ANNEX 26

ANALYSIS OF

NON-DOMESTIC WATER CONSUMPTION

1.   **Introduction**

Water is a key material for maintaining and improving economic and social activities for people's daily life.   In 2000, only 36% of the 600,000 people in Vientiane Capital City had access to treated water.

According to the June 20003 Interim Report prepared by the JICA study, the quantity of non-domestic water consumption was almost the same as the quantity of domestic water consumption.   Compared with other South-East Asian countries, the ratio of domestic to non-domestic water consumption in Vientiane seems to be high.

This report is prepared for an examination of non-domestic water consumption, and the results of this report will be a useful input for the establishment of water conservation and water demand management plans. In this report, non-domestic water consumption was analyzed in terms of the quantity and categories of usage.

2.   Overall Water Consumption

Water consumption is divided into two parts, in which one is domestic water consumption for residential usage and another is non-domestic water consumption by government offices, military camps, industries, etc.

The total water consumption in Vientiane in March 2002 was 2,423,334m3/month and 43,449 connections were registered.   Domestic water consumption, categorized as Cat.1, was 1,352,886m3/month, and accounted for about 55.8% of the total water consumption.   The number of domestic connections was 37,578 which accounted for 86.5% of total connections.   On the other hand, non-domestic water consumption, categorized as Cat.2, Cat.3, Cat.4 and Cat.5, was 1,070,448m3/month and accounted for about 44.2% of total consumption.   The number of non-domestic connections was 5,871 which accounted for 13.5% of the total connections.

Fig. 2-1   Breakdown of Water Consumption by NPVC Categories
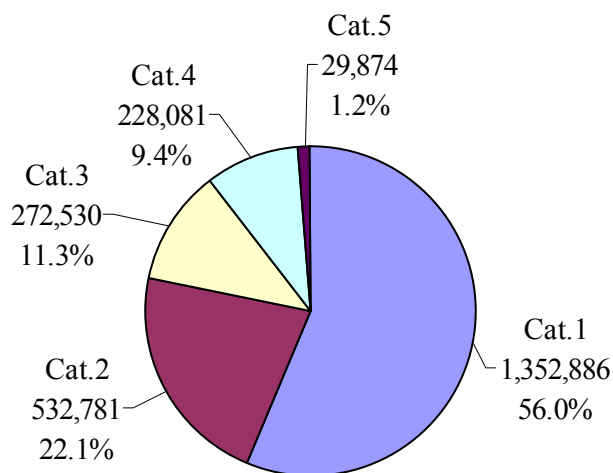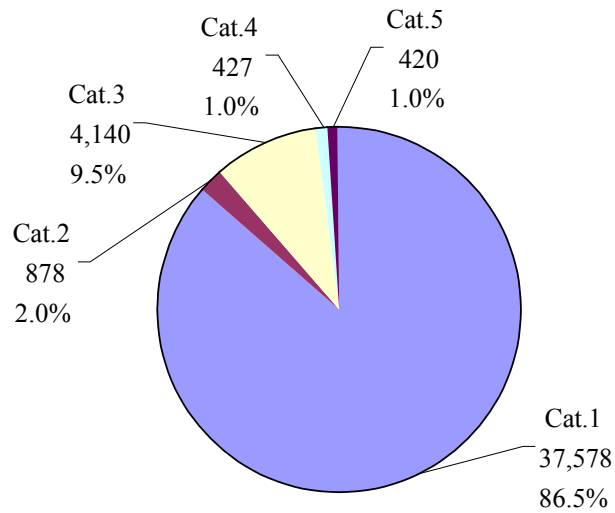**(Total=2,423,334 m3/month, March 2002)**

Fig. 2-2   Breakdown of Number of Connection by NPVC Categories

(Total=43,449 connections, March 2002)

Cat.4
427
1.0%

Cat.5
420
1.0%

Cat.3
4,140
9.5%

Cat.2
878
2.0%

Cat.1
37,578
86.5%

Note: Cat.1:   Domestic

Cat.2:   Administration offices

Cat.3:   Enterprises, factories, businesses, class 1to class 6

Cat.4:   Businesses used water as a raw material for production, hotels,
           guest houses, restaurants, and swimming pools

Cat.5   Diplomatic mission, international organizations, foreigners and expatriates

3.   Categorization of Non- Domestic Water Consumption

Connections are categorized into five categories by the NPVC, as shown in Table 3-1.

Table 3-1   Categories of the NPVC

No.	Category
1	Domestic
2	Administration office
3	Enterprises, factories, business class1 to class 6
4	Businesses using water as the raw materials for production, hotels, guest houses, restaurants, and swimming pools
5	Diplomatic missions, international organizations, foreigners and expatriates

Since these categories are considered too broad to analyze non-domestic water consumption, non-domestic water consumptions were categorized into a further eleven categories, which included government institutions and offices, military, commerce, factories and companies, schools, hospitals, embassies, banks, restaurants, services, and foreigners.

Water consumption and the number of connection of each category are shown in Fig. 3-1, 3-2, and Table 3-1.

Fig. 3-1 Breakdown of Water Consumption
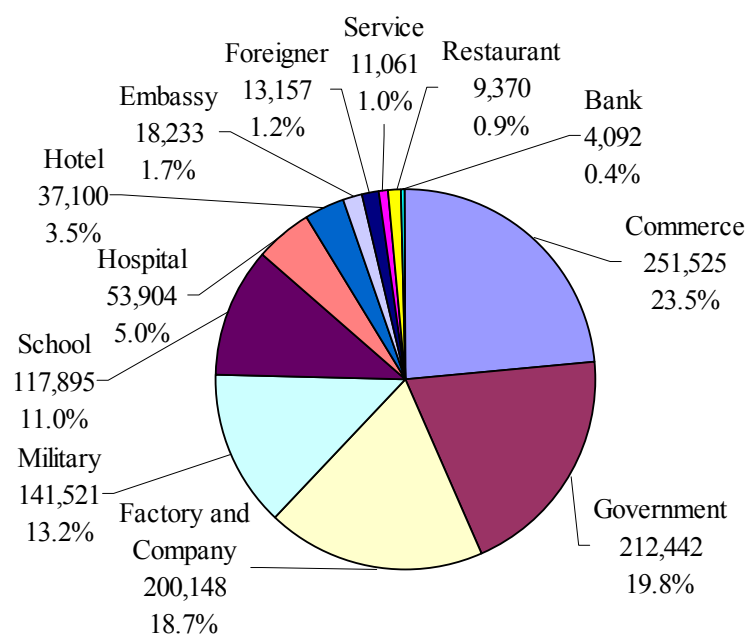**(Total=1,070,448 m3/month, March 2002)**

Fig. 3-2   Breakdown of Number of Connections
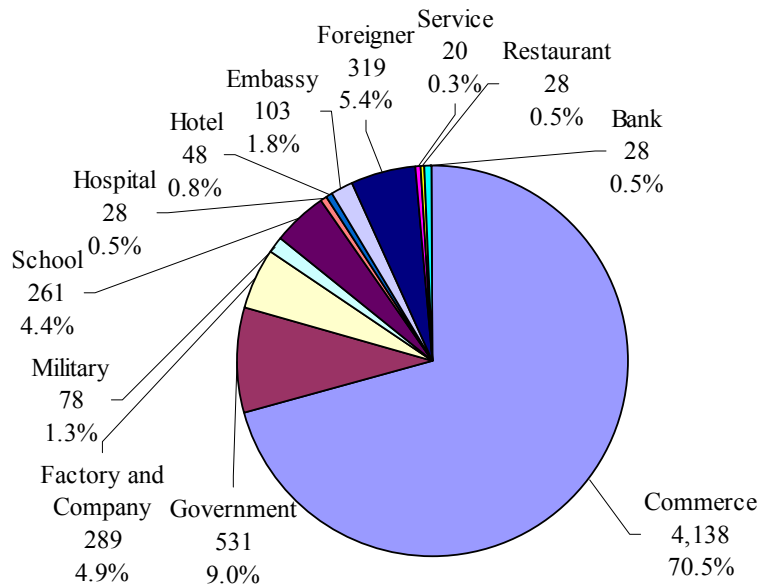**(Total=5,871 connections, March 2002)**

Table 3-1   Non-domestic Connections and Water Consumption

Category	Number of Connection	Connection Percentage	Consumption m3/month	Consumption Percentage
Commerce	4,138	70.5%	251,525	23.5%
Government	531	9.0%	212,442	19.9%
Factory and Compan	289	4.9%	200,148	18.7%
Military	78	1.3%	141,521	13.2%
School	261	4.4%	117,895	11.0%
Hospital	28	0.5%	53,904	5.0%
Hotel	48	0.8%	37,100	3.5%
Embassy	103	1.8%	18,233	1.7%
Foreigner	319	5.4%	13,157	1.2%
Service	20	0.3%	11,061	1.0%
Restaurant	28	0.5%	9,370	0.9%
Bank	28	0.5%	4,092	0.4%
Total	5,871	100%	1,070,448	100%

The top five categories in terms of water consumption are commerce, government, factories and companies, military, and schools. The total water consumption of these top five categories accounts for about 86.3% of the total non-domestic consumption.

The top five categories in terms of the number of connections are commerce, government, foreigners, factories and companies, and schools. The number of connections in the commerce category accounts for 70.5% of total connections. The category of "Military" is not included in the top five in terms of number of connections even though the "Military" is ranked No.4 in the quantity of water consumed.

4.   Big consumers in respective categories

Analyses of large consumers in the respective eleven categories, government institutions and offices, military, commerce, factories and companies, schools, hospitals, embassies, banks, restaurants, services, and foreigners, were conducted based on data obtained in March 2002.   The water consumption of each consumer used in this analysis was calculated by combining the connections of the same consumer's name into one connection because some consumers have plural connections. The number of consumers in the respective categories is shown in Table 4-1.

Table 4-1   Number of Connections and Consumers

Category	Number of Connection	Connection Percentage	Number of Consumer	Consumer Percentage
Commerce	4,138	70.5%	4,113	76.7%
Government	531	9.0%	398	7.4%
Factory and Company	289	4.9%	217	4.1%
Military	78	1.3%	52	1.0%
School	261	4.4%	171	3.2%
Hospital	28	0.5%	14	0.3%
Hotel	48	0.8%	28	0.5%
Embassy	103	1.8%	48	0.9%
Foreigner	319	5.4%	269	5.0%
Service	20	0.3%	12	0.2%
Restaurant	28	0.5%	22	0.4%
Bank	28	0.5%	16	0.3%
Total	5,871	100%	5,360	100%

4.1   Commerce

Commerce occupies the biggest portion of the water consumption category of non-domestic water consumption, which is 251,525m3/month (23.5% of the total non-domestic consumption), and also has the largest number of connections, which is 4,138 connections (70.4% of the total non-domestic connections) (See Fig.4-1 and 4-2).

Fig. 4-1   Water Consumption of Commerce
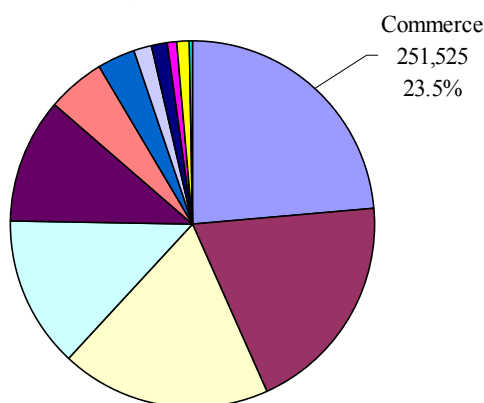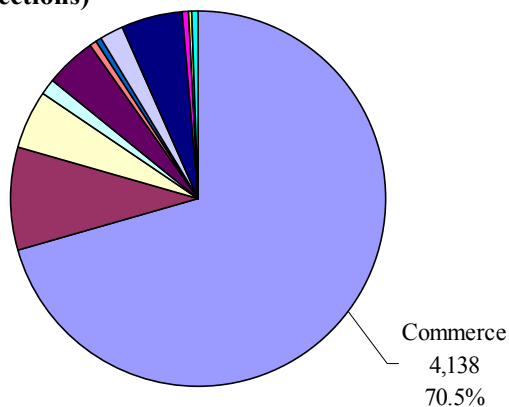**(Total Non-domestic=1,070,448 m3/month)**

Commerce
251,525
23.5%

Fig. 4-2   Number of Commerce Connections
(Total Non-domestic=5,871 connections)

Commerce
4,138
70.5%

The distribution of water consumption by each consumer sorted by its consumption is shown in Fig. 4-3, and the top five large consumers are shown in Table 4-2.   Some consumers have plural connections under the same consumer name and these connections are counted as the one connection for the analysis purpose.   Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-3   Distribution of Water Consumptions of Commerce Users
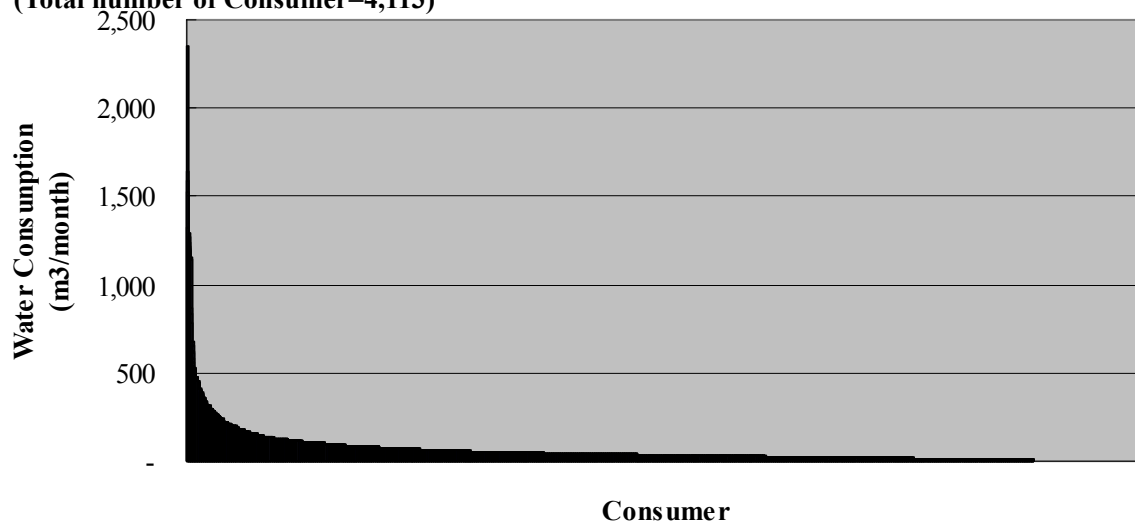**(Total number of Consumer=4,113)**

Table 4-2   Top 5 consumers in Commerce

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Commerce	10105252	Mrs. Khemngern	2,352	0.9%
	33401136	Mr. Salerm	1,646	0.7%
	53304124	Thatluang Market	1,592	0.6%
	10301678	Mrs. Bouavon Sitthipong	1,523	0.6%
	43601037	Mr. Phakop	1,325	0.5%
Total Category Consumption			251,525	3.4%

The total number of consumers in this sector is 4,113. The distribution of water consumption among consumers varies from about 2,400 m3/month to 0 m3/month (not used).   This variation is not a wide range compared with other categories.   The total water consumption of the top 5 large consumers accounts for only 3.4% of the total water consumption in this category.

4.2   Government

The government is the second biggest user in the non-domestic water consumption category, the amount consumed being 212,442m3/month (19.9% of the total non-domestic consumption), and has 531 connections (9.0% of the total non-domestic connections)(see Fig.4-4 and 4-5).

Fig.4-4   Water Consumption of Government
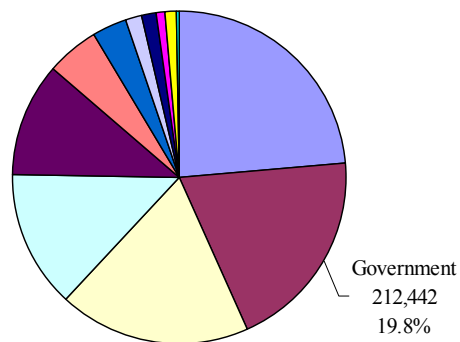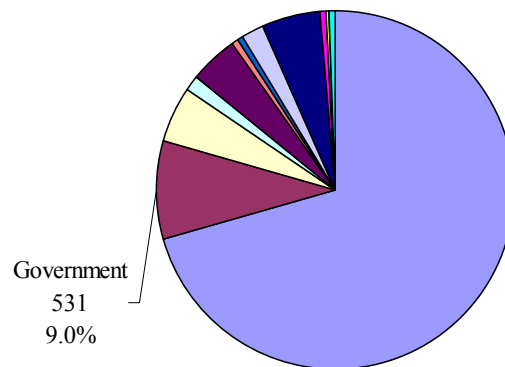**(Total Non-domestic=1,070,448 m3/month)**

Fig.4-5   Number of Government Connections
(Total Non-domestic=5,871 connections)

The distribution of water consumption by each consumer sorted by volume of consumption is shown in Fig. 4-6, and the top five largest consumers are shown in Table 4-3. Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose. Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-6   Distribution of Water Consumptions of Government Users
(Total number of Consumer=398)

Table 4-3   Top 5 consumers in Government Institutions and Offices

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Government Institutions and Offices	53302140	Cabinet of Ministry for defence	13,888	6.5%
	53302190	Industrial km9	10,798	5.1%
	53302420	Xamkhe prison	9,202	4.3%
	53302962	Airport Development Project	7,626	3.6%
	53302154	Telecom Department	6,898	3.2%
Total Category Consumption			212,442	22.7%

The total number of consumers is 398. The water consumption among consumers varies from about 14,000 m3/month to 0 m3/month (not used). There is a big difference in the quantities consumed among the consumers. The total water consumption of the top 5 largest consumers was almost a quarter (22.7%) of the total government water consumption. In the government category, a conservation plan for big consumers will be an effective method for the reduction of water

consumption.

Although the "Government Institutions and Offices" is categorized as one of the non-domestic water consumer, it is observed that some residences of staff exist in the premises of the institutions or offices and water is shared to these residences.   Therefore, this non-domestic water consumption includes certain amount of domestic use by such residents and it is not able to distinguish domestic and non-domestic since individual water meters have not been installed at each residential connection.

4.3   Factory and Company

Factories and companies are the third biggest water consumption category of non-domestic consumers, using 200,148m3/month (18.7% of the total non-domestic consumption), and has 289 connections (4.9% of the total non-domestic connections) (see Fig.4-7 and 4-8).

Fig.4-7   Water Consumption of Factory and Company
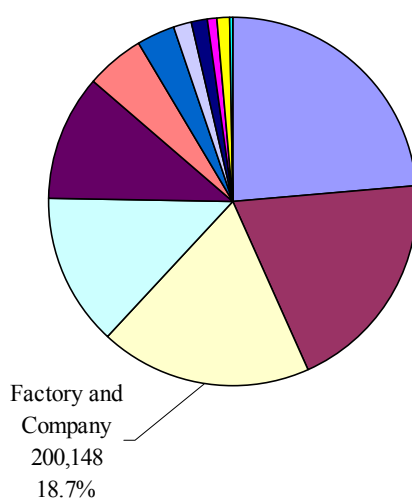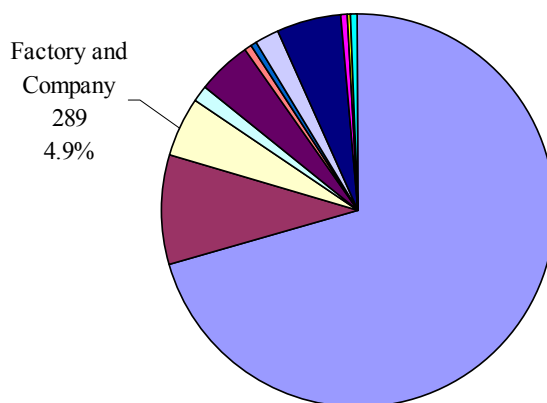**(Total Non-domestic=1,070,448 m3/month)**

Factory and
Company
200,148
18.7%

Fig.4-8   Number of Factory and Company Connections
(Total Non-domestic=5,871 connections)

Factory and
Company
289
4.9%

Distribution of water consumption by each consumers sorted by its consumption is shown in Fig. 4-9, and the top five largest consumers are shown in Table 4-4.   Some consumers have plural

connections under the same consumer name and these connections are counted as one connection for the analysis purpose. Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-9 Distribution of Water Consumptions of Factory and Company Users (Total number of Consumer=217)

Table 4-4   Top 5 consumers by Factories and Companies

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Factory	53304009	Beer lao Company	49,645	24.8%
and Company	53304169	Paper Asia Factory	12,763	6.4%
	53304092	Lao-Garment Company	10,165	5.1%
	53304132	Lanxang Garment	9,242	4.6%
	33302197	VT lao Home Tex Company	6,573	3.3%
Total Category Consumption			200,148	44.2%

The total number of consumers is 217. The water consumption among the consumers varies from about 50,000 m3/month to 0 m3/month (not used). There is a big difference in the consumption of the quantity of water among consumers. The total water consumption of the top 5 consumers accounts for 44.2% of this category. Especially the first ranking consumes almost a quarter of the total category volume.

4.4   Military

The military is the fourth water consumption user in the non-domestic water consumption, using 141,521m3/month (13.2% of the total non-domestic consumption), and also has 289 connections (1.3% of the total non-domestic connections) (see Fig.4-10 and 4-11).

Fig.4-10   Water Consumption of Military
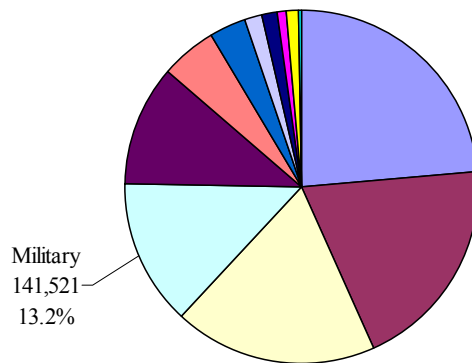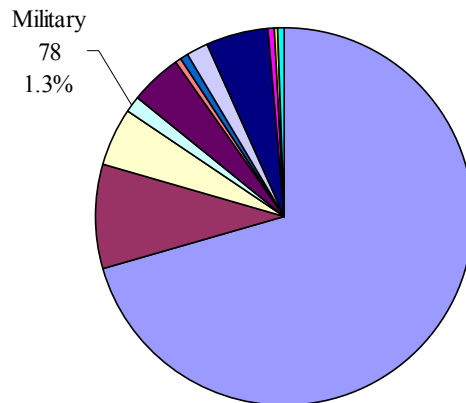**(Total Non-domestic=1,070,448 m3/month)**

Fig.4-11   Number of Military Connections
(Total Non-domestic=5,871 connections)

The distribution of water consumption by each customer sorted the volume of consumption is shown in Fig. 4-12, and top five largest consumers are shown in Table 4-5.   Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose.   Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-12   Distribution of Water Consumptions of Military Users (Total number of Consumer=52)
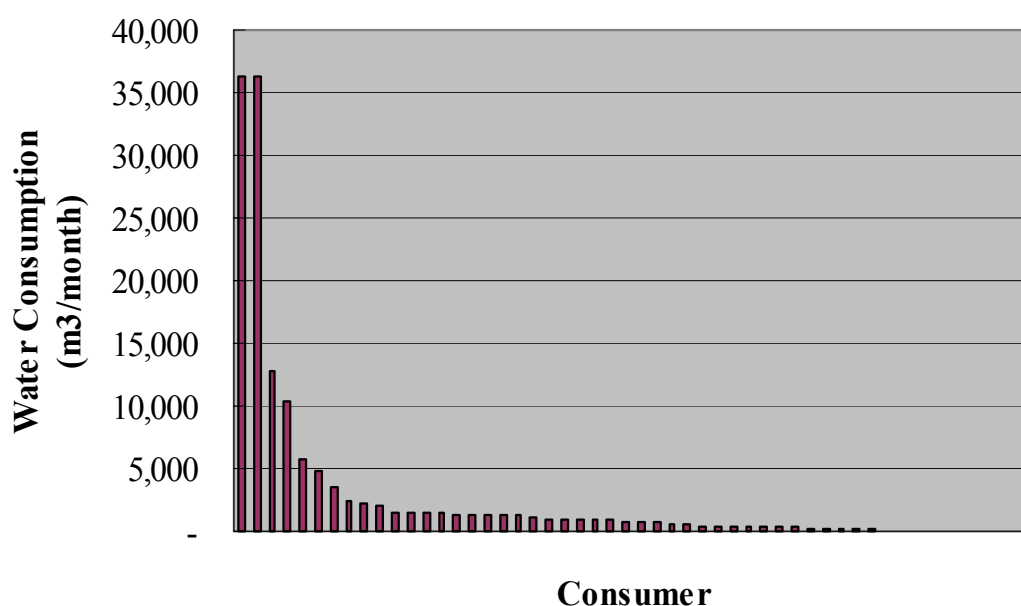

Table 4-5   Top 5 consumers by the Military

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Military	53302148	Dongpasak Defence	36,330	25.7%
	53302182	Ministry of National Defence	36,325	25.7%
	53302202	Air Force	12,742	9.0%
	53302151	Army General Department	10,297	7.3%
	53302565	Training Center	5,721	4.0%
Total Category Consumption			141,521	71.7%

The total number of consumers is 52.   The water consumption among consumers varies from about 40,000 m3/month to 0 m3/month (not used).   There is a big difference in the quantity between each customer.   The total water consumption of the top 5 consumers accounts for 71.7% of military consumption.   Especially the first two rankings accounts for almost half of total military consumption.

Although the "Military" is categorized as one of the non-domestic water consumer, it is observed that some residences of soldiers of the military exist in the premises of the military and water is shared to these residences. Therefore, this non-domestic water consumption includes certain amount of domestic use by such residents and it is not able to distinguish domestic and non-domestic since individual water meters have not been installed at each residential connection.

4.5   Schools

Schools are the fifth water consumption users in the non-domestic water consumption category, consuming 117,895m3/month (11.0% of the total non-domestic consumption), and has 261 connections (4.4% of the total non-domestic connections) (see Fig.4-13 and 4-14).

Fig.4-13   Water Consumption of School
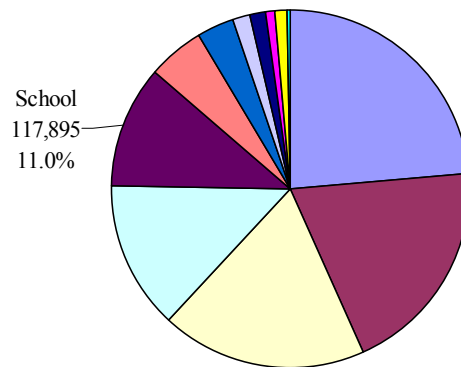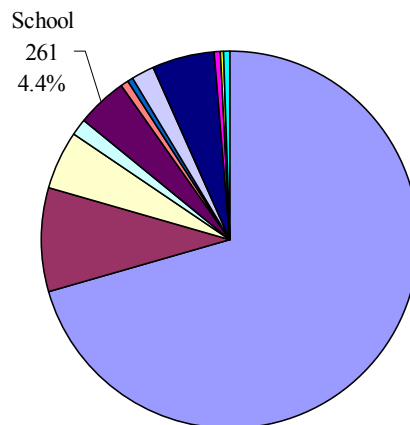**(Total Non-domestic=1,070,448 m3/month)**

Fig.4-14   Number of School Connections
(Total Non-domestic=5,871 connections)

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-15, and top five largest consumers are shown in Table 4-6.   Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose.   Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-15   Distribution of Water Consumptions of School Users
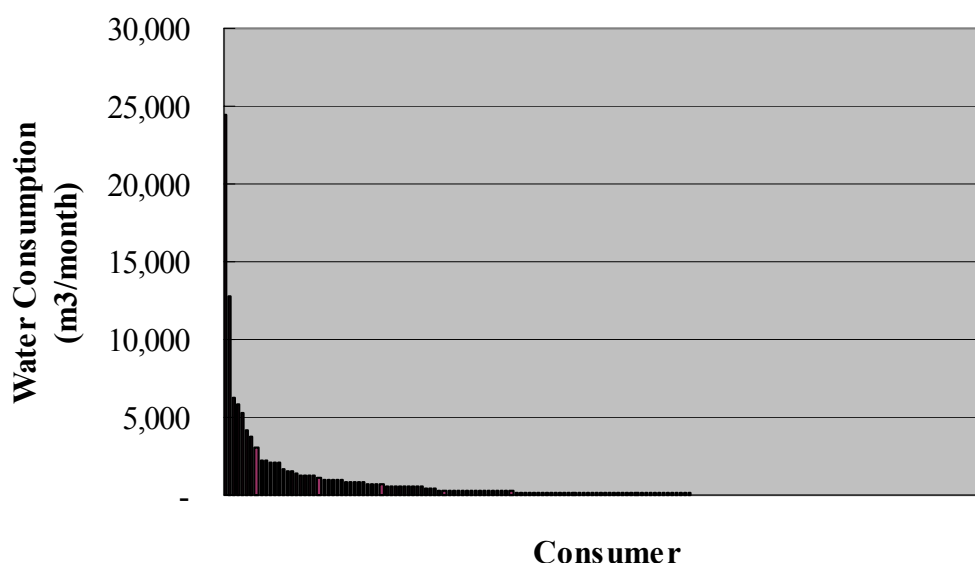**(Total number of Consumer=171)**

Table 4-6   Top 5 consumers by Schools

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
School	53302779	Dongdok Dormitory	24,393	20.7%
	53302429	Poly-technical School	12,721	10.8%
	53302180	Language School of Ministry for foreign Affairs	6,213	5.3%
	53302095	Communication School	5,822	4.9%
	53302434	Technical School	5,214	4.4%
Total Category Consumption			117,895	46.1%

The total number of consumer is 171.   The water consumption among consumers varies from about 25,000 m3/month to 0 m3/month (not used).   There is a big difference in the quantity of water consumed among each of the consumers.   The total water consumption of the top 5 consumers accounts for 46.1% of school consumption, and the first two rankings accounts for 31.5% of the total school consumption.

4.6   Hospitals

Water consumption of hospitals is 53,904m3/month (5.0% of the total non-domestic consumption), and has 261 connections (0.5% of the total non-domestic connections) (see Fig.4-16 and 4-17).

Fig.4-16   Water Consumption of Hospital
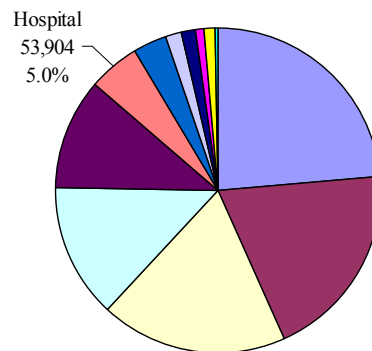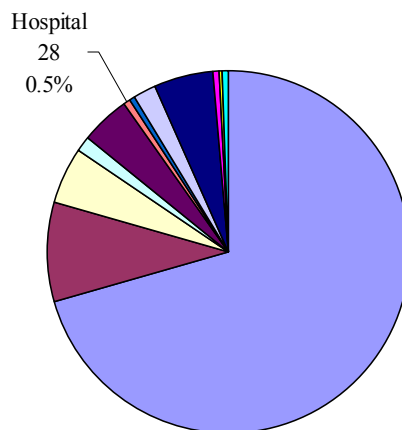**(Total Non-domestic=1,070,448 m3/month)**

Fig.4-17   Number of Hospital Connections
(Total Non-domestic=5,871 connections)

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-18, and the top five big consumers are shown in Table 4-7.   Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose.   Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-18   Distribution of Water Consumption in Hospitals
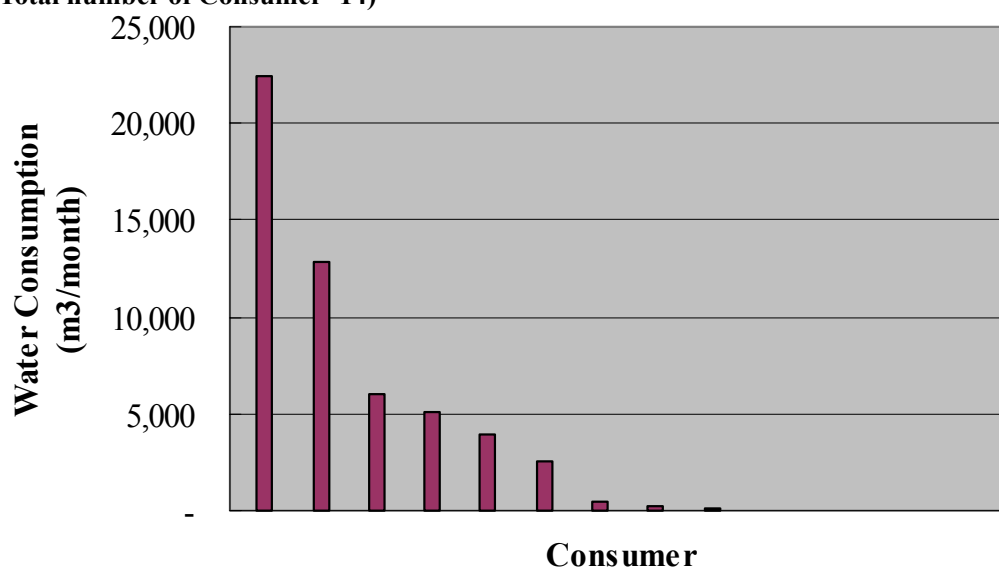
(Total number of Consumer=14)

Table 4-7   Top 5 consumers by Hospitals

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Hospital	53302165	Hospital 103	22,470	41.7%
	53302328	Mahosot Hospital	12,807	23.8%
	53302215	Hospital No2	6,023	11.2%
	53302542	Sethathirad Hospital	5,147	9.5%
	53302327	Hospital 150 beds	3,981	7.4%
Total Category Consumption			53,904	93.6%

The total number of consumers is 14.   The water consumption among consumers varies from about 23,000 m3/month to 0 m3/month (not used).   There is a big difference in the quantity of water consumed among the consumers.   The first two ranking hospitals account for 65.5% of hospital consumption.

4.7   Hotels

Water consumption of hotels is 37,100m3/month (3.5% of the total non-domestic consumption), and this sector has 48 connections (0.8% of the total non-domestic connections) (see Fig.4-19 and 20).

Fig.4-19   Water Consumption of Hotel
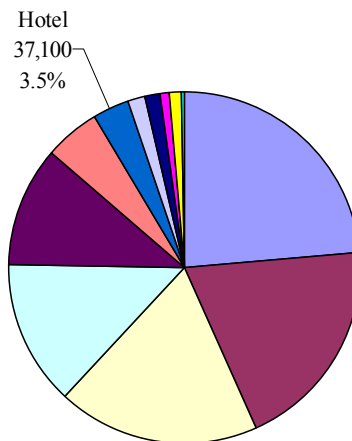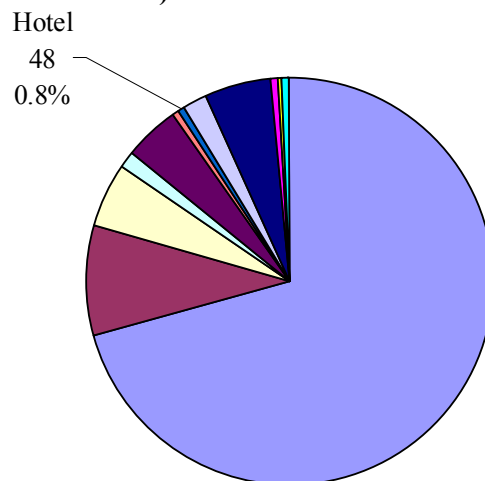**(Total Non-domestic=1,070,448 m3/month)**

Fig.4-20   Number of Hotel Connections
(Total Non-domestic=5,871 connections)

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-21, and the top five consumers are shown in Table 4-8.   Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose.   Therefore, the total number of consumer in this figure is different from the number of connection shown in the previous figure.

Fig. 4-21   Distribution of Water Consumption in Hotels
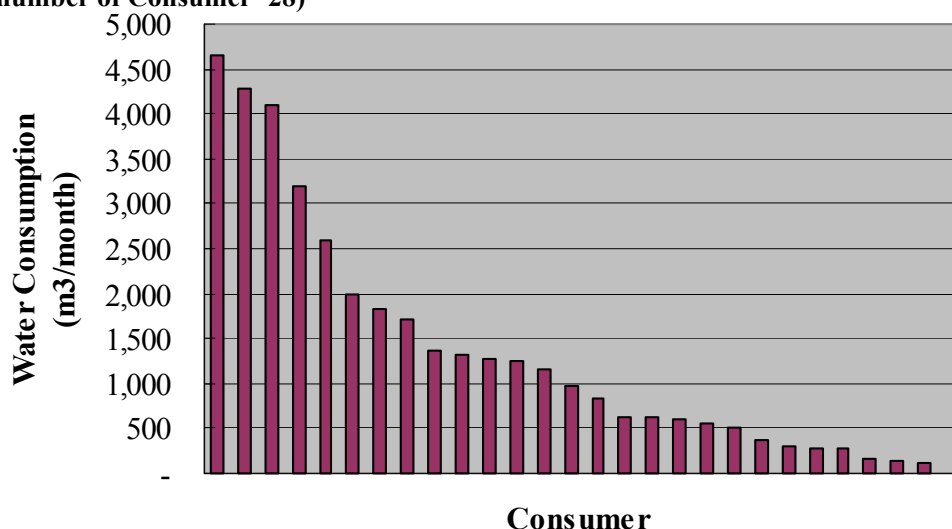**(Total number of Consumer=28)**

Table 4-8   Top 5 consumers by Hotels

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Hotel	53304067	Dokmaidang Hotel	4,642	12.5%
	53304034	Lao Plaza Hotel	4,280	11.5%
	53304050	Novotel Hotel	4,092	11.0%
	53304046	Lanexang Hotel	3,191	8.6%
	53302149	Ladsavong Hotel	2,589	7.0%
Total Category Consumption			37,100	50.6%

The total number of consumers is 28.   The distribution of water consumption among consumers varies from about 5,000 m3/month to 0 m3/month (not used).   There is a difference in quantity among each of the consumers.   The total water consumption of the top 5 consumers accounts for 50.6% of hotel consumption, and the first three ranked hotels account for 35.0% of the total hotel consumption.

4.8   Embassies

Water consumption by embassies is 18,233m3/month (1.7% of the total non-domestic consumption), and this sector has 103 connections (1.7% of the total non-domestic connections) (see Fig.4-22 and 4-23).

Fig.4-22   Water Consumptions of Embassies
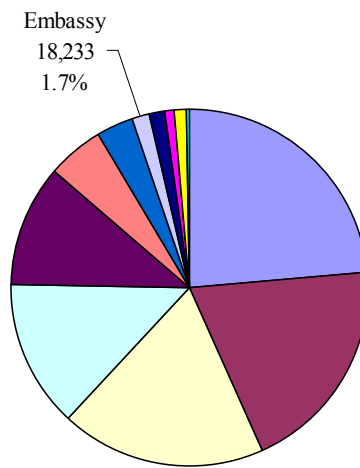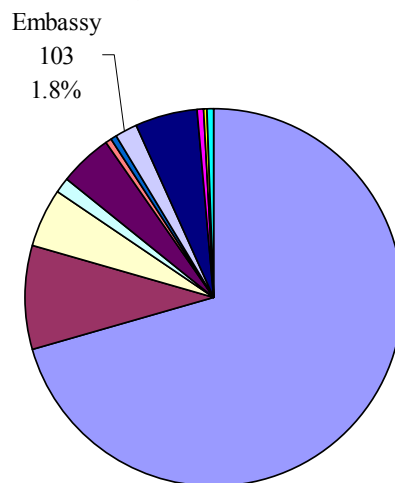**(Total Non-domestic=1,070,448 m3/month)**

Fig.4-23   Number of Embassy Connections
(Total Non-domestic=5,871 connections)

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-24, and the top five consumers are shown in Table 4-9.   Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose.   Therefore, the total number of consumer in this figure is different from the number of connection shown in the previous figure.

Fig. 4-24   Distribution of Water Consumption in Embassy
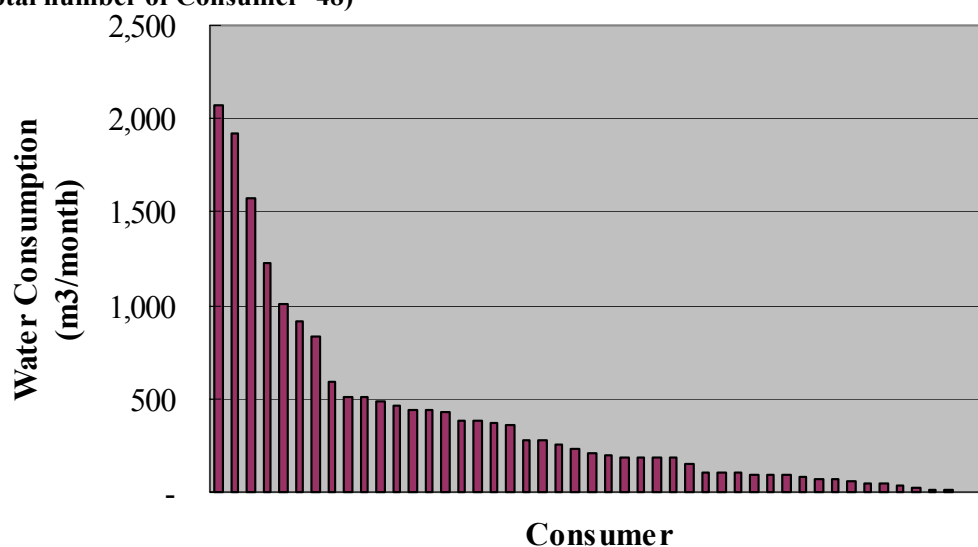
(Total number of Consumer=48)

Table 4-9   Top 5 consumers in Embassies

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Embassy	53303041	USA embassy	2,066	11.3%
	53303066	Japanese embassy residence	1,926	10.6%
	53303015	Russia Embassy	1,575	8.6%
	32101492	Korea Embassy	1,225	6.7%
	53303072	Vietnam embassy staff	1,008	5.5%
Total Category Consumption			18,233	42.7%

The total number of consumers is 48.   The water consumption among consumers varies from almost 2,000 m3/month to 0 m3/month (not used).   There is a difference in the quantity of consumption among the consumers.   The total water consumption of the top 5 consumers accounts for 42.7% of embassies consumption.

4.9   Foreigner

Water consumption by foreigners is 13,157m3/month (1.2% of the total non-domestic consumption), and there are 319 connections (5.4% of the total non-domestic connections) (see Fig.4-25 and 4-26).

Fig.4-25   Water Consumptions of Foreigners
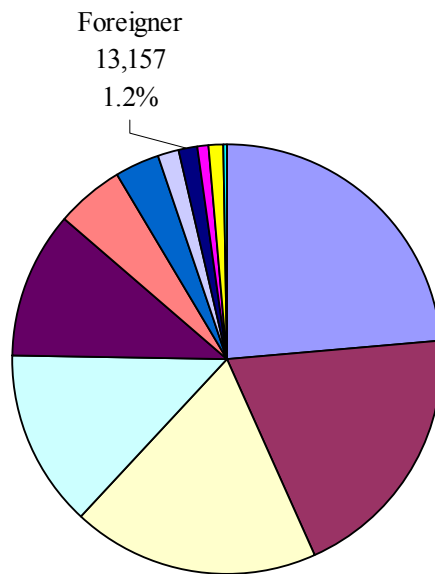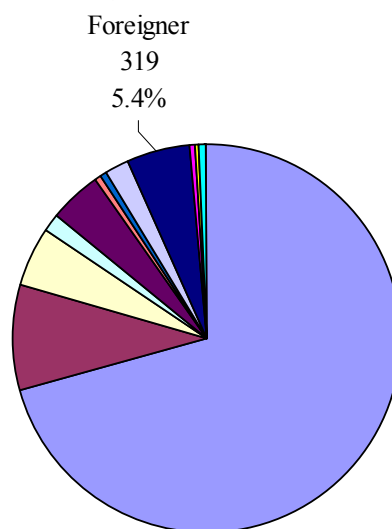**(Total Non-domestic=1,070,448 m3/month)**

Foreigner
13,157
1.2%

Fig.4-26   Number of Foreigners Connections
(Total Non-domestic=5,871 connections)

Foreigner
319
5.4%

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-27, and the top five consumers are shown in Table 4-10. Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose. Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-27 Distribution of Water Consumption for Foreigners
(Total number of Consumer=269)

Table 4-10 Top 5 consumers by Foreigners

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Foreigner	53303052	Australian swimming pool	339	2.6%
	53303315	France language center	333	2.5%
	41803578	Dr. Chanthanom	320	2.4%
	32101057	Mrs. Phouikian	318	2.4%
	41803056	Mr. Bounsou	304	2.3%
Total Category Consumption			13,157	12.2%

The total number of consumers is 269. The distribution of water consumption among consumers varies from about 400 m3/month to 0 m3/month (not used). There is not a significant difference in the quantity of water between each consumer. The total water consumption of the top 5 consumers accounts for only 12.2% of foreigner consumption.

4.10   Services

Water consumption of services is 11,061m3/month (1.0% of the total non-domestic consumption), and there are 20 connections (0.3% of the total non-domestic connections) (see Fig.4-28 and 29).

Fig.4-28   Water Consumption of Service

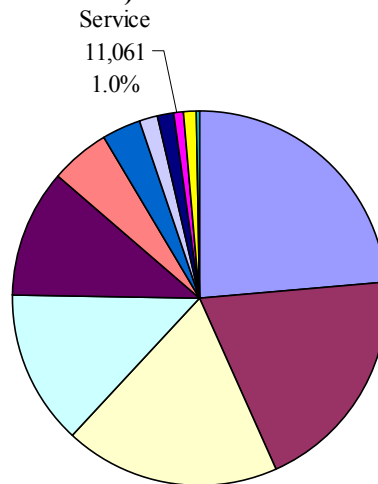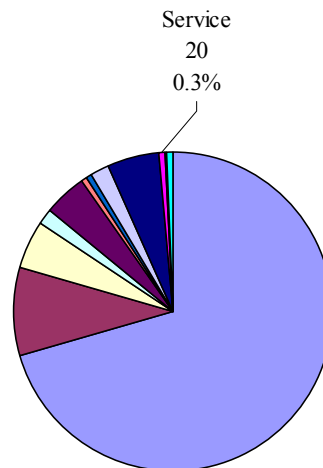**(Total Non-domestic=1,070,448 m3/month)**

Fig.4-29   Number of Service Connections

(Total Non-domestic=5,871 connections)

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-30, and the top five consumers are shown in Table 4-11. Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose. Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-30   Distribution of Water Consumption in Service
(Total number of Customer=12)
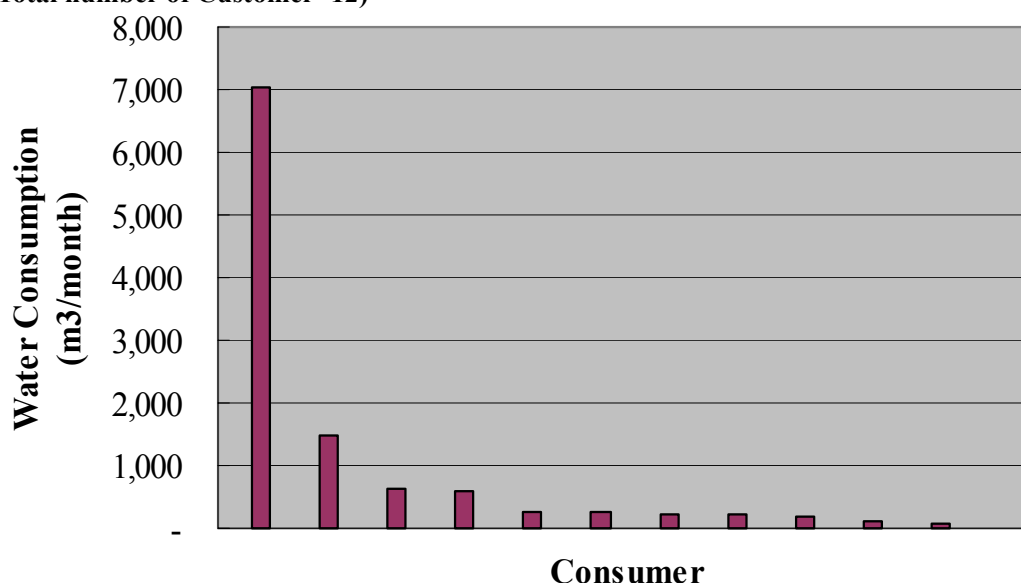
Table 4-11   Top 5 consumers by Service

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Service	53305059	Air port	7,028	63.5%
	53302021	Garage	1,475	13.3%
	53305203	New telephone center section	631	5.7%
	53302964	Embassy management office	607	5.5%
	53304130	Thatluang bus station	265	2.4%
Total Category Consumption			11,061	95.4%

The total number of consumers is 12. The water consumption among consumers varies from about 7,000 m3/month to 0 m3/month (not used). There is a big difference in the quantity of water consumed between each consumer. The first ranking accounts for 63.5% of this category of consumption.

4.11   Restaurants

Water consumption by restaurants is 9,370m3/month (0.9% of the total non-domestic consumption), and there are 28 connections (0.5% of the total non-domestic connections) (see Fig.4-31 and 4-32).

Fig.4-31   Water Consumption of Restaurants
(Total Non-domestic=1,070,448 m3/month)

Fig.4-32   Number of Restaurant Connections
(Total Non-domestic=5,871 connections)

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-33, and the top five consumers are shown in Table 4-12.   Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose.   Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.
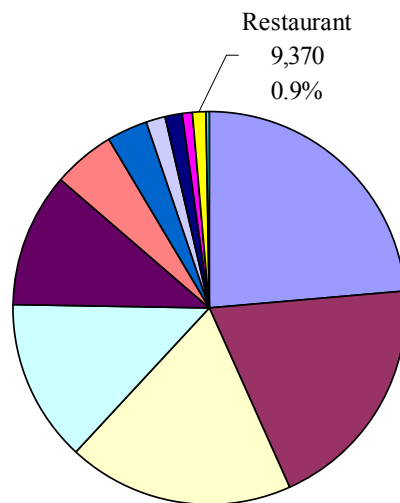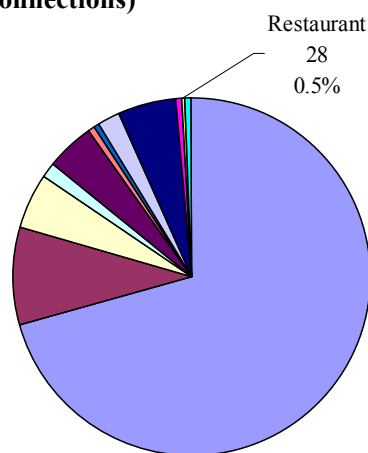
Fig. 4-33   Distribution of Water Consumption by Restaurants
(Total number of Customer=22)
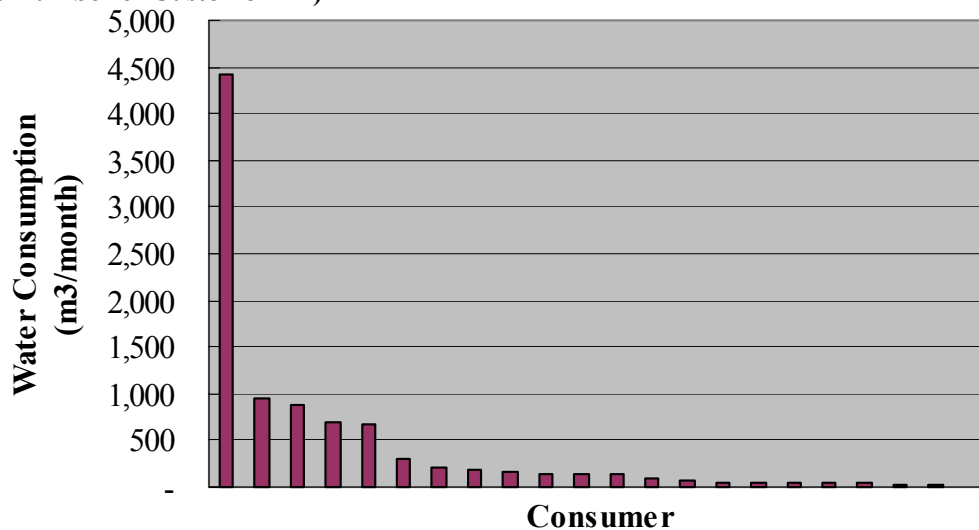
Table 4-12   Top 5 consumers by Restaurants

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Restaurant	53302878	Papao restaurant	4,426	47.2%
	42701029	Salaphone Restaurant	950	10.1%
	53304069	Daovieng restaurant	881	9.4%
	53304025	parasol restaurant	702	7.5%
	53304027	Chanhome parasol	660	7.0%
Total Category Consumption			9,370	81.2%

The total number of consumer is 22.   The water consumption among consumers varies from about 5,000 m3/month to 0 m3/month (not used).   There is a big difference in the quantity consumed between each consumer.   The first ranking accounts for 47.2% of this category of consumption.

4.12   Banks

Water consumption by banks is 4,092m3/month (0.4% of the total non-domestic consumption), and there are 28 connections (0.5% of the total non-domestic connections) (see Fig.4-34 and 4-35).

Fig.4-34   Water Consumption of Banks
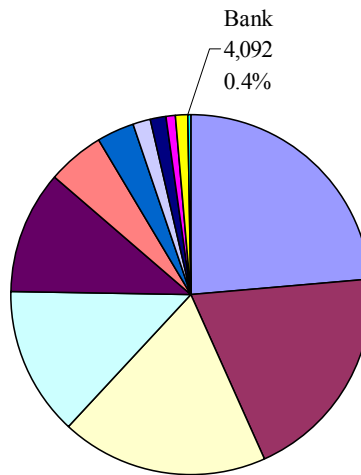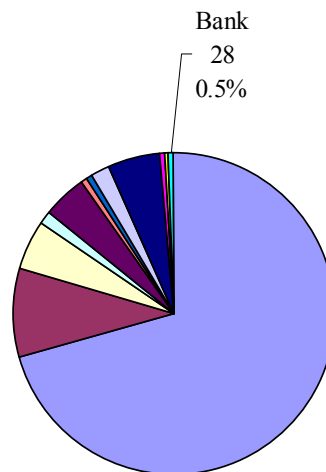**(Total Non-domestic=1,070,448 m3/month)**

Bank
4,092
0.4%

Fig.4-35   Number of Bank Connections
(Total Non-domestic=5,871 connections)

Bank
28
0.5%

The distribution of water consumption by each consumer is sorted by the volume of consumption and is shown in Fig. 4-36, and the top five consumers are shown in Table 4-13. Some consumers have plural connections under the same consumer name and these connections are counted as one connection for the analysis purpose. Therefore, the total number of consumer in this figure is different from the number of connection shown in previous figure.

Fig. 4-36   Distribution of Water Consumption in Bank
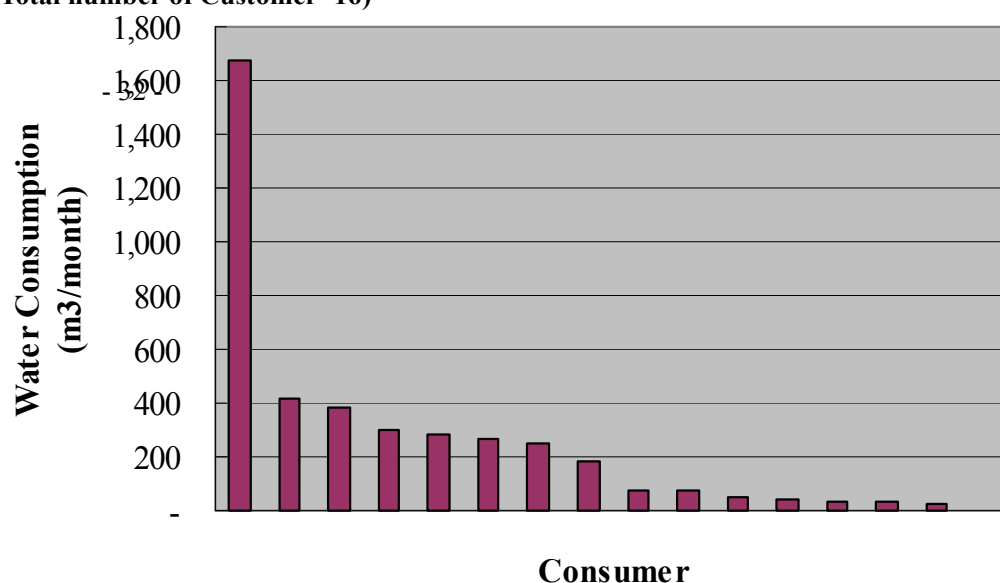
Table 4-13   Top 5 consumers by Banks

Category	Meter No.	Name	Consumption (m3/month)	Consumption Percentage
Bank	53302521	National bank	1,678	41.0%
	53305153	Commercial bank	414	10.1%
	53305324	Development bank	382	9.3%
	53305155	Laomay bank	301	7.4%
	53304033	Vientiane commercial Bank	281	6.9%
Total Category Consumption			4,092	74.7%

The total number of consumers is 16. The water consumption among consumers varies from about 2,000 m3/month to 0 m3/month (not used). There is a big difference in the quantity consumed between each consumer. The first ranking accounts for 41.0% of this category's consumption.

4.13   Overall top 50 consumers

   After analysis of the non-domestic water consumption by each category as stated in the previous section, the top fifty consumers in terms of water consumption regardless of categories are selected, and the selected top fifty consumers are classified by their categories and are shown in Table 4-13. The proportion of the top fifty consumers is less than 1% of the total number of non-domestic water consumers, since the total number of non-domestic consumers is 5360 (Table 4-1). However, these top fifty consumers account for 43% of the total non-domestic water consumption.

Table 4-13   Top Fifty Consumers and their Consumption

Category	Number of Consumers in Top Fifty	Portion of customer to Total consumer	Consumption (m3/month)	Ratio of Consumption to Total Consumption
Government	13	0.24%	87,731	8.2%
Factory and Company	12	0.22%	119,328	11.1%
Military	7	0.13%	109,759	10.3%
School	7	0.13%	62,246	5.8%
Hospital	5	0.09%	50,428	4.7%
Hotel	4	0.07%	16,205	1.5%
Service	1	0.02%	7,028	0.7%
Restaurant	1	0.02%	4,426	0.4%
Total	**50**	**0.9%**	**457,151**	**42.7%**

5.   Adequacy of meter Size

Selection of the adequate meter size is one of the important factors to measure water consumption by consumers accurately.   Based on the consumption data from March 2002, the meter size of each of the non-domestic connections was evaluated as to whether the meter size was adequate or not.

Meter size should be determined by water flow rate.   To measure the water consumption accurately, each meter size has a water flow rate range recommended by the manufacturer, which are shown in table 5-1.   Based on this table, the adequacy of meter sizes was evaluated comparing the water consumption data with the recommended minimum and maximum flow rates

Table 5-1   Recommended Service Flow rate

Meter size	Recommended Service Flow Rate(m3/ day)		Referenced Model
	Minimum	Maximum	
13	0.12	0.8	LCX13
15	0.12	1.5	GMK15
20	0.2	2.5	GMK20
25	0.28	3.5	GMK25
40	0.44	5.5	GMK40
50	1.2	27.75	WVM50
65	1.5	42	WVM65
80	2	57	WVM80
100	2.75	91	WVM100
150	4.5	227	WVM150

Source: Product Catalogue of Water Meter manufacture 'Asahi'.

The evaluation of the water meter size was conducted in the following extreme conditions.

1)   For the minimum flow, it is assumed that water is running for 24 hours per day, in a continuous flow.   If the 24 hour-running flow rate is smaller than the recommended minimum flow of installed meter size, it is evaluated that the installed meter size is too big to measure the actual flow rate.

2)   For the maximum flow rate, it is assumed that the water is running for 5 hours per day.   If the 5 hour-running flow rate is more than the recommended maximum flow, it is evaluated that the installed meter size is too small to measure the actual flow rate.

The results of the evaluation are shown in Table 5-2.   It was found that a total of 2,054 meters were

installed in a non- recommended water flow condition.   About 35% of all meters installed are not suited to the required conditions..   Especially connections in the foreigner and bank categories have high rates of inappropriate use of meters, which are 54.2% and 53.6% respectively.   98.8% of the total of un-suitable meters for the conditions (=2,030/(2,030+24)*100) are classified as " the meter is too large".

Table 5-2   **Results of Meter Size Evaluation**

	Number of un-suitable condition		Number of Connection	Un-suitable Condition Rate
	Meter is too big. Average flow rate is smaller than designed minimum	Meter is too small. Average flow rate is more than designed		
Commerce	1,521	3	4,138	36.8%
Government	122	5	531	23.9%
Factory and Company	66	4	289	24.2%
Military	12	7	78	24.4%
School	67	3	261	26.8%
Hospital	7	0	28	25.0%
Hotel	9	1	48	20.8%
Embassy	27	0	103	26.2%
Foreigner	173	0	319	54.2%
Service	5	0	20	25.0%
Restaurant	6	1	28	25.0%
Bank	15	0	28	53.6%
Total	2,030	24	5,871	35.0%

6.   Findings

Based upon the analysis of non-domestic water consumption, the following findings are noted.

1)   The top five categories in terms of water consumption are commerce, government, factories and companies, military, and schools.   The total water consumption of these top five categories accounts for about 86.3% of the total non-domestic consumption. It should be noted that the number of connection in the commerce category accounts for 70.5% of the total connections.

2)   In the commerce category, the distribution of water consumption among consumers varies from about 2,400 m3/month to 0m3/month. This variation is not a wide range compared with other categories.   The total water consumption of the top 5 consumers accounts for only 3.4% of the total water consumption in this category.

3)   In the government category, water consumption among consumers varies from about 14,000 m3/month to 0m3/month.   There is a big difference in quantity used between consumers. Total water consumption by the top 5 consumers in this category accounts for almost a quarter (22.7%) of the total government water consumption.

4)   In the factory and company category, water consumption among consumers varies from about 50,000 m3/month to 0m3.   There is a big difference in the quantity consumed between consumers.   The total water consumption of the top 5 consumers accounts for 44.2% of this category's consumption.   Especially the first ranking company accounts for almost a quarter of the total category's consumption.

5)   In the military category, water consumption among consumers varies from about 40,000 m3/month to 0m3/month.   There is a big difference in the quantity consumed between each customer.   The total water consumption of the top 5 consumers accounts for 71.7% of the military consumption.   Especially, the first two ranking institutions accounts for almost half of the total military consumption.

6)   In the schools category, the water consumption among consumers varies from about 25,000 m3/month to 0m3/months.   There is a big difference in quantity between each consumer. The total water consumption of the top 5 consumers accounts for 46.1% of school consumption, and the first two rankings accounts for 31.5% of the total school consumption.

7)   In the hospital category, the water consumption among consumers varies from about 23,000 m3/month to 0m3/month.   There is a big difference in the quantity consumed between each consumer.   The first two rankings   accounts for 65.5% of hospital consumption.

8)   In the hotel category, the distribution of water consumption among consumers varies from about 5,000 m3/month to 0m3/month.   There is a difference in quantity between each

consumer. The total water consumption of the top 5 consumers accounts for 50.6% of hotel consumption, with the first two rankings accounting for 35.0% of the total school consumption.

9) In the embassies category, the water consumption among consumers varies from almost 2,000 m3/month to 0m3/month. There is a difference in quantity consumed between each consumer. The total water consumption of the top 5 consumers accounts for 42.7% of embassy consumption.

10) In the foreigner category, the distribution of water consumption among consumers varies from about 400 m3/month to 0m3/month. There is not a significant difference in quantity between consumers. The total water consumption of the top 5 total consumers accounts for only 12.2% of foreigner consumption.

11) In the service category, the water consumption among consumers varies from about 7,000 m3/month to 0m3/month. There is a big difference in the quantity consumed between each consumer. The first ranking accounts for 63.5% of this category's consumption.

12) In the restaurant category, the water consumption among consumers varies from about 5,000 m3/month to 0m3/month. There is a big difference in the quantity consumed between each consumer. The first ranking accounts for 47.2% of this category's consumption.

13) In the bank category, the water consumption among consumers varies from about 2,000 m3/month to 0m3/month. There is a big difference in the quantity consumed between each consumer. The first ranking accounts for 41.0% of this category's consumption.

14) In the analysis of the top 50 consumers, the portion of the top fifty consumers is less than 1% of the total consumers, since the total number of non-domestic consumers is 5360. These top fifty consumers account for 43% of the total non-domestic water consumption.

15) In an evaluation of meter size, a total of 2,054 meters are installed in non-recommended water flow condition. The average number of meters installed in an un-suitable condition rate is about 35.0% of total connections. Especially meters installed in the foreigner and bank categories have high rates of incorrect meter usage, which are 54.2% and 53.6% respectively. 98.8% of the total un-suitable conditions (=2,030/(2,030+24)*100) is classified as situations where the "meter is too large".