Telecommunication Facility Plan for New City Center

Facilities	Capacity, Type, etc.	Contents	Remarks
Switching Facilities	Total 63,800 lines, Digital	New	ATC-A, ATC-B, ATC-C
Transmission System	STM-16, Digital	New	ATC-21 – ATC-A – ATC-B – ATC-C – ATC-36
DLC Equipment	Indoor Type, Outdoor Type	New	ATC-A, ATC-B, ATC-C
Outside Plant	Optical Fiber Access Network	New	ATC-A, ATC-B, ATC-C
Power Supply System	Power Receive, Rectifier, Battery, Generator, Air Conditioner	New	ATC-A, ATC-B, ATC-C
Buildings	Standard type for 73,000 L. Standard type for 34,000 L. Standard type for 16,000 L.	New	ATC-A, ATC-B, ATC-C

Note. L.: Lines

4.7.7 Implementation Schedule

(1) Project Implementation Plan

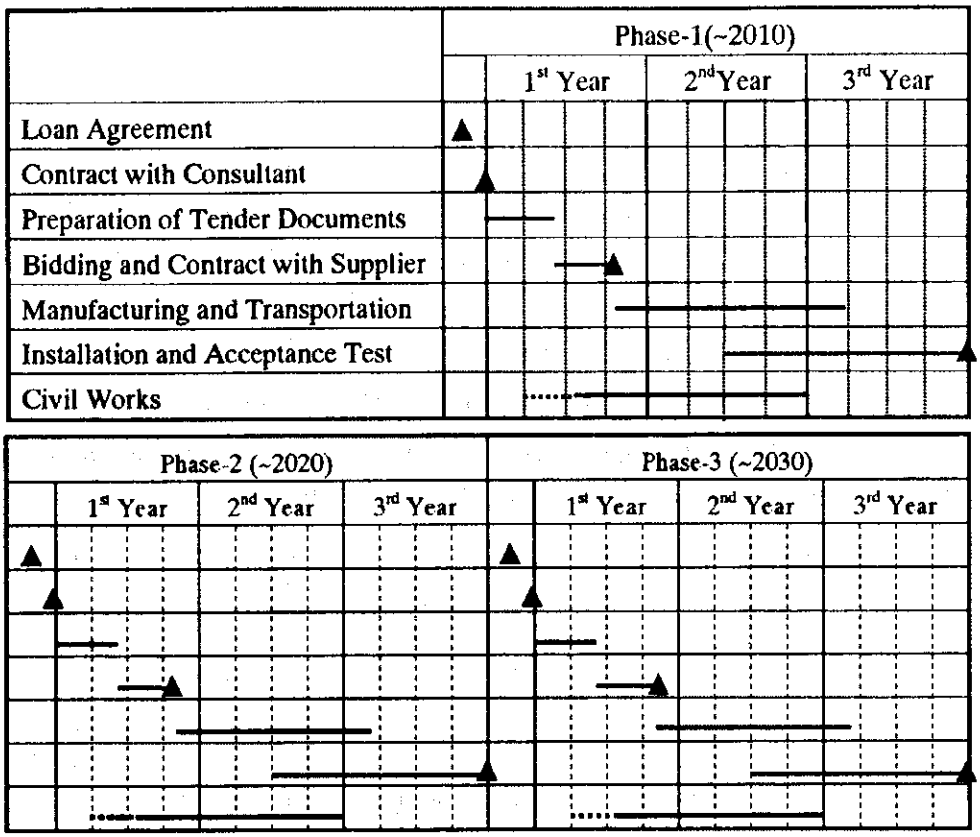
1) Basic Policy

The following matters shall be taken into consideration in formulating the implementation plan.

- The turn-key method shall be adopted for implementation of the project.
- A consultant shall be hired for smooth project implementation. The job to be performed by the consultant are as follows:
  - Preparing the detailed design, specification and tender documents
  - Examining bid documents and supporting negotiation for contract
  - Witnessing factory inspection of products
  - Supervising the construction work and witnessing the acceptance test
- The construction work shall be completed within three(3) years after the Contract of loan agreement.

2) Implementation Schedule

The following table shows the implementation schedule of the project.


Phase-1(~2010)
1st Year
2nd Year
3rd Year
Loan Agreement
Contract with Consultant
Preparation of Tender Documents
Bidding and Contract with Supplier
Manufacturing and Transportation
Installation and Acceptance Test
Civil Works
Phase-2 (~2020)
1st Year
2nd Year
3rd Year
Phase-3 (~2030)
1st Year
2nd Year
3rd Year

4.8 Planning of Solid Waste Management System[8]

4.8.1 Present Conditions of Solid Waste Disposal

(1) Institutional and Legal Structure

In the ROK, no specific laws regarding the waste management have been in effect which define and classify wastes and stipulate the roles and responsibilities of the concerned bodies. Some of the environmental protection laws include articles related to waste management, such as "Law No.160 of July 15th, 1997 on the Environmental Protection". In terms of technical and regulation aspects, technical guidelines called SNiP have been established on the process of collection and transportation of waste and on the preparation of the waste disposal facility.

Despite the lack of legal definition, the following classifications are presently in common use throughout the country.

- Municipal solid waste (known as "domestic solid waste")
- Industrial solid waste (categorized as hazardous risk)
- Hospital solid waste (including hazardous waste)

(2) Responsible Organizations

City Communal Management (*Gorcommunkhoz*) is a state enterprise under the Office of *Akim* and is responsible for the implementation of solid waste management activities including collecting, transporting and disposing of solid waste at the landfill site. Besides *Gorcommunkhoz*, three other private enterprises, namely Special Auto Transport of Almaty area (*Almaatinsky*), Special Auto Transport of Saryarka area (*Saryarkinsky*) and *TURMYS*, specialize in collecting of solid waste from the city.

From the public spaces such as streets and parks, the Department of City Care and Development under *Gorcommunkhoz* is in charge of sweeping, cleaning and removing the waste.

Ecological Police maintains the city cleanliness by watching illegal activities. Sanitary and Epidemiological Center, Environmental Protection Department and other organizations complement MSW management from the environmental view.

(3) Municipal Solid Waste (MSW)

[8] Full text of Solid Waste Management Planning appears in Appendix K of Volume III; Supporting Report

estimated at about 463,000 m^3/year in 2000. This unit generation rate complies with the range indicated in SNiP 2.07.01-89.

There are a few other estimations by pertinent agencies. The City Environmental Department estimates that approximately 364,500 m^3/year of MSW is generated in Astana City. According to an interview with the landfill manager, daily MSW volume accepted at the landfill is approximately 800 m^3 per day, which corresponds to 292,000 m^3 per year. These discrepancies may be because either the unit generation rate of MSW in Astana City is actually lower than 1.4 m^3 per day per capita, or because the current MSW collection service does not cover all MSW generated within the city.

In this M/P study, the generation quantity is estimated at 463,000 m^3/year and the collection coverage rate is 80%, meaning that approximately 370,000 m^3/year of MSW is transported to the landfill. The remaining 97,000 m^3/year of MSW is assumed to be disposed of somewhere else by individuals.

Physical composition of MSW analyzed in the Saudi master plan indicated that there are four major components; paper waste, food waste, screen residues (ash, slag), and plastic waste. Waste volume of these four categories accounts for more than 80% of all MSW. According to *Gorcommunkhoz*, the composition rate of plastic waste increased significantly in recent years. The moisture content of MSW fluctuates between 30 and 58% and bulk density of MSW is in the range of 0.18 and 0.3 ton/m^3.

For temporary storage of MSW, storage containers are used. They are positioned behind buildings or at common areas in settlements so that people can throw their garbage anytime they want. This means that small animals or stray dogs may scavenge for food from the container. MSW storage containers are emptied at regular intervals or upon request when it becomes full. In addition, there are many public trash containers positioned in streets or in public areas. Workers employed by the Department of City Care and Development regularly sweep streets and collect the waste from public trash containers.

Astana City operates one approved landfill site, which is the only way of final disposal. The landfill site is 65.6 hectares, located approximately 10 km northeast of the city center. The landfill site was commission in 1972 using an abandoned sand quarry. Astana City planned to dispose MSW at this

landfill site until 2010. Due to the rapid increase of waste generation volume in recent year, however, the site will have to be closed earlier than 2010. This early closure may also be related to apprehended groundwater pollution caused by the landfill.

Present landfill is categorized as open dump landfill, which doesn't have any seepage control facilities like liner facility in order to prevent groundwater contamination and does not operate daily cover with soil to avoid littering, odor, or breeding of rats. Such open dumping landfill must be improved to a sanitary landfill from the environmental view.

Waste collection and disposal fee is Tenge 48 to 50 per person per month, of which Tenge 3 to 4 is said to cover the fee for disposal at the landfill site.

(4) Industrial Solid Waste (ISW)

There are several data or information regarding ISW generation. About 12.7% of MSW, or 44,005 m^3, of ISW is reportedly generated annually, which account for some 20% of the total waste disposed of at the landfill. ISW is categorized into four classes depending on its hazardous risk. Most of the non-hazardous ISW constitutes construction and demolition waste. In principle, responsibility for the collection, transport, treatment and disposal of ISW lies with each individual industry enterprise. Therefore, the waste generators tend to intentionally denote hazardous waste as non-hazardous, which may inflict a public risk.

Some ISW is disposed of at the specified area within the landfill site. For example, used tires, wooden waste, scrap metals are kept separately from other waste for convenience of recycling.

(5) Hospital Solid Waste (HSW)

Though more than fifty health care facilities, such as hospitals and medical clinics, are in operation in Astana City, no comprehensive statistical data clarify the waste generated at these health facilities. In reference to a recent JICA study for waste management in Almaty, HSW generation volume in Astana City is estimated to be 7,800 m^3 annually in 2000, or 2,000 tons per year. On the same basis, HSW presumably includes 600 tons of hazardous HSW annually, such as human blood and blood products, culture and stocks of infectious agents, pathological waste or contaminated sharps.

According to *Gorcommunkhoz*, all the waste collected from the health facilities is nominally considered as non-hazardous waste and is thereby disposed of together with other MSW at the city landfill.

The present solid waste flow including MSW, ISW and HSW is shown in Figure 4.8.1, which summarizes the current waste management system in Astana City.

(6) Problems to be solved in Waste Management in Astana

The following waste issues need to be solved at present and in future.

- Remedial actions of the existing landfill site to mitigate the environmental pollution,
- Selection and securing of a future landfill site to be in use after closure of the existing one,
- Maintenance and repairing of the existing waste collection vehicles in operation and additional purchase to cater for increasing demand for collection,
- Improvement of garbage storage and rationalization of collection system for clean and sanitary urban environment and avoidance of scavenging,
- Control of illegal dumping, and
- Establishment of a hazardous waste management system for both industrial waste and hospital waste.

One of most urgent issue pertains to the existing landfill condition. City Environmental Department reports that groundwater contamination from the landfill is occurring. If this contamination is serious, appropriate remedial actions such as construction works to isolate the landfill, re-excavation of buried waste, equipping appropriate seepage control facility, or at most closure of the site, may be immediately necessitated.

Uncontrolled open burning or outbreak of pathogenic bacteria and vector at the landfill site may also be causing air pollution. This problem can be solved by daily soil covering on top of disposed waste layer. The existing landfill site is not a "sanitary landfill" with the lack of such a covering soil system and leachate control system.

In addition, it was pointed out at the seminar on Waste Management conducted by JICA M/P Study Team, that another important issue related to waste management is garbage littering at storage containers in streets by stray dogs, numbering approximately seven thousand in the city.

4.8.2 Demand Forecast

(1) Future Estimation of MSW Generation Quantity

Future MSW generation quantity is estimated and shown in Figure 4.8.2, and summarized below. Approximately 463,000 m^3 of MSW is generated in 2000 and will increase to 1,512,000 m^3 in 2030.

Future Estimation of MSW Generation Volume (m^3/year)

	2000	2010	2020	2030
1 Central Planning Region	245,700	287,700	362,780	416,860
2 Northern Planning Region	22,834	13,551	15,358	17,165
3 Southeastan Planning Region	129,370	323,135	471,925	580,857
4 Southern Planning Region	22,417	66,972	185,564	330,543
5 Northwest Planning Region	42,966	46,035	139,431	180,914
Grand Total	**463,287**	**737,393**	**1,175,058**	**1,526,339**

(2) MSW Composition Prediction

Composition of MSW is closely related to lifestyle particularly consumption practices in the current society. Generally, paper waste may increase, because Astana City will become chiefly an administrative city with a number offices generating predominantly paper waste. Plastic waste may also increase in accordance with increasing consumption of plastic goods and readily packed foodstuff. Screen residue such as ash from dwelling houses will significantly decrease in conjunction with increased connection of the central heating system and electric or gas system.

In the course of such composition changes, bulk density and lower calorific value will also change. The bulk density has a tendency to slightly decrease and the lower calorific value is estimated to rise above 4,500 kJ/kg.

(3) Industrial Waste Quantity and Quality

The industrial waste tend to differ greatly by the type of industries. The future generation quantity of industrial waste therefore is subject to uncertainties pertinent mainly to future expansion and restructuring plans of industrial activities, as well as changes in working population.

The working population of industries is projected in this Master Plan as 15,901 in 2000; 25,123 in 2010; and 35,118 in 2020; and 37,091 in 2030. If the generation quantity of industrial waste is assumed to grow in proportion to the working population, the volume of industrial waste will

increase to 158% in 2010; 221% in 2020; and 233% in 2030 compared with the volume in 2000.

The present M/P estimated the area of demolished houses and buildings for urban redevelopment mostly in the existing urban areas to be, 349 ha by 2010; additional 350 ha by 2020; and 108 ha by 2030. In due course, construction wastes will increase accordingly even though some of the demolition material will be reused.

According to the power and heat supply development plans in this Master Plan, 154,400 tons of coal ash consisting of 88% of fly ash and 12% of bottom ash will be discharged annually from the new boiler at TETs-2 commissioned in 2006. In the on-going Feasibility Study for Water Supply and Sewerage Development, approximately 4,000 to 5,000 tons of dried sludge cake will be generated annually by solar evaporation from the water purification and wastewater treatment facility.

(4) Hospital Waste Quantity and Quality

The generation quantity of hospital waste is estimated as shown in the following table using projected number of future beds and the unit generation rate adopted from a JICA Study for Almaty waste management. The number of beds will be increased in excess of 8,000 and total hospital waste will be increased to approximately 19 thousands m^3 per year, or about 4.8 thousand tons per year in 2030. The quantity of infectious waste within the hospital waste is estimated to be 1.5 thousand tons per year in 2030.

Projection of hospital waste generation quantity

	2000	2010	2020	2030
Total population	330,748	490,036	687,432	796,024
Estimated bed number	3,416	5,061	7,100	8,221
Hospital waste in volume [m3/y]	7,823	11,590	16,259	18,826
Hospital waste in weight [t/y]	2,007	2,974	4,172	4,831
Infectious waste in weight [t/y]	598	887	1,244	1,440
ditto [t/day]	1.6	2.4	3.4	3.9

4.8.3 Medium Term Development Needs

(1) Basic Concepts and Proposed Targets

The basic approach for formulating Waste Management System in Astana will be a balance of proper disposal system, optimal recycling activity and affordable cost. The following describes concepts and targets in detail.

- Waste collection rate will be raised to 95% by 2010; 100% in and after 2020.
- Waste reduction activity will commence from 2010 and waste reduction target rate is 20% in 2030.
- Appropriate sanitary landfill management system will be established to meet the environmental standards pertinent to solid waste disposal.
- Suitable location for a new landfill site will be studied and secured in the northern part of Eco-forest along the Astana-Pavlodar Highway in consideration of the geological, environmental and economic view points.
- An economical and sanitary system of MSW collection and transportation will be established in an in-depth study on the necessity of a transfer station.
- Appropriate waste treatment systems will be considered after 2010. Analysis needs to be conducted on the necessity of intermediate treatment methods such as incineration, composting, or introduction of RDF (Refuse Derived Fuel) system. Although costly, RDF is a measure to reduce the volume of waste and recover the reusable materials or energy from MSW.
- Waste disposal fee will be collected to cover whole waste disposal cost from all waste generators according to the discharged waste quantity.
- Material recycling activity on a market basis will be promoted to reduce the waste generation quantity and accelerate utilize the reusable materials.
- Industrial waste generator will have to bear responsibility for their waste disposal.
- Hazardous waste management policy shall be established as soon as possible.
- World trend of the latest waste management principles, such as PPP (Polluter Pay Principle), EPR (Extended Producer Responsibility) or Zero Emission policy, will be considered in the waste disposal system.

(2) MSW Disposal

Reducing the waste generation quantity at the source is now the main stream of waste management in the world. As mentioned earlier the waste reduction target rate is set at 20% in 2030 starting from 2010. If this target is readily

met, the annual waste generation quantity of 1,512 thousand m^3 in 2030 without any waste reduction policy will be reduced to 1,200 thousand m^3 in the same year indicated below and Figure 4.8.3.

Future Estimation of MSW Collection Volume (m^3/year)

	2000	2010	2020	2030
Unit Generatin Rate (Volume Base; m3	1.40	1.50	1.70	1.90
Collection Rate	80%	95%	100%	100%
Waste Reduction Target Rate	0%	1.0%	10.5%	20%

Collection Volume of Each Region	2000	2010	2020	2030
1 Central Planning Region	196,560	269,301	323,253	331,968
2 Northern Planning Region	18,267	12,751	13,749	13,732
3 Southeastan Planning Region	103,304	307,343	429,790	429,253
4 Southern Planning Region	17,933	58,940	148,227	283,918
5 Northwest Planning Region	34,373	43,317	131,187	151,086
Grand Total	**370,437**	**691,652**	**1,046,206**	**1,209,957**

The capacity of waste disposal facilities and machinery shall be planned for the reduced quantity hereafter.

Required area for sanitary landfill of MSW is estimated to be 12.6 ha with the depth of 20 m for the waste generated between 2000 and 2010. For direct MSW collection, about 80 to 90 waste collection vehicles will have to be newly purchased.

Recently a Spanish company has conducted a feasibility study on "Modernization of domestic waste disposal and improvement of ecological situation in Astana City". This study consists of the proposal on the improvement of the existing landfill site, construction of a new landfill site, preparation of the machinery for city cleaning, collection and landfill operation, and establishment of a Dendrological center, including preliminary surveys and design works. According to this Spanish study, new landfill area will have 15 ha of land area, with the depth of 30 m. The new site will store 4.32 million m^3 of waste including construction waste, estimated to be 12% of MSW, and its operation period is for 10 years from 2002 to 2012. This Study also proposed to introduce100 waste collection vehicles. This Spanish proposal appears to satisfy the medium-term development needs.

(3) ISW Disposal

If the volume of non-hazardous industrial solid waste is stable at about 12% of MSW until 2010, required net area of landfill for disposing of ISW is estimated to be 3.5 ha. This volume is also covered by the capacity of new landfill proposed by the Spanish company.

(4) HSW Disposal

As the quantity HSW is small compared with MSW, non-hazardous HSW can be disposed of at the landfill mixed together with MSW. Hazardous HSW, however, must be controlled strictly to prevent any infectious waste problem. In principle, the responsibility of such hazardous HSW disposal lies with each medical institution. A centralized treatment system may be considered if individual treatment turns out to be too costly, in which case the expected capacity of the treatment equipment is estimated to be about 3 tons per day.

4.8.4 Long Term and Ultimate Term Development Needs

As the following table shows, the required capacity for sanitary landfill is estimated to be approximately 11.1 million m^3 including non-hazardous ISW from 2000 to 2030.

Landfill Plan

MSW Accumulation volume		Cover Soil	ISW	Total	Landfill Plan (Capacity; m3)			Landfill	Required
YEAR	(m^3) *1	20% of MSW	12% of MSW *2	Accumulation Volume (m3)	Landfill-1 (Spanish Plan)	Landfill-2 (phase 1)	Landfill-2 (phase 2)	Depth/Height (m)	landfill area (ha)
2000 - 2010	1,473,049	294,610	707,063	2,474,721	4,320,000			30	15
2011 - 2020	2,243,941	448,788	1,077,091	3,769,820		1,924,542		15	18.3
2021 - 2030	2,872,038	574,408	1,378,578	4,825,023			4,825,023	15	46.0
2000 - 2030	6,589,027	1,317,805	3,162,733	11,069,565					79.3

*1: Compacted and stabilised as 4 times smaller than generation source
*2: No Compaction and No Necessary of Cover Soil for Demolition Waste

This estimation does not presume reduction of waste volume through intermediate treatment. As the Spanish plan (Landfill-1) covers about 4.3 million m^3 of this, the additional capacity required for landfill-2 after 2012 will be about 6.8 million m^3. Landfill-2 will be divided into two phases. Phase 1 covers until 2020 and Phase 2 covers after 2021. Unlike landfill-1 where the waste is thrown into a former quarry pit, waste will be disposed of at landfill-2 basically on the ground level. Accordingly, the height of landfill-2 should be controlled so as not to exceed 15 m

above the ground from a landscaping viewpoint. Based on this condition, the required area at landfill-2 is estimated to be 64.3 ha in the long run.

Provided that Astana City faces difficulty in securing enough area for the landfill and/or the income level reaches a high enough level to cover additional waste disposal fees, some intermediate treatment methods could be introduced as complimentary means of waste disposal.

For direct MSW collection, about 280 waste collection vehicles with the loading capacity of 16 m^3 will be newly purchased from 2011 to 2030. Collection service area can be divided into two areas on a large scale, one is North-Astana Waste Collection Area and the other is South-Astana Waste Collection Area. The reason for this division is to adjust the waste collection volumes evenly in 2030, and to avoid large amount of waste transportation particularly from Residential District 11 and 12 thorough New City Center. The proposed waste flow is shown in Figure 4.8.4.

For Hazardous HSW treatment, a capacity of approximately 5 tons for treatment equipment will be required by 2030.

4.8.5 Formulation of Master Plan for Waste Management

Refer to Figure 4.8.5 for the Master Plan on Waste Management.

(1) Master Plan until 2010

The existing landfill site will be closed as soon as a new landfill is commissioned. After closure, surface of the land will be covered by final reclamation soil, stabilized for a while, and utilized in future as green zone in accordance with the stipulation in SNiP.

A new landfill-1 will be constructed with the capacity of at least 2.5 million m^3 and it will have an electric weighbridge, liner facilities, section embankment, leachate control facilities, gas control facilities, environmental monitoring facilities, surrounding fence, vehicle washing equipment, cover soil storage area, gate and an on-site administrative office. Only non-hazardous waste indicated in SNiP can be accepted at the landfill. MSW and ISW will be dumped separately in different sections.

Collection vehicle parking and maintenance garages will be built in a suitable location in the city.

To maintain the sanitation and cleanliness of the city, current waste discharge procedures should be improved. Waste storage container with a lid will be provided and always kept closed except for discharging. The discharging hours should be determined in advance to avoid littering by stray dogs and other small animals.

A small-scale batch type incinerator with the capacity of 3 tons a day equal to 500 kg per hour, will be set up in Central Industrial District as a means of centralized hazardous HSW treatment.

(2) Master Plan until 2020

Sanitary landfill will accept a maximum of 3.8 million m^3 of solid waste in this period, while the landfill-1 proposed by Spanish Company accepts approximately half the quantity as the landfill plan in the previous sub-section shows. It means that about 18.3 ha of another landfill-2 with a height of 15 m will be constructed to cover balance after 2012 when landfill-1 becomes full.

This period will be a trial period for introducing a pilot intermediate treatment facility to assess the possibility for further expansion in view of operation and affordable costs. Proposed intermediate treatment method will be RDF system or incineration with heat recovery with the maximum capacity of 50 tons per day, or equal to about 7% of total MSW in 2020. The facility will be built in the Central Industrial District.

The hazardous HSW incinerator will be continue to be in operation by extending operation time, while a new one with the capacity of 5 tons per day will be constructed when the initial one becomes obsolete.

(3) Master Plan until 2030

The area of sanitary landfill site will be expanded in order to accommodate a further 4.8 million m^3 of solid waste with 46 ha of land and a height of 15 m. From 2000 to 2030, 79.3 ha of total land area would be required for the sanitary landfill, 15ha for the landfill-1 proposed by Spanish Company and 64.3 ha for the landfill-2 proposed in this Master Plan.

Expansion of the intermediate treatment capacity will be considered based on the result of the above-mentioned pilot scale trial.

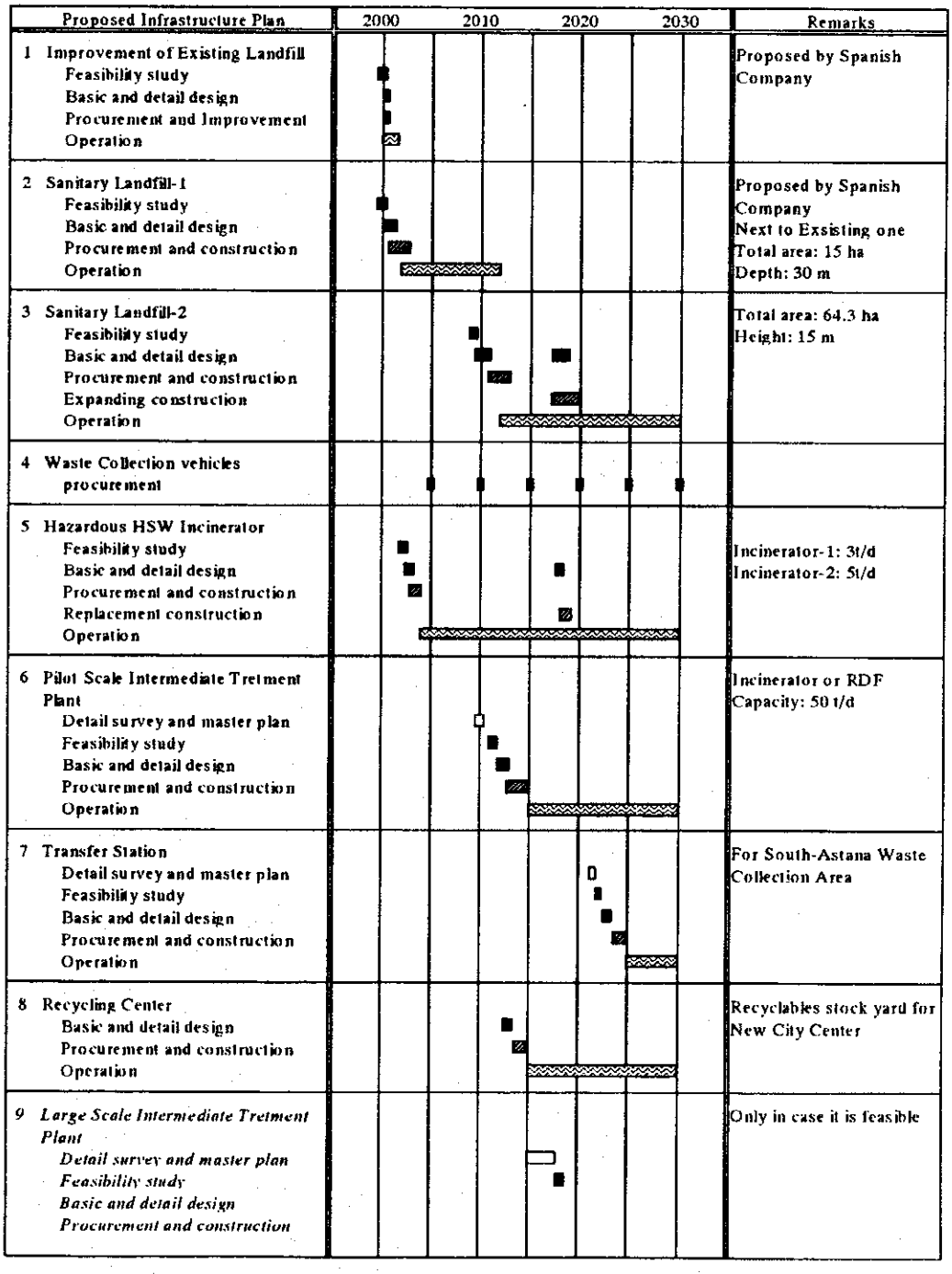
Due to the increase of waste generation, a transfer station for South-Astana Waste Collection Area may become feasible and be built in the semi-industry area of South Planning Region.

4.8.6 Infrastructure Plan for New City Center

There is no solid waste treatment or disposal facility plan proposed for the New City Center. Considering the characteristic of the waste generated from the New City Center with high composition ratio of waste paper or electrical devices such as computers, a recycling center that temporarily stores such marketable and recyclable materials separately, will be provided within the Business Area.

4.8.7 Implementation Schedule

Implementation Schedule for Solid Waste Disposal Infrastructure



TABLE

Table 4.5.1 Implementation schedule relating to Electric Power and Heat Energy Generation and Supply

Item	2001 to 2010	2011 to 2020	2021 to 2030
Electric Power & Heat Energy Generating Plants			
115 MW Coal Firing Conventional Thermal P.Plant	—— TETs-2		
150 MW N/G Firing Combined Cycle P. Plant	——	TETs-1	
200 MW N/G Firing Combined Cycle P.Plant		——	TETs-2
Heat Energy Generation and Supply Facilities			
(1)Extension of Heat Distribution Pipelines from the existing district heating system (supplied from TETs-1 and TETs-2)			
To New City Center and Dist. No.12	—		
To District No. 17	—		
To Dist. Nos. 4B, 18 and a part of Central Industrial District		—	
To Northern Industrial District			—
(2) Heat Energy Generating Facilities in the Area on the Left Bank of Ishim River		Exten.	Exten.
HC-1, HC-2, HC-3	—	—	—
HC-4, HC-5, HC-6		—	Exten. —
HC-11			—
(3) New Installation of District Heating Pipelines in the Area on the Left Bank of Ishim River			
New City Center	—		
District No.12	—		
District Nos. 12, 14, 15, 16 and 19		—	
District Nos. 11, 14 and 16			—
110 kV Transmission Lines and 110 kV/10 kV Substation (S. S)	—		
Airport switching S.S to Dist. No.13 S.S	—		
TETs-2 to Airport switching S.S	—		
Branch of TETs-2 to Airport to Eastern Swich. S.S	—		
Eastern to District No.17 S.S	—		
500 kV Central S. S to High-Tech Park in District I	—		
Airport switching S.S to District No.14		—	
500 kV Central S.S to Western Switch. S.S		—	
Western Switch. S.S to Airport Switch. S.S		—	
Branch of TETs-2 to Airport to High-Tech Park Dis.III		—	
500 kV Central S.S to TETs-2			—
Branch of 500 kV Central S.S to TETs-2 to High-Tech Park in Dist. II			—

FIGURE

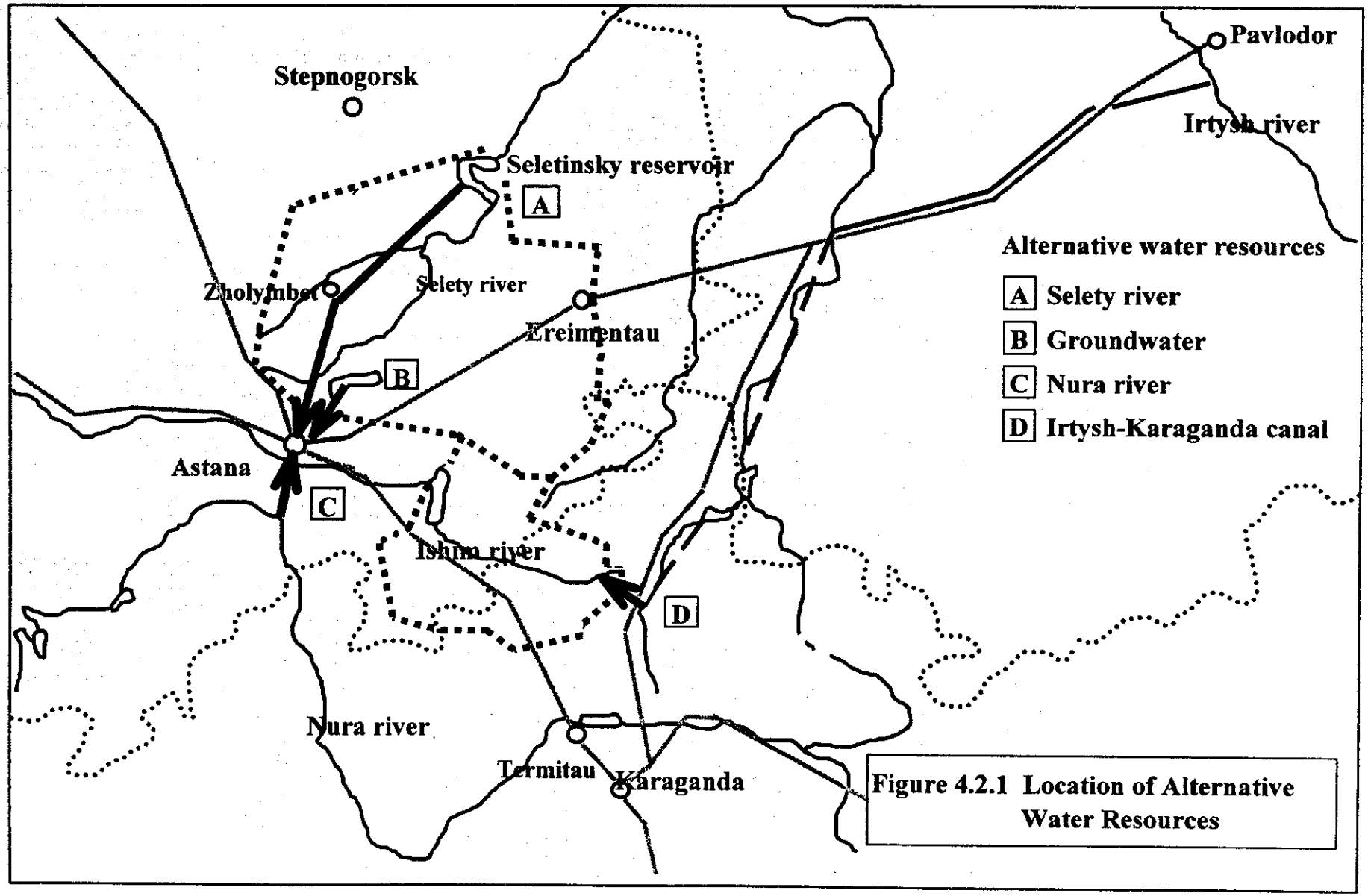
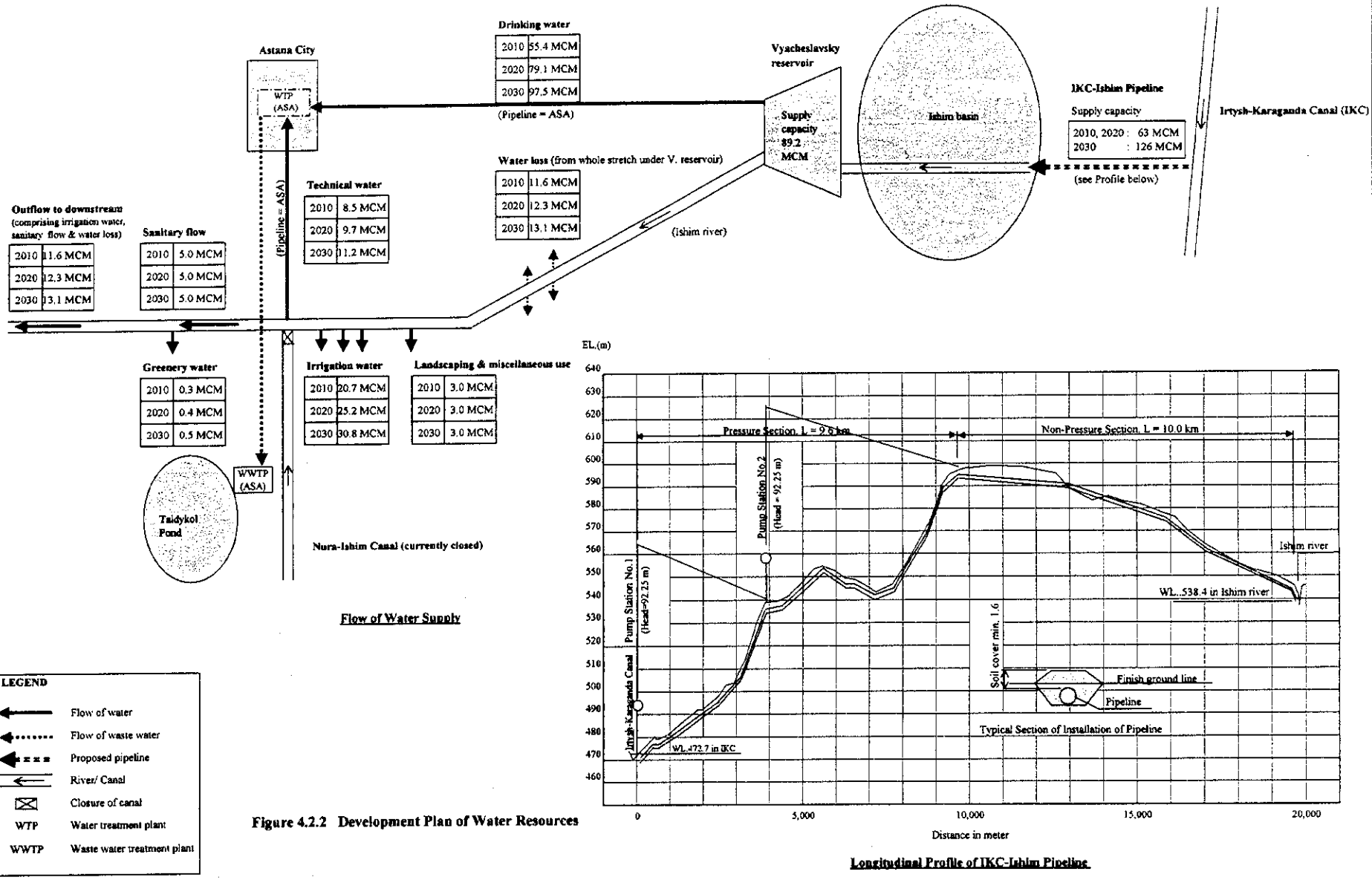


Figure 4.2.1 Location of Alternative Water Resources



Flow of Water Supply

Longitudinal Profile of IKC-Ishim Pipeline

Figure 4.2.2 Development Plan of Water Resources

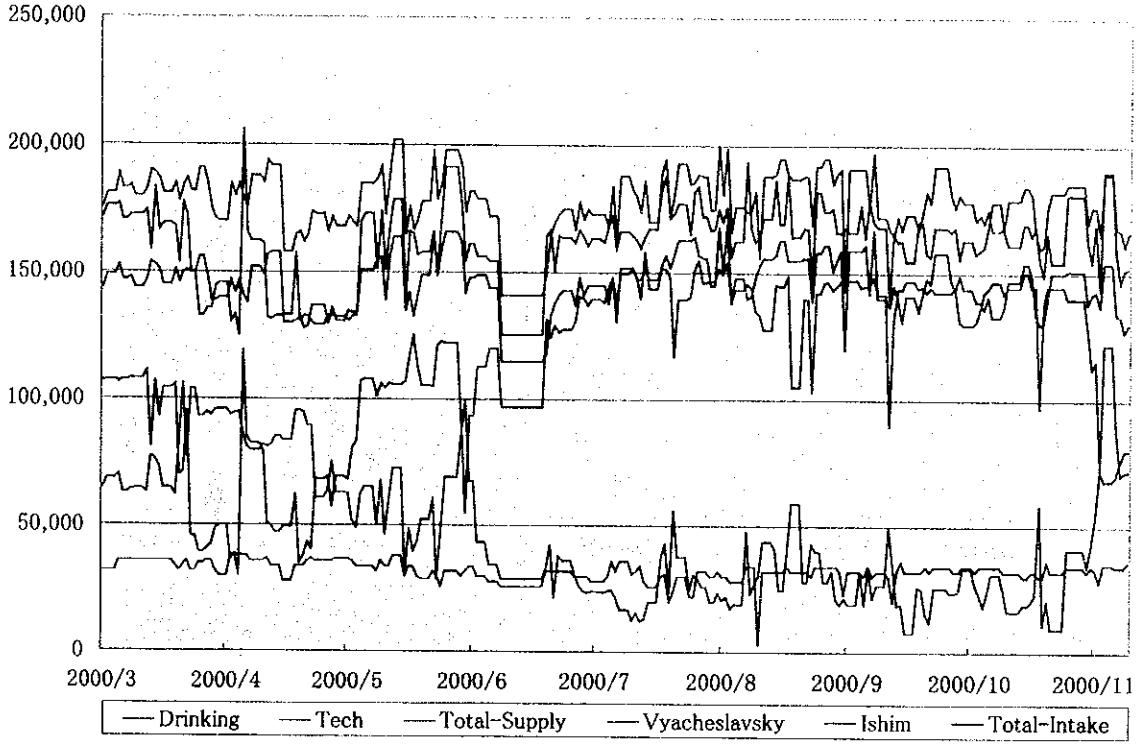


Figure 4.3.1 Operation of Water Supply Facilities (March 15 to November 25, 2000)

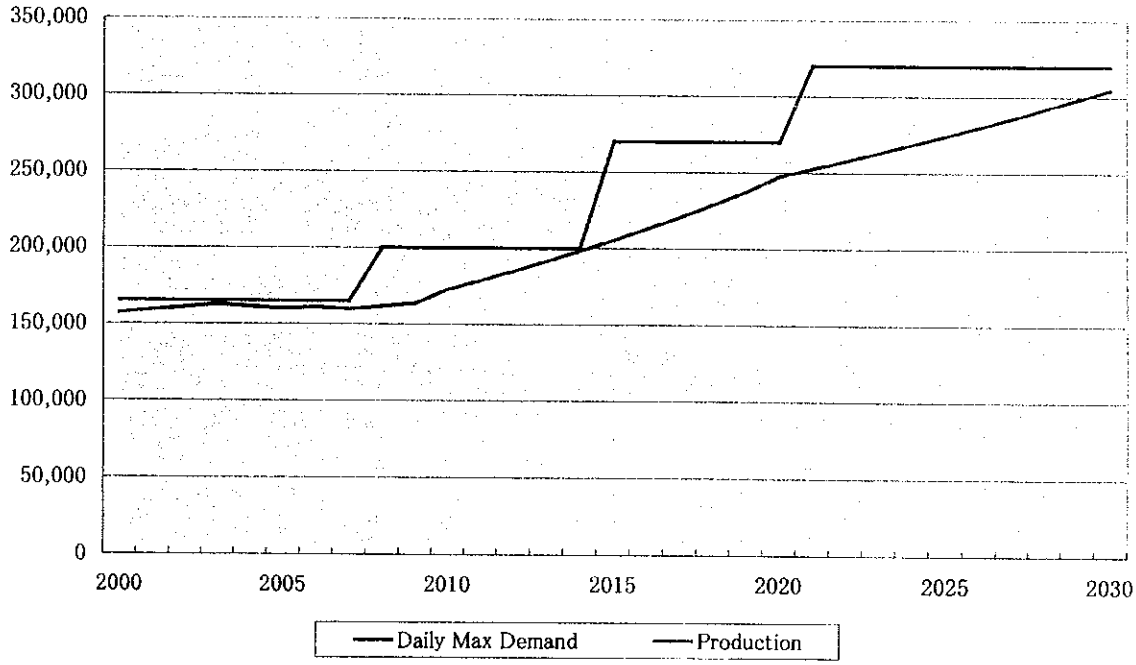


Figure 4.3.2 Daily Maximum Water Demand and Production (2000 to 2030)

ASTANA

THE STUDY ON THE MASTER PLAN
FOR
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

- WATER SUPPLY SERVICE AREA (EXISTING)
- WATER SUPPLY SERVICE AREA (2010)
- WATER SUPPLY SERVICE AREA (2020)
- WATER SUPPLY SERVICE AREA (2030)
- MAJOR WATER SUPPLY PIPELINE (EXISTING)
- MAJOR WATRE SUPPLY PIPELINE (2010)
- MAJOR WATRE SUPPLY PIPELINE (2020)
- MAJOR WATRE SUPPLY PIPELINE (2030)
- (W) WATER TREATMENT PLANT (EXISTING)
- (W) WATER TREATMENT PLANT 100,000m3/d (2010)
- (W) WATER TREATMENT PLANT 120,000m3/d (2020)
- (W) WATER SUPPLY TREATMENT PLANT 100,000m3/d (2030)
- (I) EXISTING INTAKE PUMPING STATION
- (P) EXISTING DISTRIBUTION PUMPING STATION

WATER SUPPLY DEVELOPMENT PLAN
2010,2020,2030

JICA MASTER PLAN TEAM
HEADED BY KOSHO KUNIOKAWA

0 1km 2km 5km

FIGURE 4.3.3

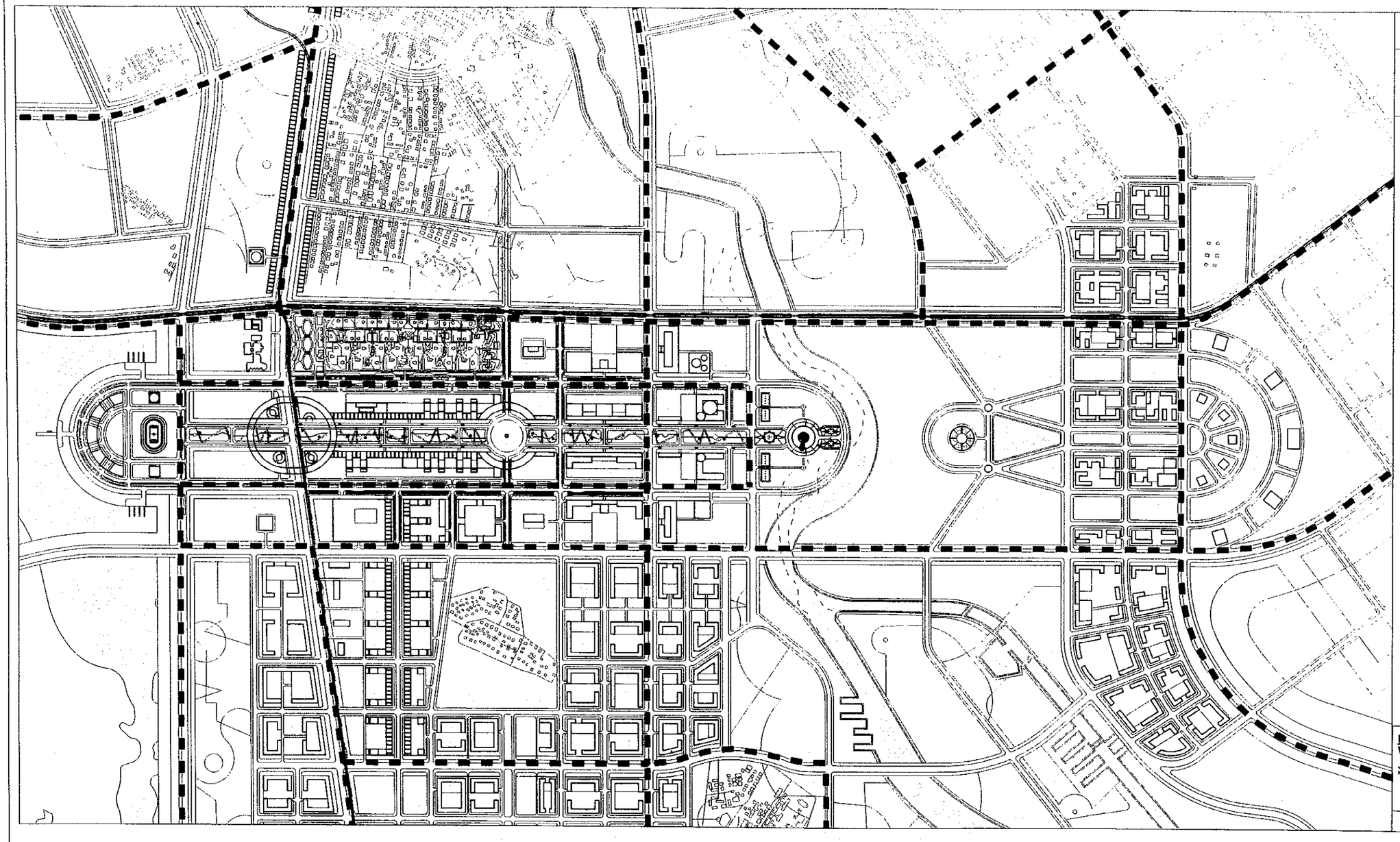

ASTANA
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN
LEGEND
MAJOR WATER
SUPPLY PIPELINE
NEW CITY CENTER
WATER SUPPLY
JICA MASTER PLAN TEAM
HEADED BY SOHO KUROKAWA
N
0
10km
20km
30km

FIGURE 4.3.4

ASTANA

THE STUDY ON THE MASTER PLAN
FOR
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

- SEWER PIPE (EXISTING)
- SEWER PIPE (2010)
- SEWER PIPE (2020)
- SEWER PIPE (2030)
- SEWAGE TREATMENT PLANT
- MAJOR PUMPING SYSTEM (EXISTIG)
- MAJOR PUMPING SYSTEM (2010)
- MAJOR PUMPING SYSTEM (2020)

KHC-6
KHC-4
KHC-7
KHC-50
Sewage Treatment Plant
KHC-52
KHC-53

PLAN FOR SEWER PIPE SYSTEM
2010,2020,2030

JICA MASTER PLAN TEAM
HEADED BY ASHIO KUNIOKA

0 1km 2km 5km

FIGURE 4.4.1

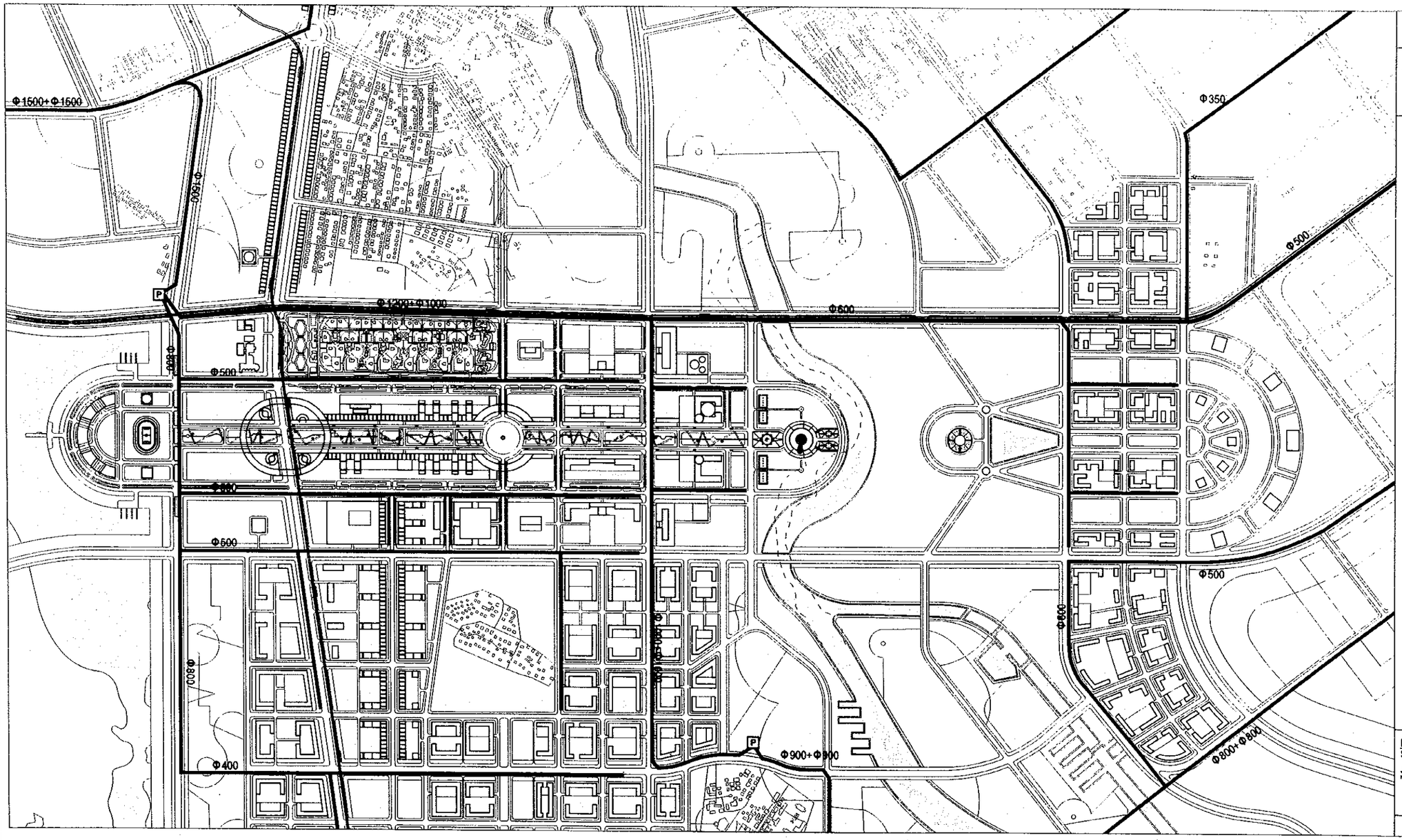
ASTANA

THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

P PUMPING STATION

SEWER



NEW CITY CENTER
SEWERAGE

JICA MASTER PLAN TEAM
HEADED BY MARIO KUMOKAWA

0 10km 20km 30km

FIGURE 4.4.2

ASTANA

THE STUDY ON THE MASTER PLAN
FOR
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

- EXISTING SWITCHING SUBSTATION
- SUBSTATION (EXISTING)
- SUBSTATION (2010)
- SUBSTATION (2020)
- SUBSTATION (2030)
- 110kV T.LINE (EXISTING)
- 110kV T.LINE (2010)
- 110kV T.LINE (2020)
- 110kV T.LINE (2030)

PLAN OF 110kV TRANSMISSION LINES,
SWITCHYARDS AND SUBSTATIONS
2010,2020,2030

JICA MASTER PLAN TEAM
HEADED BY KENJI KUROKAWA

0 1km 2km 5km

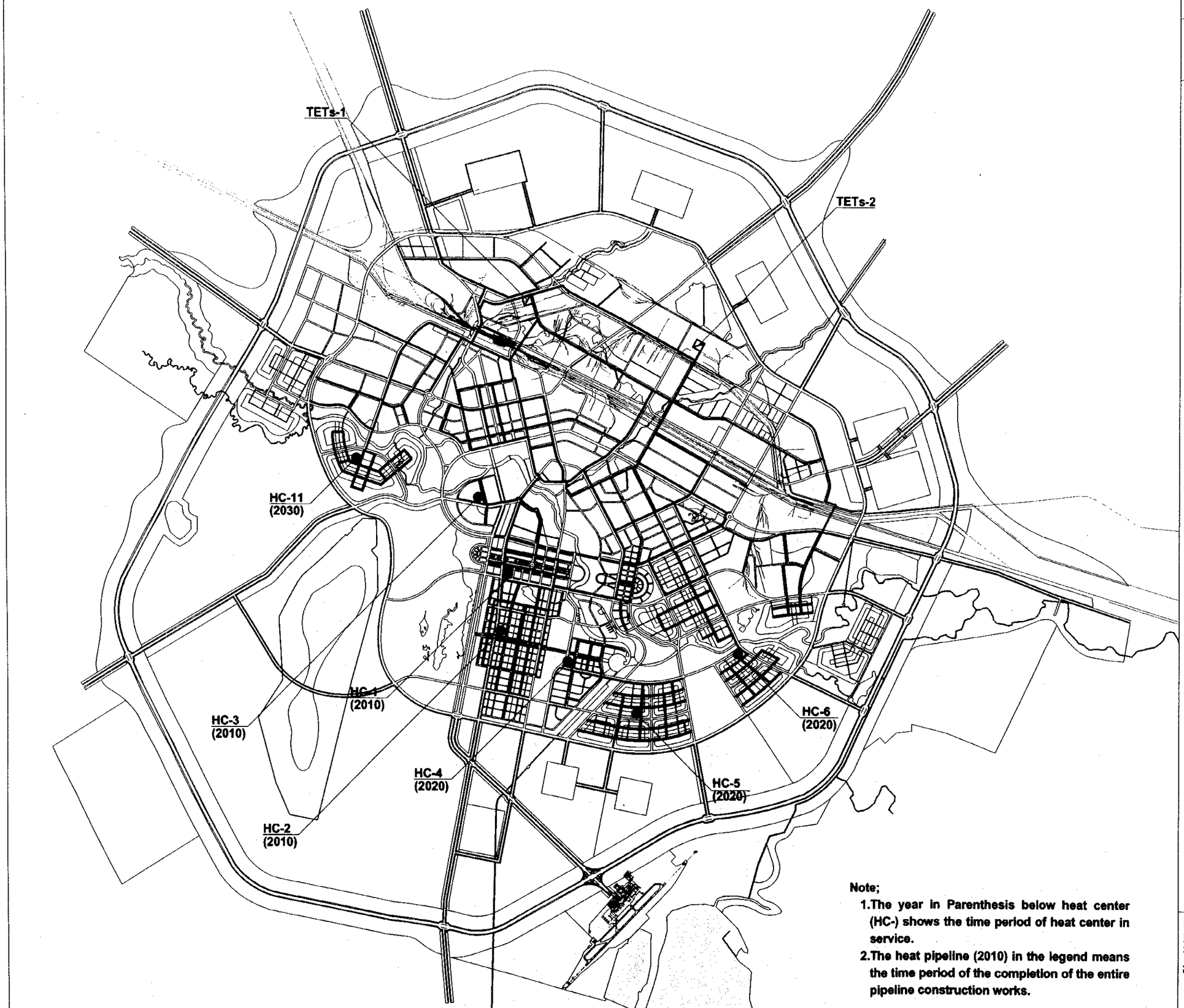
FIGURE 4.5.1

ASTANA

THE STUDY ON THE MASTER PLAN
FOR
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

- HEAT STATION (TETs-1,TETs-2)
- HEAT CENTER (HC-1,2,3,4,5,6,11)
- HEAT PIPE-LINE (EXISTING)
- HEAT PIPE-LINE (2010)
- HEAT PIPE-LINE (2020)
- HEAT PIPE-LINE (2030)



Note;

1. The year in Parenthesis below heat center (HC-) shows the time period of heat center in service.
2. The heat pipeline (2010) in the legend means the time period of the completion of the entire pipeline construction works.

LAYOUT OF MAJOR DISTRICT
HEAT PIPING AND HEAT CENTER
2010,2020,2030

JICA MASTER PLAN TEAM
HEADED BY KIYOKO KUROKAWA

0 1km 2km 5km

FIGURE 4.5.2

ASTANA

THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

- 110kV/10kV SUBSTATION
- 10kV/400V SUBSTATION
- 110kV CABLE
- 10kV CABLE (CV CABLE 250~400mm²)
- 400V CABLE

7 × 2 circuits

6 × 2 circuits

1 × 2 circuits

110kv/10kv Substation
Transformer Capacity 63MVA × 2

110kv Transmission line

Tie Line to Business City

Tie Line to District NO.17

NEW CITY CENTER
POWER CABLE NETWORK

JICA MASTER PLAN TEAM
HEADED BY KENJI KUNIKAZU

FIGURE 4.5.3

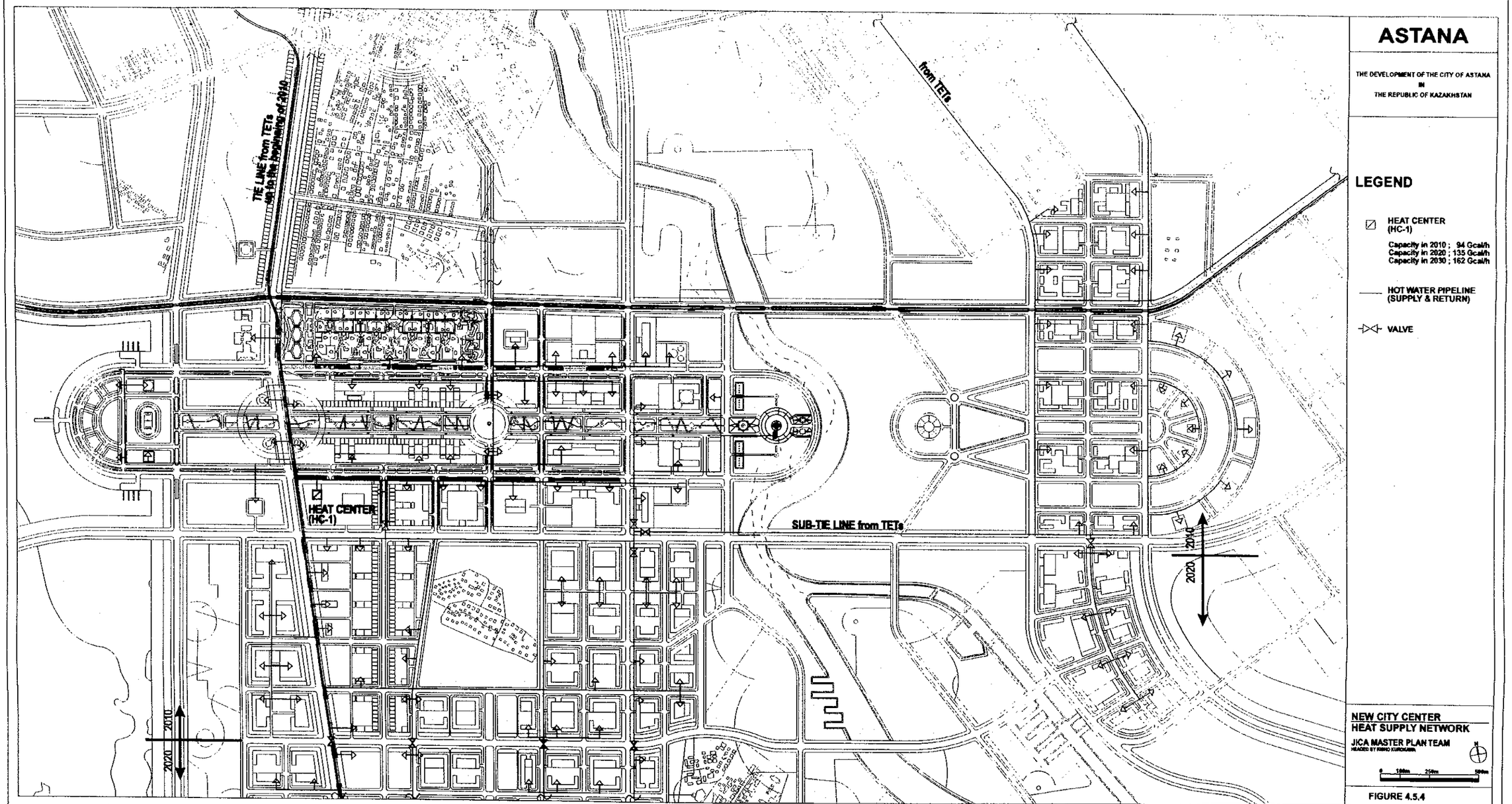

ASTANA
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN
LEGEND
HEAT CENTER
(HC-1)
Capacity in 2010 ; 94 Gcal/h
Capacity in 2020 ; 135 Gcal/h
Capacity in 2030 ; 162 Gcal/h
HOT WATER PIPELINE
(SUPPLY & RETURN)
VALVE
TIE LINE from TETs
up to the beginning of 2010
from TETs
HEAT CENTER
(HC-1)
SUB-TIE LINE from TETs
2010
2020
2010
2020
NEW CITY CENTER
HEAT SUPPLY NETWORK
JICA MASTER PLAN TEAM
HEADED BY RIHKO KUROKAWA
N
0
100m
250m
500m

FIGURE 4.5.4

ASTANA

THE STUDY ON THE MASTER PLAN
FOR
THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

- INTERNATIONAL GAS PIPELINE (BY OTHERS)
- HIGH PRESSURE NETWORK(1.2MPa) (2010)
- HIGH PRESSURE NETWORK(1.2MPa) (2020)
- HIGH PRESSURE NETWORK(1.2MPa) (2030)
- LOW PRESSURE NET WORK (BELOW 0.6MPa)
- STORAGE & PEAK SAVING FACILIYT
- HEAT CENTER (HC-1,2,3,4,5,6,11)
- GAS DISTRIBUTION STATION

From ISHIM

PRESSURE REREGULATING STATION

To KARAGANDA

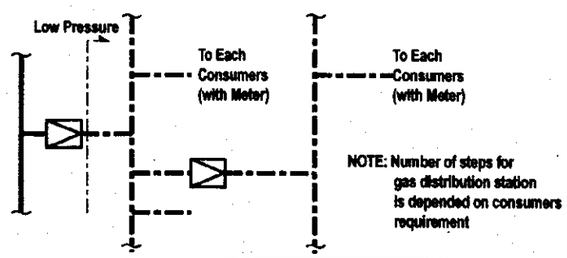
HC-2

HC-4

HC-5

HC-6

Low Pressure Network (Typical)



PLAN FOR CITY GAS NETWORK
2010,2020,2030

JICA MASTER PLAN TEAM
HEADED BY KOHKO KUROKAWA

FIGURE 4.6.1

ASTANA

THE DEVELOPMENT OF THE CITY OF ASTANA
IN
THE REPUBLIC OF KAZAKHSTAN

LEGEND

- HIGH PRESSURE NETWORK (1.2MPa)
- LOW PRESSURE NETWORK (BELOW0.6MPa)
- GAS DISTRIBUTION STATION
- HEAT CENTER

HC-1

NEW CITY CENTER
GAS SUPPLY NETWORK

JICA MASTER PLAN TEAM
HEADED BY KIMIO KUROKAWA

0 100m 200m 500m

FIGURE 4.6.2

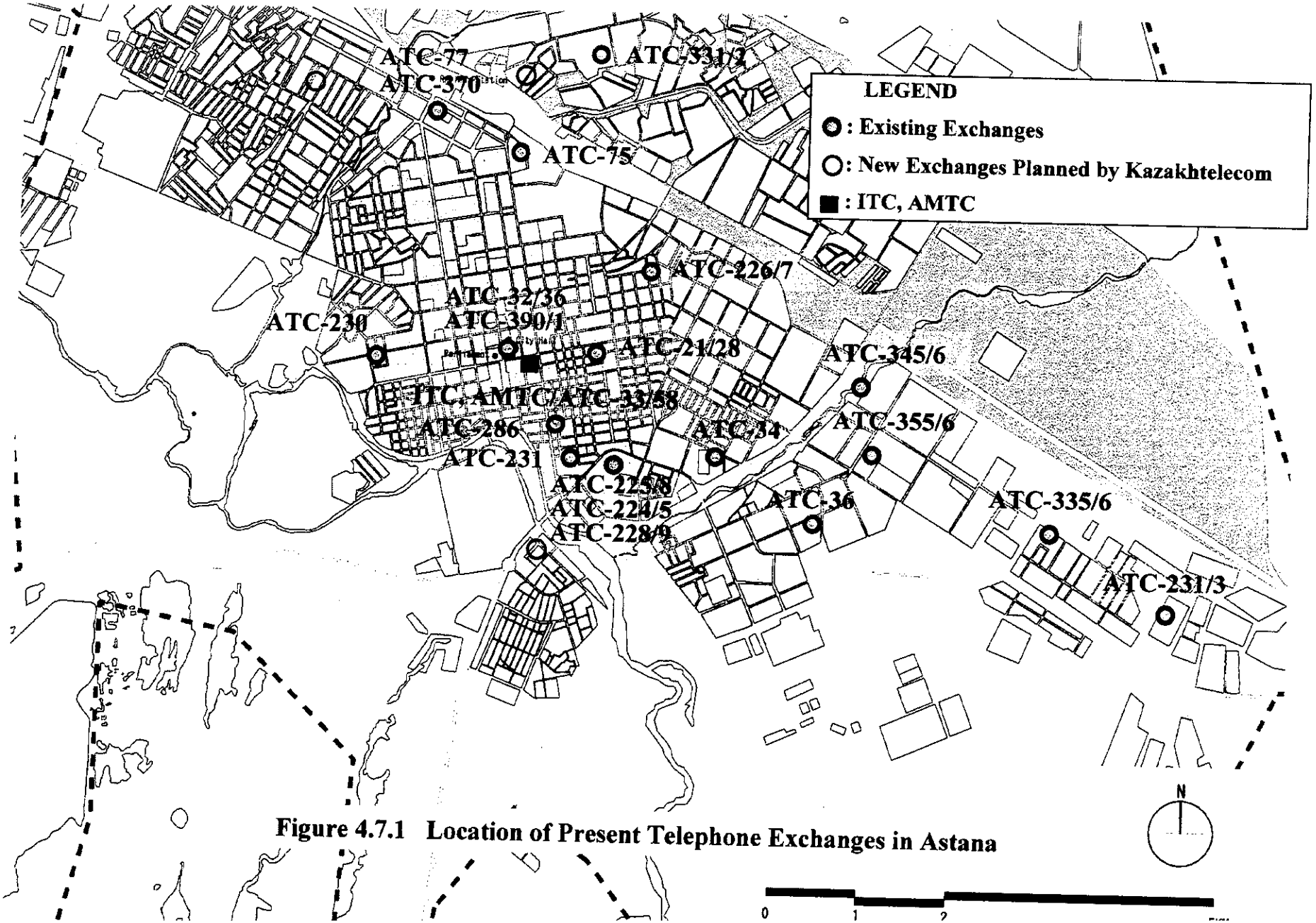


Figure 4.7.1 Location of Present Telephone Exchanges in Astana