sides will not consider to utilize the images provided by WWF Bhutan.

9-3. Warranty

Both sides agreed that the warranty period of the Product shall be one (1) year after the handover and, in principle, any changes in topography or features of the digital topographic map after the date the satellite image is acquired shall not be considered.

On the other hand, the Bhutan side commented with a favor that major infrastructures under construction shall be reflected in the Product even after the satellite image is acquired as much as possible. In this regard, both sides understood that, to avoid any confusion in the implementation stage, it is important to set the cut-off date (for example, the end of field verification) and by that time Bhutan side shall provide with the necessary information to be reflected in the map. Both sides agreed to continuously discuss and decide the cut-off date until the end of February, 2021.

9-4. Copyrights

Both sides agreed that the Bhutan side shall have the copyrights of the Product. However, both sides also agreed that JICA shall have the right of usage of the Products.

9-5. Soft Component

The Bhutan side requested the following as a Soft Component.

a. Pan-sharpening of satellite image
b. Maintenance and Update of digital topographic map
c. Quality Assurance/Quality Control
d. Handling and processing drone
e. Utilization of the digital topographic map for educational purpose

JICA will review whether the above components are necessary to the Project's goal or not. JICA will also see if those are covered in the technical cooperation project called "Project for Promotion of Utilization of Geospatial Information through

Development of National Spatial Data Infrastructure" which is newly formulated by JICA.
In addition, in light of the importance of education in digital topographic maps in Bhutan, both sides agreed to consider the utilization of the digital topographic map for educational purposes.

9-6. Visibility of Japanese Grant Aid

The Bhutan side agreed that a logo or statement indicating Japanese Grant Aid shall be put to the Products. For the purpose of promoting public awareness for the Project, the Bhutan side will take appropriate measures to make the Project widely known to the people of the Kingdom of Bhutan.

【Annex】

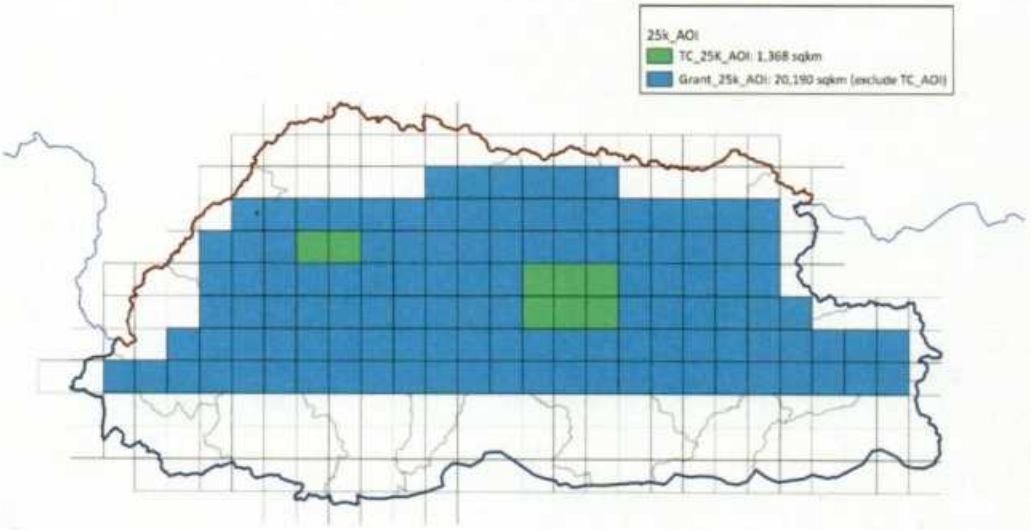
- Annex 1 Project Site
- Annex 2 Organization Chart
- Annex 3 Japanese Grant
- Annex 4 Project Monitoring Report (template)
- Annex 5 Major Undertakings to be taken by the Government of Bhutan

Annex 1

Project Site

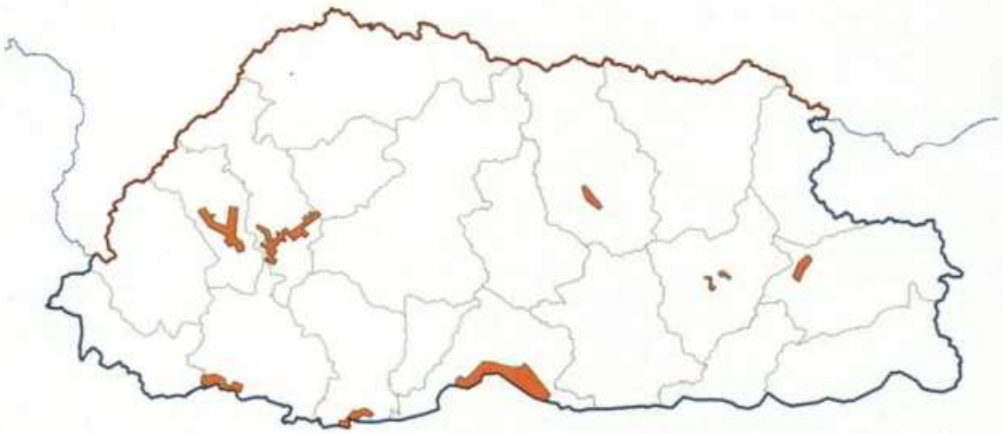
<1/25,000 Digital Topographic Map>

Both sides have planned to prepare the map for approximately 18,900km2 in the midland of Bhutan. As a result of investigation, JICA has proposed the following image, and Bhutan sides basically agreed the same. Both sides agreed to further discuss the covered area for estimate. It is taken note that, since the part of the area (colored in green) is covered by a technical cooperation project separately formulated by JICA, such area will be finally excluded from the Project.



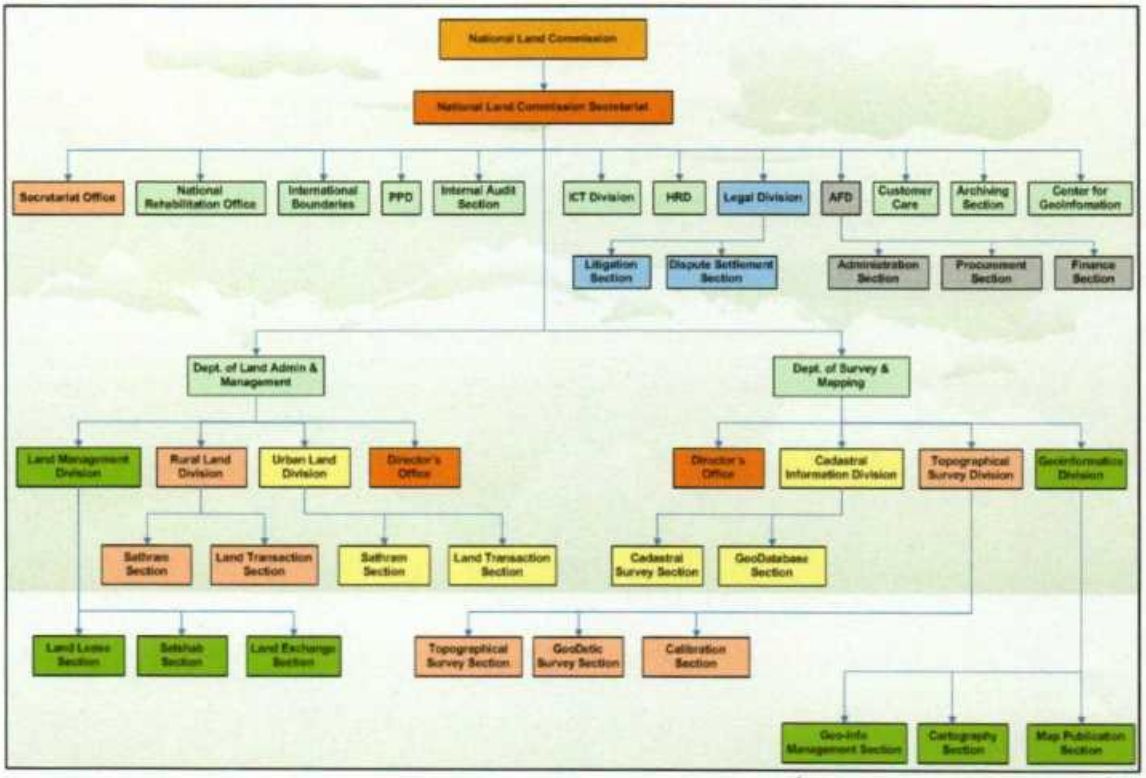
<1/5,000 Digital Topographic Map>

Both sides have planned to prepare the map for approximately 500km2. JICA has proposed the following image in which the colored area (in orange) has high priority. Both sides will further discuss the covered area for estimate.



Annex 2

Organization Chart



(Reference : NLCS website)

National Land Commission was instituted on 15th August 2007 as per the Land Act 2007. National Land Commission is the apex body for land administration, management, surveying and mapping in Bhutan. Under the Act, the National Land Commission Secretariat (NLCS) also bear the specific responsibilities for sound spatial and land use planning and land use zoning and will act as the Executing Agency for the Project. Gross National Happiness Commission (GNHC) also undertakes part of the responsibilities summarized in Annex5 for the smooth implementation.

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of

relevant agencies of the Recipient necessary for the implementation of the Project.

- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the

Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

PROCEDURES OF JAPANESE GRANT

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

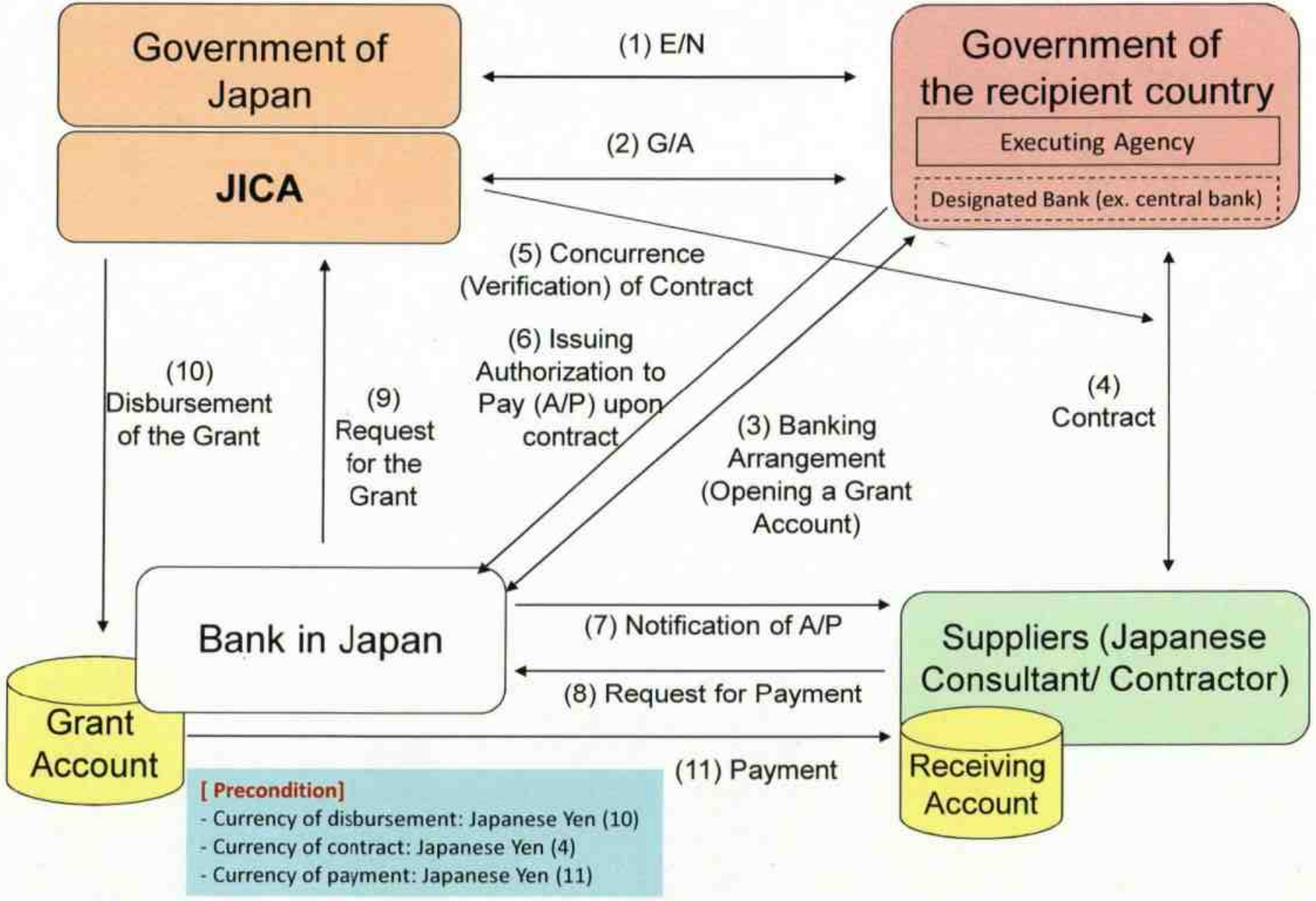
notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Attachment 2

Financial Flow of Japanese Grant (A/P Type)



Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Executing Agency	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Line Ministry	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/ Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

-
-
-

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Annex 5

Major Undertakings to be taken by the Government of Bhutan

1. Specific obligations of the Government of Bhutan which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open Grant bank account (Banking Arrangement, "B/A")	within 1 month after the signing of G/A	GNHC		
2	To issue Authorization to Pay ("A/P") to a bank in Japan (the Agent bank) for the payment to the consultant.	within 1 month after the signing of contract	GNHC		
3	To submit Project Monitoring Report	before preparation of bid documents	NLCS		

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A /P to a bank in Japan (the Agent bank) for the payment to the contractor.	before the first payment to the contractor	NLCS		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A 1) Advising commission of A/P 2) Payment commission for A/P	 within 1 month after the signing of the contracts every payment	NLCS		
3	To ensure prompt custom clearance and to assist the contractor about the inland transportation in Bhutan	over the Project	NLCS		
4	To accord Japanese persons and/or persons from third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the Bhutan and stay therein for the performance of their work	over the Project	NLCS		
5	To ensure that custom duties, internal taxes and other fiscal levies which may be imposed in the county of the Recipient (Bhutan) with respect to the purchase of the products and/or the services be exempted / be borne by its designated authority without using the Grant	over the Project	NLCS		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project including, but not limited to, personal expense of C/P's employee, accommodation fee of the personnel, travel expense	over the Project	NLCS		
7	To submit the Project Monitoring Report after each work under the contract(s) such as shipping, delivery, installation, and operational training To submit Project Monitoring Report (final)	within 1 month after the completion of each work within 1 month after issuance of completion certificate for the works under the contract(s)	NLCS		
8	To submit a report concerning the completion of the Project	within 6 months after the completion of the Project	NLCS		
9	To conduct inspection and verification of the products during the implementation	over the Project	NLCS		
10	To conduct quality control of the products during the implementation	over the Project	NLCS		
11	To provide with the facilities for distribution of electricity and other incidental facilities necessary for the implementation of the Project, when necessary.	over the Project	NLCS		
12	To give the permission for contractor to bring out the products from Bhutan for necessary processing.	over the Project	NLCS		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To set up the internal organization within C/P for inspection and verification of the products.	Soon after the completion of the Project	NLCS		
2	To set up the internal organization within C/P for quality control	Soon after the completion of the Project	NLCS		
3	To set up the internal organization within C/P for maintenance of the products	Soon after the completion of the Project	NLCS		
4	To encourage the related authorities for the utilization of the products	-	NLCS		

2. Other obligations of the Government of Bhutan funded with the Grant

NO	Items	Deadline	Amount (Million Japanese Yen)*
1			
2			
	Total		

* The Amount is provisional. This is subject to the approval of the Government of Japan.

(2) 2nd Survey (from April 27th to May 7th, 2021)

Minutes of Discussions

on the Preparatory Survey for the Project for the Development of Digital Topographic Map in the Kingdom of Bhutan

(Explanation on Draft Outline Design Report)

With reference to the Minutes of Discussions signed between National Land Commission Secretariat (hereinafter referred to as "NLCS") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on December 25th, 2020 and in response to the request from the Government of the Kingdom of Bhutan (hereinafter referred to as "Bhutan") dated July 24th, 2018, JICA prepared the Draft Preparatory Survey Report (hereinafter referred to as "the Report") for the Project for the Development of Digital Topographic Map (hereinafter referred to as "the Project").

The Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Shigehiko Sugita, Director, Team 1, Urban and Regional Development Group, Infrastructure Management Department, JICA, consulted with the concerned officials of the Government of Bhutan on the contents of the Report together with the draft preparatory report on the Project.

As a result of the discussions, both sides confirmed the main items described in the attached sheets.

Bhutan and Tokyo, May 12th, 2021

Mr. Shigehiko SUGITA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Mr. Tenzin Namgay
Director
Department of Survey and Mapping
National Land Commission Secretariat
The Kingdom of Bhutan

ATTACHEMENT

1. Project Component of the Draft Outline Design of the Project

   After the explanation of the contents of the Draft Preparatory Report on the Project by the Team, the Bhutan side agreed in principle to the project contents.

2. Objective of the Project

   The objective of the Project is to enhance the accuracy of planning and policy on the disaster prevention countermeasure and natural resource management by developing the digital topographic map of northern and central region (1/25,000 scale) and major cities (1/5,000 scale), thereby contributing to reduce the vulnerability of socio-economic foundation in Bhutan.

3. Title of the Project

   Both sides confirmed the title of the Project shall be modified and finalized as "the Project for the Development of Digital Topographic Map" from the previous title as "the Project for Making Digital Topographic Map".

4. Project site

   Both sides confirmed that the sites of the Project are northern and central region and major cities in Bhutan.

5. Responsible authority for the Project

   Both sides confirmed the authorities responsible for the Project are as follows:

   5-1. The NLCS will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be taken care by relevant authorities properly and on time. The organization charts are shown in Annex 1. NLCS appointed Mr. Kinga Loday, Dy. Chief Survey Enginner, Topographical Survey Division, Department of Survey and Mapping as the person in charge of the Project.

   5-2. The line ministry of the Executing Agency is the Gross National Happiness Commission (hereinafter referred to as "GNHC"). The GNHC shall be responsible for supervising the Executing Agency on behalf of the Government of Bhutan.

6. Project Component

Both sides confirmed the following 1) Products and 2) Consulting Services will be the main component of the Project. Both sides also confirmed the area for the digital topographic map is developed as Annex 2 and the specification of the Products as Annex 3.

1) Products
   - Digital Topographic Map
     - 1/25,000 Digital Topographic Map (Approx. 17,271km2) including Digital Elevation Model (DEM)
     - 1/5,000 Digital Topographic Map (Approx. 500km2) including Digital Elevation Model (DEM)
   - Satellite Image

2) Consulting Services
   - Detailed Design of the Project
   - Support of Tender
   - Supervision of Procurement

7. Contents of the Report

After the explanation of the contents of the Report by the Team, the Bhutan side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Bhutan side around July 2021.

8. Cost Estimation

Both sides confirmed that the Project Cost Estimation as attached in Annex 7; however, the final Project Cost described in the Exchange of Note (hereinafter referred to as "E/N") would be appraised by the Government of Japan.

9. Confidentiality of the Cost estimation and Technical Specifications

Both sides confirmed that the Project Cost Estimation and technical specifications of the Project in Annex 7 and Annex 3, and the Report should never be duplicated and/or disclosed to any third parties until all the contracts under the Project are concluded. Also, in NLCS, only Mr. Tashi, Chief Survey Engineer, Topographical Survey Division, Department of Survey and Mapping knows the cost estimate and shall keep it as confidential until above time of disclosure.

10. Japanese Grant Aid Scheme

The Bhutan fully understand the scheme of the Japan's Grant Aid and necessary measures undertaken by the Bhutan side, which was explained by the Team and confirmed, in the Minutes of Discussions signed between NLCS and JICA on December 25th, 2020, including procedures and basic principles of Japanese Grant applied to the Project.

11. Timeline for the project implementation

The Team explained to the Bhutan side that the expected timeline for the project implementation is as attached in Annex 4.

12. Expected outcomes and indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Bhutan side will be responsible for the achievement of agreed key indicators targeted in year 2026 and shall monitor the progress for Ex-Post Evaluation based on those indicators.

[Quantitative indicators]

Indicator	Baseline (Year 2020)	Target (Year 2026)
The number of Dzongkhag where digital topographic map is utilized for flood hazard assessment	0 case	3 cases
The number of downloads of digital topographic map from NLCS's website	4 times	137 times

[Qualitative indicators]

- To improve the capability for disaster management by efficiently preparing disaster risk analysis and urban planning map
- To effectively select the construction site for dam and irrigation system and promoting the constructions by identifying the catchment area with the Products (latest digital topographic map and digital elevation model)

13. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability). The result of the evaluation will be publicized. The Bhutan side is required to provide necessary support for the data collection.

14. Technical assistance ("Soft Component" of the Project)
The Bhutan side agreed that no Soft Components is planned under the Project.

15. Undertakings of the Project by the Bhutan side
Both sides confirmed the undertakings of the Project by the Bhutan side as described in Annex 5. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in 1.(2)-5 of Annex 5, both sides confirmed that such customs duties, internal taxes and other fiscal levies, which shall be clarified in the bid documents by NLCS during the implementation stage of the Project.

As also described in Annex 5, the Bhutan side agreed to bear the commission charges to a bank in Japan and all the expenses, other than those covered by the Grant, necessary for the implementation of the Project including, but not limited to, personal expense of NLCS's employee, accommodation fee of the personnel, and travel expense for control point survey, field identification, and final inspection. The Bhutan side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. Costs that are more accurate will be calculated at the Detailed Design stage.

Both sides also confirmed that the Annex 5 will be used as an attachment of G/A.

Further, both sides confirmed that NLCS shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, including the Consultant and the Contractor to be engaged by NLCS for the Project, in cooperation with relevant authorities such as police.

16. Monitoring during the implementation
The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (PMR) attached as Annex 6. The timing of submission of the PMR is described in Annex 5.

17. Project completion
Both sides confirmed that the Project completes when all the digital topographic map and satellite image procured are taken over to NLCS. NLCS will report the

completion to JICA in the form of a letter promptly, but in any event not later than six months after the completion of the Project.

18. Environmental Guidelines and Environmental Category

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as C because the Project is likely to have minimal adverse impact on the environment under the Guidelines.

19. Other Relevant Issues

19-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which project cost is excluded will be disclosed to the public after completion of the Preparatory Survey. The comprehensive report including the project estimation cost will be disclosed to the public after all the contracts under the Project are concluded.

19-2. Warranty

Both sides confirmed that the warranty period of the Products shall be one (1) year from the handover. If a defect appears in the warranty period, the Contractor shall be notified by NLCS through the Consultant and remedy the defect before the expiry date of the warranty period. The warrany shall cover the case that the Product does not meet the required specifications.

Aso, in principle, any changes in topography or features of digital topographic map after the satellite images are taken shall not be considered as the part of defect liabilty.

19-3. Additional information to be reflcted in the Products

Both sides agreed that, if NLCS provide with necessary information about major infrastructures and facilities which are under construction by the end of field identification in the Project, such changes can be reflected to the digital topographic map of the Products. The information provided by NLCS shall be technical documents, such as drawings, which are sufficient enough for the Contractor to identify and reflect the major infrastructures.

19-4. Copyrights

Both sides agreed that the Bhutan side shall have the copyrights of the Products. Both sides also agreed that JICA have the right of usage of the Products. JICA can

use the Products for any other Japanese ODA projects conducted in Bhutan and the consideration of new projects in Bhutan. Further, JICA is allowed to provide with the Products Japanese organizations or companies related to any other Japanese ODA projects conducted in Bhutan and the consideration of new projects in Bhutan.

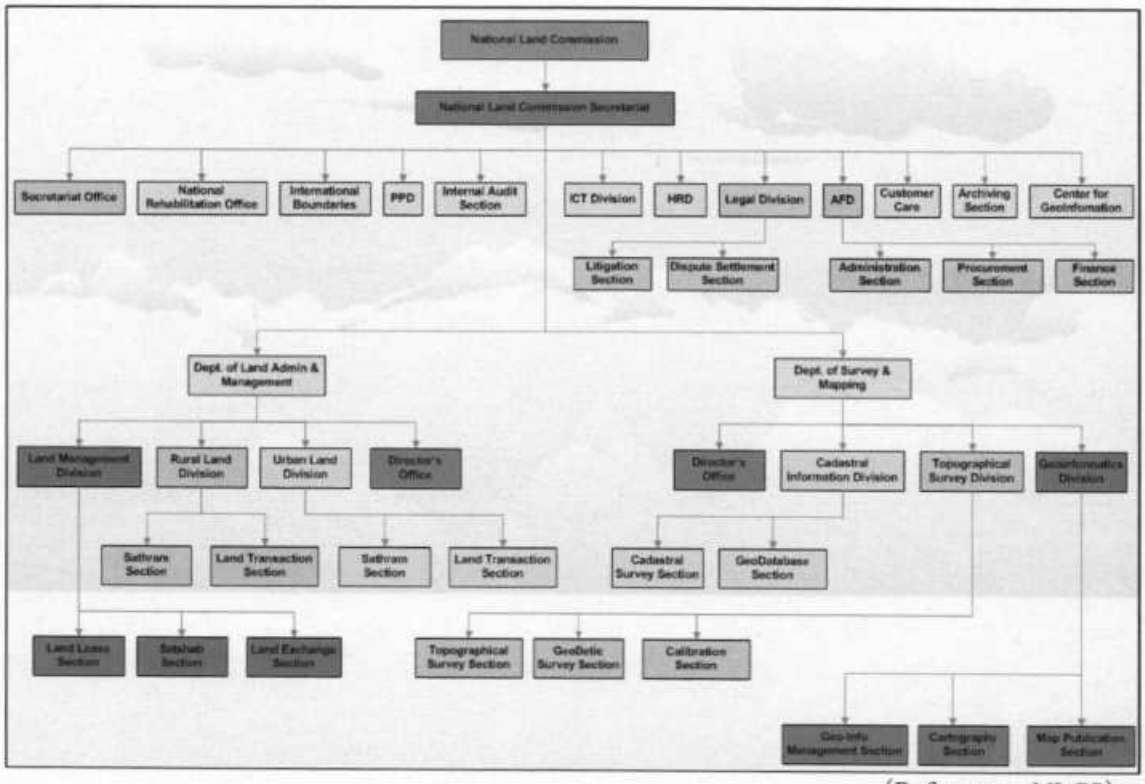
19-5. Visibility of Japanese Grant Aid

The Bhutan side agreed that a logo or statement indicating Japanese Grant Aid shall be put to the Products. For promoting public awareness to the Project, the Bhutan side will take appropriate measures to make the Project widely known to the people of the Kingdom of Bhutan.

Annex 1 Organization Chart
Annex 2 The area for the digital topographic map is developed
Annex 3 Specification of the Products
Annex 4 Project Implementation Schedule
Annex 5 Major Undertakings to be taken by the Government of Bhutan
Annex 6 Project Monitoring Report (template)
Annex 7 Project Cost Estimation

Annex 1

Organization Chart
of
the National Land Commission Secretariat



(Reference : NLCS)

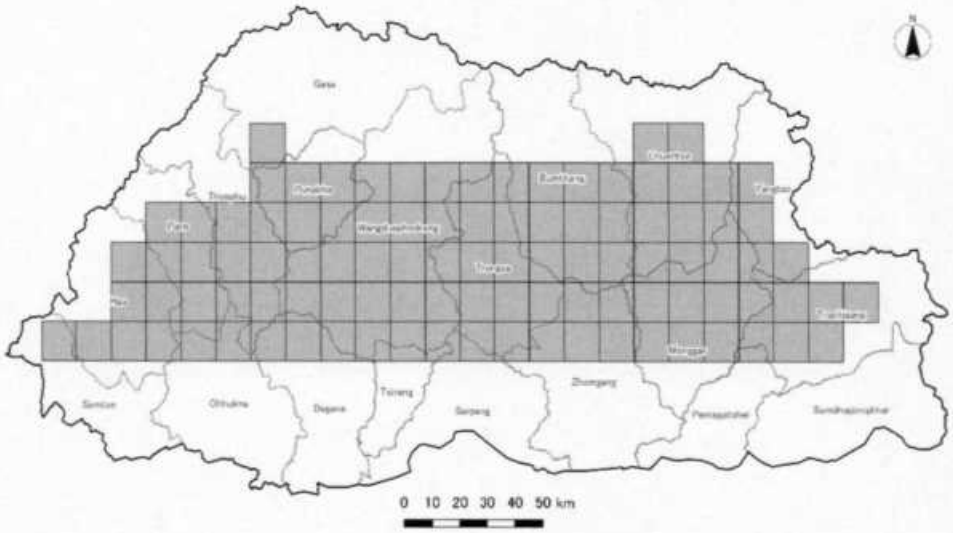
National Land Commission was instituted on 15th August 2007 as per the Land Act 2007. National Land Commission is the apex body for land administration, management, surveying and mapping in Bhutan. Under the Act, the National Land Commission Secretariat (NLCS) also bear the specific responsibilities for sound spatial and land use planning and land use zoning and will act as the Executing Agency for the Project. Gross National Happiness Commission (GNHC) also undertakes part of the responsibilities summarized in Annex5 for the smooth implementation.

Annex 2

The area for the digital topographic map is developed

<1/25,000 Digital Topographic Map>

Both sides agreed that the area of the 1/25,000 Digital Topographic Map is approximately 17,271 km^2 (101 Map Sheets) in the northern and central regions of Bhutan as shown below.



<1/5,000 Digital Topographic Map>

Both sides agreed that the area of the 1/5,000 Digital Topographic Map is approximately 500 km^2 for 9 major cities in Bhutan as shown below.

Annex 3

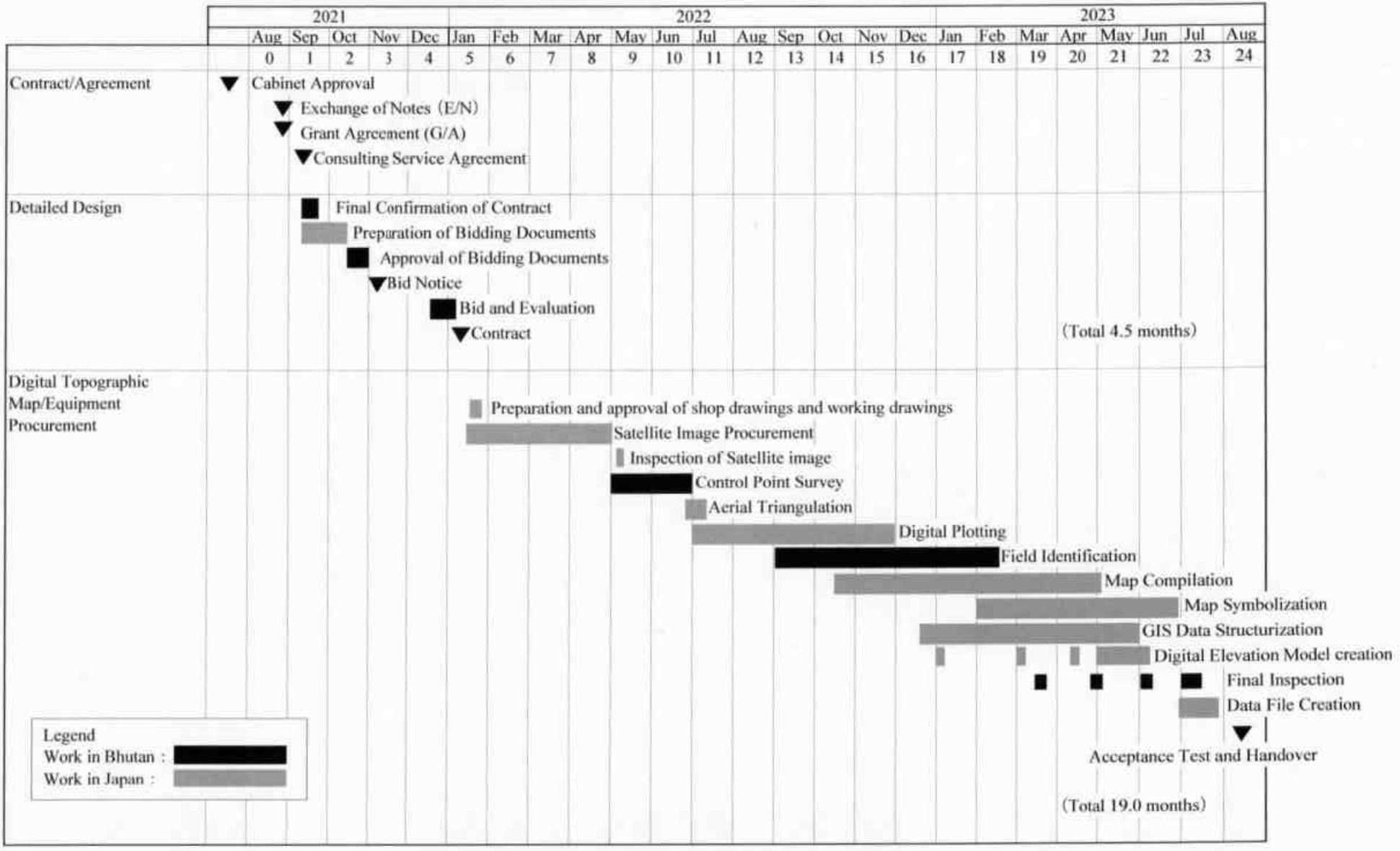
Specification of the Products

Item		Specifications
Digital Topographic Map (1/25,000)	Mapping area	Central and Northern Bhutan
	Size of mapping area	Approx. 17,271 km^2
	Map symbol specifications	In accordance with "Map symbols regulation for 1/25,000 Scale Digital Topographic Maps".
	Product specifications	In accordance with "Data Product Specification for Fundamental Geospatial Data (Scale 1/25,000) Prototype Ver.0".
	File formats	ESRI file geodatabase, MXD, and PDF*
	Map sheet size	7.5' x 7.5' grid
	DEM	10 m x 10 m grid (to be created automatically from contour data)
Digital Topographic Map (1/5,000)	Mapping area	Major urban areas
	Size of mapping area	Approx. 500 km^2
	Map symbol specifications	New specifications shall be prepared referred to the specifications for the 1/25,000 maps.
	Product specifications	New specifications shall be prepared referred to the specifications for the 1/25,000 maps.
	File formats	ESRI file geodatabase, MXD, and PDF
	Map sheet size	Instructed by NLCS
	DEM	5 m x 5 m grid (to be created automatically from data of contours and break lines)
Satellite image (GSD of 1.5 m - equivalent)	Area to be covered by procured images	Approx. 17,686 km^2
	GSD	1.5 m-equivalent
	Image capturing	October 2021 – March 2022
	Product type	Stereo-pair, pan-sharpened
	Cloud cover	5 % or less and without a cloud interfering with the plotting
	Number of end-users	Unlimited in Bhutan
	License, etc.	・Multi-license for free use and distribution of deliverables (in prints and data), including digital topographic maps and DEMs, only in Bhutan ・Image quality and positional accuracy shall be appropriate for digital topographic mapping.
Satellite image (GSD of 0.5 m - equivalent)	Area to be covered by procured images	Approx. 1,066 km^2
	GSD	0.5 m-equivalent
	Image capturing	October 2021 – March 2022
	Product type	Stereo-pair, pan-sharpened
	Cloud cover	5 % or less and without a cloud interfering with the plotting
	Number of end-users	Unlimited in Bhutan
	License, etc.	・Multi-license for free use and distribution of deliverables (in prints and data), including digital topographic maps and DEMs, in Bhutan ・Image quality and positional accuracy shall be appropriate for digital topographic mapping.

Source: Team

* MXD and PDF can be printed and used as paper map with map symbolized data such as marginal information included.

Annex4 Project Implementation Schedule



Annex 5

Major Undertakings to be taken by the Government of Bhutan

Specific obligations of the Government of Bhutan which will not be funded with the Grant are as follows

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost (BTN)	Ref.
1	To open Grant bank account (Banking Arrangement, "B/A")	within 1 month after the signing of G/A	GNHC		
2	To issue Authorization to Pay ("A/P") to a bank in Japan (the Agent bank) for the payment to the consultant.	within 1 month after the signing of contract	GNHC		
3	To bear the following commissions to a bank in Japan for the banking services based upon the B/A (regarding the payment to consultant)		NLCS		
	1) Advising commission of A/P	within 1 month after the signing of the contract with consultant		3,150	
	2) Payment commission for A/P	every payment		509,175 (*)	
4	To submit Project Monitoring Report (reflecting the result of Detail Design)	before preparation of bid documents	NLCS		

(*) This cost estimate includes the payment commission for A/P mentioned in below (2)-2-2).

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost (BTN)	Ref.
1	To issue A /P to a bank in Japan (the Agent bank) for the payment to the contractor.	before the first payment to the contractor	GNHC		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A (regarding the payment to contractor) 1) Advising commission of A/P 2) Payment commission for A/P	within 1 month after the signing of the contracts every payment	NLCS	3,150	
3	To ensure prompt custom clearance and to assist the contractor about the inland transportation in Bhutan	during the Project	NLCS		
4	To accord Japanese persons and/or persons from third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the Bhutan and stay therein for the performance of their work	during the Project	NLCS		
5	To ensure that custom duties, internal taxes and other fiscal levies, as shown below, which may be imposed in the county of the Recipient (Bhutan) with respect to the purchase of the products and/or the services be exempted / be borne by its designated authority without using the Grant. 1) Corporate tax for Japanese/third countries' companies (Exempt/Advance) 2) Personal income tax for Japanese/third countries' staff (Exempt/Advance) 3) Sales tax and import duty (in case of air transportation) (Exempt/Advance) 4) Japanese consumption tax on goods procured in Japan (goods exported to Bhutan) (Exempt/Refund) On the other hand, the tax deduction at source (TDS) for rental car charge will be applied and the tax is not exempted.	during the Project	NLCS		

NO	Items	Deadline	In charge	Estimated Cost (BTN)	Ref.
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project including, but not limited to, personal expense of C/P's employee.	during the Project	NLCS		
	1) Control Point Survey - 2 teams x 49 days, - NLCS assign the staff (1person) for each team ■Labor cost: 2 staff x 49 days x 1,250BTN/day＝122,500BTN ■Transportation and accommodation cost: Whenever it is necessary to arrange transportation and accommodation, the vehicle and/or the guest house will be arranged by NLCS			122,500	
	2) Field identification - 5 teams - NLCS assign the staff 1person for each team - Team 1 x 87 days, Team 2 x 87 days, Team 3 x 130 days, Team 4 x 65 days, Team 5 x 85 days ■Labor cost: (2 staff x 87 days + 1 staff x 130 days + 1 staff x 65 days + 1 staff x 85 days) x 1,250BTN/day＝567,500BTN ■Transportation and accommodation cost: Whenever it is necessary to arrange transportation and accommodation, the vehicle and/or the guest house will be arranged by NLCS			567,500	
	3) Final Inspection - 2 teams - NLCS assign the staff 1person for each team - Team 1 x 34 days, Team 2 x 20 days ■Labor cost: (1 staff x 34 days + 1 staff x 20days) x 1,500BTN/day＝81,000BTN ■Transportation and accommodation cost: Whenever it is necessary to arrange transportation and accommodation, the vehicle and/or the guest house will be arranged by NLCS			81,000	
7	To provide the security at the Project site during the implementation of the following works. (1) Control Point Survey for producing Digital Topographic Map (2) Field Identification for producing Digital Topographic Map	during the Project	NLCS		
8	To provide with the facilities for distribution of electricity and other incidental facilities necessary for the implementation of the Project, when necessary.	during the Project	NLCS		
9	To give the permission for contractor to bring out the products from Bhutan for necessary processing.	during the Project	NLCS		
10	To submit the Project Monitoring Report after each work under the contract(s) such as shipping, delivery, installation, and operational training To submit Project Monitoring Report (final)	within 1 month after the completion of each work within 1 month after issuance of completion certificate for the works under the contract(s)	NLCS		
11	To organize NLCS' internal team to check the Products for quality control and bear relevant expenses	during the Project	NLCS		
12	To submit a report concerning the completion of the Project	within 6 months after the completion of the Project	NLCS		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost (BTN)	Ref.
1	To organize NLCS' internal team to support the user of the Products and bear relevant expenses	Soon after the completion of the Project	NLCS		
2	To organize NLCS's internal team to update the Products and bear relevant expenses	Soon after the completion of the Project	NLCS		
3	To encourage the related authorities for the utilization of the products	-	NLCS		

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX

20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:
Executing Agency	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:
Line Ministry	Person in Charge	(Designation)
	Contacts	Address: Phone/FAX: Email:

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Attachment 6

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Annex 7

Project Cost Estimation
(Estimation of Cost Borne by the Government of Japan)

Item	Amount (Million JPY)
1) Products - Cost to develop the Digital Topographic Map (1/25,000 & 1/5,000) including DEM - Cost to procure the Satellite Image - Other general and administrative expenses	
2) Consulting Services - Cost for Detailed Design of the Project - Cost for Support of Tender - Cost for Supervision of Procurement	
Total	

Remarks;

1) As mentioned in clause 9 of Minutes of Discussions, above cost estimation of the Project should never be duplicated and/or disclosed to any third parties until all the contracts under the Project are concluded. Also, in NLCS, only Mr. Tashi, Chief Survey Engineer, Topographical Survey Division, Department of Survey and Mapping knows the cost estimation and shall keep it as confidential until above time of disclosure.
2) The estimated cost borne by the Government of Bhutan is mentioned in Annex 5.