

## 5) Result of Analysis

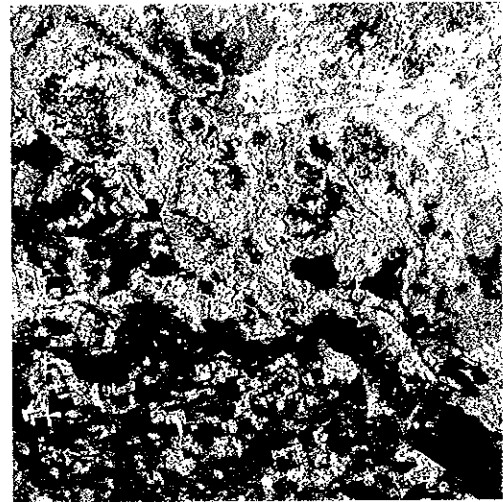
Area and method of Analysis:

- a. Along Syrdarya River : Supervised classification of SPOT XI image
- b. Other area : Interpretation with SPOT P image

Examples of acquired SPOT XI image and the results of “First stage satellite image analysis” are shown below.



SPOT Multicolor (XI) data



Result of First stage satellite image analysis

## (5) Second stage of Satellite Image Analysis

The final analysis to determine land cover classification was implemented in a “Second stage of Satellite Image Analysis” based ground truth data and the “First stage of Satellite Image Analysis.” On the other area where manual interpretation was carried out, confirmation and correction of the Land Cover Classification results were accomplished by reference to acquired ground truth data.

### 1) Data Utilized in Analysis

- a. Supervised classification of SPOT XI data
- b. Interpretation of SPOT P data

### 2) Methodology and Work Flow of Analysis

- a. Supervised classification of SPOT XI data

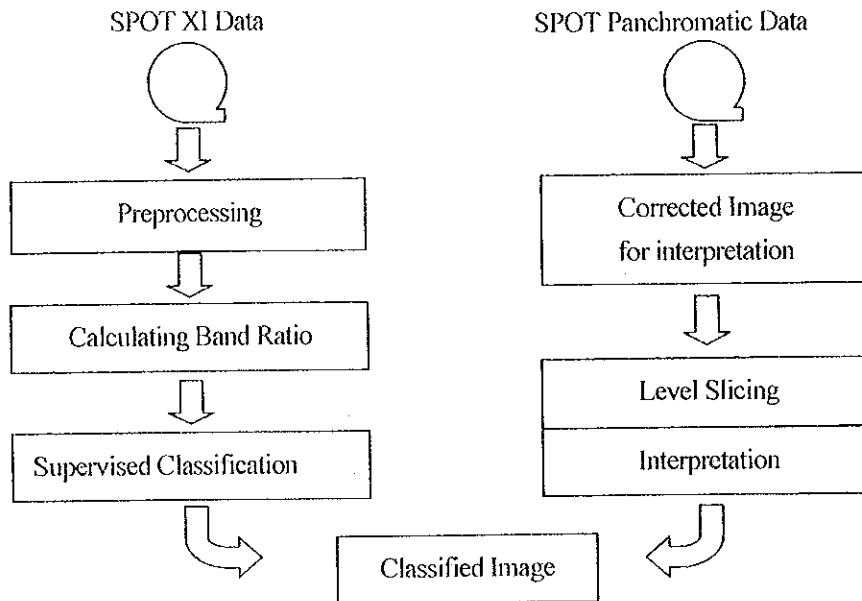
Supervised classification was undertaken for 31 scenes of XI data. The basis of the approach was to develop a general supervised classification scheme for the whole study area thereby eliminating noise caused by observations taken at different times of day and computation between spectral bands at each processed strip.

The equations used for the computation between each spectral band were:

- (Ch.2 -- Ch.3 / Ch.2 + Ch.3): NDVI generally used as vegetation index
- (Ch.2 – Ch.4 / Ch.2 + Ch.4): Enhancement of rock characteristics and soil water content

b. Interpretation of SPOT-P (panchromatic)

Interpretation of SPOT-P image was based on the Level 1 Classification Standard level slicing technique applied to each sheet.



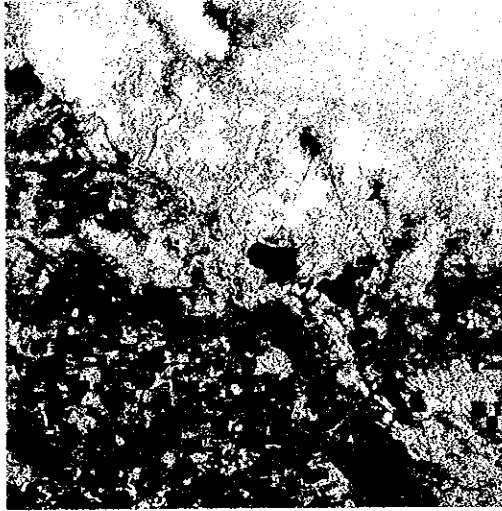
Flow chart of Data Analysis

3) Result of Analysis

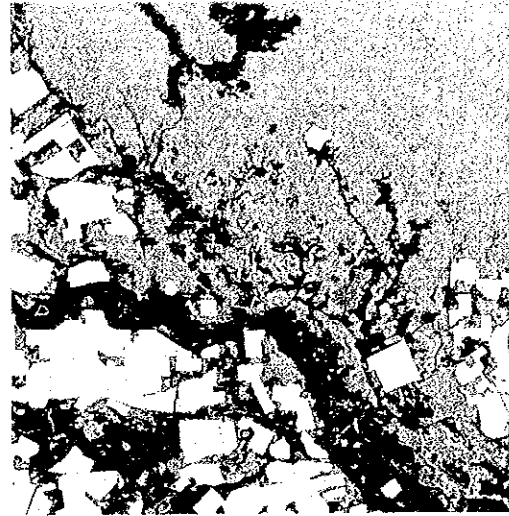
- Area along Syrdarya River: Supervised classification with SPOT XI data
- Other area : Interpretation with SPOT P data

Examples of acquired SPOT XI image and results of the “Second stage satellite image analysis” are shown below.

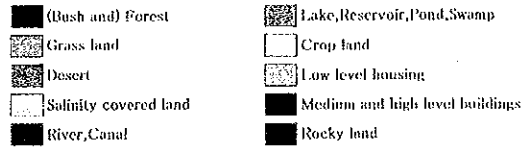
Noise relating to differences in day and time observations (change in sunlight and atmospheric conditions, etc.) was reduced by equalization computer processing between each spectral band. It was not possible however to correct changes in vegetation dynamics caused by differences in times of acquisition of the images. Analysis showed obvious vegetation boundary differences between image strip which were the result of changes occurring between different times of data acquisition.



SPOT Multicolor (XI) data



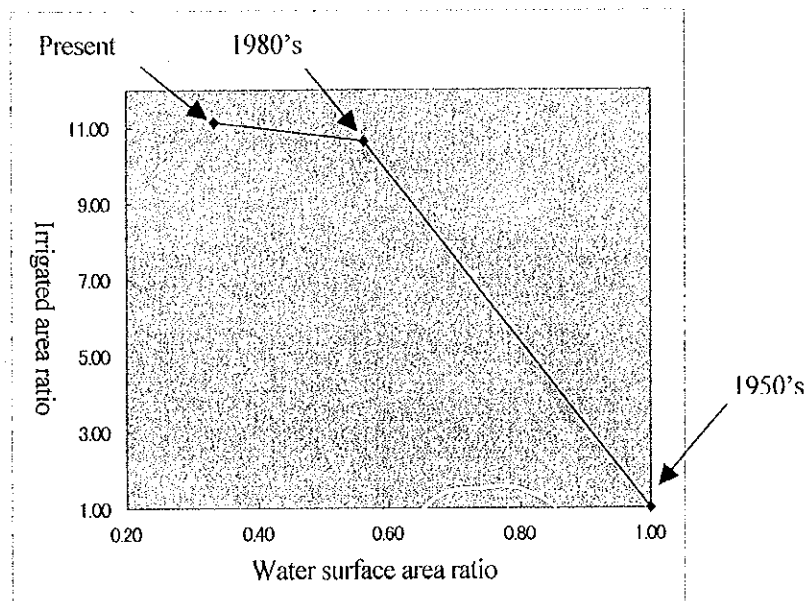
Result of Second stage satellite Image Analysis



(6) Chronological change comparison

Comparative land cover changes in three consecutive periods, namely the 1950's, 1980's and the present (1998), involving man-made irrigation developments and the impact of natural changes caused by these developments could be analyzed by utilizing old series topographic maps and SPOT XI images.

In cultivated irrigation area with water surface areas, the following area relationships can be recognized:



Trend of Irrigated Area and Water Surface Ratio

1) Increase of irrigated area

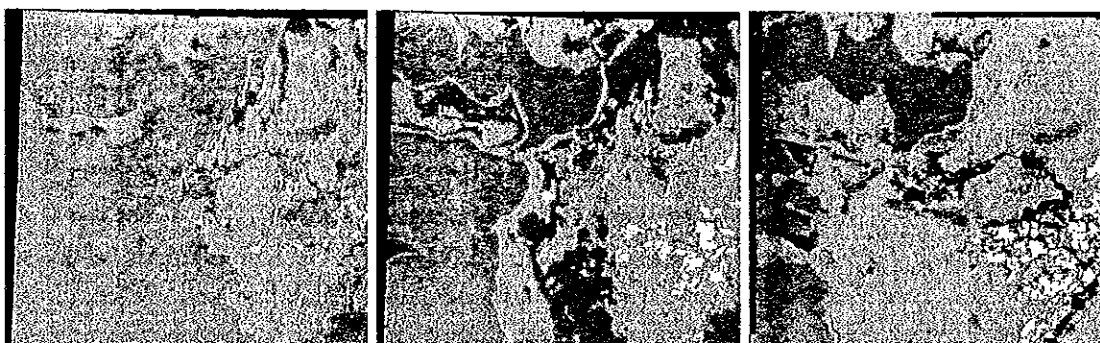
| Period           | 1950's       | 1980's        | Present (1998) |
|------------------|--------------|---------------|----------------|
| Number of pixels | 1.1 millions | 12.5 millions | 13.0 millions  |
| Ratio to 1950's  | 1.0          | 10.6          | 11.1           |

2) Decrease in water surface including Aral Sea (East from 60 E) in the three period can be summarized in the following table :

| Period           | 1950's        | 1980's        | Present (1998) |
|------------------|---------------|---------------|----------------|
| Number of pixels | 70.4 millions | 39.7 millions | 23.6 millions  |
| Ratio to 1950's  | 1.0           | 0.56          | 0.33           |

3) The following illustration shows the typical land cover change in three periods, 1950's, 1980's and present (1998)

a. Shrinking Aral Sea and increase of cultivated land in the Novokazali area



\*1950's

\*1980's

Present (1998)

\* Approximate

b. Decrease of swamp area and increase of irrigated area in Kyzylorda



\*1950's

\*1980's

Present (1998)

\* Approximate

c. Increase of irrigated area in Turkestan area

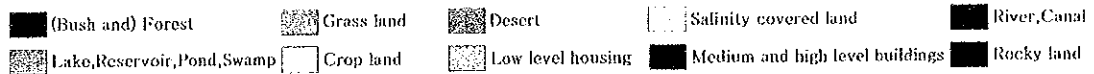


\*1950's

\*1980's

Present (1998)

\*Approximate



(7) Digitizing and Compilation of Results of Analysis

Land cover classification data, generated by using SPOT scenes in the “Second stage of satellite image analysis” was compiled in map-sheet format and digitized. A Land Cover Classification Map was then produced by overlaying the classified land cover information onto a background topographic and framework mapping base.

(8) Preparation of CD-ROMs (Generation of structured GIS data)

CD-ROMs for the presentation of Land Cover Classification Data were produced with inclusion of other final data so as to provide convenient GIS information.

(9) Field Work

1) Reconnaissance surveys and collection of data/materials

Appropriate data and materials were collected to assist in the process of digitizing for land cover classification analysis and thematic map production.

The following consultations were held with the Kazakstan beneficiary:

- a. Discussions to confirm the areal extent of “the area with significant change in environment and land use” to be analyzed by SPOT Multispectral data
- b. Discussions to confirm the extent of “the other area” to be analyzed with SPOT Panchromatic data

2) Other preparatory work

Other important preparatory activities included the planning of access routes for mobilization and ground truth data acquisition as a necessary requirement for the effective implementation of field programs.

3) Collected data/materials on Land Cover Analysis and Thematic Maps

- a. National atlas
- b. Old series maps

## (10) Ground Truth

Ground truth sampling was conducted in two stages in order to attain maximum efficiency and ensure the accuracy of the satellite image classification. The first stage of ground truth sampling was implemented in parallel with the acquisition of SPOT XS image in May - July 1998. At this time, typical land cover, especially vegetation, was investigated to confirm and understand the conditions of the study area. The second stage included investigations and verification of the classification results of the first stage Satellite Image Analysis to confirm the correlation between derived final analysis features and actual field land cover.

### 1) First stage Ground Truth

#### a. Study Objective

The objective of the study was to acquire actual land cover information for utilization with the analysis and interpretation of SPOT Multispectral Satellite Image and to determine existing land cover conditions along the Syrdariya River where conspicuous chronological land cover changes could be observed.

#### b. Study Area

The study region was divided into the Kyzylorda, Zhanakazalinsk, Aralsk and Turkestan areas.

#### c. Topics of Investigation

The following topics of interest were investigated:

- Visual observations and inspection
- Radiometer spectral measurements (acquired at typical sampling points)
- Water analysis sampling (measured at chosen sampling points)

#### d. Result of Study

Study results for the above-mentioned topics included:

- Visual investigations
  - Samples of typical plants
  - Selection of sampling points

|             |   |  |
|-------------|---|--|
| Kyzylorda   | : | Number of observation points are shown on the study area map |
| Turkestan   | : | - do -   |
| Zhanakazari | : | - do -   |
| Aralisk     | : | - do -   |
- Radiometer Spectral Measurements

The results of the radiometer spectral measurements taken at typical sampling points produced 17 levels from 400 nm to 1,050 nm. The central observed wavelengths consisting of the following:

400, 425, 450, 475, 500, 525, 550, 575, 600, 625, 650, 675, 700, 750, 850, 950, 1050.

- Water Analysis Sampling

The following analyses were undertaken on water samples taken at typical points:

- Water temperature (°C)
- pH
- Water salinity (%)

e. General condition of Study Area

<Kyzylorda area>

Soils in the area were observe to be very dry. Main highways are located on sandy desert. Takyr was also identified in various locations. The majority of the plants were not senesced due to the abnormally high rainfall of that year. Consequently most of the original vegetation color was preserved at the period of observation. Typical vegetation of the scrublands was saxaul, zhingel and zhide. There were also a large number of herbaceous plants with thorns. In the upstream regions of the Syrdariya River the height of this scrub vegetation and herbaceous plants became shorter and the area more arid. In the cultivated (irrigated) area, there were thick reed belts along canals and it was difficult to confirm the existence of paddy fields. The confirmed number of rice paddies was less frequent. The majority of cultivated land was found to be under a crop rotation of wheat and hay or fallow and abandoned land with reeds and weeds.

Many changes in actual ground conditions were noted in comparison with the land cover shown on the satellite Images of 1997 most notably with the extent of cultivated and non-cultivated lands.

Water salinity and pH of Syrdaria river water

| Point                      | Water temperature | pH  | Salinity |
|----------------------------|-------------------|-----|----------|
| No.26 Syrdaria main stream | 25.8              | 8.3 | 0.0      |
| No.27 Canal                | 26.2              | 8.3 | 0.0      |

<Turkestan area>

The region was found to consist of dry soils, flat clayey desert with the soils of the mountainous areas containing gravel. Water levels in the Syrdariya River were higher in comparison with the same period of the previous year. Some parts of the main road were moreover under water due to this high water level. The river levels also provided further evidence of the unusual weather of this year. The state of vegetation in this area was different from that of Kyzylorda as plants were partially senesced. Typical vegetation consisted of zhingel, zhida, mugwort, zhantal, thistle and herbaceous plants with thorns were widely distributed whose leaves were changing color to yellow due to the hot and dry weather.

Similar plants to those observed in the plainlands were also identified in the mountainous. The mountain area was characterized by bare land with almost no trees. This area does however possess some mineral deposits. The population of main cities and towns in the area worked in the mining industry. Many enterprises are now closed or suspended though due to the bad economic situation. In the cultivated (irrigated) area vegetation appeared almost the same as in the Kyzylorda area. Thick reed belts were located along canals and the crops identified in this study were mainly rice, wheat, cotton and hay.

Water Salinity and pH of Syrdaria River water

| Point                      | Water temperature | pH  | Salinity |
|----------------------------|-------------------|-----|----------|
| No.21 Syrdarya main stream | 26.2              | 9.2 | 0.0      |

<Zhanakazalinsk and Aralisk area>

The area consists of dry Soils with sandy desert in the lands off the main highways. Typical solonchak could be observed in various locations. Close to the Aral Sea the area, characterized by soils with dead shells, was considered to be the former sea bottom. In many places in this area the topsoil became takyr. Salyanka was also observed in a large area which is used for salt production. As the area was characterized mostly by other vegetation, such as zhingel, zhida, mugwort and herbaceous plant with thorns, the conditions proved similar to other areas. Thick reed belts occurred along canals in the cultivated (irrigated) area where it was similarly difficult to confirm whether there were paddy fields or not. Confirmed paddy fields occurred in the area adjacent to the main highways. The majority of cultivated lands were under a crop rotation of wheat and hay. Other lands were fallow and abandoned, with reeds and other weeds occurring.

Large solonchak areas with crystallized layers, 5 cm thick, were also observed in the study area.

Water Salinity and pH of Syrdariya River water

Zhanakazalinsk area

| Point                            | Water temperature | pH  | Salinity |
|----------------------------------|-------------------|-----|----------|
| No.18 main Syrdariya river       | 29.3              | 7.5 | 0.0      |
| No.19 Syrdariya river mouth      | 31.1              | 8.6 | 0.5      |
| No.23 Syrdariya river downstream | 28.8              | 8.7 | 0.0      |

Aralsk area

| Point                 | Water temperature | pH   | Salinity |
|-----------------------|-------------------|------|----------|
| No.9 Small Aral inlet | 25.7              | 10.7 | 4.0      |

2) Second stage of Ground Truth Data Collection Program

This program involved confirmation in the field of supervised sampling points used in the satellite image classification procedures. Confirmation was also required in the field of those areas classified as a result of the second phase of image analysis. Field verification and further sampling enabled much better image classifications to be produced and improvements attained in their accuracy.

a. Work period

The work started after an initial analysis of the SPOT XI (Multispectral) image with the period extending from October 13 to November 4, 1998.

b. Study Area

Field verification was undertaken in selected sample areas over a region measuring 10 x 10km mapped with pre-classified and interpreted land cover conditions. The study area was divided into three parts.



c. Type of investigation:

Visual observation.

d. Result of the Study

Study areas are shown in the following table:

| Area                      | Number of selected sampling areas | Additional sample transects |
|---------------------------|-----------------------------------|-----------------------------|
| Kyzylorda area            | 8                                 | 1                           |
| Aral, Zhanakazalinsk area | 9                                 | 1                           |
| Turkestan area            | 11                                | 2                           |

Categories of classification investigated in the Study:

- Cultivated land (rice, wheat, cotton, etc.)
- Grassland (pasture)
- Forest (near river)
- Steppe (vegetation in the sand)
- Sand area (bare land, takyr)
- Saline land (Solonchak)
- Rivers, canals
- Lakes, swamps, ponds, reservoir

e. Status of the study area land cover at the time of field investigations

<Kyzylorda area>

Soil conditions at this time were the same as the first stage of ground truth investigations. The majority of sand area vegetation was in a dried condition (brown color) with few plants maintaining chlorophyll. Some parts of the area, where crops (rice and wheat) were harvested, could be verified as agricultural lands. Many of the reeds located in cultivated areas were used as fodder for livestock. As water flow into canals was mainly terminated, most of them were dry. The water level of the Syrdarya River was observed to be higher than normal

<Aral and Zhanakazalinsk area >

Soil condition at this time was the same as referenced in the first stage of ground truth investigations. Takyr and solonchack were typical for this area with salt industries present at the lakeside town of Aralsurphalt, 15 km east of Aralsk, near the Aral Sea. Salt lakes demonstrate typical solonchak in this area where it is evident from the satellite images that the Aral Sea bed has been exposed with solonchaks extending 20 - 30 km.

Vegetation and cultivation of the desert area was the same as in the Kyzylorda area.

<Turkestan area>

Soil condition at this time was the same as described in the first stage of ground truth investigations. Desert area vegetation was as expected dry in this season although there were a few plants species keeping green in color. Some parts of the area exhibited crops, such as rice and wheat which had been

harvested. At the time of investigation, cotton was under harvest and only winter wheat appeared green in this area. There were also reeds in cultivated areas used as fodder for livestock. The surface of the Kyzylkym Desert was characterized by continuous barkhan sand dunes and fixed vegetation which gave rise to distinct geometric patterns that could readily be identified on the satellite image.

## 10. System Customization and Installation

### (1) System customization

Various programs for customization of computer hardware and software, to be installed in Kazakhstan, were developed to achieve effective OJT (On the Job Training) on digital mapping.

#### 1) Computer languages for customization

Computer languages, which can be operated on Microsoft Windows98/NT, were used for customization.

| Products                               | Purposes  |
|--|---|
| MDL(MicroStation Development Language) | Customization on MicroStation                               |
| MapBasic                               | Customization on MapInfo                                    |
| Visual C++ (by MicroSoft)              | Development of DLL(Dynamic Link Library)                    |
| Pro Fortran (by Absoft)                | Development of program for batch processing on MicroStation |

#### 2) Development of Computer Programs for Customizing

##### a.. for MapInfo

- Input menu
- Programs of Input menu pigeonholed at each map symbol to achieve effective digital mapping.
- Editing menu
- Varied programs as editing menu in order to perform effective digital map editing.
- Programs for symbolization
- Programs for automatic transformation of GIS data for printing map data.
- Programs for outlining symbols
- Programs for outlining of symbols in True-Type Font to use in the process of preparation of printing map data.
- Programs for conversion to standard file format
- Programs for constructing standard data as an intermediate file to enable the conversion of necessary data format to MicroStation format.
- Programs of standard file format conversion
- Programs for constructing standard data as an intermediate file to convert MicroStation data format to MapInfo format.

b. For MicroStation

- Input menu  
Programs of Input menu pigeonholed at each map symbol to achieve effective digital mapping.
- Programs for conversion to standard file format  
Programs for construction of standard data as an intermediate file to convert necessary data format to MapInfo format.
- Programs for conversion from standard file format  
Programs for constructing standard data as an intermediate file to convert MapInfo data format to MicroStation format.

(2) System Installation

Computer hardware and software installation and set up was carried out in Kazakstan where it was necessary to conduct OJT (On the Job Training) for the counterpart staff. System components comprised:

a. Hardware:

- Personal computers
- Color ink-jet plotter (A0)
- MO disks
- Color laser printer (A4)
- Large-size scanner (A0)
- CD-ROM writer
- Accessories for network

b. Software:

- OrthoEngine (PCI, Canada)
- PhotoShop (Adobe, USA)
- MicroStation (Bentley, USA)
- Geovec Office (Intergraph, USA)
- MapInfo (MapInfo, USA)

## 11. Technology Transfer

(1) Preparatory work

A technology transfer program is an indispensable part of establishing a digital mapping system capability in Kazakstan. In this context it was considered that Kazak specialists should develop a good command of using the equipment for managing and updating the map data prepared in this study.

Implementation of OJT by state enterprises and reception of counterpart trainees in Japan were considered as well as GIS hardware and software taking account of their suitability for Kazakstan, to manage, refer, update/add, process and input/output data. Data formats were also required to cope with a variety of employed systems.

- 1) Relevant data and materials were collected by the Contact and Preliminary Study Mission of JICA and arrangements made for acquisition of other materials/information available in Japan.
- 2) After a preliminary evaluation of the basic materials, a draft proposal on technology transfer for counterpart personnel was prepared in Kazakstan.
- 3) The principal items in this draft proposal were:
  - Geometric Correction of Satellite Images
  - Digital Mapping based on Satellite Images
  - Compilation of Digital Map Information
  - Method for updating Digital Map Information
- 4) System components included: computer hardware and software for technology transfer and software customization.
- 5) Hardware and software was planned to be acquired from Japan.
- 6) A P/C-base system was considered
- 7) Off the shelf software was acquired.
- 8) Customization programs not commercially available were developed for the software.

(2) Consultation on the computer system

Discussions were held with the Kazakstan beneficiary on technology transfer, selection of relevant hard/software systems and customization of different software. System components and policies for software customization were subsequently agreed. The main proposed software was changed to MapInfo and MapBasic was adopted as the main language for customization.

(3) Counterpart training in Japan

Counterpart training was conducted not only through OJT (On the Job Training) for engineers of state enterprises under the Agency on Land Resources Management at respective stages during the fieldwork, but also for two personnel seconded to Japan by the Kazakstan counterpart organization as JICA trainees. The training schedule outlined below was held mainly at the Technical Center of Aero Asahi Corporation.

| Names          | Office              | Position                                    | Period                    | Fields of training   |
|----------------|---------------------|---|---------------------------|--|
| Epishin V.     | ALRM                | Manager,<br>Dept., Geodesy<br>& Cartography | 20.02.99<br>~<br>14.03.99 | Surveying Administration<br>Digital Mapping<br>Satellite Image Processing<br>Global Mapping Workshop |
| Orazov<br>B.K. | KARTINFORM,<br>ALRM | Chief Expert                                | 25.07.99<br>~<br>25.08.99 | Satellite Image: Geometric<br>Correction & Processing<br>Digital Mapping<br>System Customize, etc.   |

## 12. Final Products and Equipment to be donated to the Kazakstan

Principal final products are as follows:

- Final Report, System Maintenance Manual
- Printed Topographic Map (1:100,000)
- Digital Data stored in CD-ROM : Topographic Map Data (1:100,000)  
GIS Framework Data (1:200,000)  
Land Cover Data

(Appendix 12)

All the intermediate materials acquired in the study process as satellite images, aerial photographs, interpretation key, control point survey results, etc. are donated to the government of Kazakstan.

The donated equipment and software are as follows :

| Item                                       | Maker      | Unit |
|--|------------|------|
| Desk Top PC G6-400 (ENG) GATEWAY GP Series | Gateway    | 3    |
| Laser Printer, LP-1800                     | EPSON      | 1    |
| MO Disc, MOS341ST, 640MB TURBO II          | Olympus    | 1    |
| CD-ROM Writer, CRW4416SX-VK                | YAMAHA     | 1    |
| Color Plotter, TECHJET5500 5536(A0)        | NS Calcomp | 1    |
| Color Scanner SCANPLUS III 510C (A0)       | NS Calcomp | 1    |
| EASI/PACE Image Processing Kit             | PCI        | 1    |
| MICROSTATION SE (English Version)          | Bentley    | 1    |
| GEOVEC OFFICE. SBUN6200L                   | Intergraph | 1    |
| MAPINFO PROFESSIONAL 5.0 (E)               | MapInfo    | 1    |
| Photoshop                                  | Adobe      | 1    |

## Chapter 5. Recommendations on the Use of the Study Results

### 1. The Present Status of the Study Areas

Field studies undertaken in 1998, land cover analysis based on satellite image analysis and comparison with previously issued topographical maps, have provided information on the current status of social infrastructure, agriculture/industry and environment.

Development of agriculture and industry affect the environment, aggravate the ecology of the region and can create social problems. Poor water management of the Syrdarya and Amudarya rivers has also contributed to the shrinkage of the Aral Sea.

Degradation of social and natural phenomenon which were observed in the process of reconnaissance on the study are as follows:

#### (1) Social Infrastructure

|                   |   |
|-------------------|---|
| Electric power    | : Lack of electricity supply /or frequent blackouts in many villages.<br>Collapsed high-tension lines.  |
| Drinking water    | : Frequent suspension of water supply in urban areas.<br>Many defunct water wells in rural areas and in meadows caused by polluted and saline water, low ground water table, breakage of water pumps and lack of electric supply. |
| Roads             | : Insufficient maintenance on paved, gravel roads and floating bridges.   |
| Health/Sanitation | : Increase of respiratory sickness, intestinal disorder, hepatitis and children's diseases.<br>Poor status or lack of sewerage systems in rural areas.  |

#### (2) Agriculture / Industry

|             |   |
|-------------|---|
| Agriculture | : Impact of excessive irrigation on water circulation mechanism<br>Contamination of ground water and soils as a result of water leakage from unlined canals<br>Irrigation systems have no return flow to Syrdarya River<br>Increase of abandoned cultivated lands<br>Non-observance of irrigation water norms during rice paddy cultivation<br>Lack of agricultural machinery<br>Shortage of young manpower |
| Livestock   | : Decrease of livestock due to the financial problems of their holders.   |
| Fishery     | : Reduction of fisheries caused by substantial salt content increase and decrease of Aral Sea water   |
| Industry    | : Increase of closed factories  |

### (3) Natural environment

|                |   |
|----------------|---|
| Weather        | : Extreme continental climate and desertification due to shrinking of Aral Sea                                |
| Ground water   | : Degradation of water quality (pesticides / industry drainage / community waste). Decrease of communal wells |
| Soils          | : Expansion of Solonchak (salt crusts) and Takyr  |
| Biodiversities | : Some species of flora and fauna have been introduced to "Red Data Book" under the danger of extinction      |

## 2. Geographic Information System (GIS)

The "framework vector geographic data" formulated by the Study Team has the following attributes:

- Administrative Boundary,
- Transportation network,
- Town and Settlement,
- Public Utility,
- Topography (Relief),
- Hydrology, and
- Land Cover (Vegetation).

This "framework vector geographic data" with 1/200,000 scale positional accuracy and map like attributes can provide a basis for developing Geographic Information Systems (GIS) by adding and manipulating particular spatial information required to meet specific applications interests.

For the readers who are unfamiliar with GIS, it may be useful to provide the following definitions of GIS by which several geographers have attempted to capture the nature of GIS:

"A system for capturing, storing, checking, manipulating, analyzing and displaying data which are spatially referenced to the Earth."  
DoE

"A decision support system involving the integration of spatially referenced data in a problem-solving environment."  
D.J.Cowen

"An information technology which stores, analyses, and displays both spatial and non-spatial data."  
H.D.Parker

"A form of MIS [Management Information System] that allows map display of the general information."  
H.A.Devine and R.C.Field

To summarize the above, GIS can be said to be an information system that is used to store and analyze geographically referenced data in order to support management and decision making process.

Generally application of GIS can clarify the following basic questions.

- Location *What is in ----- ?*  
What exists at a particular location?  
Examples: location of irrigation facilities, agricultural land
  
- Condition *How is it like in ----?*  
Which locations satisfy certain conditions?  
Example: the North of ---- is classified as Saxaul (desert vegetation) zone.
  
- Trend *How has it changed ----- ?*  
Identify geographic trends in the process of changing.  
Example: the saxaul zone has been changed to the irrigation area
  
- Relation *Which data is related to a particular point?*  
Analyzes the spatial relationship between objects of geographic features.  
Example: Extension of agricultural land is related to decrease of water area, causing drying area
  
- Modeling *What will happen if -----?*  
Model based questions; computes and displays an optimum path, suitable land, risky area against disasters etc. based on a model.  
Example: Appropriate decision making on land use of further cultivation or preservation

In its history GIS has experienced the following three development stages, namely, inventory applications, analytical applications, and management applications. This is summarized in the followings:

- The first stage ; Inventory Applications  
Database, which enable to extract, to combine and to update necessary information for inventory.
  
- The second stage ; Analytical Applications  
To analyze the data based on the present and/or the past information on each specialized field from *Trend* information and/or to analyze various phenomenon form complex data.
  
- The third stage ; Management Applications  
This application is for administration or management. Based on the first and second stage application, the application to support administrative decision for finding most sustainable solution, priority and etc.

The world trend of GIS development now shifts toward further applications of both second and third stages. A high quality GIS facility, however, can only be developed with viable data of good quality in a digital format. In the first stage the cost of inputting such data will form major costs. The second and the third stages of GIS development will be reliant therefore on good quality data acquired in the first stage.



### 3. Recommendations on the Use of the Study Results

The results of “The Study on Urgent Establishment of National Basic Geographic Data in the Southern Area of Kazakstan” are summarized as follows:

- 1/200,000 scale framework data covering approximately 150,000 sq. km
- 1/100,000 scale topographic and digital map data covering approximately 22,500 sq.km
- Chronological land cover data
- Provision of Personal Computers with peripheral equipment
- Provision of software for digital mapping, satellite image processing, operating manuals, etc.
- Technology transfer related to the study.

The 1/100,000 scale topographic and digital map data covering approximately 22,500 km<sup>2</sup>, around Kyzylorda city, can be used immediately for various administrative and development purposes, as it is a revised version of the existing 1/100,000 scale paper maps.

The 1/200,000 scale digital geographic framework data formatted in a CD-ROM, covers the area about 150,000 km<sup>2</sup> along the Syrdarya River (part of South Kazakstan Oblast and Kyzylorda Oblast,).

This can provide a fundamental basis for Geographic Information Systems development in this area which can be utilized for various user interests and applications as basic spatial data.

The study team recommends that the Kazakstan Government create a unified database by adding necessary information on the framework data provided by JICA study team.

This unified database should be developed for both analytical and management objectives in the next stage. The expected GIS databases for the area of East Aral and Syrdarya River is summarized in Table.

| No. | Fields and Purposes  | Advantages   | Input data   | Availabilities of input data |
|-----|--|--|--|------------------------------|
| 1   | Water resources management<br><br>Purpose:<br>To implement appropriate water control (inlet-outlet and quality of water) | -Data are maintained in a standard format<br>-Revision and updating are easier<br>-Data and information are easier to search, analyze and represent<br>-Data are more value added products<br>-Data can be shared and exchange freely<br>-Productivity is improved and more efficient<br>-Time and money are saved | -River flow quantity (Average and extreme record)                                  | yes                          |
|     |  |  | -Subsurface water quality and water level  | yes                          |
|     |  |  | -Seasonal water quantity of irrigation and drainage                                | yes                          |
|     |  |  | -Quality, capability and water level of wells                                      | to be updated                |
|     |  |  | -Pollution   | unknown                      |
|     |  |  | -Soil classification and water permeability  | unknown                      |
|     |  |  | -Irrigation lands and rainfed lands  | yes                          |
| 2   | Agricultural land use<br><br>Purpose:<br>To evaluate and determine acceptable arable land                                | - do -   | -Crops, cropping pattern and production statistics                                 | yes                          |
|     |  |  | -Abandoned fields and causes   | unknown                      |
|     |  |  | -Land ownership  | no                           |
|     |  |  | -Land use classification   | unknown                      |
| 3   | Environment and ecology<br><br>Purpose:<br>To restore natural environment and ecology                                    | - do -   | -Land cover classification   | yes                          |
|     |  |  | -Wildlife distribution and classification  | yes                          |
|     |  |  | -NOAA NVI image  | yes                          |
|     |  |  | -Hydrological data   | yes                          |
|     |  |  | -Contamination in water bodies   | unknown                      |
|     |  |  | -Solonchak and Takyr distribution  | no                           |
|     |  |  | -Micro-topography/ detailed vegetation classification of the Aral Sea exposed land | no                           |
|     |  |  | -Soils of the Aral Sea   | yes                          |
| 4   | Social environment<br><br>Purpose:<br>To acquire and maintain minimum civilization (living) standard                     | - do -   | -Population statistics   | yes                          |
|     |  |  | -Social infrastructures  | to be updated                |
|     |  |  | -Public health   | yes                          |
|     |  |  | -Education   | yes                          |

Central/local government organizations, research institutions and international organizations seem to have already acquired and studied many of the above-mentioned data.

Some data however needs to be updated and oriented as geo-referenced data. But there is also a need for new data acquisition and analysis.

To develop a viable Geographic Information System (GIS) for the East Aral and Syrdarya River Basin, the following conditions are recommended to be established and observed:

(1) Open framework data relationships with other agencies, experts and a wide range of private users

The input data for the expected GIS database should be digitized at one central organization, for instance, the Agency of Land Resources Management, which is a major counterpart agency in this study. The digitized data can be utilized on the framework data and shared by concerning organizations. Also updating of the data should be managed by such organizations.

(2) Cooperation between various agencies and experts for exchanging existing data in different field

An inter-agent committee should be established which makes coordination effective and also makes development of the inventory, analytical and management GIS applications less redundant. Regular meetings should be held by the experts of various fields to exchange their topics and opinions about updating input data, method of analysis, etc. For instance, in Japan, Information Exchange Organ has established in order to facilitate information exchange.

(3) Sound user interests in GIS applications

Some further concrete applications of GIS in such fields as water management, agricultural land use, environment and ecology and social environment should be demonstrated for users.

(4) Important factors for a sustainable GIS

1) Data input

The cost of data input will occupy about 80% of the total cost in GIS. More attention should be given to selection and classification of required Geo-spatial data by taking the digitizing method into consideration. To minimize the cost, detail assessment of available data should be done, because it is quite expensive to develop new Geo-spatial data. For a country like Kazakstan which has vast territory, satellite image data is recommended to be employed for development and updating of the input data effectively, because it can cover wide area at lower cost than aerial photographs.

2) Maintenance of data base

In Kazakstan routine maintenance of the database is carried out by limited professional personnel and with equipment. Therefore, it can be suggested to concentrate such work at one central organization.

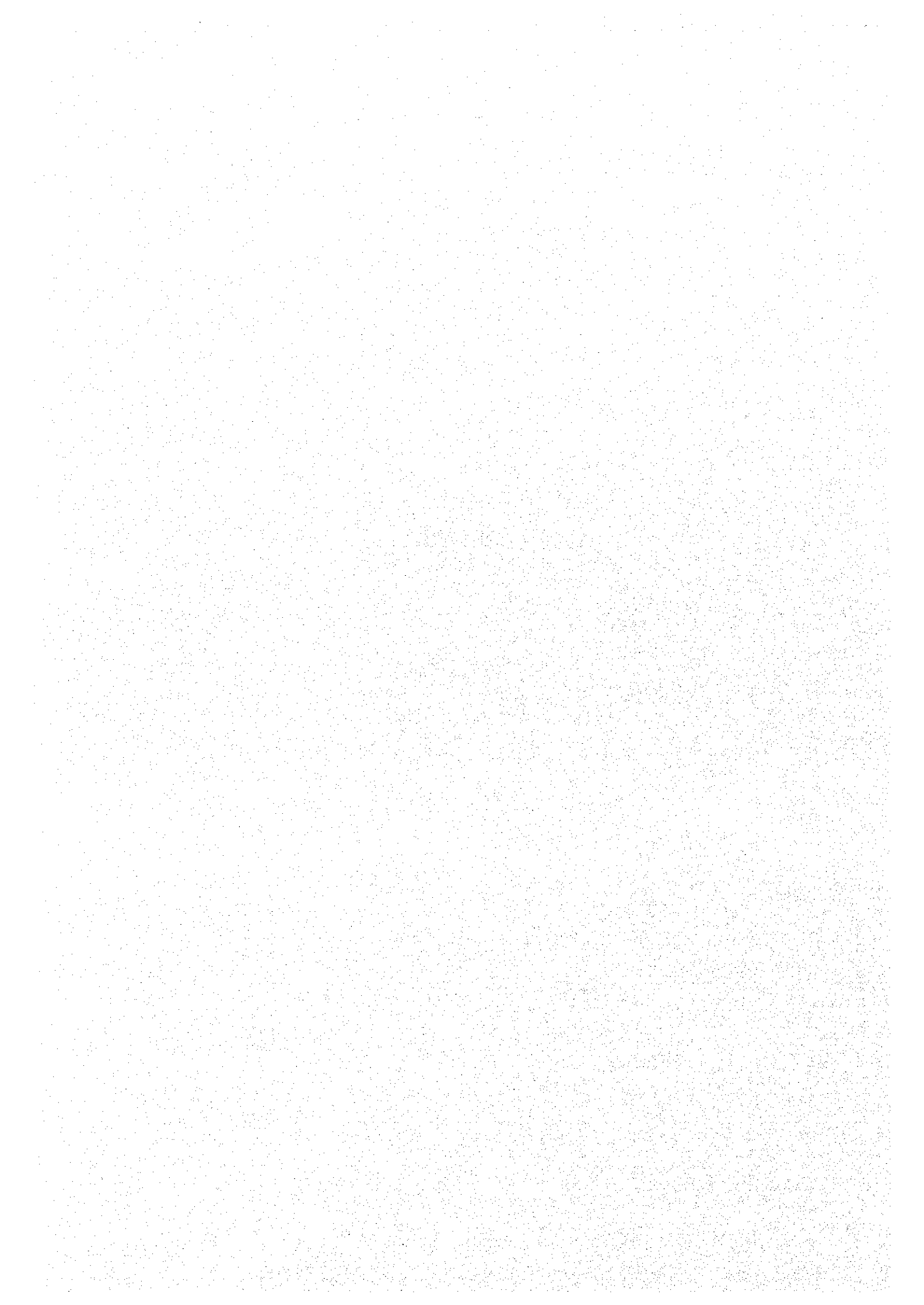
3) Education

Not only top management but also other administrative staffs and engineers should support the GIS project. Therefore, GIS education has to be extended to all the hierarchies in a GIS user organization.

#### 4) Data sharing

Data sharing is one of the important keys to minimize the total cost of data input and also to maximize the use of the database. Political and administrative problems should be solved to promote the data sharing for successful GIS.

## **Appendix**



## Appendix

|  |    |
|--|----|
| 1. SCOPE OF WORK agreed on June 19, 1997           | 1  |
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SCOPE OF WORK  
FOR  
URGENT ESTABLISHMENT OF NATIONAL BASIC GEOGRAPHIC DATA  
IN THE SOUTHERN AREA OF THE REPUBLIC OF KAZAKSTAN

AGREED UPON BETWEEN  
COMMITTEE OF LAND RESOURCES MANAGEMENT  
MINISTRY OF AGRICULTURE  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

ALMATY, JUNE 19, 1997



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Bakhyt Sagyndykovich Ospanov  
Chairman,  
Committee of Land Resources Management,  
Ministry of Agriculture



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Masatoshi Nagaoka  
Leader,  
Preparatory Study Team  
Japan International Cooperation Agency

## 1. INTRODUCTION

In response to the request of the Government of the Republic of Kazakstan (hereinafter referred to as "Kazakstan"), the Government of Japan (hereinafter referred to as "Japan") decided to conduct "The Urgent Establishment of National Basic Geographic Data in the Southern Republic of Kazakstan (hereinafter referred to "the Study") in accordance with relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of Japan, will undertake the Study in close cooperation with the authorities concerned in Kazakstan.

The Committee of Land Resources Management, Ministry of Agriculture (hereinafter referred to as "CLRМ"), the official agency responsible for survey and mapping in Kazakstan, shall act as an executing agency for to the Japanese Study Team (hereinafter referred to as "the Team") and also as a coordination body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

The present document sets forth the Scope of Work with regard to the Study.

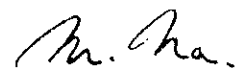
## 2. OBJECTIVES OF THE STUDY

In order to tackle the environmental problems along Syrdar'ya River basin towards the east bank of the Aral Sea, the objective of the Study is set as follows : i) to prepare the digital geographic data whose positional accuracy is corresponding to 1:100,000 topographic maps which covers approximately 21,000km<sup>2</sup>, ii) to prepare the 1:100,000 topographic maps using the former data, iii) to prepare the basic digital geographic data whose positional accuracy is corresponding to 1:200,000 topographic maps which cover approximately 150,000km<sup>2</sup> and iv) to prepare the chronological digital land cover data approximately covering 150,000km<sup>2</sup>.

## 3. STUDY AREA

Following geographic data shall be prepared and the approximate covering areas are shown on the Appendix-1. Positional accuracy of the following digital data is corresponding to the scale of the existing topographic maps shown in the round brackets.

|   |                        |
|---|------------------------|
| (1) Digital geographic data (1:100,000)           | 21,000km <sup>2</sup>  |
| (2) Digital geographic framework data (1:200,000) | 150,000km <sup>2</sup> |
| (3) Chronological digital land cover data         | 150,000km <sup>2</sup> |



#### 4. SCOPE OF THE STUDY

In order to achieve the objective mentioned above, the Study will cover the following items.

(1) Aerial photographs

1:50,000 aerial photographs shall newly be taken covering the approximate area of 150,000km<sup>2</sup>.

(2) Preparation of digital geographic data whose positional accuracy is corresponding to existing 1:100,000 topographic maps covering the approximate area of 21,000km<sup>2</sup>

(2)-1 Digital geographic data

The digital geographic data will be acquired from the newly obtained satellite images and 1:50,000 aerial photographs, referring to the existing 1:100,000 topographic maps.

(2)-2 Horizontal control and GPS Survey

The horizontal control of the satellite images and aerial photographs will basically be carried out on the existing 1:100,000 or 1:50,000 topographic maps. GPS survey, however, to establish horizontal ground controls may be carried out in necessary areas.

(3) Preparation of the printed 1:100,000 topographic maps

Revised 1:100,000 topographic maps shall be printed with the digital geographic data whose contents and accuracy are nearly equivalent to those of existing 1:100,000 maps.

(4) Preparation of digital geographic framework data whose positional accuracy is corresponding to the existing 1:200,000 topographic maps covering the approximate area of 150,000km<sup>2</sup>

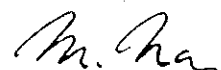
(4)-1 Digital geographic framework data

The digital geographic framework data which covers approximately 150,000km<sup>2</sup> will be acquired from the newly obtained satellite images, referring to the existing 1:200,000 topographic maps, as well as the newly taken aerial photographs.

As for the area where the existing 1:100,000 topographic maps have been digitized, these digital geographic data will effectively be applied instead of 1:200,000 data.

(4)-2 Horizontal control and GPS survey

The horizontal control of the satellite images and aerial photographs will basically be carried out on the existing 1:100,000 or 1:50,000 topographic maps. GPS survey, however, to establish horizontal ground controls may be carried out in necessary areas.



(5) Preparation of chronological digital land cover data covering 150,000km<sup>2</sup>

Interpretation of digital land cover data (land use, vegetation, water surface, etc.) will be carried out by use of existing maps and satellite images by computer analysis, through which the chronological data, being chosen in some three times around the 1950s, the 1970s and the latest, shall be prepared. The availability of the usable maps in 1950s and 1970s, however, is expected to be limited, data sources shall possibly be alterable. Some thematic maps such as geological maps, soil maps and vegetation maps etc. shall effectively be utilized to be digitized.

## 5. STUDY SCHEDULE

The whole study shall be conducted in accordance with the attached tentative schedule.

(Appendix -2)

## 6. REPORT AND FINAL PRODUCTS

JICA shall prepare and submit the following reports in English and Russian every fiscal year and final products to Kazakstan.

(1) Plan of Operation 1

20 Copies : at the commencement of the Study

(2) Plan of Operation 2

20 Copies : the second fiscal year

(3) Plan of Operation 3

20 Copies : the third fiscal year

(4) Final Report

50 Copies : At the end of the Study

(5) Digital Geographic Data

100 copies of each digital geographic data file (eg. CD-ROM) shall be prepared as follows :

i) Digital geographic data whose positional accuracy is corresponding to the existing 1:100,000 topographic maps

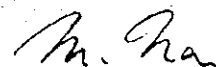
ii) Digital geographic framework data whose positional accuracy is corresponding to the existing 1:200,000 topographic maps

iii) Chronological digital land cover data

(6) Printed 1:100,000 topographic maps

500 Copies : at the end of the Study

(7) Negative films of 1:50,000 scale aerial photographs



7-4. CLRM shall, at its own expense, provide the Team with the following items, in connection with other organizations concerned:

- (1) available data and information related to the Study;
- (2) counterpart personnel;
- (3) Suitable office space with necessary equipment in Almaty;
- (4) vehicles with drivers;
- (5) credentials or identification cards;
- (6) administrative and technical support
- (7) information on necessary administrative boundaries and geographical names to be shown

on the maps. The correctness of such information is the responsibility of CLRM

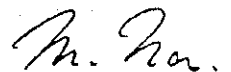
#### 8. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures:

- (1) to dispatch, at its own expense, the Team to the Republic of Kazakstan; and
- (2) to pursue technology transfer to the Kazakstan counterpart personnel in the course of the Study.

#### 9. CONSULTATION

CLRM and JICA shall consult with each other in respect of any matter that may arise from or in connection with the Study.







## Kazakstan Key Persons

| Name             | Position                                  | Organization  |
|------------------|---|---|
| A.ANDRYUSHENKO   | Vice-Minister                             | Ministry of Economy of RK   |
| E.ARYNOV         | Deputy Director                           | Ministry of Economy of RK<br>Department of Investment Policy and Foreign<br>Policy Management |
| B. OSPANOV       | Chairman                                  | Agency of the Republic of Kazakstan on Land<br>Resources Management (ALRM)                    |
| A. SIZOV         | Deputy Chairman                           | ALRM  |
| V. EPISHIN       | Head of the department                    | Dept. Geodesy & Cartography, ALRM   |
| M. SAGANDYKOVA   | Chief specialist                          | Dept. Geodesy & Cartography, ALRM   |
| S. MAKHADIL      | Chief specialist                          | Dept. Geodesy & Cartography, ALRM   |
| S. OZHYGOVA      | Director                                  | SE. "CENTRAL MAP LAND SURVEYING<br>FUND"  |
| A.MUKHAMEDGALIEV | Director                                  | SE "KARTINFORM"   |
| A. ZENKOVSKY     | Chief engineer                            | SE "KARTINFORM"   |
| B. ORAZOV        | Head of the department                    | SE "KARTINFORM"<br>Department of geo-informational technology                                 |
| K. ZHOLDYBAYEV   | Director                                  | SE "KARTOGRAFIYA"   |
| T. BADMAEVA      | Chief Engineer                            | SE "KARTOGRAFIYA"   |
| L.SELEZNYEVA     | Head of the department                    | SE "KARTOGRAFIYA" Photogrammetry<br>department  |
| S. OSPANOV       | Director                                  | SE "ZHAMBYLGEODESIA"  |
| G. PROKOPYUK     | Chief engineer                            | SE "ZHAMBYLGEODESIA"  |
| V. PETSOLD       | Head of expedition                        | SE "ZHAMBYLGEODESIA"  |
| T. AKHMETOV      | Director General                          | JSC "BURUNDAYAVIA"  |
| V. KHAN          | Head of aerial photo<br>survey department | JSC "BURUNDAYAVIA"  |
| E. SEROV         | Pilot-Instructor                          | JSC "BURUNDAYAVIA"  |
| V. CHERNYSHOV    | Chief of Photo-Lab                        | JSC "BURUNDAYAVIA"  |

Tomiichi INAGAKI – adviser (JICA expert) – Ministry of Economy, Agency on Strategic Planning and Reforms.



### List of the Study Specialists

| Name               | Task   | Organization     |
|--------------------|--|------------------|
| Shigehiko SHINO    | Team Leader  | Acro Asahi Corp. |
| Takashi HARADA     | Deputy Team Leader                                       | AAC              |
| Hisao TAKIMOTO     | Aerial Photography Supervision                           | AAC              |
| Hiroshi SUZUKI     | Ground Control Supervision                               | AAC              |
|                    | Digital Mapping Supervision                              |                  |
| Kentaro USUDA      | Interpretation Key Supervision                           | AAC              |
| Toshiya FURUKAWA   | Interpretation Key Supervision                           | AAC              |
| Shoji SAKAINO      | Land Cover Classification and Satellite Image Processing | AAC              |
| Hideo SUZUKI       | Land Cover Classification and Satellite Image Processing | AAC              |
| Kosuke TSURU       | Digital Mapping Supervision & System Design              | AAC              |
| Naoki GOTO         | System Design & System Install                           | AAC              |
| Atsushi OKUIZUMI   | General Coordination                                     | AAC              |
| Junko SUGIMORI     | Coordinator & Digital Mapping                            | AAC              |
| Toshimasa AOKI     | Land Cover Classification and Thematic Mapping           | AAC              |
| Kan XU             | Digital Mapping and Thematic Mapping                     | AAC              |
| Mai SASAKI         | Digital Mapping and Thematic Mapping                     | AAC              |
| Tsuyoshi TAKENOUCI | System Customizing                                       | AAC              |
| Kazuya NAKANO      | System Customizing                                       | AAC              |
| Shinichi KONO      | Ground Control Planning                                  | AAC              |
|                    | Report Control   |                  |
| Toshio HORIUCHI    | Interpreter and Translator                               | AAC              |
| Raushan KALIKOVA   | Office Manager and Translator                            | AAC              |

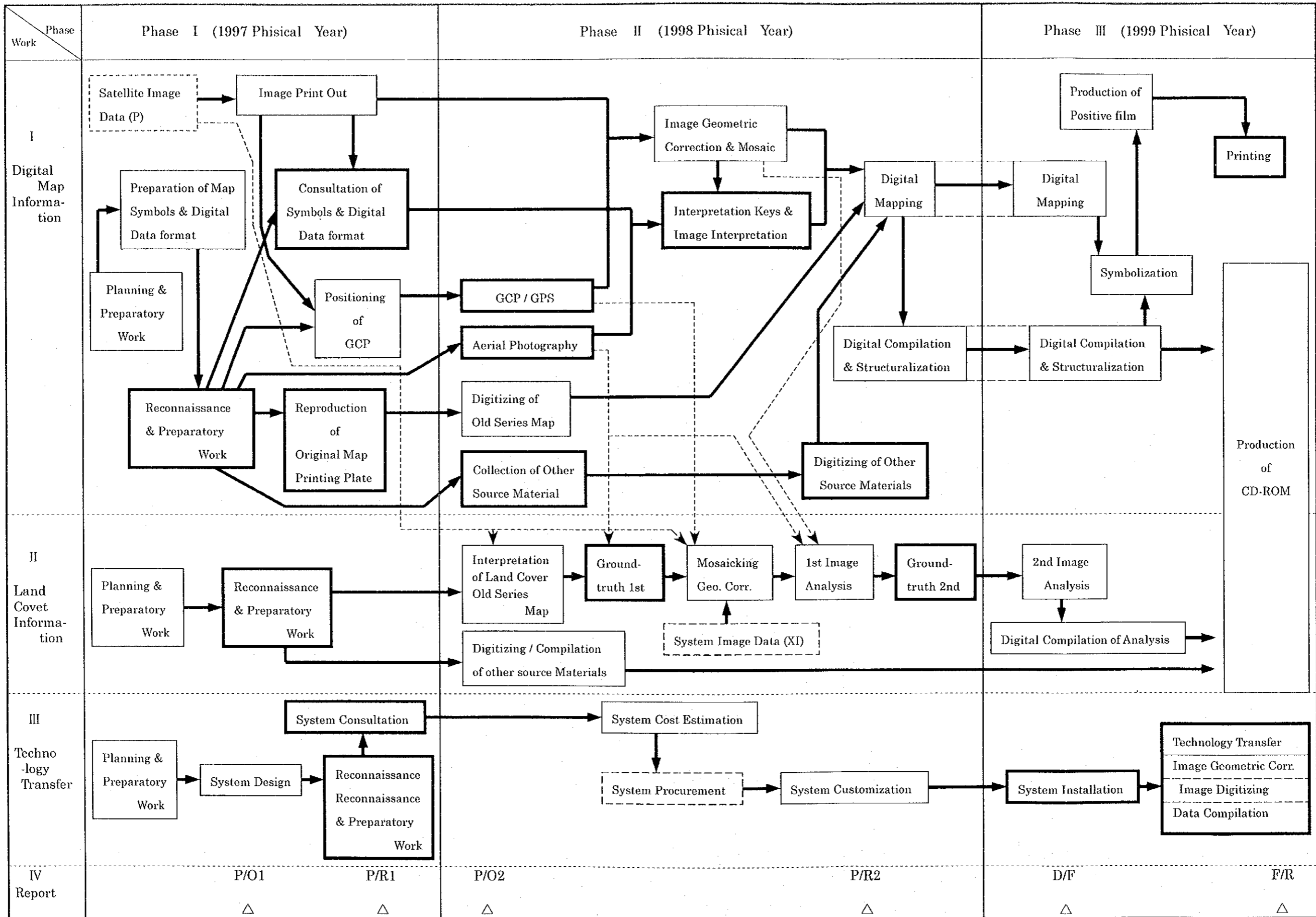
### List of JICA Technical Advisory Team

| Name               | Task                                       | Organization                               |
|--------------------|--|--|
| Toshitomo KANAKUBO | Evaluation on Technology Transfer Planning | Infrastructure Development Institute (IDI) |
| Hisashi MORI       | Evaluation on Technology Transfer Planning | Infrastructure Development Institute (IDI) |





# PROJECT WORK FLOW



Legend :   JICA        Work in Japan        Work in Kazakstan





## WORK DESCRIPTION AND VOLUME

| No. | Work   | Volume                         | Description  | Phase |    |     | Undertaking |        |
|-----|--|--------------------------------|--|-------|----|-----|-------------|--------|
|     |  |                                |  | I     | II | III | Study T     | Local  |
| 1   | Aerial photography                                 | approx. 150,000km <sup>2</sup> | 1/50,000   | ●     |    |     |             | ○      |
| 2   | Reconnaissance and data collection                 | L.S.                           | (1) Map digitizing (2) Thematic map information digitizing   | ●     |    |     |             | ○      |
| 3   | Acquisition of satellite image data                |                                |  |       |    |     |             |        |
| 1)  | SPOT, Panchromatic                                 | approx. 71 scene               | Monaural scene   | △     |    |     |             | (JICA) |
| 2)  | SPOT, Multi-color                                  | approx. 30 scene               | Monaural scene   | △     |    |     |             | (JICA) |
| 4   | Reproduction of original plate                     |                                | 1/100,000 Map 15 pcs, 1/200,000 Map 27 pcs   | ●     |    |     |             | ○      |
| 5   | Reproduction and Pre-Processing of image           | L.S.                           |  |       |    |     |             |        |
| 1)  | 1/100,000 Panchromatic image (SPOT)                | L.S.                           | Locationing of GCP for 71 scene  | ●     |    |     |             | ○      |
| 2)  | 1/200,000 Multi-color image (SPOT)                 | 30 scene                       | False color for land cover analysis  | ●     |    |     |             | ○      |
| 6   | Determination and study of symbol and digital data | L.S.                           |  | ●     |    |     |             | ○      |
| 7   | Locationing of GCP                                 | 140 points                     | 66 points from existing map. 76 points from GPS survey.  | ●     |    |     |             |        |
| 8   | Ground control point survey                        | 76 points                      | GPS observation  | ●     |    |     |             | ○      |
| 9   | Digitizing of GCP for locationing on existing map  | L.S.                           |  | ●     |    |     |             | ○      |
| 10  | Interpretation keys                                | L.S.                           | Comparison data for map, photo and image(including field ID)   | ●     |    |     |             | ○      |
| 11  | Image Interpretation                               |                                |  |       |    |     |             |        |
| 1)  | 1/100,000 map                                      | 15 sheets                      | approx.22,500km <sup>2</sup>   | ●     |    |     |             | ○      |
| 2)  | 1/200,000 map                                      | 27 sheets                      | 150,000 km <sup>2</sup> (Including 22,500km <sup>2</sup> of 1/100,000 map area)                                    | ●     |    |     |             | ○      |
| 12  | Geometric correction                               | 60 scene                       | SPOT Flat area   | ●     |    |     |             | ○      |
| 13  | DEM ortho image                                    | 11 scene                       | SPOT Mountainous and hilly area  | ●     |    |     |             | ○      |
| 14  | Digital Mosaicking                                 | 71 scene                       | 150,000 km <sup>2</sup>  | ●     |    |     |             | ○      |
| 15  | Digitizing of existing map                         | L.S.                           | 1/100,000 and 1/200,000 map contour line, other source map   | ●     |    |     |             | ○      |
| 16  | Digitizing of thematic map                         | 4 kinds                        | Existing thematic map (Geological map, Soil map, vegetation map, Geomorphological map * subject to availability)   | ●     |    |     |             | ○      |
| 17  | Digital mapping                                    |                                |  |       |    |     |             |        |
| 1)  | 1/100,000  | 15 sheets                      | Vectorizing 22,500 km <sup>2</sup>   | ●     |    |     |             | ○      |
| 2)  | 1/200,000  | 27 sheets                      | Vectorizing 150,000 km <sup>2</sup> (Frame information only)   | ●     |    |     |             | ○      |
| 18  | Digital compilation                                |                                |  |       |    |     |             |        |
| 1)  | 1/100,000  | 15 sheets                      | Data structuralizing (phase II), Symbolization(phase III)  | ●     |    |     |             | ○      |
| 2)  | 1/200,000  | 27 sheets                      | Data structuralize only (Combined with 22,500km <sup>2</sup> for 1/100,000)  | ●     |    |     |             | ○      |
| 3)  | Thematic map                                       | 4 kinds                        | Data structuralize only (Geological map, Soil map, vegetation map, Geomorphological map * subject to availability) | ●     |    |     |             | ○      |
| 19  | CD-ROM   | 1 set                          | 1/100,000, 1/200,000, Thematic map, land cover classification  |       |    | ●   |             | ○      |
| 20  | Positive printing plate                            | 15 sheets                      | 1/100,000 map symbolize data   |       |    | ●   |             | ○      |
| 21  | printing   | 15 sheets                      | 505 print / sheets   |       |    | ●   |             | ○      |
| 22  | Archaic map land cover classification              | 150,000 km <sup>2</sup>        | Archaic map 1950s,1970s  |       |    | ●   |             | ○      |
| 23  | Land cover 1st analysis                            | 150,000 km <sup>2</sup>        | SPOT multicolor actual image and panchromatic jointly  |       |    | ●   |             | ○      |
| 24  | Ground-truth, sampling                             | L.S.                           | 150,000 km <sup>2</sup>  |       |    | ●   |             | ○      |
| 25  | Land cover 2nd analysis                            | 150,000 km <sup>2</sup>        | SPOT multicolor actual image and panchromatic jointly  |       |    | ●   |             | ○      |
| 26  | Digital Compilation for analyzed result            | 150,000 km <sup>2</sup>        | Vectorizing, Structuralizing   |       |    | ●   |             | ○      |
| 27  | Technology transfer                                | L.S.                           | Image geometric correction, DM & compilation revision  |       |    | ●   |             | ○      |
| 28  | System design and installation                     | L.S.                           | Equipment for technology transfer  |       |    | ●   |             | ○      |
| 29  | Report   |                                |  |       |    |     |             |        |
| 1)  | Plan of operation                                  | L.S.                           | English · Russian  | ●     |    |     |             | ○      |
| 2)  | Progress report                                    | L.S.                           | English · Russian  | ●     |    |     |             | ○      |
| 3)  | Draft final report                                 | L.S.                           | English · Russian (main, summary, manual) Japanese (summary)   |       |    | ●   |             | ○      |
| 4)  | Final report                                       | L.S.                           | English · Russian (main, summary, manual) Japanese (summary)   |       |    | ●   |             | ○      |

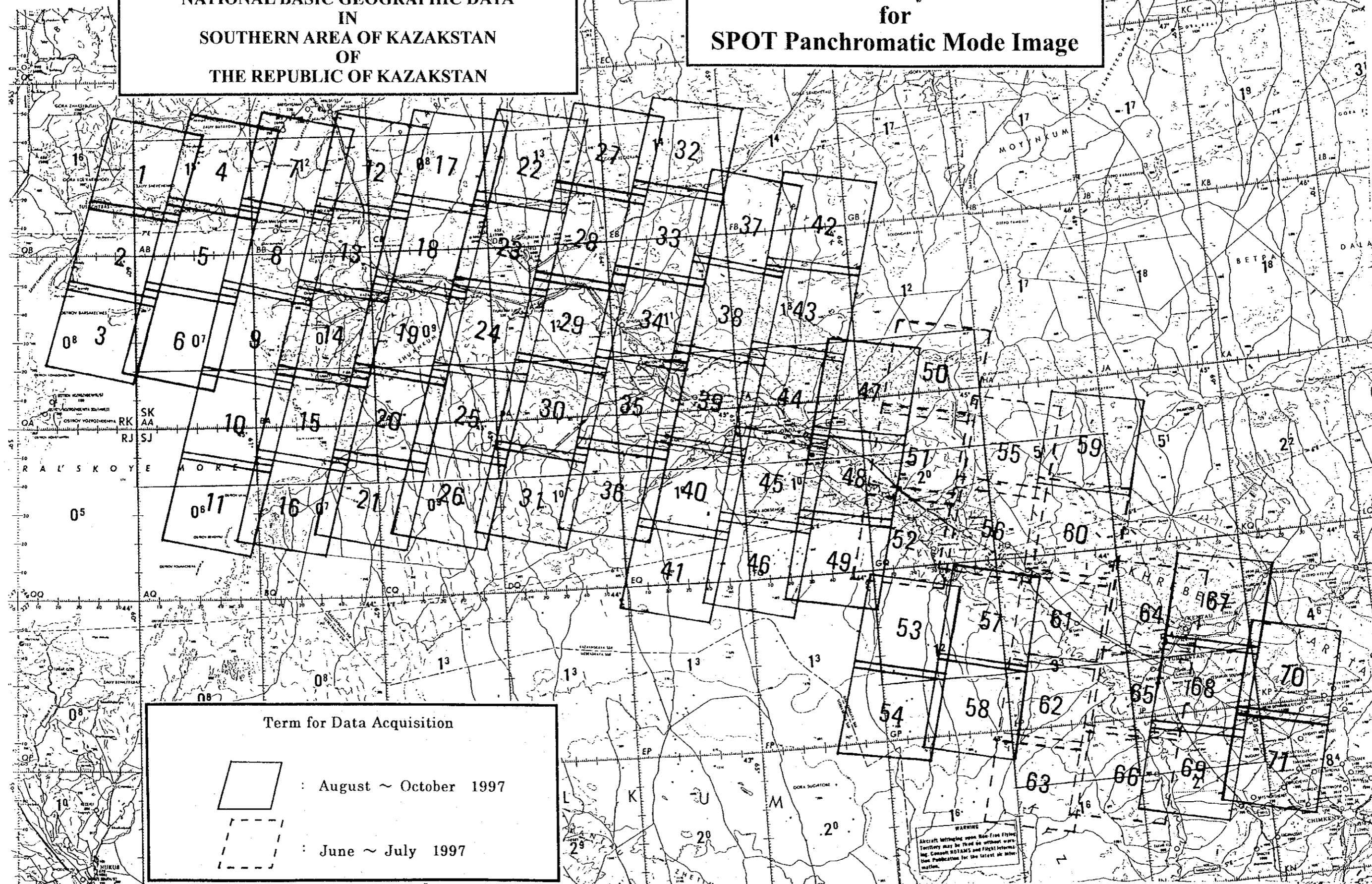






**THE URGENT ESTABLISHMENT  
OF  
NATIONAL BASIC GEOGRAPHIC DATA  
IN  
SOUTHERN AREA OF KAZAKSTAN  
OF  
THE REPUBLIC OF KAZAKSTAN**

**Scene Lay-out  
for  
SPOT Panchromatic Mode Image**













AERIAL PHOTO INDEX

Scale ; 1:1,000,000 June, 1998  
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

The Study for Urgent Establishment of National Basic Geographic Data in Southern Area of the Republic of Kazakhstan

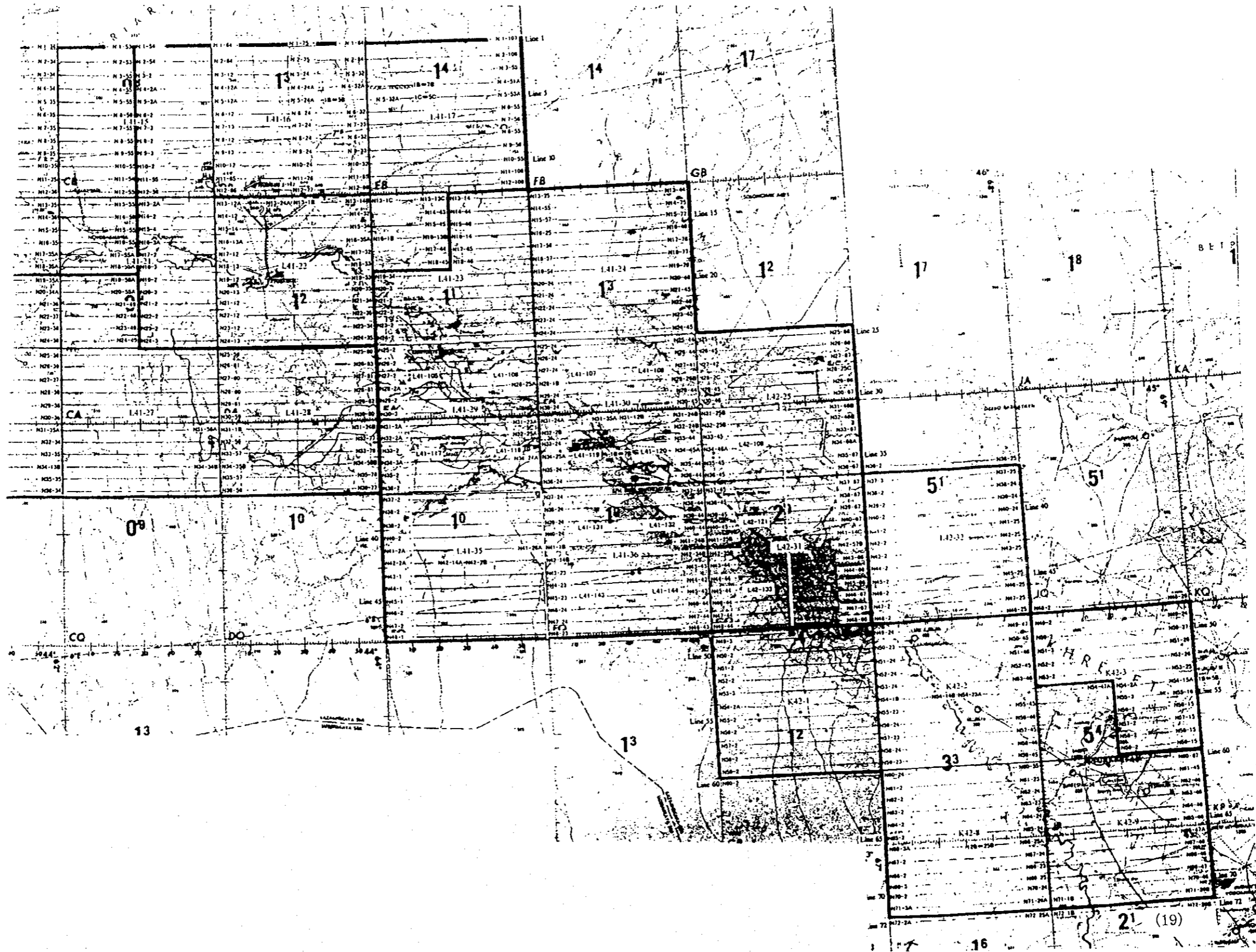
Implemented by : AERO ASAHI CORPORATION, Tokyo, JAPAN  
Photographic Scale : 1:50,000  
Aerial Camera : TAFA-10, Focal Length ; 10 cm  
Aircraft : Antonov 30, Registration No.30003 and 30038  
Photographed by : JSC "BURUNDAYAVIA", Burundai, Almaty

АЭРО ФОТО-ИНДЕКС

Масштаб: 1: 100, 000 Июнь 1998

ЯПОНСКОЕ АГЕНСТВО ПО МЕЖДУНАРОДНОМУ СОТРУДНИЧЕСТВУ (ЯИМС)  
Срочное Создание Государственных Картографо-Географических Данных в Южном Регионе Республики Казахстан

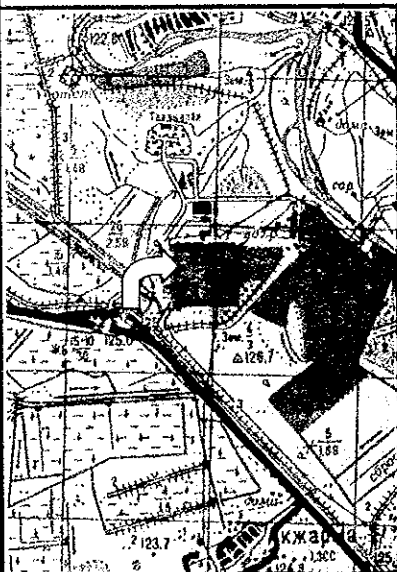

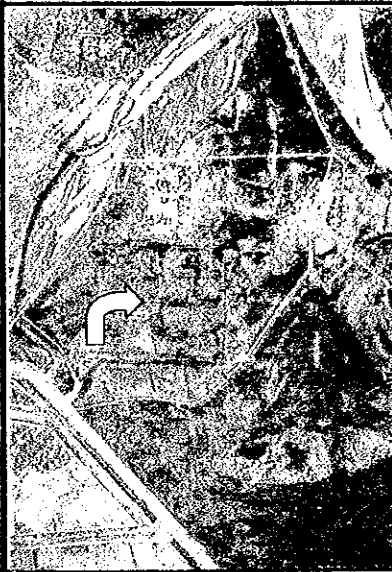
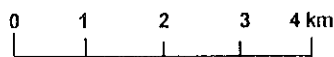
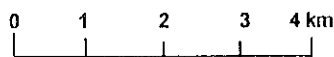
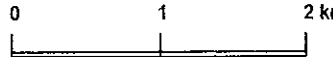
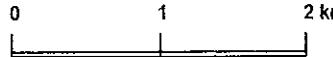
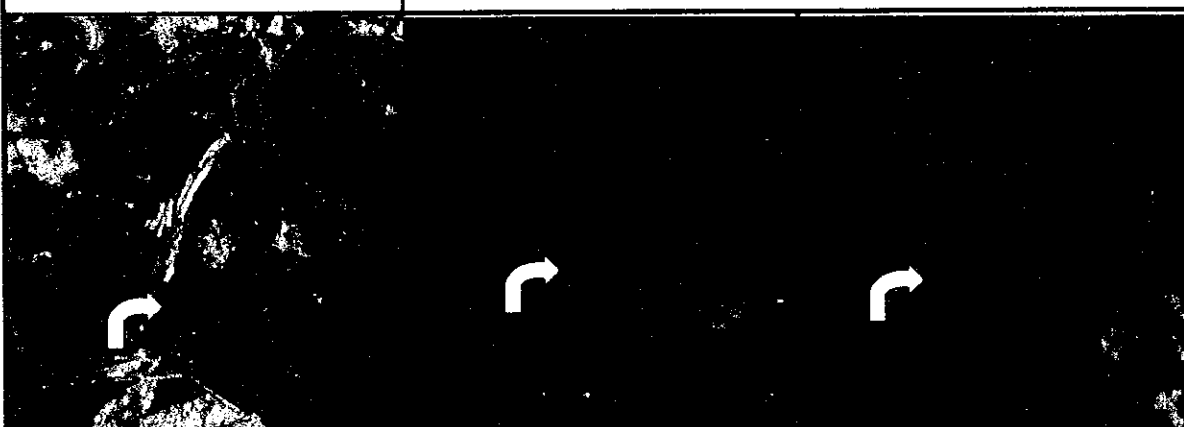
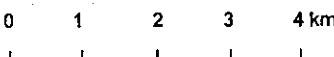
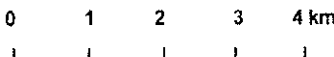
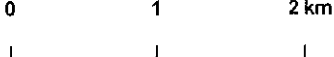
Проект осуществляется Аэро Асахи Корпорейшн, Токио, Япония  
Фотографический масштаб: 1:50,000  
Аэрофотокамера: TAFA-10, Фокусное расстояние: 10 см  
Самолет: Антонов 30, Регистрационный N 30003 и 30038  
Съемки проводились АО "БурундайАвиа" Бурундай, Алматы







# Interpretation Key

|   |  |  |
|---|--|--|
| <b>Name of Map Symbol : 261</b><br><b>Orchard and citrus</b>  |  | <b>Feature Code : 730200</b>   |
|                                    |                                    |                                   |
| <b>1 : 100,000</b><br>           | <b>Flight Date : June 22 Photo No. : 32-10B - 32-11B</b>   |  |
|                                  | <b>1 : 50,000</b><br>           |                                 |
|                                 |  |  |
| <b>CENS,1997 1 : 100,000</b><br> | <b>CENS,1997 1 : 100,000</b><br> | <b>CENS,1997 1 : 50,000</b><br> |
| <b>Satellite Image Data</b>   |  | <b>&lt;Remarks&gt;</b>   |
|   | <b>XI</b>  | <b>P</b>   |
| <b>Viewing Date</b>   | <b>July 6 1998</b>   | <b>Aug 9 1997</b>  |
| <b>Pass-Row</b>   | <b>172-259</b>   | <b>172-259</b>   |
| <b>Viewing Angle</b>  | <b>L11.7</b>   | <b>L1.6</b>  |


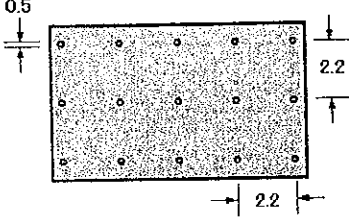
# Interpretation Key

Corresponding Scale : 1:100,000



Date : October 3 1998

## Expression

| Interpretation   | Plotting & Editing  | Symbolization   |
|--|---|---|
| <p>261</p> <div style="border: 1px solid black; width: 100px; height: 50px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> <p>261</p> </div> | <p>Plotting</p> <pre>Pen(18,1,16777215) Brush(68,32768)</pre>  <p>Editing</p> <pre>Symbol("~/Pt245.bmp",0,25,2)</pre> <p style="text-align: center;">.</p> <p style="text-align: center;">(Symbol pasting)</p> |  |

## Description

On the aerial photograph orchard is seen as a small black dots with systematic row alignment on a dark background. However on the satellite image it can not be identified clearly.

<Notes>

<Data Structure>

Adopted number of Symbols by Layer

| No. | Name of Layer | Contents  | 1/100,000 | 1/200,000 |
|-----|---------------|---|-----------|-----------|
| 1   | GeoPointK     | Control Point   | 6         | 6         |
| 2   | ResidentJ     | Residential Area  | 12        | 2         |
| 3   | InstituteJ    | Facilities for Manufacture, Industry,<br>Agriculture, Society and Culture | 35        | 2         |
| 4   | RailwayK      | Railway(input Kazakstan)  | 8         | 0         |
| 5   | RailwayJ      | Railway(input Japan)  | 11        | 3         |
| 6   | RoadJ         | Road  | 14        | 7         |
| 7   | HydroK        | Water related objects etc.<br>(input Kazakstan)                           | 26        | 2         |
| 8   | HydroJ        | Water related objects etc.<br>(input Japan)                               | 40        | 16        |
| 9   | ReliefJ       | Topographic features  | 16        | 10        |
| 10  | VegeJ         | Vegetation  | 46        | -         |
| 11  | AdditionJ     | Additional Map Symbol   | 13        | 1         |
| 12  | Boundary      | Boundary Line   | 0         | 2         |
| 13  | Boundary      | Boundary Annotation   | 10        | 10        |
| 14  | Text          | Annotation  | 22        | 14        |
| 15  | Border        | Marginal Information  | 2         | 2         |
| 16  | Gridmetr      | Grid Line   | 1         | 1         |

**No.1 Geo PointK**

| <i>Symbol No</i> | <i>Name</i>                                   | <i>Countries in charge of digitizing</i> |                  |
|------------------|---|--|------------------|
|                  |   | <i>1/100,000</i>                         | <i>1/200,000</i> |
| 1                | National geodetic triangulation stations      | Kazakstan                                | Kazakstan        |
| 2                | Triangulation stations                        | Kazakstan                                | Kazakstan        |
| 5                | Triangulation stations fixed on central place | Kazakstan                                | Kazakstan        |
| 6                | Bench mark                                    | Kazakstan                                | Kazakstan        |
| 7                | Bench marks, with National leveling network   | Kazakstan                                | Kazakstan        |
| 8                | Astronomical surveying points                 | Kazakstan                                | Kazakstan        |

**No.2 ResidentJ**

| <i>Symbol No</i> | <i>Name</i>  | <i>Countries in charge of digitizing</i> |                  |
|------------------|--|--|------------------|
|                  |  | <i>1/100,000</i>                         | <i>1/200,000</i> |
| 9-1              | Residential and non-residential individual buildings, or individual buildings which without planning to construction | Japan                                    | no               |
| 9-2              | Residential and non-residential individual buildings, or individual buildings which without planning to construction | Japan                                    | no               |
| 9-3              | Residential and non-residential individual buildings, or individual buildings which without planning to construction | Japan                                    | no               |
| 11-1             | Individual buildings can not be expressed in scale   | Japan                                    | no               |
| 11-2             | Individual buildings can not be expressed in scale   | Japan                                    | no               |
| 12               | Destroyed and incompletely destroyed houses  | Japan                                    | no               |
| 13               | Yurt   | Japan                                    | no               |
| 14-1             | Dense built-up area mainly with fire proof buildings (more than 50,000 population)                                   | Japan                                    | Japan            |
| 14-2             | Dense built-up area mainly with fire proof buildings (less than 50,000 population)                                   | Japan                                    | Japan            |
| 16               | Dense built-up area(row, street, width)which can not be expressed in scale   | Japan                                    | no               |
| 18               | Residential area in process of construction  | Japan                                    | no               |
| 20               | Ruined and semi-ruined building  | Japan                                    | no               |

No.3 InstituteJ

Countries in charge of digitizing

| Symbol No | Name   | 1/100,000           |  | 1/200,000 |  |
|-----------|--|---------------------|--|-----------|--|
|           |  |                     |  |           |  |
| 36        | Plant, factory, pipes  | Kazakstan and Japan |  | no        |  |
| 40        | Open mining  | Kazakstan           |  | no        |  |
| 42        | Open salt bed  | Kazakstan           |  | no        |  |
| 44        | Oil, Gas well with oar   | Kazakstan           |  | no        |  |
| 45        | Oil, Gas well with oar   | Kazakstan           |  | no        |  |
| 46-1      | Fuel and Gas tank, Minimal   | Kazakstan and Japan |  | no        |  |
| 46-2      | Fuel and Gas tank  | Kazakstan and Japan |  | no        |  |
| 49        | Hydrographic and thermal power station                               | Kazakstan           |  | no        |  |
| 51-1      | Power transmission station, Minimal                                  | Kazakstan and Japan |  | no        |  |
| 51-2      | Power transmission station   | Kazakstan and Japan |  | no        |  |
| 54        | TV and radio antenna tower   | Kazakstan and Japan |  | no        |  |
| 55-1      | Airports   | Japan               |  | Japan     |  |
| 55-2      | Agricultural air fields  | Japan               |  | Japan     |  |
| 56        | Site for landing on land and water                                   | Japan               |  | no        |  |
| 57        | Big tower more than 55m in height (water, etc.)                      | Kazakstan and Japan |  | no        |  |
| 58        | Big tower less than 55m in height (water, etc.)                      | Kazakstan and Japan |  | no        |  |
| 62        | Hothouse and hotbed  | Kazakstan           |  | no        |  |
| 64        | Livestock enclosure  | Kazakstan and Japan |  | no        |  |
| 68        | Churches   | Japan               |  | no        |  |
| 69        | Mosques  | Kazakstan           |  | no        |  |
| 71-1      | Chapels (Small chapels)  | Japan               |  | no        |  |
| 71-2      | Chapels  | Kazakstan and Japan |  | no        |  |
| 73        | Monument   | Kazakstan and Japan |  | no        |  |
| 74-1      | Cemetery   | Kazakstan and Japan |  | no        |  |
| 74-2      | Cemetery with trees  | Kazakstan and Japan |  | no        |  |
| 74-31     | Crmetery (minimal or part of symbol)                                 | Kazakstan and Japan |  | no        |  |
| 76        | Transmission lines   | Kazakstan           |  | no        |  |
| 78        | Power transmission lines with wooden pole and reinforced poles       | Kazakstan           |  | no        |  |
| 79        | Power transmission lines with metal and reinforced concrete poles    | Kazakstan           |  | no        |  |
| 81-1      | Oil pipeline (Ground surface)  | Kazakstan and Japan |  | no        |  |
| 81-2      | Oil pipeline (Undersurface and underwater transmission station)      | Kazakstan           |  | no        |  |
| 82-1      | Gas pipeline (Ground surface)  | Kazakstan           |  | no        |  |
| 82-2      | Gas pipeline (Under Ground press increasing station)                 | Kazakstan           |  | no        |  |
| 88        | Stone, brick and metal Fences  | Kazakstan and Japan |  | no        |  |
| 89        | Light fences for industrial, agricultural and social-culture objects | Kazakstan           |  | no        |  |

**No.4 RailwayK****No.5 RailwayJ**

| <i>Symbol No</i> | <i>Name</i>   | <i>Countries in charge of digitizing</i> |                  |
|------------------|---|--|------------------|
|                  |   | <i>1/100,000</i>                         | <i>1/200,000</i> |
| 90-1             | Railways of single track  | Japan                                    | Japan            |
| 90-2             | Railways of double track  | Japan                                    | Japan            |
| 96               | Railway stations and the main buildings of the railway station      | Japan                                    | Japan            |
| 97-1             | Railway facility (Shunting places, platforms, overtaking and stops) | Kazakstan and Japan                      | no               |
| 97-2             | Railway facility (Railway traffic regulation posts)                 | Kazakstan                                | no               |
| 97-3             | Railway facility (Offices for guarded railway crossing)             | Kazakstan                                | no               |
| 98-1             | Incoming line (Loading and unloading sites)                         | Japan                                    | no               |
| 98-2             | Incoming line (End and incoming line)                               | Kazakstan and Japan                      | no               |
| 98-3             | Incoming line (Inclined part more than 20%)                         | Kazakstan                                | no               |
| 98-4             | Incoming line (Tubes)   | Kazakstan and Japan                      | no               |
| 100-1            | Railway bridge  | Japan                                    | no               |
| 100-41           | Railway bridge (Border line)  | Japan                                    | no               |
| 100-21           | Fill  | Japan                                    | no               |
| 100-22           | Cut   | Japan                                    | no               |
| 102-1            | Railway under construction (Wide gauge)                             | Japan                                    | no               |
| 102-2            | Railway under construction (Narrow gauge)                           | Kazakstan                                | no               |

**No.6 RoadJ**

| <i>Symbol No</i> | <i>Name</i>                                       | <i>Countries in charge of digitizing</i> |                  |
|------------------|---|--|------------------|
|                  |   | <i>1/100,000</i>                         | <i>1/200,000</i> |
| 106              | Highway with improved pavement                    | Japan                                    | Japan            |
| 107              | Highway with pavement                             | Japan                                    | Japan            |
| 108-2            | Highway without pavement(maintenance in earthy)   | Japan                                    | no               |
| 110              | Earthy road, difficult for passing. Not main road | Japan                                    | Japan            |
| 111              | Road in forest and field                          | Japan                                    | Japan            |
| 116-22           | Cut   | Japan                                    | no               |
| 116-21           | Fill  | Japan                                    | no               |
| 105              | Highway   | Japan                                    | Japan            |
| 118              | Interchange                                       | Japan                                    | Japan            |
| 128              | Border of covering material                       | Japan                                    | no               |
| 118-41           | Interchange                                       | Japan                                    | no               |
| 122-41           | Grade separation                                  | Kazakstan and Japan                      | no               |
| 108-1            | Highway without pavement(maintenance in earthy)   | Japan                                    | Japan            |
| 122              | Grade separation                                  | Kazakstan and Japan                      | no               |

No.7 HydroK

No.8 HydroJ

*Countries in charge of digitizing*  
*1/100,000*      *1/200,000*

| <i>Symbol No</i> | <i>Name</i>   | <i>1/100,000</i> | <i>1/200,000</i> |
|------------------|---|------------------|------------------|
| 129              | Water line (Permanent and distinct)                                       | Japan            | Japan            |
| 130-3            | Water line (Not permanent and distinct)                                   | Japan            | Japan            |
| 133-1            | Steep shore with rock without beach                                       | Japan            | no               |
| 133-2            | Steep shore with rock   | Japan            | no               |
| 134-1            | Permanent river and stream (Width is less than 10m)                       | Japan            | Japan            |
| 134-11           | Permanent river and stream (Width is less than 10m <attenuate gradually>) | Japan            | Japan            |
| 134-2            | Permanent river and stream (Width is from 10m to 60m)                     | Japan            | Japan            |
| 134-3            | Permanent river and stream (Width is more than 60m)                       | Japan            | Japan            |
| 134-4            | Sand bar and island in river  | Japan            | Japan            |
| 135-1            | Dried river and stream (Width is less than 10m)                           | Japan            | Japan            |
| 135-11           | Dried river and stream (Width is less than 10m <attenuate gradually>)     | Japan            | Japan            |
| 135-2            | Dried river and stream (Width is between 10m and 60m)                     | Japan            | Japan            |
| 139              | Height of water level   | Kazakstan        | no               |
| 140-1            | Arrow of the direction of flow (With annotation)                          | Kazakstan        | Kazakstan        |
| 140-2            | Arrow of the direction of flow (Arrow only)                               | Kazakstan        | Kazakstan        |
| 141-1            | Feature of river and canal  | Kazakstan        | no               |
| 141-2            | Feature of river and canal  | Kazakstan        | no               |
| 143-1            | Ditch and canal (Width is less than 3m)                                   | Japan            | Japan            |
| 143-2            | Ditch and canal (Width is less than 3m <branch>)                          | Japan            | Japan            |
| 144              | Ditch and canal (Width is between 3m and 10m)                             | Japan            | Japan            |
| 145              | Water part (Width is between 10m and 60m)                                 | Japan            | Japan            |
| 146              | Water part (width is more than 60m)                                       | Japan            | Japan            |
| 150              | Water gate (Without direction)  | Kazakstan        | no               |
| 150-1            | Water gate (Two side direction)   | Kazakstan        | no               |
| 150-2            | Water gate (Single direction to right)                                    | Kazakstan        | no               |
| 150-3            | Water gate (Single direction to left)                                     | Kazakstan        | no               |
| 152-1            | Dried canal (Width is less than 10m)                                      | Japan            | no               |



| <i>Symbol No</i> | <i>Name</i>  | <i>Countries in charge of digitizing</i> |                  |
|------------------|--|--|------------------|
|                  |  | <i>1/100,000</i>                         | <i>1/200,000</i> |
| 152-2            | Dried canal (Width is more than 10m)                               | Japan                                    | no               |
| 152-3            | Dried canal (Expressed at scale)                                   | Kazakstan                                | no               |
| 155-1            | Ferry  | Kazakstan                                | no               |
| 155-2            | Ferry (Fairway)  | Kazakstan                                | no               |
| 156-1            | Bridge that overpass large obstructive object (Double line)        | Kazakstan and Japan                      | no               |
| 156-2            | Bridge that overpass large obstructive object (Single line)        | Kazakstan and Japan                      | no               |
| 157              | Symbolized bridge, Viaduct   | Kazakstan and Japan                      | no               |
| 157-41           | Symbolized bridge, Viaduct (border line)                           | Kazakstan and Japan                      | no               |
| 158              | Bridge expressed in scale, Viaduct                                 | Japan                                    | no               |
| 158-41           | Bridge expressed in scale, Viaduct (border line)                   | Japan                                    | no               |
| 162              | Float bridge   | Kazakstan and Japan                      | no               |
| 162-41           | Float bridge (Border line)   | Kazakstan and Japan                      | no               |
| 167-1            | Slice and its characteristic (Passeible)                           | Japan                                    | no               |
| 167-2            | Slice and its characteristic (Impassible)                          | Japan                                    | no               |
| 167-41           | Slice and its characteristic (Passsoble, border line)              | Japan                                    | no               |
| 167-99           | Slice and its characteristic (Passible, part of the sluice symbol) | Japan                                    | no               |
| 170              | Embankment   | Japan                                    | no               |
| 171              | Canal, ditch and creek with bank on one side or two-sided          | Japan                                    | no               |
| 172              | Aqueduct   | Kazakstan and Japan                      | no               |
| 172-41           | Aqueduct (Border line)   | Kazakstan and Japan                      | no               |
| 175-1            | Water pipes (Overground)   | Kazakstan                                | no               |
| 175-2            | Water pipes (Underground)  | Kazakstan                                | no               |
| 179              | Wells  | Kazakstan and Japan                      | no               |
| 180              | Principle well   | Kazakstan and Japan                      | no               |
| 183              | Fountain well and borehole   | Kazakstan and Japan                      | no               |
| 185              | Symbolized pump and other water taking facility                    | Kazakstan                                | no               |

*No.9 ReliefJ*

*Countries in charge of digitizing  
1/100,000 1/200,000*

| <i>Symbol No</i> | <i>Name</i>   | <i>1/100,000</i> | <i>1/200,000</i> |
|------------------|---|------------------|------------------|
| 213-1            | Contour (Index contour line)  | Japan            | Japan            |
| 213-2            | Contour (Intermediate contour line)   | Japan            | Japan            |
| 213-3            | Contour (Interval contour line)   | Japan            | Japan            |
| 213-4            | Contour (Supplementary contour line)  | Japan            | Japan            |
| 213-6            | Contour (Direction of inclination)  | Japan            | Japan            |
| 214-11           | Dried river bed, wadi including depression of dried lake (Width is less than 10m)       | Japan            | no               |
| 214-1            | Dried river bed, wadi including depression of dried lake (Width is less than 10m)       | Japan            | no               |
| 214-2            | Dried river bed, wadi including depression of dried lake (Width is between 10m and 60m) | Japan            | no               |
| 214-3            | Dried river bed, wadi including depression of dried lake (Width is more than 60m)       | Japan            | no               |
| 214-4            | Dried river bed, wadi including depression of dried lake (Cliff etc.)                   | Japan            | no               |
| 215-1            | Spot height   | Japan            | Japan            |
| 215-2            | Elevation point   | Japan            | Japan            |
| 222-1            | Depression(Minimal)   | Japan            | Japan            |
| 222-2            | Depression  | Japan            | Japan            |
| 222-3            | Barrow (Minimal)  | Japan            | Japan            |
| 222-4            | Barrow  | Japan            | Japan            |

No.10 *VegeJ*

*Countries in charge of digitizing*  
*1/100,000*                      *1/200,000*

| <i>Symbol No</i> | <i>Name</i>   | <i>1/100,000</i> | <i>1/200,000</i> |
|------------------|---|------------------|------------------|
| 238              | Contour of the vegetation and soil                      | Japan            | no               |
| 239-1            | Forest  | Japan            | no               |
| 239-2            | Forest (Depression, forest in karst depression etc.)    | Japan            | no               |
| 241              | Wind protection ribbon forest                           | Japan            | no               |
| 245              | Individual tree as the objective, meaningless           | Japan            | no               |
| 248              | Young tree and bed                                      | Japan            | no               |
| 248-31           | Young tree and bed (Minimal or part of the symbol)      | Japan            | no               |
| 253-1            | Bushes and scrubs (Individual and groups of bushes)     | Japan            | no               |
| 253-2            | Bushes and scrubs (Thick shrubbery)                     | Japan            | no               |
| 254-1            | Shrubbery with thorns (Individual and groups of bushes) | Japan            | no               |
| 254-2            | Shrubbery with thorns (Thick shrubbery)                 | Japan            | no               |
| 255-1            | Species of shrubbery (Conifer trees)                    | Japan            | no               |
| 255-2            | Species of shrubbery (Broad leaf trees)                 | Japan            | no               |
| 256              | Ribbon shrubbery and hedges                             | Japan            | no               |
| 257-1            | Saxaul (Individual)                                     | Japan            | no               |
| 257-2            | Saxaul (Thick)  | Japan            | no               |
| 257-31           | Saxaul (Minimal or part of symbol)                      | Japan            | no               |
| 261              | Orchard and citrus                                      | Japan            | no               |
| 262-1            | Vineyards   | Japan            | no               |
| 262-2            | Vineyards (Orchard and citrus with vineyards)           | Japan            | no               |
| 262-99           | Vineyards (Part of the symbol)                          | Japan            | no               |
| 264-1            | Rice field (Irrigate in planting period)                | Japan            | no               |
| 264-2            | Rice field (Irrigate in growing period)                 | Japan            | no               |
| 264-98           | Rice field (Part of the symbol(1))                      | Japan            | no               |
| 264-99           | Rice field (Part of the symbol(2))                      | Japan            | no               |
| 267              | Reeds   | Japan            | no               |
| 267-31           | Reeds (Minimal or part of symbol)                       | Japan            | no               |
| 268-03           | Liverwort in Marshes                                    | Japan            | no               |
| 269-1            | Steppe (Grass)  | Japan            | no               |
| 269-2            | Steppe (Semi-bushes)                                    | Japan            | no               |
| 269-98           | Steppe (Semi-bush, part of the symbol)                  | Japan            | no               |
| 269-99           | Steppe (Grass, part of the symbol)                      | Japan            | no               |
| 272-3            | Passable marshes  | Japan            | no               |
| 274              | Passable solonchak                                      | Japan            | no               |
| 275-1            | Takyr (Minimal)   | Japan            | no               |
| 275-2            | Takyr   | Japan            | no               |
| 277-31           | Hillrocks   | Japan            | no               |
| 282              | Flat sand   | Japan            | no               |
| 283              | Rolling sand  | Japan            | no               |

| <i>Symbol No</i> | <i>Name</i>                                | <i>Countries in charge of digitizing</i> |                  |
|------------------|--|--|------------------|
|                  |  | <i>1/100,000</i>                         | <i>1/200,000</i> |
| 283-99           | Rolling sand (Part of the symbol)          | Japan                                    | no               |
| 284              | Sequent dune and sand                      | Japan                                    | no               |
| 284-99           | Sequent dune and sand (Part of the symbol) | Japan                                    | no               |
| 285              | Sand with depression                       | Japan                                    | no               |
| 285-99           | Sand with depression (Part of the symbol)  | Japan                                    | no               |
| 286              | Sand dune                                  | Japan                                    | no               |
| 286-99           | Sand dune (Part of the symbol)             | Japan                                    | no               |

*No11. AdditionJ*

| <i>Symbol No</i> | <i>Name</i>  | <i>Countries in charge of digitizing</i> |                  |
|------------------|--|--|------------------|
|                  |  | <i>1/100,000</i>                         | <i>1/200,000</i> |
| no               | Border of the desert                                       | Japan                                    | no               |
| no               | Blank space  | Japan                                    | no               |
| no               | Road in block (0.6mm width on map)                         | Japan                                    | no               |
| no               | Road in block (0.3mm width on map)                         | Japan                                    | no               |
| no               | Mixed forest   | Japan                                    | no               |
| no               | Mixed desert (Flat sand and rolling sand)                  | Japan                                    | no               |
| no               | Mixed desert (Rolling sand, sequent dune and sand)         | Japan                                    | no               |
| no               | Mixed desert (Rolling sand and sand with depression)       | Japan                                    | no               |
| no               | Mixed desert (Sequent dune, sand and sand with depression) | Japan                                    | no               |
| no               | Airstrip   | Japan                                    | no               |
| no               | Mixed water line (Permanent water and reeds)               | Japan                                    | no               |
| no               | Mixed water line (Not permanent water and reeds)           | Japan                                    | no               |
| no               | Supplementary line   | no                                       | Japan            |

*No.12 Boundary*

*No.13 Boundary*

*Countries in charge of digitizing*

| <i>Symbol No</i> | <i>Name</i>   | <i>1/100,000</i> | <i>1/200,000</i> |
|------------------|---|------------------|------------------|
| 310              | State boundaries  | Kazakstan        | Kazakstan        |
| 313              | Borders of the Soviet Socialist Autonomous Republics, regions, oblast and administrative units of the first order on the foreign territory. | Kazakstan        | Kazakstan        |
| 322              | Name of the capital and state of kazakstan and other country  | Kazakstan        | Kazakstan        |
| 323              | Center of the republic and local autonomous oblasts, center of the jurisdiction of the local government                                     | Kazakstan        | Kazakstan        |
| 325              | Center of the republic and local autonomous oblasts, center of the jurisdiction of the local government                                     | Kazakstan        | Kazakstan        |
| 327              | Settlement(city form, more than 2,000 inhabitants)  | Kazakstan        | Kazakstan        |
| 328              | Settlement(city form, Less than 2,000 inhabitants)  | Kazakstan        | Kazakstan        |
| 332              | Village (More than 1,000 inhabitants)   | Kazakstan        | Kazakstan        |
| 333              | Village (From 500 to 1,000 inhabitants)   | Kazakstan        | Kazakstan        |
| 334-1            | Village (From 100 to 500 inhabitants)   | Kazakstan        | Kazakstan        |
| 334-2            | Village (Less than 100 inhabitants)   | Kazakstan        | Kazakstan        |
| 336              | Individual houses   | Kazakstan        | Kazakstan        |

No.14 Text

Countries in charf of digitizing  
1/100,000 1/200,000

| <i>Symbol No</i> | <i>Name</i>  | <i>1/100,000</i> | <i>1/200,000</i> |
|------------------|--|------------------|------------------|
| 338              | Stations, shunting places, platforms, overtaking and stops   | Kazakstan        | Kazakstan        |
| 339              | Annotation of the factories and flour mills  | Kazakstan        | Kazakstan        |
| 340              | Annotations and names of symbols of wells, springs and influent volume of water,lake in flood period                                 | Kazakstan        | no               |
| 342              | Marks of the administrative centers  | Kazakstan        | Kazakstan        |
| 345              | Annotation of pavement materials of the road   | Kazakstan        | no               |
| 346-1            | Annotation of channel and soil (Characteristics of channel)  | Kazakstan        | no               |
| 346-2            | Annotation of channel and soil (Characteristics of rifts)  | Kazakstan        | no               |
| 347              | Construction materials of bridge and dams  | Kazakstan        | no               |
| 348-1            | Elevation and water level (Elevation, Water level)   | Kazakstan        | Kazakstan        |
| 348-2            | Elevation and water level (Water level)  | Kazakstan        | Kazakstan        |
| 349              | Hight of command   | Kazakstan        | Kazakstan        |
| 351              | Annotation of population(in thousand)  | Kazakstan        | Kazakstan        |
| 352-1            | Objects shown on map by symbols in black color(bridges, dams, roads, water gates, tunnels, wood pillars, etc.)                       | Kazakstan        | no               |
| 352-2            | Terrain(cliffs, rivers, open digging places, depressions, hillrocks, etc.), as the same as the annotation of contours                | Kazakstan        | Kazakstan        |
| 352-3            | Hydrology(Rivers, channels, saults, marshes, etc.),as the same as the depth contour and contour annotation of the glacier, snow area | Kazakstan        | Kazakstan        |
| 352-81           | Objects shown on map by symbols in black color(bridges, dams, roads, water gates, tunnels, wood pillars, etc.)                       | Kazakstan        | Kazakstan        |
| 352-82           | Hydrology(Rivers, channels, saults, marshes, etc.),as the same as the depth contour and contour annotation of the glacier, snow area | Kazakstan        | Kazakstan        |
| 352-83           | Terrain(cliffs, rivers, open digging places, depressions, hillrocks, etc.), as the same as the annotation of contours                | no               | Kazakstan        |
| 355              | Names of rivers, streams, channels and dried river beds  | Kazakstan        | no               |
| 357              | Names of depressions, plains, steppes, sands, solonchaks, marshes, forests, ravines, basin, valley                                   | Kazakstan        | no               |
| 358              | Names of ridges, hills, mountains, rocks, kurgans, glaciers  | Kazakstan        | Kazakstan        |
| 361              | Annotation of the district, place  | Kazakstan        | Kazakstan        |
| no               | Annotation of dried river  | Kazakstan        | no               |

### No.15 Border

*Countries in charge of digitizing*  
*1/100,000*      *1/200,000*

| <i>Symbol No</i> | <i>Name</i>                            | <i>1/100,000</i> | <i>1/200,000</i> |
|------------------|--|------------------|------------------|
| no               | Outside sheet border line of 1/100,000 | Kazakstan        | no               |
| no               | Outside sheet border line of 1/200,000 | no               | Kazakstan        |
| no               | Inside sheet border line               | Kazakstan        | Kazakstan        |

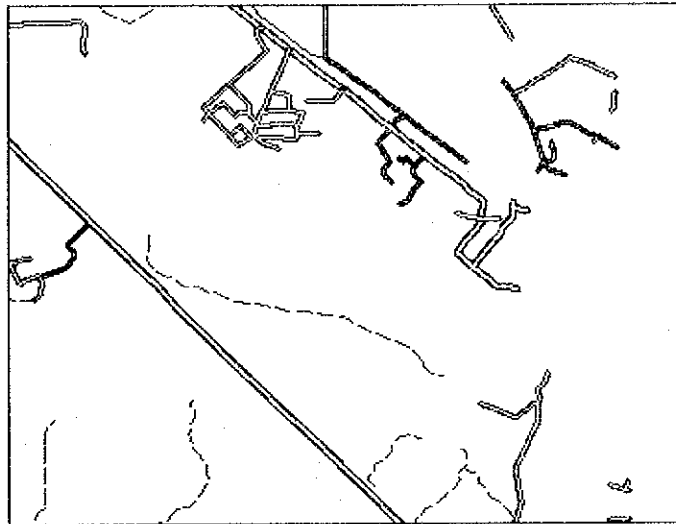
### No.16 Gridmeter

*Countries in charge of digitizing*  
*1/100,000*      *1/200,000*

| <i>Symbol No</i> | <i>Name</i> | <i>1/100,000</i> | <i>1/200,000</i> |
|------------------|-------------|------------------|------------------|
| no               | Grid        | Kazakstan        | Kazakstan        |

Example of Structured Data Layer

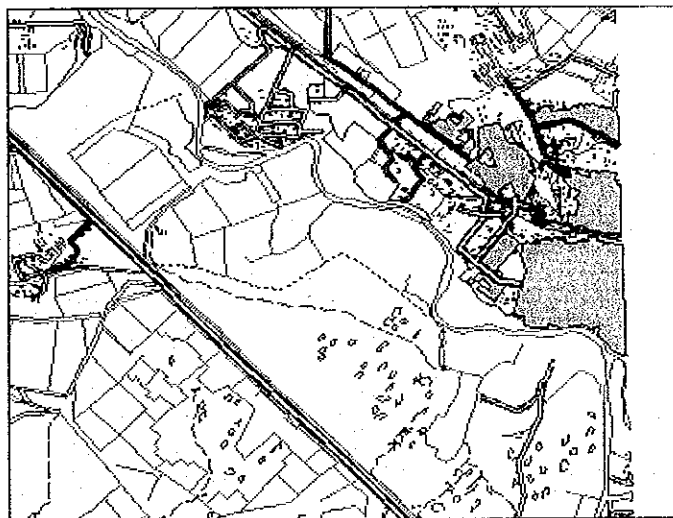
RoadJ



ResidentJ

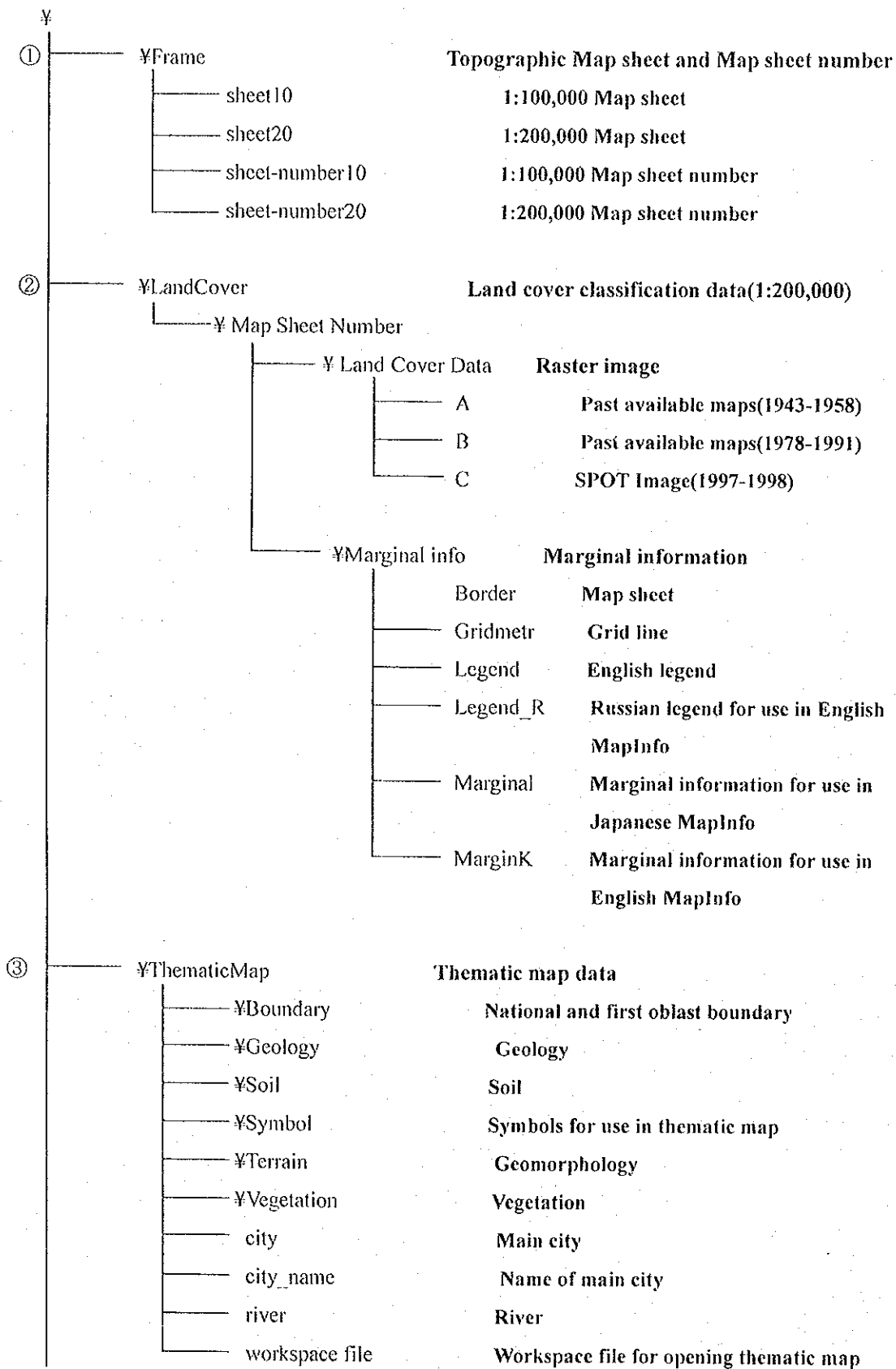


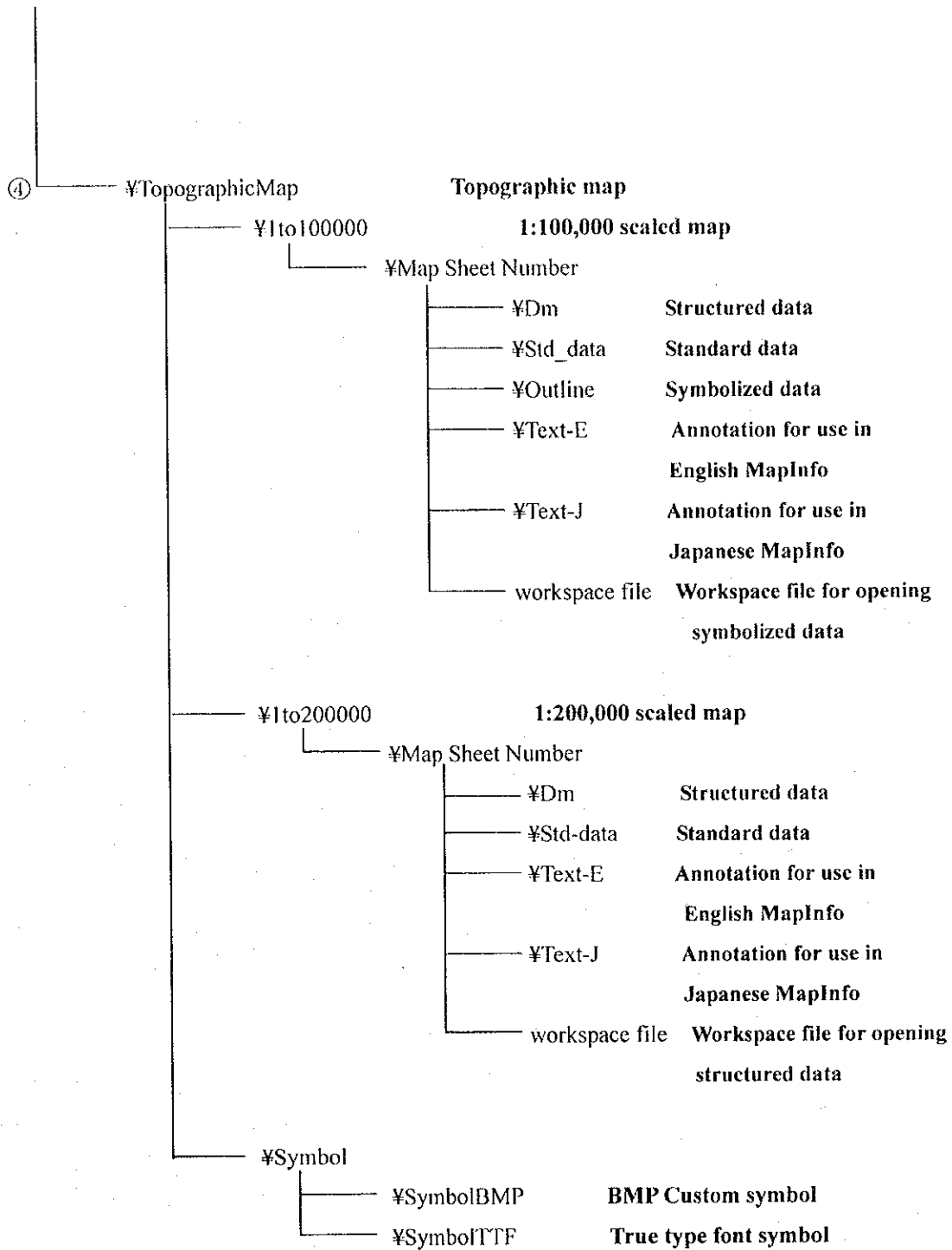
RoadJ, ResidentJ, RailwayJ,K  
HydroJ,K and ReliefJ





Structure of CD-ROM





Data format list<sup>\*1</sup>

| 1 <sup>st</sup> directory | 2 <sup>nd</sup> directory | 3 <sup>rd</sup> directory            | Data format                      |
|---------------------------|---------------------------|--------------------------------------|----------------------------------|
| ¥Frame                    |                           |                                      | MapInfo table file <sup>*2</sup> |
| ¥LandCover                | ¥Land Cover Data          |                                      | MapInfo table file               |
|                           | ¥Marginal info            |                                      |                                  |
| ¥ThematicMap              | ¥Boundary                 |                                      | MapInfo table file               |
|                           | ¥Geology                  |                                      |                                  |
|                           | ¥Soil                     |                                      |                                  |
|                           | ¥Symbol                   |                                      | True type font format symbol     |
|                           | ¥Terrain                  |                                      | MapInfo table file               |
|                           | ¥Vegetation               |                                      |                                  |
|                           | city                      |                                      |                                  |
|                           | city_name                 |                                      |                                  |
|                           | river                     |                                      |                                  |
| workspace file            |                           | MapInfo workspace file <sup>*3</sup> |                                  |
| ¥TopographicMap           | ¥1to100000                | ¥Dm                                  | MapInfo table file               |
|                           |                           | ¥Std_data                            | Digital mapping standard data    |
|                           |                           | ¥Outline                             | MapInfo table file               |
|                           |                           | ¥Text-E                              |                                  |
|                           |                           | ¥Text-J                              |                                  |
|                           |                           | workspace file                       | MapInfo workspace file           |
|                           | ¥1to200000                | ¥Dm                                  | MapInfo table file               |
|                           |                           | ¥Std_data                            | Digital mapping standard data    |
|                           |                           | ¥Text-E                              | MapInfo table file               |
|                           |                           | ¥Text-J                              |                                  |
|                           |                           | Workspace file                       | MapInfo workspace file           |
|                           | ¥Symbol                   | ¥SymbolBMP                           | BMP format symbol                |
|                           |                           | ¥SymbolTTF                           | True Type Font format symbol     |

\*1 In 1<sup>st</sup> directory of ThematicMap, city, city\_name, river, and workspace file are MapInfo files.  
In 2<sup>nd</sup> directory of 1to100000 and 1to200000, workspace file is MapInfo file.

\*2 MapInfo table file:  
Digital mapping data using MapInfo in MapInfo table file format

\*3 MapInfo workspace file:  
Opening several MapInfo files in regular sequence







