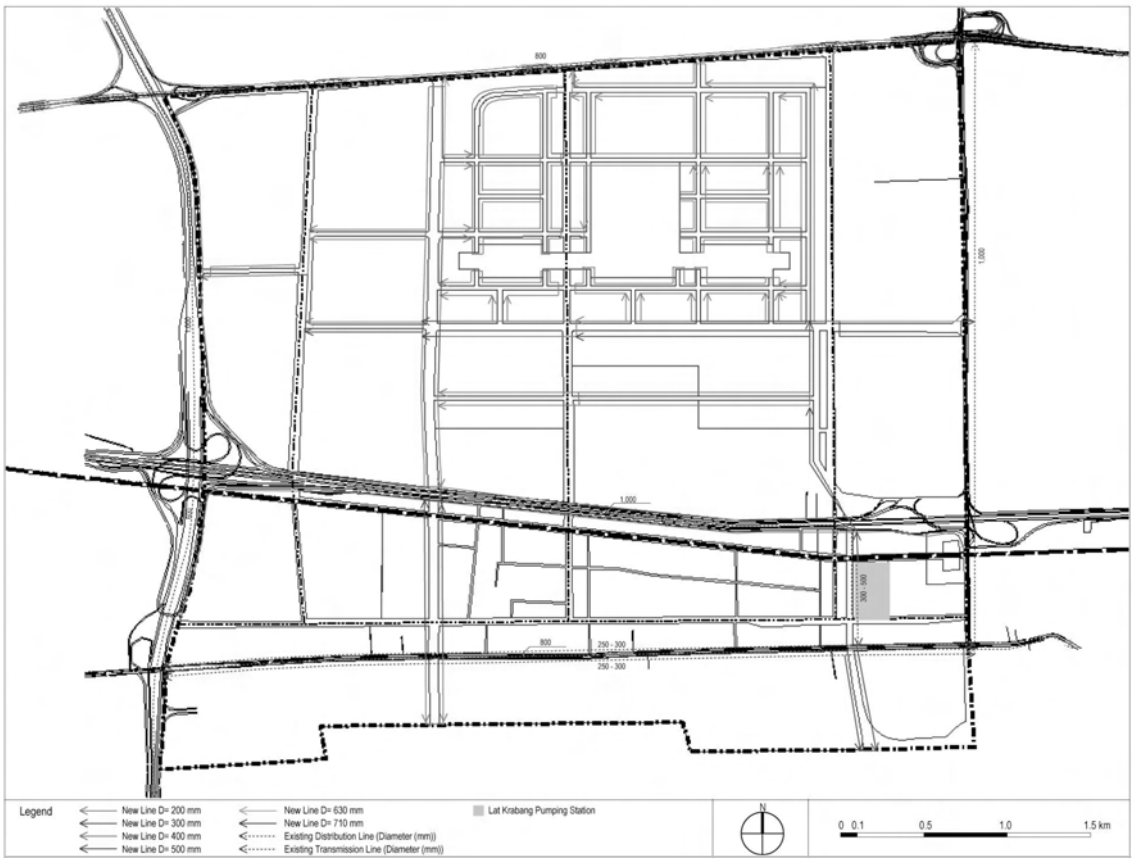

Figure 5.44: Plan of Water Supply Distribution System in 2035

5.4.2 Wastewater Management

(1) Existing Wastewater Management System

The study area is located outside of the central wastewater treatment system operated by the BMA. Every building is required to be equipped with a treatment system and discharge the treated water into the drainage system and/or *khlongs* in compliance with effluent quality regulations.

(2) Proposed Wastewater Management

In the Aerotropolis Development Plan, the development of wastewater treatment plants is planned in the area around the study area. In addition to these plants, three new treatment plants are being investigated by the BMA for the *khlong* Toey and Nong Bon areas and the Samut Prakan province. However, attempts to discharge wastewater from the study area to these plants are likely to encounter some obstacles, as follows;

1) None of the catchment areas for these treatment plants cover the study area.

2) These treatment plants are still in the feasibility study and/or proposal stage (except for the *khlong* Daeng plant). The implementation schedule has not yet been defined for these treatment plants.

3) A diversion channel of more than 15 km would be required to discharge the wastewater to the *khlong* Daeng plant.

Therefore, an independent wastewater management system will be planned for the study area.

In the Aerotropolis Development Plan, it is recommended that the wastewater management system is formed by a central treatment plant with a separate collection system in the newly developed areas and a combined collection system in the existing areas. On this basis, the wastewater system in the study area shall be formed by a central treatment plant with a separated system to the north of the expressway and a combined system to the south.

Since the wastewater management system in the BMA area is still in the progress to design and/or construct the new treatment plants in the existing developed areas in the central part, it may be impractical to develop the wastewater system to cover the whole study area. Therefore, the area serviced by the central treatment plant (or community plant, with the separated collection system) will focus on the new development area to the north of the expressway, while the wastewater in the remaining areas will be managed by on-site treatment systems that comply with the requirements of the DDS standard. If large-scale urban development is implemented in the area controlled by the regulations, the developer will be required to provide another new treatment plant(s).

The new central treatment system will be unable to fully treat the water in *khlong* Pravet (where the proposed cultural town will be located), because *khlong* Pravet has a catchment area much larger than the study area. Therefore, the DDS standard for wastewater treatment should be enforced for buildings, particularly for industrial and commercial activities which may cause larger and more contaminated wastewater discharges than residential activities.

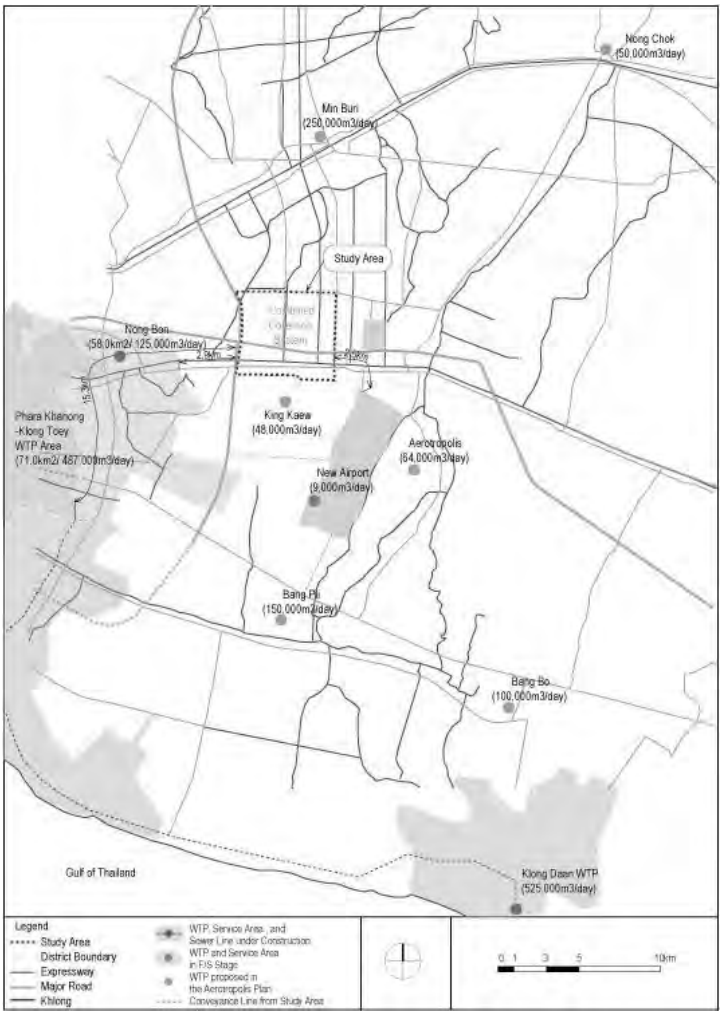

Figure 5.45: Existing Wastewater Management Plans around the Study Area

(3) Estimate of Daily Wastewater Discharge

The maximum daily wastewater discharge in the study area is estimated at 43,107 m^3/day in 2035, based on the formulae listed below.

1) Average daily wastewater discharge (Da: m^3/day) = Average daily water demand (W: m^3/day) x 0.8

2) Maximum daily wastewater discharge (Dm: m^3/s) = Da x 1.1

3) Water infiltration (I: m^3/day) = Da x 0.2

4) Capacity of wastewater treatment plant (C: m^3/day) = Dm + I

The new wastewater treatment plant is required to have a capacity of 11,769 m^3/day for the service area or the new development area.

Table 5.25: Maximum Daily Wastewater Discharge in the Study Area and Capacity of the New Treatment Plant

Land Use	Avg. Daily Water Demand	Avg. Daily Wastewater Discharge	Max. Daily Wastewater Discharge	Capacity of Wastewater Treatment Plant
	(W)	(Da= W x 0.8)	(Dm = Da x 1.1)	(C =Dm' + Da' x 0.2)
	m^3/day	m^3/day	m^3/day	m^3/day
Residential-Low rise	2,998.2	2,398.6	2,638.4	0.0
Residential-Middle-high rise	18,540.0	14,832.0	16,315.2	524.2
Culture Town	5,311.0	4,248.8	4,673.7	0.0
Trade & Distribution	6,875.0	5,500.0	6,050.0	0.0
Hybrid Town Center	4,324.5	3,459.6	3,805.6	1,361.4
RD&D & Enterprise	10,068.6	8,054.9	8,860.4	9,758.9
Public facilities	176.0	140.8	154.9	124.8
Value Creation	691.6	553.3	608.6	0.0
Total	48,984.9	39,187.9	43,106.7	11,769.3

Note: The service area of the new wastewater treatment plant is focused on the new development area.

(4) Outline Design of the Wastewater Collection System

The wastewater in the new development area will be collected by a separated collection pipe equipped with relayed pumping units passing across the *khlongs*. The collection pipe diameters and pump capacities should be designed to fulfill the conditions listed below.

1) Maximum hourly wastewater discharge (Dh: m^3/hr) = {Maximum daily wastewater discharge (Dm: m^3/day) x 1.5 (Maximum hourly factor) + Water infiltration (I: m^3/day) } / 24 (hours)

2) Discharged wastewater volume for pipe design (Ds: m^3/s) = Dh / 3,600 (seconds)

3) Minimum collection pipe diameter: 200 mm

As a result, the collection pipe diameters are in the range of 200 – 600 mm. The total length of the pipes amounts to 42.6 km.

Table 5.26: Length of Collection Pipes by Diameter in 2035

Diameter (mm)	Length (m)
200	38,676
300	816
400	2,988
500	51
600	40
Total	42,571

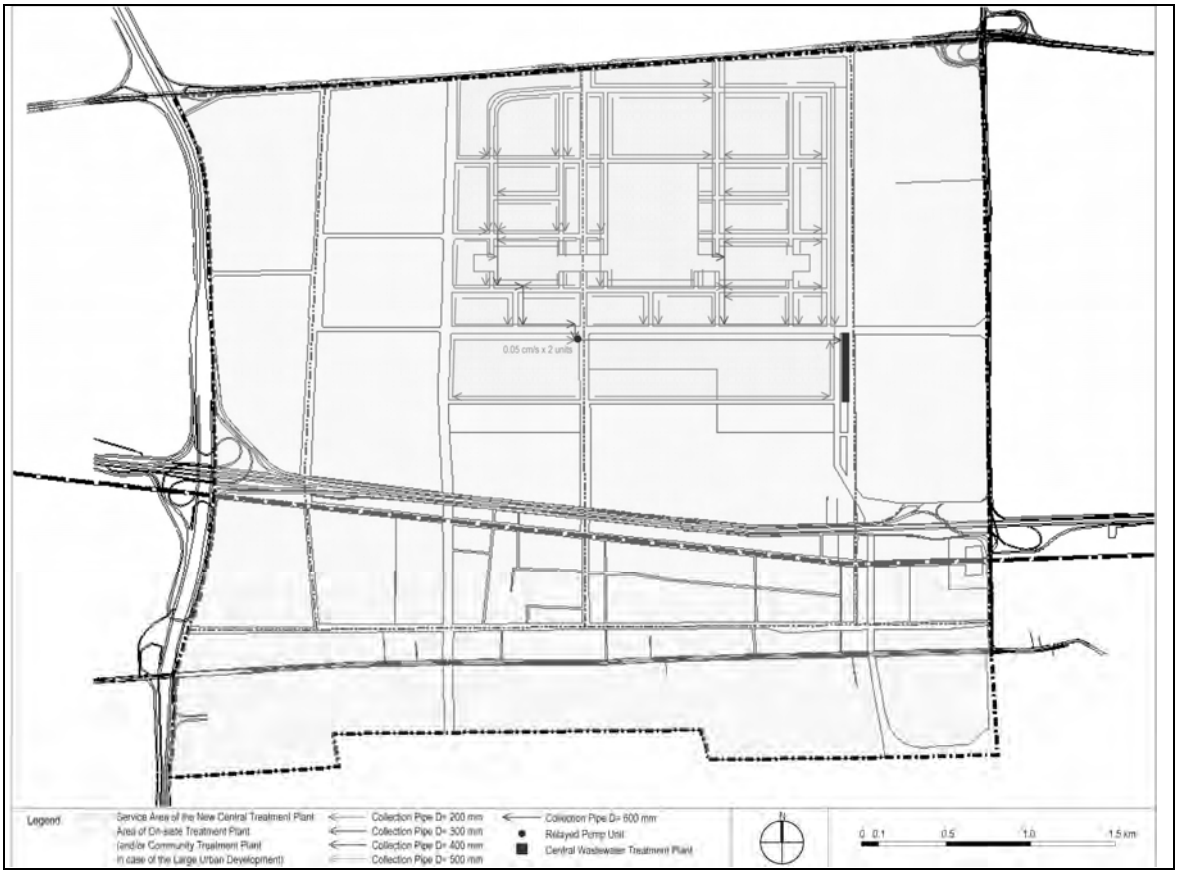

Figure 5.46: Plan of Wastewater Collection System in 2035

5.4.3 Power Supply

(1) Existing Power Supply System

Electricity is supplied by the Rom Klao substation located in the eastern part of the study area. The Rom Klao secondary substation receives electric power from the On-nut primary substation and then transforms the power, at a voltage of 24 kV, to supply electricity to the customers. To ensure a stable power supply, Rom Klao substation is interlinked with another three secondary substations; Bang Chan, Minburi, and King Kaew.

The Rom Klao substation has two transformers with a capacity of 60 MVA. As the maximum load in 2004 was recorded as 42.86 MVA and 21.11 MVA, the Rom Klao substation has sufficient remaining capacity to allow for the sub-center development.

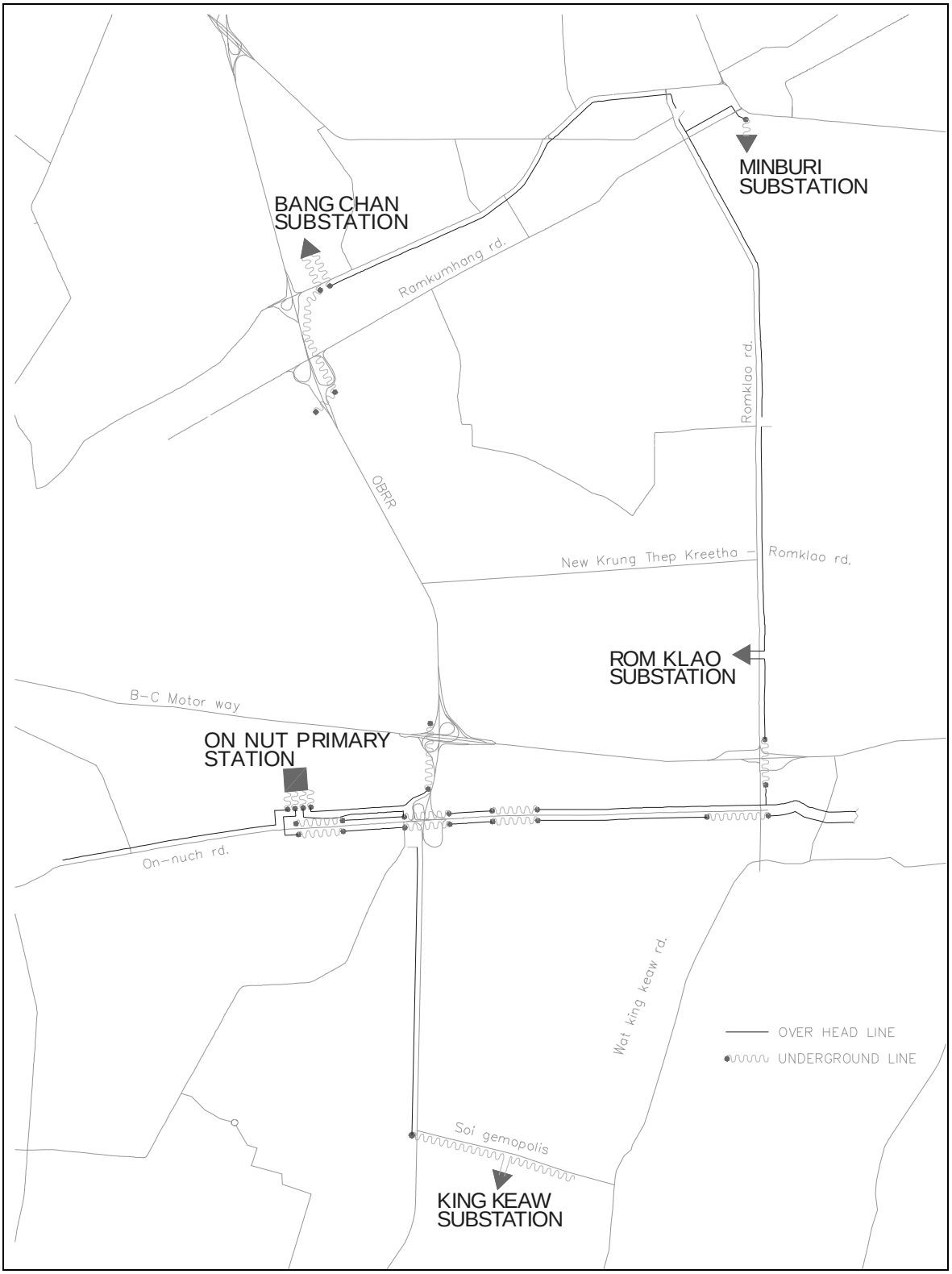

Figure 5.47: Existing Main Distribution System for Power Supply

(2) Outline Design of the Power Supply System

Electricity will be supplied from the existing Rom Klao secondary substation via 24 kV main distribution lines in the study area. The primary distribution network in the study area will be

formed by the 24 kV lines. The distributed electricity will be stepped down by the customer for large customers with power demands greater than 300 kVA. In the other areas, where general households are located, the distributed power will be stepped down by the transformer units of the MEA, and then supplied to customers via service lines.

(3) Unit Power Demand

Based on the power supply records issued by the MEA, the unit power demand per capita is set at 0.8 kW/person for the year 2015 onwards.

Table 5.27: Unit Power Demand per Population

Item	Unit	1999	2000	2001	2002	2005	2015
Service Population in the MEA Distribution System (Registered Population Base)	person	7,479	7,536	7,612	7,715	8,082	10,659
Served Household Ratio	%	80.7	81.7	83.6	84.3	88.0	100.0
Estimated Served Population (Registered Population x1.506)	person	11,263	11,349	11,463	11,619	12,171	16,053
Maximum Power Demand	MW	5,357	5,800	6,229	6,418	7,758	14,144
Growth Ratio	%	-	8.3	7.4	3.0	6.5	6.2
Unit Power Demand	kW/person	0.48	0.51	0.54	0.55	0.64	0.88
Growth Ratio	%	-	7.4	6.3	1.7	4.9	3.3

Source:
1) Power demand and population until 2002: the MEA Annual Report
2) Population in 2005 and 2015: the Suvanahvumi Development Plan by NESDB
3) Maximum power demand in 2005 and 2015: Power demand forecast by MEA

Note:
1) Served household ratio in 2005 and 2015 is estimated from the trend in 1999 and 2001.
2) Service area of the MEA distribution system covers Bangkok, Samut Prakan, and Nonthaburi.

(4) Estimate of Power Demand

The power demand in the study area in 2035 is estimated to be 134 MW based on the unit power demand per capita. For power distribution planning, the estimated power demand is divided into the demand by the plots of lands based on the number of customers which is counted by the number of households and work places.

Table 5.28: Average Number of Employee per Work Place

Item	Unit	1996	1997	1998	1999	2000
Work Place	place	144,034	152,317	153,317	165,366	158,864
Number of Employees	person	3,278,242	3,304,173	3,165,070	3,379,297	3,135,349
Average Number of Employees per Work Place	person/place	23	22	21	20	20

Source: the BMA Comprehensive Plan

Table 5.29: Estimate of Power Demand in the Study Area in 2035

Item	**Population**	**Power Demand**	**No. of Household**	**No. of Workplace**	**Power Demand Distribution**		
					Residential	**Work Place**	**Total**
	person	MW	household	place	MW	MW	MW
Residential (L)	13,150	11	3,372	66	6	1	7

Residential (M&H)	82,400	66	36	262	36	3	39
Culture Town	22,600	18	10	113	10	1	11
Trade & Distribution	15,000	12	7	812	7	10	16
Hybrid Town Center	9,600	8	4	740	4	9	13
RD&D & Enterprise	25,130	20	11	2,841	11	34	45
Public facilities	-	-	-	113	-	1	1
Value Creation	-	-	-	76	-	1	1
Total	167,880	134	74	5,023	74	61	134

Note:
1) Power consumption is recorded at 4,174 kWh/customer for the residential and at 29,453 kWh/customer for the small and medium general services in 2003 according to the MEA Annual Report. The ratio of power consumption per customer for residential to that for general services is estimated at 1.0 to 7.1.
2) The number of employees is set at 20 persons/work place to estimate the number of work places in the study area.
3) Household size is set at 3.9 persons/household according to the social survey.
4) Power demand is distributed by the power consumption ratio of the residential and the general services.

(5) Capacity of the Existing Secondary Substation

The capacity of the existing secondary substation will be insufficient for the ultimate power demand of the sub-center development in 2035. The MEA plans to develop a new secondary substation, of 60 MVA capacity, to handle the incremental power demand of the new airport. It is recommended that the capacity of the new secondary substation is increase to 60 MVA x 2 in order to satisfy the incremental power demand of both the new airport and the sub-center development. It is proposed that the new substation is located in the greenery buffer area along the NS2 road.

Table 5.30: Capacity of Rom Klao Secondary Substation

Item	Unit	Current	2015	2025	2035
Power Demand	MW	63.97	93.00	118.60	181.70
Power Demand in Study Area	MW	16.57	45.60	71.20	134.30
Capacity of Rom Klao Substation	MVA	120.00	120.00	120.00	120.00

Note:
1) Existing capacity of the secondary Rom Klao substation is 120 MVA (2 x 60 MVA).
2) Current load on the secondary substation is recorded by the MEA.

(6) Planned Power Distribution System

The primary 24 kV distribution lines are installed along the primary and secondary roads to form the looping system. In the early stages, the power will be supplied from the existing Rom Klao substation. The new substation, located in the greenery area along the NS2 Road and near Rom Klao Road, will be developed to satisfy the increased power demand in the study area in the latter stages.

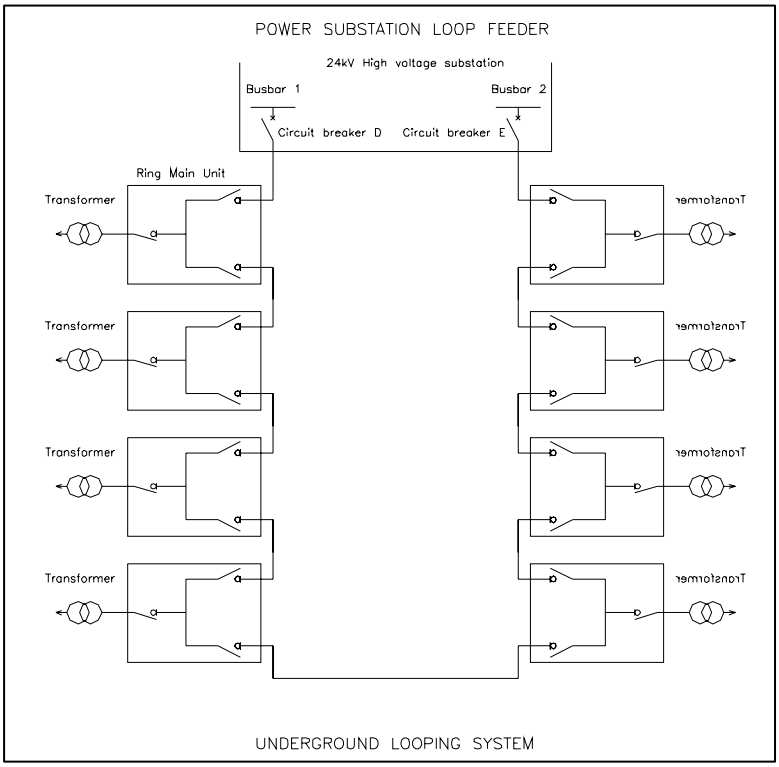

Figure 5.48: 24kV Distribution Network (Looping Type)

Customers with a power demand of more than 300 kVA will receive their power supply at the 24 kV level. In this situation, the customer will be required to provide space for the MEA's Ring Main Unit (RMU) and metering panel, and will also be responsible for providing the switch gear, transformer, and distribution panel. In other cases, where the demand is lower than 300 kVA, the customer shall receive their power supply at the 380 V or 220 V level.

Based on these conditions, the Residential Low Rise, Residential Medium Rise and Culture Town service areas will receive electricity via transformer units installed by the MEA. In these areas, the power demand per customer may be enough to be supplied by the service lines from the transformer units. An estimated 43 transformer units will be required. In other areas, including the Trade & Distribution, Public Facilities, RD&D, and Value Creation, the power demand per customer may be large enough to require the customer to install their own transformer equipment on the property.

It is planned that the primary distribution lines will be laid underground in order to prevent the landscape disturbance caused by the use of congested overhead distribution lines.

Table 5.31: Power Demand and Number of Transformer Units

Service Area	Lot Name	Power Demand (MW)	Transformer Unit (unit)
Area 1	RL1	1.8	2
Area 2	RL2	1.4	1
Area 3	RL3	1.8	2
Area 4	RL4	1.6	2
Area 5	RM1	2.4	2
Area 6	RM2 & 3	8.2	6
Area 7	RM4 – 6	7.5	5
Area 8	RM7 - 8	8.8	6
Area 9	RM9 – 14	12.5	9
Area 10	CT1 - 14	11.3	8
Total		57.2	43

Note: The capacity of the transformer unit is set at 1,500 kVA.

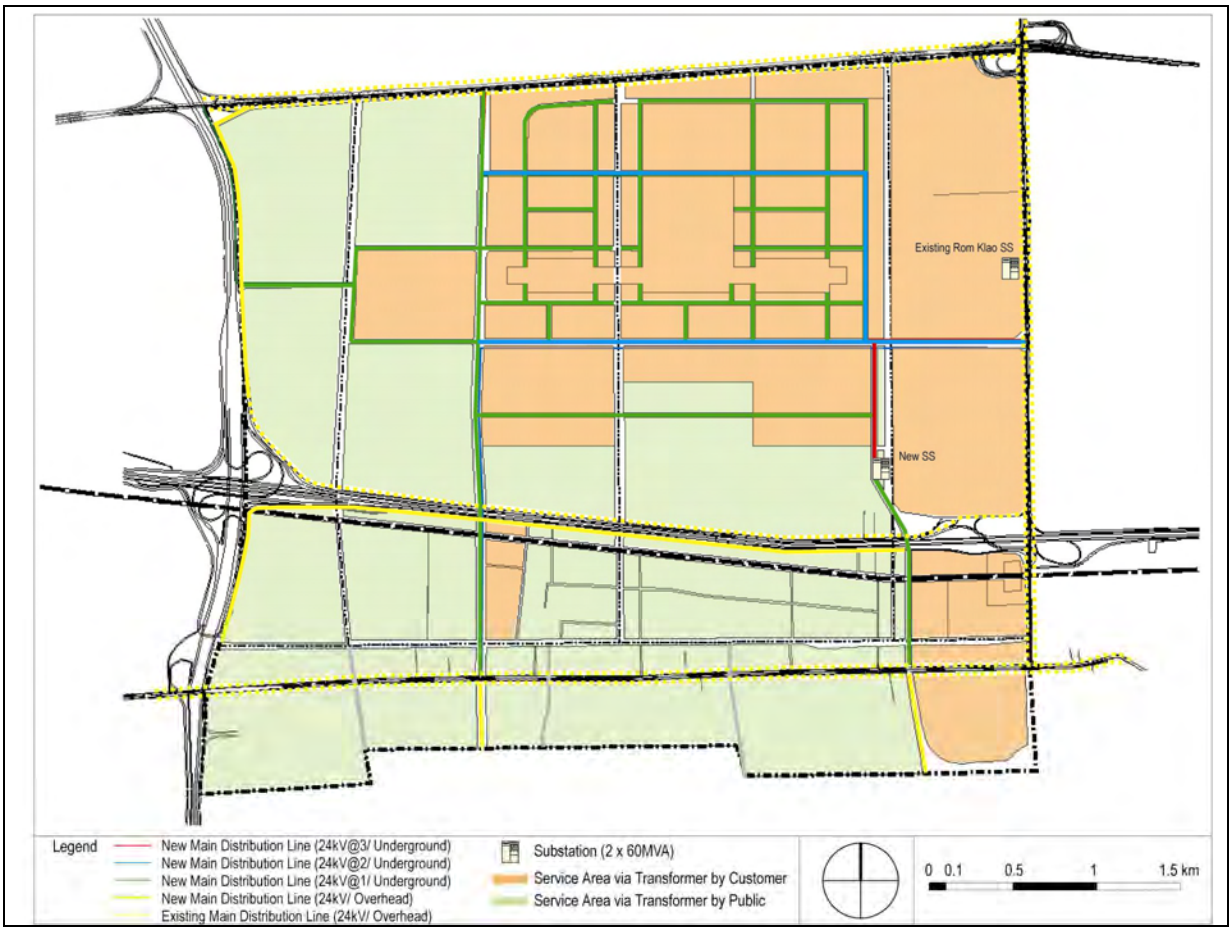

Figure 5.49: Plan of Power Distribution System in 2035

5.4.4 Communications

(1) Existing Communication System

TOT has the largest coverage network in and around the study area. The communication network consists of overhead cables and underground cables (optic fibers). These networks are interconnected by remote switching units (RSUs) which are linked with the main switching units (MSUs).

(2) Outline Design of the Communication System

The communication network in the study area shall be connected to the trunk lines of CAT and TOT via the junctions at Rom Klao Road and On-nut Road. These trunk lines give access to the On-nut and Lat Krabang exchange stations.

The primary distribution network in the study area will be formed by a 1,200 pairs-line and 600 pairs-line installed along the primary and secondary roads. The distribution lines will provide access to the PBXs provided by the customers who may have relatively large communication demands in the Trade & Distribution, Public Facility, RD & D, and Value Creation areas. In other areas the customers will access the distribution lines via the service lines and the telephone panel units installed by the public.

(3) Unit Communication Demand

Unit telephone demand per capita is estimated at 30 lines/100 persons for the year 2001 based on the service record issued by the TOT. Due to the rapid popularization of cellular phones, the fixed telephone demand for the sub-center is set the same as the current level.

Table 5.32: Unit Communication Demand per Capita

Item	Unit	1997	1998	1999	2000	2001
Service Population in TOT Distributed System (Registered Population)	1,000 pers	7,361.8	7,443.6	7,478.9	7,535.8	7,622.0
Estimated Service Population (Registered Pop. x1.506)	1,000 pers	11,086.8	11,210.0	11,263.2	11,349.0	11,478.7
Line Capacity	million lines	4.20	4.34	4.41	4.42	4.40
Diffusion Ratio	line/ 100 pers	38	39	39	39	38
Line Connected	million lines	2.75	2.77	2.83	2.98	3.21
Diffusion Ratio	line/ 100 pers	25	25	25	26	28

Source: 1) Population: the Aerotropolis Development Plan.
2) Line capacity and line connected: the statistics of TOT.
Note: The service area of the TOT system covers Bangkok, Samut Prakan, and Nonthaburi.

(4) Estimate of Communication Demand

The telephone demand in the study area in 2035 is estimated at around 50,400 lines. For planning of the communication network, the estimated demand is divided into the demands by plots of lands based on the number of households and work places. In this distribution assumption, the average number of workers is set at 20 workers per work place as specified in the BMA comprehensive plan, while the communication demand is set at 1.0 line per household and 1.5 lines per work place.

Table 5.33: Estimate of Communication Demand Estimate in 2035

Item	Population	Tel. Demand	No. of Household	No. of Workplace	Telephone Demand		
					Residential	Work Place	Total
	person	line	household	place	line/ household	line/ work place	line
Residential (L)	13,150	3,945	3,372	66	1.0	1.5	3,471
Residential (M&H)	82,400	24,720	36	262	1.0	1.5	21,519
Culture Town	22,600	6,780	10	113	1.0	1.5	5,966
Trade & Distribution	15,000	4,500	7	812	1.0	1.5	5,064
Hybrid Town Center	9,600	2,880	4	740	1.0	1.5	3,572
RD&D & Enterprise	25,130	7,539	11	2,841	1.0	1.5	10,705
Public facilities	-	-	-	113	1.0	1.5	170
Value Creation	-	-	-	76	1.0	1.5	114
Total	167,880	50,364	74	5,023	-	-	50,580

(5) Planned Communications System

The primary distribution lines of 1,200 pairs and 600 pairs lines are installed along primary and secondary roads. The Residential Low Rise, Residential Medium Rise and Culture Town areas are served by telephone panel units by the public. The required number of transformer

units is estimated at 30 units. In the remaining areas, customers with large demands may install their own transformer equipment.

It is planned that the primary distribution lines will be laid underground so as to prevent the landscape disturbance caused by congested overhead lines.

Table 5.34: Communication Demand and Number of Telephone Panel Units

Service Area	Lot Name	Telephone Demand (line)	Telephone Panel Unit (unit)
Area 1	RL1	950	1
Area 2	RL2	752	1
Area 3	RL3	924	1
Area 4	RL4	845	1
Area 5	RM1	1,337	2
Area 6	RM2 & 3	4,470	4
Area 7	RM4 – 6	4,095	4
Area 8	RM7 - 8	4,805	5
Area 9	RM9 – 14	6,812	6
Area 10	CT1 - 14	5,966	5
Total		30,956	30

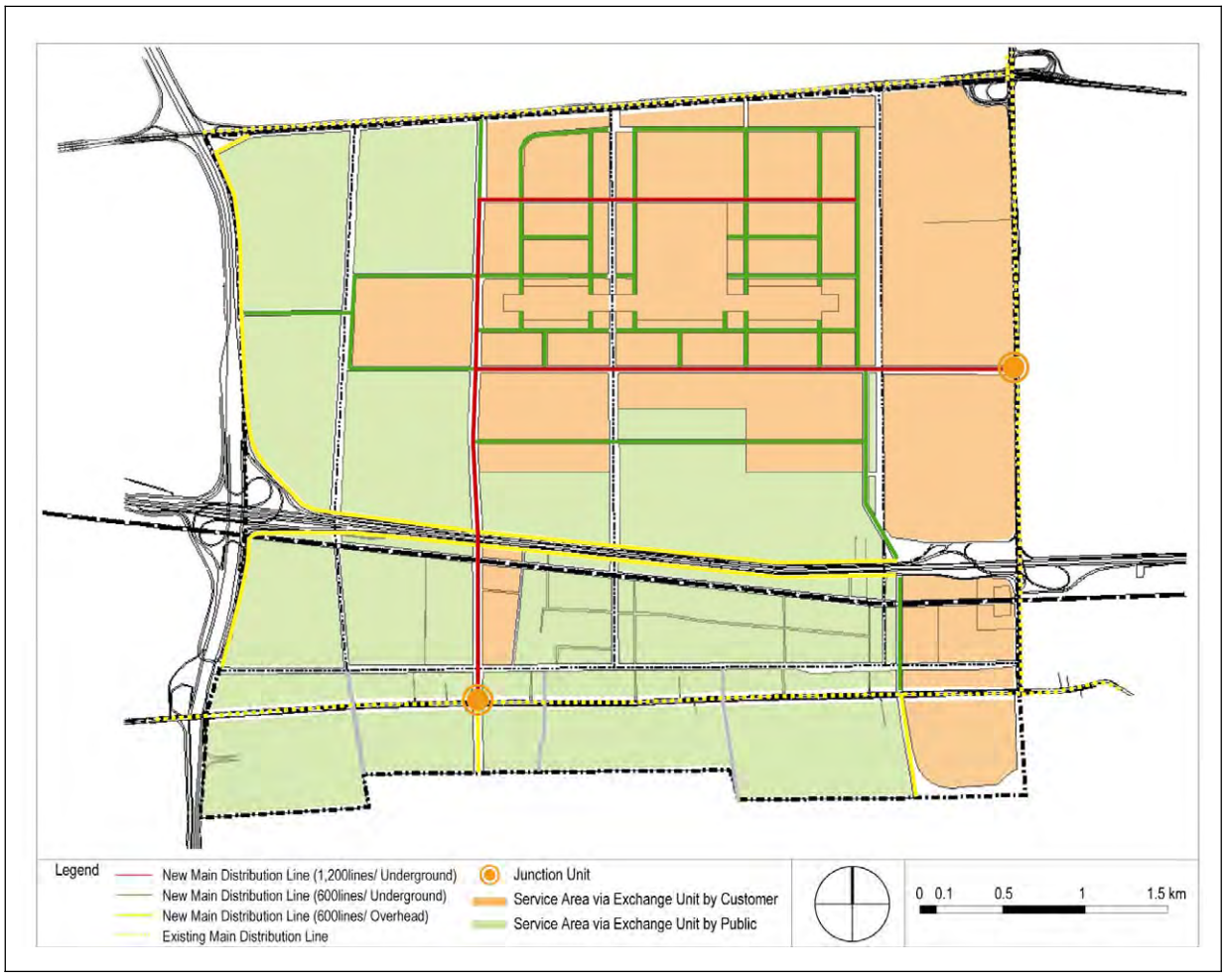

Figure 5.50: Plan of Communication Network in 2035