# ASSET SURVEY FOR SMALL SCALE PRO-POOR INFRASTRUCTURE IN VIETNAM

# FINAL REPORT

JANUARY 2011


JAPAN INTERNATIONAL COOPERATION AGENCY

NTC INTERNATIONAL CO., LTD.
KATAHIRA ENGINEERING INTERNATIONAL
TOKYO ELECTRIC POWER SERVICES CO., LTD.



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# PREFACE

In response to request from the Government of the Socialist Republic of Viet Nam, the Government of Japan had extended Sector Project Loan (SPL) for “The Rural Infrastructure Development and Living Standard Improvement Projects (SPL I to III)” from 1996 and “Small-Scale Pro-Poor Infrastructure Development Projects (SPL IV & V)” from 2003. Japan International Cooperation Agency (JICA) conducted the survey to analyze the shortcomings in the planning of the infrastructure development projects and their operation, maintenance and management, and to develop the necessary information for the Japanese review of the SPL Projects.

JICA dispatched a survey team, headed by Mr. TSUCHIYA Toshihiro of NTC International Co., Ltd. and consisting of NTC International Co., Ltd. and Katahira Engineering International and Tokyo Electric Power Services Co., Ltd. to the Socialist Republic of Viet Nam between April 2010 and October 2010.

The team held discussions with officials concerned of the Government of the Socialist Republic of Viet Nam, and conducted the site surveys in the survey area. Upon returning to Japan, the team conducted further studies and prepared this final report.

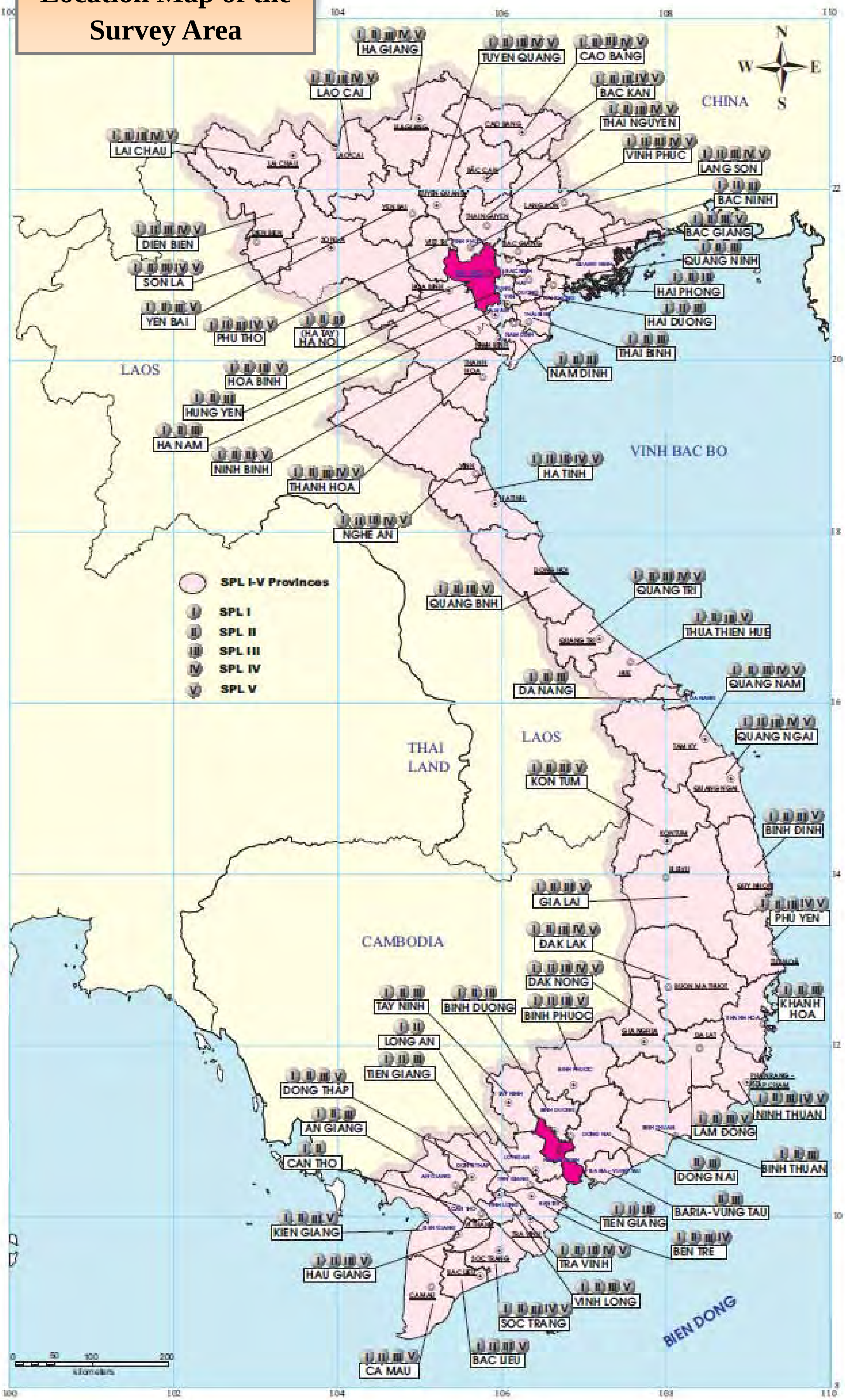
I hope that this report will contribute to the future development of the said Projects, and to the expansion of friendly and cooperative relation between our two countries.

Finally, I wish to express my sincere appreciation to the officials of Government and those concerned in the Socialist Republic of Viet Nam for the close cooperation they have extended to the survey.

January, 2011

Kazuhiho Yoneda
Director General
Southeast Asia Department 2
Japan International Cooperation Agency

# Location Map of the Survey Area



# Abbreviation

| | |
|---|---|
| AC | Asphalt Concrete |
| ACSR | Aluminum Conductor with Steel Reinforcement |
| ALUM | Aluminum Sulfate |
| AMT | Aligned Monitoring Tool |
| BMSY | Bridge Management System |
| BRM | Bituminous Penetration Macadam |
| CIS | Department of Finance and Center for Information and Statistics |
| City PC | City People's Committee |
| CL | Commodity Loan |
| CPC | Commune People's Committee |
| CPU | Central Processing Unit |
| DARD | Department of Agriculture and Regional Development |
| DBS | Database System |
| D/D | Detailed Design |
| DE | District Electricity |
| DOF | Department of Finance |
| DOT | Department of Transportation |
| DPC | District People's Committee |
| DPHC | District Preventive Health Center under PPHC |
| DPI | Provincial Department of Planning and Investment |
| DWSU | District Water Supply Undertaking |
| EVN | Electricity of Vietnam |
| FO | Farmers Organization |
| F/S | Feasibility Study |
| GOJ | Government of Japan |
| GOV | Government of Vietnam |
| IEC | International Electrotechnical Commission |
| IMC | Irrigation Management Company |
| ITD | Industry and Trade Department |
| JBIC | Japan Bank for International Cooperation |
| JICA | Japan International Cooperation Agency |
| L/A | Loan Agreement |
| LAN | Local Area Network |
| LBS | Load Break Switches |
| LVL | Low Voltage Line |
| MARD | Ministry of Agriculture and Rural Development |

| | |
|---|---|
| MB | Management Board |
| MCM | Million Cubic Meters |
| MEC | Ministry of Electricity and Coal |
| MIS | Management Information System |
| MOE | Ministry of Energy |
| MOF | Ministry of Finance |
| MOIT | Ministry of Industry and Trade |
| MOT | Ministry of Transport |
| MPI | Ministry of Planning and Investment |
| MVL | Medium Voltage Line |
| ODA | Official Development Assistance |
| OECF | Overseas Economic Cooperation Fund, Japan |
| O&M | Operation and Maintenance |
| OM/M | Operation Maintenance and Management |
| PAC | Poly-Aluminum Chloride |
| PCERWAS | Provincial Center for Rural Water Supply and Sanitation |
| PCU | Passenger Car Unit |
| PE | Provincial Electricity |
| PMT | Project Monitoring Tool |
| PMU | Project Management Unit |
| PO | Project Owner |
| PPC | Provincial People’s Committee |
| PPHC | Provincial Preventive Health Center under Ministry of Health |
| PPMU | Provincial Project Management Unit |
| PSC | Power Supply Co-operative |
| PWSC | Provincial Water Supply Company |
| PWSU | Provincial Water Supply Undertaking |
| QCVN | National Technical Regulation on Drinking Water Quality |
| RAM | Random Access Memory |
| RC | Reinforced Concrete |
| ROW | Right of Way |
| SAIDI | System Average Interruption Duration Index |
| SAIFI | System Average Interruption Frequency Index |
| SAPROF | Special Assistance for Project Formation |
| SIDA | Swedish International Development Agency |
| SME | Small Medium Enterprise |
| SPL | Sector Project Loan |
| SPMU | Sub-Project Management Unit |

| | |
|---|---|
| TPC | Town Peoples' Committee |
| UFW | Unaccounted-for Water |
| VBA | Visual Basic for Applications |
| VND | Vietnamese Dong |
| VRA | Vietnam Road Administration |
| WQC | Water Quality Control |
| WSB | Branch of Provincial Water Supply Company |
| WSC | Water Supply Company |
| WSS | Water Supply System |
| WTP | Water Treatment Plant |

# Summary

## Chapter 1 Background of the Survey

After the introduction of the Doi Moi (Reform) policy in 1986, the Government of Vietnam (GOV) had challenged to shift its planned economy to the market economy and achieved remarkable economic growth and this economic growth brought the dramatic reduction of the poverty rate in Vietnam from 58% in 1993 to 24% in 2004. However, the economic disparity between the rural area and the urban area is growing. Under these circumstances, the Government of Japan (GOJ) extended the Sector Project Loan (SPL) I to III and the loan was extended to focus on the poor areas from 2003 as the "Small-Scale Pro-Poor Infrastructure Development Projects - SPL IV & V". The total loan amounts of SPL I to V is 48,350 million Yen, and around 1,200 projects were implemented.

However, the assessment of the situations of those constructed facilities is considered to be insufficient due to a great number of projects which spreads throughout the country. Under these circumstances, this Survey aims at identifying the actual situations of all the sub-projects executed in SPL I to V.

The implementing organizations of SPLs are Ministry of Planning and Investment (MPI), Ministry of Finance (MOF), Provincial People's Committee (PPC) and Project Management Units at central level (PMU) and provincial level (PPMU). Project Owner also establishes the Sub-project Management Unit (SPMU).

The PPMU and SPMU transfer the facilities constructed under SPL to the operation, maintenance and management organization (OM/M organization) in line with the related laws and decrees of Vietnam. After the transfer, the PPC takes charge of the operation, maintenance and management of the facilities and the PPMU and the SPMUs are not responsible for the operation, maintenance and management of the facilities though they are also sub-ordinate organizations of the PPC.

## Chapter 2 Purpose of the Survey

The Survey covers four (4) sectors of the road, the electricity distribution, the water supply and the irrigation and consists of the questionnaire survey and the sub-project sites visiting in order to grasp the current operation, maintenance and management situation of them.

The replies to the questionnaire provided the database, which format was elaborated by the Survey Team, with the data and information on the facilities and their operation, maintenance and management situations. The database will hopefully contribute the efficient and cost effective operation, maintenance and management of the facilities.

The Team members could locate the facilities and such information reflected to prepare the SPL Infrastructure Map (location map of the facilities).

The purpose of this Survey is to analyze the shortcomings in the planning of the infrastructure development projects and their operation, maintenance and management, and to develop the necessary information for the Japanese review of the SPL Projects.

# Chapter 3 Implementation of the Survey

As mentioned in chapter 2, the Survey mainly consists of the questionnaire survey and the site visiting by the engineers. The Survey Team entrusted the site survey of electricity distribution and road sectors to Vietnamese consulting firms.

After the delivery of the questionnaire at the end of April, 2010, the Survey Team started the site survey at the beginning of May, 2010 and completed it at the beginning of September, 2010. Regarding the questionnaire survey, the Survey Team unfortunately could not receive the replies to the questionnaires sufficiently.

Apart from the Survey activities of four sectors, the member in charge of database management had started to prepare the database formats for the four (4) sectors. The data input was made from July through the end of September. In the course of the data input, the Survey Team held the workshop on the database targeted the persons related to the SPL projects with the cooperation of MPI in order to disseminate not only the database itself but also the rough concept of Assets Management making use of the database. The opinions collected at the workshop reflected on the database format.

## 3.1 Setting up the Items to be Surveyed

The items to be surveyed consist of i) General Information, ii) Facilities, iii) Current Situation of Facilities, iv) Effectiveness of Sub-project and v) Operation, Maintenance and Management. "General Information", which includes name and location of sub-project, etc., is in common among four (4) sectors and detail of items to be surveyed in remaining categories of each sector are summarized in chapter 3.3 to 3.6.

## 3.2 Method of the Survey

### 3.2.1 Survey Executed

The Survey Team consists of six (6) Japanese and four (4) Vietnamese members.

The General Service Department of MPI cooperated and assisted the Survey Team in the central level and the DPI of provinces worked for delivery of the questionnaires. DPI, SPMU and OM/M organizations provided the Team with indispensable assistance for site survey.

A number of infrastructures are/were constructed through sub-projects in different phases except the electricity distribution sector. The number of infrastructures of the road, electricity, water supply and irrigation sectors to be surveyed is 408, 526, 97 and 84 respectively.

The Survey started its preparation on March, 2009 in Japan and the Team continued the preparation works on April in Hanoi followed by the site visiting survey which took around four (4) months to complete. In parallel with the surveys, the database specialist prepared the database format which would have the data and information collected through the survey. The Survey Team prepared the draft final report on September for comments from the parties concerned. After having the comments, it submitted the final report on November, 2010.

### 3.2.2 Questionnaire Survey

Since it seemed very difficult for MPI and DPIs to identify the OM/M organizations related to SPL I and II, the Team sent the questionnaire to the OM/M organizations and SPMUs related to SPL III to V at the end of April with the assistance of MPI and expected to receive the replies by the end of June at the latest. However, the rate of receiving the replies was low even at the end of June; the Team continued to make effort to receive them as much as possible with the assistance of MPI and JICA. However, the rate of receiving the replies to the questionnaires is less than 50%.

### 3.2.3 Site Survey

Site survey of each sector is summarized in chapter 3.3 to 3.6.

## 3.3 Road Sector

### 3.3.1 Setting up the Items to be Surveyed

The survey items of road sector are summarized as follows:

Facilities: class of roads, width and length of roads, construction area, newly construction or rehabilitation, components of facilities, project owner

Current Situation of Facilities: damaged level, bottleneck, main type of car passing the road, public transportation, the number of traffic accidents

Effectiveness of Sub-project: traffic volume, access to public facilities (markets, schools, hospitals and so on)

Operation, Maintenance and Management: organization and system for operation and maintenance plan, record of rehabilitation, main facilities components which require periodical replacement

### 3.3.2 Site Survey

The road sector executed the survey by the local consultant. The local consultant is in compliance with "Guide for evaluation procedures for employment of consultants, June 2006". There are many sub-projects of the road sector with the total number of 518 sub-projects (The result of the survey is 518 sub-projects instead of 517). Therefore, five (5) survey teams were established to carry out the site survey, team 1 to 5, which took charge of 112, 130, 122, 97, 56 sub-projects, respectively. Site survey had been implemented from May 3rd, 2010 to July 31st, 2010.

## 3.4 Electricity Distribution Sector

### 3.4.1 Setting up the Items to be Surveyed

The survey items of electricity distribution sector are summarized as follows:

Facilities: project cost after construction, construction length of medium voltage (MV) line, construction length of low voltage (LV) line, capacity of installed transformer

Current Situation of Facilities: confirmation of problems after the construction, outage Index such as SAIFI/ SAIDI, confirmation of distribution loss, typical photograph

Effectiveness of Sub-project: construction length of medium voltage (MV) line, construction length of low voltage (LV) line, capacity of installed transformer, electric rate

Operation, Maintenance and Management: OM/M organization, number of maintenance worker, plan of maintenance, problem on maintenance

### 3.4.2 Site Survey

The electricity distribution sector executed the survey by the local consultant. The local consultant is in compliance with "Guide for evaluation procedures for employment of consultants, June 2006". There are many sub-projects of the electricity distribution sector with the total number of 526 sub-projects. Therefore, three (3) survey teams were established to carry out the site survey, North / Central / South team, which took charge of 224, 72, 230 sub-projects, respectively. Site survey had been implemented from April 22nd, 2010 to September 30th, 2010.

## 3.5 Water Supply Sector

### 3.5.1 Setting up the Items to be Surveyed

The survey items of water supply sector are summarized as follows:

Facilities: water source, specification of components of WSS, chemicals used, laboratory, spare parts stocked, year of installation and service life, etc. for grasping the outline of target WSS.

Current Situation of Facilities: amages caused by disaster, history of water supply suspension

Effectiveness of Sub-project: current situation of water supply related to consumers such as the rate of population served, and that related to performance of WSS such as the rate of facilities utilization, the rate of accounted-for water, for understanding the OM/M conditions.

Operation, Maintenance and Management: records of water supply, water surveillance, capability on maintenance, rehabilitation plan, water tariff, bill collection, maintenance of water meter, organization, consumer relations on complaints, as the focal points of OM/M

### 3.5.2 Site Survey

The water supply site survey team consisted of Japanese and Vietnamese engineers made the interview survey with the person in charge of the operation, maintenance and management of the facilities followed by the observation of them. The interview survey had aimed at understanding the current situation of the WSS by asking the questions on the OM/M organizations, current situation of water supply in terms of quality and quantity.

Referring the replies of interview survey, the team observed the WSS starting from the water source up to the distribution pumping station. The points to be paid the attention in the observation are i) injection points of chemicals, ii) water quality in the treatment facilities iii) dimension of treatment facilities, iv) composition of pumping station and v) disinfection facilities.

The site visiting had started at the beginning of May from the provinces of Mekong Delta Region and completed at Phu Xuyen WSS in Ha Noi city (former Ha Tay) on September 7$^{th}$, 2010.

## 3.6 Irrigation

### 3.6.1 Setting up the Items to be Surveyed

The survey items of irrigation sector are summarized as follows:

Facilities: dam and reservoir, headworks, pump station, irrigation canal , aquaduct, siphon, on-farm facility, drainage canal, sluiceway, flood dyke, tide gate

Current Situation of Facilities: damages due to poor quality of construction, problems of on-farm development, shortage of water resources, drought damages, drainage damages, flood damages, problems due to change of socio-economic conditions, problems relating to water quality

Effectiveness of Sub-project: beneficial area, beneficiary, planted area, harvested area, crop calendar, cropping intensity, production volume, yield of product, typical farm household economy

Operation, Maintenance and Management: OM/M organizations (name, number of staffs, equipment, responsibility), OM/M activities (manual, plan, operation records, maintenance records), irrigation water fee, financial conditions of OM/M organization (cost, subsidy, annual expenditures, annual revenues)

### 3.6.2 Site Survey

The irrigation site survey team consisted of Japanese and Vietnamese engineers made the interview survey, followed by the observation of facilities. Considering the accessibility during the rainy season, the survey was conducted from the south to north. The survey was commenced at Ca Mau province on May 5$^{th}$, 2010, and completed at Gia Lai province on September 17$^{th}$, 2010.

# Chapter 4 Outline, Current Situation and Utilization of the Facilities Constructed under SPL

## 4.1 Road Sector

### 4.1.1 Outline of Facilities

#### (1) Outline of Facilities

Number of Sub-Project:

According to the materials from MPI, there are in total of 517 sub-projects under the road sector. However, based on the result of the site visits, the number of the sub-projects was revised as follows:

| | |
|---|---|
| The number of the sub-projects based on the materials: | 517 sub-projects |
| The number of the sub-projects to be added: | 1 sub-project |
| The revised number of the sub-projects based on the site survey: | 518 sub-projects |

Approximately 100 sub-projects were executed at SPL I, II and III respectively. In contrast, number of sub-projects in SPL IV and V is 60 and 68 respectively. Hence, they were too many to have sufficient fund for reasonable scale of the road project, and accordingly the average fund for each sub-projects became too small for those in SPL I and III. Since SPL IV, number of sub-projects is reduced so that the average fund for sub-projects was increased.

Type of Construction: There are in total 518 sub-projects, out of which 421 sub-projects improved the existing roads and 97 sub-projects newly constructed roads. When the road is newly constructed, the problem of Right of Way (ROW) will occur, and this often takes the time for negotiation and the conferences with all the relevant persons. In addition, if the present topographic condition in the mountainous area changes, it will affect the environment. Therefore, the Project Owners (POs) prefer the sub-projects with improvement on the existing road. In case of consideration for the economic efficiency of projects, the improvement of existing road is usually selected. The SPL Projects accordingly implemented a number of sub-projects with such contents.

Width of Roads: Most of the roads constructed under SPL Projects are small scale as better indicated in their respective names. Approximately 70% of the roads have the width of less than 7 m and the half of them has less than 4m. It seemed to come from the facts of low traffic volume and a lot of sub-projects to improve the existing roads by widening them.

Type of Pavement: Most of the roads under the SPL Projects have asphalt pavement. Only a few roads have gravel pavement.

Road Class: The design specification of SPL road sub-projects is in accordance with "TCVN4054-85/98/2005 (the latest version is TCVN4054-2005, Third Edition), Highway-Specifications", which is applied to expressways and other general roads. "22TCN 210-92, Rural Road Design Standard" issued by the Ministry of Transport (MOT) is applied to small roads. A lot of roads were constructed under the SPL Projects (80%) with the scope of class IV-VI.

**(2) Components of Facilities**

The main components of facilities constructed under road sector sub-projects are categorized into the following six (6) types: i) Tunnel, ii) Bridge, box culvert and pipe culvert, iii) Retaining wall, iv) Embankment, v) Drainage facilities and vi) Accessory facilities.

### 4.1.2 State of Utilization of Facilities

Traffic Volume: The number of the sub-projects with their traffic volume lower than 1,000pcu/day accounts for 80% of the total. It shows that traffic of the roads constructed under SPL Projects is very small. As the width of roads becomes narrower, traffic volume comes to tend to decrease. Accordingly, road planning seems to be valid.

Main Vehicles: Motorcycle, car and truck are the main vehicles used in the sub-project roads. It is noted that cars and motorcycles occupied almost 60% of the total.

Condition of Utilization of Other Facilities: It was observed that there were many straws covering the road surface. The respondents said that it was important to dry the farm crops for farmer's living and their livestock. However, piles of straws on the road made it difficult to confirm the conditions of the road for drivers, and would cause problems in safety.

### 4.1.3 Current Conditions of Facilities

Damages Affected by Disaster: There are three (3) kinds of damages caused by disasters, i.e. landslides, rock falls and floods (scouring/earth-flow). It was confirmed there were 30 sub-projects completely or slightly damaged by such. The characteristic of the road damaged by natural disasters are: i) roads classified in lower than class IV and ii) roads in mountainous area.

Capacity:

- **SPL Sub-Project with Bottleneck**

  There are some sub-projects with a bottleneck at the constructed roads. The bottlenecks might cause traffic jam.

  Most of the bottlenecks were "the bridges", because they were not constructed as the portion of road sub-projects and the roads constructed under SPL Project was connected to the existing bridges due to the high estimated cost for the bridge construction.

- **Road without Continuity**

  From Km 27 (NR 2) to Trung Thanh Bach Ngoc Triway and Trung Thanh Bridge, SPL IV (Ha Giang province, Vi Xuyen district)

At the time of the site survey, the bridge was still under construction. The existing wire bridge was used as the detour, and people had to be careful on their speed and load of vehicles when they passed through. Also, it was deteriorated and accordingly had problems on safety.

Although the original plan included construction of the both road and bridge, due to the price escalation of the materials, SPL fund was used only for the road portion. Therefore, the bridge was completed using surplus fund of SPL IV. However, completion of the entire road section was delayed due to the bridge construction works.

In the early September, 2010, the survey team contacted with DPI in Ha Giang province and confirmed on the progress of the bridge construction. The bridge was completed and was opened for traffic in early September.

Deterioration by Aging and Insufficient Maintenance and Management: Based on the degree of damage, roads sub-projects were evaluated as follows.

(Evaluation Rank)

A: There is no damaged
B: There is pothole / the other damage; small scale
C: There is pothole / the other damage; middle scale
D: There is pothole / the other damage; overall
E: Partly damaged / problem in safety
Other: Under Construction

It is noted that damages by natural disaster which is the accidentally occurred is not included in the analysis.

Rank B is "almost in good condition ", but "There are small damages" (i.e. small rutting of pavement, a small crack of pavement). Sub-projects with rank B don’t have problem about the vehicle traffic, and it is almost considered as rank A.

The roads of 87% (453) of the sub-projects are almost in good condition. The sub-project with rank C and D are 25 and they are desirable to be repaired without delay.

Alternation of the roads under SPL Projects was not confirmed.

## 4.2 Electricity Distribution Sector

### 4.2.1 Outline of Facilities

#### (1) Outline of Facilities

In general, wires, distribution transformers and the other equipments are the essential components for the distribution network. In the SPL Projects these facilities are needed in the same way. Major constructed projects in the Electricity Distribution sector are summarized as follows.

Construction of Medium Voltage of Distribution Feeder (Poles, Conductors, Insulators etc)

Poles: Centrifugal Concrete for MVL (based on the Technical Regulations issued by MOIT)

Conductors: Aluminum Conductor with Steel Reinforcement (ACSR international acronym = AC Vietnamese)

Insulators: Standing Ceramic or Hanging Glass

Station: Outdoor Construction with Hanging Poles

**Construction of Low Voltage Line (Poles, Conductors, Insulators, etc)**

Rectangular section or centrifugal concrete poles for the LVL with naked conductor for non populated areas and with insulated wires for populated areas

**Distribution Transformer (Transformers, Branch box for LV, Arrester, Cut-out switch, etc)**

Load Break Switches (LBS) and Capacitors are installed in the MVL but the investment has been implemented by EVN sown resources in order to keep the reliability.

### (2) Components of Facilities

Medium Voltage (MV) of Distribution Feeder: the following MV feeder has been constructed.

| Voltage | Type | Size of Conductor |
|---|---|---|
| 10 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |
| 12.7 kV | Overhead Line, 1 phase | AC35, AC50, AC70, AC95(2wires) |
| 15 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |
| 22 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |
| 35 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |

Low Voltage (LV) Line: the following LV line has been constructed.

| Voltage | Type | Size of Conductor |
|---|---|---|
| 0.4 kV | Overhead Line, 3 phases | AV35, AV50, AV70, AV95,<br>A35, A50, A70, A95 |
| 0.23 kV | Overhead Line, 1 phase | AV35, AV50, A35, A50 |

Distribution Transformer: the following Distribution Transformer has been installed.

| Voltage | Capacity |
|---|---|
| 10/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA,180kVA, 250kVA, 320kVA |
| 12.7/0.23 kV | 15kVA, 25 kVA, 31.5kVA, 35kVA, 50kVA, 75kVA |

| Voltage | Capacity |
|---|---|
| 15/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA, 180kVA, 250kVA, 320kVA |
| 22/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA, 180kVA, 250kVA, 320kVA |
| 35/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA, 180kVA, 250kVA, 320kVA |

Note: Transformer of 12.7kV is used for single phase and is connected between 22kV phase and ground, so that the secondary voltage is only of 0.23kV.

### 4.2.2 State of Utilization of Facilities

Overview for Installation of Facilities is shown in the following Table.

| Region | MV and LV line (km) | Distribution Transformer (kVA) |
|---|---|---|
| North East | 2,564.0 | 45,571.0 |
| North West | 505.2 | 8,677.0 |
| Red River Delta | 620.8 | 34,440 |
| North Central Coast | 2,353.8 | 39,536.0 |
| South Central Coast | 1008.5 | 26,797.5 |
| Central Highlands | 884.7 | 18,778.0 |
| South East | 862.0 | 13,370.5 |
| Mekong River Delta | 2,487.0 | 27,280.0 |
| Total | 11,286.0 | 214,450.0 |

Electrification Rate in all sub-project areas is remarkably increased as shown in the following Table.

| Region | Electrification Rate (Before 1996) | Electrification Rate (As of 2010) |
|---|---|---|
| North East | 42% | 78% |
| North West | 30% | 68% |
| Red River Delta | 70% | 98% |
| North Central Coast | 48% | 72% |
| South Central Coast | 66% | 86% |
| Central Highlands | 48% | 82% |
| South East | 85% | 98% |
| Mekong River Delta | 72% | 96% |

### 4.2.3 Current Conditions of Facilities

Damages Caused by Disasters

Since all the power consultant companies preparing for ODA projects are the members of the EVN, the rule conformity for project preparation needs to be reliable everywhere nationwide. All the OECF and the JBIC survey missions in the past, found the best strong and stable endurance of invested electric facilities against disasters everywhere. Therefore, the facilities have shown that they can function even during and after catastrophe.

The most dangerous disaster for the electric line is landslides in wet condition. However, under the regulation, consultants-designers conduct their investigation for geological and topographical data enough for line layout selection. Hereby, this kind of disaster could not harm most of infrastructure components of the electricity sector in rural area.

The design of all feeders and lines from a network MV isolator to household connected kWh meters should be based on the "Technical Regulations for Rural Electrification System" issued by the MOIT. All facilities can endure against disasters, rarely damaged.

Capacity:

In general electric facilities endure their operational capacity during their technical-economical life stipulated by Vietnam and the IEC norms and standards.

The proper cross-section of wire conductor would be generally determined considering both the electrical factor and the mechanical factor. The former affects the voltage drop and the losses of distribution lines, while the latter has close relationship to the tension of wire and the wind force. In the site survey, some cases were found where the size of conductors seemed to be too small to maintain the line voltage in a proper range.

Small-size wires are not expensive and easy for installation, on the other hand, the resistance of conductors becomes higher in proportion to the reciprocal number of cross section. So if the size is too small in comparison with that of proper wires, the resistance of conductor would be so high. As a sequence the voltage drop will be so large and the power quality for customers won't be satisfactory. In addition, losses caused by the resistance of wires are proportional to the resistance, so too small-size wires are not beneficial. The lack of maintenance of facilities is the cause of these cases. In spite of the growth of demand for electric utility power, the OM/M organization will keep using the small-size wires and not replace the wires by the bigger one. Now the problems about voltage are not reported. But in the near future home appliances or the processing machines will be changed to more advanced ones, and then the voltage drop should be improved. As the advanced loads are so sensitive to the receiving voltage, and the proper range of voltage is essential.

Deterioration by Aging and Insufficient Maintenance and Management:

The most significant example about equipment deterioration is the rust on the surface of the equipment. About one fourth of distribution transformers had the rusts on their surfaces in spite of the mild conditions surrounding them and the short time after their installation. Rusts grow and make hole on the surface, which will bring the leakage of insulating oil filled inside the distribution transformer.

Insufficient maintenance and management could harm the facilities almost in Low Voltage side if these components belong to the ownership of non-professional agents. This case had, longtime ago, happened in the commissioning time after implementation. But while handed to local EVN members, the conditions of the maintenance and management were improved and perfected. ODA facilities are in the first priority of all careful operations in maintenance and handling. The deteriorated or damaged component should be promptly changed by other of the same size and capacity, in order to conserve the continuity of power supply to the customers.

Some outages in the distribution MV feeders occurred due to contact by tree or animals, whenever the safety corridor was encroached (tree growth, …) as the line of Medium Voltage is wholly not insulated, while the LV line under the SPL Projects has no faults by the contacts, because the LV line is installed by insulated wires especially in populated areas. But with the attention of participatory community, those defects are day by day discovered, promptly informed to EVN member's staff and treated in early time.

<u>Alternation</u>:

The alteration of 6,10,12.7,15kV into 22, 35 kV systems for the Medium Voltage are compelled after the exhaust level utilization and the last time of component technical life in the old systems.

The 10kV Medium Line under the SPL Projects were to 22/35kV Medium line under EVN finance, which means to increase the acceptable consumers and improve the distribution loss.

## 4.3 Water Supply Sector

### 4.3.1 Outline of Facilities

#### (1) Outline of Facilities

The total number of WSSs projected under the SPLs is 97 in which 23 WSSs have not been completed the construction works yet. However, two (2) WSSs under construction have already started the operation for the rehabilitation and expansion scheme. The total number of WSSs under operation is consequently 76.

The WSS varies with the water source, the raw water quality, topographic conditions, etc. If the water source is groundwater, the raw water quality is rather good and it does not necessitate complicated water treatment system. However, if the groundwater contains high concentration of iron, it should be removed by oxidization of iron followed by sedimentation and filtration. In case of surface water, usually it contains high turbidity and necessitates the system of sedimentation and filtration. The water to be distributed should be disinfected by chlorine which has residual effect, therefore it ensures the safe of drinking water for consumer. The National Technical Regulation on Drinking Water Quality - QCVN 01:2009/BYT, Ministry of Health (hereinafter referred to as QCVN01) stipulates that residual chlorine concentration of the water is 0.3 – 0.5 mg/L and it should be monitored at least one (1) time per week by the water provider. When the water becomes clear and safe after treatment, water is delivered to each consumer households through distribution and service pipelines. Volume of delivered water is measured at the outlet of WSS by a flow meter and at the inlet of each household by a water meter installed by the consumer or the water provider.

**(2) Components of Facilities**

The Water Sources of 97 WSSs are groundwater, surface water, both of them, stagnant water and another WSS, and the numbers of WSS which use respective water sources are 36, 51, 1, 7 and 2. 20 WSSs among the 36 WSSs operate the iron removal. It should be noted that the water source of Vinh Tuong WSS in Vinh Phuc province reportedly contains arsenic and constructed WTP has the arsenic removal facilities. However, the detail of arsenic contents is not clear because the raw water analysis results are not available in SPMU as well as DPC.

Outline of WTP is that the raw water delivered by pump or gravity from the surface water source contains impurities which may cause significant health problems or give the annoyance on the consumers. It is important to improve the raw water quality by a treatment system to meet the drinking water quality stipulated in the QCVN 01. Though it varies according to the raw water quality, the treatment system consists of chemical feeding facilities, sedimentation basins, filters and disinfection facilities.

Chemical Feeding Facilities: The chemical feeding facilities are used for the preparation of coagulant solution which is put into the raw water to make very small suspended substances together and they become like soft rather large stuff which is easy to settle.

Sedimentation: The large mass of impurities in the raw water made by the aid of coagulant is settled and drained in the sedimentation basin. The suspended solid contact sedimentation, which in general seems to be difficult to operate, is mainly used in the WSSs. Other types of sedimentation used for the WSSs are the horizontal-flow sedimentation (8 WSSs), inclined tube or plate sedimentation (5WSSs) and up-flow sedimentation (3 WSSs).

Filter: The filtration is the final process of removing impurity from raw water. It takes remaining purities from the water which flowed out from the sedimentation basin. During passing thorough the filter, the filter media, which is in general sand, absorbs almost 100% of purities. Types of filter used for the WSSs are rapid sand filter (66 WSSs), pressure filter (7 WSSs), up-flow filter (6 WSSs) and rapid sand filter with up-flow pre-filtration (3 WSSs). Backwashing by water using a pump or an elevated tank is mainly used for filter media cleaning and 12 WSSs apply a blower for the air washing followed by water washing by the pump.

Disinfection Facilities: The disinfection is the final stage of water treatment. Disinfectant, which form is solution, is injected into the filtered water and it is stored in the treated water tank. The WSSs surveyed use three types of disinfectants. They are liquefied chlorine (58 WSSs), sodium hypochlorite solution (22 WSSs) and calcium hypochlorite solution (5 WSSs). It is noted that five

(5)WSSs do not execute the disinfection.

Distribution: The treated water is distributed by making use of the gravity if the location of WSSs is higher than their service area. In contrast, a WSS, which locates itself in the place where its elevation is similar to that of its service area, should make the pressurized distribution by pumps. Types of distribution applied to the WSSs are by gravity (38 WSSs), by pump pressurized (49 WSSs) and both of them (4 WSSs).

53 WSSs which adopt the pressurized distribution have to control the pressure due to the fluctuation of water demand and they adopt the measures of i) control of the number of pumps in operation (16 WSSs), ii) control of pump motor rotation by frequency inverter (22 WSSs), diversion of water to high placed tank (7 WSSs) and so forth.

Laboratory: There are only 22 WSSs, which have the laboratory, among 97 WSSs though the WSS which has even only one water analysis device was considered that it has the laboratory. Only 16 WSSs among 63 WSSs, which have chemical sedimentation, have the jar tester which is necessary to determine the dose of coagulant in order to operate the WTP appropriately.

### 4.3.2 State of Utilization of Facilities

Two (2) Operation Indicators are applied by the team such as “Hour of Water Supply” and “Rate of Facility Utilization” which is acquired by “Average Daily Water Supply / Capacity of WSS” to look at the current situation of utilization of the 76 WSSs in operation.

Hour of Water Supply: Since the stable water supply is one of the targets of the water supply project, it is preferable for all the WSSs to achieve 24 hours water supply. 24 WSSs among 76 WSSs in operation do not operate 24 hours water supply.

Rate of Facility Utilization: When the Rate of Facility Utilization is defined as the ratio of “Average Water Supply” to “Capacity of WSS”, if this value is high, it implies that the WSS is utilized well. The maximum, minimum and average values of the Rate of Facility Utilization of 76 WSSs in operation are 1.75, 0.08 and 0.49 respectively. Regarding the WSSs of which Rate of Facility Utilization is low, it is discussed later.

### 4.3.3 Current Conditions of Facilities

Damages Affected by Disasters: There is no WSS damaged by disasters.

Capacity: The capacity of 97 WSSs varies from 278$m^3$/day to 16,000$m^3$/day, however, the most of WSSs have the capacity of 1,000$m^3$/day to 4000$m^3$/day. The number of WSSs of which capacity drops in this range is 77. There are 10 WSSs of which maximum daily water supply and/or average water supply is same to the design capacity or more.

Deterioration by Aging and Insufficient Maintenance and Management: The survey team did not observe any deterioration of facilities by aging or insufficient maintenance and management, however, Luong Tai WSS of Bac Ninh province has the difficulty of operation due to the subsidence of the sedimentation basin caused by the ground subsidence and Thuong Xuan WSS of Thanh Hoa province did not seem to use the WTP for long time.

Alternation: There are several WSSs which made alteration of installations or equipment. Two (2) WSSs increased capacity, One (1) WSS lost four (4) water source wells out of 10, it does not affect the capacity of WSS, Two (2) WSSs have not utilized some parts of WTP due to good water quality and Eight (8) WSSs converted the disinfectant from liquefied chlorine to hypochlorite.

## 4.4 Irrigation Sector

### 4.4.1 Outline of Facilities

#### (1) Outline of Facilities

Location: The total numbers of related provinces and facilities are 36 and 84, respectively. The maximum number of the facilities per one province is seven (7) at Ha Tinh province.

Project Owner: The project owners are PPC, DARD, DPC and IMC (Irrigation Management Company). The dominant project owners are DPC and DARD with 50% and 36% of the facility number, respectively.

Major Components: The major components of the facilities are classified into eight (8) types, i) dam, pump station and canal, ii) dam and canal, iii) dam, iv) pump station and canal, v) pump station, vi) canal, vii) sluiceway and viii) river improvement and riverbank protection. The dominant patters are “dam and canal”, “canal” and “pump station and canal” showing 42%, 19% and 18% of facility number, respectively.

Beneficial Area: The beneficiary areas of the SPL facilities range from 2.2 ha to 18,020 ha. The total area is around 107 thousands ha, and the average is 1,300 ha. The facilities with the area more than 1,000 ha, 100-200 ha and less than 100 ha account for 23%, 22% and 20% of facility number, respectively. The regional distribution of beneficial areas seems not to have remarkable tendency.

Year of Construction and SPL Phase: All facilities were/are constructed in SPL III, IV and V, and the construction periods of all the facilities range from 2000 to 2011. The facilities which were / will be completed at year 2001-2005 and 2006-2010 account for 39% and 57% of the number of facilities, respectively.

Current Conditions: Current conditions of the facilities are classified into four (4) categories, i) under D/D, ii) under construction, iii) completed and iv)completed (some portions not yet constructed). Completed facilities account for 86% of facility number.

#### (2) Features of Major Components

Dam: Dams are classified into two (2) types, i) earth fill dam and ii) concrete dam. There are facilities with plural dams. The total number of dams and the total reservoir capacity are 49 and around 113 million cubic meters, respectively.

Head Works: Head works are classified into three (3) types, i) concrete weir, ii) earth weir (protected with concrete, etc.) and iii) rubber dam. The total number of head works is 44 including 42 concrete weir type.

Pumping Station: The objectives of pumping stations are classified into three (3), irrigation, drainage and irrigation-cum-drainage. The total number of pumping stations is 51 including 39 for irrigation, 10 for drainage and 2 for irrigation-cum-drainage purpose.

Canal: Canals are classified into three (3) types, i) irrigation, ii) drainage and iii) irrigation-cum-drainage. The total canal length is around 1,420 km, of which around 1,265 km is irrigation canal, around 20 km drainage and around 135 km irrigation cum drainage. The major canal types of irrigation canal are concrete flume, brick, concrete block and earth lining canal.

### 4.4.2 State of Utilization of Facilities

General: Utilization of facility was grasped based on the farm area which was cultivated with irrigation water from the facility constructed under the SPL Projects (irrigated cultivation area). The data on the irrigated cultivation area was collected from the PO and/or OM/M organization in the interview survey because they grasped roughly the area in every year based on the harvest condition of crops, etc.

Facilities with Problem: The utilization of facilities is evaluated based on the conditions of the completed facilities (include those completed but some portions have not been yet constructed). In the evaluation, “the ratio of irrigated cultivation area to irrigation beneficiary area” was used as the indicator. As a result of the evaluation, five (5) facilities show the ratios less than 100% and these facilities were judged to have problems. The state of facility utilization is described below.

#### (1) Ea Yeng Reservoir, Dak Lak Province

The irrigation beneficial area is 50 ha. Under SPL III, Ea Yeng Dam (storage capacity 0.910 MCM) was constructed in 2001. Main canal of 1.5 km was also rehabilitated from earth lining to concrete block canal. Under these conditions, the secondary and tertiary canals are earth lining ones which locate in the downstream of the main canal constructed under the sub-project. Since there was water leakage, etc. from the secondary and tertiary canals, 92% of the irrigation beneficiary area is only irrigated.

#### (2) An Hung Dam, Ha Tinh Province

The irrigation beneficial area is 219 ha. An Hung Dam was constructed by the GOV (under own budget) in 1978. Its basin area is 140 ha. Under the SPL IV, the An Hung Dam was rehabilitated with the storage capacity of 1.06 MCM. In addition, main canals (3.8 km) were rehabilitated from earth lining to concrete flume canal. Under these conditions, the natural mixed trees in a forest of private land of around 30 ha in the dam basin was changed to rubber tree before one (1) year of the commencement of the rehabilitation. Due to the influence of this change, the runoff of water from the dam basin was reduced by around 10 %. As a result, 90% of the irrigation beneficiary area is currently irrigated.

**(3) Khe Coi Dam, Ha Tinh Province**

The irrigation beneficiary area is 80 ha. Khe Coi Dam was constructed in 1956, and main and secondary canals were also constructed by the GOV (under own budget). Its canal type was earth lining. Under SPL IV, Khe Coi Dam was rehabilitated (storage capacity 0.682 MCM). Main canal of total 2.0 km was also rehabilitated from earth lining to brick canal. Under these conditions, 88% of the irrigation beneficiary area is irrigated because a siphon of the main canal is not yet constructed. In addition, deterioration of the intake facility at the north of dam due to a gate trouble, deformation of the north main canal due to released water from the said un-controllable dam intake facility, and deformation of south main canal due to low construction quality were observed. These parts will be repaired until 2011.

**(4) Song Rac Irrigation, Ha Tinh Province**

The total beneficial area is 8,190 ha. Song Rac Dam (storage capacity 125.5 MCM), and main, secondary and tertiary canals were constructed by the GOV (under own budget) during 1986-1994. Major canal type was earth lining. Under these conditions, 7.9 km of secondary and 3.8 km of tertiary canals, which located in the end of the area, were rehabilitated from earth lining to brick, stone and concrete flume canal under SPL III. The irrigation beneficial area relating SPL is 1,490 ha. Because the main and secondary canals, located in the upstream of the SPL portions, are earth lining type constructed during 1986-1994, there is water leakage, etc. from these canals. Since the SPL canals are located in the downstream of the previous earth lining canals, the irrigation water of the SPL canals results in insufficient sometimes. As a result, 90% of the irrigation beneficial area is irrigated at present.

**(5) Quang Xuong Irrigation, Thanh Hoa Province**

The irrigation beneficial area is 1,023 ha. Quang Tam Pump Station was constructed in 1995, and main and secondary canals were constructed with earth lining in 1998. These facilities were constructed by the GOV (under own budget). Under these conditions, 6.3 km of main and 4.45 km of secondary canals were rehabilitated under SPL III. The major canal types were concrete block and brick. However, these rehabilitated canals, especially located in/around residential areas with length around 0.4 km, are deformed remarkably by scoring of sands behind concrete blocks due to low construction quality. In addition, these canals are deteriorated due to the disposal of household solid waste. 80% of the irrigation beneficial area is irrigated at present. In addition, the pumps are deteriorated.

### 4.4.3 Current Conditions of Facilities

Damages Affected by Disasters

Among natural and man-made disasters, only flood damages were reported and recognized during the site survey. The number of affected facilities is three (3) as follows:

Sin Chai Irrigation System, Lao Cai province: destruction of the canal, which is constructed on the steep slopes of the mountain, caused by floods and falling rocks (1 km length). These damages are repaired after each time of occurrence.

Khe Ngang Reservoir, Nghe An province: destruction of the canal caused by floods during rainy season (1 km length). These are repaired after each time of occurrence.

La Bach Reservoir (Stage 2): destruction of the canal caused by floods (this canal was completed in 2006) (0.4 km length). These are damages during the construction of the dam.

Capacity

Any damages are not observed and reported regarding the capacity of facility_

Deterioration by Aging and Insufficient Maintenance and Management:

Deterioration by aging and insufficient maintenance and management were confirmed and reported at two (2) facilities during the site survey, Khe Coi Dam in Ha Tinh province and Quang Xuong Irrigation in Thanh Hoa province.

Alteration:

Any alteration were not observed and reported..

# Chapter 5 Operation, Maintenance and Management of the Facilities

## 5.1 Road Sector

### 5.1.1 Conditions of Operation, Maintenance and Management of the Facilities

Operation:

There are no operation activities for the facilities constructed under the road sector sub-projects.

Maintenance

The maintenance of SPL roads are conducted by companies or state-owned organizations under DOT, DARD (Department of Agriculture & Rural Development), District People's Committee (DPC), City People's Committee (City PC) and Town People's Committee (TPC).

According to the questionnaire, total of 485 sub-projects (94%) answered as they have annual maintenance and financial plans. And, 56 sub-projects (equivalent to 11%) answered that they conducted major repair works. The number of sub-projects that have executed large scale repair / small scale repair was 148 sub-projects. However, it seemed such records and information would not be maintained.

The maintenance method of the facilities constructed under SPL is decided by a regular inspection.

There is a case to cooperate with Commune People's Committee. However, frequency of inspection is not specified, and it varies depending on the OM/M organization. The frequency of inspection is summarized as follows:

- Inspect road conditions once a week
- Inspect road conditions once a week, or urgent inspection in case of emergency caused by typhoon / heavy rain
- Inspect road conditions once a month
- Inspect road conditions once in 2-3 months

Management

The management organizations on road maintenance are divided into five types: i) DOT, ii) DARD, iii) DPC, iv) City PC and v) TPC.

Generally, under the management of DOT, OM/M was conducted by two (2) to three (3) maintenance companies according to the scale of facilities such as total length of a road.

The number of staffs in a maintenance company was usually more than that of a state organization. The numbers of sub-projects with more than 100 staffs in a maintenance company was 113 (67% of all OM/M companies).

### 5.1.2 Organization and System of Operation, Maintenance and Management of the Facilities

Operation, Maintenance and Management Organization

Implementation of a road sub-project is managed by the Project Owner (PO). After the completion of the sub-projects, the facilities are then handed over to each province. Then, a province transfers the facilities to OM/M organizations through DOT, DPC, City PC, TPC. The OM/M organizations conduct the management, operation, repair works, protection and so on in accordance with the contract or circular or degree.

Operation, Maintenance and Management System

The OM/M organizations are categorized as follows:

- Regarding the OM/M companies established under DOT such as Joint Stock Company and Limited Company, a contract with DOT or DPC is usually made for regular maintenance of the road. DOT requests the fund for the OM/M as the annual road budget to the provincial government.
- The state organizations are divided into five types such as i) DOT, ii) DARD, iii) DPC, iv) City PC / TPC and v) Commune. They are subdivided into 13 types, and the most popular OM/M organization of roads constructed under SPL Projects is "Industry & Trade Division"

under DPC. However, the state organizations rarely conduct the OM/M by themselves. Most of them entrusts the works to small scale contractors who provide works crew or worker temporally.

- Sub-Project Management Unit (SPMU) for road maintenance is under DPC.
- The maintenance organization under City PC and TPC is “Urban Infrastructure & Economic Division.”
- Concerning the roads constructed under SPL V, they are still under warranty period, so handing over the facilities to PO has not been completed yet. The warranty period is about one (1) to two (2) years after the completion of construction which highly depends on the PPC Decision to assign the OM/M organization.

## 5.2 Electricity Distribution Sector

### 5.2.1 Conditions of Operation, Maintenance and Management of the Facilities

<u>Operation</u>

Depending on the voltage, electricity distribution assets are divided into two (2) types and they belong to two (2) different owners:

- District Electricity (DE) for Medium Voltage (MV) facilities
- Power Supply Cooperative (PSC) for Low Voltage (LV) facilities

Although the final owner of the electrical assets varies, according to the Law of Electricity, district and provincial members of EVN should do their basic management task, whenever the power supply has a problem.

Nearly all the OM/M organizations, or current assets owners, belong to EVN, the operation of the facilities is proceeding smoothly. The electricity tariff is fixed by the government as current expenditure for social infrastructure that is acceptable for all users.

<u>Maintenance</u>

Maintenance (monitoring, small-scale repair, large-scale repair, improvement, alteration, etc.) of the facilities is ensured by the local member of EVN. All these activities are planned yearly by DE and approved by PE in the last month of year and then conducted in the next year without delay, nationwide.

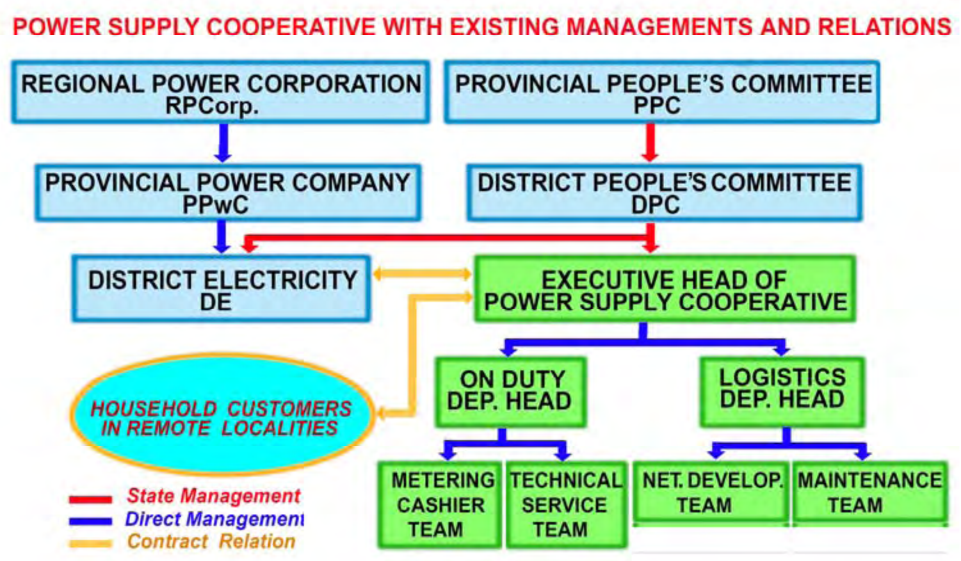
<u>Management</u>

For a long time, distribution network including facilities constructed under the SPL Projects has been managed by mainly EVN. Hence, EVN has abundant experiences, especially in the rural areas.

### 5.2.2 Organization and System of Operation, Maintenance and Management of the Facilities

Operation, Maintenance and Management Organization

The relationship among PSC, DE and government is shown in following figure.




Furthermore, OM/Ms of all facilities constructed under SPL Projects was transferred to EVN based on the decision by GOV in March 2nd 2009 and the Inter-ministerial Circular No.06-2010 / TTLT-BCT-BTC on February 3rd 2010 issued by MOIT and MOF.

Operation, Maintenance and Management System for Emergency Cases

OM/M costs for emergency is funded by EVN own resources, which are backup funds from power tariff income planned by the PE and approved by the regional power corporation. Normally DE request budget to the upstream organization of EVN. The budget is decided taking into consideration the size of the outage and a fixed time being within regulated by the Law of Electricity.

## 5.3 Water Supply Sector

### 5.3.1 Conditions of Operation, Maintenance and Management

Measurement: If the OM/M organization does not measure the water volume taken, it cannot grasp the water discharged from the sedimentation basin, used for the cleaning of the filters, and so forth. Since the water inside the WSSs is paid cost for energy, etc., it is important to measure and record such water in order to reduce it. The average UFW (Unaccounted-for Water) rate of 50WSSs in operation is around 21%. For reducing the UFW, having correct volume delivered from the WSS and that received by each consumer is important. It is consequently necessary to install the flow meter properly and to use appropriate size of the flow meter and to know the characteristics of the meters.

The QCVN 01: The QCVN 01 stipulates the allowable values of copper, iron and manganese more strict than those in the old one and added the parameters of pesticides, disinfectant by-products, radioactive constituents, etc. Frequency of water quality monitoring was a little bit increased. However, it can be said that there is not a big difference between new regulation and old one. New regulation, QCVN 01 does not seem to affect the operation, maintenance and management of the WSSs.

Water Analysis: Most of WSSs depend their water analysis which is the duty of water provider on the PWSC or PPHC which is the WQC agency though they analyze basic parameters such as turbidity, residual chlorine, etc. by themselves. Two (2) WSSs do not execute WQC. Parameters analyzed in the WQC by water provider is mainly Turbidity, pH and Residual Chlorine, however, a number of WSSs analyze more. The water analysis frequency applied by 53 WSSs varies from "every one (1) hour" to four (4) months. However, 22 WSSs execute the water analysis in the frequency of everyday or less.

Maintenance Plan: 44 WSSs among 76 in operation prepared the maintenance plan while 25 WSSs do not prepare. It is said that if the transfer of the facilities from the PO to the OM/M organization has not been completed, the OM/M organization usually does not prepare the maintenance plan. There are two OM/M organizations which do not execute the maintenance saying that the facilities are quite new. However, it is generally recognized that the possibility of taking place of troubles in the first or second years from starting the operation high.

Daily Maintenance: Daily maintenance is mainly looking over of all the installations, equipment, etc. of the WSS for taking necessary measures when staffs observe abnormal phenomena such as noise, leakage of liquid, etc, and supply movable devices such as pump, motor, valve, etc. with grease and/or oil, and so forth.

Breakdown Maintenance: Breakdown maintenance of the WSBs, the method applied is similar in most of the provinces. When staffs of a WSS find out a breakdown, they inform it to PWSC and it sends a staff to the site for the measures should be taken and the breakdown is repaired immediately. In case of DWSU, there is less information. However, it also gives the priority to repair the breakdown.

Preventive Maintenance: Preventive maintenance is to keep equipment or installations working and/or to extend the life of them by systematic inspection, detection, and correction of early stage of failures either before they occur or before they develop into major defects. A small number of the WSSs apply the preventive maintenance.

The Water Tariff: The water tariff mainly consists of domestic, industry, office, service and public institution categories. The water rate applied to domestic use of 65 WSSs is 1800 – 5000 VND/$m^3$. According to the Circular No. 100/2009/TT-BTC on the drinking water tariff frame for domestic use, the domestic water rate applied to small towns is 2,000 to 10,000 VND/$m^3$ and that to rural areas is 1,000 to 8,000VND/$m^3$. Most of WSSs can collect water rate with almost 100%.

The Water Supply Coverage: The water supply coverage of the 62 WSSs in operation varies from 9.2% to 95%. However, 33 WSSs cannot reach 50%. Existence of alternative water sources of population and insufficient distribution pipelines are main reasons of the low coverage.

The Per Capita Consumption: The per capita consumption based on the average daily water supply and number of consumers is 150 liters in average.

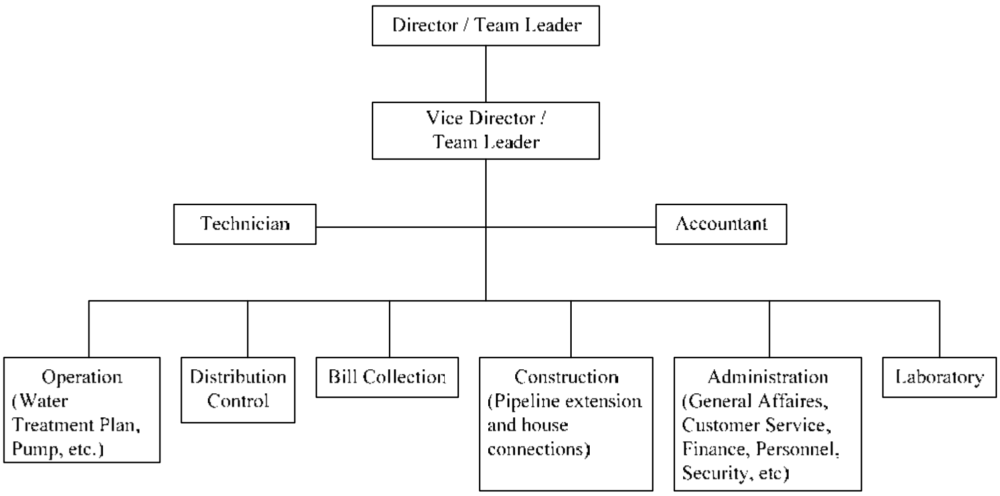
### 5.3.2 Organization and System for Operation, Maintenance and Management of the Facilities

Operation, Maintenance and Management Organization

OM/M organization of 75[1] WSSs in operation is mainly the Branch of PWSC and DWSU under DPC or Town PC. The Ministry of Construction reportedly has the policy to put the DWSU under the management of PWSC due to its weak operation, maintenance and management capability. Therefore a number of DWSU are being transferred to PWSC in the near future.

Operation, Maintenance and Management System

Operation, maintenance and management system is shown as the following figure: structure of OM/M organization:




## 5.4 Irrigation Sector

### 5.4.1 Conditions of Operation, Maintenance and Management

General

Main components of the facilities (dams, head works, pumping stations, main canals, etc.) are operated, maintained and managed by DARD, DPC, CPC, IMC (Irrigation Management Company) and FO (Farmers' Organization)[2], and on-farm canals, etc. are maintained by farmers without

[1] One (1) WSS has started its operation though the construction work has not been completed yet and the OM/M organization has not been decided yet accordingly.
[2] A section in charge of the OM/M within these organizations implements the OM/M of facility.

compensation. On the other hand, the asset management is implemented based on the ministerial ordinance of MOF. The maintenance and management of the flood control structures are not implemented.

<u>OM/M Regulation</u>

OM/M organization establishes its regulation based on the MARD ordinances, provincial ordinances and relevant correspondences, etc.

<u>Existence of OM/M Plan and Record</u>

82% (base of facility number of answered) of facilities prepare O/M plan, and 75% (same base) prepare OM/M record. In many cases, the facilities having OM/M plan prepare OM/M record.

<u>Operation</u>

For the facilities having OM/M plan, the OM/M organization prepares an operation plan under the support of relating government institutions usually. The main contents of the operation plan are an irrigation schedule, an irrigation area, an operation cost and electricity charges of pumping stations, etc. On the other hand, for the facilities not having O/M plan, the beneficiary area is small and the facility is simple in many cases, and the OM/M organization operates facilities based on the reality of production and experience.

<u>Maintenance</u>

The OM/M organization prepares a maintenance plan based on the inspection and examination. The main contents of the maintenance plan are a repair and maintenance schedule, and a maintenance cost, etc. On the other hand, for the facilities not having the OM/M plan, facilities are maintained based on the reality of production and experience.

<u>Management</u>

Irrigation assets are managed in accordance with the ministerial ordinances of MOF. Therefore, in every province, the DOF is responsible for the management of the irrigation assets. Although all relating personnel do not know the ministerial ordinances, all provinces implement the asset management in accordance with the ministerial ordinances.

### 5.4.2 Organization and System for Operation, Maintenance and Management of the Facilities

<u>OM/M Organization</u>

The OM/M organization is determined by PPC based on the provincial ordinances, ministerial ordinances of MARD or Law on Construction, etc. After the decision of OM/M organization by the PPC, it authorizes the DPI to carry out the OM/M of the facilities. Then, the DPI authorizes the selected organization responsible for the OM/M of the facilities. In some cases, the authorized organization authorizes a lower organization

The OM/M organizations of irrigation facilities are i) DARD, ii) DPC, iii) CPC, iv) IMC and v) FO in general. However, some facilities are operated, maintained and managed by several organizations. The organization corresponds to the biggest number of facilities is IMC accounting for 40%.

Number of Personnel of OM/M Organization and OM/M Post

For DARD and IMC, the numbers of personnel range from 20 to more than 150 persons, and for DPC, CPC and FO, from 2 to 80 persons. This shows DARD and IMC are comparatively bigger organizations than DPC, CPC and FO. On the other hand, the number of persons of OM/M post is subject to a condition of beneficial area and facility type, etc. For IMC, it is less than 60 persons, and for the others, less than 20 persons.

Source of OM/M Budget

Collection of irrigation water fee was abolished in 2008. After the abolition, the central government bears the OM/M cost of the facilities.

The OM/M organization prepares the expenditure plan, and after the approval of all relating PCs, the budget is determined. Considering this system, in general, it takes time to disburse the budget to the OM/M organizations.

# Chapter 6 Impact and Effectiveness of SPL Sub-projects

## 6.1 Road Sector

### 6.1.1 Sub-Projects with Less Effectiveness

Sub-Project with Increased Traffic Accident: The number of traffic accidents before and after improvement or new construction of the roads under SPL Projects was confirmed from the interview survey. Around a half of the sub-projects, respondents commented that "traffic accident increased". It is considered that the reasons for this are the speed of a vehicle accelerated by i) improvement of vertical slope / horizontal section / road alignments and ii) improvement of the road surface conditions.

### 6.1.2 Sub-projects with Impact on the Regional Development Plan

There is no sub-project which gave the impact on the Regional Development Plan.

## 6.2 Electricity Distribution Sector

### 6.2.1 Sub-Projects with Less Effectiveness

Aside from the following sub-projects, there have not been any sub-projects with problems, as maintenance and management by EVN has been well implemented.

- Ly Son Island District Electric Network Sub Project, Ly Son District, SPL II: Generator in Island is broken, therefore, the medium distribution network connected to Generator has not been operating. Residents of the island are living without electric power up to today.

- Six (6) sub-projects in Bac Lieu province: PMU refused to disburse because of the mistakes in established procedure. In 2003, these sub-projects were disbursed by provincial budget after completion and handed over for operation.

- Giang Son electric line / SPL I, Van Tuong Commune Electric line / SPL II: Two (2) out of eight (8) sub-projects of Bac Ninh province are only partially completed due to the lack of money.

### 6.2.2 Sub-Projects with Impact on the Regional Development Plan

Together with the other ODA financial sources (national budget and EVN internal fund) the rural electrification in Vietnam has greatly achieved to reduce the poverty and enhance the social-economic development at remote areas.

There were no projects with negative influences. The SPL Projects have contributed to the Vietnam society, especially the resident in poverty areas. The major examples are as follows:

- Cung Re Commune Electric Line / Lam Dong Province / Cung Re District / SPL II
- Huong Phung Commune Electrification Project / Quang Tri Province / Huong Hoa District / SPL IV
- Lap Thach Electric Network in four (4) Communes / Vinh Phuc Province / Lap Thach District / SPL IV.
- Electric Network in Dam Thuy Commune / Cao Bang Province / Trung Khanh District / SPL III
- Xuong Thinh-Tung Khe Electric Network / Phu Tho Province / Cam Khe District / SPLIV
- Phuc Sen Electric Network / CaoBang Province / QuangUyen District /SPL IV
- Xuan Tho commune – Trung Trinh + Vung La + Tu Nham Communes Electrification Networks / Phu Yen Province / Song Cau District Coast / SPL II + SPL IV

## 6.3 Water Supply Sector

### 6.3.1 Water Supply Sector Sub-projects with Less Effectiveness

<u>Tho Xuan WSSs of Thanh Hoa Province</u> : the WSS has not been completed yet due to the shortage of budget for secondary, tertiary distribution pipelines and service pipelines, and electricity works. The parties concerned should resume the works as soon as possible in order to prevent from construction cost increase due to the deterioration of the facilities already constructed. However, the population in the sub-project area uses the shallow groundwater and it does not seem to have any difficulty for water and it is said that most of population does not want to pay for the cost to connect with the projected WSS. It is necessary to review the plan and design from the viewpoint of water demand.

<u>Chlorination is not practiced</u> in five (5) WSSs saying that the population in the service area does not

use disinfected water due to smell and taste caused by disinfectant, i.e. chlorine, or the quality of source groundwater is quite good. Supplying population with water which has high risk of infectious diseases due to the lack of disinfection makes the water supply project less effective.

Low rate of facility Utilization of WSS can be said that the sub-project of such WSS is less effective. 59 WSSs out of 76 WSSs in operation are judged to be less effective based on the assumption set by the survey team.

### 6.3.2 Sub-projects with Impact on the Regional Development Plan

There are no sub-projects which gave the impact on the Regional Development Plan. The responsible person of DPI said that even if there is an impact from the implementation of sub-project, such impact was considered during the preparation stage of the sub-project.

## 6.4 Irrigation Sector

### 6.4.1 Irrigation Sector Sub-projects with Less Effectiveness

Considering this survey is one for grasping the current conditions of infrastructure, effects of sub-project was grasped based on the farm area, which was cultivated with irrigation water from facility constructed or rehabilitated under SPL, instead of the increase of production volume of crops and annual farm income, etc. which were primarily used to grasp the said effects.

It is assumed that "the ratio of irrigated cultivation area to irrigation beneficiary area" indicates the level of achievement of sub-project benefit which farm households receive. Based on this idea, it is considered that the ratio can be the substitution of the indicator to evaluate the effectiveness of sub-project. On the other hand, this ratio is applied as the indicator to evaluate the utilization of facilities, and the following five (5) sub-projects indicate the ratios less than 100%. Therefore, these sub-projects are regarded as those with less effective.

(1) Ea Yeng Reservoir, Dak Lak Province
(2) An Hung Dam, Ha Tinh
(3) Khe Coi Dam, Ha Tinh
(4) Song Rac Irrigation, Ha Tinh
(5) Quang Xuong Irrigation, Thanh Hoa province

### 6.4.2 Sub-Projects with Impact on the Regional Development Plan

There are no sub-projects with impact on the regional development plan. On the other hand, it was confirmed that the number of cropping times and the yield of rice had been increased as the effects of irrigation which were derived from the facilities constructed or rehabilitated under the SPL Projects.

# Chapter 7 Subjects to be Discussed

## 7.1 Road Sector

### 7.1.1 Operation

There is no particular comment on the operation of road sector.

### 7.1.2 Maintenance

<u>Unevenness in the inspection / judgment on damage</u>:

Having current conditions of the facilities is important for the operation, maintenance and management (OM/M of them). The OM/M organizations do not necessarily execute the task of OM/M based on quantitative criteria and they actually did maintenance works when the necessity arose. The frequency of inspection and / or patrol depends on each OM/M organization.

<u>Traffic volume of facilities</u>:

The rate of reply on the traffic volume to the interview survey using questionnaire and the survey form was around 60%. Some of the replies mentioned a big traffic volume, however, the result of the site survey did not show such volume. This fact implies following weakness.

- There is no standardized manual and /or guideline on the periodical traffic survey
- The accuracy of the answered data on traffic volume varies among the organizations.

<u>Overload of Vehicle</u>:

It was confirmed that there were a lot of OM/M organizations worried about the damages of road caused by overloaded trucks. The large pothole and rutting were supposed to be caused by the overloaded vehicle. It was surely overloads that caused such damages provided that the roads (especially sub-grade and embankment) were properly constructed as reported by the OM/M organizations.

<u>Sub-Projects with Progressive Damages</u>:

The roads in rank C and D needed to be urgently repaired by PPC, DOT and / or DPC, based on the reports prepared by the OM/M organizations.

### 7.1.3 Management

<u>Significance of the Road</u>:

Concerning SPL Projects, it seemed that the significance of roads was not considered as a management factor. All the roads constructed under SPL Projects are equally important for local people. However, for instance, the district road which links communes in the mountainous area has a function as the community road, and such nature of road is different from the significance of road as follows: i) the evacuation route at the time of disaster, ii) transportation route for goods during emergency, iii) the road with an important lifeline (underground facilities such as electricity, water supply, etc.), iv) the road connected with a railway station, and /or sea ports being terminals of river, v) the road with high traffic volume or with a possibility on an increase.

Conditions on Grasping Road Facilities by Operation, Maintenance and Management Organizations

OM/M organizations were not necessarily aware of the current conditions of the road facilities. It seemed that the persons in charge of road facilities such as bridge, culvert, pavement, etc. exclusively grasped their conditions. Therefore, there was the risk that grasping the conditions of the facilities would be insufficient when the persons in charge would be transferred.

### 7.1.4 Organization

Any problem was not observed concerning the system of the organization.

### 7.1.5 Sub-project Implementation

Roads which Have the Problem of Continuity

It had been reported that access roads to the starting points or ending points of roads constructed under SPL Projects were not maintained well and it was difficult for vehicles to run smoothly and took time to reach the newly constructed roads. So it is time-consuming to access the constructed section under SPL.

Moreover, there was the care that the delay of construction of a bridge under Vietnamese fund made difficult for vehicles to access the road constructed under the SPL. It was the problem of continuity. It is preferable to construct a road and a bridge simultaneously, however, the delay of construction work due to the failure to prepare the budget which was initially secured was reported. To minimize the influence of such a problem in the future, PPC and DOT should prepare the proper development plan including prioritization of road construction and improvement projects and financial plan for the rural road system.

Sub-Projects with Increased Traffic Accidents

Nearly half of the replies to the questionnaire reported that “traffic accidents had increased”. The PO is required to give the design consultants the instruction to consider the safety instruments such as guardrails, markers, warning signs, etc. in the detailed design and the consultants employed by MPI for the SPL Project implementation should control these items to be installed in the road facilities.

Sub-Projects in the Area with Natural Disaster

For the areas with high risk on the occurrence of natural disasters, therefore, it is necessary to strengthen the patrol especially during rain. When designing a project, it is necessary for PO to recommend the design consultant to consider the change of the routes and / or slope protection in order to secure the road especially in the chronic disaster areas. The Consultants must assist the POs on such recommendations regarding the matter.

Sub-Projects with Bottlenecks

The roads with the SPL Projects with bottlenecks have the possibility to cause frequent congestions in the near future if the traffic continues to increase. It is recommended to set the criteria on the selection of the sub-projects favorable for the scheme to improve the places where the bottleneck exists in consideration for the PO who will prepare the sub-project with such scheme.

## 7.2 Electricity Distribution Sector

### 7.2.1 Operation

There have not been any operational problems under EVN. In a rare case, there are a few communes running on their own, however, this will be transferred to EVN in the near future.

### 7.2.2 Maintenance

Problems such as rusts on the surface of distribution transformer, destroy by disaster can be solved by EVN. The maintenance on all of the projects was implemented by EVN, therefore, there has not been any problems on the maintenance.

### 7.2.3 Management

The management for all of sub-projects has been already transferred to EVN. Therefore, there have not been any problems on the management.

### 7.2.4 Organization

Operation, maintenance and management are mainly conducted by EVN, thus there have not been any problems.

### 7.2.5 Sub-Project Implementation

Even though all of the sub-projects are operating sustainably, there are a few sub-projects with procedural problems.

- One (Binh Duong Commune Electric line / SPL II) out of 11 sub-projects in Quang Nam province has been implemented, but electricity distribution is not yet done.
- SPL disbursement document for one (Phu Cuong Commune Electric line / SPLII) out of nine (9) sub-projects in Quang Ngai province was not be confirmed.

## 7.3 Water Supply Sector

### 7.3.1 Operation

Water quantity control: a number of WSSs do not install the flow meter for raw water, the size of flow meter is not appropriate under the low water demand operation and the installation of such flow meter may give considerable error to the value measured. Having intake flow rate is necessary to determine the coagulant dose in order to appropriately operate the sedimentation process. It is also important to improve the situation to measure the flow rate of distribution in order to reduce the leakage from the distribution pipelines.

Water quality control: the survey team observed several weak points on the water quality control:

- The jar testing for the determination of coagulant dose is not executed in a number of WSSs.
- It did not seem to measure the turbidity at the outlet of the sedimentation basin.
- Frequency of residual chlorine monitoring is not necessarily sufficient.
- A few WSSs do not analyze both raw and treated water.

It seems to be difficult to improve the conditions on the water quality control due to scarce well equipped laboratories and human resources in rural areas, however, taking actions is necessary.

### 7.3.2 Maintenance

Daily maintenance: the survey team observed that most of the WSSs carry out the daily maintenance appropriately, however, it is preferable that the good daily maintenance is ensured by the record of breakdown frequency.

Breakdown maintenance: it seems that the methodology of breakdown maintenance has been established. If the parties concerned evaluate the system by the data such as mean time of failure, they will improve the methodology.

Preventive maintenance: a number of WSSs have not introduced the preventive maintenance yet. However, it is effective to reduce the maintenance cost and to prepare the monthly and annual maintenance plans.

### 7.3.3 Management

The current water supply coverage and the rate of facility utilization are not sufficient for most of WSSs. It means that revenue of OM/M organization might be insufficient for its activities.

### 7.3.4 Organization

The assignment of a technical administrator: the survey team proposes the assignment of a technical administrator and a water quality manager who are important for the OM/M of the WSS. Tentative job descriptions of the technical administrator are i) keeping all the technical data and information ii) preparation of operation records and keeping and analysis of them, iii) letting staffs do above-mentioned tasks, iv) understanding the water analysis results and keeping them, and time series analysis, and those for the water quality manager are i) sampling and water analysis, ii) control of devices for water analysis, iii) training of other staffs on the water analysis, iv) raising the awareness of all the staff on the significance of water quality, v) consumers relation in terms of the quality of water supplied.

The OM/M organizations under the district do not have the organization for having the sufficient technical assistance and they seem to be weak in terms of finance. Because, around 70% of DWSU received the subsidy from DPC, etc. while the rate of WSB is 15%.

### 7.3.5 Sub-project Implementation

The low water supply coverage seems to come from the existence of alternative water sources for the population in the service area and the insufficient distribution pipelines. Since the water from the tap is in principle charged and has strange smell by chlorine, the population who firstly experiences the piped water supply sometimes refuses to use the water from the tap. Having the acceptance of population of piped water supply depends on the activities to raise the awareness of the population with respect to public hygiene.

## 7.4 Irrigation Sector

### 7.4.1 Operation

In the site survey, with the rate of one (1) facility or more per 10 facilities, it was observed stones were placed in canals to take water into own paddy fields, and holes were dug in canal walls to take water at convenient time ignoring irrigation rotation. In addition, it was observed canals were deteriorated due to disposed garbage in canals (such as Quang Xuong Irrigation, Thanh Hoa province). It was considered the number of canals with these conditions would increase from the viewpoint of the entire canal observation, because only a few parts of the canals were observed in the site survey.

It was found that problem was lack of recognition of current conditions and issues on insufficient sharing of information among farm households, difficulty of transmission of water distribution schedule from a facility manager to farm households, and holes in canal walls and disposal of garbage into canals, etc.

### 7.4.2 Maintenance

The GOV developed irrigation projects in the past, and these facilities are forming enormous assets (DPMU, Binh Dinh province). It is mentioned in the MOF DECISION (No: 32/2008/QD-BTC) that these assets should be managed strictly and the effectiveness in utilization of the assets should be improved. In order to follow this, POs prepared assets list, and the OM/M organizations calculated the depreciation. These organizations are requested to manage the facilities constructed under the SPL Projects year by year.

Under these conditions, based on the site survey, it was found that problems were requiring long time to draw out information/data of the sub-projects in some cases, and lost and hoarded storing away of information/data, since POs and OM/M organizations preserve SPL information/data with paper medium in many cases although they use computers.

### 7.4.3 Management

In the site survey, there were reports expressing that monitoring and evaluation of FO is necessary (Quang Ngai DPI, July 5, 2010), and strengthening of monitoring and evaluation is required through authorizing POs (Thua-Thien-Hue DPI, July 9, 2010).

On the other hand, in the SPL III, IV and V, the Consultants conducted monitoring and evaluation on the effects, implementation and OM/M of the sub-projects using survey sheets. Regarding this monitoring and evaluation, various problems were pointed out, such as difficulty in data collection, clarification of implementing body of monitoring, update of data, etc.

It is considered that the monitoring and evaluation system is under arrangements at present. The monitoring and evaluation is desired to be implemented periodically, however, the current system is not suitable for periodic monitoring and evaluation, etc.

### 7.4.4 Organization

Within the sphere of site survey, thick weed and trees are not observed at the facilities operated, maintained and managed by DARD, DPC and IMC, although part of farmers open holes at canal walls. In addition, it is considered that they keep data in good condition in general, because they can provide necessary data in a relatively short time in many cases. Therefore, it seems that there are no serious problems in their OM/M.

On the other hand through the site survey, there are reports expressing technical guidance is necessary (from CPC, OM/M organization of Khe Ngang Reservoir, Nghe An province), and technical training is necessary (from FO, OM/M organization of Buon Chao Dam, Phu Yen province). In addition through the facility survey, cases are observed at some dams and canals of CPC and FO, where thick weed and trees are growing and they make OM/M difficult.

Since above cases are seen and providing necessary data from CPC and FO takes long time in many cases, it is considered that there is necessity of technical capacity development for CPC and FO.

### 7.4.5 Sub-Project Implementation

#### (1) Planning and Design

In the site survey, there are reports expressing farmers' intension is to be reflected in planning and design (Quang Ngai DPI, July 5, 2010), and DPC and CPC are desirable to participate in planning and design (Nghe An DPI, July 22, 2010). In addition, it is also reported canal alignment was re-designed because it was not fitted to site topography (Trieu Duong Reservoir, Nghe An province).

In the past SPL, District Development Boards (DDBs) were established at the pilot provinces and districts (5 provinces and 22 districts which include 5 provinces and 10 districts for 15 irrigation sub-projects). The purposes of the establishment are to reflect residents' intension properly in project implementation, and to raise residents' ownership of sub-projects to assure the realization and sustainability of sub-project effectiveness. DDB participates in project preparation, planning, implementation, monitoring and evaluation, and facility OM/M, etc.

It is considered that the participation in planning and design, etc. is not executed for 69 facilities located in the areas other than the pilot areas, because the reported Quang Ngai and Nghe An provinces are not included in the pilot areas.

Among 84 facilities, there are two (2) facilities having problem regarding earth ling canal (Ea Yeng Reservoir in Dak Lak province and Song Rac Irrigation in Ha Tinh province). The problem is the irrigated cultivation area becomes less than the irrigation beneficial area due to water leakage, etc. from earth lining canal. These present questions in the validity of sub-project planning.

**(2) Facility Construction**

In the site survey, gully erosions are observed at a few facilities, and these gullies are to be repaired by maintenance works (Cho Moi Irrigation System, Bac Kan province, etc.). In addition, at two (2) facilities (Khe Coi Dam in Ha Tinh province and Quang Xuong Irrigation in Thanh Hoa province) among 84 facilities, canals, etc. are deformed greatly due to the low construction quality. The problem is found in the construction quality management.

# Chapter 8 Sustainability of SPL Projects

## 8.1 Road Sector

### 8.1.1 Project Planning and Design

<u>Selection of Road Sub-Projects that Continuity of Road can be Secured</u>: Continuity of road should be secured. It is necessary to include the evaluation item on "the continuity of projected road should be secured" in the criteria to select to select sub-projects in the future SPL Projects.

<u>Bottleneck Improvement:</u> Bottleneck sections were confirmed during the site survey. Currently, traffic congestions were not observed at the bottleneck sections. However if the traffic volume continues to increase in the near future, the bottleneck may affect the effects of the road sub-project. In addition, most of the bottleneck sections were previously constructed bridges in the past. Reconstruction of the bridges necessitates big amount of capital investment compared with that of a road. Therefore it is quite difficult to implement the construction of a road and a bridge at the same time.

Therefore, it is consequently necessary to prepare the sub-projects, which do not exclude the related bridge based on the estimated future traffic volume. It is recommended to set the criteria on the selection of the sub-projects favorable for the scheme to improve the places where the bottleneck exists in consideration for the PO who will prepare the sub-project with such scheme.

### 8.1.2 Facilities Construction

Construction of Gravel Road: Number of sub-projects applied gravel pavement to the road was 20, but most of them were confirmed in bad conditions during the site survey. The following reasons are considered; i) Surface gravels are washed out and overflowed water runs over the road surface when the drainage system is not functioning properly. ii) Ruts and potholes are made when water is collected in uneven places and iii) Once a small damage occurs, it can be easily extended by passages of vehicles and even motorbikes. Therefore, when applying the gravel pavement, it is necessary to carefully design and construct a drainage system considering detail site condition and to take into consideration the maintenance of the gravel road.

### 8.1.3 Administrative System of the Constructed Facilities

There was no problem on the administrative system of the constructed facilities.

### 8.1.4 Asset Management System

Prioritization of the roads: following are the types of road with significance.

- The evacuation route at the time of disaster
- Transportation route for goods during emergency
- The road with an important lifeline (underground facilities such as electricity, water supply, etc.)
- The road connected with a railway station, and /or sea ports being terminals of river
- The road with high traffic volume or with a possibility on an increase

It is important to manage and maintain regularly the roads which may play important roles at times of emergency and catastrophes. If there are a number of roads with considerable damages, the roads with significance should be selected for the maintenance and repair under the budget constraint

Necessity of the Inspection Manual

The objectives of the inspection are i) to grasp the current condition of the road for better management, ii) to discover earlier damages on the roads to prevent negative influence on the safety and the usability, iii) to take appropriate measures to secure safety and smooth traffic, and in addition to these, iv) to carry out the continuous and effective inspection and systematic maintenance and reinforcement of the facilities by storing basic information which enable the effective maintenance.

The evaluation based on quantitative indicators will contribute the maintenance of the whole facilities. The current inspection and evaluation methods depend on an individual for the results of them and it brings the variations from the viewpoint of the SPL Projects. Therefore the inspection manual should be prepared for at least following items:

- Frequency and degree of the inspection
- Inspection items (pavement, slope stability, structures, etc.)
- Type of damage and method to judge it
- Methods of maintenance, repair and rehabilitation

Execution of the Traffic Survey and Preparation of the Traffic Survey Manual:

The traffic volume survey should be carried out regularly according to the rule shown below set by a competent organization:

- At least once a year ( it is preferable to conduct twice a year; farming season and off season)
- Type of vehicles should be recorded
- The traffic volume should be recovered by pcu in accordance with TCVN4054.

It is also necessary to prepare the manual and guide for carrying out the traffic volume survey.

Road Protection against Overloaded Trucks

The damage of road caused by overloaded trucks is very serious. It is generally considered that the damage of road surface will increase in proportion to approximately four (4) times of the axel load when it exceeds the design load on the road and the overload accelerates the damage of the road. In other words, when the weight of the vehicle becomes double, the load to the road becomes eight (8) times. Therefore, it is necessary to check overloaded vehicles, and to install devices which restrict them. Following countermeasures against the overloaded trucks are proposed:

- To punish the overloaded vehicle drivers severely under cooperation with other related authorities
- To install car stops to restrict the height and width of vehicles at the starting and ending points in order to compel the oversized vehicles to pass the roads.
- To install toll gates to collect maintenance fee.

Straight Line Diagram

Straight line diagram is the effective tool for preparing road inventory to manage the roads. It is possible to manage all installations in the road by indicating the kilometer post, and this is quite useful to understand the progress of the sub-project. It also enables to show the quantities of installations which are the basic information of financial asset.

- Positions of origin-destination and location of installations
- Type of pavement and type of structure
- To record the construction year and the repair year by every sections

- To put colors in completed maintenance sections and the structures, and to record their dates.

## 8.2 Electricity Distribution Sector

### 8.2.1 Project Planning and Design

Up to now, equipments for all the projects were planned, designed and constructed according to the Technical Regulations for Rural Electrification. Therefore, they could stably provide the electricity service to people in rural areas. This has improved life standard of the habitants and helped further development of the industries.

### 8.2.2 Facilities Construction

There are no problems for the construction of facilities due to the improper manner of construction. There are some problems concerning the distribution network after the construction. The problem is that voltage drops seems to be so high in many sub-project, because the size of the conductors of LV lines are apparently so small considering the load of the sub-project areas and the length of LV lines. To reduce the voltage drops, it would be essential to construct and maintain the data of the facilities, such like the length, the size of each LV lines.

### 8.2.3 Administrative System of the Constructed Facilities

Many of LV assets invested by other financial sources are being in not good condition, due to insufficiently prepared and out-of-law-regulation implemented rural electrification items, which conducted into the large power losses nationwide, and possible death dangers in countryside. Therefore, it is recommended that all of LV assets will be handed over to EVN in accordance with the Request No. 1287/VPCP-KTN of the Government Office dated March 2$^{nd}$ 2009 and the Inter-ministerial Circular No.06-2010/TTLT-BCT-BTC dated Feb. 3$^{rd}$, 2010 signed and issued by MOIT and MOF.

### 8.2.4 Asset Management System

The OM/M for all the sub-project assets has been already implemented by EVN system, except some cases which are not handed over to EVN and will be treated in the near future. EVN supervises and administrates all assets of their distribution facilities including the equipment implemented under SPL Projects and now there are no troubles.

## 8.3 Water Supply Sector

### 8.3.1 Sub-project Planning and Design

Raising water supply coverage: the survey team proposes to take following measure to raise water supply coverage, though there will be a several barriers to execute them: “The SPMU shall collect the signed subscription to planned water supply from the population during the planning and design stage and if the collection rate can not reach designate percentage, e.g. 70%, the PMU should not put such sub-project into implementation." The measure necessitates activities to get sufficient number of agreement of population with piped water supply:

- Campaign on the raising awareness of population about the public hygiene related to water supply.
- Making the population understood the difference between the water from conventional water source such as shallow wells, rain water, etc., and that from the piped WSS.
- To convince the population that the disinfection is necessary for safe drinking water supply.
- To explain the reasons why consumers should pay for the water from the piped WSS and the connection with a house and the WSS
- Presentation of the outline of water supply plan; service area, designed specific consumption per capita, period of hours of water supply

The service area: the SPMU or The PO did not seem to transfer the definition of service area to the OM/M organization. Because a number of OM/M organizations could not understand the concept of the service area and accordingly could not answer the number of households and/or the population in the service area. It is difficult for the OM/M organization to prepare the OM/M plan as well as future rehabilitation plan without having the data and information on the service area. The team recommends preparing the definition of the service area and the socio-economic data and other necessary data and information with their source, and SPMU or PO should transfer all the information on the service area to the OM/M organization of the WSS.

### 8.3.2 Facilities Construction

The water proof or water tightness of the installations of WSS is essential to prevent leakage of water. The team observed the marks of leakage from the treated water tanks or other concrete structures. Strengthening the quality control of the construction works, especially that for concrete work is essential for preventing the leakage. Considering the scarce civil engineers resources in the water supply field, the team recommends assigning a technical administrator in each province or region who has the power to approve the design and the construction works planning. SPMU should supervise the construction works according to the design and the construction plan approved by such technical administrator.

### 8.3.3 Administrative System of the Constructed Facilities

Operation indicators: the WSS should have the operation indicators such as the rate of facility utilization, etc. to judge the efficiency and effect of the water supply for understanding the performance of OM/M organization and the public relations to make the population understood on the piped water supply. The OM/M organization should record value of the indicators, and keep and accumulate them and analyze them from the time-series viewpoint in order to reflect it to the preparation of OM/M plan.

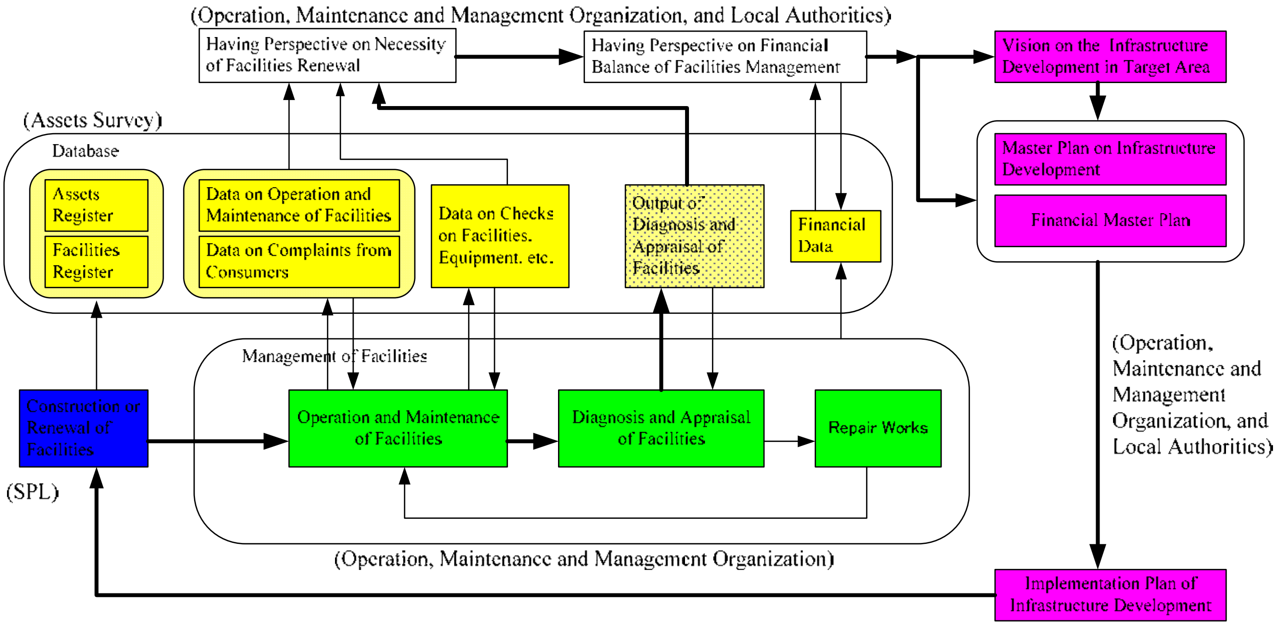
Water quality control: the team proposes all the WSSs to organize the campaign on the awareness of the water quality control to all the staff of WSS. The director or responsible person of the WSS should take the initiative. It is accordingly necessary for the director to have the training on the water quality control of the water supply. The director should organize the training on the minimum knowledge of parameters of water to be analyzed method of water analysis, sampling and transportation of samples. The WSS should equip the devices to analyze turbidity, residual chlorine, color everyday in order to enable all the staff of WSS to measure these parameters. The staff should learn how to keep analysis results and to understand them.

#### 8.3.4 Asset Management System

Diagnosis of WSSs: the survey team observed several unfavorable conditions of the WSS operation such as carry over from the sedimentation basin to the filter, the mud balls in the filter, weak water analysis, inappropriate installation of liquefied chlorine, etc. The survey team recommends PMU to implement the diagnosis of operation of the new WSS at the end of the start-up year for the consolidation of the appropriate operation of the WSS. Moreover, other diagnoses of the operation and the facilities is necessary during fifth to tenth year in order to confirm the appropriate water supply and to prepare the preventive maintenance plan for the facilities, etc. for forthcoming rehabilitation and renewal. PMU can entrust these tasks to the PWSC of different province in order to provide the OM/M organization with opportunity to share the experience of OM/M of WSS.

Disinfection: most of WSSs use the liquefied chlorine for disinfection of treated water. However, liquefied chlorine is hazardous for population due to its strong oxidization effect when it leaks from a container. The survey team recommends the parties concerned to survey current situation of the disinfection facilities of the Water Supply Systems, if necessary and to set the course on the arrangement of disinfection facilities including the standard of hypochlorite such as the concentration of solution, etc. If the subsidy will be available for the WSSs which will improve the disinfection facilities using liquefied chlorine in line with TCXD-66 or its revised one or convert the system from the liquefied chlorine to hypochlorite, the risk of accidents related to liquefied chlorine will be hopefully reduced rapidly.

Water Tariff is mainly decided by the PPC based on the proposal by the OM/M organizations. However, around 70% of WSSs conceive that the current water tariff is insufficient for future rehabilitation of the WSS. The OM/M organization should consequently prepare the scheme to raise the water tariff for the continuous sound management of the WSS. Following Figure shows the concept of the water tariff arrangements.




## 8.4 Irrigation Sector

### 8.4.1 Sub-project Planning and Design

#### 8.4.1.1 Planning and Design

#### (1) Earth Lining Canal

It is important to reduce irrigation water loss regarding earth lining canals. So as to reduce the loss, it is desired to make efforts to raise irrigation efficiency. The following countermeasures are applicable in order to raise the irrigation efficiency:

- To share the information on problems regarding water distribution and facilities, etc. among farm households.
- To disseminate decided water distribution schedule to farmers, and consequently to raise the water application efficiency of farm level by obeying water rotation.
- To improve division works and water measurement facility, etc. to raise the water management efficiency.
- To improve earth lining canal to concrete flume, etc. to raise the conveyance efficiency.
- To formulate irrigation plan with integrity of technical and economic aspects considering financial plan including donors. Especially, to formulate irrigation plan based on the survey of irrigation efficiency when planned the rehabilitation of earth lining canal and dam, etc.

#### (2) Participatory Planning and Design

In order to assure the realization and sustainability of sub-project effectiveness, it is desirable that residents' intension is reflected properly in project implementation, and residents' ownership of sub-projects is raised. Based on this idea, it is desired that the persons in charge of irrigation of DPC and CPC, and farmers participate in the planning and design of SPL facilities.

### 8.4.2 Facility Construction

Due to low quality of construction, deformed canals, etc. are observed in the site survey. It is required to construct appropriate facilities which correspond with the specification and quality indicated in design drawings, following to the construction law and DOC guideline, etc. which regulate construction quality, etc. The desired countermeasures are shown below.

- To carry out physical, chemical and mechanical tests based on the construction law and DOC guideline, etc.
- To record the results of tests in control chart and summary table, etc., and to give a decision on the results by statistical methods.
- To help prevent any defective work, identify any problem and improve measures.
- To conduct quality control in combination with progress control and output control for the purpose of securing stable quality and progress of the construction.

### 8.4.3 Administrative System of Facilities

It is considered that development of technical capacity, etc. is desired for CPC and FO. On the other hand relating SPL sub-projects, there are two (2) ways of capacity development, as follows:

1) Development of human resources and strengthening of organization at district, province and central levels implemented under SPL III, VI and V.
2) JICA projects for capacity development on PIM.

It is considered above-mentioned JICA projects will develop the capacity of FO. However, as developing method of CPC seems to be not clear, the following discussion on this issue is desired among relevant organizations:

- DPC conducts capacity development of CPC based on the development of human resources and strengthening of organization at district level executed under SPL sub-project, or
- CPC is also targeted together with FO when capacity development under JICA project is executed.

### 8.4.4 OM/M

#### (1) Monitoring and Evaluation

It is desirable to solve problems regarding monitoring and evaluation, such as difficulty in data collection, non-clearness of implementation body, and updating of data, etc. It is desirable to discuss this issue continuously among relevant organizations. In addition, environmental conservation and watershed management seem to be important for the facility management. Therefore, inclusion of the following items is desired:

- Environmental Conservation: Water quality problems, waste management problems, etc.
- Watershed Management: Upstream and downstream problems, problems regarding water utilization, problems regarding land utilization, minority race problems, etc.

**(2) Farm Household Education**

It is desirable to promote Participatory Irrigation Management (PIM) for the farm household education. Based on this ides, it is desirable to apply the outputs of the following JICA projects which are instances of this attempt:

1) "The Project for Capacity Development of Participatory Irrigation Management System through Vietnam Academy for Water Resources for Improvement of Agricultural Productivity in Vietnam", June 2005 – June 2010

2) "Project for Promotion of Participatory Irrigation Management for Sustainable Small-Scale Pro Poor Infrastructure Development", 2010 – three years (plan)

In the application of the outputs, it is desirable to plan the farm household education is executed in the all SPL sub-project areas. Support from the relevant personnel of the projects is desired on this point.

### 8.4.5 Method of Infrastructure Assets Management

Information arrangement will be required through recording daily maintenance in order to manage infrastructure assets. To cope with this, it is considered that preparation of database and its manual is effective which update, refer and edit respective information at any time and easily.

# Chapter 9 Construction of Database on Facilities and their Operation, Maintenance and Management

## 9.1 Introduction

### 9.1.1 Significance

The Survey was made to grasp the present status of all the 1115 facilities including 408 roads, 526 power distributing stations, 97 water supply facilities and 84 irrigation facilities constructed in the SPL Projects (I – V) which had been implemented so far, by questionnaire survey and site visits. The database on such data and information was developed by using a personal computer in order to ensure the common ownership and effective use of such data and information by the agencies related to the SPL Projects.

### 9.1.2 Objectives

The objectives of developing the database are as described below, but the data and information that were collected in the Survey were insufficient to achieve those objectives. It was essential that the related agencies would continue to collect and store such data and information in the database or update it.

- To collect and arrange the status data and information on the facilities constructed under SPL I – V in order to allow the related users to easily retrieve and filter necessary data and information for their efficient works, such as early monitoring any projects which may involve any problem or fault.
- To check on the history of the implemented SPL projects, review these projects and grasp the current status in the Central level and in the Provincial level in order to provide materials and information for formulating any future project.
- To allow the OM/M organizations to reliably grasp the current status of the individual facilities operated by them and improve the operation, maintenance and management procedures through their works of collecting the data and information necessary for maintenance and updating of the database.
- To allow the OM/M organizations to systematically monitor the operational status, financial status and equipment conditions of the facilities by developing the database as the facilities register and the recording system for operation, maintenance and management of the facilities.

### 9.1.3 Users of the Database

For the time being, the database users are considered to be the Ministry of Planning & Investment in the Central level and DPI (Department of Planning & Investment) and the agencies engaged in operation, maintenance and management of the facilities in the provincial level.

## 9.2 IT Infrastructure Survey

In assuming that the important users of the database are OM/M organizations, the questionnaire-based survey of information technology infrastructure was made to grasp the status of the IT-related infrastructure of those organizations together with the status survey of facilities prior to the development of the database.

## 9.3 Development of the Database

### 9.3.1 Software

The software for the use of the database was considered to be available in 2 types as follows:

(1) Application software for the database

For the software to be created to use the database, it was considered to simplify the data entry, and to allow the users familiarized with the application methods to make complicated retrievals and sorting, to compile sum-up tables and various forms from filtered data.

However, such software is relatively expensive and probably, it is necessary to train and assign the personnel in charge of the software in full time, for whom it takes a cost.

(2) Spreadsheet Software

The spreadsheet programs are the general software used for calculation of values, which has the database functions capable of data sorting and filtering and of editing graphs from the filtered data. However, this software has many functional restrictions in comparison with the dedicated application software as described above. In particular, it is almost impossible to edit forms. In developing the database with a complicated structure, the number of spreadsheets and the number of files will increase and it will be necessary to take some considerations for designing the database.

Based on the results of the IT infrastructure surveys as described above, it was planned that the database was developed in using the universal spreadsheet software.

### 9.3.2 Input Data

#### (1) Types of Data

The data used in the database is available in 2 types, one is facilities data and the other is socio-economic data. The facilities data consists of "General Project Information", "Outline of Facility", "Current Status of Facility", "Effectiveness of Sub-project" and "Operation, Maintenance and Management" as mentioned in "3.1 Setting up the Items to be Surveyed".

The facilities data include supplementary data and information, such as i) administrative maps indicating the locations of the facilities, ii) site scene photos, iii) standard diagrams of the facilities obtained by the survey members from DPI and OM/M organization, iv) facility handover certificates and circulars related to operation, maintenance and management which the survey members obtained from DPI and OM/M organization, v) examples of planning documents used by OM/M organization.

About the socio-economic information, the data in the materials used in implementation of the past SPL projects and the statistic materials issued by the Government of Vietnam was used for data entry. The input data items are i) Area by year, ii) Population by year, iii) Agricultural output by year (rice, other agricultural products than rice, cattle), iv) Industrial output by year, v) Poverty rate by year.

The data entry was made on 670 Rural Districts under 62 Provinces throughout Vietnam.

**(2) Names of Provinces and Rural Districts**

The names of some Provinces and Rural Districts were different between the past projects and this Project because the change, consolidation and division of administrative districts were made several times after the start of the SPL Projects. Those names was entered into the database based on the "Administrative Division in 2008" issued by Statistical Publishing Office.

**(3) Project Implemented in Phases**

Each of the projects implemented in phases were marked with its project code numbers and the phase code to identify it as a continued project.

## 9.4 Database

### 9.4.1 System Features

The database has the following features:

- This database can be operated independently and used even in areas where the communications environment is not fully provided.
- The database file can be sent as the attached document to an E-mail message to an area to which the Internet is connectable.
- It is expected that the database can be operated by computers used by many maintenance and management agencies because it is operated by the spreadsheet software (concretely Microsoft Excel, hereinafter called "Excel") which is commonly used.
- The operation of the database is basically the same as that of Excel, needing no special operation.
- This database is created by macro, but all the Excel functions are available.
- All the projects can be displayed and edited or analyzed (Allover Summary function). There is also a function of displaying the entire project by sector and the editing and analysis within a sector is available (Sector Brief function).
- The Print function in Excel is used for printing and the data can be printed by a printer in use.
- A large-sized illustration file such as diagram or photo data is not imported in the system, thereby causing no load on the system. Thus, a computer with a low basic specifications does not operate slowly.
- Some items in the input sheet can be entered by using the pull-down menu and selecting the data. In the water supply or irrigation sector having many input items, the data items are divided into sheets. This can reduce the users' trouble in inputting data as much as possible to facilitate the data entry job.

- As the capacity of the Excel-based system is low, it will be easy to upload the data on the Internet.
- The data communications between DPI or PMU and the operation, maintenance and management agencies use electronic mail where it is available. Where no electronic mail is available, the database system is copied in a CD, which is sent by EMS (registered mail).
- Data updating is easily made by anybody who can operate Excel. The backup file is created automatically when file is saved.

### 9.4.2 System Design and Composition

#### (1) System Design

The procedure of designing the database is shown in following Table.

| Step | Item | Description |
|---|---|---|
| 1. | Analysis by User | Analyzing on what personal computers, operating system and software the database users are using at present. |
| 2. | Preparation of Codes | Preparing the tables of codes for each Province and each project which are necessary to build the database. |
| 3. | Examination of Processing Method of Related Materials | Examining how the related materials such as maps, photos, diagrams and documents are imported in the database. |
| 4. | Screen Design | Designing the screen configuration and the rough plan of images on each screen. |
| 5. | Examination of Storing Method | Examining the method of storing input data. |
| 6. | VBA Design | Programming by the use of Excel VBA based on the above mentioned. |
| 7. | Trial Operation | Searching for failures, problems and points to be improved for improvement of operating conditions. |

#### (2) System Composition

##### 1) Coding

Codes include “Continued Project Code” to be affixed to the same project (having a similar project name and the same operation, maintenance and management organization) to be implemented in different SPL phases because it is necessary to create the consolidated data for such a project

##### 2) Screen Design

The screen design was considered to make the screen as simple as possible and for the user not to confuse the buttons to be clicked.

##### 3) Discussions on Storing Method

Data can be stored in 2 types, input data storage and database template storage (storage of a model file for several similar files to be created). Input data storage is available in 2 types of storage of database and illustration data.

**4) VBA Design**

The project database created by Excel VBA (Visual Basic for Applications – a collection of program execution systems) is as follows:

1) 55 types of worksheet;

2) One type of user form for file version; and

3) 3 types of module having the following configuration:

| | |
|---|---|
| Action module (mdlAction): | To execute all correlative processes (sheet changeover, file storage, etc.) |
| Common module (mdlCommon): | To execute data-related processes (data comparison, data retrieval, etc.) |
| File module (mdlFileFolder): | To execute the file and folder operation processes (file retrieval, opening of a designated file, directory creation, etc.) |

### 9.4.3 Database Configuration

This database is divided into facility and socio-economic types. The facility type database stores the materials prepared or collected in the Survey as illustration data.

The input sheet of the database is basically available in 6 types of sheet the combinations of which are different from sector to sector: i) General information, ii) Technical information, iii) Information at the time of construction, iv) Operational effects, v) Status of SPL facilities and vi) Maintenance and management.

The illustration data is stored in the folder by Province and the main index data by Rural District is stored in the socio-economic information system.

The retrieval can be made on the following items:

1) Facility data: Province, Sector, input date, etc.

2) Illustration data: Province, Sector, file type (image, text, map, etc.), input date, etc.

3) Overview table of all projects: Project name, code number, name of Province/District, etc.

The database has the warning function. If the cell indicating the file is red when the retrieved results are output, such red cell indicates that it has passed one year or more for the file after data entry and that it should be updated.

**(1) Socioeconomic Database**

This database covers the socioeconomic information entered on all the Provinces (62 Provinces and special cities) and 670 Rural Districts in Vietnam, which is browsable.

**(2) Input Data**

The facility data and illustration data based on the results of the Survey have already been input in this database.

**1) Facility data types**

- General information – Sector, Province name, project name, SPL number, year, Rural District/Commune name, decision number and date, authorization agency, project entity, project cost, construction cost, date of facility completion, etc.
- Technical information by Sector – Details of facilities constructed by SPL
- Project implementation information – F/S and D/D, land expropriation, tender, procurement, construction work and other information on project implementation including date of completed project handover to maintenance and management agency.
- Information on operation effect – Demonstration of effects of facilities
- Payment information – Loan portion payment for the project (if any materials are available.)
- Facility status information – Present status and use conditions based on site survey
- Maintenance and management information – Date of facility acceptance, name of maintenance and management agency and its organization, address and telephone number, person in charge, number of employees (number of technicians by job, etc.), equipment in possession, the actual condition and the present status of maintenance and management.

**2) Illustration data types**

- Map information – Map by Province indicating the locations of all the facilities constructed by SPL I-V.
- Photographic information – Photos taken in the Survey and photos obtained before, during and after completion of the Projects
- Drawing information – Drawings including the general standard drawings of facilities and drawings related to operation, maintenance and management of facilities.
- Document information – Facility handover documents, circulars issued by local governments for operation, maintenance and management of facilities, etc.

- Various types of sample form – Daily report, weekly report and monthly report, data input format by Sector, road budget application form, etc.

The forms and number of sheets for the facility data are different from sector to sector except for the general information.

In creating the illustration data, the following items were taken into consideration:

**Map by Province**

The maps of 62 Provinces and special cities except Ho Chi Ming City that were used in the Survey were purchased from private map sales companies under the control of Department of Map Publication, Ministry of Natural Resources and Environment, having the following features:

- The basic maps are prepared in accordance with the VN-2000 coordinate system under the Prime Minister’s Decision No. 83/2000/QD-TTg issued on July 12, 2000. The geodetic system is the World Geodetic System 1984 called WGS-84.
- The maps are created by vector images which are applicable to computer graphics without deterioration in change such as enlargement or reduction in scale and can be stored in the format of Portable Document File (PDF).
- The latest administrative divisions as of December 2009 are depicted in the maps.

The following works were done in using those maps:

- The administrative division names of main areas on the maps were checked based on the 2008 revised edition of Administrative Division issued by General Statistics Office of Vietnam under the Prime Minister’s Decision No. 124/2004/QD-TTg.
- The locations of facilities are indicated on the maps by Commune and the name of project was also entered. For the road sector, the start and end points and routes were depicted on the maps.
- The maximum file size is 2MB.
- The file name is indicated as Item_Province Code_Year/Month/Day; for example: **map_NE1_20100601**.

**Photographs**

- The whole view and partial views of each facility, and the parts having any problem were photographed.
- Up to 6 sheets in A4-size form can be pasted and the maximum file size is 2MB.

- The file name is indicated as Item_Project Code_Year/Month/Day; for example: **photo_I-W-NE1-04_20100601.**
- Province name, project name, date/time of photography and description are indicated on each sheet of photo.

**<u>Drawings</u>**

- The maximum file size is 2MB.
- The file name was indicated as Item_Project Code_Year/Month/Day; for example: **drawing_I-W-NE1-04_20100601**.
- The typical general drawings and specially important detailed drawings are stored as drawing information.

**<u>Documents</u>**

- The maximum file size is 500KB.
- The file name is indicated as Item_Project Code_Year/Month/Day; for example: **document_I-W-NE1-04_20100601**.

**<u>Various types of forms</u>**

- The maximum file size is 100KB.
- The file name was indicated as Item_Sector Code*_Year/Month/Day; for example: **form_xx_20100601.**
  * Sector code: road – ro, water- ws, irrigation – ir, and electricity – el
- The sample forms were prepared based on the materials made available from related ministries.

### 9.5 Output Forms

Various types of form are required for the operation, maintenance and management works for facilities. Provincial People's Committee doesn't prepare specific form, but a form specified for each office is prepared.

In the Survey, it was attempted to make a request to acquire any existing forms from an operation, maintenance and management agency, but it was made clear that each office used its independent forms in many cases as described above. The form that could be obtained was only the request form, but the schedules such as estimation sheets to be attached to the request and other forms were not available in most cases.

The sample forms of the request for budget and the schedule for estimation for the road sector were prepared based on the request form made available from Quang Tri Province. These forms were stored in the illustration folder in the database.

### 9.6 Method of Using Database

This database is intended to be used by operation, maintenance and management agencies, Provincial DPI in the local level, and Ministry of Planning & Investment in the central level. The concept of the database users system is shown in below.

It should be mentioned repeatedly that the data storage for at least 5 years or more is desirable to ensure the future prediction in the effective use the database for the purposes as described below. On the other hand, the data to be stored for such long period may be obsolete, leading to low prediction accuracy. Therefore, it is desirable to use the database in understanding such low accuracy of prediction and to improve the accuracy, to screen data items strictly and to grasp the data volume per data item to be stored at minimum.

#### (1) Formulation of new project plans

1) This database covers the map information indicating the locations of the facilities constructed by the SPL projects, which allows the undeveloped areas and sectors to be monitored visually. In addition, the social and economic conditions of the project sites and their future tendencies such as pollution growth rate can be presumed based on the socioeconomic information in Rural District level stored in the database, ensuring the effective primary selection of the project.

2) If a sector or site for a new project is selected, the existing projects in the same sector having similar natural and socioeconomic conditions can be retrieved from the database to monitor the data including public service demand and consumption, construction costs, and costs of operation, maintenance and management. In using such monitored data, the pre-feasibility study of the new project can be made efficiently for a short period, ensuring efficient project selection. It is also natural that it is effective to execute the feasibility study.

#### (2) Use for facilities operation, maintenance and management

1) This database is also intended to be used as a register of equipment of a facility. A user agency of operation, maintenance and management evaluates the grade of importance of equipment and apparatuses in maintaining the functionality and in operating efficiency of the facility and makes the storage, arrangement and analysis of the data per equipment. By doing these, the user agency can formulate the facility maintenance plan, take quick action in event of failure occurrence, and make the future failure prediction and estimate the annual repair cost, and presume the time of equipment renewal or repair.

| | |
|---|---|
| Formulation of Maintenance Plan: | Year of installation, elapse of years, usable life, records on accidents and failures and complaints from users |

| | |
|---|---|
| Quick Action in Failure Occurrence: | Records on accidents and failures, source of purchase of equipment, list of spare parts |
| Failure Prediction, Estimation of Annual Repair Cost, and Presumption of Time of Equipment Renewal and Repair: | Year of installation, elapse of years, usable life, records on accidents and failures |

2) Each operation, maintenance and management agency sets the operation indexes for its own facilities and stores and analyzes the data, thereby allowing the results to serve for the income and expenditure forecasts for the facilities, to reflect on future rehabilitation plans and to improve the works of operation, maintenance and management of the facilities.

The data and information available from the above-mentioned work processes and a lack of data for a certain operation which is found through the actual use of the database can be made clear and by storing and accumulating other data necessary for retrieval and sorting, the database will become easier to use and more effective.

### 9.7 Database Manual

The User Manual for use of this database was prepared as attached hereto. Its contents are as follows:

- System Operating Environment
- Main Functions
- Installation
- Basic Operations
- Retrieval
- Socioeconomic Information
- Data Input
- Illustration Data Input
- Warning Functions
- Data Analysis and Graph Creation
- Storing and Printing
- Updating and Correction
- Sending of Updating File
- Protective Functions
- Frequently Asked Questions

## 9.8 Database Maintenance and Management

### 9.8.1 Database Maintenance and Management

Each operation, maintenance and management agency is required to assign one person to the maintenance and management of the database. Such person is not needed to have special technology and management experience. One staff member of the office can arrange and input collected data daily/ weekly / monthly, and update the database.

### 9.8.2 Data Storage and Updating

It is desirable that the data to be stored (almost all data including daily operation and management records and complaints) and the data to be updated (renewal of facilities, equipment and apparatus and equipment deliverers; the data such as failure records on older equipment should desirably be taken in custody separately.) should be input into the database regularly or whenever it is needed, in order to make the data storage and updating, and that the time and method of transmitting the updated database should be determined between the agency and the Provincial level and MPI.

## 9.9 Management Information System (MIS)

MIS was web communication system developed under SPL V and supports the management of the progress of sub-projects. POs store data concerning work progress in web server from their PC. PMU and PPMU review and approve data registered by POs on the web and supervise work progress.

Main features of MIS are shown in below.

| PMU, PPMU | PO |
|---|---|
| • Review and Approve General Information on Project<br>• Review and Approve Information on Work Progress<br>• Edit and Review Project Information List<br>• Review and Approve Social and Economic Information<br>• Review and Approve Illustration data (Photo, Map, Drawing)<br>• Send mails to PO to approve or request revision of data registered | • Register General Information on Project<br>• Register Information on Work Progress<br>• Register Social and Economic Information<br>• Register Illustration data (Photo, Map, Drawing) |

If possible, it is desirable to retrieve and utilize data accumulated in MIS

## 9.10 Present Status of Databases of Other Agencies

### 9.10.1 Necessity of Confirmation

Some agencies such as MPI and MARD have been operating the database system developed by them. MARD plans to integrate the systems in operation in its departments. In some Provinces, there is a move to develop a database system as the basic system for OM/M. In consideration of these circumstances, the present status of the databases of other agencies was checked and confirmed to avoid the competition between the database developed in this Project and the existing or planned databases.

### 9.10.2 Ministry of Planning & Investment (MPI)

It happened to be known to us that a few DPIs had the programs operated under the control of MPI to monitor the ODA projects. The survey results are shown in below.

| Name | Developer | Objective | Remark |
|---|---|---|---|
| Aligned Monitoring Tool （AMT） | MPI | To monitor and make report on each quarter/year of the Project Owner for ODA projects | Excel sheets |
| Project Monitoring Tool （PMT） | MPI | To monitor implementation and activities of ODA project s | Excel sheets |

These programs were developed mainly for the progress management and preparation of reports on the ODA projects.

### 9.10.3 Ministry of Agriculture and Regional Rural Development (MARD)

The development and operation of the MARD databases by Department of Planning, Department of Finance and Center for Information and Statistics (CIS) under the MARD is described below.

- Various types of database system are operated by different Departments at present. Therefore, MARD is preparing the integration of those database systems.

  First of all, the systems operated by CIS at 3 main Central Project Offices (CPO) will be consolidated into one two-way system (Central and Regional). It is expected to complete such consolidation in 2 to 3 years, but its prospect is unclear because of the severe financial situation of CIS.

- There are surely some ODA projects to develop database systems, but those projects including the project implemented by MARD do not consider the maintenance and management of the database systems after its completion and instruction.

- CIS is collecting statistic materials regularly (the deadline of which is the 25th day of each month) from Departments of Agriculture and Regional Development (DARD) of Provinces.

### 9.10.4 Province

#### (1) Ha Tinh Province

- Department of Transportation (DOT) has the road and bridge maintenance and management systems by operated by VRA (Vietnam Road Administration): i) ROADNAM (an integrated road and bridge database system developed by VRA and the WB; ii) BMSY (a bridge management system); and iii) General Road Management System.

- The first of those systems was introduced in 2006. Actually, the systems had not been operated so far for the reasons that it was difficult to acquire necessary data and information due to lack of road surveyors and that there was no staff capable of operating the systems.
- However, the Provincial Decision No. 764 was issued in March 2010 to permit the budget for data collection. This Decision No. 764/QD-UBND provides that DOT will build the local area network (LAN) with database functions in and after 2010 and Ha Tinh province DOT is preparing the database development project at present.

**(2) Quang Tri Province**

- The OM/M budget for each of the facilities is estimated by the head office of PWSC based on the budgets submitted by those facilities. Their application forms are different from facility to facility.
- The head office in road maintenance company operates 10 personal computers. The database system is not used. "ROADNAM" had been introduced by DOT before, but some system failures were discovered by DOT. Since then, Quang Tri Province has not used the system.
- In any case, there is no specific application form for annual maintenance and management fund budgeted by DOT.

As explained above, the database system related to the rural infrastructure is still in a condition in which it is deemed that each agency is working in the start-up period. This means that each agency is not in a position to develop an integrated database system for rural infrastructure. Therefore, it is important to operate the developed database system and to promote the improvement of the developed database systems through exchange of opinions with other agencies which have developed and are operating their similar database systems.

## 9.11 Database Training Courses

### 9.11.1 Details of the Database Training Courses

When the construction of the database had been almost completed, training courses were implemented for people in charge of database at MPI and provincial DPIs, with the aims of teaching the participants how to maintain and manage the database and raising their interest in operation, maintenance and management of the facilities constructed in SPL projects. In the courses, the participants were asked to use the constructed database on trial basis and to provide thoughts and opinion about the database. They were also asked to take part in the discussion on systems and methods of the database operation.

Each provincial DPI was requested to recommend two staff members for the training courses. The training courses were held in three areas, in the north (Yen Bai Province), in the central (Dak Lak Province) and in the south (Kien Giang Province), in order not to have too many participants at one venue, for better understanding of the training contents by participants. The details of the participants are summarized in below.

| Venue/Date | Number of provinces | Number of participants | Participants' affiliation | Specialties of participants | Participants' ages |
|---|---|---|---|---|---|
| Buon Ma Thuot,<br>Dac Lak Province<br>September 7th, 2010 | 15 | 29 | DPI | Managerial (15)<br>Technical (1)<br>Administrative (2) | 20-30 (3)<br>30-40 (7)<br>>40 (10) |
| Rach Gia,<br>Kien Giang Province<br>September 10th, 2010 | 12 | 29 | DPI | Managerial (23)<br>Administrative (1) | 20-30 (5)<br>30-40 (7)<br>>40 (12) |
| Yen Bai,<br>Yen Bai Province<br>September 14th, 2010 | 21 | 44 | DPI | Managerial (27)<br>Technical (3) | 20-30 (6)<br>30-40 (7)<br>> 40 (14) |

The participants were divided into groups in the training courses. The program of the courses are shown below.

| | Subject | Allocated time |
|---|---|---|
| 1 | Explanation of the outline of the constructed database | 30 minutes |
| 2 | Explanation on how to operate the database | 45 minutes |
| 3 | Practice on the database operation | 45 minutes |
| 4 | Group discussion | 60 minutes |
| 5 | Presentation of the outcomes of the group discussion and question-and-answer sessions on the presentation | 60 minutes |
| 6 | A question-and-answer session on the responses to the questionnaire | 45 minutes |
| | Total | 4 hours and 45 minutes |

The themes in the group discussion and the questions in the questionnaire mentioned in the table above are as follows:

<u>The themes of the group discussion</u>

(1) How to use the database

(2) What to expect from the database

(3) The best way to use the database continuously

(4) Expected problems associated with operation, maintenance and management of the database

(5) Suggestions for effective use of the database

Questionnaire

(6) Name of the affiliated organization

(7) Type of job (managerial, technical, administrative, etc.)

(8) Age

(9) Sex

(10) Evaluation of the level of understanding of the database

(11) Issues difficult to understand on the database

(12) Things required for the use of the database

(13) Comments and suggestions after using the database

### 9.11.2 Opinions Expressed in the Group Discussion and Responses to the Questionnaire

Many participants expressed similar views on Theme (1) - (5) in the group discussion and Questions (12) and (13) in the questionnaire. Therefore, after excluding some opinions and responses, such as "to use data," considered not consistent with the objectives of the training courses, in which the use of data was a precondition, the Survey Team classified the remaining 147 opinions and responses.

| Subject of participants' opinions | Point of participants' opinions | Number of responses |
|---|---|---|
| Opinions on the database operation | Establishment of an organizational framework for the database operation | 29 |
| | Budgetary measures and human resources | 26 |
| | Guarantee of maintenance and update of the database | 19 |
| | Need to train personnel concerned | 17 |
| | Information sharing among personnel concerned | 14 |
| Purposes of the database use | Assistance to management works | 14 |
| | Assistance to the operation, maintenance and management (OM/M) | 8 |
| | Assistance to project implementation | 7 |
| | Assistance to project formulation | 1 |
| Opinions on database construction | Request to make the database easy and simple to use | 5 |
| | Improvement of the database | 3 |
| | Application of the database to other projects | 3 |

| Subject of participants' opinions | Point of participants' opinions | Number of responses |
|---|---|---|
| | Integration with other databases | 1 |
| | Total | 147 |

As shown in the table above, the main interests of the participants of the training courses are in "establishment of an organizational framework among the central and local governments and the OM/M organizations" and "budgetary and human resources," issues expected from the database operation.

Since the issue of sufficient human resources is one of the issues to be solved when operating databases, the Survey Team recommends that the outlines of the capacities required for the human resources and the contents of the training required for developing such capacities should be formulated through implementation of the database operation on trial basis, described below.

### 9.11.3 Database Operation on Trial Basis

The collected data and information were used in constructing the database in this survey. Each operation, maintenance and management (OM/M) organization will have to not only improve and expand the database but also facilitate its use. Therefore, each operation, maintenance and management (OM/M) organization will have to consider ways to use the database in accordance with its facilities and the mode of their operation.

For the reasons mentioned above, it seems necessary to select several existing projects in each sector, identify requests from the projects and operate the database practically on trial basis in several provinces. This process is considered essential for acquisition of the understanding that the database and a system for database use are different and data are to be accumulated by each operation, maintenance and management (OM/M) organization while it is performing its duties.

# Asset Survey for Small Scale Pro-Poor Infrastructure in Vietnam

## Final Report

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# Chapter 1 Background of the Survey

## 1.1 The SPL Projects Executed

After the introduction of the Doi Moi (Reform) policy in 1986, the Government of Vietnam (GOV) had challenged to shift its planned economy to the market economy and achieved remarkable economic growth, which is marked by the average annual growth rate of 8.9% from 1992 to 1996. This economic growth brought the dramatic reduction of the poverty rate in Vietnam (The current poverty lines set in the rural area and the urban area are VND 200,000/month and VND 260,000/month respectively.) from 58% in 1993 to 24% in 2004. However, the economic disparity between the rural area and the urban area is growing, and in the rural area where 90% of the poor live, the poverty rate was 25% in 2004 which was far higher than the 3.6% poverty rate of urban area.

Under these circumstances, the Government of Japan (GOJ) extended loans for the sectors with urgency such as rural road and water supply as “Rehabilitation Loan I & II” (CL I & II). In addition to these sectors, electricity distribution, irrigation and afforestation were added in “The Rural Infrastructure Development and Living Standard Improvement Projects – Sector Project Loan (SPL) I to III”. Furthermore, from 2003, the loan was extended to focus on the poor areas of road, electricity distribution, water supply and irrigation sectors as “Small-Scale Pro-Poor Infrastructure Development Projects - SPL IV & V”. SPL I to IV have already been completed and SPL V project is on-going. Besides, the loan agreement of the SPL VI was signed in November 2009. The total loan amounts of SPL I to V is 48,350 million Yen, and a little less than 1,200 projects were implemented in all the administrative districts except Ho Chi Minh municipality.

However, the assessment of the situations of those constructed facilities is considered to be insufficient due to a great number of the sub-projects, which spreads throughout the country, of SPL I – V Project. For example, the facilities constructed in the SPL I were already utilized for over 10 years, which indicates that the age of facilities will exceed their projected service life, which is 15 years in most of water supply sub-projects, in the near future. Moreover, some facilities seem to be not used as planned because of the modification of laws, damages caused by natural disasters, etc.

Under these circumstances, this Survey aims at grasping the actual situations of all the sub-projects executed in SPL I to V.

## 1.2 Outline of SPL Projects

In 1994, based on the request of the GOV, the GOJ decided to extend the rehabilitation loans (CL I&II) for the purpose of improving international trade unbalance caused by chronic war and subsequent economic recession. The loan covered for the procurement of imported materials (fuel, asphalt, pumps and pipes etc.) for water supply and road construction sub-projects. In order to continue the assistance for the economic growth of Vietnam, it was indispensable to reduce the disparities between the urban and rural areas and to develop the rural areas where the majority of population lives. For this purpose, the Rural Infrastructure Development and Living Standard Improvement Projects (SPL I, II and III) were carried out from 1996. In these SPL Projects, the loans covered cost including the insufficient construction cost which was one of the major problems in the execution of sub-projects under the rehabilitation loan. In addition to this, electricity distribution sector was added in SPL II (1997) and the irrigation sector was started in SPL III (1999).

From 2003, in coordination with Vietnamese policy on the poverty reduction strategy, the loan was extended as “Small-Scale Pro-Poor Infrastructure Development Projects - SPL IV & V”. In these SPL Projects, the target areas were focused on the less-developed areas (northern mountainous area, central highland area, etc.) where a number of ethnic minority groups live, and covered road, water supply, electricity distribution and irrigation sectors. Besides, the loan agreement (L/A) of the SPL VI was signed in November 2009 for the Phase-3 Small-Scale Pro-Poor Infrastructure Development Projects which covers mainly the northwest mountainous area and the central highland area, where the poverty rate is high.

Total amount of SPL I-V loans are summarized in the Table 1.2-1.

**Table 1.2-1 Loan Amount SPLI-V** **Unit: Million yen**

| | | |
|---|---|---|
| SPL I | (March 1996, L/A was signed) | : 7,000 |
| SPL II | (February 1997, L/A was signed) | : 4,000 |
| SPL III | (March 1999, L/A was signed) | : 12,000 |
| SPL IV | (March 2003, L/A was signed) | : 10,562 |
| SPL V | (March 2006, L/A was signed) | : 14,788 |
| | Total | 48,350 |

Around 1,200 sub-projects have been implemented under the SPLs as shown in Table 1.2-2.

**Table 1.2-2 Numbers of Sub-Projects by each Sector under SPLs**

| Sector | Road | Electricity distribution | Water Supply | Irrigation | Afforestation | Total |
|---|---|---|---|---|---|---|
| Number of Subprojects | 518 | 526 | 96 | 85 | 5 | 1,230 |
| Number of Target Provinces | 62 | 60 | 44 | 36 | 5 | |

## 1.3 The Projects Area

The sub-projects spread through the whole country of Vietnam except Ho Chi Minh municipality, i.e. in 62 provinces. The number of sub-projects of each sector sorted by the region is summarized in the Table 1.3-1 below. Regarding the region, refer to the Appendix 1.1. The list of the sub-projects and their distribution by province are shown in Appendix 1.2 and 1.3.

**Table 1.3-1 Numbers of Sub-Projects by Region**

| Sector / Region | Road | Electricity distribution | Water Supply | Irrigation | Total |
|---|---|---|---|---|---|
| North East | 118 | 115 | 19 | 20 | 272 |
| North West | 35 | 26 | 8 | 4 | 73 |
| Red River Delta | 114 | 83 | 8 | 2 | 207 |
| North Central Coast | 79 | 82 | 27 | 23 | 211 |
| South Central Coast | 39 | 55 | 9 | 13 | 116 |
| Central Highland | 36 | 42 | 9 | 14 | 101 |
| South East | 32 | 45 | 2 | 3 | 82 |
| Mekong Delta | 65 | 78 | 14 | 6 | 163 |
| Total | 518 | 526 | 96 | 85 | 1225 |

Note: Five afforestation sub-projects are not included

## 1.4 Vietnamese Implementing Organization

The implementing organizations of SPLs are Ministry of Planning and Investment (MPI), Ministry of Finance (MOF), Commercial Bank for Foreign Trade of Vietnam (Vietcombank), Provincial People's Committee (PPC) and Project Management Units at central level (PMU) and provincial level (PPMU). Project Owner (PO) decided in the investment decision also establishes the Sub-project Management Unit (SPMU). Followings are the duties of each organization.

### (1) Ministry of Planning and Investment (MPI)

- To ensure program investment decisions in accordance with the law and the development plan, and to meet the objectives of the SPL Project.
- To coordinate with JICA to review and select the sub-project base on proposal of the PPC.
- Informing PPC for implementation of the list of sub-projects and allocated JICA fund for each sub-project.
- To approve selecting consultants for the SPL Project (hereinafter referred to as "the Consultants") in accordance with current procurement legislation.
- To inspect and supervise the implementation of the SPL Project.
- To ensure the necessary resources for monitoring activities, the management and supervision of the SPL Project.
- To develop and implement the measures prescribed by law for the prevention and fighting against corruption and improper use of the fund which affect the SPL Project's objectives.

- To be responsible on the authority in accordance with current laws on violations of regulations in the process of supervising the implementation of the SPL Project.
- To be responsible on the process of implementing the SPL Project, for causing the delay, leakage and waste and corruption in accordance with current legislation.
- To coordinate with JICA to consider and decide the utilization of the remaining fund.

**(2) Ministry of Finance (MOF)**

- To make payment for sub-projects.
- To make out balance sheet for the Provincial Finance Department in time.
- To conduct withdrawal from the loan account to special account.
- To repay the principal and interest as stipulated in the L/A.
- To coordinate with the PMU and the JICA in monitoring and evaluation of the SPL Project.

**(3) Commercial Bank for Foreign Trade of Vietnam (Vietcombank)**

- To make a disbursement in accordance with the methods stipulated in the L/A at the request of the MOF and to notify to the relevant authorities as stipulated in the Circular on mechanism for debt management of the SPL.
- To monitor and report to the MOF and PMU the special account balance after each disbursement and withdrawal to special account.

**(4) Provincial People's Committee (PPC)**

- To ensure the sub-project investment meeting, discussing about the objectives, plans and relevant laws.
- To ensure sufficient counterpart fund for sub-project implementation as the schedule stipulated in the L/A.
- To approve the contractors selection process for the sub-projects in accordance with current legislation on the procurement.
- To inspect and supervise the implementation of the sub-projects.
- To develop and implement the measures prescribed by the law for the prevention and fighting against corruption, delay in implementation, etc. which affect the objectives of the sub-project.
- To be responsible on the authority in accordance with current laws on violations of regulations in the process of monitoring on the implementation of the sub-project.
- To be responsible in accordance with the current legislation on the implementation of the sub-project.
- To be responsible to report and explain to the MPI and the JICA on the change of sub-project (if any) in every September.

### (5) Project Management Units

#### 1) SPLs Project Management Unit (PMU)

MPI issues the decision on the establishment of the PMU. The tasks of PMU are as follows:

- Scheduling the implementation plan for the sub-projects
- Procurement and contract management
- Finance, properties management and disbursement for the sub-projects
- Administration, coordination and accountabilities
- Monitoring, evaluation and report of implementation of the sub-projects.

#### 2) Provincial Project Management Unit (PPMU)

PPMU is under the Department of Planning and Investment (DPI) in each province and it was established by decision of the competent authorities of the province. The tasks of PPMU are as follows:

- Acting as the focal point in planning, managing and reporting on implementation of sub-projects carried out in the province.
- Making the plan to arrange counterpart fund for sub-projects in the province and operation expenditure for PPMU, and submit it to the PPC for approval.
- To monitor the bidding activities and contract management.
- To carry out the tasks of managing financial assets and disbursements:
- To carry out the administrative tasks, coordination with parties concerned and making sub-projects accountable.
- To carry out the tasks of monitoring, evaluation and reporting of the sub-projects.

#### 3) Sub-Project Management Unit (SPMU)

Sub- Project Management Unit is to be established by PO. Followings are the tasks of the SPMU:

- Scheduling the project implementation.
- To carry out the tasks for bidding and contract management.
- To carry out the tasks of managing financial assets and disbursements.
- To carry out the administrative tasks, coordination with parties concerned and reporting.
- To carry out the duties on the acceptance, transfer and final financial settlement of the sub-projects.

### (6) Operation, Maintenance and Management Organization (OM/M organization)

The PPMU and SPMU transfer the facilities constructed under the SPL to the operation, maintenance and management (OM/M) organization in line with the related laws and decrees of Vietnam. After the transfer, the PPC takes charge of the operation, maintenance and management of the facilities.

Following Table 1.4-1 presents the examples of OM/M organizations shown in a number of provinces.

**Table 1.4-1 Operation, Maintenance and Management Organizations**

| Sector | Organization |
|---|---|
| Road | Management Unit for Transportation, DOT, Board for OM/M which invites contractor for maintenance, Road management company<br>Provincial Road: PMU for Transportation, DOT or its contracted maintenance company, Joint Stock Company for OM/M, Company for transportation, construction and management belongs to DOT<br>District Road: DPC, MB under DPC, District Department of Industry and Trade (or Department of Commerce), SPMU, Center for exploitation and management of public works<br>Communal Road: Management Organization like Cooperative under CPC |
| Electricity Distribution | EVN, Affiliate or Subsidiary of EVN, Provincial Electricity Company under EVN, MB under PPC, Provincial Water Supply and Electricity Company, Provincial Electricity Company under Provincial Department of Industry and Trade, DPC, Management Organization like Cooperative , CPC |
| Water Supply | Branch of Provincial Water Supply Company, OM/M organization under DPC or Town PC, Independent Autonomous OM/M organization established in City, Town, etc., PCERWAS (Provincial Center for Rural Water Supply and Sanitation), Commune People's Committee, Provincial Water Supply Company<br>Branch of Provincial Water Supply Undertaking such as Provincial Irrigation Service and Construction Ltd. Co. under PPC |
| Irrigation | DARD, DPC,CPC,IMC, FO (Farmers Organization) |

It should be noted that most of the provincial companies, which were controlled by line department of PPC, has become the “Limited Company” or “Joint Stock Company” under the direct control of PPC on the first of July, 2010 based on the Decree on Conversion of Enterprises with 100% State Owned Capital into Shareholding Companies, No. 109-2007-ND-CP.

# Chapter 2 Purpose of the Survey

## 2.1 Outline of the Survey

The Survey covers four sectors of the road, the electricity distribution, the water supply and the irrigation and consists of the questionnaire survey and the sub-project sites visiting by the Team members to 1,115 infrastructures constructed under the sector project loans (SPL) in order to grasp the current operation, maintenance and management (OM/M) situation of them.

Though the SPLs contain the afforestation sector, because of small number of sub-projects implemented, the Survey intends to cover all the constructed facilities of road, electricity distribution, water supply and irrigation sectors.

The replies to the questionnaire provided the database, which format was elaborated by the Survey Team, with the data and information on the facilities and their OM/M situations. The database will hopefully contribute the efficient and cost effective OM/M of the facilities.

The Team members could locate the facilities and such information reflected to prepare the SPL Infrastructure Map (location map of the facilities).

The members of Survey Team prepared the final report, which includes the recommendations on the problematic conditions and points to be improved of the OM/M of the facilities, after the completion of the site visiting.

## 2.2 Purpose of the Survey

In accordance with the decentralization policy of the GOV, the implementation of the survey, design, construction, OM/M of the sub-projects under the SPLs are performed by the initiatives of the Vietnamese local government authorities. However, considering the possibility that the constructed facilities are not always utilized as per the initial plans, the purpose of this Survey is to analyze the shortcomings in the planning of the infrastructure development projects. In addition, considering the possibility that OM/M of the facilities are not conducted properly after the transfer, the purpose of this Survey is to develop the necessary information for the Japanese review of the SPL Projects.

For this purpose, the following tasks were carried out;

- Comprehension of the current situation of each sub-project under SPL I to V.
- Comprehension of the OM/M organization of the constructed facilities of the sub-projects and its functions.
- Constructing the database of collected information, data, etc. through the activities mentioned above. This database has the functions such as the facilities register and records of OM/M, etc. Further, database instruction manuals was prepared.
- Mapping out the location of the infrastructures (the SPL infrastructure map).

- To recommend the effective and efficient utilization measures for the parties concerned based on the outcome of the above tasks. In particular, recommendations were made on the administrative system of the sub-projects after the transfer of facilities to the OM/M organization for the Ministry of Planning and Investment (MPI) and on the infrastructure asset management for the Department of Planning and Investment of Provinces (DPI).

The activities of this Survey are summarized in following Figure 2.2-1.

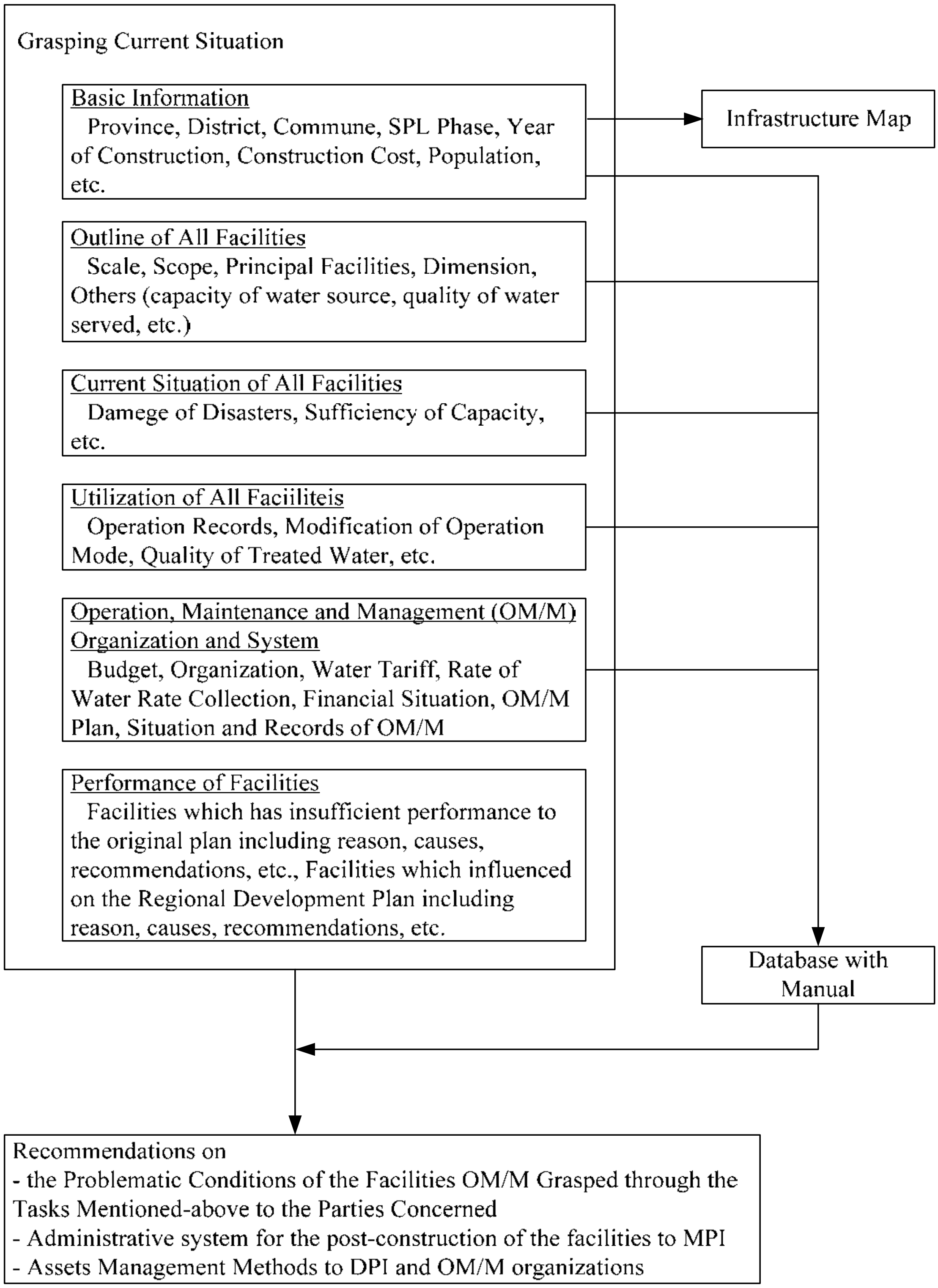



**Figure 2.2-1 Main Tasks of the Survey**

# Chapter 3 Implementation of the Survey

As mentioned earlier, the Survey was implemented in the four sectors which mainly consist of the questionnaire survey and the site visiting by the engineers for visual confirmation on the current situation of the facilities constructed under SPL I to V.

The Survey Team had the meeting with Ministry of Planning and Investment (MPI) for the explanation of the inception report and the request to cooperate in the survey immediately after the arrival in Ha Noi followed by the survey planning, entrusting the site survey of the road and electricity distribution sectors on Vietnamese consulting firms and the delivery of the questionnaires.

After the delivery of the questionnaire at the end of April, 2010, the Survey Team started the site survey including the meeting with Provincial Department of Planning and Investment (DPI) and other parties concerned at the beginning of May, 2010.

The road sector firstly completed the site survey at the end of July and the water supply sector finally finished the survey at the beginning of September.

Regarding the questionnaire survey, the Survey Team unfortunately couldn't receive the replies to the questionnaires sufficiently though the Team had been waiting by the middle of September.

Apart from the Survey activities of four sectors, the member in charge of database management had started to prepare the database formats for the fours sectors after the exchange of idea with MPI on the database as one of the outputs of the Survey. The data input was made from July to the end of September.

In the course of the data input, the Survey Team held the workshop on the database targeting the persons related to the SPL Projects with the cooperation of MPI in order to disseminate not only the database itself but also the rough concept of Assets Management making use of the database. The opinions collected at the workshop were reflected on the database format.

## 3.1 Setting up the Items to be Surveyed

The items to be surveyed consist of following five (5) categories:

- General Information
- Facilities
- Current Situation of Facilities
- Effectiveness of Sub-project
- Operation, Maintenance and Management (OM/M)

Four sectors set the same items to be surveyed in the category of "General Information", which are "SPL phase", basic information on sub-project such as name, location, organization in charge, project owner (PO), and implementation period, and funds and costs of sub-project.

Details of items to be surveyed in remaining categories of each sector are summarized from Chapter 3.3 to Chapter 3.6.

## 3.2 Methods of the Survey

### 3.2.1 Survey Executed

#### 3.2.1.1 Survey Team

The Survey Team consisted of six (6) Japanese members and four (4) Vietnamese members who worked for the Team on the contract basis.

The following Figure 3.2-1 shows the structure of the Survey Team.

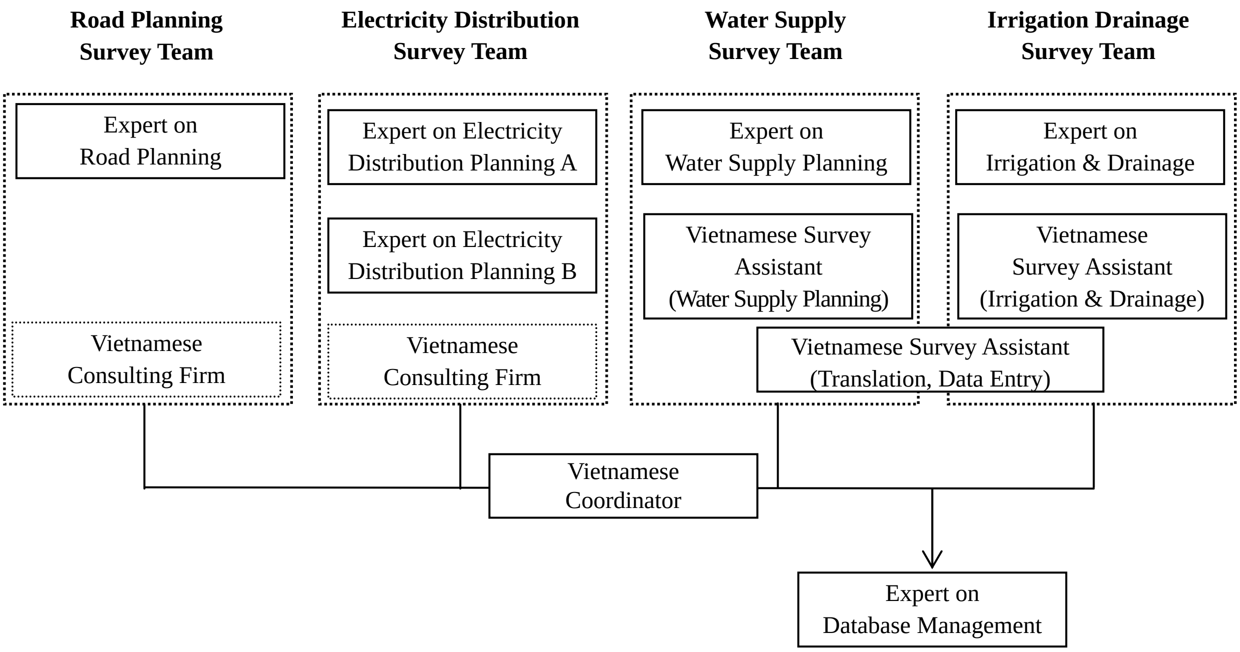



**Figure 3.2-1 Structure of the Survey Team**

#### 3.2.1.2 Vietnamese Organizations Cooperated with the Survey

The General Service Department of MPI cooperated and assisted the Survey in the central level, and the Department of Planning and Investment of provinces coordinated with the Sub-project management units (SPMUs[1]) and the OM/M organizations for delivery of the questionnaires and sending the replies to the Team.

Following Figure 3.2-2 shows the concept of the Vietnamese organizations concerned in the Survey.

[1] In case that the facilities constructed under the sub-project have not been transferred to the OM/M organization, SPMU still have all the data and information even after starting the operation of facilities.

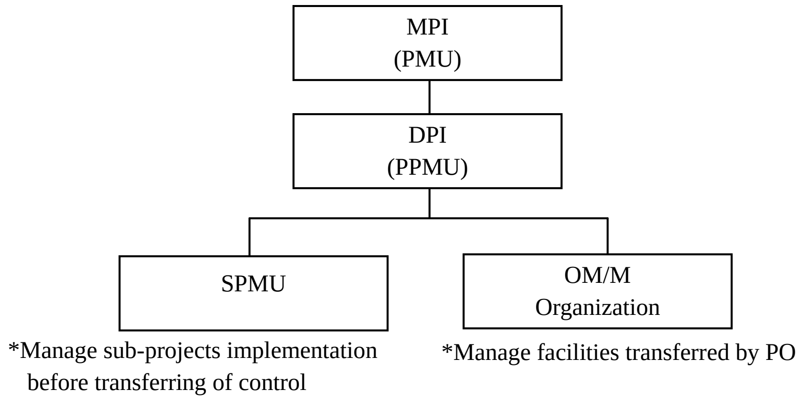



**Figure 3.2-2 Concept of the Vietnamese Organizations Concerned in the Survey**

#### 3.2.1.3 Entrusting the Site Survey on the Vietnamese Consulting Firms

The Survey Team entrusted the tasks of site visiting survey of the road and the electricity distribution sectors to confirm the current situations of all the facilities constructed under SPLs considering a great number of facilities to be surveyed within four (4) months.

The Survey Team members in charge of the road and the electricity distribution sectors respectively started the selected Vietnamese Consulting Firms who have the experiences of the SPL Projects and their related surveys such as the Special Assistance for Project Formation (SAPROF) studies, etc. followed by the evaluation of the cost estimates submitted by the candidate consultant firms.

The Team completed the selection at the middle of April, 2010 and submitted the report on the procedure of selection to JICA immediately.

#### 3.2.1.4 Number of Infrastructures Surveyed

There is an infrastructure which was constructed through the sub-project in different phases. A number of infrastructures are/were constructed through sub-projects in different phases except the electricity distribution sector; the number of infrastructures is accordingly less than that of sub-projects. In case of water supply sector, three (3) sub-projects have the scheme to construct two (2) WSSs.

After all, the number of sub-projects surveyed is as follows:

**Table 3.2-1 Number of Infrastructures**

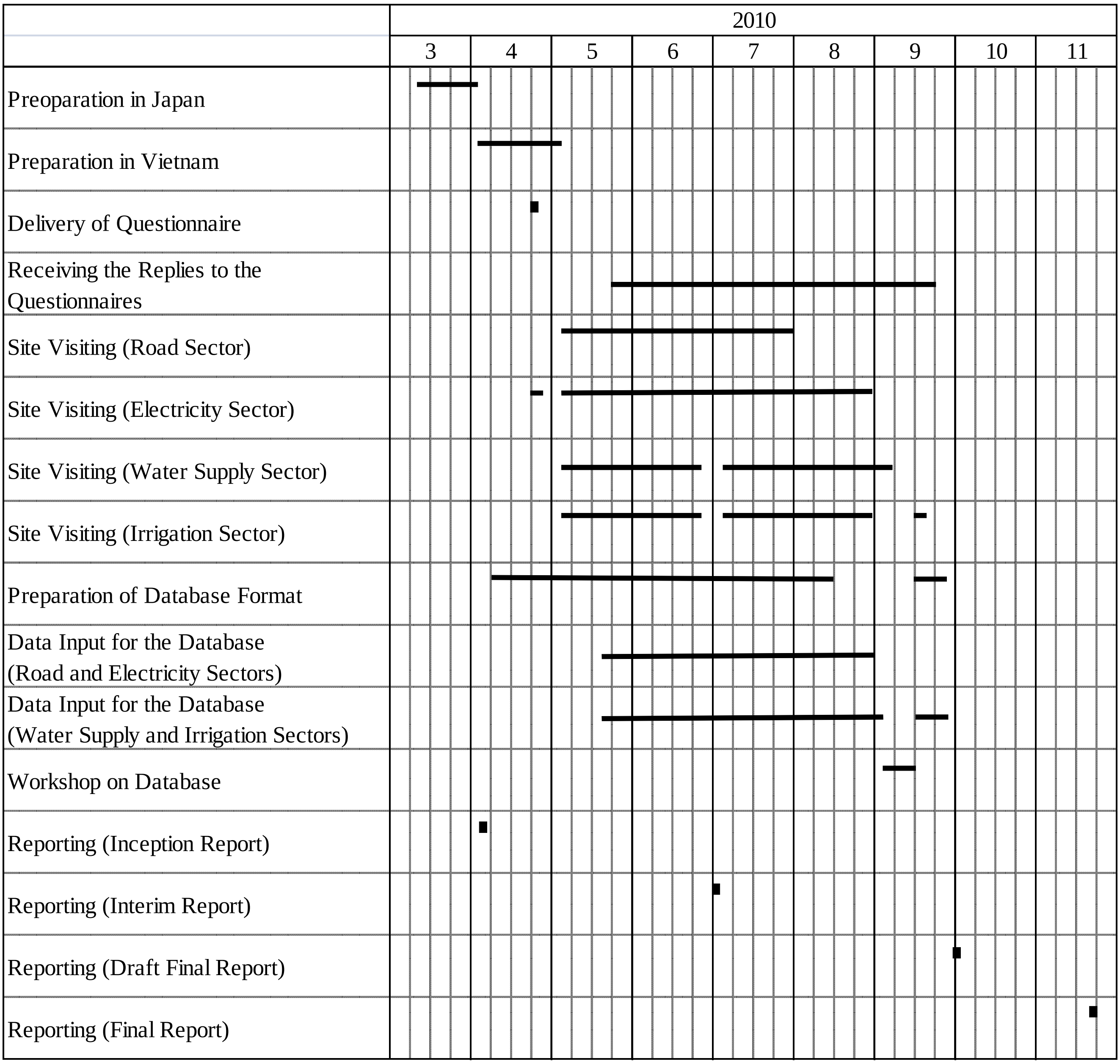
| Sector | Road | Electricity Distribution | Water Supply | Irrigation | Total |
|---|---|---|---|---|---|
| No. of Sub-projects | 518 | 526 | 96 | 85 | 1,225 |
| No. of Infrastructures | 408 | 526 | 97 | 84 | 1,115 |

The list of the infrastructures and their distribution by province are shown in Appendices 1.2, 1.3 and 3.1.

#### 3.2.1.5 Timeline of Survey Carried Out

The Survey started its preparation on March, 2010 in Japan and the Team continued the preparation works including discussion with MPI, deliver of the questionnaires, etc. on April in Hanoi followed by the site visiting survey which took around four (4) months to complete. In parallel with the questionnaire and site surveys, the database specialist prepared the database format which would have the data and information collected through the survey. The Survey Team prepared the draft final report on September for comments from the parties concerned. After having the comments, it submitted the final report on November, 2010.

**Table 3.2-2 Timeline of the Survey**



### 3.2.2 Questionnaire Survey

The Survey Team intended to send the questionnaires to MPI, DPIs, District People's Committees (DPCs) and OM/M organizations of all the facilities, however, the Team excluded the OM/M organizations relative to SPL I and II after the discussion with MPI due to the difficulties to identify them of which facilities had been constructed long ago and were altered, renewed or replaced up to present.

The Survey for the facilities relative to SPL I and II and their OM/M organization were made with the visual confirmation and interview by the Survey Team members with the assistance of DPIs.

The Team sent the questionnaire at the end of April with the assistance of MPI and expected to receive the replies by the end of June at the latest, though the Team requested to reply to the questionnaires by 20th May, 2010. However, the rate of receiving the replies was quite low even at the end of June; the Team continued to make effort to receive them as much as possible with the assistance of MPI and JICA. Appendix 3.2 shows the record on receiving the replies to the questionnaires. As shown in the Appendix 3.2, the average rate of receiving the replies to the questionnaires is less than 50%.

It might come from the complexity of the questionnaire and sending its reply. MPI sent the questionnaire by the request of the Survey Team to DPI and DPI makes copies of it to send them to the SPMUs through the DPC concerned or send it to the OM/M organizations sometimes through DPC and the replies were not necessarily sent through the opposite way to the Survey Team.

In the course of the delivery of the documents, the questionnaire might not reach the just person of the OM/M of the facilities and the reply long time after the delivery might go an inappropriate place.

The questionnaire made out for the Asset Survey is shown in the Appendix 3.3.

### 3.2.3 Site Survey

Appendix 3.4 shows the Progress Record of the Survey.

## 3.3 Road Sector

### 3.3.1 Setting up the Items to be Surveyed

Road sector surveyed based on the following items with objectives.

**Table 3.3-1 Survey Items and Objectives of Road Sector**

| Subject | Items to be Surveyed | Objectives of Survey through the Survey Item |
|---|---|---|
| Facilities | • Class of Roads<br>• Width and Length of Roads<br>• Construction Area<br>• Newly Construction or Rehabilitation<br>• Components of Facilities<br>• Project Owner | • Inquiries in this category mainly aim at grasping the specification of target roads, year of completion of construction, scale, construction cost |
| Current Situation of Facilities | • Damaged Level<br>• Bottleneck<br>• Main Type of Car passing the Road<br>• Public Transportation<br>• The Number of Traffic Accidents | • Inquiries in this category mainly aim at grasping the situation of damage on the facility and the parts where some troubles are observed of the facility. |
| Effectiveness of Sub-project | • Traffic Volume<br>• Access to Public Facilities (Markets, Schools, Hospitals and so on) | • Inquiries in this category mainly aim at confirming situation of utilization of the roads and degree of time saving for access to public facilities. |
| Operation, Maintenance and Management (OM/M) | • Organization and System for OM/M<br>• O & M Plan<br>• Record of Rehabilitation<br>• Main Instruments which needs Replacement | • Inquiries in this category mainly aim at grasping the actual situation of OM/M and confirming whether systematic O&M is conducted or not, OM/M plan arrangement and preparation of an OM/M manual, also confirming the OM/M budget, records of repair, rehabilitation, etc. and main instruments to be maintained. |

### 3.3.2 Site Survey

#### 3.3.2.1 The Number of the Survey Team and Scope of Work of Each Team

The road sector executed the survey by the Vietnamese consultant. The Vietnamese consultant was employed in compliance with "Guide for evaluation procedures for employment of consultants, June 2006".

As shown in Table 3.3-2, there are 518 sub-projects in the road sector. Six (6) survey teams were necessary to complete the Survey for 518 sub-projects within the contracted survey period, which is three (3) months, with the Vietnamese consulting firm.

**Table 3.3-2 Number of Sub-Projects of Road Sector**

| Area | Region | No of Sub-projects | |
|---|---|---|---|
| Northern Area | North East | 118 | 267 |
| | North West | 35 | |
| | Red River Delta | 114 | |
| Central Area | North Central Coast | 79 | 118 |
| | South Central Coast | 39 | |
| Southern Area | Central Highlands | 36 | 133 |
| | South East | 32 | |
| | Mekong River Delta | 65 | |
| Total | | 518 | 518 |

In road sector, about half of sub-projects are located in the northern area. Moreover, since the area is a mountainous, time was needed for the travel between sites. Considering these conditions, three teams were assigned for the northern area, one for central area and one for southern area. Moreover, another team in charge of management of site survey and data input was established.

The number of sub-projects and provinces for each survey team are shown in the following table:

**Table 3.3-3 Outline of the Site Survey for Each Team**

| Site Survey Team | No of Sub-projects | No of Province | Province |
|---|---|---|---|
| Team 1 | 112 | 11 | Son La , Hoa Binh, Vinh Phuc, Yen Bai, Tuyen Quang, Thai Nguyen, Bac Kan, Cao Bang, Lang Son, Bac Giang, Quang Ninh |
| Team 2 | 130 | 11 | Hai Duong , Hai Phong, Hung Yen, Bac Ninh, Thai Binh, Nam Dinh, Ha Nam, Ninh Binh, Thanh Hoa, Nghe An, Ha Noi |
| Team 3 | 122 | 15 | Ha Tinh , Quang Binh, Quang Tri, Thua Thien Hue, Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa, Lam Dong, Dak Nong, Dak Lak, Gia Lai, Kon Tum |
| Team 4 | 97 | 20 | Ninh Thuan , Binh Thuan, Binh Phuoc, Dong Nai, Ba Ria Vung Tau, Binh Duong, Tay Ninh, Long An, Tien Giang, Vinh Long, Can Tho, An Giang, Hau Giang, Kien Giang, Ca Mau, Bac Lieu, Dong Thap, Soc Trang, Ben Tre, Tra Vinh |
| Team 5 | 56 | 5 | Ha Giang , Lao Cai , Lai Chau , Dien Bien, Phu Tho |
| Team 6 | In Charge of Management of Site Survey and Data Input | | |
| Total | 517 | 62 | |

#### 3.3.2.2 Structure of the Survey Team

Team five (5) was responsible to coordinate with the remaining survey teams and informed necessary instructions and schedule arrangement for each survey team. As a result, discrepancies of outputs by each team were minimized. The number of sub-projects and provinces were evenly shared by each survey team, thus each survey team completed the site survey within the schedule.

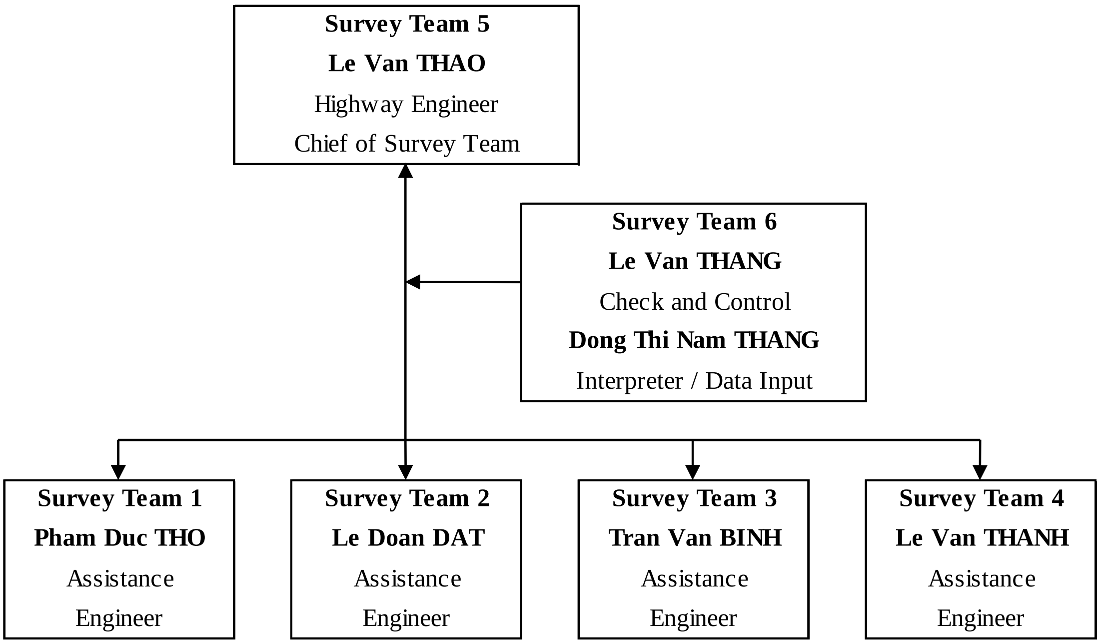



**Figure 3.3-1 Structure of Road Sector Survey Team**

#### 3.3.2.3 Item of the Site Survey

The direct observation was executed to the following items on sub-projects which were already constructed.

- Whether obstruction factors (bottleneck) of the traffic function exist or not
- The trend (pattern of a vehicle) of the road users
- The development conditions of the road adjacent and surrounding areas
- The situation of damaged road

#### 3.3.2.4 Survey Schedule

Contract with the Vietnamese Consulting Firm was made to execute the survey works within five months. Accordingly, the schedule of work was prepared to meet the contract as follows. The overall survey progress had to be assured within the schedule. The site survey period was planned within three months from May to July, 2010. The survey teams had to consider to be able to conduct the survey at 518 places of sub-project within this period.

The overall schedule of the survey is shown in Table 3.3-4.

**Table 3.3-4 Survey Schedule of Road Sector**

| | 2010 | | | | | |
|---|---|---|---|---|---|---|
| | 4 | 5 | 6 | 7 | 8 | 9 |
| Preparation in Vietnam | | | | | | |
| Delivery of Questionnaire | | | | | | |
| Receiving the Replies to the Questionnaires | | | | | | |
| Site Visiting | | | | | | |
| Data Input for the Database | | | | | | |
| Reporting (Inception Report) | | | | | | |
| Reporting (Interim Report) | | | | | | |
| Reporting (Draft Final Report) | | | | | | |

## 3.4 Electricity Distribution Sector

### 3.4.1 Setting up the Items to be Surveyed

Electricity Distribution sector has been surveyed based on the following items with objectives.

**Table 3.4-1 Survey Items and Objectives of Electricity Distribution Survey**

| Category | Items to be Surveyed | Objectives of Survey through the Survey Item |
|---|---|---|
| Facilities | • Project Cost after construction<br>• Construction length of Medium Voltage (MV) line<br>• Construction length of Low Voltage (LV) line<br>• Capacity of installed Transformer | In order to confirm that the projects were implemented |
| Current Situation of Facilities | • Confirmation of problems after the construction<br>• Outage Index such as SAIFI / SAIDI<br>• Confirmation of distribution loss<br>• Typical photograph | In order to confirm problems under operation |
| Effectiveness of Sub-project | • Construction length of Medium Voltage (MV) line<br>• Construction length of Low Voltage (LV) line<br>• Capacity of installed Transformer<br>• Electric Rate | In order to confirm whether Electric rate based on construction is improved or not |
| Operation, Maintenance and Management | • Operation organization<br>• Maintenance organization<br>• Management organization<br>• Number of maintenance worker<br>• Plan of maintenance<br>• Problem on maintenance | In order to confirm that the operation, maintenance and management are implemented suitable |

### 3.4.2 Site Survey

#### 3.4.2.1 The Number of the Site Survey Team and Scope of Work of Each Team

There are 526 sub-projects in Electricity Distribution Sector, so that three (3) teams are assigned, one team for North, one for Central and one for South.

**Table 3.4-2 Outline of the Site Survey for Each Team**

| Team | No. of Sub-projects | No. of Province |
|---|---|---|
| North | 224 | 25 |
| Central | 72 | 5 |
| South | 230 | 30 |
| Total | 526 | 60 |

#### 3.4.2.2 The Structure of the Survey Team

Three (3) teams are assigned as shown in Figure 3.4-1.

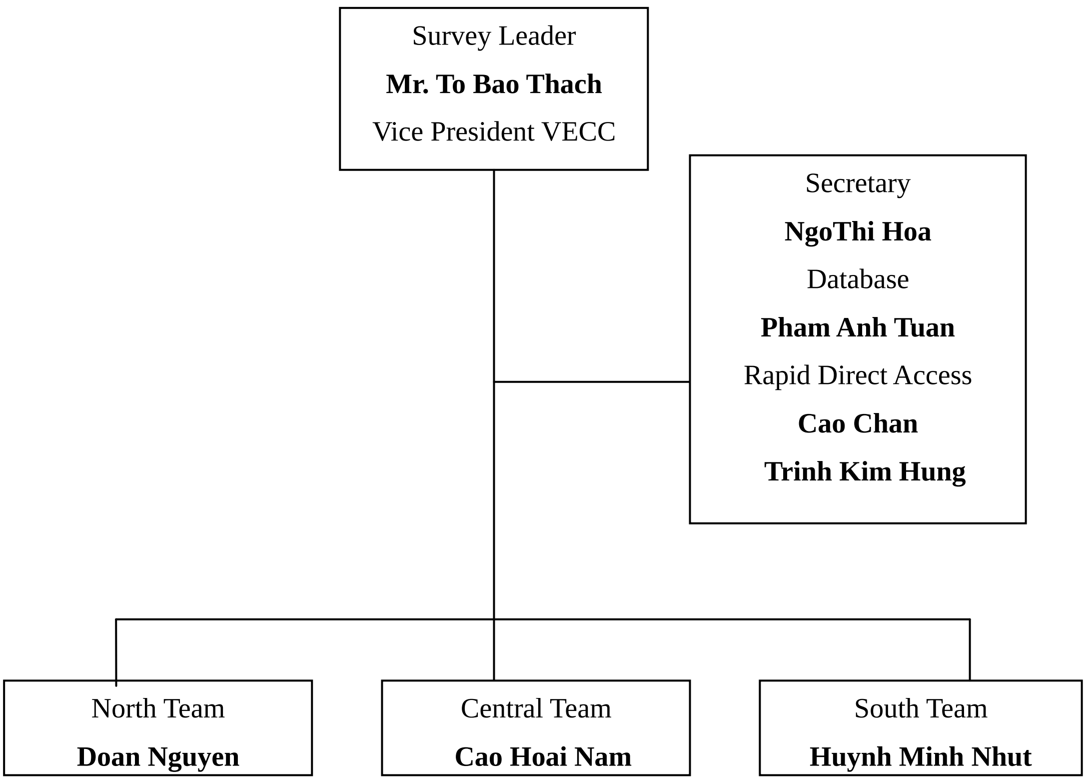



**Figure 3.4-1 The Structure of Electricity Distribution Team**

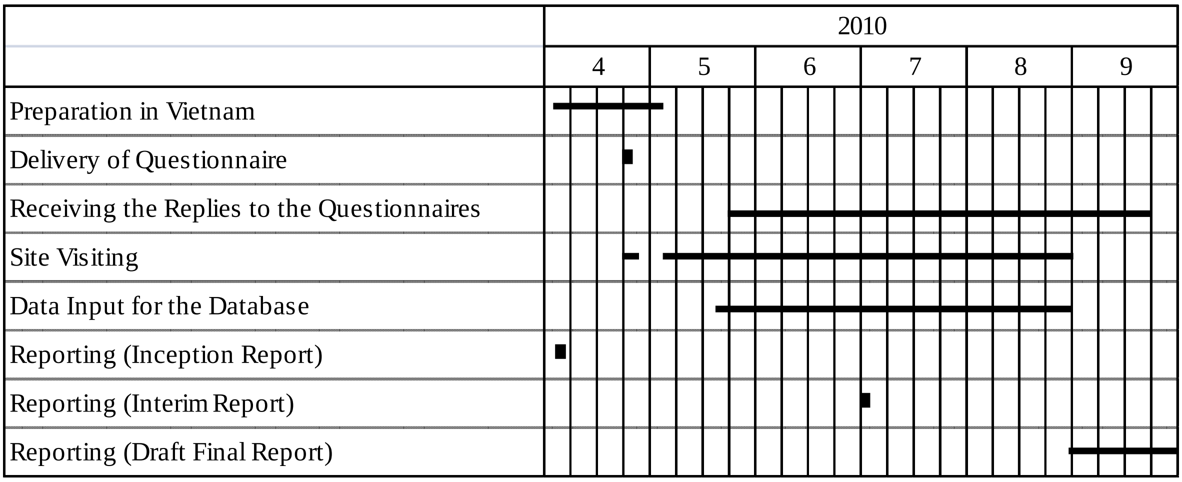
The survey leader mobilizes a secretary to follow up the survey activity all over the country and a group of EVN personnel for Rapid Direct Access service to join as the sites surveyors in case necessary.

Every Regional Team manager mobilizes temporarily some local assistant engineers and technicians for site survey depending on the number and situation of sub-projects in every province.

#### 3.4.2.3 Survey Schedule

The site survey had been implemented from Apr 22nd 2010 to Sep 30th 2010. The survey schedule is shown in Table 3.4-3.

**Table 3.4-3 Survey Schedule of Electricity Distribution Sector**




## 3.5 Water Supply Sector

### 3.5.1 Setting up the Items to be Surveyed

The components of water supply system vary with the water source, the water quality, topographic conditions, etc. It is accordingly difficult to prepare the questionnaire suitable for respective WSSs. The Team accordingly prepared the questionnaires applicable to all the WSSs to be surveyed, therefore, they includes questions which do not meet some WSSs, however, such question is necessary for other WSSs depending on its system.

**Table 3.5-1 Survey Items and Objectives of Water Supply Sector**

| Category | Items to be Surveyed | Objectives of Survey through the Survey Item |
|---|---|---|
| Facilities | • outline of WSS<br>• capacity and quality of water source<br>• dimensions, quantity and capacity of installations which compose the WSS main components of WSS are as follows:<br>- raw water intake facilities<br>- raw water storage facilities<br>- sedimentation basins<br>- filters<br>- chemical feeding facilities<br>- disinfection facilities<br>- treated water tank<br>• diameter, length and material of pipelines for | Inquiries in this category mainly aim at grasping the target WSS to understand the key factors on OM/M, the components to do the maintenance and the capability of water quality control.<br>Since the age of the installations, equipment, apparatuses, etc. is quite important to roughly judge the time to inspect them for changing main parts or overhaul, the questionnaire also includes the inquiries on the year of installation and service life of most of installations, equipment, etc.<br>The facilities and their detail components |

| Category | Items to be Surveyed | Objectives of Survey through the Survey Item |
|---|---|---|
| | water delivery to other destinations such as:<br>- raw water conveyance pipelines<br>- connecting pipes among installations mentioned above<br>- treated water transmission pipelines<br>- distribution pipelines<br>- service pipelines<br>• type, capacity, quantity, etc. of waste water treatment facilities<br>• specification of rotating machines which move the water. rotating machines used in the WSS are:<br>- pumps with motor to deliver water<br>- chemical pumps to mix necessary chemical with water<br>- blower for washing the filter media<br>- agitator to prepare the chemical solution<br>- facilities for electricity<br>• type, size and material of ancillary facilities of pipelines:<br>- pipe fittings for composition of pipelines<br>- valves to control water flow<br>- expansion joint to protect pipelines from forces generated by temperature, etc.<br>• type, size and location of the flow meters<br>• characteristics of chemicals used for water treatment and name of manufacturer with its location:<br>- coagulant<br>- coagulant aid<br>- disinfectant (liquefied chlorine)<br>- disinfectant (sodium hypochlorite)<br>• apparatuses and devices for water analysis in the laboratory<br>• spare parts stocked<br>• maintenance tools<br>• vehicles for maintenance and repair<br>• buildings to protect installations, equipment, etc.<br>• year of installation and service life of most of installations, equipment, etc. | gotten through the questionnaire survey are the basis of the database to be constructed under the Survey. |
| Current Situation of Facilities | • damages caused by disaster which affect/affected the WSS.<br>• history of water supply suspension: year/month, period of time and causes | It aims to have the information regarding the water supply suspension by disaster, trouble, etc. |
| Effectiveness of Sub-project | Operation and effect indicators stipulated in the SAPROF Study for the water supply sector under the SPL IV are applied as the items to be surveyed to this category.<br>• number of households connected with the WSS<br>• rate of population served<br>• capacity of the WSS<br>• average daily water consumption<br>• per capita water consumption<br>• maximum daily water supply in a year<br>• rate of facilities utilization (= average daily | The questions in this category relate to the consumers, therefore it is important for the OM/M organization to know the basis of its management from the viewpoints of effectiveness of the sub-project. |

| Category | Items to be Surveyed | Objectives of Survey through the Survey Item |
|---|---|---|
| | water supply / capacity of the WSS)<br>• rate of accounted-for water<br>• monthly operation hours of treated water pump<br>The questionnaire also requested following information on public health<br>• issues on public health in the target area<br>• mal-nutrition rate of under five (5) years old from 1998 to 2009 | Inquiries related to public health are prepared for understanding the indirect effect of the water supply. |
| Operation, Maintenance and Management | <u>Operation</u><br>• average daily water supply by month<br>• hourly water supply in the day of the maximum water supply in 2009 or 2008<br>• water surveillance<br>- water surveillance plan (parameters to be analyzed daily, monthly, yearly)<br>- sampling points<br>- the latest water analysis result<br>- change or alternation of the OM/M affected by the revision of drinking water quality standards in Vietnam in 2009<br>- information on the laboratories<br><u>Maintenance</u><br>• confirming the keeping of completion drawings and detailed pipeline map.<br>• rate of pipeline rehabilitation<br>• Records of repair and its cost<br>• prioritization of installations, equipment, etc.<br>• whether the preventive maintenance is introduced or not<br>• rehabilitation, renewal or expansion plan<br><u>Management</u><br>• water tariff applied<br>There are various type of water rate charging system, the inquiry requests OM/M organization to explain detail by selecting the system from those exemplified.<br>• water rate collecting system<br>- meter reading<br>- mode of bill delivery<br>- water rate collecting method<br>- percentage of water rate collection<br>- measures against a person who does not pay water rate.<br>• the cost to connect with the WSS born by a consumer<br>• regulation related to water tariff<br>• frequency and method of flow meter and water meter calibration for having the official certification on the precision of meters<br>• prepared own fund<br>• financial data<br>• organization<br>• consumer relations on complaints<br>• staff training system | Inquiries on the OM/M of the WSS.<br>Regarding the operation, efficient water supply and water quality control are focal points.<br>As for the maintenance, it is necessary for the WSS to equip design drawings of WSS and detailed pipeline network drawings, records of repair to prepare the maintenance plan and execute the maintenance work.<br>The capability of the OM/M organization can be assessed by confirming the introduction of preventive maintenance.<br><br>Prioritization of installations, equipment is also necessary for the maintenance plan.<br>With respect to the management, water tariff and water rate collection are the important for the autonomous management of the WSS.<br>According as the development of economy and society, consumers will be aware of the accurate measurement of water used. It is important to maintain the flow meter and water meter in good conditions.<br>Complaints from the consumers are one of the important information to improve the OM/M of WSS. How to deal with the consumers' complaints might show the capability of the OM/M organization.<br>Even if the revenue from water rate collection is plenty, if the financial situation of OM/M organization is not good, the OM/M of WSS cannot be carried out appropriately due to possible shortage of OM/M budget.<br>Preparation of own fund is desirable to implement the renewal of WSS. |

### 3.5.2 Site Survey

#### 3.5.2.1 Number and Distribution of Water Supply Systems

The number of Water Supply sub-projects and that of the WSSs constructed under the SPLs are different because there are three (3) sub-projects constructing two (2) WSSs and there are two (2) WSSs, each of which is constructed/being constructed by two sub-projects. As a result of it, total number of WSSs constructed under SPLs is 97, while total number of water supply sub-projects is 96. Following Table 3.5-2 shows the details and Appendix ws.3.1 present the list of WSSs surveyed and Appendix 3.1 shows their distribution by province respectively.

**Table 3.5-2 Sub-Projects with two (2) WSSs and WSS through two (2) Sub-Projects**

| Province | District | SPL Phase | Sub-project | WSS | Capacity ($m^3$/day) | Water Source | Remarks |
|---|---|---|---|---|---|---|---|
| Ca Mau | Tram Van Thoi | V | Song Doc WSS | Song Doc WSS (North) | 4,000 | ground water | |
| | | | | Song Doc WSS (South) | 2,000 | ground water | |
| Ca Mau | Phu Tan | V | Cai Doi Vam Town WSS (South) | Cai Doi Vam Town WSS (North) | 2,000 | ground water | Construction works had not been started yet |
| | | | | Cai Doi Vam Town WSS (South) | 2,000 | ground water | |
| Ha Tinh | Ky Anh | III | Vung An WSS | Vung An WSS | 9,000 | stagnant water | DPI as well as WSC explained that Vung An WSS was the objective of Ky Anh WSS sub-project |
| | Ky Anh | V | Ky Anh WSS | | | | |
| Lai Chau | Phong Tho | V | Phong Tho WSS | Phong Tho WSS (WEST) | 1,000 | surface water | |
| | | | | Phong Tho WSS (EAST) | 300 | surface water | |
| Quang Nam | Que Son | V | Dong phu - Que Son WSS (Phase II) | Dong phu - Que Son WSS | 1,500 | stagnant water | Construction of WTP and Distribution, and that of intake pumping station and conveyance were separately executed |
| | Que Son | V | Dong Phu Pump Station in Que Son and Bau Vang Reservoir | | | | |

#### 3.5.2.2 Survey Team

The water supply site survey team consisted of the member of Survey Team in charge of the water supply sector and a Vietnamese engineer. Both engineers have sufficient experience on the implementation of SPL water supply sub-projects and they also know the topographic and climate conditions, and road networks.

The Japanese member led the meeting with the OM/M organization and the Vietnamese engineer played a role of interpretation and supplemented the explanation of OM/M organization through his experience and knowledge. They made the observation of the facilities together and complement the survey each other.

#### 3.5.2.3 Activities at the Site

The water supply site survey team made the interview survey with the person in charge of the OM/M of the facilities followed by the observation of them.

**(1) Interview survey**

The interview survey had aimed at understanding the current situation of the WSS by asking the questions on the following topics:

- OM/M organization
- Water supply situation with the data related to consumers
- OM/M situation on facilities, and water quality and quantity
- Disinfection
- Water supply system

**(2) Observation of Facilities**

Referring the replies of interview survey, the team observes the installations, equipment, devices, etc. of the WSS starting from the installation to receive the raw water up to the distribution pumping station which delivers the treated water to the consumers.

Since the water source sometimes locates several kilometers from the WSS, visiting the water source depended on the progress of the survey. However, topographic condition and/or weather sometimes hindered the team to visit.

The points to be paid the attention in the observation are as follows:

- Injection points of chemicals to understand the appropriate treatment
- Water in the treatment facilities to know the appropriate treatment
- Dimension of treatment facilities to understand the capacity of WSS and operating conditions
- Exterior of the treated tank to confirm the water tightness of it
- Composition of pumping station to understand the water delivery operation
- Disinfection facilities to confirm the conduct of disinfection

The results of the observation reflect to the contents of following chapters.

#### 3.5.2.4 Survey Schedule

Water supply sector site visiting had started at the beginning of May from the provinces of Mekong Delta Region followed by the provinces in the North Central Coast Region for avoiding the extremely hot weather in July.

The survey team returned to Ha Noi after the North Central Coast Region for the preparation of interim report and participating in the intermediate meeting on the Survey.

Then the survey team went through the provinces in the South Central Coast and Central Highland Regions. The survey of North Regions came to the last half of the Survey period and the site survey completion date was September 7, 2010. Table 3.5-3 shows the planned survey schedule of water supply sector.

**Table 3.5-3 Planned Survey Schedule of Water Supply Sector**

| | Unit | Qty | Apr | May | June | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|
| Preparation | L.S. | 1 | | | | | | |
| Site Survey | Site | 95 | | | | | | |
| Preparation for Interim Report | L.S. | 1 | | | | | | |
| Preparation for Draft Final Report | | | | | | | | |

## 3.6 Irrigation Sector

### 3.6.1 Setting up the Items to be Surveyed

The details of items to be surveyed of the irrigation sector and those objectives are summarized, as follows:

**Table 3.6-1 Survey Items and Objectives of Irrigation Survey**

| Category | Items to be Surveyed | Objectives of Survey through the Survey Items |
|---|---|---|
| Facilities | ・Dam and Reservoir<br>・Headworks<br>・Pump Station<br>・Irrigation Canal<br>・Aquaduct<br>・Siphon<br>・On-farm Facility<br>・Drainage Canal<br>・Sluiceway<br>・Flood Dyke<br>・Tide Gate | ・Facility Scale<br>・Construction Year<br>・Cost<br>・Service Life |
| Current Situation of Facilities | ・Damages due to Poor Quality of Construction<br>・Problems of On-farm Development<br>・Shortage of Water Resources<br>・Drought Damages<br>・Drainage Damages<br>・Flood Damages<br>・Problems due to Change of Socio-Economic Conditions<br>・Problems Relating to Water Quality | ・Present Conditions of Facilities<br>・Damages Caused by Natural Disaster<br>・Shortage of Facility Capacity |
| Effectiveness of Sub-project | ・Beneficial Area<br>・Beneficiary<br>・Planted Area | ・Facility Utilization Conditions<br>・Farming Conditions<br>・Sub-project Effectiveness |

| Category | Items to be Surveyed | Objectives of Survey through the Survey Items |
|---|---|---|
| | ・Harvested Area<br>・Crop Calendar<br>・Cropping Intensity<br>・Production Volume<br>・Yield of Product<br>・Typical Farm Household Economy | ・Necessary Technical Support |
| Operation, Maintenance and Management | ・OM/M Organization<br>(Name, Number of Staffs, Equipment, Responsibility)<br>・OM/M Activities<br>(Manual, OM/M Plan, Operation Records, Maintenance Records)<br>・Irrigation Water Fee<br>・Financial Conditions of OM/M Organization<br>(OM/M Cost, Subsidy, Annual Expenditures, Annual Revenues) | ・OM/M System<br>・Financial Conditions<br>・State of Budget<br>・State of OM/M Activities |

### 3.6.2 Site Survey

The details of site survey methods are shown below.

#### 3.6.2.1 Survey Personnel

One (1) team is arranged for the survey and data collection considering the survey period of within four (4) months. One (1) team consists of two (2) members, the member of the Survey Team in charge of irrigation and drainage and Vietnamese engineer.

#### 3.6.2.2 Activities at the Site

The irrigation site survey team conducted: 1) interview survey and 2) locale survey.

In the locale survey, the direct observation is conducted to grasp following items at the sites as much as possible:

- Conditions of Facilities
- Conditions of Irrigation Water Utilization
- Location of Major Facility (Using GPS or Map)

#### 3.6.2.3 Survey Schedule

The SPL sub-projects of the irrigation sector are located from the south to the north regions. Considering the accessibility during the rainy season, the survey is conducted from the south to north. The process of the survey is shown below.

**Table 3.6-2 Process of Survey**

| Item | Unit | Q'ty | Apr | May | June | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|
| Preparation | L.S. | 1 | | | | | | |
| Site Survey | Site | 85 | | | | | | |
| Report | L.S. | 1 | | | | | | |

# Chapter 4 Outline, Current Situation and Utilization of the Facilities Constructed under SPL

## 4.1 Road Sector

### 4.1.1 Outline of Facilities

#### 4.1.1.1 Outline of Facilities

**(1) Number of Sub-Projects**

According to the materials from MPI, there are in total of 517 sub-projects under the road sector. However, based on the result of the site visits, the number of the sub-projects was revised as follows:

| | |
|---|---|
| The number of the sub-projects based on the materials: | 517 sub-projects |
| The number of the sub-projects to be added: | 1 sub-project |
| The revised number of the sub-projects based on the site survey: | 518 sub-projects |

In Gia Lai province, hydroelectric project had been planned near the site of the sub-project of "Province Road 675" (SPL V) by private sector and DPI proposed the "Inter-commune Road of Eastern of Ben Mong bridge" sub-project as the relocation of the hydroelectric project. Thus, one sub-project was added.

**(2) Number of Sub-Projects in Each Phase**

As shown in Table 4.1-1, approximately 100 sub-projects were executed at SPL I, II and III respectively. In contrast, number of sub-projects in SPL IV and V is 60 and 68 respectively. Hence, they were too many to have sufficient fund for reasonable scale of the road project, and accordingly the average fund for each sub-projects became too small for those in SPL I and III. Since SPL IV, number of sub-projects is reduced so that the average fund for sub-projects was increased.

**Table 4.1-1 Number of Sub-Projects by each SPL Phase**

| Phase | No. of Sub-projects in Flat Area | No. of Sub-projects in Mountainous Area | Total |
|---|---|---|---|
| SPL I | 103 | 51 | 154 |
| SPL II | 90 | 52 | 142 |
| SPL III | 52 | 42 | 94 |
| SPL IV | 11 | 49 | 60 |
| SPL V | 19 | 49 | 68 |
| Total | 275 | 243 | 518 |

There is a tendency that the number of sub-projects in mountainous roads is increasing since SPL IV.

### (3) Type of Construction

There are in total 518 sub-projects, out of which 421 sub-projects improved the existing roads and 97 sub-projects newly constructed roads.

When the road is newly constructed, the problem of Right of Way (ROW) will occur, and this often takes the time for negotiation and the conferences with all the relevant persons. In addition, if the present topographic condition in the mountainous area changes, it will affect the environment. Therefore, the Project Owners (POs) prefer the sub-projects with improvement on the existing road. In case of consideration for the economic efficiency of projects, the improvement of existing road is usually selected. The SPL Projects accordingly implemented a number of sub-projects with such contents.

**Table 4.1-2 Number of Sub-Projects by Type of Construction**

| Phase | New Construction | Improvement of the Existing Road | Total |
|---|---|---|---|
| SPL I | 23 | 131 | 154 |
| SPL II | 27 | 115 | 142 |
| SPL III | 17 | 77 | 94 |
| SPL IV | 13 | 47 | 60 |
| SPL V | 17 | 51 | 68 |
| Total | 97 | 421 | 518 |

### (4) Width of the Road

Most of the roads constructed under SPL Projects are small scale as better indicated in their respective names. As shown in Table 4.1-3, approximately 70% of the roads have the width of less than 7 m and the half of them has less than 4m. It seemed to come from the facts of low traffic volume and a lot of sub-projects to improve the existing roads by widening them.

**Table 4.1-3 Width of Road Constructed under SPL Sub-projects**

| Width of the Road | No. of Sub-projects | No. of Sub-projects (%) |
|---|---|---|
| Less than 4m | 202 | 39.0 |
| More than 4m-Less than 7m | 195 | 37.6 |
| More than 7m-Less than 10m | 49 | 9.5 |
| More than 10m-Less than 13m | 10 | 1.9 |
| More than 13m-Less than 16m | 8 | 1.5 |
| More than 16m-Less than 19m | 4 | 0.8 |
| More than 19m | 50 | 9.7 |
| Total | 518 | 100.0 |

### (5) Type of Pavement

Most of the roads under the SPL sub-projects have asphalt pavement. Only a few roads have gravel pavement.

**Table 4.1-4 Number of Sub-Projects by Type of Pavement**

| Type of the Pavement | No. of Sub-projects |
|---|---|
| Asphalt Concrete (AC) | 100 |
| Bituminous Penetration Macadam (BPM) | 380 |
| AC and BPM | 8 |
| Concrete pavement | 9 |
| Asphalt/Gravel pavement | 1 |
| Gravel pavement | 20 |
| Total | 518 |

### (6) Road Class

The design specification of SPL road sub-projects is in accordance with “TCVN4054-85/98/2005 (the latest version is TCVN4054-2005, Third Edition), Highway-Specifications”, which is applied to expressways and other general roads. "22TCN 210-92, Rural Road Design Standard" issued by the Ministry of Transport (MOT) is applied to small roads.

The road class stipulated in TCVN4054-2005 and 22TCN 210-92 are shown in Table 4.1-5 and Table 4.1-6, respectively.

**Table 4.1-5 Major Functions of Expressway and Other General Roads by Road Class**

| Road Class | Clasification of Area | Design Traffic Volume (PCU/day) | Major Functions |
|---|---|---|---|
| Class I | Plain | > 15,000 | arterial road, connecting large national economic, political, cultural centers, national highway |
| Class II | Plain | > 6,000 | arterial road, connecting large national economic, political, cultural centers, national highway |
| Class III | Plain<br>Mountain | > 3,000 | arterial road, connecting large national and regional economic, political, cultural centers, national highway or provincial road |
| Class IV | Plain<br>Mountain | > 500 | highway connecting regional centers , depots, residential areas, national highways, provincial road, district roads |
| Class V | Plain<br>Mountain | > 200 | road serving for local traffic. provincial road, district road,communal road |
| Class VI | Plain<br>Mountain | < 200 | district road, communal road |

Note: Classification of the mountain is the road where 30% or more of its full length is a cut slope. This is defined in TCVN4054-2005.

Source: TCVN4054-2005 Highway - Specifications for Design, Third Edition

**Table 4.1-6 Major Functions of Rural Roads by Road Class**

| Road Class | Clasification of Area | Design Traffic Volume (PCU/day) | Major Functions |
|---|---|---|---|
| Rural A | - | - | Road from commune to village (Carriageway 3.5m) |
| Rural B | - | - | Commune Road (Carrigeway 3.0m) |

Source：22TCN 210-92:1993, Rural Road Design Standard

A lot of roads were constructed under the SPL Projects (80%) with the scope of class IV-VI as shown in Table 4.1-7.

**Table 4.1-7 Classes of Roads Constructed under SPL**

| Road Class | Plain | Mountain | Total |
|---|---|---|---|
| Class I | 6 | 0 | 6 |
| Class II | 15 | 6* | 21 |
| Class III | 24 | 9 | 33 |
| Class IV | 145 | 80 | 225 |
| Class V | 63 | 79 | 142 |
| Class VI | 18 | 45 | 63 |

| Road Class | Plain | Mountain | Total |
|---|---|---|---|
| Rural A | 2 | 20 | 22 |
| Rural B | 2 | 4 | 6 |
| Total | 275 | 243 | 518 |

Note: TCVN4054-2005 was not applied to the mountainous area road. However, more than 30% of the cut slope was observed in a number of roads during the site investigation, thus such roads were classified as the mountainous area.

#### 4.1.1.2 Components of Facilities

The main components of facilities constructed under road sector sub-projects are categorized into the following six (6) types.

- Tunnel
- Bridge, box culvert, pipe culvert
- Retaining wall
- Embankment
- Drainage facility
- Accessory facility

**(1) Tunnel**

The structure is formed artificially along the underground due to high embankment or mountains from the ground to the destination. In other words, the tunnel is slenderer than its sectional height or width. Under SPL Projects, only one sub-project of Road 207 (Ha Lang-Bang Ca-ly Van) in Cao Bang province under SPL IV has this component.

**(2) Bridge, Box Culvert, Pipe Culvert**

Bridge, box culvert, and pipe culvert are installed for the purpose of crossing the river. The drainage facilities are installed along the roads. There are many different types of bridges, depending on span such as steel bridge, reinforce concrete bridge, pre-stressed concrete bridge and so on. 50 bridges, 103 spillways, and the 3403 box/pipe culverts were constructed under SPL Projects.

**(3) Retaining wall**

Retaining walls are mainly used to support the soil against the earth pressure. They are made of concrete, masonry or mattress-gabion. The standby retaining wall defending a dropping boulder from the slope is constructed in the mountainous area. Under the SPL Projects, the retaining wall was commonly constructed in the embankment section of the rear of bridge abutment. After a landslide, the site was repaired by the mattress-gabion in order to withstand another attack of landslide.

**(4) Embankment**

The structure consists of earth and sand to keep flatness of the road surface. The embankment is often constructed in the rear section of bridge abutment like retaining wall. The surfaces are often protected by the riprap.

**(5) Drainage facilities**

The side ditch or the catch-basin is installed in order to drain surface water on the road. Under SPL Projects, a lot of drainage facilities were constructed of riprap. However, majority of the drainage facilities of urban roads are made of concrete.

**(6) Utilities**

Utilities are installed on the road surface. They are guardrails, kilometer posts, medians, lighting facilities, road signs, planting and so on. The utilities of the SPL Projects were only seen on the urban roads. Regarding small-scale roads in the mountainous area, only guardrails and the kilometer posts made of concrete were seen.

### 4.1.2 State of Utilization of Facilities

#### 4.1.2.1 Traffic Volume

The survey teams conducted interview survey about traffic volume by the questionnaire and the survey form to obtain the current conditions of facilities. Total number of the sub-projects answered to the interview was 296 (about 60%). The number of sub-projects without any answers was 190, and no answer due to under construction was 29, as shown in Table 4.1-8.

**Table 4.1-8 Numbers of Sub-Projects by Traffic Volume**

| Traffic Volume (PCU) | No. of Sub-projects according to the Road Class | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | A | B | |
| Less than 200 | 1 | 1 | 5 | 13 | 39 | 19 | 6 | 3 | 87 |
| More than 200 - Less than 500 | - | 6 | 2 | 44 | 34 | 11 | 1 | - | 98 |
| More than 500 - Less than 1,000 | - | 5 | 6 | 31 | 12 | 5 | 2 | - | 61 |
| More than 1,000 - Less than 2,000 | - | - | 5 | 19 | 9 | - | - | - | 33 |
| More than 2,000 - Less than 3,000 | - | 1 | 3 | 3 | 1 | - | - | - | 8 |
| More than 3,000 | 4 | - | - | 4 | - | 1 | - | - | 9 |
| No answer | 1 | 8 | 11 | 101 | 37 | 22 | 9 | 3 | 192 |
| Under Construction | - | - | 1 | 9 | 11 | 5 | 4 | - | 30 |
| Total | 6 | 21 | 33 | 224 | 143 | 63 | 22 | 6 | 518 |

According to the above results, the number of the sub-projects with their traffic volume lower than

1,000pcu/day accounts for 80% of the total. It shows that traffic of the roads constructed under SPL Projects is very small. As shown in Table 4.1-9, as the width of roads becomes narrower, traffic volume comes to tend to decrease. Accordingly, road planning seems to be valid. When refering it to the Japanese road criterion[2], the roads are almost equivalent to Class 3-4 (designed daily volume 500-1,500pcu/day) and Class 3-5 (designed daily volume 500pcu/day). The traffic volume of the roads constructed under SPL Projects can be said as standard when compared with the designed daily volume.

**Table 4.1-9 Relations between Traffic Volume and the Width**

| Traffic Volume (PCU) / Width of the Road | Less than 200 | Less than 200 More than 500 | Less than 500 More than 1000 | Less than 1000 More than 2000 | Less than 2000 More than 3000 | More than 3000 | No Answer | Under Const -ruction | Total |
|---|---|---|---|---|---|---|---|---|---|
| Less than 4m | 54 | 43 | 13 | 8 | 1 | 1 | 58 | 23 | 201 |
| More than 4m-Less than 7m | 22 | 35 | 23 | 14 | 1 | 3 | 65 | 7 | 170 |
| More than 7m-Less than 10m | 8 | 9 | 15 | 8 | 4 | 1 | 49 | - | 94 |
| More than 10m-Less than 13m | - | 3 | 3 | 2 | 1 | - | 6 | - | 15 |
| More than 13m-Less than 16m | 2 | 3 | 5 | - | 1 | - | 2 | - | 13 |
| More than 16m-Less than 19m | - | - | 2 | - | - | - | 2 | - | 4 |
| More than 19m | 1 | 5 | - | 1 | - | 4 | 9 | - | 20 |
| other | - | - | - | - | - | - | 1 | - | 1 |
| Total | 87 | 98 | 61 | 33 | 8 | 9 | 192 | 30 | 518 |

On the other hand, there were nine (9) sub-projects with traffic volume more than 3,000pcu/day, they are sub-projects for Urban and District Roads. Table 4.1-10 shows the list of the sub-projects with their traffic volume more than 3,000 pcu/day.

[2] A commentary and application of "Road Structure Ordinance" February,2004 Japan Road Association

**Table 4.1-10 Sub-Projects Having Traffic Volume more than 3000pcu/day**

| Province | Phase | Sub-project | Class of Road | Annual Average Daily Traffic (pcu) | Remark |
|---|---|---|---|---|---|
| Binh Dinh | SPL I | Nguyen Hue A Road | Class I | 5,114 | Urban Road |
| Binh Dinh | SPL II | Quy Nhon - Song Cau Road | Class IV | 4,489 | Urban Road |
| Can Tho | SPL I | Mau Than Road Upgrading | Class I | 4,758 | Urban Road |
| Can Tho | SPL I | Thirty April Road（Hoa Binh-Dau Sau） | Class I | 4,218 | Urban Road |
| Can Tho | SPL II | Thirty April Road（Cau Tham Tuong-Duong Lao） | Class I | 4,218 | Urban Road |
| Quang Ngai | SPL I | Son Ha - Son Tay Road | Class VI | 3,468 | District Road |
| Quang Ngai | SPL II | Ca Dao Pass | Class IV | 3,468 | District Road |
| Quang Ngai | SPL II | Quang Ngai - Co Luy Road | Class IV | 4,535 | District Road |
| Thanh Hoa | SPL II | Tinh Gia - Bim Son - Hoang Hoa Road | Class IV | 3,270 | District Road |

Note: Urban road : Lying within the administrative boundaries of inner cities or urban centers.
District Road: Linking districts' administrative centers with the administrative centers of communes or commune clusters or with adjacent districts' administrative centers.

After SPL Projects completion, the Class I road was upgraded to the national highway. Thus, rather big traffic volume was observed. Concerning the other district roads, such increase was not observed at the time of investigation. It was assumed that annual average daily traffic of motorbike was also counted as Passenger Car Unit (PCU) in Table 4.1-10. The definition of urban and district road are stated in “Prescribing the Management and Protection of Road Traffic Infrastructures Government Decree No.186/204/ND-CO”.

#### 4.1.2.2 Main Vehicles

The road survey teams also carried out interview on different types of vehicles used on the roads constructed under SPL Projects by the questionnaire and the survey form. According to the results summarized in Table 4.1-11, motorcycle, car and truck are the main vehicles used in the sub-project roads. It is noted that cars and motorcycles occupied almost 60% of the total.

**Table 4.1-11 Number of Sub-Projects by Type of Main Vehicle**

| Type of main vehicle | No. of Sub-projects |
|---|---|
| Motorcycle | 102 |
| Car/ Motorcycle | 309 |
| Truck | 6 |
| Truck/Motorcycle | 24 |
| Truck/ Car/ Motorcycle | 33 |
| No answer | 14 |
| Under Construction | 30 |
| Total | 518 |

#### 4.1.2.3 Condition of Other Utilization of Facilities

Regarding the conditions of other road utilization, it was observed that there were many straws covering the road surface. The respondents said that it was important to dry the farm crops for farmer's living and their livestock. However, piles of straws on the road made it difficult to confirm the conditions of the road for drivers, and would cause problems in safety.


**Figure 4.1-1 Example of Unsuitable Use of the Road (Phu Tho Province Road 315)**

### 4.1.3 Current Conditions of Facilities

#### 4.1.3.1 Damages Affected by Disasters

According to the site survey results, there are three (3) kinds of damages caused by disasters, i.e. landslides, rock falls and floods (scouring/earth-flow). It was confirmed there were 30 sub-projects completely or slightly damaged by such. The characteristic of the road damaged by natural disasters are: i) roads classified in lower than class IV and ii) roads in mountainous area. However, after receiving the information on damages to roads by disaster, PMU-MPI requested the provinces to repair the damaged spots immediately.

**Table 4.1-12 Sub-Project Affected by Natural Disaster**

| Province | Phase | Sub-project | The Type of the Disaster | Remark |
|---|---|---|---|---|
| Bac Giang | SPL V | Yen Dinh - Thanh Luan Road | Land Slide | |
| Bac Kan | SPL II | Boc Bo-Cong Bang Road | Land Slide | |
| Bac Kan | SPL III | Quang Phong-Dong Xa Road | Land Slide | |
| Bac Kan | SPL IV | Nong Ha - Thanh Van Road | Land Slide | |
| Bac Kan | SPL IV | Van Tung- Thuan Mang Road | Land Slide | |
| Bac Kan | SPL V | Cong Bang - Co Linh Road | Land Slide | |
| Cao Bang | SPL III | Ban Nga - Xuan Truong Commune Road | Land Slide | |
| Cao Bang | SPL IV | Provincial Road No.207 | Land Slide | |
| Cao Bang | SPL IV | Provincial Road No.213 | Land Slide | |
| Cao Bang | SPL IV | Trung Khanh - Kham Thanh - Phong Nam | Land Slide | |
| Dac Lak | SPL IV | Road D22 | Wash Out | Problem |
| Dien Bien | SPL IV | Na Say - Muong Mun Road | Rock Fall | |
| Dien Bien | SPL IV | Phi Nhu - Xa Dung Road | Land Slide | |
| Hoa Binh | SPL V | Road 433 (Km55-Km84) | Rock Fall | Problem |
| Lai Chau | SPL IV | Nam Cay - Sin Cai Road | Land Slide | Problem |
| Lai Chau | SPL V | Dao San - Pa Vay Su Road | Land Slide | |
| Lang Son | SPL III | Na Sam-Na Hinh Road | Land Slide | |
| Lang Son | SPL IV | Hoa Binh - Binh La - Gia Mien road | Land Slide | |
| Lang Son | SPL IV | Provincial Road No.237C | Land Slide | |
| Lao Cai | SPL IV | Hoang Lien Son II Road | Rock Fall | |
| Lao Cai | SPL V | Bac Ngam - Bac Ha Road | Land Slide | |
| Nghe An | SPL IV | Hanh Dich - Muong Don Road | Rock Fall | |
| Nghe An | SPL IV | Song Giang Bridge | Wash Out | Problem |
| Phu Tho | SPL IV | Station 312 - Hung Long Triway Road | Land Slide | |
| Quang Tri | SPL IV | Ta Rut – A Vao Road | Wash Out | Problem |
| Son La | SPL III | Van Ho - Xuan Nha Road | Land Slide | |
| Son La | SPL IV | Xuan Nha - Tan Xuan Road | Land Slide | |
| Thai Nguyen | SPL I | Dinh Ca - Khuon Manh Road | Wash Out | Problem |
| Tuyen Quang | SPL III | Khau Lang - Cao Duong Road | Land Slide | Problem |
| Tuyen Quang | SPL IV | Phuc Thinh – Trung Ha Road | Wash Out | Problem |

Although areas with frequent natural disasters are limited, since it occurs unexpectedly, it is difficult to predict. Once a natural disaster occurs, traffic will be shut out. Therefore, the road network will stop to function and thus a sub-project becomes less effective.

In provinces and districts shown in Table 4.1-13, probability of the natural disasters occurrence is high. Therefore, it is necessary to take measures such as the inspection at rainfall to prevent any damages and so on.

**Table 4.1-13 Districts Prone to Natural Disaster**

| Province | District | No. of Sub-projects | Remark |
|---|---|---|---|
| Bac Giang | Son Dong | 1 | Yen Dinh-Thanh Luan Road |
| Bac Kan | Pac Nam, Na Ri, Bac Kan, Cho Moi, Ngan Son | 6 | |
| Cao Bang | Bao Lac, Trung Khanh, Ha Lang | 4 | |
| Dac Lak | M'Drak | 1 | Road D22 |
| Dien Bien | Dien Bien Dong, Dien Bien Dong | 3 | |
| Hoa Binh | Da Bac | 1 | Road No.433 |
| Lai Chau | Phong Tho | 2 | |
| Lang Son | Van lang, Loc Binh, Van Quan, Binh Gia | 3 | |
| Lao Cai | Muong Khuong、 Bac Ha | 2 | |
| Nghe An | Que Phong | 1 | Hanh Dich - Muong Don Road |
| Phu Tho | Yen Lap | 1 | Station 312 - Hung Long Triway Road |
| Quang Tri | Dakrong | 1 | Central Road in Dakrong District |
| Son La | Moc Chau, | 3 | |
| Thai Nguyen | Vo Nhai | 1 | Dinh Ca - Khuon Manh Road |
| Tuyen Quang | Ham Yen, Chiem Hoa, | 2 | |

Although 30 sub-projects shown in table 4.1-12 are passable, there are eight (8) sub-projects with "problem" as shown in the “Remark” of the table. Those sub-projects are difficult to pass or possess risks on safety. Their detail explanations are made as follows:

**(1) Khau Lang - Cao Duong Road, SPL III (Tuyen Quang province, Ham Yen district)**

The road was constructed by ripping rock face with fragile and high collapsibility at Km 5. Therefore, there are a lot of fallen rocks on the road from Km 5 to Km 6, and a lot of small-size rocks are seen in the shoulder. There are also a lot of fallen rocks piled nearly ending point, thus it was very difficult to pass through by a standard vehicle.

**Figure 4.1-2 Condition at Km 5 and Km 6**
(Left: Km 5, Right: Km 6)

**(2) Phuc Thinh - Trung Ha Road, SPL IV (Tuyen Quang province, Chiem Hoa district)**

A submerged bridge was constructed near Km 26+200. This type of bridge is designed for water overflow in case of floods. The safe posts at the downstream of the bridge have been damaged by rock flowed. They need to be repaired for vehicles including motorcycle and bicycle to safely pass through.

**Figure 4.1-3 Condition of Submerged Bridge at Km 26+200**

**(3) Dinh Ca - Khuon Manh Road, SPL I (Thai Nguyen province, Vo Nhai district)**

The spillway was constructed to cross the river, however it was unable to pass because it had been flowed out by flood. However, it was not a serious problem for the people living there, because the river was located at the end of the road and a new nearby bridge had been already constructed.

**Figure 4.1-4 Condition of the River crossing at Km 7+930**

**(4) Nam Cay - Sin Cai Road, SPL IV (Lai Chau province, Phong Tho district)**

The road was buried with earth and sand flowed out from the mountains and the valleys at Km 16 of the road. The section of approximately 100m long was affected. The section was accessible during the site survey. However, it was difficult to drive through with a vehicle except a four-wheel vehicle.

**Figure 4.1-5 Condition of Buried Road Section at Km 16**

**(5) Road 433 (Km 55-Km 84), SPL V (Hoa Binh province, Da Bac district)**

The road constructed by ripping rock face with fragile and high collapsibility at Km 75-Km 84. A lot of fallen rocks were observed on the road. The size of fallen rocks in this area was large, and the size of some rocks was more than one (1) meter. It is desirable to remove them.

**Figure 4.1-6 Condition of Ripped Rock Section at Km 75+100, Fallen Rocks at Km 80+700**
(Left: Km 75+100, Right: Km 80+700)

**(6) Song Giang Bridge, SPL IV (Nghe An province, Thanh Chuong district)**

The type of the bridge is a submerged bridge, thus the water flow can exceed the bridge surface at the time of flood. The five (5) and six (6) safety posts were damaged by rocks flowed at the upstream and the downstream areas, respectively. Therefore the condition of the bridge was not good for safe driving. The slope protection beside abutment was also damaged by scour. It is desirable to take measures to protect it in advance.

**Figure 4.1-7 Conditions of Damaged Safety Posts and Damaged Slope Protection**
(Left: Damaged Safety Posts, Right: Damaged Slope Protection)

**(7) Ta Rut - A Vao Road , SPL IV (Quang Tri province, Dakrong district)**

The submerged bridge was constructed at Km 1+200 and Km 4+450 of the road. There was a problem that stones, roots and any other dusts piled up in the upper side of it and they damaged the structure, safety posts (wheel guards) and road surface were especially. The safety posts play important role in case of overflows.

**Figure 4.1-8 Damaged Safety Posts and Surface at Km 1+200, Blocked by Obstacles at Km 4+450**

(Left: Km 1+200, Right: Km 4+450)

**(8) Road D22, SPL IV (Dac Lak province, M'Drak district)**

A half of the road width was unable to pass near from Km 10+800 to Km 10+850 due to subsidence of the spillway by scouring. The spillway was located at the sag of downhill, which accelerates the speed of vehicle easily, it was consequently so dangerous to pass the damaged section. It was necessary to repair without delay. In addition, all of the safety posts had been broken due to flood and the situation was quite dangerous.

**Figure 4.1-9 Overview of the Section at Km10+800, Damaged Spilway at Km10+850**

(Left: Km 1+200, Right: Km 4+450)

### 4.1.3.2 Capacity

**(1) Sub-Project with Bottleneck**

There are some sub-projects with a bottleneck at the constructed roads. The bottlenecks might cause traffic jam. Hence, the sub-projects might become less effective when traffic volume would increase. However, at the site survey, the traffic jam nor a vehicle with decreased speed caused by the bottleneck were observed.

**Table 4.1-14 List of Sub-Projects Having Potential of Bottleneck**

| Province | Phase | Sub-project | District | Station | Reason of the Bottleneck |
|---|---|---|---|---|---|
| Bac Giang | SPL III | Yen Dinh-Thanh Luan Road | Son Dong | Km 7+732 | Bridge |
| Bac Kan | SPL IV | Nong Ha - Thanh Van Road | Bac Kan, Cho Moi | Km 4+000 | The width decrease by the landslide |
| Ben Tre | SPL IV | Provincial Road No.883 | Binh Dai | Km 53+800 | Bridge |
| Dong Thap | SPL I | PR No.847<br>(Thet - My An - Bang Lang Rd.) | Thap Muoi | Km 10+600 | Bridge |
| Ha Nam | SPL I | Road No.62 | Phu Ly, Binh Luc | Km 16+700 | Bridge |
| Hung Yen | SPL I | Road No.200<br>(My Van, An Thi, Tien Lu) | An Thi, Tien Lu | Km 15 | Width is narrow partially |
| Lam Dong | SPL II | Hoa Ninh - Hoa Nam Road | Di Linh | Km 9+300 | Bridge |
| Ninh Thuan | SPL II | Phan Rang-Phap Cham Dike Road | Phan Thiet | Km 6+300 Dike | Width is narrow partially |
| Tien Giang | SPL I | Provincial Road No.867 | Chau Thanh | Km 2+548 | Bridge |
| Vinh Phuc | SPL II | Trung My - Huong Canh Road | Binh Xuyen | Km 2+000 | Bridge |

Most of the bottlenecks were "the bridges", because they were not constructed as the portion of road sub-projects and the roads constructed under SPL Project was connected to the existing bridges due to the high estimated cost for the bridge construction.

With well understanding the situation, in the process of managing the SPLs, PMU repeatedly requested provinces to utilize other source of fund (from government, other donors) to solve the issue of bottlenecks in order to have SPL sub-projects efficiently operated.

In the near future, if the bridges will be constructed, the bottleneck section will hopefully be dissolved, because Tien Giang and Dong Thap province are currently working on the problems concerning the bottlenecks.

**(2) Road without Continuity**

**From Km 27 (NR 2) to Trung Thanh Bach Ngoc Triway and Trung Thanh Bridge, SPL IV (Ha Giang province, Vi Xuyen district)**

The sub-project under SPL IV includes the road with its total length of 2.4 km and the bridge. At the time of the site survey, the bridge was still under construction. The existing wire bridge was used as the detour, and people had to be careful on their speed and load of vehicles when they passed through. Also, it was deteriorated and accordingly had problems on safety.

According to the explanation by DOT, although the original plan included construction of the both road and bridge, due to the price escalation of the materials, SPL fund was used only for the road portion. Therefore, the bridge was completed using surplus fund of SPL IV. However, completion of the entire road section was delayed due to the bridge construction works.

In the early September, 2010, the survey team contacted with DPI in Ha Giang province and confirmed on the progress of the bridge construction. The bridge was completed and was opened for traffic in early September.

**Figure 4.1-10 Bridge under Construction, Deteriorated Existing Wire Bridge Used as a Detour** (Left: Bridge, Right: Wire Bridge)

#### 4.1.3.3 Deterioration by Aging and Insufficient Maintenance and Management

**(1) Evaluation Method on the Survey**

The survey team set evaluation criteria on the current conditions of roads under SPLs in order to make the road survey effective. The evaluation method is explained as follows. It is noted that damages by natural disaster which is the accidentally occurred is not included in the analysis

(Evaluation Rank)

A: There is no damaged

B: There are potholes / the other damages; small scale

C: There are potholes / the other damages; middle scale

D: There are potholes / the other damages; overall

E: There are partial damages / problem in safety

Other: Under construction

Rank B is "almost in good condition ", but "There are small damages" (i.e. small rutting of pavement, a small crack of pavement). Sub-projects with rank B don’t have problem about the vehicle traffic, and it is almost considered as rank A.

**(2) Evaluation Results**

Rank B can be considered as almost same as the rank A. The roads of 87% (453) of the sub-projects are almost in good condition. The sub-project with rank C and D are 25 and they are desirable to be repaired without delay.

Since the funds for rehabilitation is limited, PMU is requesting each provinces to do OM/M in order to prolong the effective service life of sub-projects, especially roads on rank C, D, E.

Table 4.1-15 shows the evaluation result and that of 25 sub-projects with rank C and D are shown in Table 4.1-16.

Concerning the sub-projects with rank E, they had sections that are partly damaged. Hence, they could not be applied as the indicator of damage to the whole roads. Therefore, they will be reported separately. Table 4.1-17 shows the sub-projects with rank E.

**Table 4.1-15 Evaluation of Road Deterioration**

| Evaluation Rank | SPL I | SPL II | SPL III | SPL IV | SPL V | Total | No. of Sub-project (%) |
|---|---|---|---|---|---|---|---|
| No. of Sub-project | 154 | 142 | 94 | 60 | 68 | 518 | 100 |
| A | 35 | 18 | 2 | 8 | 11 | 74 | 14 |
| B | 108 | 115 | 84 | 51 | 21 | 379 | 73 |
| C | 11 | 4 | 3 | 1 | - | 19 | 4 |
| D | - | 3 | 2 | - | 1 | 6 | 1 |
| Other | - | 2 | 3 | - | 35 | 40 | 8 |
| Total | 154 | 142 | 94 | 60 | 68 | 518 | 100 |

**Table 4.1-16 Sub-projects with Rank C, D**

| Province | Phase | Sub-project | District | Rank |
|---|---|---|---|---|
| Bac Giang | SPL I,IR* | Road No.268 (Bo Ha - Mo Tang) | Yen The | C |
| Bac Kan | SPL III | Quang Phong-Dong Xa Road | Na Ri | C |
| Bac Ninh | SPL I | Lang Ngan - Van Thai Road | Gia Binh | C |
| Bac Ninh | SPL II | Road No.270, Tien Son | Tien Du | C |
| Cao Bang | SPL II | Road No.204 | Thong Nong | C |
| Dac Lak | SPL II | Urban Road Ea Soup Town | Ea Sup | D(E) |
| Dien Bien | SPL III | Na Son - Xa Dung Road | Dien Bien Dong | D |
| Ha Nam | SPL I | Road No.57A(485 Road) | Thanh Liem | C |
| Ha Nam | SPL II | Road No.484, Thanh Liem | Thanh Liem | C |
| Hai Duong | SPL I | Road No.20B | NA | C |
| Kon Tum | SPL I | Road Ngoc Tem | Kon Plong | C |
| Kon Tum | SPL II | Road to Ngoc Tem Commune | Ngoc Hoi | C |
| Kon Tum | SPL III | Road to Ngoc Tem Commune | Konplong | C |
| Nam Dinh | SPL I | Road No.12A (Vu Ban) | Vu Ban | C |
| Nam Dinh | SPL I | Road No.12A (Y Yen) | Y Yen | C |
| Ninh Binh | SPL II | Cong Go - Mua Thu Road | Yen Mo | D |
| Ninh Binh | SPL II | Qui Hau - Do Muoi Road | Yen Khanh, Kim Son | D |
| Phu Tho | SPL I | Road P2 | Phu Ninh | C(E) |
| Quang Nam | SPL I | An Diem - A So Road | Dai Loc | C |
| Quang Nam | SPL IV | An Diem - Ka Dang - A So Road | Dai Loc | C |
| Quang Ngai | SPL V | Tra Phong - Tra Khe - Tra Bao Road | Tay Tra | D |
| Son La | SPL III | Inter-commune Road Ban Moong-Muong Chanh | Son La Town | D |
| Tuyen Quang | SPL III | Khau Lang - Cao Duong Road | Ham Yen | C |
| Yen Bai | SPL I | Yen Bai - Khe Sang Road | Tran Yen | C |

*: IR means Reallocation of SPL I

**Table 4.1-17 Sub-projects with Rank E**

| Province | Phase | Name of Sub-project | District | Rank |
|---|---|---|---|---|
| Ba Ria Vung Tau | SPL II,III | Provincial Road No.765 | Chau DUc | B(E) |
| Dac Lak | SPL II | Urban Road Ea Soup Town | Ea Sup | D(E) |
| Dac Lak | SPL IV | Road D22 | M'Drak | B(E) |
| Ha Giang | SPL I,II | Yen Minh - Mau Due - Meo Vac Road | Yen Minh-Meo Vac | B(E) |
| Hoa Binh | SPL V | Road 433 (Km55-Km84) | Da Bac | B(E) |
| Hung Yen | SPL II,III | Road No.203B, Cau Cap - Quan Thu Road | Tien Lu, Phu Cu | B(E) |
| Hung Yen | SPL III | Road No.195, 201, 204 | Phu Cu, Khoai Chau, Kim Dong | B(E) |
| Lai Chau | SPL IV | Nam Cay - Sin Cai Road | Phong Tho | B(E) |
| Lang Son | SPL I | That Khe - Quoc Khanh Road (PR No.228) | Trang Dinh | B(E) |
| Lang Son | SPL III | Na Sam-Na Hinh Road | Van lang | B(E) |
| Nghe An | SPL IV | Song Giang Bridge | Thanh Chuong | B(E) |
| Phu Tho | SPL I | Road P2 | Phu Ninh | C(E) |
| Phu Tho | SPL V | Van Mieu - Thuong Cuu Road | Thanh Son | B(E) |
| Quang Ninh | SPL I,II,III | Hoanh Mo - Dong Van Road | Binh Lieu | B(E) |
| Quang Tri | SPL IV | Ta Rut - A Vao Road | Dakrong | B(E) |
| Thai Nguyen | SPL I | Dinh Ca - Khuon Manh Road | Vo Nhai | B(E) |
| Thanh Hoa | SPL V | Road from Do Trap bridge to Hai Ninh Coast | Tinh Gia | B(E) |
| Tuyen Quang | SPL IV | Phuc Thinh - Trung Ha Road | Chiem Hoa | B(E) |
| Vinh Phuc | SPL II | Quang Yen - Phu Hau Road | Lap Thach | B(E) |
| Yen Bai | SPL I,II | Nguyen Thai Hoc Road | Yen Bai City | A(E) |

**1) Yen Minh - Mau Due - Meo Vac Road, SPL I, II (Ha Giang province, Yen Minh-Meo Vac district)**

The road was evaluated as rank B. However, handrail of the bridge at Km 12+700 was damaged and thus it was considered dangerous for vehicle traffic. Hence, the sub-project was degraded to rank E.

**Figure 4.1-11 Damaged Handrail of Bridge at Km 12+700**

**2) Phuc Thinh - Trung Ha Road, SPL IV (Tuyen Quang province, Chiem Hoa district)**

The road was evaluated as rank B. However, a large pothole and rutting were observed at near Km 6 and it was considered dangerous for vehicle traffic. Hence, the sub-project was graded down to rank E.

**Figure 4.1-12 Pothole of the Neighborhood at Km 6**

### 3) That Khe - Quoc Khanh Road (PR No.228), SPL I (Lang Son province, Trang Dinh district)

The road was evaluated as rank B. However, a big pothole and rutting were observed at near Km 114+50, and it was considered dangerous for vehicle traffic. The sub-project was accordingly degraded to rank E.

**Figure 4.1-13 General View and Damaged Section at near Km 114+50**
(Left: General View, Right: Damaged Section)

### 4) Na Sam-Na Hinh Road, SPL III (Lang Son province, Van Lang district)

Due to the progressive damages, the road was evaluated as rank C. Deep potholes and rutting were found at near Km 2+800 and it was considered dangerous for vehicle traffic. Hence, the sub-project was degraded to rank E.

**Figure 4.1-14 General View and Deep Rutting Section at near Km 2+800**
(Left: General View, Right: Deep Rutting Section)

**5) Nguyen Thai Hoc Road, SPL I,II (Yen Bai province, Yen Bai city)**

The road was evaluated as rank A. However, the drainage side ditch constructed in boundary between sidewalk and roadway did not have a cover and it was possible for pedestrians and motorbikes to fall. The sub-project was accordingly degraded to rank E.

**Figure 4.1-15 Side Ditch without Cover**

**6) Dinh Ca - Khuon Manh Road , SPL I (Thai Nguyen province ,Vo Nhai district)**

Details are mentioned in "4.1.3.1 Damages Affected by Disasters"

**7) Road P2 , SPL I (Phu Tho province, Phu Ninh district)**

Due to the progressive damage, the road was evaluated as rank C. The beam of the guardrail was damaged at the bridge constructed near Km 1+500 and it was considered dangerous for pedestrians, motorbikes and cars to pass through. Hence, the sub-project was degraded to rank E.

**Figure 4.1-16 Damaged Guardrail Beam at a Bridge near Km 1+500**

### 8) Van Mieu - Thuong Cuu Road, SPL V (Phu Tho province, Thanh Son district)

The road was evaluated as rank B. The road was constructed very recently, but a big pothole was observed. The damage was sectional, but it was large. It might be dangerous for motorcycles to run through.

In addition, according to the explanation by OM/M organization, since the road was still in warranty period, it needed to be repaired as soon as possible.

**Figure 4.1-17 Damaged Road Section between Km 8 and Km 9**

### 9) Hoanh Mo - Dong Van Road, SPL I, II, III (Quang Ninh province, Binh Lieu district)

The road was evaluated as rank B. The spillway was constructed near Km 6+500, but its shoulder had been eroded by the overflow of the drainage water.

This spillway was constructed in the curve section, and it was possible that a vehicle might fall, therefore the sub-project was graded down to rank E.

**Figure 4.1-18 Spillway Conditions near Km 6+500**

**10) Nam Cay - Sin Cai Road, SPL IV (Lai Chau province, Phong Tho district)**

**11) Road 433 (Km55-Km84), SPL V (Hoa Binh province, Da Bac district)**

The situation of above two sub-projects are explained in “4.1.3.1 Damages Affected by Disasters”

**12) Quang Yen - Phu Hau Road , SPL II, (Vinh Phuc province, Lap Thach district)**

The road was evaluated as rank B. However, large potholes were partially observed near Km 1+850. The road was considered dangerous for vehicle traffic, therefore the sub-project was graded down to rank E.

**Figure 4.1-19 General View and Rutting Section near Km 1+150**
(Left: General View, Right: Deep Rutting Section)

**13) Road No.203B, Cau Cap - Quan Thu Road, SPL II, III (Hung Yen province, Tien Lu, Phu Cu district)**

The road was evaluated as rank B. However, the damage of the reinforced deck slab of the Quan Thu bridgewas observed, the bridge constructed at near Km 5+000 was degraded to rank E. This was the place where an impact by the wheel load came directly and it was supposed that the jump of traveling vehicles caused by the subsidence of the backside of bridge abutment was the direct factor.

There was a hole in reinforced concrete deck slab, and it made difficult for vehicle traffic even at the time of the site survey. It needed to be repaired as soon as possible to prevent further damages.

**Figure 4.1-20 Damaged Deck Slab at Quan Thu Bridge, Road Surface of the Backside of Abutment**

**14) Road No.195, 201, 204, SPL III (Hung Yen province, Phu Cu, Khoai Chau, Kim Dong district)**

The road was evaluated as rank B. Large potholes were observed partially near Km 4+000, and it was considered dangerous for vehicle traffic, therefore the sub-project was graded down to rank E.

**Figure 4.1-21 General View and Rutting near Km 4+000**

(Left: General View, Right: Rutting Section)

**15) Road from Do Trap bridge to Hai Ninh Coast, SPL V (Thanh Hoa province, Tinh Gia district)**

The road was evaluated as rank B. However, the damage with the big pothole was observed near Km 1+100, Km 6+450 and it was considered dangerous for vehicle traffic. Hence, the sub-project was graded down to rank E.

**Figure 4.1-22 Damage of the Neighborhood at Km 1+100, Km 6+450**
(Left: Km 1+100, Right: Km 6+450)

**16) Song Giang Bridge, SPL IV (Nghe An province, Thanh Chuong district)**

**17) Ta Rut - A Vao Road, SPL IV (Quang Tri province, Dakrong district)**

**18) Urban Road Ea Soup Town, SPL II (Dac Lak province, Ea Sup district)**

The situation of above three (3) sub-projects are explained in “4.1.3.1 Damages Affected by Disasters”

**19) Road D22, SPL IV (Dac Lak province, M'Drak district)**

The road was evaluated as rank B. However, the damage with big pothole was observed at near Km 0+700 and Km 0+850 and it was considered dangerous for vehicle traffic. Hence, the sub-project was graded down to rank E.

**Figure 4.1-23 Damaged Road Surface near Km 0+700, Km 0+850**
(Left: Km 0+700, Right: Km 0+850)

**20) Provincial Road No.765, SPL II, III (Ba Ria Vung Tau province, Chau Duc district)**

The road was evaluated as rank B. However, deep rutting with pothole was observed near Km 7+700 and it was considered dangerous for vehicle traffic. Hence, the sub-project was graded down to rank E.

**Figure 4.1-24 Damage of the Neighborhood at Km 0+700**

### 4.1.3.4 Alteration

As a result of site survey, there were no altered facilities.

## 4.2 Electricity Distribution Sector

### 4.2.1 Outline of Facilities

#### 4.2.1.1 Outline of Facilities

In general, wires, distribution transformers and the other equipments are the essential components for the distribution network. In the SPL Projects these facilities are needed in the same way. Major constructed projects in the Electricity Distribution sector are summarized as follows.

- Medium Voltage (MV) Distribution Feeder
- Low Voltage Line (LVL)
- Distribution Transformer

The number of electricity distribution sector sub-projects is 526. The total length of MV and LV distribution lines is 11,286km, while the whole outputs of distribution transformers is 214,450kVA.

The line length and the transformers' outputs by each SPL phase is shown as below.

**Table 4.2-1 Line Length and the Transformers' Outputs by each SPL Phase**

| Phase | Line Length (km) | Output of DTs (kVA) |
|---|---|---|
| SPL I | 3,081 | 74,289 |
| SPL II | 3,617 | 70,903 |
| SPL III | 2,358 | 38,522 |
| SPL IV | 1,111 | 19,495 |
| SPL V | 1,119 | 11,241 |
| Total | 11,286 | 214,450 |

In addition, the following three (3) projects were implemented in the SPL Projects.

- Medium Voltage Disconnector at the Tapping Point
- Low Voltage Protection Structure
- Household Connection and Drop Service

The details are the followings:

**(1) Construction of Medium Voltage of Distribution Feeder (Poles, Conductors, Insulators etc)**

- Normal Construction

  Poles: Centrifugal Concrete for MVL (based on the Technical Regulations issued by MOIT)

  Conductors: Aluminum Conductor with Steel Reinforcement (ACSR international acronym = AC Vietnamese)

  Insulators: Standing Ceramic or Hanging Glass

Station: Outdoor Construction with Hanging Poles

**(2) Construction of Low Voltage Line (Poles, Conductors, Insulators, etc)**

Rectangular section or centrifugal concrete poles for the LVL with naked conductor for non populated areas and with insulated wires for populated areas

**(3) Distribution Transformer (Transformers, Branch box for LV, Arrester, Cut-out switch, etc)**

Load Break Switches (LBS) and Capacitors are installed in the MVL but the investment has been implemented by EVN sown resources in order to keep the reliability.

#### 4.2.1.2 Components of Facilities

In the SPL Projects, distribution networks have been newly constructed aiming at the electric power supply for the non-electricity areas. These networks have connected to the existing power systems, which have the varieties of their system voltages. So the voltages of the networks constructed under the SPL Projects are not unified. As for the main facilities, such like poles, wires and the distribution transformers, no significant differences were observed between North and South, one province and the neighboring. One feature is that SPL Projects were implemented in the area where demands for electricity are relatively low. So the size of the wires and the outputs of the transformers are small in general. In some areas where a lot of lightning attack exist, the surge arresters are installed in the LV network based on the guidance of the general planning and designing policies for the distribution network in the case of having severe thunder attack.

As a result of the site survey, the necessary distribution facilities were exactly constructed using the SPL fund appropriately, so that we confirmed that each sub-project had contributed to livelihood improvement of population in poverty.

The components of facilities are as follows (See Figure 4.2-1, 4.2-2, 4.2-3).

**(1) Construction of Medium Voltage of Distribution Feeder**

The Medium Voltage of Distribution Feeder is the network whose voltage is 10-35kV in general. The network is an essential infrastructure for the electricity supply to the customers, its power source is the distribution substation and the configuration of network is web-like in cities, towns or villages.

Main elements of distribution network are utility poles, wires, LBS and distribution transformers.

Utility poles are installed in order to hold the wires and the equipments such like LBS or distribution transformer, and they are made of concrete. They are installed each other in the distance of 20-40 meters.

The conductors of the wires are aluminum, because of its low electric resistance and the light weight.

The LBS is the switching facility which control the power flow of distribution network, by opening or shutting the current of distribution line. It is installed at the point where branching line will depart from the main line, so it is useful when the fault should be isolated or de-energize one section in construction.

The electrical power system for MV network is 3-phase 3-wire, which is the most efficient system for the power transmission and can supply the rotating magnetic fields indispensable for driving the medium-sized or bigger motors. In the 3-phase 3-wire system, three (3) wires are needed and the each voltage applied to each wire is different. 22kV system voltage means that the voltage between two wires out of three is 22kV.

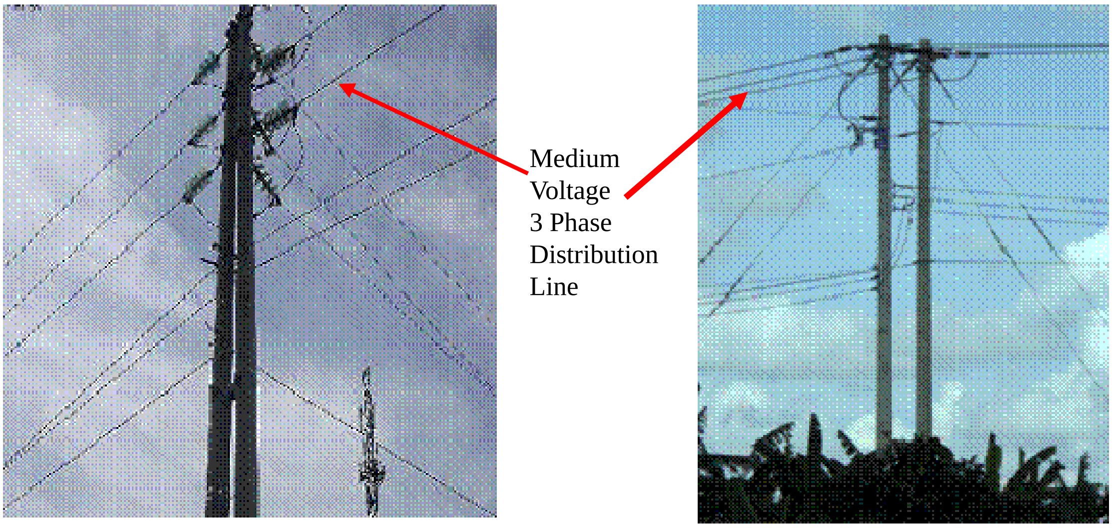
In case the demand for electricity is small, the simpler single-phase 2-wire system may be introduced. In this system, only two wires are needed and the voltage applied to one wire only, the other is connected to the earth. But this system can not supply the rotating magnetic fields.

There are many varieties of wires. For the distribution network, typical diameters of the wire are 2-15 mm. Big-sized wires are used mainly in near distribution substations, because the electrical resistance of big-sized wires is low and the current flow limitation is high. On the other hand, big-sized wires are no longer needed in the area which is far from the distribution substation. And the voltage of distribution network has no linkage with the size of the wires. Wires for the MV lines have no insulators in the same way as the wires for electrical transmission lines.

The MV distribution lines with concrete poles as shown in Table 4.2-2 had constructed and installed in order to supply the power to non-electric areas as the main objective. The table shows that there are many system voltages besides 22 or 35 kV, the standard voltage for MV network in Vietnam. It suggests that the voltage of existing network, which are the power source of network constructed under the SPL Projects, have not been unified or standardized for a lot of reasons. "AC35" means Aluminum Conductor whose nominal cross-section is 35mm$^2$.

**Table 4.2-2 Medium Voltage Line Typically Installed in the SPL Projects**

| Voltage | Type | Size of Conductor |
|---|---|---|
| 10 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |
| 12.7 kV | Overhead Line, 1 phase | AC35, AC50, AC70, AC95(2wires) |
| 15 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |
| 22 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |
| 35 kV | Overhead Line, 3 phases | AC35, AC50, AC70, AC95(3wires) |




Location: My Cam　　　　Location: My Xuyen, SocTrang

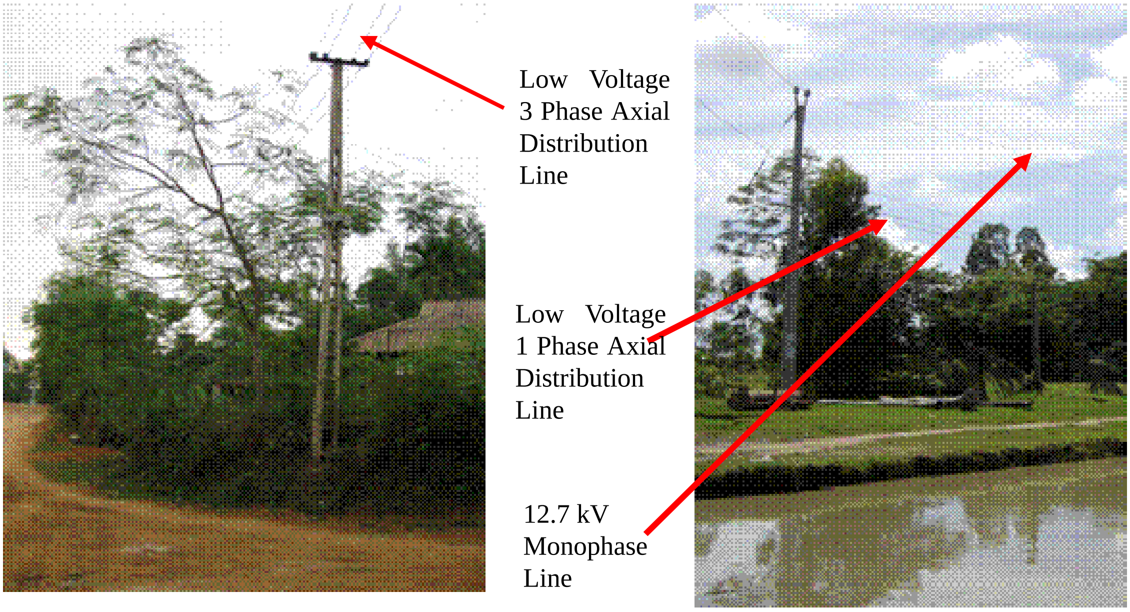
**Figure 4.2-1　Medium Voltage Distribution Line**

### (2)　Construction of Low Voltage Line

LVL is the network constructed from the distribution transformer, which is the power source of LV line, to the each receiving point of consumer.　Its voltage is 400V (0.4kV) or 230V (0.23kV).　When LVLs are constructed with MVLs together, LVLs are 1-some meters below the MVLs, and the utility poles for MVLs hold the LV wires.　When there are no poles, newly installed poles for LVLs will grasp the LV wires.　The poles are made of concrete in the same way as MVLs, their interval is about 20-40m also, but the switch applied for LV network is so scarce.

The electrical power system for LVLs is 3- phase 4-wire, whose configuration is 3-phase 3-wire plus one additional wire (connected to earth).　It supplies electrical power to the motors and the big power machines by three hot lines(the voltage between each hot line is 400V), while to the popular home appliance or lights by one hot line and one earthing wire(the voltage between hot line and the earthing wire is 230V).

In some cases, single-phase 2-wire system may be adapted where the demand is small.




Location: Van Son Commune – Hoa Binh Province

Combined 1 phase Distribution Line MyXuyen dist.– Soc Trang Province

**Figure 4.2-2 Low Voltage 3 Phase and Combined 1 Phase Distribution Lines**

The bigger size of LV wires becomes, the more current can flow through the conductor in the same manner as MV wires. So big-sized wires are used near the distribution transformers, and small-sized wires are installed in the end of main line or in the branching line. LV wires have their insulators covering the conductors in order to avoid the contact between near-by trees and the conductors.

Typically installed wires are shown in Table 4.2-3, "AV35" and “A35” mean Aluminum conductor whose nominal cross-section is 35mm$^2$ with insulators made of Vinyl, and Aluminum conductor whose nominal cross-section is 35mm$^2$ without insulators, respectively. Also Table 4.2-3 shows that the LVL consists of main line (3-phase 4-wire system) and branching line (3-phase 4-wire system or single-phase 2-wire system).

**Table 4.2-3 Low Voltage Line Typically Installed in the SPL Projects**

| Voltage | Type | Size of Conductor |
|---|---|---|
| 0.4 kV | Overhead Line, 3 phases | AV35, AV50, AV70, AV95,<br>A35, A50, A70, A95 |
| 0.23 kV | Overhead Line, 1 phase | AV35, AV50, A35, A50 |

### (3) Distribution Transformer

The function of distribution transformers is to transform the medium voltage (10-35kV) to low voltage (400V, 230V). The construction of distribution transformers are winding coil and the core, they are both assembled inside the body of transformers. The body is filled with the insulating oil with purposes of cooling the heat from the winding coil and insulating a hot point from the earthing. Accessories are also equipped with distribution transformers shown as below.

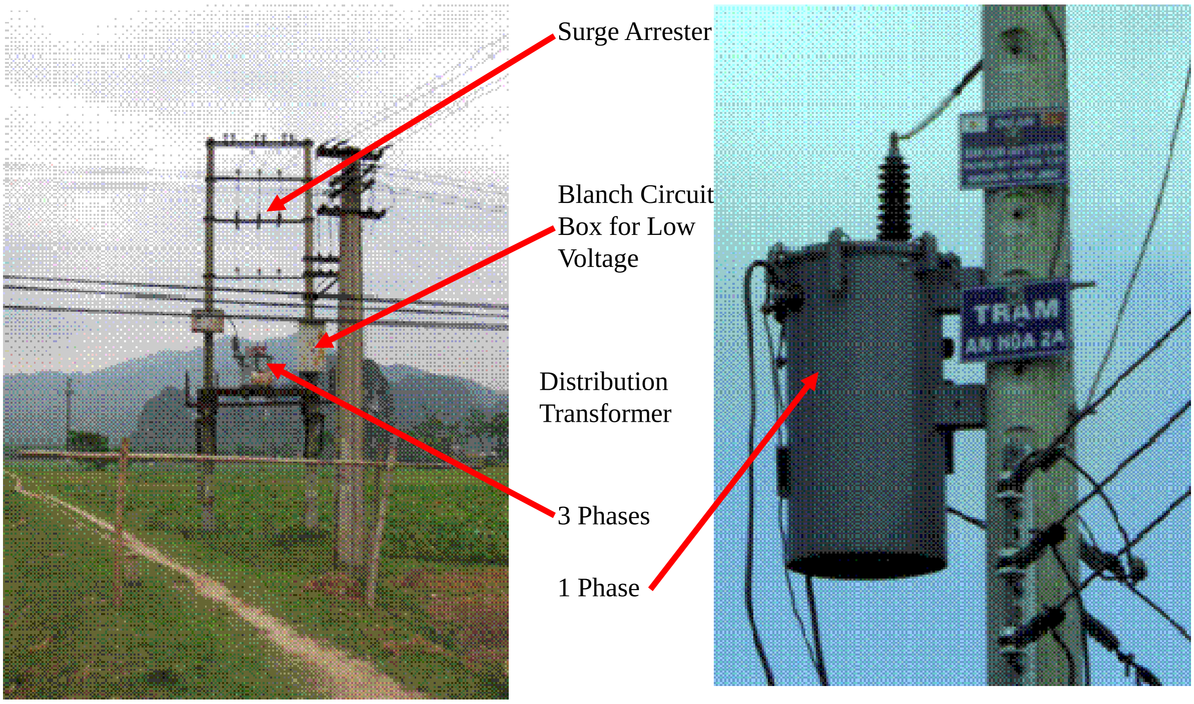
- High voltage cut-out switch with fuse: for protection and maintenance of distribution transformer
- Surge arrester: for protection of the transformer against a lightning surge
- Branch circuits of low voltage: for supplying power to the consumers

Distribution transformers installed under the SPL Projects are shown in Table 4.2-4, "10/0.4kV, 0.23kV" means that the primary voltage of distribution transformer is 10kV while secondary voltage is 0.4kV (400V) between the hot lines and 0.23kV (230V) between the hot line and the earthing wire. The capacity of distribution transformer is equal to multiply the voltage by the current. Distribution transformers in proper capacity are selected and installed in accordance with the load of the network.

**Table 4.2-4 Distribution Transformer Installed in the SPL Projects**

| Voltage | Capacity |
|---|---|
| 10/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA,180kVA, 250kVA, 320kVA |
| 12.7/0.23 kV | 15kVA, 25 kVA, 31.5kVA, 35kVA, 50kVA, 75kVA |
| 15/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA, 180kVA, 250kVA, 320kVA |
| 22/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA, 180kVA, 250kVA, 320kVA |
| 35/0.4, 0.23 kV | 50kVA, 75kVA, 100kVA,160kVA, 180kVA, 250kVA, 320kVA |

Note: Transformer of 12.7kV is used for single phase and is connected between 22kV phase and ground, so that the secondary voltage is only of 0.23kV.




Location：Hop Kim Commune – Hoa Binh Province

Thanh Thoi An Commune, My Xuyen District – Soc Trang Province

**Figure 4.2-3  Distribution Transformer**

### (4) Medium Voltage Disconnector at the Tapping Point of Local Medium Voltage Line Network

Usually this component is used for all kinds of electric line at projected tapping point to separate the sub-project lines and cut out the current when needed (for repairing or removing the load).

**Figure 4.2-4  35 kV Triphases Disconnector in one of Phu Tho – Vinh Phuc Sub-Projects**

### (5) Low Voltage Protection Structure

At the ending pole of a LVL stretching in mountainous locations, low voltage lightning arresters are installed in order to avoid surge discharge spreading along the LVL which can damage all facilities connected to the line, and also the distribution transformer.

**Figure 4.2-5 Thang Tin Sub-Project of Hoang Su Phi District in Ha Giang Province**

### (6) Household Connection and Drop Service

As determined by the Law of Electricity approved by the Vietnam National Assembly in 2004, the Power supplier has to furnish inhabitant customer with Household connection and kWh meter with free of charge, these finalizing facilities of the power supply line are also included in the investment cost of the sub-project.


**Figure 4.2-6 Electricity Workmen Implementing the Drop Service for Inhabitants' Household in Thanh Phu Commune of My Xuyen District in Soc Trang Province**

### (7) Special Construction

For coastal areas, following installations are equipped with the MV feeder for poor fishermen's floating communities.

Conductors: Copper, preventing against rust.

Station: Closed

Poles and insulators: Same as the normal construction


**Figure 4.2-7 Cam Nhuong Commune Electric Line of Cam Xuyen Coastal District in Ha Tinh Province**

**For Poor Communes in Solitary River Islets and Promontories**

35 kV Submerged Cable is used for the feeder lines in some sub-projects in Ben Tre and Soc Trang provinces.

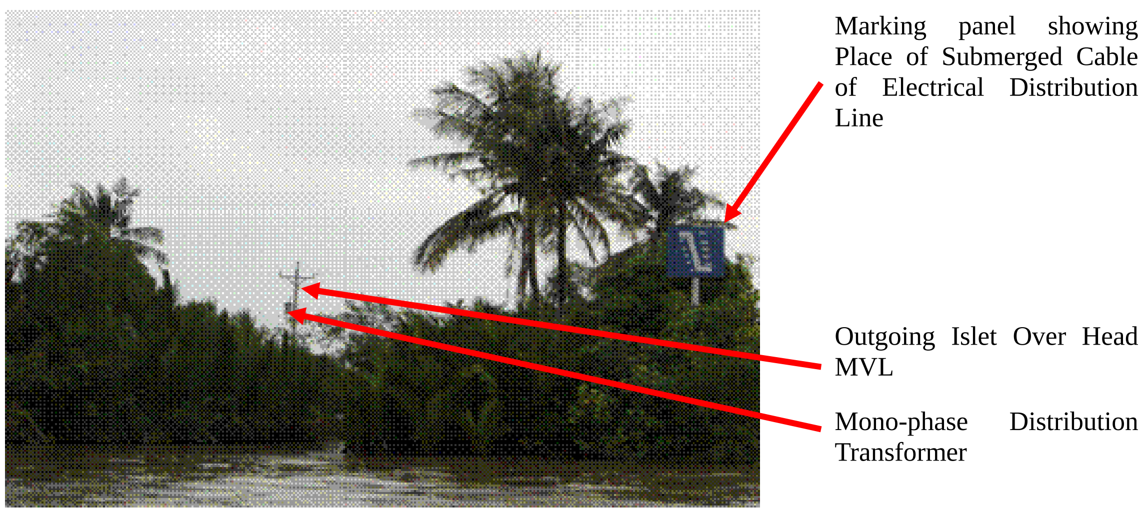



**Figure 4.2-8 Submerged Medium Voltage Feeder Cable (Ben Tre Province, Ke Sach District)**

Warning Panel to prohibit the anchrage for boats and floating facilities at the submerged cable place

**Figure 4.2-9 Submerged Medium Voltage Feeder Cable under Song Hau River (Soc Trang Province, Ke Sach District)**

**<u>For Ethnic Minority Hamlets Living in Solitary High Mountainous Land</u>**

To cross over great distances from one hill top to another, the MVL long span construction should be used.

<u>Poles:</u> separate pole for each phase

<u>Conductors:</u> Aluminum, having best steel reinforcement cores

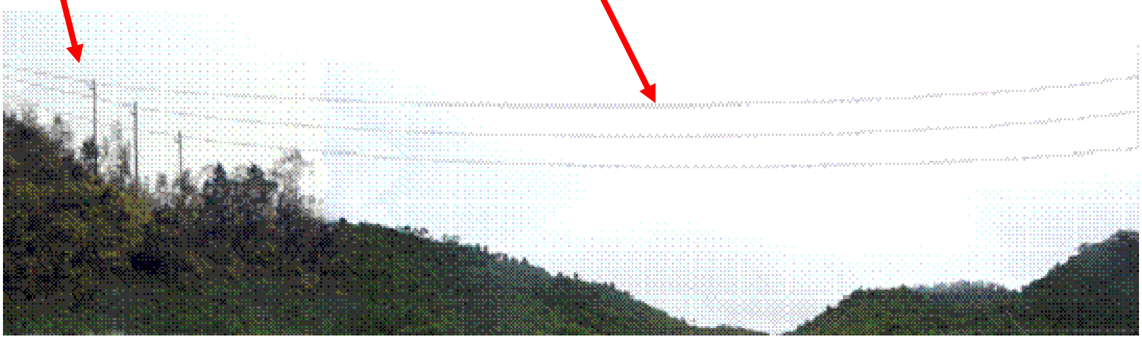


**Figure 4.2-10 Long Span Medium Voltage Line (Tuyen Quang Province, Yen Son District)**

### 4.2.2 State of Utilization of Facilities

#### 4.2.2.1 Overview of Installation of Facilities

The confirmed sub-projects were operated since the completion of the construction. The summarized data of the confirmed sub-projects is introduced in Table 4.2-5.

**Table 4.2-5 Installation of Facilities as of Aug 31, 2010**

| Region | MV and LV line (km) | Distribution Transformer (kVA) |
|---|---|---|
| North East | 2,564.0 | 45,571.0 |
| North West | 505.2 | 8,677.0 |
| Red River Delta | 620.8 | 34,440 |
| North Central Coast | 2,353.8 | 39,536.0 |
| South Central Coast | 1008.5 | 26,797.5 |
| Central Highlands | 884.7 | 18,778.0 |
| South East | 862.0 | 13,370.5 |
| Mekong River Delta | 2,487.0 | 27,280.0 |
| Total | 11,286.0 | 214,450.0 |

#### 4.2.2.2 Electrification Rate

The Small-scale Pro-poor Electricity Distribution Sub-project has a role to increase the percentage of household with an access to electricity. The power line is extended to the center of the village or to the commune, however, a lot of people are living far from the center thus don't have access to electricity.

After the SPL Projects implementation, in all sub-project areas, the electrification rate was increased remarkably. Following Table 4.2-6 shows them for evaluating the effectiveness of facility utilization:

**Table 4.2-6 Indicator for Evaluating the Effectiveness of Facilities Utilization**

| Region | Electrification Rate (Before 1996) | Electrification Rate (As of 2010) |
|---|---|---|
| North East | 42% | 78% |
| North West | 30% | 68% |
| Red River Delta | 70% | 98% |
| North Central Coast | 48% | 72% |
| South Central Coast | 66% | 86% |
| Central Highlands | 48% | 82% |
| South East | 85% | 98% |
| Mekong River Delta | 72% | 96% |

### 4.2.3 Current Conditions of Facilities

The SPL Projects in electricity distribution sector have been smoothly conducted. The constructed length of (MV + LV) line is of 11,286km and the total capacity of Transformer is of 214,450 KVA.

The current condition and problems after the projects are as follows:

#### 4.2.3.1 Damages Caused by Disasters

Vietnam is one of the tropical severest climates in the world. Every year, the country endures several natural disasters - such disastrous events,,which can harm all types of infrastructure, are stated below:

- Tropical typhoons (12 times/year is the highest number ever recorded)
- Floods and landslides (after strong tropical rains and showers in a number of places)
- Drought
- Whirlwinds
- Earthquakes (rare and weak – under level 2)

In order to accommodate to such climates, the GOV has progressed various measures to reduce and limit the damages caused by catastrophe on social infrastructure.

Since 1980, *The Technical Regulations for Rural Electric Systems* had been prepared and published by the Ministry of Electricity and Coal (MEC), then amended and recompiled in 1995 by the Ministry of Energy (MOE). Currently the Ministry of Industry (MOI), with the assistance of the SIDA and the JICA recompiled once more, approved for circulation by Minister Hoang Trung Hai, electricity engineer, and published in 2006 (Now Mr. Hoang Trung Hai is being Vice Prime Minister, in charge of National Infrastructure Development).

Since all the power consultant companies preparing for ODA projects are the members of the EVN, the rule conformity for project preparation needs to be reliable everywhere nationwide. All the OECF and the JBIC survey missions in the past, found the best strong and stable endurance of invested electric facilities against disasters everywhere. Therefore, the facilities have shown that they can function even during and after catastrophe.

In October 2006, a follow-up mission of the JBIC-MPI visited the SPL-IV electricity subproject in Son Bang – Son Thinh communes of Huong Son district in Ha Tinh province just after a strong flood, the best endurance of all the facilities were observed.


**Figure 4.2-11 Damaged Electricity Facilities (Ha Tinh Province, Huong Son District, Son Thinh Communes)**

The most dangerous disaster for the electric line is landslides in wet condition. However, under the regulation, consultants-designers conduct their investigation for geological and topographical data enough for line layout selection. Hereby, this kind of disaster could not harm most of infrastructure components of the electricity sector in rural area.

The design of all feeders and lines from a network MV isolator to household connected kWh meters should be based on the "Technical Regulations for Rural Electrification System" issued by the MOIT. All facilities can endure against disasters, rarely damaged.

In case of a lightning surge, the EVN also has repaired the damaged facilities such as distribution transformers, insulators, etc, so that the projects have been satisfactorily re-operated promptly.

#### 4.2.3.2 Capacity

In general electric facilities endure their operational capacity during their technical-economical life stipulated by Vietnam and the IEC norms and standards.

The proper cross-section of wire conductor would be generally determined considering both the electrical factor and the mechanical factor. The former affects the voltage drop and the losses of distribution lines, while the latter has close relationship to the tension of wire and the wind force. In the site survey, some cases were found where the size of conductors seemed to be too small to maintain the line voltage in a proper range.

Small-size wires are not expensive and easy for installation, on the other hand, the resistance of conductors becomes higher in proportion to the reciprocal number of cross section. So if the size is too small in comparison with that of proper wires, the resistance of conductor would be so high. As a sequence the voltage drop will be so large and the power quality for customers won't be satisfactory. In addition, losses caused by the resistance of wires are proportional to the resistance, so too small-size wires are not beneficial. The lack of maintenance of facilities is the cause of these cases. In spite of the growth of demand for electric utility power, the O/M organization will keep using the small-size wires and not replace the wires by the bigger one. Now the problems about voltage are not reported. But in the near future home appliances or the processing machines will be changed to more advanced ones, and then the voltage drop should be improved. As the advanced loads are so sensitive to the receiving voltage, and the proper range of voltage is essential.

#### 4.2.3.3 Deterioration by Aging and Insufficient Maintenance and Management

Since electric equipment in power distribution function is static entity not kinetic or dynamic mechanically, the aging factor of deterioration concept is not clear. In general, the facilities having rotors or movements show their specific features on their aging, so information about when they should be checked periodically or should be replaced by new equipment is obtained easily. The OM/M organization can do checking or replacement in proper way because this kind of information is given in such ways of operation-years or operation-time. On the other hand, most of distribution facilities are static ones, so their aging depends on the circumstances in which they are installed. It means that the varieties of the sites prevent the distribution companies from checking or replacing their assets timely.

The most significant example about equipment deterioration is the rust on the surface of the equipment. About one fourth of distribution transformers had the rusts on their surfaces in spite of the mild conditions surrounding them and the short time after their installation. In average 25% of the surfaces on the distribution transformers having the rusts were covered by the stains. In the worst the rusts in red colour are observed to be there and developing. Rusts grow and make hole on the surface, which will bring the leakage of insulating oil filled inside the distribution transformer. Then OM/M organizations will face the following problems.

- If the leakage of insulating oil would happen at the distribution transformer installed above the rice fields, the blowout of oil will fall in the rice fields and diffuse in the whole of that fields. Then a lot of crops will be damaged widely.
- The leakage of insulating oil may bring the lack of cooling effect, then distribution transformer would be in extraordinary high temperature. It means that distribution transformers would burn, or the insulation oil would catch fire or blow out from the

transformers. When these accidents happen, the buildings, trees or vegetables which are very near to the distribution transformers would catch fire so easily. Furthermore the outage due to the malfunction of transformers would occur, and the blowing insulating oil would injure the crops or the person severely, which are next to the distribution transformers.

- The amount of insulation oil would be diminished due to the leakage, then the oil would be no longer able to avoid short circuit inside the distribution transformers. As a result, electric power supply would be interrupted.

Insufficient maintenance and management could harm the facilities almost in Low Voltage side if these components belong to the ownership of non-professional agents. This case had, longtime ago, happened in the commissioning time after implementation. But while handed to local EVN members, the conditions of the maintenance and management were improved and perfected. ODA facilities are in the first priority of all careful operations in maintenance and handling. The deteriorated or damaged component should be promptly changed by other of the same size and capacity, in order to conserve the continuity of power supply to the customers.

Some outages in the distribution MV feeders occurred due to contact by tree or animals, whenever the safety corridor was encroached (tree growth, …) as the line of Medium Voltage is wholly not insulated, while the LV line under the SPL Projects has no faults by the contacts, because the LV line is installed by insulated wires especially in populated areas. But with the attention of participatory community, those defects are day by day discovered, promptly informed to EVN member’s staff and treated in early time.

#### 4.2.3.4 Alteration

As shown in *The Technical Regulations for Rural Electrification*, the alteration of 6,10,12.7,15kV into 22, 35 kV systems for the Medium Voltage are compelled after the exhaust level utilization and the last time of component technical life in the old systems.

The 10kV Medium Line under the SPL Projects were to 22/35kV Medium line under EVN finance, which means to increase the acceptable consumers and improve the distribution loss.

Up to this survey period, there are not existing 6 kV MVL, and most of solitary TFS at 10 kV had changed to 22-35 kV primary voltage. Existing 10 kV components only endure in the localities situated near Intermediary Substation 110/35-22-10 kV of which site is near urbanized and populated situation.

### 4.3 Water Supply Sector

#### 4.3.1 Outline of Facilities

As mentioned in the Chapter 3.2.1.4, total number of WSSs constructed under the SPLs is 97 in which, however, 23 WSSs have not been completed the construction works yet. Though most of them were expected to be completed within 2010, four (4) WSSs in Ca Mau (two (2) WSSs), Kon Tum (one (1) WSS) and Quang Nam (one (1) WSS) provinces were still under the preparation of construction works. Detail is shown in Appendix ws.3.1 “List of Water Supply Systems Constructed under Sector Project Loan Phase I to V”.

However, two (2) WSSs under construction have already started the operation because their project scheme is the rehabilitation and expansion. The total number of WSSs under operation is consequently 76.

##### 4.3.1.1 Outline of Facilities

As explained earlier, the WSS varies with the water source, the raw water quality, topographic conditions, etc.

If the water source is groundwater, the raw water quality is rather good and it does not necessitate complicated water treatment system such as sedimentation, filter, etc. It accordingly enables low cost operation of the WSS.

However, a number of groundwater sources in Vietnam contains iron to be treated in order to meet the QCVN 01. In case that the groundwater contains high concentration of iron, it should be removed by oxidization of iron followed by sedimentation and filtration. Though the iron is not considered hazardous to health, when the level of iron in water exceeds 0.3 mg/L, which is the maximum value of iron content in drinking water stipulated in the National Technical Regulation on Drinking Water Quality (hereinafter referred to as QCVN01), we experience red, brown, or yellow staining of laundry, glassware, dishes, and house fixtures such as bathtubs and sinks. The water may also have a metallic taste and an offensive odor. Water system piping and fixtures can also become restricted or clogged. In case of surface water, usually it contains high turbidity and it necessitates the system of sedimentation and filtration.

The water to be distributed among the consumers should be disinfected by chlorine which has residual effect, therefore it ensures the safe of drinking water from the WSS to consumer’s households, if the chlorine dose is appropriate. QCVN01 stipulates that residual chlorine concentration of the water is 0.3 – 0.5 mg/L and it should be monitored at least one (1) time per week by the WSC.

When the water becomes clear and safe after treatment, it goes to the treated water tank. Water is delivered to each consumer houses through distribution (it does not connect with houses) and service pipeline (it connects with houses) by pump. In case, the treated water tank located on the higher place than the area where consumer's houses exist, water is delivered by gravity.

Volume of delivered water is measured at the outlet of WSS by a flow meter and at the inlet of each house by a water meter installed by the consumer or the WSC.

#### 4.3.1.2 Components of Facility

##### (1) Water Source

Following Table 4.3-1 shows the water sources of 97 WSSs by type and those necessity of the iron removal. It should be noted that the water source of Vinh Tuong WSS in Vinh Phuc province reportedly contains arsenic and constructed Water Treatment Plant (WTP) has the arsenic removal facilities. However, the detail of arsenic contents is not clear because the raw water analysis results are not available in sub-project management unit (SPMU) as well as District Peoples' Committee (DPC).

**Table 4.3-1 Water Source of WSSs Surveyed**

| Type of Water Source | Number of WSSs | Necessity of Iron Removal | Necessity of Arsenic Removal |
|---|---|---|---|
| groundwater | 32 | 20 | 1 |
| infiltration | 2 | 2 | 0 |
| spring | 2 | 0 | 0 |
| surface water | 51 | 0 | 0 |
| surface water and groundwater | 1 | 1 | 0 |
| stagnant water | 7 | 1 | 0 |
| another WSS | 2 | 0 | 0 |
| Total | 97 | 24 | 1 |

groundwater: groundwater, spring, infiltration
stagnant water: reservoir, pond, lake, etc.
surface water: river, stream, canal, etc.
WSS: water is supplied from other WSS

Number of WSSs use/will use groundwater source is 32 in which 20 WSSs operate the iron removal facilities. Most of groundwater sources necessitate the iron removal. It shows that around 63% of groundwater source is contaminated with iron.

The deep well is main facility of the piped water supply to exploit the groundwater source in the confined second or more aquifers taking into consideration the contamination of first aquifer by agricultural chemicals, etc. from ground surface. The groundwater from the deep wells sometimes has rather high concentration of iron.

Though using groundwater makes operation cost low in general, it seems to be difficult to find out good quality groundwater source in Vietnam. It may be the reason why around 62% of the WSSs use the water sources other than the groundwater[3].

[3] Surface water, stagnant water and another WSS are not categorized in the "groundwater".

### (2) Water Treatment Facilities

The raw water delivered by pump or gravity from the water source contains impurities which may cause significant health problems or give the annoyance on the consumers. It is important to improve the raw water quality by a treatment system to meet the drinking water quality stipulated in QCVN 01.

Though it varies according to the raw water quality, the treatment system in general consists of chemical feeding facilities, sedimentation basins, filters and disinfection facilities.

#### 1) Chemical Feeding Facilities

The treatment system applied to the WSSs constructed under the SPLs is the rapid filtration system which necessitates the chemical coagulation and flocculation. Putting aluminum sulfate (ALUM) or poly-aluminum chloride (PAC) into the raw water, it puts very small suspended substances together and they become like soft rather large stuff which is easy to settle.

It is important to solve the coagulant (ALUM or PAC) into water well and put the solution into the raw water by a dosing pump at the entrance of the treatment system. A cylinder of which diameter is around 1.5m and depth is around 2m to 3m with single or double paddle agitator is used for this operation.

The number of WSSs in operation, except those with low iron content groundwater source, which should apply coagulant is 67. 21 WSSs out of 67 do not use the coagulant. Following Table shows the number of WSSs sorted by type of water source and coagulant.

**Table 4.3-2 Number of WSSs by Water Source and Coagulant**

| Type of Coagulant / Type of Water Sorce | ALUM | PAC | ALUM or PAC* | Not Used | Total |
|---|---|---|---|---|---|
| Groundwater | 0 | 0 | 0 | 16 | 16 |
| Infiltration | 1 | 1 | 0 | 0 | 2 |
| Spring | 2 | 0 | 0 | 0 | 2 |
| Surface Water | 21 | 10 | 6 | 3 | 40 |
| Surface Water and Groundwater | 1 | 0 | 0 | 0 | 1 |
| Stagnant Water | 4 | 0 | 0 | 0 | 4 |
| Another WSS | 0 | 0 | 0 | 2 | 2 |
| Total | 29 | 11 | 6 | 21 | 67 |

* Application of ALUM or PAC depends on the turbidity of raw water

### 2) Sedimentation Basin

The large mass of impurities in the raw water made by the aid of coagulant is settled and drained in the sedimentation basin.

The types of sedimentation basin observed in the survey are shown in the Table 4.3-3 below:

**Table 4.3-3 Type of Sedimentation Basin by Water Source**

| Type of Sedimentation / Type of Water Sorce | Horizontal-Flow | Up-Flow | Suspended Solid Contact | Horizontal-Flow Inclined Tube or Plate | Vertical-Flow Inclined Tube or Plate | Not Applied | No Information | Total |
|---|---|---|---|---|---|---|---|---|
| Groundwater with Iron Removal | 1 | 3 | 3 | | | 11 | 5 | 23 |
| Groundwater without Iron Removal | | | | | | 9 | | 9 |
| Spring | | | 2 | | | | | 2 |
| Infiltration | | | 2 | | | | | 2 |
| Surface Water | 6 | | 37 | 1 | 3 | 4 | | 51 |
| Surface Water and Groundwater | | | 1 | | | | | 1 |
| Stagnant Water | 1 | | 2 | | 1 | 2 | 1 | 7 |
| Another WSS | | | | | | 2 | | 2 |
| Total | 8 | 3 | 47 | 1 | 4 | 28 | 6 | 97 |

Only eight (8) WSSs uses the horizontal-flow sedimentation which is easy to operate though the size of installation is rather big than other types of sedimentation.

Up-flow sedimentation is used for taking rather big size iron compounds after the oxidization by aeration of groundwater followed by the rapid sand filtration.

47 WSSs applied the suspended solid contact type sedimentation and five (5) WSSs adopted inclined tube or plate type of sedimentation. They occupy around 83% of the WSSs with sedimentation facility under the SPLs. It is considered that both types are difficult to operate in terms of high turbidity raw water, change within short time of turbidity and temperature of water to be treated.

### 3) Filter

The filtration is the final process of removing impurity from raw water. It takes remaining purities from the water which flowed out from the sedimentation basin. During passing thorough the filter, the filter media, which is in general sand, absorbs almost 100% of purities.

**Table 4.3-4 Number of WSS by Filter Type**

| Filter Type | No. of WSSs |
|---|---|
| Rapid Sand Filter | 66 |
| Pressure Filter | 7 |
| Up-Flow Filter | 6 |
| Up-Flow and Rapid Sand Filters | 3 |
| Not Applied* | 9 |
| No Information** | 6 |
| Total | 97 |

* not applied: The WSSs of which water source is groundwater which does not require iron removal
** no information: Sub-projects now under construction

As shown Table 4.3-4 above, there are three (3) types of filter in 91 WSSs surveyed (9 WSSs do not necessitate the filter). 66 WSSs installed rapid sand filtration which is the most popular in the water treatment system, seven (7) WSSs use the pressure filter which has advantage of higher filtration speed than the rapid sand filter, and long hours operation without taking place the negative pressure, however, it is difficult to monitor inside the filter, and six (6) WSSs adopted the up-flow filtration which uses plastic floating filter media with easy operation, however, there is a risk that sludge is carried over to the treated water tank at the expansion of filter media layer after long hours operation and at the backwashing of filter media.

Besides above, there are three (3) WSSs which install the rapid sand filter and the up-flow filter. One WSS applies two stages filtration without sedimentation basin due to rather good raw water quality and another WSS has several small WTPs and some of them use the up-flow filtration and the other WSS is the case that up-flow filtration is installed between the sedimentation basin and the rapid sand filter.

Backwashing by water using a pump or an elevated tank is mainly used for filter media cleaning and 12 WSSs apply a blower for the air washing followed by water washing by the pump.

#### 4) Disinfection Facility

The disinfection is the final stage of water treatment. Disinfectant which form is solution is injected into the filtered water and it is stored in the treated water tank.

The WSSs surveyed use three types of disinfectants. They are liquefied chlorine, sodium hypochlorite solution and calcium hypochlorite solution. Following Table 4.3-5 shows the number of WSSs by type of disinfectant.

**Table 4.3-5 Number of WSS by Type of Disinfectant**

| Type of Disinfectant | No. of WSS |
|---|---|
| Liquefied Chlorine | 58 |
| Sodium Hypochlorite | 22 |
| Calcium Hypochlorite | 5 |
| Disinfected in Another WSSs | 2 |
| No Disinfection | 5 |
| No Information | 5 |
| Total | 97 |

These disinfectants are injected to the treated water by devices or other methods. Table 4.3-6 below shows the method to inject chlorine solution into the treated water.

**Table 4.3-6 Devices for Disinfectant Injection**

| Device | Disinfectant | Number of WSS |
|---|---|---|
| Chlorinator | Liquefied Chlorine | 58 |
| Dosing pump | Hypochlorite | 23 |
| Dripping | Hypochlorite | 1 |
| Gravity | Hypochlorite | 3 |
| Disinfection is not executed | | 12 |
| Total | | 97 |

Chlorinator: Device to measure chlorine gas and inject it into the treated water continuously.

### (3) Distribution

Distribution facilities consist of tanks to store treated water and distribution pipelines to deliver treated water to the service area. In case that it is difficult to distribute the water by gravity due to topographic condition of the service area, the pump pressurized distribution is applied.

The treated water is distributed by making use of the gravity without a pump which consumes costly energy if the location of WSSs is higher than their service area. In contrast, a WSS, which locates itself in the place where its elevation is similar to that of its service area, should make the pressurized distribution by pumps. However, such WSSs sometimes construct an elevated tank or high placed tank and make distribution by gravity. The distribution system of 91 WSSs is classified into three types as follows:

**Table 4.3-7 Type of Distribution System**

| Type of Distribution | No. of WSS |
|---|---|
| By Gravity | 38 |
| By Pump Pressurized | 49 |
| By Gravity and By Pump Pressurized | 4 |
| No Information | 6 |
| Total | 97 |

The water demand by consumers fluctuates hourly and it becomes a little in the night. In case of pump pressurized distribution, the pressure in the distribution pipeline becomes high when the water demand become a little, if the pump operation does not change. 51 WSSs which adopt the pressurized distribution by pump take following measures to control the pressure.

**Table 4.3-8 Distribution Pressure Control**

| Method of Control Distribution Pressure | No. of WSS |
|---|---|
| Control of the number of pumps in operation | 16 |
| Diversion of water to elevated or high placed tank | 7 |
| Control of pump motor rotation by frequency inverter | 22 |
| Control of value opening | 2 |
| Control of the number of pumps in operation and value opening | 1 |
| Diversion of water to elevated or high-place tank and control of pump motor rotation by frequency inverter | 2 |
| Change to the distribution by gravity | 1 |
| Sub-Total | 51 |
| By gravity (no need to control) | 38 |
| No Information | 8 |
| Total | 97 |

The treated water tank is installed to balance the supply rate from the treatment plant with the fluctuating water demand in the distribution area. The tank capacity should be large enough to hold the cumulative differences between water supply and demand. The necessary treated water tank capacity can be determined by adding the water for firefighting and other necessary water to consider troubles of the treatment plant, temporary deterioration of raw water quality, etc. to the calculated volume mentioned above. The capacity of treated water tank of 86[4] WSSs of which data is available is 60m$^3$ to 3300m$^3$ and the average is 650m$^3$. Considering the total capacity of tanks of each WSSs as

[4] Following 11 WSSs are excluded: the information on the distribution tank of five (5) WSSs under construction is not available, four (4) WSSs did not provide with the capacity of distribution tank and two (2) WSSs which make the direct distribution with controlling the flow rate by the frequency inverter after the disinfection.

equivalent to number of hours volume, the minimum is 1.4 hours (Gia Lai province, Ia Kha Town WSS, 1200m$^3$/day) and the maximum is 20.4 hours (Phu Tho, Thanh Ba WSS, 2000m$^3$/day) and the average is seven (7) hours. This indicator shows the stability of water supply when WSSs have a trouble to suspend the water supply. For example, “Design Guidelines for Waterworks in Japan” (Japan Waterworks Association, 1990) describes that five (5) to six (6) hours amount of the maximum daily water supply is necessary for the distribution tank to meet the water demand fluctuation. It shows that at least one (1) or two (2) hours amount is available during the water supply suspension by troubles of the WSS.

**(4) Laboratory**

There are only 22 WSSs, which have the laboratory, among 97 WSSs constructed under SPL Project though the WSS which has even only one water analysis device was considered that it has the laboratory.

There are two types of water analysis in the WSS. One is the water analysis to confirm whether qualities of treated water meet the QCVN01or not and another is that for appropriate operation of the WSS. The latter includes the analysis of turbidity, residual chlorine, etc. and the jar test. The jar test gives the most effective coagulant dose through preparing raw water with different coagulant concentration in several beakers under same mixing condition. Following Figure 4.3-1 shows the jar tester.


**Figure 4.3-1 Jar Tester**

Though 63 WSSs have the WTP which in principle uses the coagulant, only 16 WSSs have the jar tester which is necessary to determine the coagulant dose in order to operate the WTP appropriately.

Appendix ws.4.1 shows the WSSs which has the laboratory with equipped devices and parameters can be analyzed. It shows most of laboratories have only three (3) or four (4) devices to analyze water and accordingly the number of parameters can be analyzed is limited such as Residual Chlorine, Turbidity, pH, etc. Though, three (3) laboratories can analyze a number of parameters by an Ionic Electrometry[5] devices, further study is necessary on the precision of values analyzed by this device.

MPI express its course for the arrangement of laboratories.

- Strengthening the laboratory of PWSCs.
- Arrangement for regular sampling and sending samples to the PPHC/PWSC and other relevant agencies

### 4.3.2 State of Utilization of Facilities

The team applies two (2) indicators such as "Hour of Water Supply" and "Rate of Facility Utilization" which is acquired by "Average Daily Water Supply / Capacity of WSS" to look at the current situation of utilization of the 76 WSSs in operation.

#### 4.3.2.1 Hour of Water Supply

Since the stable water supply is one of the targets of the water supply project, it is preferable for all the WSSs to achieve 24 hours water supply. 24 WSSs among 76 WSSs in operation do not operate 24 hours water supply. Though there is a particular reason of each WSS why it cannot do, the main reasons seem to be low water demand of the service area and/or that in the night or other particular period of time. Table 5.3-6 "Reason of Low Coverage" also implies the causes why such WSSs cannot operate 24 hours of water supply. Following Table 4.3-9 shows the WSSs of which hour of water supply is less than 24 hours.

[5] To measure the ion concentration of solution by the electrode that corresponds to the ion to be measured. However, other co-existing ions in the solution sometimes affect the measurement.

**Table 4.3-9 WSSs with less than 24 hours Water Supply**

| Province | Phase | WSS | progress (%) | Startup Year | Capacity ($m^3$/day) | Hour of Water Supply | Average Daily Wate Supply ($m^3$/day) |
|---|---|---|---|---|---|---|---|
| Bac Lieu | SPL V | Ngan Dua WSS | 100 | 40026 | 1800 | 3.5 | 600 |
| Dien Bien | SPL IV | Tua Chua WSS | 100 | 39600 | 2000 | 8-10 | 1250 |
| Gia Lai | SPL I | Chu Pah WSS | 100 | 2000 | 1970 | <24 | 280 |
| Ha Noi (Including former Ha Tay) | SPL III | Phu Xuyen WSS | 100 | 2008 | 2000 | 8 | 870 |
| Ha Tinh | SPL III | Vu Quang | 100 | 39022 | 2000 | 2 | 200 |
| Ha Tinh | SPL IV | Nghen Town WSS | 100 | 39873 | 3000 | 8 | 1400 |
| Kon Tum | SPL III | Kon Plong WSS | 100 | 38687 | 1000 | 3 | 450 |
| Lam Dong | SPL V | Loc Thang Town WSS | 100 | 40179 | 3400 | 19.5 | 1700 |
| Nghe An | SPL IV | Nam Dan WSS | 100 | 39965 | 2000 | 6 | 500 |
| Nghe An | SPL IV | Yen Thanh WSS | 100 | 39783 | 2000 | 9 | 750 |
| Ninh Binh | SPL I | Kim Son WSS | 100 | 2003 | 3000 | 6 | 1000 |
| Phu Tho | SPL III | Ha Hoa WSS | 100 | 39873 | 3000 | 12 | 1650 |
| Phu Tho | SPL IV | Thanh Ba WSS | 100 | 40148 | 2000 | 4 / 14* | 650 |
| Quang Ninh | SPL III | HAI HA WSS | 100 | 39448 | 3000 | 4 | 300 |
| Quang Tri | SPL I | Ho Xa WSS | 100 | 2000 | 2000 | 20 | 1132 |
| Quang Tri | SPL III | Hai Lang WSS | 100 | 38961 | 2500 | 10 | 400 |
| Quang Tri | SPL IV | Ben Quan WSS | 100 | 39692 | 2000 | 3 | 1000 |
| Quang Tri | SPL IV | Cam Lo WSS | 100 | 39600 | 2000 | 6 | 250 |
| Son La | SPL III | Moc Chau WSS | 100 | 38353 | 1500 | 14 | 2000 |
| Thai Binh | SPL III | Kien Xuong WSS | 100 | 38899 | 2000 | 7.5 | 650 |
| Thai Nguyen | SPL V | TRAI CAU Town WSS | 100 | 39904 | 960 | 8-10 | 150 |
| Thanh Hoa | SPL IV | Nhu Thanh WSS | 100 | 40148 | 1500 | 1.5 | 120 |
| Thanh Hoa | SPL V | Hau Loc WSS | 100 | 39539 | 2000 | 4 | 300 |
| Vinh Phuc | SPL III | Yen Lac WSS | 100 | 2002 | 3000 | 2 | 400 |

There are two (2) distribution areas and four (4) hours and fourteen hours water supplies are made respectively.

### 4.3.2.2 Rate of Facility Utilization

When the Rate of Facility Utilization is defined as the ratio of “Average Water Supply” to “Capacity of WSS”, if this value is high, it implies that the WSS is utilized well, though it is necessary to consider other factors such as unaccounted-for water, etc. to see the efficiency of the WSSs.

Appendix ws.4.2 shows the Rate of Facility Utilization of 76 WSSs in operation. The maximum, minimum and average values are 1.75, 0.08 and 0.49 respectively.

The Rate of following three (3) WSSs, which are shown in the Table 4.3-11, is over 1.0 or more. They have the expansion plan of the WSS, however, it is difficult for them to prepare the budget.

In case that the Rate is more than 1.0 means that the WSSs operate beyond its design capacity. They are Tri Ton WSSs in An Giang province, Moc Chau WSS in Son La province and My Xuyen WSS in Soc Trang province. Following shows the briefing of each WSS.

Tri Ton WSS (An Giang province) : Design capacity is 2,000m$^3$/day. There are four (4) rapid sand filters of which total area is 30m$^2$. Since the filtration speed of rapid sand filter is generally 120 to 150m/day, the filtration capacity of Tri Ton WSS may be 2,880-3,600m$^3$/day. It does not seem difficult to increase the operation capacity.

Moc Chau WSS (Son La province) : Design capacity is 1,500m$^3$/day. Pressure filter is installed. Recently, the WSB replaced the raw water pump, which connected with the pressure filter, with higher performance one and it accordingly could increase its water supply capacity.

My Xuyen WSS (Soc Trang province) : Design capacity is 4,000m$^3$/day. The water supply system is to pump up groundwater and treat it by pressure filter and then distribute water to the service area. Though the groundwater quality is good, the filtration is necessary to remove sand in the groundwater. The good groundwater quality enables to operate the pressure filter with high load. If the friction loss head in the distribution network is less than the designed one, it seems to be possible to operate the WSS with higher capacity than the designed one.

### 4.3.3 Current Conditions of Facilities

#### 4.3.3.1 Damages Affected by Disasters

There is no WSS damaged by disasters.

#### 4.3.3.2 Capacity

The capacity of 97 WSSs varies from 278m$^3$/day to 16,000m$^3$/day, however, the most of WSSs have the capacity of 1,000m$^3$/day to 4,000m$^3$/day. The number of WSSs of which capacity drops in this range is 77. Table 4.3-10 below shows the distribution of number of WSSs by their capacity.

**Table 4.3-10 Distribution of Number of WSS by Capacity**

| Design Capacity (m$^3$/day) | No. of WSSs |
|---|---|
| 1000 or less | 5 |
| 1000 - 2000 | 24 |
| 2000 - 3000 | 39 |
| 3000 - 4000 | 14 |

| Design Capacity ($m^3$/day) | No. of WSSs |
|---|---|
| 4000 - 5000 | 6 |
| 5000 - 10000 | 6 |
| 10,000 or more | 3 |
| Total | 97 |

Regarding the sufficiency of the capacity for the water demand, following Table 4.3-11 shows the WSSs of which maximum daily water supply and/or average water supply is same with the designed capacity or more.

**Table 4.3-11 The WSSs of which Capacity Seems to be Insufficient to the Water Demand**

| Province | Phase | WSS | Startup Year | Designed Capacity (A) ($m^3$/day) | Average Daily Water Supply in 2009 (B) ($m^3$/day) | Maximum Daily Water Supply in 2009 (C) ($m^3$/day) | (B)/(A) | (C)/(A) |
|---|---|---|---|---|---|---|---|---|
| An Giang | SPL III | Tri Ton WSS | 2005 | 2000 | 3500 | | 1.75 | |
| Dien Bien | SPL III | Tuan Giao WSS | 2006/09 | 2500 | 2400 | 2500 | 0.96 | 1.00 |
| Lai Chau | SPL IV | Than Uyen WSS | 2004 | 1000 | 1000 | 1400 | 1.00 | 1.40 |
| Lam Dong | SPL I | Bao Loc WSS | 2003 | 7500 | 6500 | 7500 | 0.87 | 1.00 |
| Lao Cai | SPL IV | Bac Ha WSS | 2007/07 | 1500 | 675 | 1500 | 0.45 | 1.00 |
| Phu Tho | SPL I | Phu Tho WSS | 2001 | 10000 | 8000 | 10000 | 0.80 | 1.00 |
| Quang Ninh | SPL I | Dong Trieu WSS | 2001 | 2000 | 1900 | 2000 | 0.95 | 1.00 |
| Quang Tri | SPL I | Lao Bao WSS | 2001/01 | 3000 | 3000 | | 1.00 | |
| Soc Trang | SPL IV | My Xuyen WSS | 2008 | 4000 | 4500 | | 1.13 | |
| Son La | SPL III | Moc Chau WSS | 2005/01 | 1500 | 2000 | 2850 | 1.33 | 1.90 |

As mentioned in Chapter 4.3.2.2, the effort of OM/M organization of WSSs shown in the Table 4.3-11 above, enables to operate the WSS under the critical situation of the strong water demand, however, the OM/M organization has to take the expansion of the WSS into consideration.

### 4.3.3.3 Deterioration by Aging and Insufficient Maintenance and Management

Though the survey team did not observe any deterioration of facilities by aging or insufficient maintenance and management, following two (2) cases seemed to be necessary to report.

#### (1) Luong Tai WSS, Bac Ninh province

The OM/M organization reported that the drainage of deposit in the sedimentation basin is difficult due to the ground subsidence (The sludge of sedimentation is in general evacuated by gravity. If the elevation of drain outlet pipe in the sedimentation basin is lowered and that of sludge basin does not change, the drainage of deposit becomes difficult).

#### (2) Thuong Xuan, Thanh Hoa province

he survey team observed that the OM/M of Thuong Xuan WSS did not seem to use the WTP for long time. Though it is only the observation, the survey team is afraid of the possibility of rapid deterioration of the facilities unless it is used continuously.

#### 4.3.3.4 Alteration

Though the survey team did not confirm the significant alternation of the facilities, there are several WSSs which made alteration of installations or equipment.

**(1) Moc Chau, Son La province**

The OM/M organization replaced two pumps initially installed by a high performance pump for pressure filters to increase the capacity of WSS in order to meet with increasing water demand.

**(2) Dong Trieu, Quang Ninh province**

The OM/M organization installed two pressure filter vessels to increase the capacity of WSS in order to meet with increasing water demand. The pressure filters replaced the up-flow filtration initially installed.

**(3) Buong Ho, Dak Lak province**

There had been 10 water source wells, however, four (4) wells out of them were depleted and PWSC constructed one (1) well, accordingly there are seven (7) wells.

**(4) CHAN MAY, Thua Thien Hue province**

The water source is surface water in the deep mountain stream and its quality is usually very good. Therefore, coagulant is usually not used for the water treatment and the OM/M organization or PWSC dismounted the tank to bring it to another WSS for preparation of coagulant solution. Staffs empirically determine the coagulant dose and put its solution into raw water manually during short periods when turbidity of raw water becomes a little bit high.

**(5) Duc Pho, Quang Ngai province**

The water source is groundwater.

The up-flow filtration was installed according to the design for iron removal, however, the OM/M organization noticed the good raw water quality and it did not use the filtration. Since the rapid filtration necessitates the costly coagulant, delivering disinfected water without filtration to the distribution network is economical. However, it is necessary continuously to monitor the raw water quality.

**(6) Sao Do, Hai Duong province**

The OM/M organization installed the filter to improve the water quality to be supplied.

**(7) Conversion of Disinfectant**

The WSSs shown in the Table below converted the disinfectant from the liquefied chlorine to sodium hypochlorite or calcium hypochlorite. Since the liquefied chlorine is very dangerous substance even for population, it is preferable to use sodium or calcium hypochlorite which is safe and easy to handle.

**Table 4.3-12 WSSs of Disinfectant Conversion**

| Province | Phase | WSS | Disinfectant |
|---|---|---|---|
| Lai Chau | SPL III | Tam Duong | Calcium Hypochlorite |
| Ninh Binh | SPL I | Kim Soon | Sodium Hypochlorite |
| Quang Binh | SPL III | Minh Hoa | ditto |
| Quang Nam | SPL I | Thang Binh | ditto |
| Quang Ngai | SPL III | Duc Ho | ditto |
| Quang Ninh | SPL I | Dong Trieu | ditto |
| Quang Ninh | SPL III | Hai Ha | ditto |
| Thua Thien Hue | SPL I | Chan My | ditto |

## 4.4 Irrigation Sector

### 4.4.1 Outline of Facilities

#### 4.4.1.1 Outline of Facilities

Outline of the facilities (systems) constructed under the SPL Projects can be grasped from the viewpoints of 1) location, 2) PO, 3) major components, 4) beneficial area, 5) year of construction and SPL phase and 6) current conditions. Each facility has different combination of these aspects, as shown in Appendix ir.4.1 and ir.4.3.

**(1) Location (Province)**

The facilities of the irrigation sector are located from the south to north (Appendix 3.1), and the total numbers of the provinces and facilities are 36 and 84, respectively. Table 4.4-1 shows the number of facilities by each province. Ha Tinh province shows the maximum number of seven (7).

**Table 4.4-1 Location of Facilities**

| Province | No. of Facilities | Province | No. of Facilities |
|---|---|---|---|
| Bac Giang | 1 | Lao Cai | 2 |
| Bac Kan | 3 | Nghe An | 4 |
| Bac Lieu | 1 | Ninh Binh | 1 |
| Binh Dinh | 4 | Ninh Thuan | 3 |
| Ca Mau | 1 | Phu Tho | 5 |
| Cao Bang | 1 | Phu Yen | 3 |
| Dak Lak | 5 | Quang Binh | 1 |
| Dak Nong | 2 | Quang Nam | 1 |
| Dien Bien | 1 | Quang Ngai | 4 |
| Dong Thap | 1 | Quang Tri | 3 |
| Gia Lai | 3 | Thai Nguyen | 3 |
| Ha Giang | 1 | Thanh Hoa | 6 |
| Ha Tinh | 7 | Thua Thien Hue | 2 |
| Hoa Binh | 2 | Tra Vinh | 2 |
| Kon Tum | 2 | Tuyen Quang | 2 |
| Lai Chau | 1 | Vinh Long | 1 |
| Lam Dong | 2 | Vinh Phuc | 1 |
| Lang Son | 1 | Yen Bai | 1 |
| | | | 84 |

### (2) Project Owner (PO)

The POs are PPC, DARD, DPC and IMC (Irrigation Management Company). The POs are mainly DPC and DARD with the percentage of 50% and 36% of facility number, respectively. The details of the project owners are shown in Table 4.4-2.

**Table 4.4-2 Project Owner of Facilities**

| Project Owner | No. of facilities | No. of Facilities (%) |
|---|---|---|
| PPC | 3 | 4 |
| DARD | 30 | 36 |
| DPC | 42 | 50 |
| IMC | 8 | 9 |
| DARD and DPC | 1 | 1 |
| Total | 84 | 100 |

### (3) Major Components

The major components of the facilities constructed under SPL are classified into eight (8) patterns, 1) dam, pump station and canal, 2) dam and canal, 3) dam, 4) pump station and canal, 5) pump station, 6) canal, 7) sluiceway and 8) river improvement and riverbank protection. The word of "canal" in this clause includes irrigation, drainage and irrigation-cum-drainage canals, and the word of "dam" also includes head works[6]. As shown in Table 4.4-3, the main component patterns are "dam and canal", "canal" and "pump station and canal" accounting for 42%, 19% and 18% of facility number, respectively.

**Table 4.4-3 Major Components**

| Major Components of Facility | No. of Facilities | | | | |
|---|---|---|---|---|---|
| | SPL III | SPL IV | SPL V | Total | Total (%) |
| Dam, Pump Station, Canal | 1 | 1 | 2 | 4 | 5 |
| Dam, Canal | 6 | 13 | 16 | 35 | 42 |
| Dam | 3 | 2 | 4 | 9 | 11 |
| Pump Station, Canal | 3 | 5 | 7 | 15 | 18 |
| Pump Station | 1 | 0 | 0 | 1 | 1 |
| Canal | 4 | 6 | 6 | 16 | 19 |
| Sluiceway | 0 | 0 | 1 | 1 | 1 |
| River Improvement and Riverbank Protection | 2 | 0 | 1 | 3 | 4 |
| Total | 20 | 27 | 37 | 84 | 100 |

[6] Dam and head works are treated as facilities of same category in Vietnam.

### (4) Beneficiary Area

The beneficiary areas of the SPL facilities range from 2.2 ha to 18,020 ha. The total area is around 107 thousands ha, and the average is 1,300 ha. As shown in the following table, the facilities with the area more than 1,000 ha, 100-200 ha and those less than 100 ha account for 23%, 22% and 20% of facility number, respectively.

**Table 4.4-4 Beneficiary Area of SPL Facilities**

| Beneficial Area (ha) | Number of Facilities | Number of Facilities (%) |
|---|---|---|
| ～100 (including 100) | 16 | 20 |
| 100～200 | 18 | 22 |
| 200～300 | 11 | 13 |
| 300～400 | 2 | 2 |
| 400～500 | 4 | 5 |
| 500～1,000 | 12 | 15 |
| 1,000～ | 19 | 23 |
| Total (106,608.4 ha) | 82* | 100 |

* Excluding 2 flood control facilities.

The following table shows regional distribution of facilities by beneficiary area. Based on the table, there does not seem to have any remarkable tendency in the distribution.

**Table 4.4-5 Regional Distribution of Facilities by Beneficiary Area**

| Beneficiary Area (ha) | North East | North West | Red River Delta | North Central Coast | South Central Coast | Central Highland | South East | Mekong Delta | Total |
|---|---|---|---|---|---|---|---|---|---|
| -100 | 4 | | | 3 | 2 | 5 | 1 | 1 | 16 |
| 100-200 | 5 | 2 | | 5 | 3 | 3 | | | 18 |
| 200-300 | 2 | | | 2 | 4 | 3 | | | 11 |
| 300-400 | | | | 2 | | | | | 2 |
| 400-500 | | 1 | | 1 | 1 | | 1 | | 4 |
| 500-1,000 | 3 | 1 | 1 | 5 | 1 | 1 | | | 12 |
| 1,000- | 6 | | 1 | 5 | 1 | 1 | | 5 | 19 |
| Total | 20 | 4 | 2 | 23 | 12 | 13 | 2 | 6 | 82 |

### (5) Year of Construction and SPL Phase

All facilities were/are constructed in SPL III, IV and V, and the construction periods of all the facilities range from 2000 to 2011. The facilities which were / will be completed at year 2001-2005 and 2006-2010 account for 39% and 57% of the number of facilities, respectively. The details of the construction completion year and SPL phase are shown in Table 4.4-6.

**Table 4.4-6 Construction Completion Year and SPL Phase**

| Construction Completion Year | No. of Facilities | No. of Facilities (%) | SPL Phase (No. of Facilities) |
|---|---|---|---|
| 2001-2005 | 33 | 39 | III (18), IV (15) |
| 2006-2010 | 48 | 57 | III (2), IV (12), V (34) |
| 2011 | 3 | 4 | V (3) |
| Total | 84 | 100 | 84 |

### (6) Current Conditions

Current conditions of the facilities are classified into four (4) categories, 1) under D/D, 2) under construction, 3) completed and 4) completed (some portions not yet constructed). Completed facilities account for 86% of facility number, as shown in Table 4.4-7.

**Table 4.4-7 Current Conditions of Facilities**

| Current Conditions | No. of Facilities | No. of Facilities (%) |
|---|---|---|
| Under D/D | 2 | 2 |
| Under Construction | 9 | 11 |
| Completed | 72 | 86 |
| Completed (some portions not yet constructed) | 1 | 1 |
| Total | 84 | 100 |

#### 4.4.1.2 Components of Facility

The most dominant components of the facilities constructed under the SPL Projects are dam, head works, pumping stations and canals. Main features of these facilities are tabulated in Appendix ir.4.2. The summary of the major components are described below.

**(1) Dam**

The Dams are classified into two (2) types, 1) earth fill dam and 2) concrete dam. Table 4.4-8 shows the number of dams, ranges of height and crest length and reservoir capacity by each type. Main and secondary dams are counted independently for these features. There are facilities with plural dams as shown in Appendix ir.4.2. The total number of dams and the total reservoir capacity are 49 and around 113 MCM (million cubic meters)[7], respectively.

**Table 4.4-8 Summary of Dams**

| Dam Type | Height (m) | Crest Length (m) | Reservoir Capacity (MCM) |
|---|---|---|---|
| Earth Fill Dam | 3.0-43.8 | 30.5-1,352 | 0.03-9.0 |
| Concrete Dam | 10.0 | 30 | 56.0 |
| Total | - | - | 112.8 |

The highest Dam is Phuong Mao Dam (Phu Tho province) constructed under SPL IV. Its height is 43.8 m, beneficiary area is 928 ha, beneficiary population is 17,500 and JBIC fund allocated is 16.21 BVND.

**(2) Head Works**

Head works are classified into three (3) types, 1) concrete weirs, 2) earth weirs (protected with concrete, etc.) and 3) a rubber dam[8]. Table 4.4-9 shows the number of head works, ranges of height and crest length by each type. The total number of head works is 44.

**Table 4.4-9 Summary of Head Works**

| Type of Head Works | No. | Height (m) | Crest Length (m) |
|---|---|---|---|
| Concrete Weir | 42 | 0.5-7.4 | 3-220 |
| Earth Weir (Protected with concrete, etc.) | 1 | 2.6 | 2,163 |
| Rubber Dam | 1 | 2.0 | 18 |
| Total | 44 | - | - |

[7] Main and secondary dams form reservoir. Therefore, the secondary dams are not considered in summing up the reservoir capacity.
[8] Rise and fall weir made of cloth and rubber mobilized by air or water.

### (3) Pumping Station

The objectives of pumping stations are classified into three (3); irrigation, drainage and irrigation-cum-drainage, and pump types are three (3); horizontal shaft, vertical shaft and submersible[9]. Based on the combination of these, pumping stations can be classified into seven (7) types; 1) irrigation-horizontal shaft pump, 2) irrigation-vertical shaft pump, 3) irrigation-submersible pump, 4) drainage-horizontal shaft pump, 5) drainage-vertical shaft pump, 6) irrigation-cum-drainage - horizontal shaft pump and 7) irrigation-cum-drainage - vertical shaft pump. Table 4.4-10 shows the numbers of pump stations and pumps and range of pump capacity of each type. The total numbers of pumping stations and pumps are 51 and 120, respectively.

**Table 4.4-10 Summary of Pump Stations**

| Objectives of Pumping Station (No. of Pump Stations) | Pump Construction | No. of Pumping Stations | No. of Pumps | Pump Capacity ($m^3$/hr) |
|---|---|---|---|---|
| Irrigation (39) | Horizontal | 21 | 51 | 270-1,500 |
| | Vertical | 13 | 29 | 190-1,500 |
| | Submersible | 5 | 11 | 108-450 |
| Drainage (10) | Horizontal | 9 | 12 | 290-4,000 |
| | Vertical | 1 | 6 | 4,000 |
| Irrigation-cum-Drainage (2) | Horizontal | 1 | 4 | 1,000 |
| | Vertical | 1 | 7 | 1,500-2,500 |
| Total | - | 51 | 120 | - |

### (4) Canal

Canals are classified into three (3) types; 1) irrigation canals[10], 2) drainage canals[11] and 3) irrigation-cum-drainage canals[12]. Table 4.4-11 shows the total canal length and major canal types.. The total canal length is around 1,420 km.

**Table 4.4-11 Summary of Canals**

| Objectives of Canal | Total Canal Length (km) | Major Canal Type |
|---|---|---|
| Irrigation | 1,264.6 | Concrete Flume, Brick, Concrete Block, Earth Lining |
| Drainage | 22.5 | Earth Lining |

9 Horizontal and vertical shaft are classification from the viewpoint of direction of pump main shaft.
10 Canal conveys and distributes irrigation water to fields.
11 Canal collects drainage from the drainage area, and discharges collected drainage into river.
12 Canal that is used for irrigation and drainage canals simultaneously.

| Objectives of Canal | Total Canal Length (km) | Major Canal Type |
|---|---|---|
| Irrigation-cum-Drainage | 134.8 | Earth Lining |
| Total | 1,421.9 | - |

### 4.4.2 State of Utilization of Facilities

#### 4.4.2.1 General

The major components of the facilities are dams, head works, pump stations and canals.

Utilization of facility was grasped based on the farm area which was cultivated with irrigation water from the facility constructed under the SPL Projects (irrigated cultivation area). The data on the irrigated cultivation area was collected from the PO and/or OM/M organization in the interview survey because they grasped roughly the area in every years based on the harvest condition of crops, etc. Since the survey year (2010) was judged to be extraordinary drought year[13], the area of 2010 was not applied.

#### 4.4.2.2 Facilities with Problem

The utilization of facilities is evaluated based on the conditions of the completed facilities (include those completed but some portions have not been yet constructed). In the evaluation, "the ratio of irrigated cultivation area to irrigation beneficiary area[14]" was used as the indicator. As a result of the evaluation, five (5) facilities show the ratios less than 100% and these facilites were judged to have problems. The state of facility utilization is described below. Appendix ir.4.3 shows relevant basic data, i.e. the ratio of irrigated cultivation area to irrigation beneficiary area, number of beneficiaries, main crops, yield of rice, etc.

**(1) Ea Yeng Reservoir, Dak Lak Province**

The irrigation beneficiary area is 50 ha with main crop of paddy.

Under the SPL III, the Ea Yeng Dam (earth fill type) was constructed in 2001 with the storage capacity of 0.910 MCM, and the dam height and length are 10.0 m and 420 m, respectively. Main canal of 1.5 km was also rehabilitated from earth lining to concrete block canal.

Under these conditions, the secondary and tertiary canals are earth lining ones which locate in the downstream of the main canal constructed under the sub-project. Since there was water leakage, etc. from the secondary and tertiary canals, 92% of the irrigation beneficiary area is only irrigated.

[13] In extraordinary drought year, irrigation beneficial area is not ensured.
[14] The irrigated cultivation area is that actually cultivated and the irrigation beneficiary area is that benefited by an irrigation project.


Ea Yeng Dam and Reservoir


SPL Main Canal and Irrigation Area

**Figure 4.4-1 Conditions of Ea Yeng Reservoir**

### (2) An Hung Dam, Ha Tinh Province

The irrigation beneficiary area is 219 ha with main crops of paddy, groundnuts and maize.

The An Hung Dam (earth fill type) was constructed by the GOV (under own budget) in 1978. Its basin area is 140 ha. Under the SPL IV, the An Hung Dam was rehabilitated with the storage capacity of 1.06 MCM, and the dam height and length are 25.0 m and 460 m, respectively. In addition, two (2) main canals were rehabilitated from earth lining to concrete flume canal, namely West Main Canal with 2,980 m and South Main Canal with 800 m.

Under these conditions, the natural mixed trees in a forest of private land of around 30 ha in the dam basin was changed to rubber tree before one (1) year of the commencement of the rehabilitation. Due to the influence of this change, the runoff of water from the dam basin was reduced by around 10 %. As a result, 90% of the irrigation beneficiary area is currently irrigated. (information from relating personnel).


An Hung Dam and Reservoir

Vegetation of Dam Basin

**Figure 4.4-2 Conditions of An Hung Dam**

### (3) Khe Coi Dam, Ha Tinh Province

The irrigation beneficiary area is 80 ha with main crops of paddy, groundnuts and potatoes.

Khe Coi Dam (earth fill type) was constructed in 1956, and main canal of 2.0 km and secondary canal of 2.5 km were also constructed by the GOV (under own budget). Its canal type was earth lining. Under SPL IV, Khe Coi Dam was rehabilitated with the storage capacity of 0.682 MCM, and the dam height and length are 10.0 m and 400 m, respectively. Main canal of total 2.0 km was also rehabilitated from earth lining to brick canal, namely North Main Canal with 1,400 m and South Main Canal with 600 m.

Under these conditions, 88% of the irrigation beneficiary area is irrigated because a siphon[15] of the main canal has not been yet constructed. This siphon will be constructed under the GOV budget after five (5) years (PO will be DPC). In addition, deterioration of the intake facility at the north of dam due to a gate trouble, deformation of the north main canal (length 200 m) due to released water from the said un-controllable dam intake facility, and deformation of the south main canal (length 5 m) due to low construction quality were observed. These parts will be repaired until 2011.

North Intake Facility of Dam

Deformation of North Main Canal

**Figure 4.4-3 Conditions of Khe Coi Dam**

### (4) Song Rac Irrigation, Ha Tinh Province

The total beneficiary area is 8,190 ha including 40 ha of fisheries.

Song Rac Dam (earth fill type), and main canal of 18.2 km, secondary canal of 40.0 km and tertiary canal of 95.0 km were constructed by the GOV (under own budget) during 1986-1994. The storage capacity of the dam is 125.5 MCM, and the dam height and length are 26.8 m and 1,263 m, respectively. Major canal type is earth lining.

Under these conditions, 7.9 km of secondary canals and 3.8 km of tertiary canals, which located in the end of the area, were rehabilitated from earth lining to brick, stone and concrete flume canal under the SPL III. The irrigation beneficiary area relating the SPL Project is 1,490 ha with main crops of paddy,

[15] Canal constructed under a river, a lake and a depression in order to cross these obstacles.

groundnuts and maize.

Because the main and secondary canals, located in the upstream of the SPL portions, are earth lining type constructed during 1986-1994, there were water leakages, etc. from these canals. Since the canals constructed under the SPL Projects are located in the downstream of the earth lining canals, the irrigation water of the downstream canals results in insufficient sometimes. As a result, 90% of the irrigation beneficiary area is currently irrigated.


Earth Lining Canal Located in the Upstream of SPL Canal


Division Works to SPL Canal

**Figure 4.4-4 Conditions of Song Rac Irrigation**

**(5) Quang Xuong Irrigation, Thanh Hoa Province**

The irrigation beneficiary area is 1,023 ha with main crops of paddy, groundnuts and maize.

Quang Tam Pumping Station, with four (4) pumps of each 1,400 $m^3$/hr capacity, was constructed in 1995, and main canal of 7.4 km and secondary canal of 6.5 km were constructed with earth lining in 1998. These facilities were constructed by the GOV (under own budget).

Under these conditions, 6.3 km of main canals and 4.45 km of secondary were rehabilitated under the SPL III. The major canal types are concrete block and brick.

However, these rehabilitated canals, especially located in/around residential areas with length of around 0.4 km, were deformed remarkably by scoring of sands behind concrete blocks due to low construction quality. In addition, these canals were deteriorated due to the disposal of household solid waste. 80% of the irrigation beneficiary area is currently irrigated. In addition, the pumps were deteriorated, and their electricity charges increased. It was also observed the reaching time of irrigation water to the end of facility increased.


Deformation of Main Canal and Disposal of Solid Waste


Deformation of Secondary Canal and Disposal of Solid Waste

**Figure 4.4-5 Conditions of Quang Xuong Irrigation**

### 4.4.3 Current Conditions of Facilities

#### 4.4.3.1 Damages Affected by Disasters

Among natural and man-made disasters, only flood damages were reported and recognized during the site survey. The number of affected facilities is three (3). Table 4.4-12 shows these facilities and relevant information.

**Table 4.4-12 Facilities Affected by Flood**

| Province | Facility Name | Affected Facilities and Length under the SPL Project | Conditions |
|---|---|---|---|
| Lao Cai | Sin Chai Irrigation System | Main Canal (L=1 km, Concrete Flume and Earth Lining) | Destruction of the canal, which is constructed on the steep slopes of the mountain, caused by floods and falling rocks. These damages are repaired after each time of occurrence. |
| Nghe An | Khe Ngang Reservoir | Secondary Canal (L=1 km, Earth Lining) | Destruction of the canal caused by floods during a rainy season. These damages are repaired after each time of occurrence. |
| Phu Yen | La Bach Reservoir (Stage 2) | Main and Secondary Canal (L=0.4 km, Earth Lining) | Destruction of the canal caused by floods (this canal was completed in 2006). These are damages during the construction of the dam. |


Destructed Canal Caused by Floods


Destructed Canal Caused by Falling Rocks

**Figure 4.4-6 Conditions of Sin Chai Irrigation System**


Khe Ngang Dam and Reservoir


Main Concrete Flume Canal

**Figure 4.4-7 Conditions of Khe Ngang Reservoir**


Dam under Construction


Destructed Canal Caused by Floods

**Figure 4.4-8 Conditions of La Bach Reservoir (Stage 2)**

#### 4.4.3.2 Capacity

Any damages are not observed and reported regarding the capacity of facility.

#### 4.4.3.3 Deterioration by Aging and Insufficient Maintenance and Management

Deterioration by aging and insufficient maintenance and management were confirmed and reported at two (2) facilities during the site survey. The Table 4.4-13 shows conditions of these facilities.

**Table 4.4-13 Facilities with Deterioration**

| Province | Facility Name | Deteriorated Facilities under the SPL Projects and Length | Remarks |
|---|---|---|---|
| Ha Tinh | Khe Coi Dam | Dam Intake Facility and Main Canal (L=205 m, Brick) | Facility conditions are described at 4.4.2.2 (3). |
| Thanh Hoa | Quang Xuong Irrigation | Main and Secondary Canal (L=400 m, Concrete Block) | Facility conditions are described at4.4.2.2 (5). |

#### 4.4.3.4 Alteration

Any alteration were not observed and reported.

# Chapter 5 Operation, Maintenance and Management of the Facilities

## 5.1 Road Sector

### 5.1.1 Conditions of Operation, Maintenance and Management of the Facilities

#### 5.1.1.1 Operation

There are no operation activities for the facilities constructed under the road sector sub-projects.

#### 5.1.1.2 Maintenance

The maintenance of SPL roads are conducted by companies or state-owned organizations under DOT, DARD (Department of Agriculture & Rural Development), District People's Committee (DPC), City People's Committee (City PC) and Town People's Committee (TPC). The number of sub-projects by each maintenance organization is shown in Table 5.1-1:

**Table 5.1-1 Number of Sub-Projects by Maintenance Organization**

| Organization | DOT | DARD | DPC | City PC | TPC | Other* | Total |
|---|---|---|---|---|---|---|---|
| No. of Sub-projects | 295 | 1 | 180 | 14 | 19 | 9 | 518 |

Note: "Other" includes on-going sub-projects and unsubmitted projects to project owners.

The established year of each organization varies, some were established in 1961. According to the survey, total of 261 (approximately 50 % of all) organizations were established before 2000.

Regarding annual maintenance and financial plans, total of 485 sub-projects (94%) answered as they have plans, as shown in Table 5.1-2.

**Table 5.1-2 Number of Sub-Projects Having Annual Maintenance and Financial Plans**

| Annual Maintenance and Financial Plans | Have plans | Don't have Plans | No answer | Other | Total |
|---|---|---|---|---|---|
| No. of Sub-projects | 485 | 3 | 0 | 30 | 518 |

According to the questionnaire, 56 sub-projects (equivalent to 11%) answered that they conducted major repair works. The details are shown in Table 5.1-3.

**Table 5.1-3 Number of Sub-Projects Conducted Major Repair Works**

| Large-Scale Repair Work | Pavement | Widening | Embankment | Re-construction | Ongoing & Not answer | Total |
|---|---|---|---|---|---|---|
| No. of Sub-projects | 15 | 5 | 1 | 35 | 462 | 518 |

According to the interview survey, questionnaire and survey form, the number of sub-projects that have executed large scale repair / small scale repair was 148 sub-projects. However, it seemed such records and information would not be maintained. Especially, when the person in charge changes, the data will be lost.

The contents of maintenance are as follows:

- Inspection (Normal inspection or Urgent inspection)
- Weeding
- Cleaning of side ditch
- Small scale repair (repair of potholes, shoulders and so on)
- Large scale repair (Normally it is not included in a regular maintenance, thus it will be dealt with a contract).

The maintenance work items (sample) are shown in Table 5.1-4.

**Table 5.1-4 Detail of Maintenance Work Items (Sample)**

| No. | Work Items | Unit |
|---|---|---|
| 1 | Filling of shoulder and embankment and , clean up slip soil. | $m^3$ |
| 2 | Hauling embankment material and remove spoil soil by damp truck 5 tons | $m^3$ |
| 3 | Demolish damaged pavement | $m^2$ |
| 4 | Repairing potholes | $m^2$ |
| 5 | Stone masonry for damaged slop protection | $m^3$ |
| 6 | Construction of foundation, slope and longitudinal ditches by masonry with cement mortar M75 | $m^3$ |
| 7 | Repairing box culvert (excavation & backfilling, sand fill for foundation, concrete base, form work, reinforced concrete) | place |
| 8 | Repairing pipe culvert (excavation & backfilling, sand fill for foundation, concrete base, sealing joint) | place |
| 9 | Repairing inlet and outlet of culverts (excavation & backfilling, sand fill for foundation, concrete base, form work, reinforced concrete) | place |
| 10 | Weeding | $m^2$ |
| 11 | Cleaning side ditch | $m^2$ |

The maintenance method of the facilities constructed under SPL is decided by a regular inspection. There is a case to cooperate with Commune People's Committee. However, frequency of inspection is not specified, and it varies depending on the OM/M organization. The frequency of inspection is summarized as follows:

- Inspect road conditions once a week
- Inspect road conditions once a week, or urgent inspection in case of emergency caused by typhoon / heavy rain
- Inspect road conditions once a month
- Inspect road conditions once in 2-3 months

#### 5.1.1.3 Management

The management organizations on road maintenance are divided into five types i) DOT, ii) DARD, iii) DPC, iv) City PC and v) TPC. See more details in Table 5.1-5.

**Table 5.1-5 Number of Sub-Projects by Management Organizations**

| Organization | DOT | DARD | DPC | City PC | TPC | Other | Total |
|---|---|---|---|---|---|---|---|
| Company | 168 | 0 | 0 | 0 | 0 | 0 | 168 |
| State | 127 | 1 | 180 | 14 | 19 | 9 | 350 |
| Total | 295 | 1 | 180 | 14 | 19 | 9 | 518 |

Generally, under the management of DOT, OM/M was conducted by two (2) to three (3) maintenance companies according to the scale of facilities such as total length of a road.

States organizations that were in charge of maintenance differ from the department of PPC, the division of DPC/City PC/TPC and the commune under DPC. More details are explained in Chapter 5.1.2.1.

Some maintenance companies were found in 1961. However, according to the survey, total of 119 out of 168 companies were established before 2000.

The number of staffs in a maintenance company was usually more than that of a state organization. The numbers of sub-projects with more than 100 staffs in a maintenance company was 113 as shown in Table 5.1-6.

**Table 5.1-6 Number of Staffs of Maintenance Company and State Organization**

unit: number of sub-projects

| No. of Staffs | < 10 | 11-100 | >101 | No Answer | No Staff | Total |
|---|---|---|---|---|---|---|
| Maintenance Company | 8 | 43 | 113 | 4 | 0 | 168 |
| State Organization | 122 | 132 | 36 | 41 | 10 | 341 |
| Total | 130 | 175 | 149 | 45 | 10 | 509 |

Note: Not included eight (8) sub-projects which were ongoing and hadn't been handed over yet.

The number of the maintenance companies and state organizations with maintenance equipments, such as bulldozer, grader, excavator, road roller, dump trucks and so on, was 157 and 95 respectively. This shows that the capacity (manpower and equipment) of the maintenance companies was much larger than that of the state organizations.

Most of the maintenance companies have some branch offices in provinces with heavy equipments and some have mobile units with only the most basic equipments.

Due to limited volume of maintenance work, the main income sources of the most maintenance companies were construction of road and bridge, installation of warning signs, safety post, traffic safety facilities such as guard rail and so on.

### 5.1.2 Organization and System for Operation, Maintenance and Management of the Facilities

#### 5.1.2.1 Operation, Maintenance and Management Organization

Implementation of a road sub-project is managed by the Project Owner (PO). After the completion of the sub-projects, the facilities are then handed over to each province. Then, a province transfers the facilities to OM/M organizations through DOT, DPC, City PC, TPC. The OM/M organizations conduct the management, operation, repair works, protection and so on in accordance with the contract or circular or degree.

The details of OM/M organization are shown in Table 5.1-7:

**Table 5.1-7 Breakdown of Operation, Maintenance and Management Organization**

| State | Sub-projects | Company | Sub-projects |
|---|---|---|---|
| S1. Department of Transport (DOT) | 14 | C1. Joint Stock Company | 156 |
| S2. Road Management Division under DOT | 75 | C2.Limited Company | 12 |
| S3. Road & Water Management Division under DOT | 28 | | |
| S4. Transport Management & Repair Center under DOT | 9 | | |
| S5. Public Transport & Operation and Maintenance Center under DOT | 4 | | |
| S6. Transport Management & Repair Enterprise under DOT | 5 | | |
| S7. Irrigation Division under DARD | 1 | | |
| S8. Urban Infrastructure & Economic Division under City PC/TPC | 42 | | |
| S9. SPMU under DPC | 5 | | |
| S10. Industry & Trade Division under DPC | 139 | | |
| S11. Public transport Division, DPC | 4 | | |
| S12. Volunteer Youth No.11, Thanh Chuong District under DPC | 1 | | |
| S13. Commune | 14 | | |
| Total | 341 | Total | 168 |

Note: The difference between Joint Stock Companies and Limited Companies is offering of stock to the public. The former is offering and the latter isn't.

Some OM/M organizations are listed below:

**(1) Bac Kan province Boc Bo − Cong Bang Road**

OM/M organization was Road Management Division No.7

There was one team, which always visited the site and checked the condition of roads, then reported to OM/M office if any problems or damages. In case of a small damage, the site inspection team would repair by themselves. In case of a large damage, they would request DPC for allocation of fund to repair.

**(2) Bac Kan province Urban Road**

OM/M organization was Bac Kan Urban Works and Environment Joint Stock Company.

All the urban roads were inspected every week, and an urgent inspection was conducted during large storm and / or heavy rain. An inspection was also conducted when the company obtained information from the communes. If there was a small damage, the company will repair it based on the annual contract with Bac Kan PPC. If there was a large damage, the company would estimate the cost, then, reported to Bac Kan PPC in order to apply for the repair fund.

**(3) Yen Bai province Yen Bai - Khe Sang Road, Bac Giang province Thang - Vat Road**

OM/M organization was Road Management Division.

One team visited to the site every week to check the current conditions of the roads and to report to the OM/M office. If there was a large damage, they would submit the report and estimate the cost for repair.

**(4) Quang Ninh province Duc Chung − An Sinh Road, Bac Giang province Bo Ha - Mo Trang Road, Cao Bang province Trung Khanh - Kham Thanh - Phong Nam Road, Lang Son province Na Sam - Na Hinh Road**

OM/M organization was Industry and Trade Department of the district. The department made a contract with one of the OM/M teams and it conducted annual repair of the road including land clean, weeding, the side-ditch cleaning and so on. The team was usually conducting minor repairs of the road. In case of a natural disaster, the department obtained the information from people living along the road and the team would conduct the repair.

**(5) Nam Dinh province, Xuan Truong district:**

Every week, the staffs of the Industry and Trade Department of Xuan Truong district visited the site and checked the conditions of the road.

**(6) Ha Nam province, Thanh Liem district**

Every week, the staffs of the Industry and Trade Department of Thanh Lien district visited the site and checked the conditions of the road.

**(7) Thanh Hoa province Tinh Gia district**

Once a month, Road Management Division of Tinh Gia district visited the site and checked the conditions of the road.

**(8) Nghe An province Tuong Duong district**

From each commune, Industry and Trade Department (ITD) of the district received information on roads with any damages. After that the staffs of ITD would visit the site and check the conditions.

**(9) Hai Phong province Vinh Bao district**

Vinh Bao Road Management Division together with all communes using the road checked the condition of the road and reported to Vinh Bao Road Management Division if any damages. In addition, the staffs of Vinh Bao Road Management Division conducted site visit every week and checked on the damaged parts.

#### 5.1.2.2 Operation, Maintenance and Management System

There are some types of the OM/M organization. They depend on each category of roads such as province road, district road, city / town road, commune road, determined by each province. The OM/M organizations are categorized as follows:

- Regarding the OM/M companies established under DOT such as Joint Stock Company and Limited Company, a contract with DOT or DPC is usually made for regular maintenance of the road. DOT requests the fund for the OM/M as the annual road budget to the provincial government.
- The state organizations are divided into five types such as i) DOT, ii) DARD, iii) DPC, iv) City PC / TPC and v) Commune. They are subdivided into 13 types as shown in Table 5.1-7, and the most popular OM/M organization of roads constructed under SPL Projects is "Industry & Trade Division" under DPC. However, the state organizations rarely conduct the OM/M by themselves. Most of them entrusts the works to small scale contractors who provide works crew or worker temporally.
- Sub-Project Management Unit (SPMU) for road maintenance is under DPC.
- The maintenance organization under City PC and TPC is "Urban Infrastructure & Economic Division."
- Concerning the roads constructed under SPL V, they are still under warranty period, so handing

over the facilities to PO has not been completed yet. The warranty period is about one to two years after the completion of construction which highly depends on the PPC Decision to assign the OM/M organization.

**Table 5.1-8 Number of Staffs in each OM/M Organization**

(The meaning of S1-S13, C1-C2 is shown in Table 5.1-7)

unit: number of sub-projects

| State Organizations | <10 | 11-100 | >101 | NA | Total | Company | <10 | 11-100 | >101 | NA | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1. | 5 | 9 | 0 | 0 | 14 | C1. | 8 | 37 | 109 | 2 | 156 |
| S2. | 0 | 34 | 22 | 19 | 75 | C2. | 0 | 6 | 4 | 2 | 12 |
| S3. | 28 | 0 | 18 | 10 | 28 | | | | | | |
| S4. | 0 | 9 | 0 | 0 | 9 | | | | | | |
| S5. | 0 | 4 | 0 | 0 | 4 | | | | | | |
| S6. | 0 | 5 | 0 | 0 | 5 | | | | | | |
| S7. | 1 | 0 | 0 | 0 | 1 | | | | | | |
| S8. | 10 | 27 | 4 | 1 | 42 | | | | | | |
| S9. | 0 | 5 | 0 | 0 | 5 | | | | | | |
| S10. | 104 | 16 | 0 | 19 | 139 | | | | | | |
| S11. | 0 | 4 | 0 | 0 | 4 | | | | | | |
| S12. | 0 | 1 | 0 | 0 | 1 | | | | | | |
| S13,* | 2 | 0 | 0 | 2 | 4 | | | | | | |
| Total | 122 | 132 | 36 | 41 | 331 | Total | 8 | 43 | 113 | 4 | 168 |

*: There are ten (10) sub-projects which do not have staff in S13: Commune

Table 5.1-8 shows:

- The state organizations have less staffs (worker) than that of the company.
- "Industry & Trade Division" under DPC occupies the biggest number of the OM/M organizations for the roads constructed under the SPL Projects. However, the number of staff is small, almost less than 10 staffs.
- Most of the "Communes" don't have any staffs engaged in the OM/M. The road maintenance work is often conducted by beneficiaries in each commune.
- The company and the state organization which have more than 100 staffs take charge of the OM/M of 113 (22%) and 36 (7%) sub-projects, respectively.

## 5.2 Electricity Distribution Sector

### 5.2.1 Conditions of Operation, Maintenance and Management of the Facilities

#### 5.2.1.1 Function of Project Management Unit and Operation, Maintenance and Management Organization during the Sub-Project Development Stages

All electricity distribution sub-projects have the clear demarcation of the development function between implementation stage and utilization stage of the facilities. Defects liability period and Hand-over Documentation with signature of all concerning entities are the definitive remark on this function demarcation.

Normally, project management unit is assigned by the chairman of provincial peoples' committee (PPC) when budget allocation for the sub-project is approved by PPC.

Function of the project management unit is to implement projects, thus it terminates with the end of the defects liability period.

In Vietnam, there are four (4) types of project management unit and they are selected by the PPC Chairman.

- Project Management Unit under Provincial Electricity ( PE, provincial member of EVN)
- Project Management Unit under DOIT
- Project Management Unit under DPI
- DPC

Facilities constructed under sub-projects are transferred to operation, maintenance and management (OM/M) organizations like shown below:

- DE (District Electricity, district member of EVN)
- Provincial Electricity Company under PPC
- DPC

Depending on the voltage, electricity distribution assets are divided into two (2) types and they belong to two (2) different owners:

- DE for Medium Voltage (MV) facilities
- Power Supply Cooperative (PSC) for Low Voltage (LV) facilities

Although the final owner of the electrical assets varies, according to the Law of Electricity, district and provincial members of EVN should do their basic management task, whenever the power supply has a problem.

#### 5.2.1.2 Operations

Nearly all the OM/M organizations, or current assets owners, belong to EVN, the operation of the facilities is proceeding smoothly. The electricity tariff is fixed by the government as current expenditure for social infrastructure that is acceptable for all users.

#### 5.2.1.3 Maintenance

Maintenance (monitoring, small-scale repair, large-scale repair, improvement, alteration, etc.) of the facilities is ensured by the local member of EVN. All these activities are planned yearly by DE and approved by PE in the last month of year and then conducted in the next year without delay, nationwide.

DE also has responsibility for the maintenance of LV facilities, though they belong to PSC. DE conducts maintenance based on the power purchase contract signed by director of DE and head of PSC.

The following picture shows the regular investigation of the facilities, which are owned by PSC, conducted by DE.


**Figure 5.2-1 Maintenance Conducted by Kim Son Electricity (District Electricity) of Low Voltage Facilities which belongs to Hung Tien Power Supply Cooperative (Ninh Binh Province, Kim Son District)**

#### 5.2.1.4 Management

For a long time, distribution network including facilities constructed under the SPL Projects has been managed by mainly EVN. Hence, EVN has abundant experiences, especially in the rural areas. The electrification rate of households is about 98% in Vietnam, it is approximately 20 million families have access to the electricity in Vietnam.

All the operational data of the facilities is kept in the district archives. And in some areas, the data is saved also in the computerized systems. Therefore, EVN can conduct appropriate management of the facilities to ensure electricity supply timely, which is indispensible for stable livelihood and socio-economic activities.

The challenge EVN faces now is not in the electricity distribution, but in the power generation. Though 60% of power generation sources are hydropower, because of lack of water due to world climate change, power supply hasn't met the current rapid demand in the economic in Vietnam in this decade.

During dry season, power supply is cut in some rural areas. However, this is not the problem found in all the distribution networks.

### 5.2.2 Organization and System of Operation, Maintenance and Management of the Facilities

#### 5.2.2.1 Operation, Maintenance and Management Organization

SPL Project assets are small-scale electricity distribution networks, which mostly supply power to the people living in the rural area. The small-scale network starts from one MV disconnector, which separates the tapping point in the nearby existing MV feeder.

Hence, OM/M organization of the distribution network constructed under the SPL Projects is DE (See "Figure 7.2-1 Overview of EVN Organization for Operation, Maintenance and Management")

All DEs have their head office in the center of the district. DEs are organized well for operation and maintenance of district power distribution systems, including the facilities constructed under the SPL Projects (See the Figure 5.2-2).

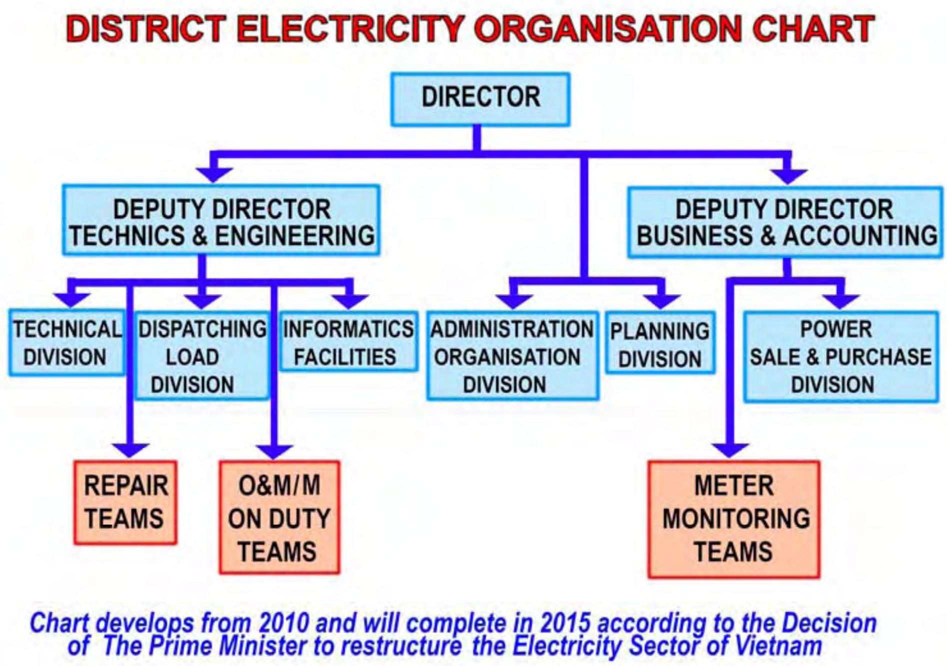



**Figure 5.2-2 DE Organization Chart**

As mentioned in 5.2.1.1, some OM/Ms of LV facilities are conducted by PSC based on the decision by chairman of PPC (these were observed in some LV facilities constructed under SPL II, III and IV in remote mountainous and coastal areas).

To make the situation mentioned in Chapter 5.2.1.3, understandable, the relationship among PSC, DE and government is shown in Figure 5.2-3.

Furthermore, OM/Ms of all facilities constructed under SPL Projects was transferred to EVN based on the decision by GOV in March 2nd 2009 and the Inter-ministerial Circular No.06-2010 / TTLT-BCT-BTC on February 3rd 2010 issued by MOIT and MOF.

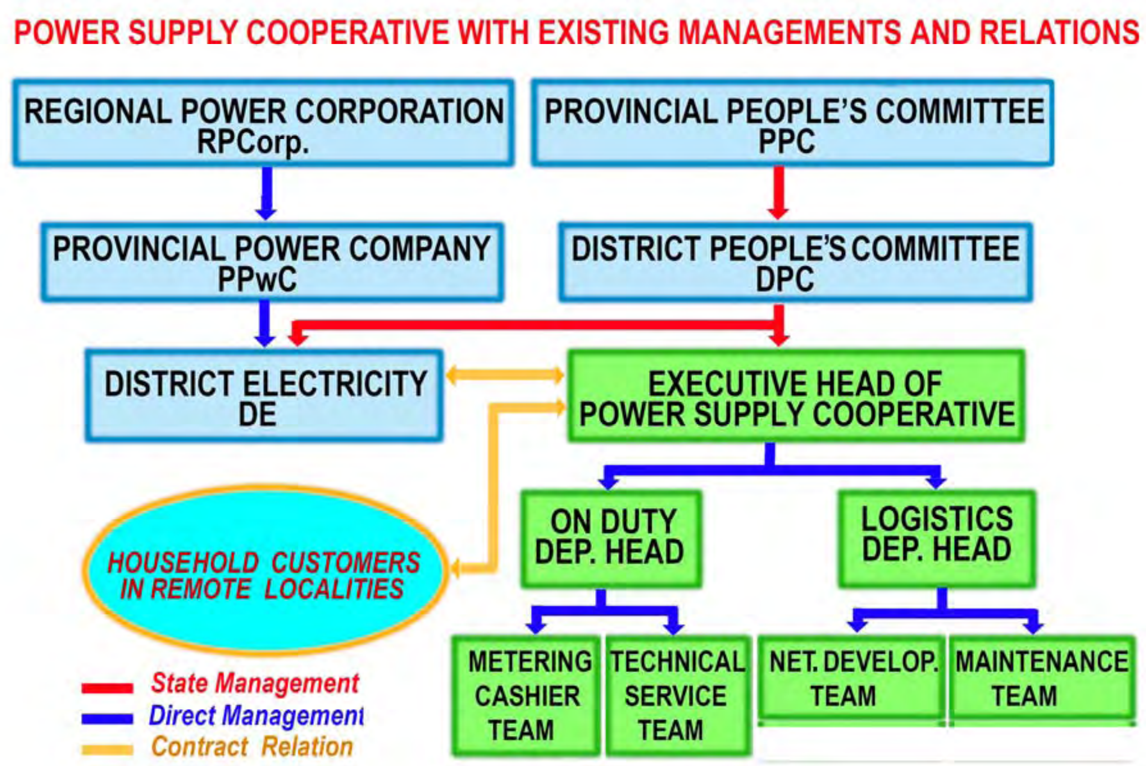



**Figure 5.2-3 Relation among Power Supply Cooperative, District Electricity and Local Government**

### 5.2.2.2 Operation, Maintenance and Management System for Emergency Cases

OM/M costs for emergency is funded by EVN own resources, which are backup funds from power tariff income planned by the PE and approved by the regional power corporation. Normally DE request budget to the upstream organization of EVN. The budget is decided taking into consideration the size of the outage and a fixed time being within regulated by the Law of Electricity.

## 5.3 Water Supply Sector

### 5.3.1 Conditions of Operation, Maintenance and Management of the Facilities

#### 5.3.1.1 Operation

**(1) Water Quantity Control**

**1) Water in the Water Treatment Plant**

Most of the WSSs install the flow meter[16] at the outlet of treated water tank, however, only a few WSSs install it to measure the water intake volume.

The water taken from water source is delivered through the facilities in the WTP by energy for treatment (except the WSSs of which water source is good quality groundwater) and the water is finally sent to distribution network.

If the OM/M organization does not measure the water volume taken, it cannot grasp the water discharged from the sedimentation basin, used for the cleaning of the filters, the unexpected leakage from various installations, and so forth. (It is expressed as the difference of the meter readings of flow meters for raw water and for treated water, though the flow meter has a little bit error.)

Since the water inside the WSSs is paid cost for energy, etc., it is important to measure and record such water in order to reduce the unaccounted-for water[17].

**2) Unaccounted-for Water**

The UFW (Unaccounted-for Water) rate (rate of the water which cannot bring the revenue to the OM/M organization) of 50WSSs in operation varies from 0% to 54%. Average UFW rate is around 21%. For reducing the UFW, having correct volume delivered from the WSS and that received by each consumer is important. Appendix ws.5.1 shows the UFW rate of 50 WSSs.

It is consequently necessary to install appropriate size of the flow meter and to know the characteristics of the meters.

For example, one WSS with 2500m$^3$/day capacity which installed a 200 mm flow meter and the current water supply is 300m$^3$/day (12.5m$^3$/hour in average) and pump pressurized distribution is applied.

**(i) Size of Flow Meter**

Following Figure 5.3-1 shows the performance curve on relationship between flow rate and error. In case of the flow rate of 12.5m$^3$/h, the figure shows that the 200mm diameter flow meter does not

16 A flow meter means the device to measure the flow rate of rather big diameter pipe and it is in general installed in the water intake facility, WTP, distribution pipelines, etc.

17 The definition of "Unaccounted-for Water" in this report is sum of "water cannot be revenue such as non-detectable water of the flow meter and water meter" and "leakage from the distribution pipelines and other facilities".

detect the flow. The flow rate that the flow meter starts to detect correctly is 60m$^3$/hour (1440m$^3$/day). It shows that the WSS cannot measure the water volume delivered to consumers in several years from starting its operation unless the OM/M organization installs a bypass pipe with small size diameter at in the outlet pipe from the treated water tank, for example.

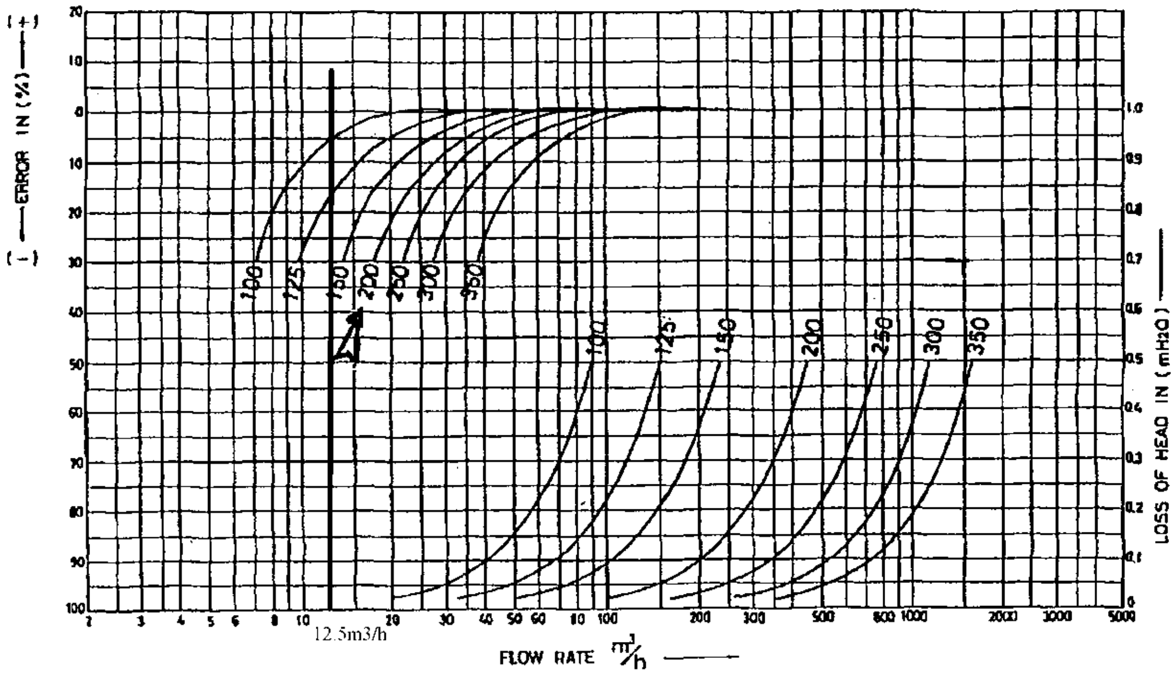



**Figure 5.3-1 Flow Meter Performance Curve**

Source: Water Meter Catalogue of KIMMON Manufacturing Co., Ltd., Japan

**(ii) Installation of Flow Meter**

Most of the types of flow meter used in the water supply necessitate the certain length of straight pipes before and after the flow meter in order to measure the flow rate appropriately. Following Figure 5.3-2 is the curve of relationship[18] between the error of flow rate and the upstream straight pipe length of the flow meter. It shows that if there is not straight pipe in the upstream area of the flow meter, the error of meter reading cannot be ignored. This condition is similar to the downstream area.

[18] It can not be applied to the real flow meter because it is a theoretical concept drawing. Plus or minus of error depends on the type of flow meter and condition of unsteady flow in pipe.

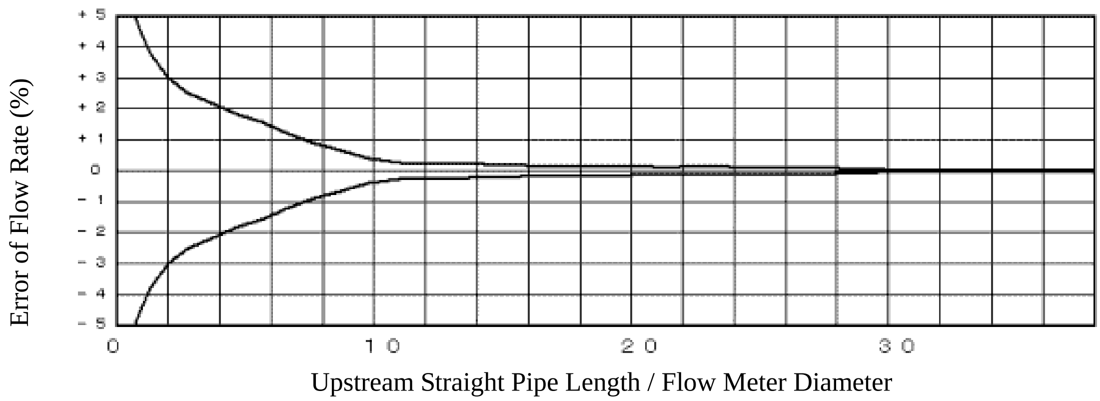



**Figure 5.3-2 Influence of Upstream Straight Pipe Length to the Measurement Error of Flow Meter**

Source: Technical Report of RYUTAI KOGYO Co., Ltd., Japan

However, flow meter necessitates certain size of area to be installed to minimize error, most of the WSSs install the flow meter in a small pit to sacrifice the accuracy of it. Refer to the picture below.

**Figure 5.3-3 Condition of Flow Meter Installation**

Over half of OM/M organization of WSSs surveyed did not seem to notice such characteristic of the flow meter. The staff of WSSs should be conscious about this condition referring the performance curve attached to the flow meter and evaluate the meter reading appropriately.

**(2) Water Quality Control (WQC)**

**1) Water Quality Standard**

Ministry of Health had revised the National Technical Regulation on Drinking Water Quality, No.

1329/2002/BYT/DQ dated 18th April 2002 and stipulated the new regulation "QCVN 01: 2009/BYT" in 2009. Appendix ws.5.2 shows the difference between the old regulation and revised one. New regulation stipulated the allowable values of Copper, Iron and Manganese more strict than those in the old one and added the parameters of pesticides, disinfectant by-products, radioactive constituents, etc. Frequency of water quality monitoring was a little bit increased. However, it can be said that there is not a big difference in the OM/M of WSS between new regulation and old one.

New regulation, QCVN 01: 2009/BYT, does not seem to affect the OM/M of the WSSs.

**2) Water Quality Control**

Appendix ws.5.3 shows the conditions on the WQC of 76 WSSs in operation.

**(i) Organizations in Charge of Water Quality Control**

Organizations in charge of WQC are summarized in the following Table 5.3-1 based on the Appendix ws.5.3.

Table 5.3-1 shows that two (2) WSSs do not execute the WQC regardless of WQC plan that both WSSs have prepared, and 16 WSSs do not take responsibility on the WQC as the water provider stipulated in QCVN 01 and depend on the result of the water analysis executed by the PPHC or DPHC as the Control Agency.

The OM/M organizations other than mentioned above make effort to do the WQC having the support from the laboratory of provincial organizations.

**Table 5.3-1 Organization in Charge of Water Quality Control (WQC)**

| Organization in charge of Water Analysis as the Water Provider | No. of WSSs | Remarks |
|---|---:|---|
| PPHC | 9 | Based on the contract between OM/M organization and PPHC |
| Other Provincial Control Agency | 2 | Center of products quality inspection under department of technology and environment of province, etc. |
| Laboratory of PCERWAS | 1 | Detail is not clear though OM/M organization said that 10 parameters such as pH, turbidity, etc. can be analyzed. Analysis of microbes is depended note) on the PPHC. |
| PWSC/PPHC | 3 | PPHC supplement the WQC of PWSC based on the contract with OM/M organization. |
| PWSC/PPHC with DPHC | 1 | PPHC and DPHC supplement the WQC of PWSC based on the contract with OM/M organization. |
| PWSC | 33 | PWSC executes the WQC as the headquarter of OM/M organization |
| WSC/PPHC | 1 | PPHC supplements the WQC of WSB. PPHC works based on the contract with OM/M organization |
| WSB/DPHC/PPHC | 1 | PPHC and DPHC supplement the WQC of WSB based on the contract with OM/M organization. |
| WSB/PWSC/PPHC | 1 | PWSC and PPHC supplement the WQC of WSB. PPHC works based on the contract with OM/M organization |
| WSB/PWSC | 5 | PWSC supplements the WQC of WSB |
| WSB | 5 | Branch of PWSC executes WQC as the OM/M organization |

| Organization in charge of Water Analysis as the Water Provider | No. of WSSs | Remarks |
|---|---|---|
| WSB and Laboratory of Neighboring WSS | 1 | Neighboring WSS is another WSB of same PWSC |
| DWSU | 2 | WQC is executed by DWSU itself. |
| Depends [note)] on the WQC Agency (PPHC) | 15 | WQC is not executed by OM/M organization |
| Depends [note)] on the WQC Agency (DPHC) | 1 | WQC is not executed by OM/M organization |
| The course of WQC has not been determined | 14 | Sub-projects of which construction Works have not been completed |
| WQC is not executed | 2 | Phu Xuyen WSS (Ha Noi city) and An Chau Town WSS (Bac Giang province). Whether PPHC intervenes or not was not clear. |
| total | 97 | |

DWSU : District Water Supply Undertaking
PWSC : Provincial Water Supply Company
WSB : Branch of PWSC
PPHC : Provincial Preventive Health Center under Ministry of Health
DPHC : District Preventive Health Center under PPHC
PCERWAS : Provincial Center for Rural Water Supply and Sanitation

Note: “depend” means that the water providers make use of the water analysis results executed by “functional agencies” on drinking water supply such as PPHC, DPHC, etc.

#### (ii) Parameters Analyzed and Water Analysis Frequency

Parameters analyzed in the WQC by water provider is mainly Turbidity, pH and Residual Chlorine, however, a number of WSSs analyze more. The parameters analyzed by the OM/M organization of WSSs shown in Appendix ws.5.3. Table 5.3-2 also shows the examination level of each parameter. Examination Level means the water analysis frequency stipulated by QCVN 01.

Here:

- A: At least one (1) time per week by the water provider and at least one (1) time per month by the control agency.
- B: At least one (1) time per six (6) months by the water provider and at least one (1) time per six (6) months by the control agency.
- C: At least one (1) time per two (2) years by the water provider and at least one (1) time per two (2) years by the control agency.

**Table 5.3-2 Parameters Analyzed in the Water Quality Control by OM/M Organization**

| Parameter | Unit | Maximum limit | Examination Level |
|---|---|---|---|
| Color | TCU | 15 | A |
| Taste and odour | - | No strange taste & odour | A |
| Turbidity | NTU | 2 | A |
| pH | - | Within 6.5-8.5 | A |
| Hardness | mg/l | 300 | A |
| Chloride | mg/l | 250 | A |
| Iron | mg/l | 0,3 | A |
| Nitrate | mg/l | 50 | A |
| Nitrite | mg/l | 3 | A |
| Sulfate | mg/l | 250 | A |
| Dissolve Oxygen | mg/l | 2 | A |
| Residual Chlorin | mg/l | Within | A |
| Total Coliform | MPN/100ml | 0 | A |
| E.coli or thermotolerant coliform | MPN/100ml | 0 | A |
| Total Manganese | mg/l | 0,3 | A |
| Total Dissolved Solid (TDS) | mg/l | 1000 | B |
| Aluminum | mg/l | 0,2 | B |
| Ammonium | mg/l | 3 | B |
| Total Arsenic | mg/l | 0,01 | B |
| Flouride | mg/l | 1,5 | B |
| Lead | mg/l | 0,01 | B |
| Total Mercury | mg/l | 0,001 | B |
| Total Chromium | mg/l | 0,05 | C |
| Total Copper | mg/l | 1 | C |
| Cyanide | mg/l | 0,07 | C |
| Nickel | mg/l | 0,02 | C |
| Zinc | mg/l | 3 | C |
| MPN: Most Probable Number | | | |

Source: National Technical Regulation on Drinking Water Quality, QCVN01:2009/BYT Ministry of Health

The water analysis frequency applied by 76 WSSs shown in the Appendix ws.5.3 varies from "every one (1) hour" to four (4) months. However, 22 WSSs execute the water analysis in the frequency of everyday or less. The water analysis frequency of three (3) WSSs is more than one week which is stipulated frequency of the parameters of which examination level is "A" shown in Table 5.3-2.

#### 5.3.1.2 Maintenance

##### (1) Maintenance Plan

Following Table 5.3-3 shows the situation about the preparation of maintenance plan. 44 WSSs among 76 in operation prepared the maintenance plan while 25 WSSs do not prepare. It is said that if the transfer of the facilities from the implementation organization to the OM/M organization has not been completed, the OM/M organization usually does not prepare the maintenance plan.

**Table 5.3-3 Preparation of Maintenance Plan**

| OM/M organization / Maintenance Plan Preparation | WSB | DWSU | Company | PWSC | PWSU | PCERWAS | Economic Zone Water Supply Center | CPC | N/I | total |
|---|---|---|---|---|---|---|---|---|---|---|
| prepared | 23 | 5 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 33 |
| prepared but no documentation | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| prepared with PWSC | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| prepared by PWSC | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| no information | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 |
| not clear | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| not prepare | 13 | 6 | 1 | 0 | 0 | 1 | 2 | 1 | 0 | 24 |
| total | 51 | 13 | 3 | 1 | 2 | 2 | 2 | 1 | 1 | 76 |

note:
PWSC Provincial Water Supply Company
WSB Branch of Provincial Water Supply Company (PWSC)
DWSU District Water Supply Undertaking such as Management Board of DPC
Company Independent Automonous OM/M organization established in City, Town, etc
PWSU Provincial Water Supply Undertaking which is different from PWSC
CPC Commune People's Committee
N/I No information

##### (2) Maintenance Activities

OM/M organizations of Thua Chua WSS, Dien Bien province and Sop Cop Town WSS, Son La province do not execute the maintenance, saying that the facilities are quite new. However, it is generally recognized that the troubles occurrence possibility in the first or second years from starting the operation is high. This condition is called as Initial Failure or Start-up Problems. Hence, it is essential for the WSS to start maintenance from the starting of the operation.

##### 1) Daily Maintenance

The activities of daily maintenance are mainly looking over all the installations, equipment, etc. of the WSS for taking necessary measures when staffs observe abnormal phenomena such as noise, leakage of liquid, etc, and supply movable devices such as pump, motor, valve, etc. with grease and/or oil, and so forth.

Not so many WSSs mentioned the cleaning of the facility, it may be considered as the matter of course.

##### 2) Breakdown Maintenance

Regarding the breakdown maintenance of the WSBs, the method applied is similar in most of the provinces.

When staffs of a WSS find out a breakdown, they inform it to PWSC and it send a staff to the site for preparing the minute on the measures which should be taken and the breakdown is repaired immediately. The cost used for the repair will be settled later. All the activities are reported step by step to the director of PWSC.

In case of DWSU, there is less information, however, it also gives the priority to repair the breakdown.

**3) Preventive Maintenance**

Preventive maintenance is to keep equipment or installations working and/or to extend the life of them by systematic inspection, detection, and correction of early stage of failures either before they occur or before they develop into major defects.

A small number of the WSSs apply the preventive maintenance to pumps, chlorinators etc. according to the instruction manual of the manufacturer. There are a few cases that the technical department of PWSC executes it to the branch WSS.

### 5.3.1.3 Management

#### (1) Water Tariff

The Water tariff for five (5) categories; domestic, industry, office, service and public institution of 65 WSSs is summarized in the Table 5.3-4 below:

**Table 5.3-4 Water Tariff** (VND/$m^3$)

| domestic | industry | office | service | public institution |
|---|---|---|---|---|
| 1,800 – 5,000 | 3,000 – 12,000 | 3,000 – 8,500 | 3,300 – 14,800 | 3,300 – 9,780 |

Appendix ws.5.4 shows the structure of water tariff of 65 WSSs.

According to the Circular No. 100/2009/TT-BTC on the drinking water tariff frame for domestic use, it in principle should cover all reasonable production cost which ensures the rights and eligible benefits of water providers and water users/clients. The domestic water rate applied to small towns is from 2,000 to 10,000 VND/$m^3$, and that to rural areas is 1,000 to 8,000VND/$m^3$. The domestic water rate applied to the WSSs under SPLs meets with the Circular.

Appendix ws.5.4 also shows the collection rate of water rate. Most of WSSs can collect water rate with almost 100% except the An Chau Town WSS in Bac Giang province which had started the operation on January, 2010 and had the problem on the distributed water quality on August, 2010 that caused the low water rate collection index. The OM/M organization changed the location of intake suction pipe in order to avoid high turbidity raw water. The quality of water supplied will be hopefully improved in the near future.

### (2) Water Supply Coverage

The water supply coverage of the 62 WSSs in operation is shown in Appendix ws.5.5 and summarized in Table 5.3-5 below. Two types of coverage are presented in it: one is acquired by calculating as the number of household connected with the WSS divided by the number of households in the service area and another is the coverage reported by the OM/M organization.

The Appendix ws.5.5 also gives the current per capita consumption based on the average daily water supply and number of consumers which was acquired from the number of households connected and average member of households. It accordingly included the water consumption by industries, public institutions, services, etc. and the consumption of such sectors affected the values.

**Table 5.3-5 Water Supply Coverage**

| | Coverage based on Consumer Households 1) | Coverage reported by WSS 2) | Current Per Capita Consumption 3) |
|---|---|---|---|
| No. of WSS with Data | 62 | 35 | 64 |
| Maximum (%) | 95 | 100 | 962 liter |
| Minimum (%) | 6.7 | 29.1 | 44 liter |
| Median (%) | 50 | 60 | 150 liter |
| No. of WSS less than Median | 33 | 18 | 33 |

Note:
1) Number of households supplied with water / number of households in the service area
2) Based on the report from the OM/M organization
3) Average daily water supply/number of households supplied with water x average member of households

It is noted that there are 33 WSSs of which water supply coverage is less than 50%. The survey team asked the reason to 24 OM/M organizations and the replies from them were as follows:

12 OM/M organizations replied two reasons and total number of replies were accordingly 36.

**Table 5.3-6 Reason of Low Coverage**

| Reason of Low Coverage | Remark | No. of WSSs |
|---|---|---|
| Alternative Water Source note) | Wells, Rain Water Tanks, etc. | 12 |
| Insufficient Distribution Pipelines | Distribution sub-mains and service pipelines were not included in the sub-project scope | 12 |
| Low Income | | 4 |
| Inappropriate Water Demand Projection | Population inflow has not been considered in the initial plan of WSS | 3 |
| Suspicion about Treated Water Quality by Population | | 3 |
| Insufficient Intake Pump Capacity | Inappropriate Design | 1 |
| Insufficient Number of Water Meters | Water meters were not included in the sub-project scope | 1 |
| Total | | 36 |

Note: Most of alternative water sources are used by population before construction of the WSS and they are wells, rainwater tanks, etc. The water from them is usually not disinfected, however, it does not have smell of chlorine and it is generally free of charge.

The calculated per capita consumption of small town with population of 5,000 to 10,000 based on the method described in the Design Standard of Water Supply Facilities, TCXD 33- 2006, Ministry of Construction, is around 150 liter. Since the WSSs under SPLs were designed based on the Design Standard of the Ministry of Construction, the median of per capita consumption shown in the Table above is almost same as the designed value. Therefore 33 WSSs have not reached the designed value of per capita consumption.

### 5.3.2 Organization and System for Operation, Maintenance and Management of the Facilities

#### 5.3.2.1 Operation, Maintenance and Management Organization

The OM/M organization of 75[19] WSSs in operation is classified into eight (8) types and they are shown in the Table 5.3-7 below:

**Table 5.3-7 Operation, Maintenance and Management (OM/M) Organizations**

| Type of OM/M organization | Description | No. of WSSs |
|---|---|---|
| PWSC note) | Provincial Water Supply Company | 1 |
| PCERWAS | Provincial Center for Rural Water Supply and Sanitation | 2 |
| Economic Zone Water Supply Center | Organization in Ha Tinh province | 2 |
| WSB | Branch of Provincial Water Supply Company | 51 |
| DWSU | OM/M organization under DPC or Town PC | 13 |
| Company | Independent Automonous OM/M organization established in City, Town, etc. | 3 |
| PWSU | Branch of Provincial Water Supply Undertaking which is different from PWSC. For example: TUAN GIAO Water Treatment Plant belongs to Provincial Irrigation Service and Construction Ltd. Co. under PPC | 2 |
| CPC | Commune People's Committee | 1 |
| Total | | 75 |

note: as mentioned earlier, the PWSC has been converted from the state own company to the limited company or the joint stock company

Most of the OM/M organizations are WSB; Branch of Provincial Water Supply Company, because the Ministry of Construction reportedly has the policy to put the DWSU under the management of PWSC due to its weak OM/M capability.

Therefore a number of DWSU are being transferred to PWSC in the near future. Five (5) WSSs managed by Company seem to be in good situation. It seems to be necessary to watch the OM/M of two (2) WSSs under PCERWAS.

In case of the WSS managed by CPC, it is actually very small scale water supply and it is considerably different from the scope of other WSSs under SPLs. Parties concerned with this sub-project are

[19] One (1) WSS has started its operation though the construction work has not been completed yet and the OM/M organization has not been decided yet accordingly.

recommended monitoring this WSS.

#### 5.3.2.2 Operation, Maintenance and Management System

The Figure 5.3-4 below shows the concept of organization structure summarized from 45 WSSs in operation and Appendix ws.5.6 shows the number of staff of 65 WSSs in which 45 WSSs present the structure of staff.

The staff is not necessarily assigned to all positions and sections of 45 WSSs. The Vice director, Technician who might work as the technical administrator, and accountant are assigned in 19, 12 and 14 WSSs respectively. The staff is combined with several tasks of distribution pipelines control, construction works for house connection and bill collection, and so forth in most of the WSSs. Only four (4) WSSs have the staff in charge of water analysis.

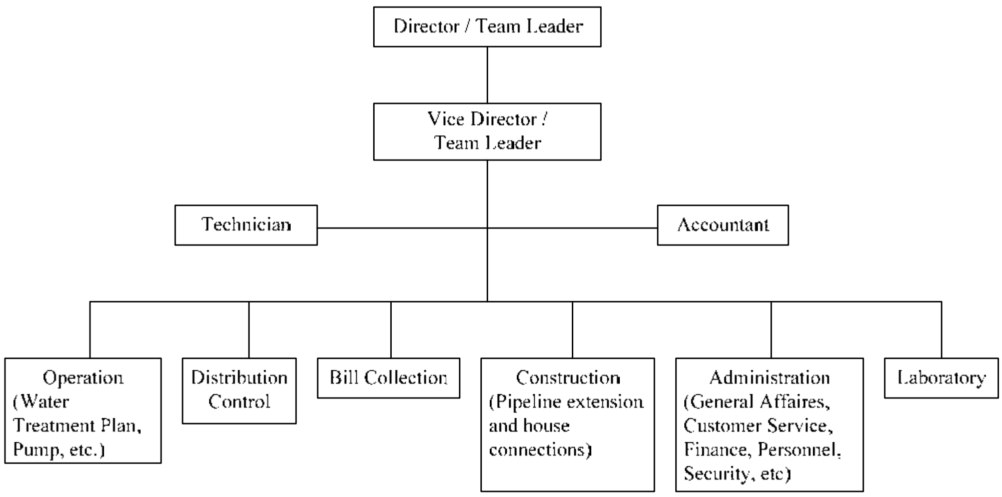



**Figure 5.3-4 General Concept on Structure of OM/M Organization**

Though, it is difficult to say about the appropriate number of staff in each WSS in case of small scale rural water supply, the WSSs managed by PCERWAS have only three (3) staffs saying that the headquarter of PCERWAS always supports the WSSs. Considering the complexity of the WSSs, it seems insufficient to operate the WSSs with WTP.

## 5.4 Irrigation Sector

### 5.4.1 Conditions of Operation, Maintenance and Management of the Facilities

#### (1) General

Main components of the facilities (dams, head works, pumping stations, main canals, etc.) are operated, maintained and managed by DARD, DPC, CPC, IMC (Irrigation Management Company) and FO (Farmers' Organization)[20], and on-farm canals, etc. are maintained by farmers without compensation. On the other hand, the asset management is implemented based on the ministerial

[20] A section in charge of the OM/M within these organizations implements the OM/M of facility.

ordinance of MOF. The maintenance and management of the flood control structures are not implemented.

#### (2) OM/M Regulation

IMC (if IMC is the OM/M organization) establishes its regulation based on the 1) ministerial ordinances of MARD, i.e., “Ordinance on Irrigation Facility Protection and Development" and “Ordinance on Dyke and Dam”, 2) provincial ordinances and 3) relevant correspondences, etc. For other cases (if IMC is not OM/M organization), a local consultant prepares a manual/regulation based on the same ordinances, etc.

#### (3) Existence of OM/M Plan and Record

As shown in Appendix ir.5.1, 53 facilities prepare OM/M plan (82% of 65 facilities of answered), and 12 facilities do not schedule to prepare (remainings are under design stage). On the other hand, 50 facilities prepare OM/M records (75% of 67 facilities of answered), and 17 facilities do not schedule to prepare (remainings are under design stage). In many cases, the facilities having OM/M plan prepare OM/M record.

### 5.4.1.1 Operation

#### (1) Operation Plan

For the facilities having OM/M plan, the OM/M organization prepares an operation plan under the support of relating government institutions usually. The main contents of the operation plan are an irrigation schedule, an irrigation area, an operation cost and electricity charges of pumping stations, etc. On the other hand, for the facilities not having O/M plan, the beneficiary area is small and the facility is simple in many cases, and the OM/M organization operates facilities based on the reality of production and experience.

Case studies of operation planning are, as follows:

1) IMC Case

- (i) DARD decides the irrigation area, and estimates irrigation water demand based on a DARD guideline.
- (ii) IMC prepares the operation plan based on the irrigation area and irrigation water demand decided by DARD.
- (iii) IMC submits the operation plan to DPI and DOF.
- (iv) DPI, DOF and DARD appraise the operation plan.
- (v) After the appraisal, IMC submits the operation plan to PPC for a budget.

2) FO Case

- (i) DPC prepares the general plan of irrigation schedule.

(ii) CPC (Steering Production Board) prepares the detailed plan of irrigation schedule.

(iii) CPC prepares the seasonal plan of irrigation schedule including irrigation water demand, and CPC disseminates the irrigation schedule to farmers.

(iv) FO prepares the operation plan based on the above mentioned schedule and water demand, and submits the plan to CPC, and informs to DPC.

(v) DPC makes a field inspection and a recommendation on operation plan to FO.

(vi) FO submits the record of inspection conducted by DPC to CPC for budget procurement.

**(2) Operation Conditions**

For the facilities having OM/M record, the OM/M organization prepares an operation record of dams, head works and pumping stations, however, does not prepare the operation record of canal gate in many cases. The main items of the operation record are ratio of gate opening and relating water level, and the operation record is tabulated.

#### 5.4.1.2 Maintenance

**(1) Maintenance Plan**

The OM/M organization prepares a maintenance plan based on the inspection and examination. The main contents of the maintenance plan are a repair and maintenance schedule, and a maintenance cost, etc. On the other hand, for the facilities not having the OM/M plan, facilities are maintained based on the reality of production and experience.

**(2) Maintenance Conditions**

As a result of the site survey, basic maintenance activities are commonly executed in every facility, although frequencies of activities are different. The basic maintenance activities are summarized below.

1) Dam

(i) Protect a dam and appurtenant structures

(ii) Cut grass and trees on and around the dam

(iii) Dredge deposition around an intake facility

(iv) Inform problems to an upper organization

(v) Execute small scale repairs (for example, < soils 2 $m^3$, < repair materials 0.5 $m^3$)

(vi) Execute large scale repairs (carried out by upper organization)

2) Head Works

(i) Cut grass and trees around head works

(ii) Dredge deposition in front of intake gates

(iii) Execute small scale repairs (for example, < soils 2 $m^3$, < repair materials 0.5 $m^3$)

(iv) Execute large scale repairs (carried out by the upper organization)

3) Pumping Station

(i) Maintain pumps (lubrication and easy maintenance and repairs, etc.)

(ii) Cut grass and trees around a pumping station

(iii) Dredge deposition in and around suction and discharge sumps

(iv) Execute all repairs by the OM/M organization

4) Canal

(i) Cut grass and trees around canals

(ii) Dredge deposition in the canals

(iii) Execute small scale repairs (for example, < soils 2 $m^3$, < repair materials 0.5 $m^3$)

(iv) Implement large scale repair (implemented by upper organization)

For the facilities having an OM/M record, the OM/M organization prepares a maintenance record of the above activities. Most of maintenance records have diary style showing daily maintenance activities.

#### 5.4.1.3 Management

Irrigation assets are managed in accordance with the ministerial ordinances of MOF. Therefore, in every province, the DOF is responsible for the management of the irrigation assets. Although all relating personnel do not know the ministerial ordinances, all provinces implement the asset management in accordance with the ministerial ordinances. The standard procedure of the management is, as follows:

1) A PO prepares the inventory of assets, and submits the inventory to the organization PO belongs. This inventory includes the scale, value, land area, persons in charge, year of construction and type of assets.

2) The PO hands over the assets and the inventory to the OM/M organization.

3) The OM/M organization submits the inventory to the DOF.

4) The OM/M organization calculates the depreciation of the assets, and submits it to the DOF. The service life of each item of the asset is determined based on the ministerial ordinance of MOF.

5) DOF assesses the deprecation based on the MOF ordinance, and informs to PPC annually.

### 5.4.2 Organization and System of Operation, Maintenance and Management of the Facilities

#### 5.4.2.1 Operation, Maintenance and Management Organization

**(1) Operation, Maintenance and Management Organization**

The OM/M organization is determined by PPC based on the provincial ordinances, ministerial ordinances of MARD or Law on Construction, etc. Although actual selection is different from province to province, the typical pattern of selecting is described below.

**Table 5.4-1 Selecting Pattern of Operation, Maintenance and Management Organization**

| Selected Organization | Typical Pattern |
|---|---|
| CPC | Facility exists in one (1) commune, and so forth. |
| DPC | Facility exists in several communes which belongs to one (1) district, and so forth. |
| DARD, IMC | Facility with large scale and complicated exists in several districts, and so forth. |
| FO | Facility with small scale and simple exists in one (1) commune, and so forth. |

After the decision of OM/M organization by the PPC, it authorizes the DPI to carry out the OM/M of the facilities. Then, the DPI authorizes the selected organization responsible for the OM/M of the facilities. In some cases, the authorized organization authorizes a lower organization, like DPC to CPC, and CPC to FO. The authorized organization must establish the OM/M post based on the provincial ordinance, and others. The component of the OM/M post is also stipulated.

The OM/M organizations of irrigation facilities are 1) DARD, 2) DPC, 3) CPC, 4) IMC and 5) FO in general. However, some facilities are operated, maintained and managed by several organizations[21]. Table 5.4-2 shows the number of facilities by OM/M organization types. The organization corresponds to the biggest number of facilities is IMC accounting for 40% (refer to Appendix ir.5.1).

**Table 5.4-2 Operation, Maintenance and Management Organization**

| OM/M Organization | No. of Facilities | No. of Facilities (%) | Beneficiary Area per Facility 1) (ha) | Remarks |
|---|---|---|---|---|
| DARD | 3 | 4 | 2.2-2,200 | |
| DPC | 9 | 11 | 53-10,900 | |
| CPC | 9 | 11 | 70-650 | Including one (1) flood control facility |
| IMC | 34 | 40 | 45-18,020 | Including one (1) flood control facility |
| FO | 15 | 18 | 29-600 | |
| DPC and CPC | 2 | 3 | 90-92 | DPC: Repair of dam and canal<br>CPC: OM/M of dam and canal |

[21] Plural organizations operate, maintain and manage one (1) facility by components, areas and roles (refer to Table 5.4-2).

| OM/M Organization | No. of Facilities | No. of Facilities (%) | Beneficiary Area per Facility 1) (ha) | Remarks |
|---|---|---|---|---|
| IMC, DPC and Town PC | 1 | 1 | 650 | IMC: OM/M of dam<br>DPC, TPC: OM/M of canal |
| IMC and FO | 1 | 1 | 5,950 | IMC: OM/M of one (1) head works and one (1) pumping station (one (1) area each, total two (2) areas)<br>FO: OM/M of one (1) pumping station (one (1) area) |
| Not Yet Decided | 10 | 12 | - | In cases of under D/D or construction, or right after the completion of construction |
| Total | 84 | 100 | | |

Note:
1) Sum of irrigation and drainage beneficiary areas.

### (2) Number of Personnel of Operation, Maintenance and Management Organization and Operation, Maintenance and Management Post

Table 5.4-3 shows the numbers of personnel of OM/M organization and OM/M post. For DARD and IMC, the numbers of personnel range from 20 to more than 150 persons, and for DPC, CPC and FO, from 2 to 80 persons. This shows DARD and IMC are comparatively bigger organizations than DPC, CPC and FO. On the other hand, the number of persons of OM/M post is subject to a condition of beneficial area and facility type, etc. For IMC, it is less than 60 persons, and for the others, less than 20 persons (for details, refer to Appendix ir.5.1 and ir.5.2).

**Table 5.4-3 Number of Personnel of Operation, Maintenance and Management Organization and Operation, Maintenance and Management Post**

| OM/M Organization | No. of Personnel of OM/M Organization (person per organization) | No. of Persons of OM/M Post (person per facility) 1) | Remarks |
|---|---|---|---|
| DARD | 60-148 | 1-20 | |
| DPC | 17-78 | 0-7 | No OM/M post for "Irrigation in 30/4 Area of Chua Phat" (Sea Water Utilization for Fishponds, Bac Lieu Province) |
| CPC | 7-36 | 0-17 | No OM/M post for "Dakpoko Irrigation" (Flood Control, Kon Tum Province) |
| IMC | 23-980 | 0-60 | No OM/M post for "Ninh Phuoc Irrigation" (Flood Control, Ninh Thuan Province) |
| FO | 2-47 | 1-52 2) | |
| DPC and CPC | DPC: 22, 100<br>CPC: 22, 30 | 3-5 | |
| IMC, DPC and Town PC | IMC: 257<br>DPC: 106<br>TPC: 25 | 10 | |
| IMC and FO | IMC: 150<br>FO: 9 | 18 | |

Note
1) Excluded from the table, when number of persons cannot be identified.
2) One facility (Lien Minh-Tung Chau Irrigation System, Ha Tinh Province) is operated, maintained and managed by four (4) FO. Total number of staffs in the posts of 4 FOs is 52 and it is accordingly 13 staffs per one FO.

#### 5.4.2.2 Operation, Maintenance and Management System

**(1) Source of Operation, Maintenance and Management Budget**

Collection of irrigation water fee was abolished in 2008 (Decree 115/2008/CP). After the abolition, the central government bears the OM/M cost of the facilities.

Based on the site survey in 36 provinces, seven (7) provinces reported that the subsidy from GOV did not cover all the OM/M costs. As for the remaining 29 provinces, they did not report the shortage of subsidy.

The OM/M organization prepares the expenditure plan, and after the approval of all relating PCs (Figure 5.4-1), the budget is determined. Considering this system, in general, it takes time to disburse the budget to the OM/M organizations.

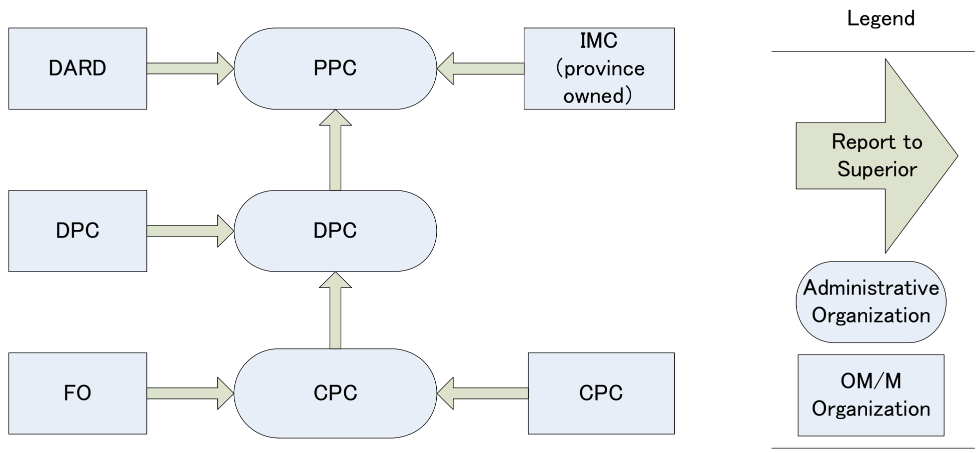



**Figure 5.4-1 People's Committees Approving Budget**

Under these conditions, two (2) IMCs make effort, as follows:

1) Developing of Irrigation Limited Liability Company of Thai Nguyen Province

70% of OM/M budget is raised from GOV, and 30% is from a hydroelectric joint stock company which is affiliated company with the OM/M organization.

2) Management and Operation of Irrigation Schemes of Tra Vinh Province

75% of the OM/M budget is raised from GOV, and remaining 25% is from the fee for consulting services which are rendered by this company.

# Chapter 6 Impact and Effectiveness of SPL Projects

## 6.1 Road Sector

### 6.1.1 Sub-Projects with Less Effectiveness

#### 6.1.1.1 Sub-Projects with Increased Traffic Accidents

The number of traffic accidents before and after improvement or new construction of the roads under SPL Projects was confirmed from the interview survey (the questionnaire / the survey form). The result from 228 replies is shown below:

| | |
|---|---|
| The total replies | 228 sub-projects |
| The number of accidents was decreased | 57 sub-projects |
| The number of accidents was not changed | 70 sub-projects |
| The number of accidents was increased | 101 sub-projects |

Around a half of the sub-projects, respondents commented that "traffic accident increased". It is considered that the reasons for this are the speed of a vehicle accelerated by i) improvement of vertical slope / horizontal section / road alignments and ii) improvement of the road surface conditions. The main problem of the increased accident is not only to threaten life, but also to reduce the effectiveness of the sub-project. Due to traffic hindrance and congestion, traffic speed and volume will decrease, thus function of the road as a whole will also be degraded.

### 6.1.2 Sub-Projects with Impact on the Regional Development Plan

There is no sub-project which gave the impact on the Regional Development Plan.

## 6.2 Electricity Distribution Sector

### 6.2.1 Sub-Projects with Less Effectiveness

Aside from the following sub-projects, there have not been any sub-projects with problems, as maintenance and management by EVN has been well implemented.

Some Less Effectiveness cases are as follows:

#### 6.2.1.1 Ly Son Island District Electric Network / Quang Ngai Province / Ly Son District / SPL II

In Ly Son Island, Quang Ngai province, the generator was broken, and the electric power has halted in the distribution MV feeder connecting to the generator, power supply cut to the islanders.

In Ly Son Island (Ly Son Island District Electric Network, Ly Son district / SPL II), the diesel generator (380 kVA) in SPL Project did not work around 5 years ago. Household inhabitant power customers have bought small diesel generators to furnish the family demand. Recently the Prime Minister, Mr. Nguyen Tan Dung, during his visit to the island, directly decided to invest one (1) small coal fired thermal power generation unit of three (3) MW responding to the social economic development of the island inhabitants. The Feasibility Study (F/S) was carried out and the project will be implemented in 2010-2011 by VINACOMIN project owner (Project reviewed by VECC in 2009).

#### 6.2.1.2 All of Sub-Projects (6) in Bac Lieu Province

All of the six (6) sub-projects in Bac Lieu province are completed and are under operation. However, PMU refused to disburse the communication costs because of the mistakes in procedure. In 2003, these sub-projects costs were disbursed by provincial budget after completion and handed over for operation.

#### 6.2.1.3 Giang Son Electric Line / SPL I, Van Tuong Commune Electric Line / SPL II, Bac Lieu Province

Two (2) out of eight (8) sub-projects of Bac Ninh province are only partially completed. Currently, a portion of the sub-projects financed by SPL fund is in service, such as small electric line, however, rest of the sub-projects are not yet completed due to lack of fund.

Due to the limited SPL fund, an additional sub-project (Trung Xa Commune Electric line / SPL II) in Bac Ninh province was completed by EVN own resources.

#### 6.2.1.4 Then Chu Phin Commune Electric Line / Ha Giang province / SPL V

Out of five (5) sub-projects in Ha Giang province, a sub-project (Then Chu Phin Commune Electric line / SPL V) was completed in 2003. Hence, it should not be listed as the SPL V (2006).

### 6.2.2 Sub-Projects with Impact on the Regional Development Plan

Together with the other ODA financial sources (national budget and EVN internal fund) the rural electrification in Vietnam has greatly achieved to reduce the poverty and enhance the social-economic development at remote areas.

Facilities constructed under SPL Project made possible sustainable economic growth in rural area in Vietnam;

- Road for transportation of products,
- Electricity and Clean Water Supply for development of economy and improvement of living standard,
- Irrigation for prevention of environmental pollution.

There were no projects with negative influences. The SPL Projects have contributed to the Vietnam society, especially the resident in poverty areas. Several communes strongly requested us to continue SPL Projects. The major examples are introduced as follows.

#### 6.2.2.1 Cung Re Commune Electric Line / Lam Dong Province / Cung Re District / SPL II

Up to 1998, the electrification rate was 0 %. Although after the project, it improved up to 100%. According to the commune, population of the area increased more than 60% after the project and also education level has improved. Moreover, many tea and coffee farms were established. The economy has grown 10 times better than before the project.

(Suzuki tea and coffee firms were found after the project completion, about 300 employees from the poverty area. This has improved living standard of the people.)

#### 6.2.2.2 Huong Phung Commune Electrification Project / Quang Tri Province / Huong Hoa District / SPL IV

**(1) Aim: Development of coffee plantation in remote frontier region of Quang Tri province**

Coffee is commercial vegetation selected by Huong Hoa district in Quang Tri province, as a main objective for the local agriculture development.

Huong Hoa is a boundary district neighboring the DPR Laos. In the near future, the border gate at Lao Bao will be the first gate of East-West corridor to Burma, the nearest gate from East Sea Coast.

The district has basalt red earth, the same one as in the Central Highland of Vietnam where "Coffee of Trung Nguyen" has been the national trading mark that is known internationally.

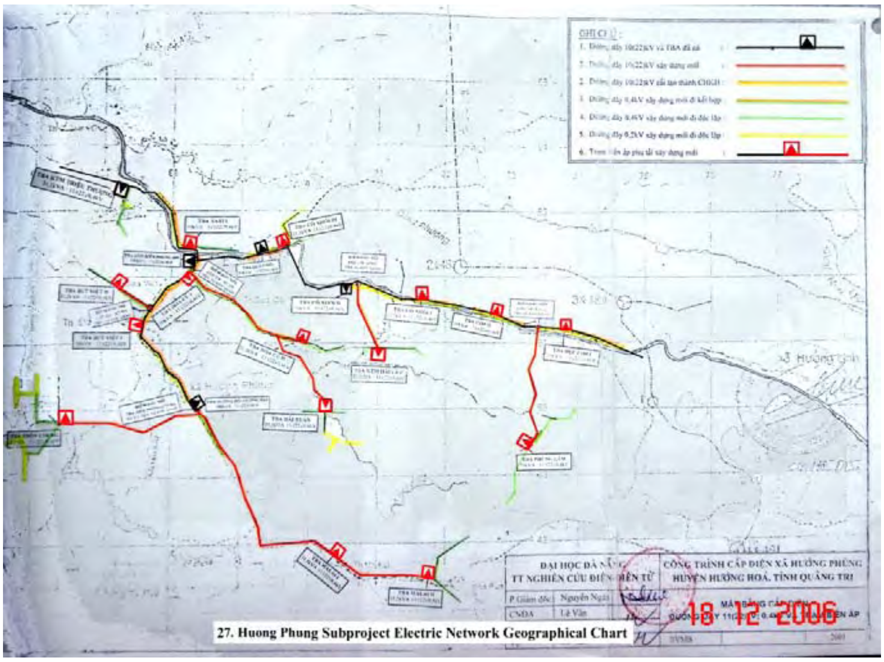



**Figure 6.2-1 Huong Phung Electric Network Project, Completed and in Operation under SPL IV**

Huong Phung commune was the underdeveloped pilot site, and was chosen for coffee plantation of the district. DPC had proposed that SPL fund should be allocated for improvement of road and electricity distribution to grow and transport coffee, and the rural road was constructed under SPL Project.

Under SPL IV, the sub-project "Huong Phung commune electrification" was selected by DPI-DOIT, submitted to PMU and approved by GOV and JBIC. The sub-project was implemented in a short time, thus it was completed ahead of the schedule, and has been operating in a good condition.

**Figure 6.2-2 Coffee Field in Doa Cu Hamlet and its Distribution Transformer, Coffee Preparation Shop Energized by SPL IV**

(Left: Coffee Field, Right: Coffee Preparation Shop)

Electric power is available, not only for the coffee fields, but also for heating-mechanical shop. Increased production of coffee kernel has been reflected as a benefit for all the coffee farms in Huong Phung commune.

**Figure 6.2-3 Electric Ventilator, Coffee Kernel Dryer - Conveyor**

### 6.2.2.3 Lap Thach Electric Network in four (4) Communes / Vinh Phuc Province / Lap Thach District / SPL IV

**(1) Aim 1: Traditional Industry Rehabilitation and Development**

As provincial development plan, the sub-project "Lap Thach Electric network in four (4) communes" was completed in 2005, and it has been operating in a good condition. This has created a remarkable change in the social economy of Hai Luu commune; one of the four (4) beneficiary communities, located at the left bank of the historic river Lo of North Vietnam.

Hai Luu has a high potential on building in stone production. In the past, the commune had produced variety of hand-made building stones for rural building, temples and churches. Nevertheless, because of the low productivity and restricted sale price, the workmen could not escape from the poverty. However, with the current development in electricity, the production has boosted and enlarged. The quality met the international standards. Hai Luu began to export its stone products worldwide.


**Figure 6.2-4 Stone Production Improved by Electricity Sub-Projects**

On the other hand, using local stone as raw materials and mechanical portable instruments as an electric drive, the art of stone carving has promptly developed in order to improve the product value. Stone carved statues are sold at high prices in and outside the country as traditional products of the Vinh Phuc province.


**Figure 6.2-5 Private Stone Company, Lion and Dolphin Statues, Art Works Completed, Lion Statues at District People's Committee's Office**

**(2) Aim 2: Non-Traditional Industries Development and Small Medium Enterprise Set up**

In the past, machine industries did not exist in Lap Thach district. After electrification under SPL IV project, non-traditional industries have developed on the Lo river bank. One example is: electro-mechanical and welding shops of private economic sector are opened to satisfy the local demand.


**Figure 6.2-6 Turning Lathe, Welding Transformers, Metal Sheet Forming, Steel Bucket Semi-Products**

Industry development of the region has stepped towards a new phase by exploiting sediment sand from Lo River. Infrastructure construction needs the sand as a basic material. In Hai Luu commune, electro-mechanical and welding shops were set up by private practices. They built up a line utilizing steel buckets in order to transport the sand from the river. The residents claim that without a proper electrical power supply, they would not have manufactured the transportation line and also the infrastructure would not have developed as the present condition.


**Figure 6.2-7 Mechanical Shop on Lo River Bank, Engineering Ferries Ready to be Handed Over to Customers**

As for the harmonious Regional Economic Development conducted by Vinh Phuc province, the mechanical industry has been firmly advancing. This sector requires a lot of SME, thus it's important to create a business linkage among the related industries. The most fundamental elements of industrial development are infrastructure and industrial linkage.

Considering the above conditions, Vinh Phuc has adequate environment. This is because there are already invested some strong industrial parks, and the necessity to develop small and medium size industries near the central industrial parks is well understood. Therefore, SME will be the first subcontractor found in the region.

SPL electricity distribution and road sub-projects have resulted in the successful industrialization growth of the province.

#### 6.2.2.4 Electric Network in Dam Thuy Commune / Cao Bang Province / Trung Khanh District / SPL III

**(1) Aim: Small-scale tourism development in Trung Khanh district of Cao Bang province**

Since 1999, Trung Khanh district of Cao Bang province, that is famous for Ban Gioc waterfall, has developed Dam Thuy commune electrification project under SPL III.

After the project completion, DPC of Trung Khanh district did not wait for a large-scale tourism project to be implemented by the central government which required time for implementation, and decided to pursue a small-scale tourist project on its own.

**Figure 6.2-8 Ban Gioc Waterfall with its Distribution Transformer (50 kVA) Installed under SPL III**

After the opening of the tourism in Ban Gioc Waterfall, the district discovered another tourist item, that is the Nguom Ngao cave of a large limestone. DPC decided to light up the beautiful sites of the inner cave with a hope to attract tourists.

In 2001, the Cao Bang tourism industry further decided to electrify four more additional tourist attractions; Pac Bo Cave of Ha Quang district and Tran Hung Dao Forest of Nguyen Binh district (historical), Cao Bang City and Ban Gioc water fall of Trung Khanh district.

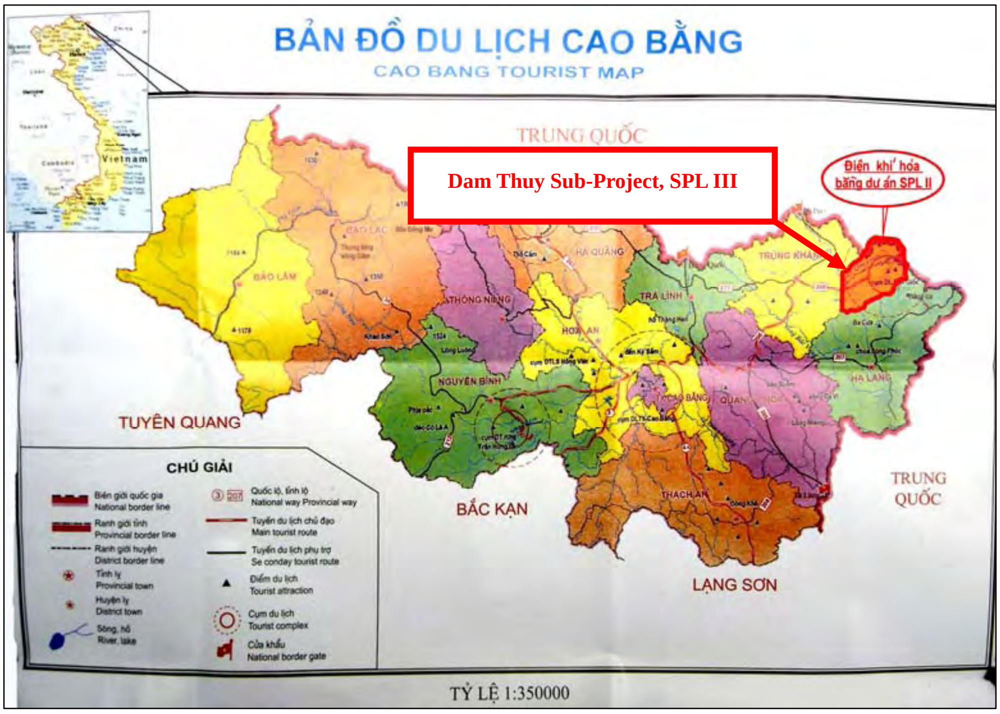



**Figure 6.2-9 Four Tourist Places Already Electrified**

### 6.2.2.5 Xuong Thinh-Tung Khe Electric Network / Phu Tho province / Cam Khe district / SPLIV

### (1) Aim: Modernized Household Work and SME Formation

Successfully in the Tung Khe commune, 100% of the household obtained an access to electricity, after a year of electrification project under SPL IV. Employment rate has increased, and income growth also doubled.


**Figure 6.2-10 Living Standard Improved by the Electricity Distribution Sub-Projects**

During agricultural off-season, farmers could also open a small wood processing industry. Mr. Nguyen Van Hoang who lives in the Tung Khe commune, first assembled a crop-trimmer for his family and then begun to sell it for the neighbors. He also built a handcart for transporting agricultural products on a rural road, very convenient for every farmer. The Electric drive is very small; that is only a tri-phased electric motor of 1.1 kW capacity.


**Figure 6.2-11 Wood Processing Small Industry**

### 6.2.2.6 Phuc Sen Electric Network / CaoBang Province / QuangUyen District /SPL IV

#### (1) Aim: Enhancement on the Village Traditional Profession

**Figure 6.2-12 Private Mechanical Shop, Pneumatic Hammer of 11 kW, Phuc Sen Blacksmith Products**

Formerly, in Phuc Sen commune of Quang Uyen district, Cao Bang province, a blacksmith industry used to be a small traditional profession. The district had a strong desire to develop this profession into a mechanical basis in order to encounter an increasing local demand on tools and farming facilities. After SPL electrification project, the profession was rediscovered with unexceptional development.

### 6.2.2.7 Xuan Tho commune – Trung Trinh + Vung La + Tu Nham Communes Electrification Networks / Phu Yen Province / Song Cau District Coast / SPL II + SPL IV

#### (1) Long-term Aim: Investment on a fishery in North Song Cau district -Phu Yen province

Promotion of fishery and water-product industries require a multi-sector infrastructure development: roads for product transportation and marketing, electricity for water treatment and freezing technology, pier for boat anchorage, boat-building and boat-repair SME, irrigation for drainage, and clean water supply for food processing.

Phu Yen province is an underdeveloped province located between two large potential provinces: Binh Thuan in the North and Khanh Hoa in the South, separated by two high mountains (Deo Cu Mong in the North and Deo Ca in the South of the Phu Yen province). These provinces already have extremely larger than that of Phu Yen province.


**Figure 6.2-13 Song Cau District Map**

During the SPL program implementation, parties concerned in Phu Yen province learnt from the guideline shown by the Consultants; Vietnamese are second to Japanese as a big fun of fish and therefore fishing is economically and socially a very important industry of the province.

Electricity distribution is the most important infrastructure for fishery. Without electricity, fishery would not be modernized and incomes of fishermen would always be unstable. Under such situation, fishermen would not be able to escape from the poverty.

Fish is a typical perishable food. Hence a proper function of freezing and storing of caught fish is very important. Otherwise, market value of fish wouldn't be maintained.

Therefore, a fishing port requires an ice plant to supply ice for fishing boats. The port should also install freezing facilities even for cold chains of cargo boats and trucks. Preferably it should also be attached to effective processing plants. The electricity is required for all.

Fish ponds or fish pens quite often need aeration.

In the beginning, Phu Yen province was in very poor underdeveloped conditions. However, after sub-projects, step by step, more fishery multi-sector infrastructures have been constructed in Song Cau district as follows:

- In 1997-1998, Xuan Tho southern neighboring commune of Dan Phuoc was electrified under SPL II.
- In 1998-1999, coastal road of Dan Phuoc commune was constructed under SPL II, and the site was electrified by extension of the invested network from Xuan Tho under local fund. Nearby the rows of coconut trees along the Dan Phuoc commune coastal road, a new hamlet appeared, namely Van Phuoc.

**Figure 6.2-14 Coastal Road and Electricity in Van Phuoc Hamlet, Fishermen's New Hamlet Van Phuoc "Ten thousand Happiness"**

Oceanic tuna fishing was initiated right after the pier constructed in Dan Phuoc commune shore. Ice is also prepared nearby. The fishermen don't prefer to wait so long for fishing-preparation. Therefore, small size boats with already-made ice are commonly used for tuna fishing.

Phu Yen province has started a new product since 2000, and has greatly contributed to the oceanic tuna yield. Together with neighboring provinces, northern Binh Dinh and southern Khanh Hoa formed a tuna product supply zone in south central coast.

**Figure 6.2-15 Van Phuoc Dock and Boats, Ice, Tuna**

After the initial achievement of oceanic tuna fishing, the province decided to develop the lobster rearing pools in Xuan Dai bay of North Song Cau district.


**Figure 6.2-16 Lobster Breeding Beach in Xuan Phuong Commune, SPL Phu My No.1 and Phu My No.2 Distribution Transformer (Power Source for Sea-Product Area), Lobster Breeding Zone in Xuan Dai Bay**

Trung Trinh - Vung La - Tu Nham electrification sub-project for two (2) west-coastal communes, Xuan Phuong and Xuan Thinh of the northern peninsula of Song Cau district, were included in SPL IV allocation project. This was completed within four (4) months, right after the GOV-JBIC agreement.

## 6.3 Water Supply Sector

### 6.3.1 Sub-Projects with Less Effectiveness

#### 6.3.1.1 Tho Xuan WSS of Thanh Hoa Province

The WSS of Tho Xuan has not been completed yet due to the shortage of budget for secondary, and tertiary distribution pipelines, and service pipelines, and electricity works. The construction works had been started in 2006 and continued up to February, 2007 then they were stopped. Because three (3) years have been already passed since the suspension of the works, the parties concerned should resume the works as soon as possible in order to prevent from construction cost increase due to the deterioration of the facilities already constructed.

In this regard, Ministry of Planning and Investment (MPI) had sent official letter on 21 July 2010 requesting Provincial Department of Peoples' Committee (DPI) to arrange local fund to complete the sub-project in 2011 and the DPI promised to arrange it to complete the sub-project by then.

The machinery and devices purchased such as pumps, chlorinators, etc. had been being kept in storage in order to prevent them from deterioration.

By the way, the population in the sub-project area uses the shallow groundwater and it does not seem to have any difficulty for water and it is said that most of population does not want to pay for the cost to connect with the projected WSS. It is consequently necessary to review the plan and design from the viewpoint of water demand.

#### 6.3.1.2 WSSs without Execution of the Disinfection

**Vu Quang WSS of Ha Tinh Province**
**Ngan Dua WSS of Bac Lieu Province**
**Yen Han WSS, Bac Kan Province**
**Chu Pah WSS, Gia Lai Province**
**Sao Do WSS, Hai Duong Province**

Captioned five (5) WSSs do not practice the chlorination, saying that the population in the service area does not use disinfected water due to smell and taste caused by disinfectant, i.e. chlorine, or the quality of source groundwater is quite good. However, since one of the important objectives of water supply project is safe drinking water supply, it should be said that to supply population with water which has high risk of infectious diseases due to the lack of disinfection makes the water supply project less effective.

#### 6.3.1.3 WSSs of which Rate of Facility Utilization is Low

Considering above, the survey team assumes the water supply planning taking into consideration the sound management of WSSs like following:

The rate of facility utilization: "average daily water supply"/"capacity of WSS" should be 53% at the first year in operation and it immediately increases by 3% annually during the project period, which is assumed 15 years. The operation rate will be 65% at fifth year and 80% at tenth year.

If the survey team verified the performance of WSSs surveyed shown in Appendix ws.6.1 based on the above mentioned assumption, 59 WSSs out of 76 WSSs in operation are judged to be less effective. Though the rate of facility utilization is not only the indicator on the effectiveness of the WSS, the survey team believes that the Water Supply System shall supply the population in the target service area with drinking water as much as possible by all means.

### 6.3.2 Sub-Projects with Impact on Regional Development Plan

There is no sub-project which gave the impact on the Regional Development Plan. The responsible person of a DPI said that even if there was an impact from the implementation of sub-project, such impact had been considered during the preparation stage of the sub-project.

## 6.4 Irrigation Sector

### 6.4.1 Sub-Projects with Less Effectiveness

Considering this survey is one for grasping the current conditions of infrastructure, effects of sub-project was grasped based on the farm area, which was cultivated with irrigation water from facility constructed or rehabilitated under SPL, instead of the increase of production volume of crops and annual farm income, etc. which were primarily used to grasp the said effects.

It is assumed that "the ratio of irrigated cultivation area to irrigation beneficiary area" indicates the level of achievement of sub-project benefit which farm households receive. Based on this idea, it is considered that the ratio can be the substitution of the indicator to evaluate the effectiveness of sub-project. On the other hand, this ratio is applied as the indicator to evaluate the utilization of facilities (Chapter 4.4.2.2), and the following five (5) sub-projects indicate the ratios less than 100%. Therefore, these sub-projects are regarded as those with less effective. The conditions of these facilities are described in the Chapter 4.4.2.2.

(1) Ea Yeng Reservoir , Dak Lak Province

(2) An Hung Dam, Ha Tinh Province

(3) Khe Coi Dam, Ha Tinh Province

(4) Song Rac Irrigation, Ha Tinh Province

(5) Quang Xuong Irrigation, Thanh Hoa Province

### 6.4.2 Sub-Projects with Impact on the Regional Development Plan

There are no sub-projects with impact on the regional development plan. On the other hand, there are other effects of the sub-projects as described below.

Based on the interview survey from farmers, etc., it was confirmed that the number of cropping times and the yield of rice had been increased as the effects of irrigation which were derived from the facilities constructed or rehabilitated under the SPL Projects, as follows:

**Table 6.4-1 Effect on Production Increase of Rice of SPL Facilities**

| Effect on Production Increase of Rice | Facility Name |
|---|---|
| Increase from Single to Double Cropping | Dak Nong Province, Electric Pumping Station in Choah Village<br>Lam Dong Province, Bo Kabang Irrigation<br>Lam Dong Province, Da-Don Dam<br>Ninh Binh Province, Dong Dinh Pump Station<br>Ninh Thuan Province, Bau Ngu Reservoir<br>Thua-Thien-Hue Province, Dien Hoa-Dien Hai Irrigation System |
| Increase from Double to Triple Cropping | Vinh Long province, Rach Tra-Thien My Irrigation Canal |

# Chapter 7 Subjects to be Discussed

## 7.1 Road Sector

### 7.1.1 Operation

There is no particular comment on the operation of road sector.

### 7.1.2 Maintenance

#### 7.1.2.1 Unevenness in the Inspection / Judgment on Damage

Having current conditions of the facilities is important for the operation, maintenance and management (OM/M of them). The OM/M organizations do not necessarily execute the task of OM/M based on quantitative criteria and they actually did maintenance works when the necessity arose. The frequency of inspection and / or patrol depends on each OM/M organization.

OM/M organizations seemed to make effort to conduct the maintenance of roads with insufficient staffs. However, looking at the OM/M of all the facilities constructed under the SPL Projects, considering all the facilities constructed under SPL project as a whole, the following points were found to be studied.

- Frequency of inspection and / or patrol tends to varied among the OM/M organizations.
- Methods of maintenance and repair were different among the OM/M organizations.
- Neither standardized manual nor guideline on the inspection and patrol, and maintenance and repair

#### 7.1.2.2 Traffic Volume of Facilities

The rate of reply on the traffic volume to the interview survey using questionnaire and the survey form was around 60%. Some of the replies mentioned a big traffic volume, however, the result of the site survey did not show such volume. This fact implies following weakness.

- There is no standardized manual and /or guideline on the periodical traffic survey
- The accuracy of the answered data on traffic volume varies among the organizations.

Survey data on the traffic volume is important indicator on maintenance and repair. The periodical survey of traffic volume gives PPC and DOT the following benefits;

- The data can be utilized for any kind of road improvement projects including further SPL Projects.
- The data on the traffic volume can be utilized to make more realistic plan for the maintenance and management of the facilities.

#### 7.1.2.3 Concerning the Overload

It was confirmed that there were a lot of OM/M organizations worried about the damages of road caused by overloaded trucks. The large pothole and rutting were supposed to be caused by the overloaded vehicle as reported in Chapter 4.1.3.3. It was surely overloads that caused such damages provided that the roads (especially sub-grade and embankment) were properly constructed as reported by the OM/M organizations.

#### 7.1.2.4 Sub-projects with Progressed Damages

As explained in Chapter 4.1.3.3, the roads in rank C and D needed to be urgently repaired by PPC, DOT and / or DPC, based on the reports prepared by the OM/M organizations.

### 7.1.3 Management

#### 7.1.3.1 Significance of the Road

Concerning SPL Projects, it seemed that the significance of roads was not considered as a management factor. All the roads constructed under SPL Projects are equally important for local people. However, for instance, the district road which links communes in the mountainous area has a function as the community road, and such nature of road is different from the significance of road shown below:

- The evacuation route at the time of disaster
- Transportation route for goods during emergency
- The road with an important lifeline (underground facilities such as electricity, water supply, etc.)
- The road connected with a railway station, and /or sea ports being terminals of river
- The road with high traffic volume or with a possibility on an increase

Consequently, the road has an administrative meaning to conduct an important role at the time of emergency or disaster. No distinction was made presently between community roads and the roads mentioned above.

#### 7.1.3.2 Conditions on Grasping Road Facilities by Operation, Maintenance and Management Organizations

OM/M organizations were not necessarily aware of the current conditions of the road facilities. It seemed that the persons in charge of road facilities such as bridge, culvert, pavement, etc. exclusively grasped their conditions. Therefore, there was the risk that grasping the conditions of the facilities would be insufficient when the persons in charge would be transferred.

### 7.1.4 Organization

Any problem was not observed concerning the system of the organization.

### 7.1.5 Sub-Project Implementation

#### 7.1.5.1 Roads which Have the Problem of Continuity

It had been reported that access roads (e.g. the existing province / district roads) to the starting points or ending points of roads constructed under SPL Projects were not maintained well and it was difficult for vehicles to run smoothly and took time to reach the newly constructed roads. So it is time-consuming to access the constructed section under SPL.

Moreover, as explained in Chapter 4.1.3.2, there was the care that the delay of construction of a bridge under Vietnamese fund made difficult for vehicles to access the road constructed under the SPL. It was the problem of continuity. It is preferable to construct a road and a bridge simultaneously, however, the delay of construction work due to the failure to prepare the budget which was initially secured was reported. To minimize the influence of such a problem in the future, PPC and DOT should prepare the proper development plan including prioritization of road construction and improvement projects and financial plan for the rural road system.

#### 7.1.5.2 Sub-Projects with Increased Traffic Accidents

As explained in Chapter 6.1.1.1, nearly half of the replies to the questionnaire reported that “traffic accidents had increased”. The PO is required to give the design consultants the instruction to consider the safety instruments such as guardrails, markers, warning signs, etc. in the detailed design and the consultants employed by MPI for the SPL Project implementation (hereinafter referred to as “the Consultant”) should control these items to be installed in the road facilities.

#### 7.1.5.3 Sub-Projects in the Area with Natural Disaster

As explained in Chapter 4.1.3.1, the areas listed in table 4.1-13 have high risk on the occurrence of natural disasters, therefore, it is necessary to strengthen the patrol especially during rain. When designing a project, it is necessary for PO to recommend the design consultant to consider the change of the routes and / or slope protection in order to secure the road especially in the chronic disaster areas. The Consultants must assist the POs on such recommendations regarding the matter.

#### 7.1.5.4 Sub-projects with Bottlenecks

As explained in Chapter 4.1.3.2, the roads with the SPL Projects with bottlenecks have the possibility to cause frequent congestions in the near future if the traffic continues to increase. It is recommended to set the criteria on the selection of the sub-projects favorable for the scheme to improve the places where the bottleneck exists in consideration for the PO who will prepare the sub-project with such scheme.

### 7.1.6 Others

The sub-project of “Province Road 675” in Gia Lai province had initially planned to implement. However, it was relocated by the sub-project of “Inter-commune Road of Eastern of Ben Mong Bridge” due to the implementation of private sector hydropower project in neighboring area. Since the sub-project of “Province Road 675” still remains in the sub-project list of MPI, it should be confirmed about said sub-project with MPI.

## 7.2 Electricity Distribution Sector

### 7.2.1 Operation

Operation is implemented by EVN, except the rare cases of communes as mentioned in Chapter 5.2.1.1. There have not been any operational problems under EVN. In a rare case, there are a few communes running on their own, however, this will be transferred to EVN in the near future.

### 7.2.2 Maintenance

Followings are the notable problems on SPL Projects;

- The rust on the surface of distribution transformer was observed
- Equipments were destroyed by lightning
- Distribution line was destroyed by such disaster like a typhoon.

The maintenance on all the projects was already transferred to EVN. Therefore, the above mentioned problems can be easily solved.

Accordingly, there are no problems on the periodical maintenance conducted by EVN.

However, there are the following problems.

- Voltage-drop can largely occur at the end of distribution line in SPL Project areas.
- Power-cut due to its weak power generation and the priority for recovery is low in SPL Project areas

EVN should consider solving the above problems (One solution is to install a renewable power resource such as solar at the end of distribution line).

### 7.2.3 Management

The management for all of sub-projects has been already transferred to EVN. Therefore, there have not been any problems on the management.

EVN also manages the database of distribution network including SPL Projects and its maintenance.

### 7.2.4 Organization

The organization for SPL project is explained in Chapter 5. Operation, maintenance and management are mainly conducted by EVN, thus there have not been any problems.

The organizations under EVN in charge of operation, maintenance, management are shown in Figure 7.2-1. District Electricity (DE) is responsible for operation, maintenance, management of sub-projects.

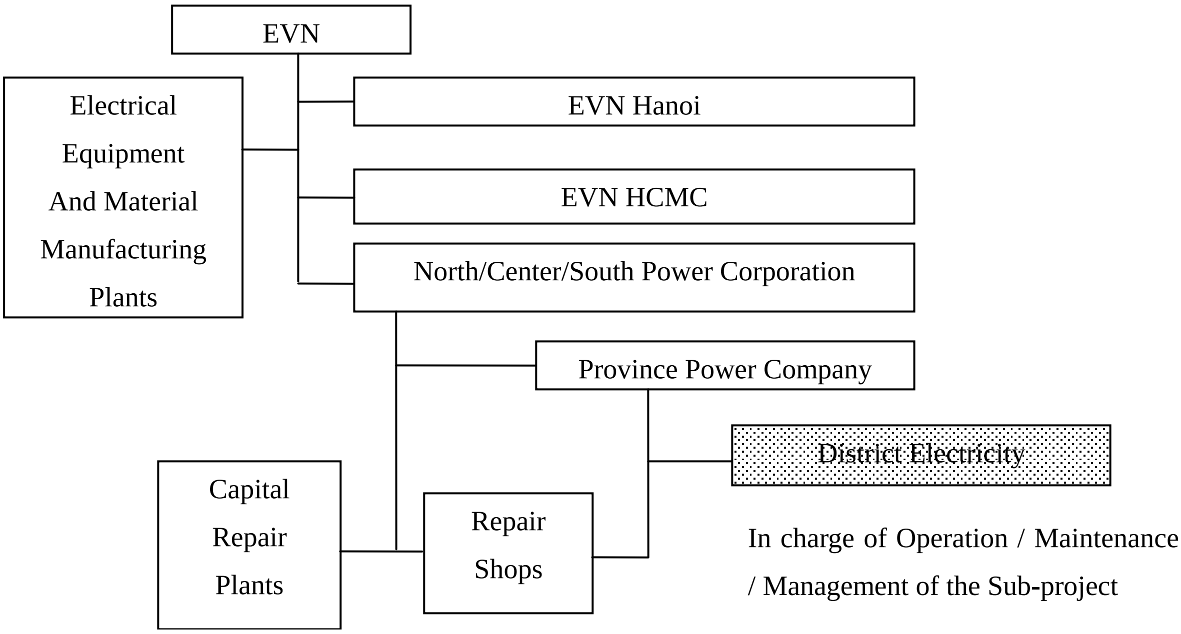



**Figure 7.2-1 Overview of EVN Organization for Operation, Maintenance and Management**

### 7.2.5 Sub-Project Implementation

Even though all of the sub-projects are operating sustainably, there are a few sub-projects with procedural problems.

- One (Binh Duong Commune Electric line / SPL II) out of 11 sub-projects in Quang Nam province has been implemented, but electricity distribution is not yet done.

SPL allocation for this sub-project has been disbursed for power supply mainly to the district hospitals. The sub-project implementation has to be executed simultaneously with the district hospital project. However, the hospital project has not yet been completed. Immediately after the completion of hospital construction, distribution line should be installed.

- SPL disbursement document for one (Phu Cuong Commune Electric line / SPLII) out of nine (9) sub-projects in Quang Ngai province was not be confirmed.

DPI reaffirmed the reception of SPL allocation for this electricity sub-project, but new leader of Phu Cuong commune in Duc Pho district did not know about these official documents of disbursement and hadn’t kept them.

## 7.3 Water Supply Sector

### 7.3.1 Operation

#### 7.3.1.1 Water Quantity Control

As mentioned in Chapter 5, a number of WSSs do not install the flow meter for raw water, the size of flow meter is not appropriate under the low water demand operation and the installation of such flow meter may give considerable error to the value measured.

Having intake flow rate is necessary to determine the coagulant dose in order to appropriately operate the chemical coagulation, flocculation and sedimentation process which is adopted most of the WSS.

It is also important to improve the situation to measure the flow rate of distribution in order to reduce the leakage from the distribution pipelines.

Though, it is possible to guess the flow rate from the pump operation, it necessitates knowing the accurate flow rate by using e.g. potable ultrasonic or electromagnetic flow meter because the pump discharge is variable according to the operating conditions, aging, etc.

#### 7.3.1.2 Water Quality Control

The survey team observed several weak points regarding the water quality control:

- The jar testing for the determination of coagulant dose was not executed in a number of WSSs though some of WSSs had the assistance from their headquarters such as Provincial Water Supply Company (PWSC). The dose of coagulant and how to solve it into raw water thoroughly is the most important for the chemical coagulation and sedimentation.
- It did not seem to measure the turbidity at the outlet of the sedimentation basin. How to improve the turbidity in the sedimentation process will affect the low cost operation such as backwashing frequency, etc. of the filter which follows the sedimentation.
- Frequency of residual chlorine monitoring was not necessarily sufficient. Safe drinking water supply is one of the important objectives of the water supply, therefore, disinfection of treated water and keeping the residual chlorine concentration within the designated range by National Technical Regulation on Drinking Water Quality (QCVN 01) is essential. In spite of the description on the residual chlorine surveillance frequency, which is at least one time per week, it is recommended to measure every day the residual chlorine at the end of each distribution area.
- A few WSSs did not analyze both raw and treated water. Several WSSs depended on the Provincial Preventive Health Center under Ministry of Health (PPHC) who carried out the duty as the control agency of water supply and did not execute water analysis by themselves. Carrying out the water quality control by the operation, maintenance and management

(OM/M) organization itself is necessary in order to ensure the safe water supply and to operate the WSS appropriately. There are OM/M organizations of which headquarter executes all the water analysis. However, it is preferable for the staff of OM/M organization to analyze turbidity, residual chlorine and color, and to execute jar test in case of WSSs with Water Treatment Plant (WTP).

It seems to be difficult to improve the conditions on the water quality control due to scarce well-equipped laboratories and human resources in the rural area, however, taking actions is necessary.

### 7.3.2 Maintenance

#### 7.3.2.1 Daily Maintenance

The survey team observed that most of the WSSs carried out the daily maintenance appropriately, however, it was preferable that the good daily maintenance was ensured by the record of breakdown frequency. However, it was questioned that the OM/M organization with only three (3) staffs of the WWSs which have the facilities of chemical coagulo-sedimentation and filtration executes good daily maintenance because the operation, maintenance and management of such facilities necessitated more attentions than others.

#### 7.3.2.2 Breakdown Maintenance

It seemed that the methodology of breakdown maintenance had been established. If the parties concerned evaluate the system by the data such as mean time of failure, they will improve the methodology.

#### 7.3.2.3 Preventive Maintenance

A number of WSSs did not introduce the preventive maintenance yet. However, it is effective to reduce the maintenance cost and to prepare the monthly and annual maintenance plans. Preventive maintenance should accompany with the diagnosis of the facilities, installations, equipment, etc.

### 7.3.3 Management

#### 7.3.3.1 Water Supply Coverage and Rate of Facility Utilization

As mentioned in Chapter 5.3.1.2 and 6.3.1.3, the current water supply coverage and the rate of facility utilization are not sufficient for a great number of WSSs. It means that revenue of OM/M organization might be insufficient for the OM/M of the WSS.

Considering the fact that the OM/M organization cannot implement any improvement schemes of the WSS without sufficient revenue, increasing the water supply coverage and the rate of facility utilization are essential for the long lasting autonomous OM/M of the WSS.

### 7.3.4 Organization

#### 7.3.4.1 Assignment of Staff

The structure of OM/M organization is in general explained by the name of the positions such as director, vice director, technician. Of course, it is assumed that there is a job description for each position, section, etc.

However, the survey team could not recognize the responsible persons for technical administration, water analysis, etc. The survey team proposes the assignment of a technical administrator and a water quality manager who are important for the OM/M of the WSS. Followings are the tentative job description of the technical administrator and the water quality manager.

**Technical Administrator**

- Keeping all the technical data and information such as completion drawings, and other drawings, register of facilities, installations, equipment, devices, etc.,
- Preparation of operation records and keeping and analysis of them, especially time series analysis
- Letting staffs do above-mentioned tasks having in part the on-the-job training
- Understanding the water analysis results and keeping them and analyzing them in time series

**Water Quality Manager**

- Sampling and water analysis
- Control of devices for water analysis
- Procurement of the devices, reagents and other consumables
- Training of other staffs on the water analysis
- Raising the awareness of all the staff on the significance of water quality
- Consumers relation in terms of the quality of water supplied

#### 7.3.4.2 Water Supply Systems Managed by District Organization

A lot of WSSs are the branch of PWSC and they can receive the various supports from their headquarters. In contrast, the OM/M organizations under the district do not have the organization for having the sufficient technical assistance and they seem to be weak in terms of finance. Because, around 70% of District Water Supply Undertaking (DWSU) received the subsidy from DPC, etc. while the rate of Branch of Provincial Water Supply Company (WSB) is 15%.

On the other hand, the Ministry of Construction has the policy to put the DWSU in the PWSC probably due to less capability of OM/M.

Considering above, it seems necessary to discuss how to support the DWSUs.

### 7.3.5 Sub-Project Implementation

#### 7.3.5.1 Certain Involving the OM/M Organization in the Sub-Project Implementation

The prospective OM/M organization should be involved by all means in the implementation of the sub-project for smooth transfer not only the facility but also the planning of the WSS and information, data such as raw water quality, concept of service area and its socio-economic conditions, scope of the project: the facilities, installations, equipment included and excluded.

There are a number of sub-projects of which Project Owner (PO) is the PWSC and the WSS constructed under the sub-project will be transferred to the PWSC.

It is preferable to give the priority to the sub-projects under such conditions at the selection stage of the sub-projects to be implemented.

#### 7.3.5.2 Campaign on Raising Awareness of Public Hygiene Related to Water Supply

As mentioned in Chapter 5.3.1.3, the water supply coverage of around half of the WSSs under the SPLs is less than 50%. The main reasons of low coverage are the existence of alternative water sources such as a dug well, a rain water tank, etc for the population in the service area and the insufficient distribution pipelines for the prospective consumers.

The existence of alternative water sources for the population hinders piped water supply development in a number of countries. Since the water from the tap is in principle charged and have strange smell by disinfectant which is in general chlorine, the population who firstly experiences the piped water supply sometimes refuses to use the water from the tap.

Having the acceptance of population of piped water supply depends on the activities to raise the awareness of the population with respect to public hygiene.

Considering above, conducting the campaign on raising awareness of public hygiene related to water supply in the implementation stage should be considered. If the OM/M organization is involved in the implementation of sub-projects, it should be the leader of such campaign.

## 7.4 Irrigation Sector

### 7.4.1 Operation

In the site survey, with the rate of one (1) facility or more per 10 facilities, it was observed stones were placed in canals to take water into own paddy fields, and holes were dug in canal walls to take water at convenient time ignoring irrigation rotation. In addition, it was observed canals were deteriorated due to disposed garbage in canals (such as Quang Xuong Irrigation, Thanh Hoa province). It was considered the number of canals with these conditions would increase from the viewpoint of the entire canal observation, because only a few parts of the canals were observed in the site survey.

It was found that problem was lack of recognition of current conditions and issues on insufficient sharing of information among farm households, difficulty of transmission of water distribution schedule from a facility manager to farm households, and holes in canal walls and disposal of garbage into canals, etc.

### 7.4.2 Maintenance

The GOV developed irrigation projects in the past, and these facilities are forming enormous assets (DPMU, Binh Dinh province). It is mentioned in the MOF DECISION (No: 32/2008/QD-BTC) that these assets should be managed strictly and the effectiveness in utilization[22] of the assets should be improved. In order to follow this, POs (DPC, DARD, IMC, PPC, etc.) prepared assets list, and the OM/M organizations (IMC, FO, DPC, CPC, etc.) calculated the depreciation. These organizations are requested to manage the facilities constructed under the SPL Projects year by year.

Under these conditions, based on the site survey, it was found that problems were requiring long time to draw out information/data of the sub-projects in some cases, and lost and hoarded storing away of information/data[23], since POs and OM/M organizations preserve SPL information/data with paper medium in many cases although they use computers.

### 7.4.3 Management

In the site survey, there were reports expressing that monitoring and evaluation of FO is necessary (Quang Ngai DPI, July 5, 2010), and strengthening of monitoring and evaluation is required through authorizing POs (Thua-Thien-Hue DPI, July 9, 2010).

On the other hand, in the SPL III, IV and V, the Consultants conducted monitoring and evaluation on the effects, implementation and OM/M of the sub-projects using survey sheets. Regarding this monitoring and evaluation, various problems were pointed out, such as difficulty in data collection, clarification of implementing body of monitoring, update of data, etc. (The Report on SAPROF for SPL 6, August 2008).

It is considered that the monitoring and evaluation system is under arrangements at present. The monitoring and evaluation is desired to be implemented periodically, however, the current system is not suitable for periodic monitoring and evaluation, etc.

### 7.4.4 Organization

Within the sphere of site survey, thick weed and trees were not observed in the facilities operated, maintained and managed by the DARD, the DPC and the IMC, although some farmers dug holes in canal walls. In addition, it was considered that they kept data in good condition in general, because they could provide the survey team with necessary data in a relatively short time in many cases.

[22] In the first page of DECISION, it is mentioned as “in order to manage strictly and improve the effectiveness in using assets of the state agencies, non-profit public and organizations using the state budget.”
[23] Lost and hoarded storing are mostly observed in the information/data regarding figure and drawing.

Therefore, it seemed that there were no serious problems in their OM/M.

On the other hand, through the site survey, there were reports expressing that a technical guidance was necessary (from the CPC, the OM/M organization of Khe Ngang Reservoir, Nghe An province), and a technical training was necessary (from the FO, the OM/M organization of Buon Chao Dam, Phu Yen province). In addition, through the facility survey, the following cases were observed in the facilities of the CPC and the FO:

- It was considered the inspection of a dam would be difficult since weed and trees were growing thickly on the downstream of the dam body (Nam Kar Dam, Dak Lak province), and so on.
- It was considered that the inspection, operation and repair of canals would be difficult since weed and trees were covering thickly on the canals (Nam Chay Irrigation, Lao Cai province), and so on.

Since above cases were observed and providing necessary data from the CPC and the FO took long time in many cases, it was considered that there was necessity of technical capacity development for the CPC and the FO (there were nine (9) facilities whose OM/M organization was the CPC, and 15 facilities of the FO).

### 7.4.5 Sub-project Implementation

#### 7.4.5.1 Planning and Design

In the site survey, there were reports expressing that farmers' intension was to be reflected in the planning and design (Quang Ngai DPI, July 5, 2010), and the DPC and the CPC were desirable to participate in the planning and design (Nghe An DPI, July 22, 2010). In addition, it was also reported that canal alignment was re-designed because it was not fitted to site topography (Trieu Duong Reservoir, Nghe An province).

In the past SPL Project, the District Development Boards (DDBs) were established in the pilot provinces and districts (five (5) provinces and 22 districts), as shown in Table 7.4-1 (15 irrigation sub-projects were in 10 districts of five (5) provinces.). The objectives of the DDBs are to reflect residents' intension properly in sub-projects implementation, and to raise residents' ownership of sub-projects to ensure the effectiveness and sustainability of sub-projects effectiveness. The DDB comprises representatives of communes and public organizations (a women's association, a youth association, etc.). The DDB participates in sub-project preparation, planning, implementation, monitoring and evaluation, and facility OM/M, etc. (Executive Committee Appraisal Report (SPL V), JICA, 2006).

**Table 7.4-1 Pilot Provinces and Districts**

| Province | DDB Established District (I and II) | Additional DDB Established District (II) | No. of Districts | No. of Irrigation Sub-projects |
|---|---|---|---|---|
| Ha Tinh | Cam Xuyen, Can Loc | Huong Son, Huong Khe, Thach Ha, Ky Anh, Hong Linh | 7 (5) | 6 |
| Hoa Binh | - | Da Bac, Yen Thuy, Tan Lac | 3 (1) | 1 |
| Ninh Thuan | - | Bac Ai, Ninh Phuoc, Ninh Son, Ninh Hai | 4 (1) | 3 |
| Phu Tho | Tam Nong, Song Thao | Thanh Son, Cam Khe, Yen Lap | 5 (2) | 3 |
| Phu Yen | Song Hinh, Phu Hoa | Son Hoa | 3 (1) | 2 |
| 5 (5) Provinces | 6 (4) Districts | 16 (6) Districts | 22 (10) Districts | 15 |

Note: Provinces and districts with underline have irrigation sub-projects, and their numbers are indicated in parentheses.

It is considered that the participation in planning and design, etc. was not executed for 69 facilities located in the areas other than the pilot areas, because Quang Ngai and Nghe An provinces who reported the necessity of the participation in planning and design, etc. are not included in the pilot areas.

As mentioned in the Chapter 4.4.2.2, among 84 facilities, there were two (2) facilities which have problem regarding earth ling canals (constructed by the GOV budget). The problem was that the irrigated cultivation area became less than the irrigation beneficiary area due to water leakage, etc. from earth lining canals. As shown below, there are two types of problem from the viewpoint of location of the canals constructed under the sub-projects and earth lining canals. They present questions in the validity of sub-project planning.

**Table 7.4-2 Problems Regarding Earth Lining Canal**

| Facilities with Problems | Problems |
|---|---|
| Ea Yeng Reservoir, Dak Lak province | This is small scale irrigation sub-project with the beneficiary area of 50 ha and JBIC fund of 3.0 BVND. The concrete block canal constructed under the sub-project locates in the upstream are, and the earth lining canal locates in the downstream area. The irrigated cultivation area becomes less than irrigation beneficial area due to water leakage, etc. from the earth lining canal in the downstream area(refer to 4.4.2.2 (1)). |
| Song Rac Irrigation, Ha Tinh province | This is large scale irrigation sub-project with the beneficiary area of 8,190 ha and JBIC fund of 7.0 BVND. The earth lining canal locates in the upstream area (about 20 km length of the main and secondary canals), and the brick, stone and concrete block canals constructed under the sub-project locates in the downstream area. The irrigated cultivation area becomes less than irrigation beneficial area due to water leakage, etc. from the earth lining canal in the upstream area (refer to 4.4.2.2 (4)). |

### 7.4.5.2 Facility Construction

In the site survey, gully erosions were observed in a few facilities, and these gullies were to be repaired by maintenance works (Cho Moi Irrigation System, Bac Kan province, etc.). In addition, as mentioned in the Chapter 4.4.3.3, at the following two (2) facilities among 84 facilities, canals, etc. were deformed greatly due to the low construction quality. The problem was found in the construction quality management.

**Table 7.4-3 Problems Regarding Facility Construction**

| Facilities with Problems | Condition |
| --- | --- |
| Khe Coi Dam, Ha Tinh province | For details, refer to 4.4.2.2 (3) |
| Quang Xuong Irrigation, Thanh Hoa province | For details, refer to 4.4.2.2 (5) |

# Chapter 8 Sustainability of SPL Projects

## 8.1 Road Sector

### 8.1.1 Project Planning and Design

#### 8.1.1.1 Selection of Road Sub-Projects that Continuity of Road can be Secured

As mentioned in Chapter 4.1.3.2 and 7.1.5.1, continuity of road should be secured. It is necessary to include the evaluation item on “the continuity of projected road should be secured” in the criteria to select to select sub-projects in the future SPL Projects.

#### 8.1.1.2 Bottleneck Improvement

Bottleneck sections were confirmed during the site survey. Currently, traffic congestions were not observed at the bottleneck sections. However if the traffic volume continues to increase in the near future, the bottleneck may affect the effects of the road sub-project.

Most of the bottleneck sections were previously constructed bridges in the past. Reconstruction of the bridges necessitates big amount of capital investment compared with that of a road. Therefore it is quite difficult to implement the construction of a road and a bridge at the same time. It is also difficult to execute the planned reconstruction of those bridges in the rural areas. The SPL fund is limited hence some of the bridges were not improved nor reconstructed in conformity with the construction of respective connected roads. It is consequently necessary to prepare the sub-projects, which do not exclude the related bridge based on the estimated future traffic volume. It is recommended to set the criteria on the selection of the sub-projects favorable for the scheme to improve the places where the bottleneck exists in consideration for the PO who will prepare the sub-project with such scheme.

### 8.1.2 Facility Construction

#### 8.1.2.1 Construction of Gravel Road

Number of sub-projects applied gravel pavement to the road was 20, but most of them were confirmed in bad conditions during the site survey. The following reasons are considered; i) Surface gravels are washed out and overflowed water runs over the road surface when the drainage system is not functioning properly. ii) Ruts and potholes are made when water is collected in uneven places and iii) Once a small damage occurs, it can be easily extended by passages of vehicles and even motorbikes. Therefore, when applying the gravel pavement, it is necessary to carefully design and construct a drainage system considering detail site condition and to take into consideration the maintenance of the gravel road.

### 8.1.3 Administrative System of the Constructed Facilities

There was no problem on the administrative system of the constructed facilities.

### 8.1.4 Asset Management System

#### 8.1.4.1 Prioritization of Roads

As explained in Chapter 7.1.3.1, following are the types of road with significance.

- The evacuation route at the time of disaster
- Transportation route for goods during emergency
- The road with an important lifeline (underground facilities such as electricity, water supply, etc.)
- The road connected with a railway station, and /or sea ports being terminals of river
- The road with high traffic volume or with a possibility on an increase

It is important to manage and maintain regularly the roads which may play important roles at times of emergency and catastrophes. If there are a number of roads with considerable damages, the roads with significance should be selected for the maintenance and repair under the budget constraint.

#### 8.1.4.2 Necessity of the Inspection Manual

The objectives of the inspection are i) to grasp the current condition of the road for better management, ii) to discover earlier damages on the roads to prevent negative influence on the safety and the usability, iii) to take appropriate measures to secure safety and smooth traffic, and in addition to these, iv) to carry out the continuous and effective inspection and systematic maintenance and reinforcement of the facilities by storing basic information which enable the effective maintenance.

The evaluation based on quantitative indicators will contribute the maintenance of the whole facilities. The current inspection and evaluation methods depend on an individual for the results of them and it brings the variations from the viewpoint of the SPL Projects. Therefore the inspection manual should be prepared for at least following items:

- Frequency and degree of the inspection
- Inspection items (pavement, slope stability, structures, etc.)
- Type of damage and method to judge it
- Methods of maintenance, repair and rehabilitation

#### 8.1.4.3 Execution of the Traffic Survey and Preparation of the Traffic Survey Manual

As explained in Chapter 7.1.2.2, a traffic volume survey should be carried out regularly according to the rule shown below set by a competent organization

- At least once a year ( it is preferable to conduct twice a year; farming season and off season)
- Type of vehicles should be recorded
- The traffic volume should be recovered by pcu in accordance with TCVN4054.

It is also necessary to prepare the manual and guide for carrying out the traffic volume survey.

#### 8.1.4.4 Road Protection against Overloaded Trucks

As mentioned in Chapter 7.1.2.3, the damage of road caused by overloaded trucks is very serious. It is generally considered that the damage of road surface will increase in proportion to approximately four (4) times of the axel load when it exceeds the design load on the road and the overload accelerates the damage of the road. In other words, when the weight of the vehicle becomes double, the load to the road becomes eight (8) times. Therefore, it is necessary to check overloaded vehicles, and to install devices which restrict them. Following countermeasures against the overloaded trucks are proposed:

- To punish the overloaded vehicle drivers severely under cooperation with other related authorities
- To install car stops to restrict the height and width of vehicles at the starting and ending points in order to compel the oversized vehicles to pass the roads.
- To install toll gates to collect maintenance fee.

#### 8.1.4.5 Straight Line Diagram

Straight line diagram is the effective tool for preparing road inventory to manage the roads. It is possible to manage all installations in the road by indicating the kilometer post, and this is quite useful to understand the progress of the sub-project. It also enables to show the quantities of installations which are the basic information of financial asset. Following are the example on the items to be recorded and the Straight Line Diagram

- Positions of origin-destination and location of installations
- Type of pavement and type of structure
- To record the construction year and the repair year by every sections
- To put colors in completed maintenance sections and the structures, and to record their dates.

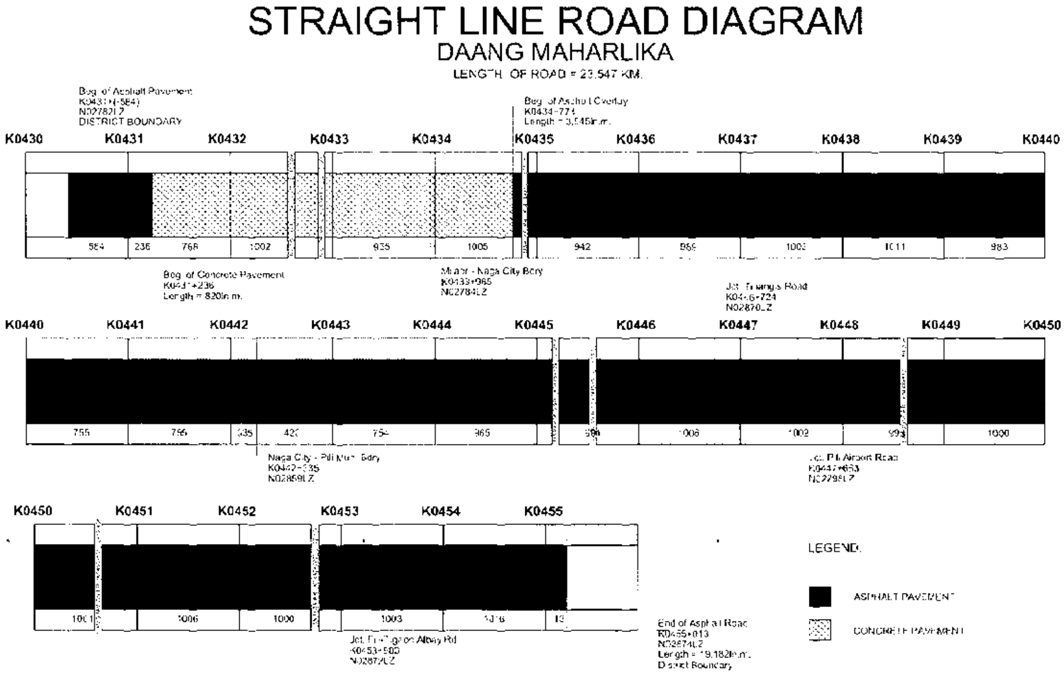


**Figure 8.1-1 Sample of Straight Line Diagram**

## 8.2 Electricity Distribution Sector

### 8.2.1 Project Planning and Design

Distribution facilities are constructed mainly in outdoor and thus they are confronting with the severe natural conditions; such as typhoons, strong wind, lightning and so on. Up to now, equipments for all the projects were planned, designed and constructed according to the Technical Regulations for Rural Electrification. Therefore, they could stably provide the electricity service to people in rural areas. This has improved life standard of the habitants and helped further development of the industries.

### 8.2.2 Facilities Construction

According to the results of the site survey, there were no problems on the facilities construction concerning the improper manner of construction. Nonetheless, problems were found concerning the distribution network after the construction.

High voltage drops in many sub-projects are the problems caused by the size of the conductors of Low Voltage Lines (LVL), which is apparently so small for the load of the project areas and the length of LVLs.

In order to reduce the voltage drop, it would be essential to construct and maintain the data of the facilities, such as the length, the size of each LVLs. The data on each customer's demand is also required to estimate the current flow from the LVLs to each customer. In order to administrate the quality of supplied electricity, the predicting system on the voltage of LV network is indispensable, such by reducing the voltage drops and keeping it in proper ranges.

In addition, mostly structural components of MV and LV facilities, such as conductors / insulators / distribution transformers / arresters / reclosers, circuit breakers / kWh meters, are manufactured inland and has been installed under SPL Projects. The electrical materials and equipments produced in Viet Nam are consistently supplied to installation site with the shortest delivery time and have created strong sustainability for operation, maintenance and managements of facilities under SPL Projects.

### 8.2.3 Administrative System of the Constructed Facilities

Regarding electricity distribution sector, after studying the experiences of international specialists participated in SPL Projects, the administrative system of the constructed facilities was established as follows:

In the first stages (SPL-I & portion of II): Most of the MV Facilities in <u>MVL extension new projects</u> were recommended by DOI (now DOIT) and Provincial Electricity (PE). Therefore in this step, MVL was chosen as the first priority, and the Project Owner are professional of electricity sector. The administrative system has its enough ability to fulfill its full function. No complaints were heard regarding its management.

In the following stage (SPL II-III-IV-V), most of Provincial DPI were experienced, the project development process was smoothly implemented. All the small power-cuts were treated promptly and did not harm the quality of the project investment, nationwide.

The above situations exist only in the SPL Project due to the rational procedure of project management and disbursement, decided in JICA-GOV agreements and actually proceeded in Vietnam since SPL II.

During the project development, the considerable international consultant perfectly conducted SPL Project formation, survey, monitoring, follow-up activities and building in the project management capacity within the participatory community. Therefore, the best final results were achieved.

In order to proceed the Request No. 1287/VPCP-KTN of the Government Office dated March $2^{nd}$ 2009 of Handing-Over all Rural Low Voltage Systems to EVN management in spite of their investment source, recently the Inter-ministerial Circular No.06-2010/TTLT-BCT-BTC dated Feb. $3^{rd}$, 2010 signed and issued by MOIT and MOF <u>has compelled to hand over all LV assets to EVN members</u>.

The real cause of this circular issuance is that many of the LV assets were invested by other financial sources (Some International Banks, Collective Co-operative fund, Private Ownership, etc.). Therefore those were in not a good condition, due to insufficient preparation and applied illegal regulation to be implemented for rural electrification items, which conducted into the large power losses nationwide, and possible death dangers in countryside.

#### 8.2.4 Asset Management System

Operation, maintenance and management for all of SPL project assets have been already implemented by EVN system, except a few, however, those will also be treated in the near future. EVN supervises and administrates all assets of their distribution facilities, including the equipments under SPL Projects, there has not been any troubles.

### 8.3 Water Supply Sector

#### 8.3.1 Project Planning and Design

##### 8.3.1.1 Ensuring the Sufficient Water Supply Coverage

The results of the Survey show the difficulty to acquire the sufficient water supply coverage to ensure the effectiveness of the sub-projects. Insufficient water supply coverage does not bring the sufficient revenue to the water supply undertakings necessary for the operation, maintenance and management (OM/M) and future renewal of the WSS. It is accordingly necessary to take measures to raise water supply coverage.

The survey team proposes to take following measure, though there will be a several barriers to execute them:

"The sub-project management unit (SPMU) shall collect the signed subscription to planned water supply from the population during the planning and design stage and if the collection rate cannot reach designate percentage, e.g. 70%, the project management unit (PMU) should not put such sub-project into implementation."

Above-mentioned measure necessitates activities below to get sufficient number of agreement of population with piped water supply:

- Aforementioned campaign on the raising awareness of population regarding the public hygiene related to the water supply.
- Making the population understood the difference between the water from conventional water source such as shallow wells, rain water, etc., and that from the piped WSS.
- To convince the population that the disinfection by chlorine is necessary for safe drinking water supply.
- To explain the reasons why consumers should pay for the water from the piped WSS and the connection between a house and the WSS
- Presenting the outline of water supply plan; service area, designed specific consumption per capita, period of hours of water supply

##### 8.3.1.2 Definition of the Area to be Supplied with Water

The team took it for granted that the definition of the service area had been made in the planning and design stage of the sub-project. However, the team felt in the course of survey that SPMU or Project Owner (PO) did not transfer such definition of the service area to OM/M organizations. Because a number of OM/M organizations could not understand the concept of the service area and accordingly could not answer the number of households and/or the population in the service area or answered approximate figures on the data.

Though water demand projection in terms of quantity and specific areas for coming several years is important to prepare the OM/M plan as well as the planning of WSS rehabilitation, it is difficult for the OM/M organization to do such tasks without having the data and information on the service area.

The team recommends SPMU or PO preparing the definition of the service area and its socio-economic data and other necessary data and information with their source, SPMU or PO should transfer all the information on the service area to the OM/M organization of the WSS to be constructed.

### 8.3.2 Facilities Construction

Following two (2) pictures show the example of the leakage from reinforced concrete structures:

**Figure 8.3-1 Examples of Leakage from Reinforced Concrete Structure**

The water proof or water tightness of the installations of WSS is essential to prevent leakage of water which is delivered and treated by using the cost. However, the team observed the marks of leakage from the treated water tanks or other concrete structures in a number of WSSs. In case of wall of installations, we can observe the leakage and repair it. However, if such leakage takes place from the bottom of facilities, it is almost impossible to notice it except the serious case, e.g. the water disappears in a few hours. In case of concrete structure, it is difficult to identify the inside place where the leakage takes place and it is accordingly difficult to repair it.

Strengthening the quality control of the construction works, especially that for concrete work is consequently essential for preventing the leakage.

Considering the scarce civil engineers resources in the water supply field, the team recommends assigning a technical administrator in each province or region who has the power to approve the design submitted by the design consultant company and the construction works planning submitted by the contractor.

SPMU should supervise the construction works according to the design and the construction plan approved by such technical administrator.

### 8.3.3 Administrative System of the Constructed Facilities

#### 8.3.3.1 Operation Indicators

The team conceives that each WSS should have the operation indicators to judge the efficiency and effect of the water supply for understanding the performance of OM/M organization and the public relations to make the population understood on the piped water supply.

Followings are operation indicators can be considered, however, each WSS should apply the appropriate ones considering the characteristics of the WSS and the service area. It can be added or modified, if necessary.

- Number of households connected with the WSS
- Rate of population served (number of consumers / total population in the service area)
- Average daily water consumption (annual water consumption / 365)
- Maximum daily water supply in the year
- Per capita consumption per day (average daily water supply / number of consumers)
- Rate of facility utilization (average daily water supply / capacity of WSS)
- Rate of accounted for water (water consumption charged / total water supply)
- Monthly operation hours of treated water distribution pumps

The OM/M organization should record the value of indicators applied, and keep and accumulate them in convenient manner for review, and analyze them from the time-series viewpoint in order to reflect it to prepare an OM/M plan.

#### 8.3.3.2 Campaign on the Awareness of the Water Quality Control to All the Staff of WSS

The team has pointed out the weakness in the water quality control of most of the WSSs.

Considering the significance of water quality of the water supply, the team proposes all the WSSs to organize the campaign on the awareness of the water quality control to all the staff of WSS.

The director or responsible person of the WSS should take the initiative and technical administrator and water quality manager proposed in Chapter 7.3.4.1 have to assist him. It is accordingly necessary for the director to have the training on the water quality control of the water supply.

The water quality manager should be the responsible person of the campaign and it will organize the training on the minimum knowledge of parameters of water to be analyzed, method of water analysis, sampling and transportation of samples under the supervision and assistance of the director and the technical administrator.

Though it might be a little burden for the WSS, all the WSSs should equip the devices to analyze turbidity, residual chlorine, color everyday in order to enable all the staff of WSS to measure these parameters.

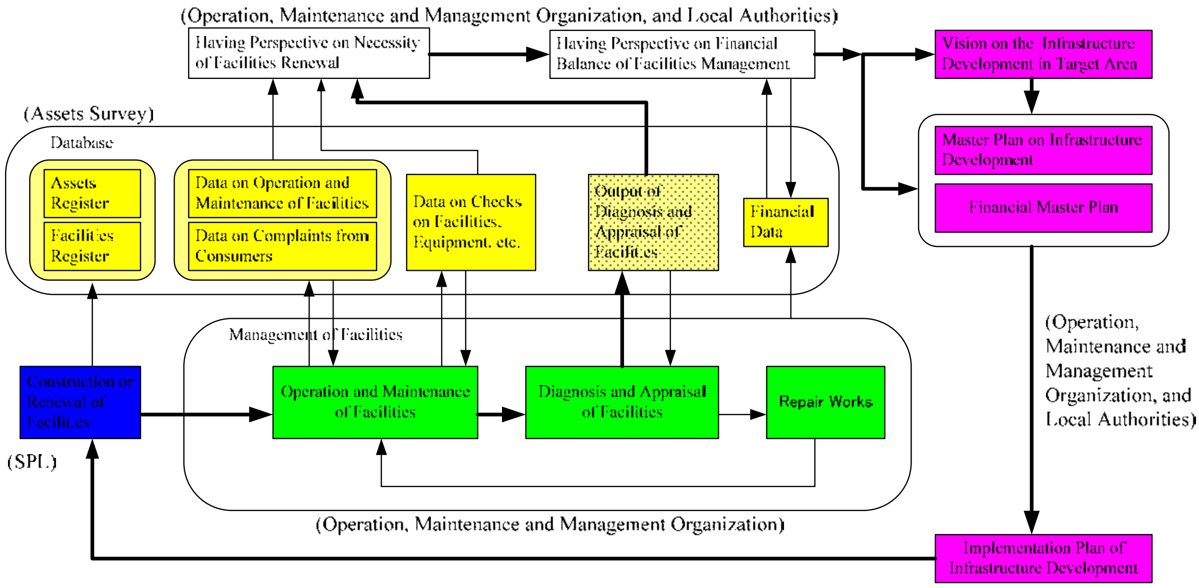
The staff should learn how to keep analysis results and to understand them.

### 8.3.4 Assets Management System

Asset management is primarily the maintenance of infrastructure, in addition, grasping the current / future condition of facilities, such as deterioration of facilities, decrease in efficiency and function of facilities for most cost-effective operation and maintenance practices in an organized way. Specifically,

| | | |
|---|---|---|
| 1 | Formulation of Master Plan | Setting the objective |
| 2 | Grasping the Status of Asset | Data collection, establishment of database and inspection of equipment and installations. |
| 3 | Evaluation and Analysis of Asset | Estimation of OM/M cost to make it possible operation of equipment and facilities for sustainable water supply for demand |
| 4 | Sub-Project Planning | Set priorities for each facility to decide repair, renewal, revamping of the facilities |
| 5 | Sub-Project Decision and Implementation | Sub-project implementation based on the financial status |
| 6 | Evaluation of Sub-Project | Revision to master plan and database |

It is desirable to introduce asset management and properly operate, maintain, manage the facilities, and formulate revamping and renewal plan in a reasonable scale and time in rural WSSs for maximization of benefits of SPL sub-project. Figure 8.3-2 shows a conceptual diagram of rural WSSs which introduced asset management.




Source: Conceptual diagram of the Asset Management prepared by the Ministry of Health, Labour and Welfare, Japan partially modified by the Survey Team

**Figure 8.3-2 Concept of Asset Management**

Considering the future introduction of the “Asset Management”, as mentioned several times so far, the actual tasks for rural WSSs to be carried out by stages are setting and collect the data relating OM/M, and storing and analyzing these data through time to expect condition of OM/M and financial status of WSSs in the short term and long term.

This section proposes diagnosis of WSS, improvement of disinfection facilities, preparation for the revision of water tariff as immediate task with concept of asset management in mind.

It is desirable for all the related agencies to consider fully proposal in this section within the framework of current legislation.

### 8.3.4.1 Diagnosis of the WSS

The survey team observed several unfavorable conditions of the WSS operation such as carry over from the sedimentation basin to the filter, the mud balls in the filter, weak water analysis, inappropriate installation of liquefied chlorine, etc.

Considering the fact that most of the WSSs are small scale and located in rural area, the OM/M organization might have the difficulty to operate new water supply system, even if it could receive the support from the Provincial Water Supply Company (PWSC).

The survey team recommends PMU to implement the diagnosis of operation of the new WSS at the end of the start-up year for the consolidation of the appropriate operation of the WSS. Moreover, other diagnoses of the operation and the facilities, installations and equipment is necessary during fifth to tenth year in order to confirm the appropriate water supply and to prepare the preventive maintenance plan for the facilities, etc. for forthcoming rehabilitation and renewal.

PMU can entrust these tasks to the PWSC of different province in order to provide the OM/M organization with opportunity to share the experience of OM/M of WSS. In this regard, PMU will be able to collaborate with the Vietnam Water Supply and Sewerage Association which issued the instruction manual of Operation and Maintenance of Water Supply System.

#### 8.3.4.2 Disinfection Facility

As shown in Chapter 4.3.1.2, most of WSSs use the liquefied chlorine for disinfection of water to be supplied. It is conceived as less expensive than other types of chlorine such as sodium hypochlorite solution produced by electrolysis at the site or purchase in Da Nang and calcium hypochlorite produced by dissolving breeching powder or purchase in Da Nang and Hai Phong. However, liquefied chlorine is hazardous for population due to its strong oxidization effect when it leaks from a container.

From the view point of hazardous characteristics of chlorine, it necessitates following cautions[24] when we handle the liquefied chlorine, however, the survey team could not see any disinfection facilities which satisfy all the requirement of the cautions.

- Separation between chlorine storage and room for chlorinator
- Installation of a prevention wall of chlorine container to prevent from flowing out of liquefied chlorine from the storage or the chlorinator room because chlorine gas is heavier than air
- Channel in the chlorine storage for cleaning should not be connected with outside
- Installation of chlorine gas detector
- Keeping emergency kits and chemical for neutralization and absorption of chlorine

Besides, as Table 8.3-1 below shows that the number of WSSs using sodium or calcium hypochlorite as the disinfectant is increasing and most of the WSSs of phase I and III which use hypochlorite converted from the liquefied chlorine.

**Table 8.3-1 Number of WSSs by Type of Disinfectant and SPL Phase**

| Phase / Disinfectant | SPL I | SPL III | SPL IV | SPL V | Total |
|---|---|---|---|---|---|
| Liquefied Chlorine | 8 | 21 | 15 | 14 | 58 |
| Sodium Hypochlorite | 4 | 3 | 3 | 12 | 22 |
| Calcium Hypochlorite | 0 | 1 | 2 | 2 | 5 |
| Another WSS | 0 | 0 | 2 | 0 | 2 |
| No Disinfection | 1 | 2 | 1 | 1 | 5 |
| No Information | 0 | 0 | 1 | 4 | 5 |
| Total | 13 | 27 | 24 | 33 | 97 |

[24] The survey team has found out TCXD-66, 1991, Ministry of Construction which stipulate the regulation on the handling of liquefied chlorine at the end of site survey. However, the team is not sure whether this norm is currently applicable or not.

Sodium hypochlorite and calcium hypochlorite are safer than liquefied chlorine but they are more costly than the liquefied chlorine, though it depends on the distance from the manufacturer to the WSS.

The survey team recommends the parties concerned to survey current situation of the disinfection facilities of the WSSs, if necessary and to set the course on the arrangement of disinfection facilities including the standard of hypochlorite such as the concentration of solution, etc.

Following two ways can be considered as the course to arrange the disinfection facilities:

- To improve the disinfection facilities using liquefied chlorine in line with TCXD-66 or its revised one
- To convert the system from the liquefied chlorine to hypochlorite

If the subsidy will be available for the arrangement of disinfection facilities, the risk of accidents related to liquefied chlorine will be hopefully reduced rapidly.

#### 8.3.4.3 Water Tariff

Water Tariff is mainly decided by the Provincial Peoples' Committee (PPC) based on the proposal by the OM/M organization, though there are some exceptional cases that the DPC makes the decision of water tariff. However, around 70% of WSSs conceive that the current water tariff is insufficient for future rehabilitation of the WSS.

The OM/M organization should consequently prepare the scheme to raise the water tariff for the continuous sound management of the WSS. The scheme may consist of following activities:

- Preparation of assets register
- Preparation of facilities register
- Collection of data on the OM/M
- Collection of data on complaints from consumers
- Collection of data on the inspection results on facilities, installations, equipment, etc.
- Diagnosis on the facilities, installations, equipment, etc.
- Arrangement of the financial data and having perspective on financial balance on the OM/M of WSS
- Preparation of water supply planning in the area
- Advertisement on the water supply conditions and the activities of OM/M organization

Figure 8.3-2 also shows the concept of the water tariff arrangements.

## 8.4 Irrigation Sector

### 8.4.1 Project Planning and Design

#### 8.4.1.1 Planning and Design

**(1) Earth Lining Canal**

The following items are hopefully to be considered in the facilities planning and design of the SPL Projects including two (2) facilities which currently have problem that the irrigated cultivation area becomes less than the irrigation beneficiary area due to water leakage, etc. from earth lining canal.

It is important to reduce the irrigation water loss regarding earth lining canals. So as to reduce the loss, it is necessary to make efforts to raise the irrigation efficiency[25]. The following countermeasures are applicable in order to raise the irrigation efficiency:

- To share the information on problems regarding water distribution and facilities, etc. among farm households.
- To disseminate the water distribution schedule to farmers, and consequently to raise the water application efficiency[26] of farm level by following the water rotation.
- To improve division works and water measurement facilities[27], etc. to raise the water management efficiency.
- To improve earth lining canals to concrete flumes, etc. to raise the conveyance efficiency[28].
- To formulate an irrigation plan with integrity of technical and economic aspects considering a financial plan including donors. The irrigation plan should especially formulated based on the survey of irrigation efficiency for the rehabilitation planning of earth lining canal and dam, etc.

**(2) Participatory Planning and Design**

In order to ensure the effectiveness and sustainability of the sub-projects, it is desirable that residents' intension is reflected properly in the sub-projects implementation, and residents' ownership of sub-projects is raised. Based on this idea, it is desired that the persons in charge of the irrigation of DPC and CPC, and farmers participate in the planning and design of the facilities to be constructed under the SPL Projects.

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[25] Ratio of water stored in farm field (effective soil layer) to volume of intake water to system.
[26] Ratio of water stored in farm field (effective soil layer) to volume of intake water to farm field.
[27] Division works are facilities which divert water into designated area with designated discharge. Water measurement facility is one which measures designated discharges of intake, diverted and conveyed water.
[28] Efficiency taking into accounts the water loss in water conveyance along canal.

### 8.4.2 Facility Construction

Due to low quality of construction, deformed canals, etc. were observed in the site survey. It is required to construct appropriate facilities which correspond with the specification and quality indicated in design drawings, following the construction law and DOC guidelines, etc. which regulate construction quality, etc. The desired countermeasures are shown below.

- To carry out physical, chemical and mechanical tests based on the construction law and DOC guideline, etc.
- To record the results of tests in a control chart and a summary table, etc., and to give a decision on the results by statistical methods.
- To help preventing any defective works, and identifying any problems and improving measures.
- To conduct quality control in combination with progress control and output control for the purpose of securing stable quality and progress of the construction.

### 8.4.3 Administrative System of Facilities

It is considered that development of technical capacity, etc. is desired for CPC and FO. On the other hand relating to the sub-projects, there are two (2) ways of capacity development, as follows:

1) In SPL III, VI and V, the development of human resources and strengthening of organization was executed through consulting services and cooperation with NGO in order to improve the capacity of sub-project implementation and supervision of PMU, PPMU and SPMU (Executive Committee Appraisal Report, JICA, 1999, 2003 and 2006).
2) JICA projects for the capacity development on PIM (refer to 8.4.4 (2)).

It is considered above-mentioned JICA projects will develop the capacity of FO. However, as developing method of CPC seems to be not clear, the following discussion on this issue is desired to be discussed among relevant organizations:

- The DPC conducts the capacity development of CPC based on the development of human resources and the strengthening of organizations at district level executed under the SPL Project implementation, or
- CPC is also targeted together with FO when the capacity development under the JICA project is executed.

### 8.4.4 Operation, Maintenance and Management

#### 8.4.4.1 Monitoring and Evaluation

It is desirable to solve problems regarding the monitoring and evaluation, such as difficulty in data collection, unclearness of implementation body, and updating of data, etc. It is necessary to discuss this issue continuously among relevant organizations. In addition, the environmental conservation and the watershed management seem to be important for the facility management. Therefore, inclusion of the following items is desired:

- Environmental Conservation: Water quality problems, waste management problems, etc.
- Watershed Management: Upstream and downstream problems, problems regarding water utilization, problems regarding land utilization, minority race problems, etc.

#### 8.4.4.2 Farm Household Education

It is desirable to promote the Participatory Irrigation Management (PIM) in order to recognize for farm households current conditions and issues regarding insufficient information sharing among farm households, difficulty with the transmission of water distribution schedule from facility manager to farm households, digging holes in canal walls, and the disposal of garbage into canals, etc. Based on these ideas, it is preferable to apply the outputs of the following JICA projects which are instances of this attempt:

1) "The Project for Capacity Development of Participatory Irrigation Management System through Vietnam Academy for Water Resources for Improvement of Agricultural Productivity in Vietnam", June 2005 – June 2010

The outputs are to strengthen the function of the PIM Center of VAWR, to acquire the knowledge, technology and experience of water management for IMC engineers, and to improve the water management of farmers' organization at the model site (Quang Ninh and Hai Duong provinces) and to diversify agricultural products.

2) "Project for Promotion of Participatory Irrigation Management for Sustainable Small-Scale Pro Poor Infrastructure Development", 2010 – three years (plan)

The contents are to disseminate the outputs of the above JICA project to the SPL sub-project areas. The outputs are to carry out effective PIM at the project site, to improve the capacity of provincial irrigation engineers concerned with PIM, and to utilize effectively the irrigation facilities constructed/rehabilitated under international yen loan, etc.

In the application of the outputs, it is desirable to plan that the farm household education is executed in the all SPL sub-project areas. Support from the relevant personnel of the projects is desired on this point.

### 8.4.5 Method of Infrastructure Assets Management

Information arrangement will be required through recording daily maintenance in order to manage infrastructure assets. To cope with this, it is considered that preparation of a database of which information easily can be updated, referred and edited at any time, and its manual is effective.

In order to accumulate, arrange and analyze the items of information, data, etc. that are desired to be input into database are shown below, and Figure 8.4-1 shows the diagram of database utilization (Guideline of Function Preservation of Irrigation Facilities, Council of Food, Agriculture and Farm Village Policy, March 2007).

1) Specification of facilities, and inspection and repair in daily management, etc. executed by a facility manager.

2) Periodic diagnostic function survey and evaluation to grasp facility conditions continuously.

3) Classification of facilities based on the survey results and deterioration prediction, and comparison study on effective countermeasures.

4) Sharing information among relevant organizations, and implementation of necessary countermeasure works by role-sharing.

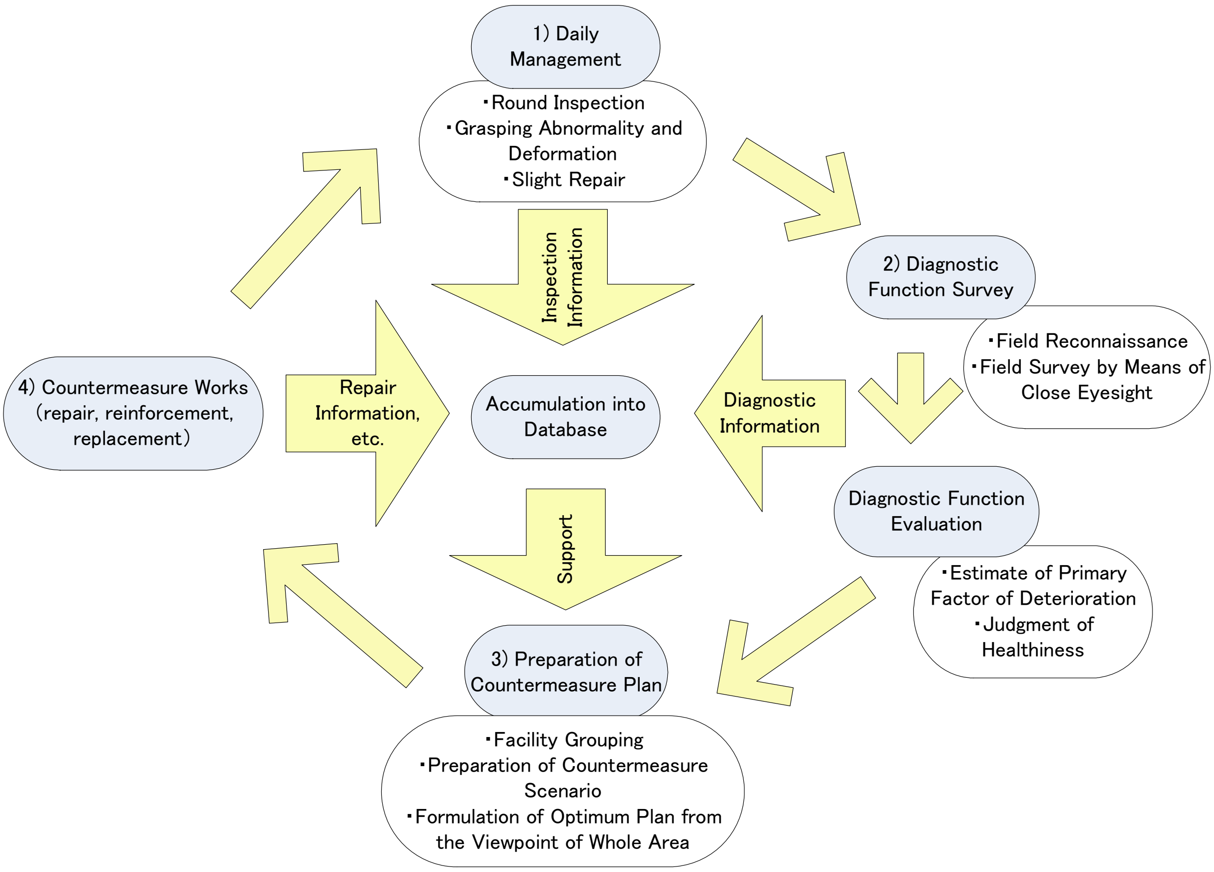



**Figure 8.4-1 Flow Chart of Database Utilization**

# Chapter 9 Development of the Database

## 9.1 Introduction

### 9.1.1 Significance

The “Asset Survey for Small Scale Pro-Poor Infrastructure in Vietnam” was made to grasp the present status of all the 1115 facilities including 408 roads, 526 power distributing stations, 97 water supply facilities and 84 irrigation facilities constructed in the SPL Projects (I – V) which had been implemented so far, by questionnaire sheets and site visits. As there had been few cases in which the status data and information of so many facilities have been collected, the database on such data and information was developed by using a personal computer in order to ensure the common ownership and effective use of such data and information by the agencies related to the SPL Projects.

### 9.1.2 Objectives

The objectives of developing the database are as described below, but the data and information that were collected in the Survey were insufficient to achieve those objectives. It was essential that the related agencies would continue to collect and store such data and information in the database or update it.

- To collect and arrange the status data and information on the SPL I – V in order to allow the related users to easily retrieve and filter necessary data and information for their efficient works;
- To check on the history of the implemented SPL Projects, review these projects and grasp the current status in the Central level and in the Provincial level in order to provide materials and information for formulating any future project.
- To allow the related agencies to early monitor any projects which may involve any problem or fault.
- To allow the agencies engaged in operation, maintenance and management of the related facilities to reliably grasp the current status of the individual facilities operated by them and improve the operation, maintenance and management procedures through their works of collecting the data and information necessary for maintenance and updating of the database.
- To allow the agencies engaged in operation, maintenance and management of the related facilities to systematically monitor the operational status, financial status and equipment conditions of the facilities by developing the database as the register of the facilities and the recording system for operation, maintenance and management of the facilities.
- To allow the related agencies to optimize any future project formulated for efficient operation, maintenance and management and rehabilitation, renewal and reinforcement of the facilities by arrangement, filtering and analysis of necessary data and information.

### 9.1.3 Users of the Database

As seen from the objectives in 9.1.2 above, the users of the database are expected to be the agencies as mentioned below, but for the time being, the database users are considered to be the Ministry of Planning & Investment in the Central level and DPI (Department of Planning & Investment) and the agencies engaged in operation, maintenance and management of the facilities in the provincial level.

Central level: Ministry of Planning & Investment (including SPL Project PMU) that is a SPL implementing agency, Ministry of Construction, Ministry of Agriculture & Rural Development and Ministry of Transportation & Communications which are the ministries in the related sectors, and Electricity of Vietnam (EVN) which undertakes the power distribution business in the national scale and the operation, maintenance and management of power distributing equipment under the SPL projects.

Provincial level: Provincial People's Committee, the SPL-related departments DPI, DOT and DARD under the Provincial People's Committee, and Provincial Electricity as Provincial operator under EVN, and Provincial Water Supply Corporation.

Operation, maintenance and management agencies: Refer to Table 1.4-1.

## 9.2 IT Infrastructure Survey

In assuming that the important users of the database are OM/M organizations, the questionnaire-based survey of information technology infrastructure was made to grasp the status of the IT-related infrastructure of those organizations together with the status survey of facilities prior to the development of the database. The questionnaire sheet included the items related to the Management Information System (MIS) which is operated in the SPL-V.

## 9.3 Development of the Database

### 9.3.1 Software

The software for the use of the database was considered to be available in 2 types as follows:

(1) Application software for the database

For the software to be created to use the database, it was considered to simplify the data entry, and to allow the users familiarized with the application methods to make complicated retrievals and sorting, to compile sum-up tables and various forms from filtered data.

However, such software is relatively expensive and probably, it is necessary to train and assign the personnel in charge of the software in full time, for whom it takes a cost. As the demand for such personnel who can deal with such software is relatively high, there is a fear that such personnel cannot be made available if requested.

(2) Spreadsheet Software

The spreadsheet programs are the general software used for calculation of values, which has the database functions capable of data sorting and filtering and of editing graphs from the filtered data. However, this software has many functional restrictions in comparison with the dedicated application software as described above. In particular, it is almost impossible to edit forms. In developing the database with a complicated structure, the number of spreadsheets and the number of files will increase and it will be necessary to take some considerations for designing the database.

Based on the results of the IT infrastructure surveys as described above, it was planned that the database was developed in using the universal spreadsheet software and that the database users would procure the application software dedicated to the database and export necessary data from the database if necessary to operate it.

### 9.3.2 Input Data

#### 9.3.2.1 Types of Data

The data used in the database is available in 2 types, one related to facilities and the other related to socio-economy. The facilities data are items of “General Project Information”, “Outline of Facility”, “Current Status of Facility”, “Effects of the Project” and “Operation, Maintenance and Management” as mentioned in Chapter 3 of this Report.

The facilities data include supplementary data and information as listed below, which are handled under the name of ‘illustration data’:

- Administrative maps indicating the locations of the facilities;
- Site scene photos (taken by survey members and past photos);
- Standard diagrams of the facilities obtained by the survey members from DPI and the operation, maintenance and management agencies;
- Facility handover certificates and circulars related to maintenance and management which the survey members obtained from DPI and maintenance-related agencies;
- Examples of planning documents used by operation, maintenance and management agencies; and
- Circulars and rules and regulations related to operation, maintenance and management.

About the socio-economic information which is important as the basic information for the future projects for rehabilitation and renewal of the facilities and fixing the charges of use, the questionnaire survey was made. However, the rate of answer collection was a little less than 7% as foreseen from the hearing from a DPI that the socio-economic information is difficult to obtain. Therefore, the data in the materials used in implementation of the past SPL projects and the statistic materials issued by the Government of Vietnam was used for data entry. The input data items are as follows:

- Area by year;
- Population by year;
- Agricultural output by year (rice, other agricultural products than rice, cattle);
- Industrial output by year; and
- Poverty rate by year.

The data entry was made on 670 Rural Districts under 62 Provinces throughout Vietnam/

#### 9.3.2.2 Names of Provinces and Rural Districts

The names of some Provinces and Rural Districts were different between the past projects and this Project because the change, consolidation and division of administrative districts were made several times after the start of the SPL Projects. Those names was entered into the database based on the "Administrative Division in 2008" issued by Statistical Publishing Office.

#### 9.3.2.3 Project Implemented in Phases

Each of the projects implemented in phases were marked with its project code numbers and the phase code to identify it as a continued project.

## 9.4 Database

### 9.4.1 System Features

The database has the following features:

- This database can be operated independently and used even in areas where the communications environment is not fully provided.
- The database file can be sent as the attached document to an E-mail message to an area to which the Internet is connectable.
- No computer with high functions (such as high-speed CPU and 1GB or more RAM) is required. It is expected that the database can be operated by computers used by many maintenance and management agencies because it is operated by the spreadsheet software (concretely Microsoft Excel, hereinafter called "Excel") which is commonly used.
- The operation of the database is basically the same as that of Excel, needing no special operation.
- The language can be changed over between Vietnamese and English and the operation and data entry are available in either of the languages. If Vietnamese is used, "_vi" is affixed to the end of the file name and if English is used, "_en" is indicated automatically.
- This database is created by macro, but all the Excel functions are available. For example, the character retrieval function (Find) in Excel can be used for the retrieval in a file. In addition,

the data editing and analysis such as sorting or filtering of entered data are also available. Graph creation is also possible.

- All the projects can be displayed and edited or analyzed (Allover Summary function). There is also a function of displaying the entire project by sector and the editing and analysis within a sector is available (Sector Brief function).
- The Print function in Excel is used for printing and the data can be printed by a printer in use.
- A large-sized illustration file such as diagram or photo data is not imported in the system, thereby causing no load on the system. Thus, a computer with a low basic specifications does not operate slowly.
- Some items in the input sheet can be entered by using the pull-down menu and selecting the data. In the water supply or irrigation sector having many input items, the data items are divided into sheets. This can reduce the users' trouble in inputting data as much as possible to facilitate the data entry job.
- As the capacity of the Excel-based system is low, it will be easy to upload the data on the Internet.
- The data communications between DPI or PMU and the operation, maintenance and management agencies use electronic mail where it is available. Where no electronic mail is available, the database system is copied in a CD, which is sent by EMS (registered mail).
- Data updating is easily made by anybody who can operate Excel. The backup file is created automatically when file is saved.

### 9.4.2 System Design and Composition

#### 9.4.2.1 System Design

The procedure of designing the database is shown in Table 9.4-1.

**Table 9.4-1 Database System Designing Procedure**

| Step | Item | Description |
|---|---|---|
| 1. | Analysis by User | Analyzing on what personal computers, operating system and software the database users are using at present. |
| 2. | Preparation of Codes | Preparing the tables of codes for each Province and each project which are necessary to build the database. |
| 3. | Examination of Processing Method of Related Materials | Examining how the related materials such as maps, photos, diagrams and documents are imported in the database. |
| 4. | Screen Design | Designing the screen conFigure uration and the rough plan of images on each screen. |
| 5. | Examination of Storing Method | Examining the method of storing input data. |
| 6. | VBA Design | Programming by the use of Excel VBA based on the above mentioned. |
| 7. | Trial Operation | Searching for failures, problems and points to be improved for improvement of operating conditions. |

#### 9.4.2.2 System Composition

**(1) Coding**

"Continued Project Code" is to be affixed to the same project (having a similar project name and the same operation, maintenance and management organization) to be implemented in different SPL phases because it is necessary to create the consolidated data for such a project.

**(2) Screen Design**

The screen design was considered to make the screen as simple as possible and for the user not to confuse the buttons to be clicked. The language selector button for English and Vietnamese was arranged at the upper right position on the initial screen which is easy to see for the user. The retrieval screen was considered to have the sorting function (Sort) for each item column which is easy to retrieve. The overview table of the entire project was arranged in the Retrieval Selection screen and the overview table by sector was arranged in the Sector Input Selection screen so that the code numbers are easy to refer to. In the Input screen, on which the contents and number of sheets are different from sector to sector, a tab was affixed to each of multiple sheets to ensure the sheets to be changed over by clicking the tab.

**(3) Discussions on Storing Method**

Data can be stored in 2 types, input data storage and database template storage (storage of a model file for several similar files to be created). Input data storage is available in 2 types of storage of database and illustration data.

**(4) VBA Design**

The project database created by Excel VBA (Visual Basic for Applications – a collection of program execution systems) is as follows:

1) 55 types of worksheet;

2) One type of user form for file version; and

3) 3 types of module having the following conFigure uration:

| | |
|---|---|
| Action module (mdlAction): | To execute all correlative processes (sheet changeover, file storage, etc.) |
| Common module (mdlCommon): | To execute data-related processes (data comparison, data retrieval, etc.) |
| File module (mdlFileFolder): | To execute the file and folder operation processes (file retrieval, opening of a designated file, directory creation, etc.) |

### 9.4.3 Database Configuration

As described above, this database is divided into facility and socio-economy related types. The facility type database stores the materials prepared or collected in the Survey as illustration data.

The input sheet of the database is basically available in 6 types of sheet the combinations of which are different from sector to sector: (1) General information; (2) Technical information; (3) Information at the time of construction; (4) Operational effects; (5) Status of SPL facilities and (6) Maintenance and management.

The illustration data is stored in the folder by Province and the main index data by Rural District is stored in the socio-economic information system.

The retrieval can be made on the following items:

1) Facility data: Province, Sector, input date, etc.

2) Illustration data: Province, Sector, file type (image, text, map, etc.), input date, etc.

3) Overview table of all projects: Project name, code number, name of Province/District, etc.

The database has the warning function. If the cell indicating the file is red when the retrieved results are output, such red cell indicates that it has passed one year or more for the file after data entry and that it should be updated. Figure 9.4-1 shows the screen of data retrieval results.

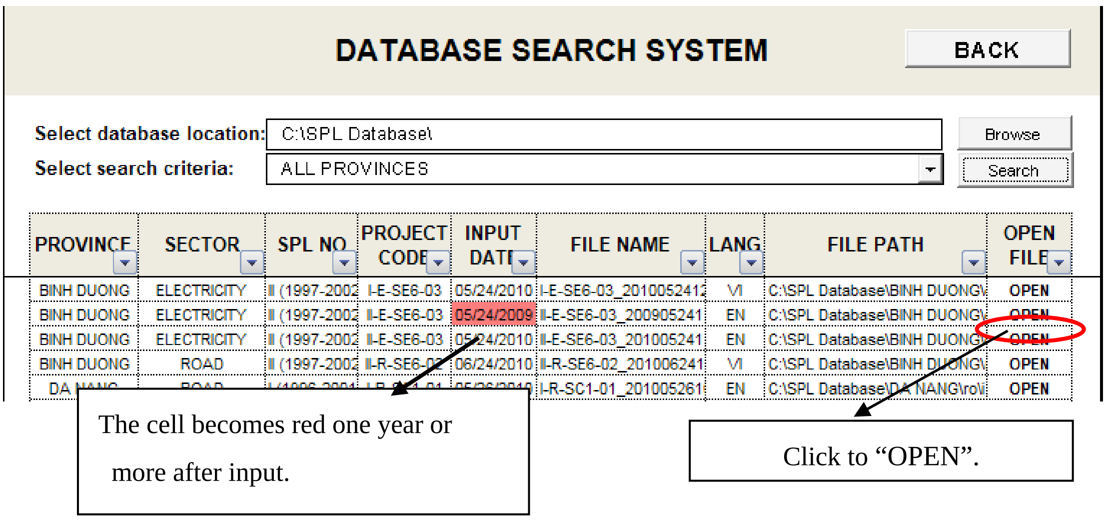



**Figure 9.4-1 Database Retrieval Results**

The illustration data retrieval screen is shown in Figure 9.4-2.

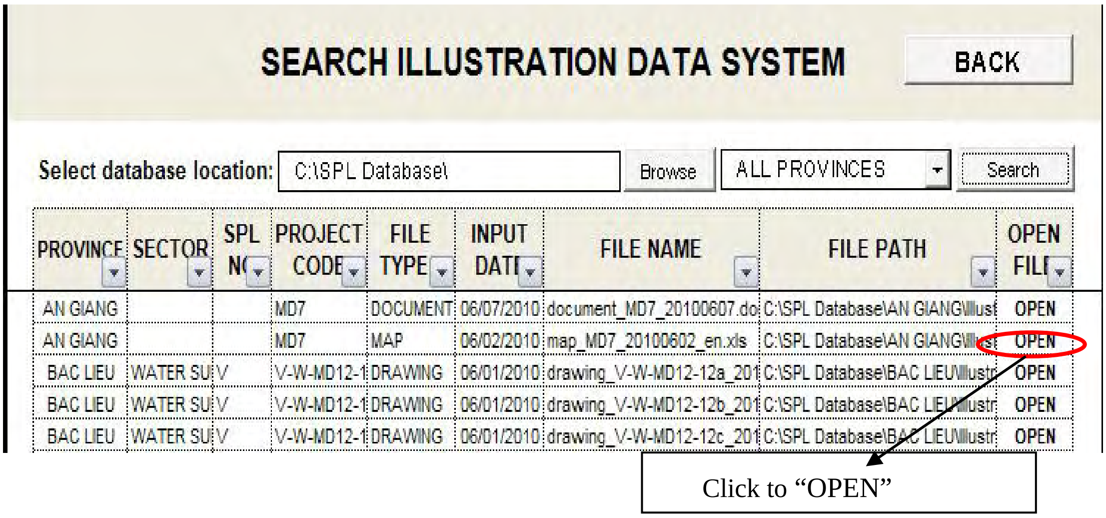



**Figure 9.4-2 Data Retrieval Results**

#### 9.4.3.1 Socioeconomy-related Database

This database covers the socioeconomic information entered on all the Provinces (62 Provinces and special cities) and 670 Rural Districts in Vietnam, which is browsable.

#### 9.4.3.2 Input Data

The facility data and illustration data based on the results of the Survey have already been input in this database.

(1) Facility data types

- General information – Sector, Province name, project name, Developing Partner, year, Rural District/Commune name, decision number and date, authorization agency, project entity, project cost, construction cost, date of facility completion, etc.
- Technical information by Sector – Details of facilities constructed by SPL
- Project implementation information – F/S and D/D, land expropriation, tender, procurement, construction work and other information on project implementation including date of completed project handover to maintenance and management agency.
- Information on operation effect – Demonstration of effects of facilities
- Payment information – Loan portion payment for the project (if any materials are available.)
- Facility status information – Present status and use conditions based on site survey

- Maintenance and management information – Date of facility acceptance, name of maintenance and management agency and its organization, address and telephone number, person in charge, number of employees (number of technicians by job, etc.), equipment in possession, the actual condition and the present status of maintenance and management.

(2) Illustration data types

- Map information – Map by Province indicating the locations of all the facilities constructed by SPL I-V.
- Photographic information – Photos taken in the Survey and photos obtained before, during and after completion of the Projects
- Drawing information – Drawings including the general standard drawings of facilities and drawings related to operation, maintenance and management of facilities.
- Document information – Facility handover documents, circulars issued by local governments for operation, maintenance and management of facilities, etc.
- Various types of sample form – Daily report, weekly report and monthly report, data input format by Sector, road budget application form, etc.

The forms and number of sheets for the facility data are different from sector to sector except for the general information.

In creating the illustration data, the following items were taken into consideration:

1) Map by Province

The maps of 62 Provinces and special cities except Ho Chi Ming City that were used in the Survey were purchased from private map sales companies under the control of Department of Map Publication, Ministry of Natural Resources and Environment, having the following features:

- The basic maps are prepared in accordance with the VN-2000 coordinate system under the Prime Minister's Decision No. 83/2000/QD-TTg issued on July 12, 2000. The geodetic system is the World Geodetic System 1984 called WGS-84.
- The maps are created by vector images which are applicable to computer graphics without deterioration in change such as enlargement or reduction in scale and can be stored in the format of Portable Document File (PDF).
- The latest administrative divisions as of December 2009 are depicted in the maps.

The following works were done in using those maps:

- The administrative division names of main areas on the maps were checked based on the 2008 revised edition of Administrative Division issued by General Statistics Office of Vietnam under the Prime Minister's Decision No. 124/2004/QD-TTg.
- The locations of facilities are indicated on the maps by Commune and the name of project was also entered. For the road sector, the start and end points and routes were depicted on the maps.
- The maximum file size is 2MB.
- The file name is indicated as Item_Province Code_Year/Month/Day; for example: **map_NE1_20100601**.

2) Photographs

- The whole view and partial views of each facility, and the parts having any problem were photographed.
- Up to 6 sheets in A4-size form can be pasted and the maximum file size is 2MB.
- The file name is indicated as Item_Project Code_Year/Month/Day; for example: **photo_I-W-NE1-04_20100601.**
- Province name, project name, date/time of photography and description are indicated on each sheet of photo.

3) Drawings

- The maximum file size is 2MB.
- The file name was indicated as Item_Project Code_Year/Month/Day; for example: **drawing_I-W-NE1-04_20100601**.
- The typical general drawings and specially important detailed drawings are stored as drawing information.

4) Documents

- The maximum file size is 500KB.
- The file name is indicated as Item_Project Code_Year/Month/Day; for example: **document_I-W-NE1-04_20100601**.

5) Various types of forms

- The maximum file size is 100KB.

- The file name was indicated as Item_Sector Code*_Year/Month/Day; for example: **form_xx_20100601.**
  * Sector code: road – ro, water- ws, irrigation – ir, and electricity – el
- The sample forms were prepared based on the materials made available from related ministries.

## 9.5 Output Forms

Various types of form are required for the operation, maintenance and management works for facilities. For instance, for the request for annual budget which is made by an operation, maintenance and management agency to a higher level of agency (such as ministry or controlling branch office or head office), the form specified by a Provincial People's Committee is not used, but a form specified for each office is prepared.

In the Survey, it was attempted to make a request to acquire any existing forms from an operation, maintenance and management agency, but it was made clear that each office used its independent forms in many cases as described above. The form that could be obtained was only the request form, but the schedules such as estimation sheets to be attached to the request and other forms were not available in most cases. A low number of forms that were made available are shown in Table 9.6-4.

**Table 9.5-1 Obtained Application Form for Budget and Attachment**

| Province | Sector | No. of Sub-project | Obtained Materials |
|---|---|---|---|
| Bac Giang | Road | 2 | Application Form for Budget |
| Dac Lak | Road | 1 | Application Form for Budget |
| Nghe Anh | Road | 1 | Application Form for Budget |
| Quang Tri | Road | 1 | Application Form for Budget and Attachment |
| Binh Dinh | Water Supply | 1 | Application Form for Budget |
| Lam Dong | Water Supply | 1 | Application Form for Budget and Attachment |
| Quang Tri | Water Supply | 1 | Application Form for Budget |
| Thai Nguyen | Water Supply | 1 | Attachment only |
| Thanh Hoa | Irrigation | 1 | Application Form for Budget and Attachment |

The sample forms of the request for budget and the schedule for estimation for the road sector were prepared based on the request form made available from Quang Tri Province. These forms were stored in the illustration folder in the database.

## 9.6 Method of Using Database

As described in 9.1.3, this database is intended to be used by operation, maintenance and management agencies, Provincial DPI in the local level, and Ministry of Planning & Investment in the central level. The concept of the database users system is shown in Figure 9.6-1.

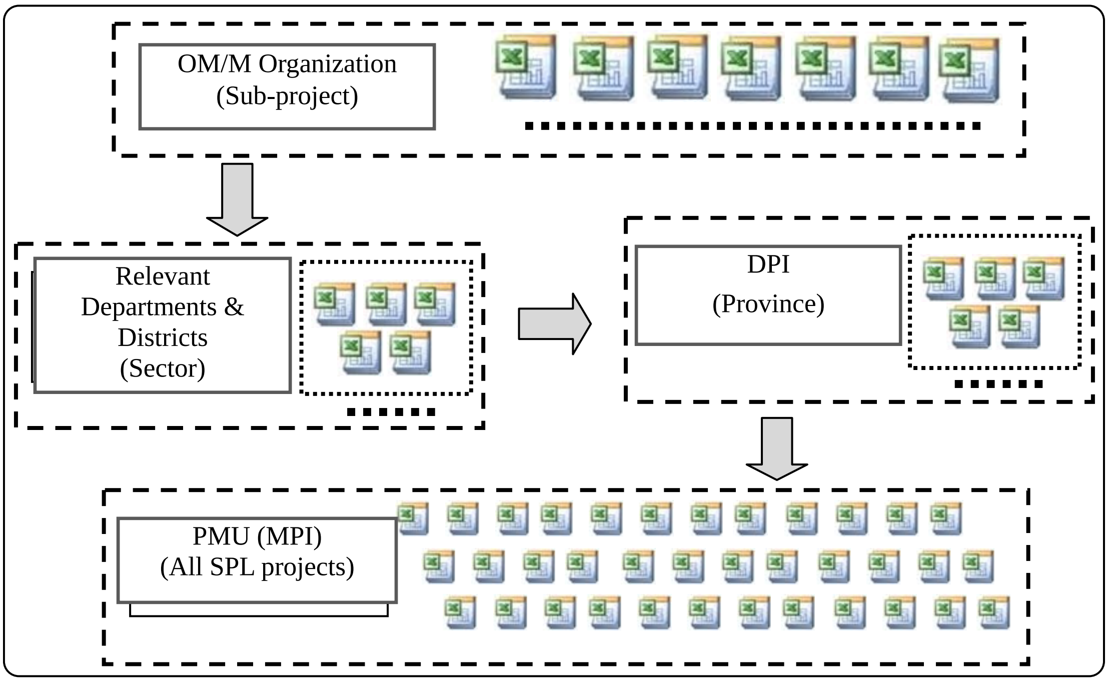



**Figure 9.6-1 Database User**

In the above diagram, it is expected that the effective use of the database will allow the agencies in the central level and in the local level (Provinces) to formulate the plans of new projects based on the feedback of the completed projects and allow the operation, maintenance and management agencies to formulate the plans of efficient operation, maintenance and management of constructed facilities. However, it should be mentioned repeatedly that the data storage for at least 5 years or more is desirable to ensure the future prediction in the effective use the database for the purposes as described below. On the other hand, the data to be stored for such long period may be obsolete, leading to low prediction accuracy. Therefore, it is desirable to use the database in understanding such low accuracy of prediction and to improve the accuracy, to screen data items strictly and to grasp the data volume per data item to be stored at minimum. The objectives of using the database are described below.

**(1) Formulation of new project plans**

1) In planning a new project, the locations and details of the existing projects are important information. This database covers the map information indicating the locations of the facilities constructed by the SPL projects, which allows the undeveloped areas and sectors to be monitored visually. In addition, the social and economic conditions of the project sites and their future tendencies such as pollution growth rate can be presumed based on the socioeconomic information in Rural District level stored in the database, ensuring the effective primary selection of the project. It is of course that the information on the local infrastructure developed in other projects than the SPL projects are required, but even if such information is not available, the database would be effective to select the primarily planned site or sector.

2) If a sector or site for a new project is selected, the existing projects in the same sector having similar natural and socioeconomic conditions can be retrieved from the database to monitor the data including public service demand and consumption, construction costs, and costs of operation, maintenance and management. In using such monitored data, the pre-feasibility study of the new project can be made efficiently for a short period, ensuring efficient project selection. It is also natural that it is effective to execute the feasibility study.

Such a new project will be different in the coverage in the central level and in the local Provincial level, but not largely different in the works to be done in the project.

**(2) Use for facilities operation, maintenance and management**

1) This database is also intended to be used as a register of equipment of a facility. A user agency of operation, maintenance and management evaluates the grade of importance of equipment and apparatuses in maintaining the functionality and in operating efficiency of the facility and makes the storage, arrangement and analysis of the data per equipment. By doing these, the user agency can formulate the facility maintenance plan, take quick action in event of failure occurrence, and make the future failure prediction and estimate the annual repair cost, and presume the time of equipment renewal or repair.

| | |
|---|---|
| Formulation of Maintenance Plan: | Year of installation, elapse of years, usable life, records on accidents and failures (date/time of occurrence and data/time of recovery, period of facility operation stoppage, failure symptoms and causes, recovery method and cost, etc.), and complaints from users |
| Quick Action in Failure Occurrence: | Records on accidents and failures (date/time of occurrence and date/time of recovery, period of facility operation stoppage, failure symptoms and causes, recovery method and cost, etc.), source of purchase of equipment, list of spare parts (It is also necessary to provide the emergency communications system.) |
| Failure Prediction, Estimation of Annual Repair Cost, and Presumption of Time of Equipment Renewal and Repair: | Year of installation, elapse of years, usable life, records on accidents and failures (date/time of occurrence and date/time of recovery, period of facility operation stoppage, failure symptoms and causes, recovery method and cost, etc.) |

2) Each operation, maintenance and management agency sets the operation indexes for its own facilities and stores and analyzes the data, thereby allowing the results to serve for the income and expenditure forecasts for the facilities, to reflect on future rehabilitation plans and to improve the works of operation, maintenance and management of the facilities.

For instance, if the ratio of the current volume of facility usage to the facility capacity is defined as the rate of facility usage, which is used as the operation index, the daily volume of facility usage, cost and income can be recorded to estimate the rate of facility usage, the cost per unit volume of usage and the income. By analyzing the stored data in time series (for example, the monthly changes), the monthly income and expenditure can be forecast. In addition, by forecasting when the monthly volume of usage reaches the facility capacity, the necessity for formulation of the facility rehabilitation plan can be determined. If the rate of facility usage in a certain month indicates a different value from those in the past months, the relations with the operation, maintenance and management works are checked, thereby leading to the improvement of such works.

Some examples of the use of the database have been described above, but the data and information available from the above-mentioned work processes and a lack of data for a certain operation which is found through the actual use of the database can be made clear and by storing and accumulating other data necessary for retrieval and sorting, the database will become easier to use and more effective.

### 9.7 Database Manual

The User Manual for use of this database was prepared as attached hereto. Its contents are as follows:

- System Operating Environment
- Main Functions
- Installation
- Basic Operations
- Retrieval
- Socioeconomic Information
- Data Input
- Illustration Data Input
- Warning Functions
- Data Analysis and Graph Creation
- Storing and Printing
- Updating and Correction
- Sending of Updating File
- Protective Functions
- Frequently Asked Questions

## 9.8 Database Maintenance and Management

### 9.8.1 Database Maintenance and Management

Eeach operation, maintenance and management agency is required to assign one person to the maintenance and management of the database. Such person is not needed to have special technology and management experience. For instance, one staff member of the office can do the work under the control of the responsible person and such work includes the jobs as shown in Table 9.8-1.

**Table 9.8-1 Operation, Maintenance and Management of Database**

| Period | Type of works |
|---|---|
| Daily | Arrange and input collected daily data |
| Weekly | Arrange and input collected weekly data |
| Monthly | Arrange and input collected monthly data |
| Annually | Update the data and illustration data files based on the above. In addition, inspection of facility should be conducted by the officer at least once a year. |

Note: The sample forms of daily report, weekly report, monthly report have been installed in the database.

### 9.8.2 Data Storage and Updating

It is desirable that the data to be stored (almost all data including daily operation and management records and complaints) and the data to be updated (renewal of facilities, equipment and apparatus and equipment deliverers; the data such as failure records on older equipment should desirably be taken in custody separately.) should be input into the database regularly or whenever it is needed, in order to make the data storage and updating, and that the time and method of transmitting the updated database should be determined between the agency and the Provincial level and MPI.

## 9.9 Management Information System (MIS)

MIS was web communication system developed under SPL V and supports the management of the progress of sub-projects. POs store data concerning work progress (construction schedule, progress of construction, financial status, information on OM/M, etc) in web server from their PC. PMU and PPMU review and approve data registered by POs on the web and supervise work progress.

**Table 9.9-1 Main Features of MIS**

| PMU, PPMU | PO |
|---|---|
| • Review and Approve General Information on Project<br>• Review and Approve Information on Work Progress<br>• Edit and Review Project Information List<br>• Review and Approve Social and Economic Information<br>• Review and Approve Illustration data (Photo, Map, Drawing)<br>• Send mails to PO to approve or request revision of data registered | • Register General Information on Project<br>• Register Information on Work Progress<br>• Register Social and Economic Information<br>• Register Illustration data (Photo, Map, Drawing) |

POs register data by uploading excel file, and these file are saved separately by saved time and accumulated in server.

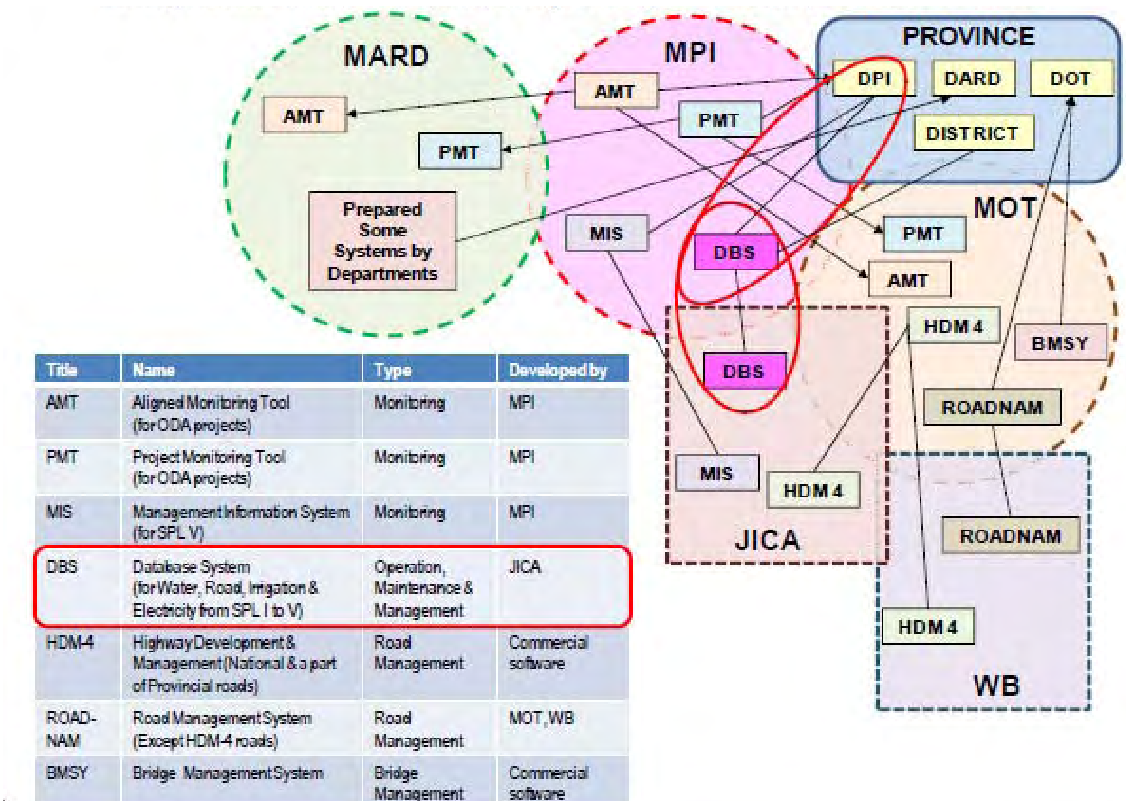
Based on the result of IT infrastructure questionnaire, 86% responded "don't know MIS" or "No answer". In the workshop on database, only one province (Nghe An province) responded "Using MIS". Considering these conditions, it seems that most of the provinces couldn't utilize MIS. Therefore, it is important to improve information communication environment and conduct training course on operation of system for utilizing MIS.

If possible, it is desirable to retrieve and utilize data accumulated in MIS

## 9.10 Present Status of Databases of Other Agencies

### 9.10.1 Necessity of Confirmation

Some agencies such as MPI and MARD have been operating the database system developed by them. MARD plans to integrate the systems in operation in its departments. In some provinces, there is a move to develop a database system as the basic system for operation, maintenance and management. In consideration of these circumstances, the present status of the databases of other agencies was checked and confirmed to avoid the competition between the database developed in the Survey and the existing or planned databases.




| Title | Name | Type | Developed by |
|---|---|---|---|
| AMT | Aligned Monitoring Tool (for ODA projects) | Monitoring | MPI |
| PMT | Project Monitoring Tool (for ODA projects) | Monitoring | MPI |
| MIS | Management Information System (for SPL V) | Monitoring | MPI |
| DBS | Database System (for Water, Road, Irrigation & Electricity from SPL I to V) | Operation, Maintenance & Management | JICA |
| HDM-4 | Highway Development & Management (National & a part of Provincial roads) | Road Management | Commercial software |
| ROAD-NAM | Road Management System (Except HDM-4 roads) | Road Management | MOT, WB |
| BMSY | Bridge Management System | Bridge Management | Commercial software |

**Figure 9.10-1 Existing or Planned Project Management System / Database System and Database Developed in the Survey**

Note : "DBS" shows the database developed in the Survey. Arrows shows the directions to use systems, and continuous line shows having system in common among related agencies.

### 9.10.2 Ministry of Planning & Investment (MPI)

It happened to be known to us that a few DPIs had the programs operated under the control of MPI to monitor the ODA projects. Then, those programs were checked on Website (National Monitoring & Evaluation Website: http://tddg.mpi.gov.vn/Home/?852615528). The survey results are shown in Table 9.10-1 below.

**Table 9.10-1 Program for Management of ODA projects in MPI**

| Name | Developer | Objective | Remark |
|---|---|---|---|
| Aligned Monitoring Tool （AMT） | MPI | To monitor and make report on each quarter/year of the Project Owner for ODA projects | Excel sheets |
| Project Monitoring Tool （PMT） | MPI | To monitor implementation and activities of ODA project s | Excel sheets |

These programs were developed mainly for the progress management and preparation of reports on the ODA projects.

### 9.10.3 Ministry of Agriculture and Regional Rural Development (MARD)

The development and operation of the MARD databases by Department of Planning, Department of Finance and Center for Information and Statistics (CIS) under the MARD is described below.

- Various types of database system are operated by different Departments at present, some of which had been developed by foreign assistance organizations in Switzerland and others. Therefore, MARD is preparing the integration of those database systems.

  First of all, the systems operated by CIS at 3 main Central Project Offices (CPO) will be consolidated into one two-way system (Central and Regional). It is expected to complete such consolidation in 2 to 3 years, but its prospect is unclear because of the severe financial situation of CIS.

- There are surely some ODA projects to develop database systems, but those projects including the project implemented by MARD do not consider the maintenance and management of the database systems after its completion and instruction. Therefore, it is necessary to consider the budget for maintenance and management in future studies and projects because the installed equipment could not be operated normally without the maintenance costs.

- CIS is collecting statistic materials regularly (the deadline of which is the 25th day of each month) from Departments of Agriculture and Regional Development (DARD) of Provinces. These materials are prepared in designated entry formats and sent in E-mail or by mail.

### 9.10.4 Province

#### (1) Ha Tinh Province

- Department of Transportation (DOT) has the road and bridge maintenance and management systems by operated by VRA (Vietnam Road Administration): 1) ROADNAM (an integrated road and bridge database system developed by VRA and the WB; 2) BMSY (a bridge management system); and 3) General Road Management System.
- The first of those systems was introduced in 2006. Actually, the systems had not been operated so far for the reasons that it was difficult to acquire necessary data and information due to lack of road surveyors and that there was no staff capable of operating the systems.
- However, the Provincial Decision No. 764 was issued in March 2010 to permit the budget for data collection. This Decision No. 764/QD-UBND provides that DOT will build the local area network (LAN) with database functions in and after 2010 and Ha Tinh province DOT is preparing the database development project at present.

#### (2) Quang Tri Province

- The water supply facilities were constructed at only 5 sites in the SPL projects and the MIS in the SPL V project has not been used.
- The OM/M budget for each of the facilities is estimated by the head office of PWSC based on the budgets submitted by those facilities. Their application forms are different from facility to facility.
- The head office in road maintenance company operates 10 personal computers. The database system is not used. "ROADNAM" had been introduced by DOT before, but some system failures were discovered by DOT. Since then, Quang Tri Province has not used the system.
- The annual maintenance and management cost budgeted by DOT includes the costs of mowing, cleaning of drains, and repair of pot holes in the case of roads. In the case of bridges, it includes the costs of re-painting, removing obstacles, and replacing bridge seats. In the case of urgent repair, the team organized by DOT, PPC and the operation, maintenance and management companies decides the repair plan, work items and costs. However, in any case, there is no specific application form.

As explained above, the database system related to the rural infrastructure is still in a condition in which it is deemed that each agency is working in the start-up period. Therefore, it is important to operate the developed database system and to promote the improvement of the developed database systems through exchange of opinions with other agencies which have developed and are operating their similar database systems.

## 9.11 Database Training Courses

### 9.11.1 Details of the database training courses

When the construction of the database had been almost completed, training courses were implemented for people in charge of database at MPI and provincial DPIs, with the aims of teaching the participants how to maintain and manage the database and raising their interest in operation, maintenance and management of the facilities constructed in SPL projects. In the courses, the participants were asked to use the constructed database on trial basis and to provide thoughts and opinion about the database. They were also asked to take part in the discussion on systems and methods of the database operation.

Each provincial DPI was requested to recommend two staff members for the training courses. The training courses were held in three areas, in the north (Yen Bai Province), in the central (Dak Lak Province) and in the south (Kien Giang Province), in order not to have too many participants at one venue, for better understanding of the training contents by participants. The details of the participants are summarized in Table 9.8-1 below.

**Table 9.11-1 Participants of the training courses**

| Venue/Date | Number of provinces | Number of participants | Participants' affiliation | Specialties of participants | Participants' ages |
|---|---|---|---|---|---|
| Buon Ma Thuot,<br>Dac Lak Province<br>September 7th, 2010 | 15 | 29 | DPI | Managerial (15)<br>Technical (1)<br>Administrative (2) | 20-30 (3)<br>30-40 (7)<br>>40 (10) |
| Rach Gia,<br>Kien Giang Province<br>September 10th, 2010 | 12 | 29 | DPI | Managerial (23)<br>Administrative (1) | 20-30 (5)<br>30-40 (7)<br>>40 (12) |
| Yen Bai,<br>Yen Bai Province<br>September 14th, 2010 | 21 | 44 | DPI | Managerial (27)<br>Technical (3) | 20-30 (6)<br>30-40 (7)<br>> 40 (14) |

The participants were divided into groups in the training courses. Table 9.11-2 below shows the program of the courses.

**Table 9.11-2 Program of the training courses**

| | Subject | Allocated time |
|---|---|---|
| 1 | Explanation of the outline of the constructed database | 30 minutes |
| 2 | Explanation on how to operate the database | 45 minutes |
| 3 | Practice on the database operation | 45 minutes |
| 4 | Group discussion | 60 minutes |
| 5 | Presentation of the outcomes of the group discussion and question-and-answer sessions on the presentation | 60 minutes |
| 6 | A question-and-answer session on the responses to the questionnaire | 45 minutes |
| | Total | 4 hours and 45 minutes |

The themes in the group discussion and the questions in the questionnaire mentioned in the table above are as follows:

The themes of the group discussion

(1) How to use the database

(2) What to expect from the database

(3) The best way to use the database continuously

(4) Expected problems associated with operation, maintenance and management of the database

(5) Suggestions for effective use of the database

Questionnaire

(6) Name of the affiliated organization

(7) Type of job (managerial, technical, administrative, etc.)

(8) Age

(9) Sex

(10) Evaluation of the level of understanding of the database

(11) Issues difficult to understand on the database

(12) Things required for the use of the database

(13) Comments and suggestions after using the database

### 9.11.2 Opinions Expressed in the Group Discussion and Responses to the Questionnaire

All the participants responded to Question (10) in the questionnaire that they had "understood" the database. However, for example, responses of 18 out of 23 participants to Theme (1) were on how to use data in the databases, *e.g.* "to use data in SPL projects" and "to use technical data for the operation and maintenance (O & M)," instead of how to use the database itself. Since these responses suggest that the respondents are not concerned with data sources (one can obtain the same data from relevant documents, instead of the database), they cause concern over the level of understanding of the database by the participants.

Many participants expressed similar views on Theme (1) - (5) in the group discussion and Questions (12) and (13) in the questionnaire. Therefore, after excluding some opinions and responses, such as "to use data," considered not consistent with the objectives of the training courses, in which the use of data was a precondition, the Survey Team classified the remaining 147 opinions and responses. Table 9.11-3 below shows the results of the classification. The Survey Team uses the phrase "Point of opinion" in the table to describe the main points of the expressed opinions and responses. The tables at the end of this chapter list all the opinions and responses classified in accordance with the "point of opinion" in Table 9.11-3.

**Table 9.11-3 Summary of the opinions expressed in the group discussion and Responses to the questionnaire**

| Subject of participants' opinions | Point of participants' opinions | Number of responses |
|---|---|---|
| Opinions on the database operation | Establishment of an organizational framework for the database operation | 29 |
| | Budgetary measures and human resources | 26 |
| | Guarantee of maintenance and update of the database | 19 |
| | Need to train personnel concerned | 17 |
| | Information sharing among personnel concerned | 14 |
| Purposes of the database use | Assistance to management works | 14 |
| | Assistance to the operation, maintenance and management (OM/M) | 8 |
| | Assistance to project implementation | 7 |
| | Assistance to project formulation | 1 |
| Opinions on database construction | Request to make the database easy and simple to use | 5 |
| | Improvement of the database | 3 |
| | Application of the database to other projects | 3 |
| | Integration with other databases | 1 |
| | Total | 147 |

As shown in the table above, the main interests of the participants of the training courses are in "establishment of an organizational framework among the central and local governments and the operation, maintenance and management (OM/M) organizations" and "budgetary and human resources," issues expected from the database operation. The table also includes "need to train personnel concerned" and "information sharing among personnel concerned." In a wider sense, the former can be considered as an issue of human resources and the latter as an issue of organizational framework. Therefore, more than 60 % of the opinions expressed were concerned with establishment of an organizational framework and budgetary and human resources.

It is considered that, since the participants were from DPIs, they gave responses assuming database operation at their places of work. Nonetheless, since the issue of sufficient human resources is one of the issues to be solved when operating databases, the Survey Team recommends that the outlines of the capacities required for the human resources and the contents of the training required for developing such capacities (in principle, on-the-job training is assumed) should be formulated through implementation of the database operation on trial basis, described below.

### 9.11.3 Database Operation on Trial Basis

The collected data and information were used in constructing the database in this survey. Each operation, maintenance and management (OM/M) organization will have to not only improve and expand the database but also facilitate its use. Therefore, each operation, maintenance and management (OM/M) organization will have to consider ways to use the database in accordance with its facilities and the mode of their operation. During the process mentioned above, it may turn out that it is necessary to add new data items to the database. There may also be a possibility for an organization to modify the database structure into its own structure.

For the reasons mentioned above, it seems necessary to select several existing projects in each sector, identify requests from the projects and operate the database practically on trial basis in several provinces. This process is considered essential for acquisition of the understanding that the database and a system for database use are different and data are to be accumulated by each operation, maintenance and management (OM/M) organization while it is performing its duties. This process will also enable personnel concerned to have more concrete idea on the contents of “the opinions expressed in the group discussion and responses to the questionnaire” in the training courses mentioned above.

# Appendix

## General

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## Database

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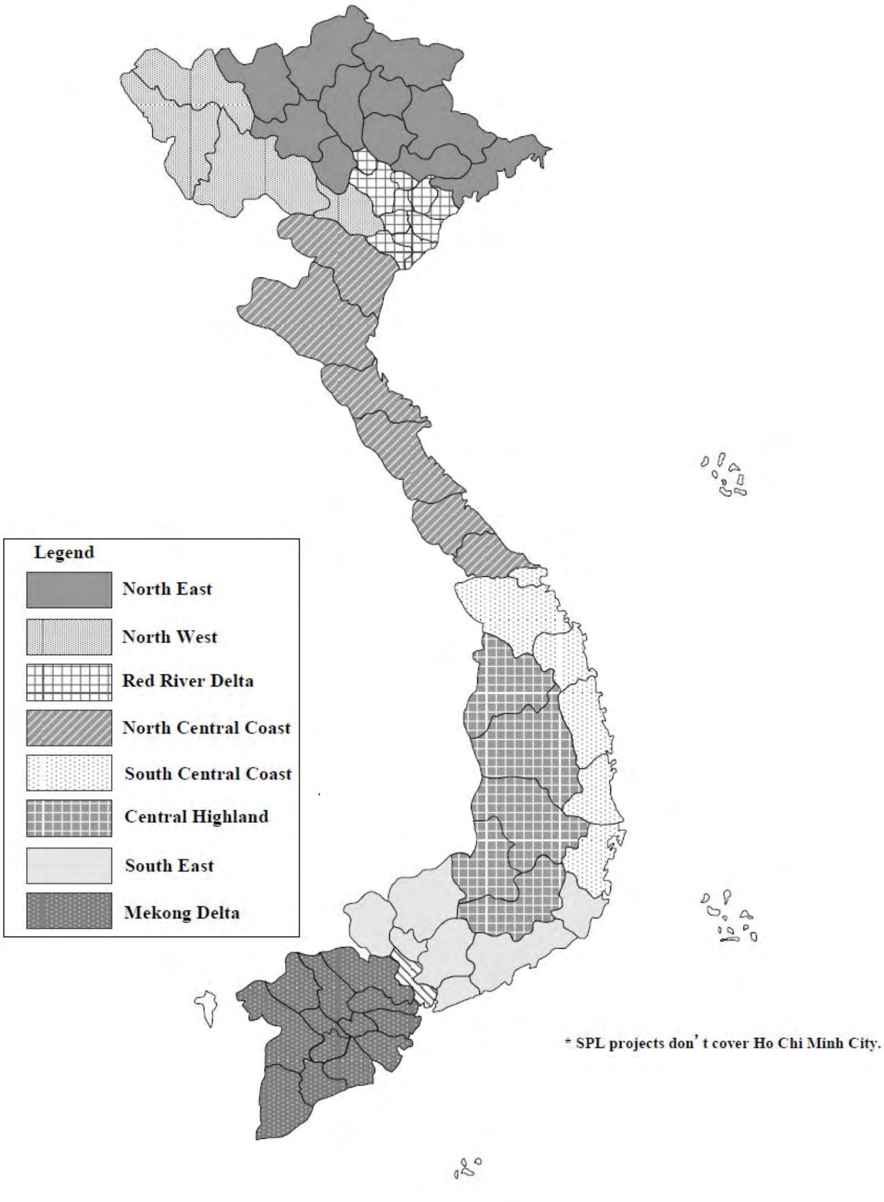
# General

# Appendix 1.1 Region and Provinces

| Region | Province |
|---|---|
| North East | Ha Giang |
| | Cao Bang |
| | Lao Cai |
| | Tuyen Quang |
| | Bac Kan |
| | Lang Son |
| | Yen Bai |
| | Thai Nguyen |
| | Phu Tho |
| | Bac Giang |
| | Quang Ninh |
| North West | Lai Chau |
| | Dien Bien |
| | Son La |
| | Hoa Binh |
| Red River Delta | Vinh Phuc |
| | Bac Ninh |
| | Ha Noi |
| | Hai Duong |
| | Hung Yen |
| | Hai Phong |
| | Thai Binh |
| | Ha Nam |
| | Nam Dinh |
| | Ninh Binh |
| North Central Coast | Thanh Hoa |
| | Nghe An |
| | Ha Tinh |
| | Quang Binh |
| | Quang Tri |
| | Thua-Thien Hue |
| South Central Coast | Da Nang |
| | Quang Nam |
| | Quang Ngai |
| | Binh Dinh |
| | Phu Yen |
| | Khanh Hoa |
| Central Highland | Kon Tum |
| | Gia Lai |
| | Dac Lak |
| | Dak Nong |
| | Lam Dong |
| South East | Ninh Thuan |
| | Binh Thuan |
| | Binh Phuoc |
| | Dong Nai |
| | Ba Ria Vung Tau |
| | Binh Duong |
| | Tay Ninh |
| Mekong Delta | Long An |
| | Tien Giang |
| | Ben Tre |
| | Dong Thap |
| | Vinh Long |
| | Tra Vinh |
| | An Giang |
| | Can Tho |
| | Hau Giang |
| | Soc Trang |
| | Kien Giang |
| | Bac Lieu |
| | Ca Mau |



# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 1 | MD | An Giang | NA | Road | SPL I | Provincial Road No.956 |
| 2 | MD | An Giang | NA | Road | SPL I | Le Hong Phong Street |
| 3 | MD | An Giang | NA | Road | SPL II | Provincial Road No.941 |
| 4 | MD | An Giang | Tri Ton | Road | SPL III | Road 17 |
| 5 | MD | An Giang | Phu Tan | Electricity | SPL I | Hoa Lac-Phu Hiep Commune Electric |
| 6 | MD | An Giang | Phu Tan | Electricity | SPL I | Phu Thanh-Phu Long Electric Network |
| 7 | MD | An Giang | An Phu | Electricity | SPL I | Da Phuoc-Phuoc Quan Electric Network |
| 8 | MD | An Giang | An Phu | Electricity | SPL I | Khanh Binh-Nga 3 Dinh Electric Network |
| 9 | MD | An Giang | An Phu | Electricity | SPL I | Nhon Hoi-Ca Coi Electric Network |
| 10 | MD | An Giang | Thoai Son | Electricity | SPL I | Nui Sap Electric Network |
| 11 | MD | An Giang | Thoai Son | Electricity | SPL II | Vinh Thang-Vinh Khanh Commune |
| 12 | MD | An Giang | Phu Tan | Electricity | SPL II | Binh Thanh Dong-Tay Commune Electric |
| 13 | MD | An Giang | An Phu | Electricity | SPL II | 15-22KV, Phuoc Hung-Chua Co-Cau S |
| 14 | MD | An Giang | Chau Thanh | Electricity | SPL II | Vinh Loi-Vinh Thuan Electric Network |
| 15 | MD | An Giang | Cho Moi | Electricity | SPL II | Long Thuong-Kien An Commune Electric |
| 16 | MD | An Giang | Cho Moi | Electricity | SPL II | 15-22KV Kien An |
| 17 | MD | An Giang | Thoai Son | Electricity | SPL III | Vinh Khanh-Kenh Dao Commune Electric |
| 18 | MD | An Giang | Phu Tan | Electricity | SPL III | Kenh K16-Phu Thanh Commune Electric |
| 19 | MD | An Giang | An Phu | Electricity | SPL III | Nga 3 Dinh Ca Coi Commune Electric |
| 20 | MD | An Giang | Phu Tan | Electricity | SPL III | Phu An-Phu Xuan Commune Electric Line |
| 21 | MD | An Giang | Tri Ton | Water Supply | SPL III | Tri Ton WSS |
| 22 | SE | Ba Ria Vung Tau | NA | Road | SPL II | Road No.329 |
| 23 | SE | Ba Ria Vung Tau | Chau Duc | Road | SPL II | Provincial Road No.765 |
| | | | | | SPL III | Road 765 |
| 24 | SE | Ba Ria Vung Tau | Long Dat | Electricity | SPL III | Long Dat Distric Electric Line |
| 25 | SE | Ba Ria Vung Tau | Chau Duc | Electricity | SPL III | Chau Duc Distric Electric Line |
| 26 | SE | Ba Ria Vung Tau | Xuyen Moc | Electricity | SPL III | Xuyen Moc Distric Electric Line |
| 27 | SE | Ba Ria Vung Tau | Tan Thanh | Electricity | SPL III | Tan Thanh Distric Electric Line |
| 28 | NE | Bac Giang | Bac Giang City | Road | SPL I | Urban Road of Bac Giang, 10 Roads |
| 29 | NE | Bac Giang | Hiep Hoa | Road | SPL I | Road No.296 (Thang - Vat) |
| 30 | NE | Bac Giang | Yen The | Road | SPL I | Road No.268 (Bo Ha - Mo Tang) |
| | | | | | SPL I | Road No.268 (Mo Tang - Bo Ha) |
| 31 | NE | Bac Giang | Bac Giang City | Road | SPL II | Bac Giang Town Road, 2 Streets |
| 32 | NE | Bac Giang | NA | Road | SPL II | Vat Bridge |
| 33 | NE | Bac Giang | NA | Road | SPL II | Provincial Road No.284 |
| 34 | NE | Bac Giang | Bac Giang City | Road | SPL II | Bac Giang Town Road, 3 Streets |
| 35 | NE | Bac Giang | Son Dong | Road | SPL III | Yen Dinh-Thanh Luan Road |
| | | | | | SPL V | Yen Dinh - Thanh Luan Road |
| 36 | NE | Bac Giang | Son Dong | Electricity | SPL I | Tuan Dao Commune Electric Commune |
| 37 | NE | Bac Giang | Yen The | Electricity | SPL I | Tuan Soi Commune Electric Commune |
| 38 | NE | Bac Giang | Hiep Hoa | Electricity | SPL I | Danh Thang Commune Electric Commune |
| 39 | NE | Bac Giang | Yen Dung | Electricity | SPL I | Dong Phuc Commune Electric Commune |
| 40 | NE | Bac Giang | Luc Ngan | Electricity | SPL I | Phuong Son Commune Electric Commune |
| 41 | NE | Bac Giang | Luc Nam | Electricity | SPL I | Kham Lang Commune Electric Commune |
| 42 | NE | Bac Giang | Luc Nam | Electricity | SPL I | Dan Hoi Commune Electric Commune |
| 43 | NE | Bac Giang | Yen The | Electricity | SPL I | Tam TIen Commune Electric Commune |
| 44 | NE | Bac Giang | Yen The | Electricity | SPL I | Canh Nau Commune Electric Commune |
| 45 | NE | Bac Giang | Lang Giang | Electricity | SPL I | Quang Thinh Commune Electric Commune |
| 46 | NE | Bac Giang | Tan Yen | Electricity | SPL I | Lien Son Commune Electric Commune |
| 47 | NE | Bac Giang | Yen Dung | Electricity | SPL I | Neo Town Commune Electric Commune |
| 48 | NE | Bac Giang | Hiep Hoa | Electricity | SPL I | Huong Lam Commune Electric Commune |
| 49 | NE | Bac Giang | Yen The | Electricity | SPL II | Dong Vuong Commune Electric Line |
| 50 | NE | Bac Giang | Luc Ngan | Electricity | SPL II | Tan Moc Commune Electric Line |
| 51 | NE | Bac Giang | Son Dong | Electricity | SPL II | An Chau Commune Electric Line |
| 52 | NE | Bac Giang | Viet Yen | Electricity | SPL II | Van Ha Commune Electric Line |
| 53 | NE | Bac Giang | Luc Nam | Electricity | SPL II | Yen Son Commune Electric Line |
| 54 | NE | Bac Giang | Luc Nam | Electricity | SPL III | Truong Son Commune Electric Line |
| 55 | NE | Bac Giang | Yen Dung | Electricity | SPL III | Tan Lieu Commune Electric Line |
| 56 | NE | Bac Giang | Luc Ngan | Electricity | SPL III | Tam Lap Commune Electric Line |
| 57 | NE | Bac Giang | Son Dong | Electricity | SPL III | Que Son Commune Electric Line |
| 58 | NE | Bac Giang | Luc Nam | Electricity | SPL V | Truong Son Commune Electric Line |
| 59 | NE | Bac Giang | Son Dong | Water Supply | SPL V | An Chau Town WSS |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

## Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 60 | NE | Bac Giang | Luc Ngan | Irrigation | SPL V | Khuon Than Reservoir |
| 61 | NE | Bac Kan | Bac Kan Town | Road | SPL I | Urban Road in Bac Kan Town |
| 62 | NE | Bac Kan | Na Ri | Road | SPL I | Road No.256 (km19-km38) |
| | | | | | SPL II | Road No.256 |
| 63 | NE | Bac Kan | NA | Road | SPL I | Pho Moi Road |
| 64 | NE | Bac Kan | Ba Be | Road | SPL II | Road No.258, Bach Thong-Ba Be Road |
| 65 | NE | Bac Kan | Pac Nam | Road | SPL II | Boc Bo-Cong Bang Road |
| | | | | | SPL III | Boc Bo-Cong Bang Road |
| 66 | NE | Bac Kan | Na Ri | Road | SPL III | Quang Phong-Dong Xa Road |
| 67 | NE | Bac Kan | Pac Nam | Road | SPL III | Ban Khua - Ban Man Road |
| 68 | NE | Bac Kan | Bac Kan, Cho Moi | Road | SPL IV | Nong Ha - Thanh Van Road |
| 69 | NE | Bac Kan | Ngan Son | Road | SPL IV | Van Tung- Thuan Mang Road |
| 70 | NE | Bac Kan | Pac Nam | Road | SPL V | Cong Bang - Co Linh Road |
| 71 | NE | Bac Kan | Cho Don | Road | SPL V | Bang Lung - Dai Sao Road |
| 72 | NE | Bac Kan | Na Ri | Electricity | SPL I | Kim Lu-Na Ri Commune Electric Line |
| 73 | NE | Bac Kan | Cho Don | Electricity | SPL II | 6 Communes in Cho Don Town Electric |
| 74 | NE | Bac Kan | Cho Don | Electricity | SPL III | Electric Network in Southern of Cho Don |
| 75 | NE | Bac Kan | Cho Don | Electricity | SPL III | Phuong Vien-Ra Ban Commune Electric |
| 76 | NE | Bac Kan | Pac Nam | Electricity | SPL V | Pac Nam Commune Electric Network |
| 77 | NE | Bac Kan | Cho Moi | Water Supply | SPL IV | Yen Han WSS |
| 78 | NE | Bac Kan | Pac Nam | Irrigation | SPL IV | Phieng Luong Irrigation System |
| 79 | NE | Bac Kan | Cho Don | Irrigation | SPL IV | Cho Don Distric Irrigation System |
| 80 | NE | Bac Kan | Cho Moi | Irrigation | SPL V | Cho Moi Irrigation System |
| 81 | MD | Bac Lieu | Bac Lieu Town | Road | SPL I | Hiep Thanh - Xiem Can Road |
| | | | | | SPL II | Hiep Thanh - Xiem Can Road |
| 82 | MD | Bac Lieu | Vinh Loi | Road | SPL III | National Road No.1A-Chau Thoi Road |
| 83 | MD | Bac Lieu | Hong Dan | Road | SPL IV | Xeo Quao - Thong Nhat Road |
| 84 | MD | Bac Lieu | Hong Dan | Road | SPL V | Thong Nhat Road No II |
| 85 | MD | Bac Lieu | Gia Rai | Electricity | SPL I | Phong Thanh Dong Commune Electric |
| 86 | MD | Bac Lieu | Vinh Loi | Electricity | SPL II | Chau Thoi Commune Electric Line |
| 87 | MD | Bac Lieu | Vinh Loi | Electricity | SPL III | Vinh Thinh Commune Electric Line |
| 88 | MD | Bac Lieu | Bac Lieu Town | Electricity | SPL III | Vinh Trach Commune Electric Line |
| 89 | MD | Bac Lieu | Hong Dan | Electricity | SPL III | Vinh Phu Tay Commune Electric Line |
| 90 | MD | Bac Lieu | Hong Dan | Electricity | SPL III | Ninh Hoa Commune Electric Line |
| 91 | MD | Bac Lieu | Hong Dan | Water Supply | SPL V | Ngan Dua WSS |
| 92 | MD | Bac Lieu | Vinh Loi | Irrigation | SPL V | Irrigation in 30/4 Area of Chua Phat |
| 93 | RRD | Bac Ninh | Bac Ninh City | Road | SPL I | Urban Road (Bac Ninh Town) |
| 94 | RRD | Bac Ninh | Tam Giang | Road | SPL I | Cho - Tam Giang Road |
| 95 | RRD | Bac Ninh | Gia Binh | Road | SPL I | Lang Ngan - Van Thai Road |
| 96 | RRD | Bac Ninh | Que Vo | Road | SPL I | Road No.291 (Pho Moi) |
| 97 | RRD | Bac Ninh | Bac Ninh City | Road | SPL II | Central Road in Bac Ninh Town |
| 98 | RRD | Bac Ninh | NA | Road | SPL II | Road No.270, Tien Son |
| 99 | RRD | Bac Ninh | NA | Road | SPL II | Road No.286 |
| 100 | RRD | Bac Ninh | Gia Binh, Luong Tai | Road | SPL II | Bach Mon-Lac Ve Road |
| | | | | | SPL III | Bach Mon-Lac Ve Road |
| 101 | RRD | Bac Ninh | Tien Du | Road | SPL III | Provincial Road No.280 (Nui Dong Binh, |
| 102 | RRD | Bac Ninh | Yen Phong | Electricity | SPL I | Yen Phong Electric Line |
| 103 | RRD | Bac Ninh | Yen Phong | Electricity | SPL I | Phong Khe Electric Line |
| 104 | RRD | Bac Ninh | Gia Binh | Electricity | SPL I | Giang Son Electric Line |
| 105 | RRD | Bac Ninh | Que Vo | Electricity | SPL II | Pho Moi Electric Network |
| 106 | RRD | Bac Ninh | NA | Electricity | SPL II | Van Tuong Commune Electric Commune |
| 107 | RRD | Bac Ninh | Luong Tai | Electricity | SPL II | Trung Xa Commune Electric Commune |
| 108 | RRD | Bac Ninh | NA | Electricity | SPL II | Vu Ninh Commune Electric Commune |
| 109 | RRD | Bac Ninh | Thuan Thanh | Electricity | SPL II | Ho Town Commune Electric Commune |
| 110 | RRD | Bac Ninh | Luong Tai | Water Supply | SPL III | Luong Tai WSS |
| 111 | MD | Ben Tre | NA | Road | SPL I | Provincial Road No.884 |
| | | | | | SPL I | Provincial Road No.884 |
| | | | | | SPL II | Provincial Road No.884 |
| 112 | MD | Ben Tre | Ba Tri | Road | SPL III | Provincial Road No.885 |
| 113 | MD | Ben Tre | Binh Dai | Road | SPL IV | Provincial Road No.883 |
| 114 | MD | Ben Tre | Thanh Phu | Electricity | SPL I | An Diem Electric Network |
| 115 | MD | Ben Tre | NA | Electricity | SPL II | Con Linh Commune Electric Network |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 116 | MD | Ben Tre | Cho Lach | Electricity | SPL III | Phu Da Commune Electric Line |
| 117 | MD | Ben Tre | Chau Thanh | Electricity | SPL III | Con Tien Loi Commune Electric Line |
| 118 | MD | Ben Tre | Binh Dai | Electricity | SPL III | Long Hoa Commune Electric Line |
| 119 | SCC | Binh Dinh | Binh Dinh City | Road | SPL I | Urban Road (Tang Bat Ho Road) |
| 120 | SCC | Binh Dinh | Binh Dinh City | Road | SPL I | Urban Road (Ngo Gia Tu Road, Binh Dinh |
| 121 | SCC | Binh Dinh | Binh Dinh City | Road | SPL I | Nguyen Hue A Road |
| 122 | SCC | Binh Dinh | NA | Road | SPL II | Quy Nhon - Song Cau Road |
| 123 | SCC | Binh Dinh | NA | Road | SPL II | Kien My Bridge |
| 124 | SCC | Binh Dinh | Phu My | Road | SPL V | Van An - Phu Thu Road |
| 125 | SCC | Binh Dinh | Van Canh | Electricity | SPL I | Canh Nghiep-Canh Hoa-Canh Thuan |
| 126 | SCC | Binh Dinh | Tay Son | Electricity | SPL I | Vinh An Commune Electric |
| 127 | SCC | Binh Dinh | Phu Cat | Electricity | SPL I | Cat Lam-Cat Nghiep Electric |
| 128 | SCC | Binh Dinh | Phu Cat | Electricity | SPL II | Cat Thanh Commune Electric Line |
| 129 | SCC | Binh Dinh | Hoai An | Electricity | SPL II | An Hao Commune Electric Line |
| 130 | SCC | Binh Dinh | Hoai Nhon | Electricity | SPL II | Hoai Hai Commune Electric Line |
| 131 | SCC | Binh Dinh | Phu Cat | Electricity | SPL III | Cat Hai Commune Electric Line |
| 132 | SCC | Binh Dinh | Tay Son | Electricity | SPL III | Binh Thuan Commune Electric Line |
| 133 | SCC | Binh Dinh | Phu My | Electricity | SPL III | My Tai Commune Electric Line |
| 134 | SCC | Binh Dinh | Tay Son | Electricity | SPL III | Tay Phu Commune Electric Line |
| 135 | SCC | Binh Dinh | Vân Canh | Electricity | SPL V | Medium and low voltage electrical line in |
| 136 | SCC | Binh Dinh | Tay Son | Water Supply | SPL V | Phu Phong Town WSS |
| 137 | SCC | Binh Dinh | An Nhon | Irrigation | SPL III | Tan An-Dap Da Irrigation System |
| 138 | SCC | Binh Dinh | Phu Cat | Irrigation | SPL V | Upgrade Tam Son Reservoir |
| 139 | SCC | Binh Dinh | Phu My | Irrigation | SPL V | Suoi So Reservoir |
| 140 | SCC | Binh Dinh | Phu My | Irrigation | SPL V | Chi Hoa 2 Reservoir |
| 141 | SE | Binh Duong | Tan Uyen | Road | SPL II | Provincial Road 742, Phu Chanh - Cong |
| 142 | SE | Binh Duong | Dau Tieng | Electricity | SPL II | Thanh An-Dinh Hiep Electric Network |
| 143 | SE | Binh Duong | Tan Uyen | Electricity | SPL II | Tan Phuoc Khanh Town Electric Line |
| 144 | SE | Binh Duong | Dau Tieng | Electricity | SPL III | Long Tan Commune Electric Line |
| 145 | SE | Binh Duong | Dah Hoai | Electricity | SPL III | Da Ton Commune Electric Line |
| 146 | SE | Binh Phuoc | NA | Road | SPL I | Road No.741 |
| | | | | | SPL II | Road No.741, Dong Xoai - Thuan Loi |
| 147 | SE | Binh Phuoc | Phuoc Long | Road | SPL II | Town Road Phuoc Long District (Thac Mo |
| 148 | SE | Binh Phuoc | Phuoc Long | Road | SPL II | Song Be Bridge on PR 749 Road |
| | | | NA | | SPL III | Provincial Road No.749 |
| | | | Phuoc Long | | SPL III | Song Be Bridge on PR 749 Road |
| 149 | SE | Binh Phuoc | Dong Phu, Binh Long | Road | SPL V | Dong Phu - Binh Long Road |
| 150 | SE | Binh Phuoc | Phuoc Long | Electricity | SPL I | Dinh Thang Electric |
| 151 | SE | Binh Phuoc | Phuoc Long | Electricity | SPL II | Binh Thang Commune Electric Line |
| 152 | SE | Binh Phuoc | Loc Ninh | Electricity | SPL II | Loc Tan-Thanh Luong Commune Electric |
| 153 | SE | Binh Phuoc | Du Dang | Electricity | SPL III | Duc Lieu Commune Electric Line (stage 1) |
| 154 | SE | Binh Phuoc | Binh Long | Electricity | SPL III | Phuoc An Commune Electric Line (Stage1) |
| 155 | SE | Binh Phuoc | Binh Long | Electricity | SPL III | Thanh Luong Commune Electric Line |
| 156 | SE | Binh Phuoc | Phuoc Long | Electricity | SPL V | Long Hung Commune Electric Line |
| 157 | SE | Binh Thuan | Tanh Linh | Road | SPL I | Ba Ta - Gia Huynh Road |
| 158 | SE | Binh Thuan | Ham Thuan Bac | Road | SPL I | An Lam - Dong Giang - La Da Road |
| 159 | SE | Binh Thuan | Tuy Phong | Road | SPL I | Lien Son - Phan Dung Road |
| | | | | | SPL III | Phong Phu-Phan Dung Road |
| | | | | | SPL III | Lien Huong-Phan Dung Road |
| 160 | SE | Binh Thuan | Tanh Linh, Duc Linh | Road | SPL II | Lac Tanh - Vo Xu Road |
| 161 | SE | Binh Thuan | Phan Thiet | Road | SPL II | Phan Thiet - Ke Ga Road |
| 162 | SE | Binh Thuan | Phan Thiet | Electricity | SPL I | Long Son-Suoi Nuoc Electric Network |
| 163 | SE | Binh Thuan | Ham Tan | Electricity | SPL I | 46-Song Han Electric Network |
| 164 | SE | Binh Thuan | NA | Electricity | SPL I | Km32-Ta Mon Electric Network |
| 165 | SE | Binh Thuan | NA | Electricity | SPL I | Thon 1-Co Khe-Trade Center Electric |
| 166 | SE | Binh Thuan | Phan Thiet | Electricity | SPL II | Long Son-Suoi Nuoc Electric Network |
| 167 | SE | Binh Thuan | Ham Tan | Electricity | SPL II | Nga Ba 46-Song Phan Electric Line |
| 168 | SE | Binh Thuan | NA | Electricity | SPL II | Tra Mon Km32 Electric Line |
| 169 | SE | Binh Thuan | NA | Electricity | SPL II | Koke-KTM Electric Line |
| 170 | SE | Binh Thuan | Phan Thiet | Electricity | SPL II | Ham Tien-Bau Me Commune Electric Line |
| 171 | SE | Binh Thuan | NA | Electricity | SPL II | Bau Me-Bau Tang Commune Electric Line |
| 172 | SE | Binh Thuan | Ham Tan | Electricity | SPL II | Tan Thang Commune Electric Line |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 173 | SE | Binh Thuan | Ham Tan | Electricity | SPL III | Can Cu 6-Ham Tan Electric Line 22KV |
| 174 | SE | Binh Thuan | Phan Thiet | Electricity | SPL III | Long Sim-Suoi Nuoc Electric Line 22KV |
| 175 | SE | Binh Thuan | Ham Tan | Electricity | SPL III | Tan Thang KTM Commune Electric Line |
| 176 | SE | Binh Thuan | Ham Thuan Bac | Electricity | SPL III | Ham Duc-Duong Tieu Electric Line 22KV |
| 177 | MD | Ca Mau | Ca Mau City | Road | SPL I | Urban Road (Phuong Tam) |
| 178 | MD | Ca Mau | Ca Mau City | Road | SPL I | Phan Boi Chau Road |
| 179 | MD | Ca Mau | Ca Mau City, Tac Thu | Road | SPL II | Ngo Quyen Road (Ca Mau - Tac Thu) |
| 180 | MD | Ca Mau | Tran Van Thoi | Road | SPL III | Tac Thu-Rach Rang Road |
| | | | | | SPL III | Nong Truong Bridge (Tac Thu - Rach Rang |
| | | | | | SPL V | Bridges & culvert on Tac Thu - Rach Rang |
| 181 | MD | Ca Mau | Cai Nuoc | Electricity | SPL I | Cai Nuoc-Dam Thi Tuong Electric |
| 182 | MD | Ca Mau | U Minh, Khanh Hoi | Electricity | SPL II | Khanh Lam Commune Electric Line |
| 183 | MD | Ca Mau | Dam Doi | Electricity | SPL III | Tan Thuan Commune Electric Line |
| 184 | MD | Ca Mau | Phu Tan | Electricity | SPL III | Phu My Commune Electric Line |
| 185 | MD | Ca Mau | Nam Can | Electricity | SPL III | Dat Moi Commune Electric Line |
| 186 | MD | Ca Mau | Thoi Binh, Ung Minh, | Electricity | SPL V | Electric Network in Ca Mau Forest and |
| 187 | MD | Ca Mau | Tram Van Thoi | Water Supply | SPL V | Song Doc WSS (South) |
| 188 | MD | Ca Mau | Tram Van Thoi | Water Supply | SPL V | Song Doc WSS (North) |
| 189 | MD | Ca Mau | Phu Tan | Water Supply | SPL V | Cai Doi Vam Town WSS (South) |
| 190 | MD | Ca Mau | Phu Tan | Water Supply | SPL V | Cai Doi Vam Town WSS (North) |
| 191 | MD | Ca Mau | U Minh | Irrigation | SPL V | Lung Ranh Irrigation System |
| 192 | MD | Can Tho | Can Tho | Road | SPL I | Mau Than Road Upgrading |
| 193 | MD | Can Tho | Can Tho | Road | SPL I | Thirty April Road(Hoa Binh-Dau Sau) |
| | | | | | SPL II | Thirty April Road(Cau Tham Tuong- |
| 194 | MD | Can Tho | Can Tho | Road | SPL I | Urban Road of Can Tho city(15,000m2) |
| 195 | NE | Cao Bang | Ha Quang | Road | SPL I | Road No.203 |
| 196 | NE | Cao Bang | Thong Nong | Road | SPL II | Road No.204 |
| | | | Hoa An | | SPL II | Mo Sat Bridge (Road No.204) |
| 197 | NE | Cao Bang | Ha Lang | Road | SPL II | Road No.207 |
| | | | Quang Uyen-Ha Lang | | SPL III | Road 207 (Quang Yen-Ha Lang) |
| | | | Ha Lang | | SPL IV | Provincial Road No.207 (Ha Lang-Bang |
| 198 | NE | Cao Bang | Bao Lac | Road | SPL III | Ban Nga - Xuan Truong Commune Road |
| 199 | NE | Cao Bang | Trung Khanh | Road | SPL IV | Provincial Road No.213 (Trung Khanh - Po |
| 200 | NE | Cao Bang | Trung Khanh | Road | SPL IV | Trung Khanh - Kham Thanh - Phong Nam |
| 201 | NE | Cao Bang | Nguyen Binh | Road | SPL V | Hoa Tham - National Road No. 3 |
| 202 | NE | Cao Bang | Thach An | Road | SPL V | Kim Dong - Duc Thong Road |
| 203 | NE | Cao Bang | Hoa An | Electricity | SPL I | Be Trieu Electric Network |
| 204 | NE | Cao Bang | Hoa An | Electricity | SPL II | Be Trieu Electric Network |
| 205 | NE | Cao Bang | Tra Linh | Electricity | SPL II | Hung Quocs Electric Network |
| 206 | NE | Cao Bang | Quang Hoa | Electricity | SPL III | Ta Lung Electric Network |
| 207 | NE | Cao Bang | Trung Khanh | Electricity | SPL III | Dam Thuy Electric Network |
| 208 | NE | Cao Bang | Trung Khanh | Electricity | SPL IV | Kham Thanh Commune Electric Line |
| 209 | NE | Cao Bang | Quang Hoa | Electricity | SPL IV | Phuc Xen Commune Electric Line |
| 210 | NE | Cao Bang | Thach An | Electricity | SPL IV | Quang Trong-Canh Tan Commune Electric |
| 211 | NE | Cao Bang | Nguyen Binh | Electricity | SPL IV | Minh Tam Commune Electric Line |
| 212 | NE | Cao Bang | Hoa An | Electricity | SPL IV | Hong Viet Commune Electric Line |
| 213 | NE | Cao Bang | Hoa An | Electricity | SPL IV | Hung Dao Commune Electric Line |
| 214 | NE | Cao Bang | Hoa An | Electricity | SPL IV | Nguyen Hue Commune Electric Line |
| 215 | NE | Cao Bang | Phuc Hoa | Electricity | SPL V | Cat Dinh-Hong Dai Communes Electricity |
| 216 | NE | Cao Bang | Thong Nong | Irrigation | SPL V | Luong Thong Irrigation System |
| 217 | SCC | Da Nang | Da Nang City | Road | SPL I | Tieu La Road |
| 218 | SCC | Da Nang | Da Nang City | Road | SPL II | Tran Cao Van Road |
| 219 | SCC | Da Nang | Hoa Vang | Electricity | SPL I | Hoa Phong Commune Electric |
| 220 | SCC | Da Nang | Hoa Vang | Electricity | SPL II | Hoa Phu Commune Electric Line |
| 221 | SCC | Da Nang | Hoa Vang | Electricity | SPL II | Hoa Phong Commune Electric |
| 222 | SCC | Da Nang | Hoa Vang | Electricity | SPL III | Hoa Phat Commune Electric Line |
| 223 | SCC | Da Nang | Hoa Son | Electricity | SPL III | Electric Network and Transformer in Hoa |
| 224 | SCC | Da Nang | Hoa Son | Electricity | SPL III | Electric Network and Transformer in Hoa |
| 225 | SCC | Da Nang | Hoa Vang | Electricity | SPL III | Hoa Phong Commune Electric |
| 226 | CH | Dac Lak | NA | Road | SPL I | Road No.9 |
| | | | | | SPL III | Province Road 9 |
| 227 | CH | Dac Lak | Krong Pak | Road | SPL II | Phuoc An - Khue Ngoc Dien Road |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 228 | CH | Dac Lak | Ea Sup | Road | SPL II | Urban Road Ea Soup Town |
| 229 | CH | Dac Lak | Buon Don | Road | SPL II | Central Road Buon Don District |
| 230 | CH | Dac Lak | Eah Leo | Road | SPL III | Ea Khal - Ea Nam - Ea Wy Road |
| 231 | CH | Dac Lak | Krong Nang | Road | SPL IV | Krong Nang District to Phu Xuan |
| 232 | CH | Dac Lak | M'Drak | Road | SPL IV | Road D22 |
| 233 | CH | Dac Lak | Ea H'leo | Road | SPL V | Ea Wy - Cu Mot - Ea Khal Road |
| 234 | CH | Dac Lak | Ea H'leo | Road | SPL V | Dlieyang - Eahiao Inter-commune Road |
| 235 | CH | Dac Lak | Krong Buk | Electricity | SPL I | Ea-Drong Electric Network |
| 236 | CH | Dac Lak | NA | Electricity | SPL I | Dak-Rong Electric Network |
| 237 | CH | Dac Lak | Eah Leo | Electricity | SPL II | Eam Nang Commune Electric Line |
| 238 | CH | Dac Lak | Krong Bong | Electricity | SPL II | Hoa Le Commune Electric Line |
| 239 | CH | Dac Lak | Buon Don | Electricity | SPL II | Krong Na Commune Electric Line |
| 240 | CH | Dac Lak | Krong Nang | Electricity | SPL II | Phu Xuan Commune Electric Line |
| 241 | CH | Dac Lak | Krong Bong | Electricity | SPL III | Hoa Thanh Commune Electric Line |
| 242 | CH | Dac Lak | M'Drak | Electricity | SPL IV | Ia Rieng Commune Electric Line |
| 243 | CH | Dac Lak | Cu M'Gar | Electricity | SPL V | Electric Line in Highland Village Win Ea |
| 244 | CH | Dac Lak | Krong Buk | Water Supply | SPL I | Buon Ho Water Supply System |
| 245 | CH | Dac Lak | Cu M'Gar | Water Supply | SPL IV | Quang Phu WSS |
| 246 | CH | Dac Lak | Lak | Irrigation | SPL III | Buon Chua Irrigation System |
| 247 | CH | Dac Lak | Lak | Irrigation | SPL III | Nam Kar Dam |
| 248 | CH | Dac Lak | Krong Pak | Irrigation | SPL III | Ea Yeng Reservoir |
| 249 | CH | Dac Lak | Krong Ana | Irrigation | SPL IV | Ea Bin Irrigation System |
| 250 | CH | Dac Lak | NA | Irrigation | SPL V | Ho Ke Reservoir |
| 251 | CH | Dak Nong | Dak Nong Town | Road | SPL III | Gia Nghia - Quang Thanh Road |
| 252 | CH | Dak Nong | Dak Song | Road | SPL IV | Road No 6 |
| 253 | CH | Dak Nong | Dak Nong | Road | SPL V | Quang Khe - Dak Rmang Road |
| 254 | CH | Dak Nong | Dak Mil | Road | SPL V | Dak Mam - 7 station (PR No.3) |
| 255 | CH | Dak Nong | Buon Don | Electricity | SPL I | Buon Don Electric Network |
| 256 | CH | Dak Nong | Dak Mil | Electricity | SPL II | Dak Gan Commune Electric Line |
| 257 | CH | Dak Nong | Dak Nong | Electricity | SPL III | Truong Xuan Commune Electric Line |
| 258 | CH | Dak Nong | Dak Rlap | Electricity | SPL III | Nhon Co Commune Electric Line |
| 259 | CH | Dak Nong | Dak Nong | Irrigation | SPL III | Dak Mam Reservoir |
| 260 | CH | Dak Nong | Krong No | Irrigation | SPL V | Electric Pumping Station in Choah Village |
| 261 | NW | Dien Bien | Dien Bien | Road | SPL I | Road in East of Dien Bien |
| | | | | | SPL II | East Road of Dien Bien District |
| | | | | | SPL III | East Dien Bien Road |
| 262 | NW | Dien Bien | Dien Bien | Road | SPL II | West Road of Nam Rom River |
| | | | | | SPL III | Road in West of Nam Ron River |
| 263 | NW | Dien Bien | Dien Bien Dong | Road | SPL III | Na Son - Xa Dung Road |
| 264 | NW | Dien Bien | Dien Bien Dong | Road | SPL IV | Pu Nhi - Na Son Road |
| 265 | NW | Dien Bien | Tuan Giao | Road | SPL IV | Na Say - Muong Mun Road |
| | | | | | SPL IV | Na Say - Muong Thin - Muong Mun Road |
| 266 | NW | Dien Bien | Dien Bien Dong | Road | SPL IV | Phi Nhu - Xa Dung Road |
| 267 | NW | Dien Bien | Dien Bien Dong | Road | SPL V | Phi Nhu - Chieng So Road |
| 268 | NW | Dien Bien | Dien Bien | Electricity | SPL I | Dien Bien Electric Network |
| 269 | NW | Dien Bien | Tuan Giao | Water Supply | SPL III | Tuan Giao Water Supply System |
| 270 | NW | Dien Bien | Tua Chua | Water Supply | SPL IV | Tua Chua WSS |
| 271 | NW | Dien Bien | Muong Cha | Water Supply | SPL V | Muong Cha WSS |
| 272 | NW | Dien Bien | Dien Bien | Irrigation | SPL V | Huoi Un Irrigation System |
| 273 | SE | Dong Nai | NA | Road | SPL II | Intercommune Road No.16 |
| 274 | SE | Dong Nai | Dinh Quan | Road | SPL III | Traffic System NR20-Dong Nai River, Phu |
| 275 | MD | Dong Thap | NA | Road | SPL I | PR No.847(Thet - My An - Bang Lang Rd.) |
| 276 | MD | Dong Thap | Tam Nonh, Thanh Binh | Road | SPL II | Tam Nong - Thanh Binh Road |
| 277 | MD | Dong Thap | Lai Vung | Road | SPL III | Road No.851 |
| | | | | | SPL V | Provincial Road No. 851 (Km2 - |
| 278 | MD | Dong Thap | Binh Thanh | Electricity | SPL I | Binh Thanh Electric |
| 279 | MD | Dong Thap | Thap Muoi | Electricity | SPL I | Thanh My Electric Network |
| 280 | MD | Dong Thap | Lai Vung | Electricity | SPL II | Long Thang Commune Electric Line |
| 281 | MD | Dong Thap | Hong Ngu | Electricity | SPL II | Thuong Thoi Tuyen Commune Electric |
| 282 | MD | Dong Thap | Tam Nong | Electricity | SPL III | Phu Ninh Commune Electric Line |
| 283 | MD | Dong Thap | Lap Vo | Electricity | SPL III | Long Hung A Commune Electric Line |
| 284 | MD | Dong Thap | Tan Hong | Electricity | SPL III | Tan Thanh Commune Electric Line |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 285 | MD | Dong Thap | Chau Thanh | Electricity | SPL V | Electric Network in Tan Thuan Dong, Tan |
| 286 | MD | Dong Thap | Tam Nong | Water Supply | SPL V | An Long WSS |
| 287 | MD | Dong Thap | Tam Nong | Irrigation | SPL V | Upgrade Tam Nong Irrigation System |
| 288 | CH | Gia Lai | Gia Lai Town | Road | SPL I | Nguyen Trai - Nguyen Thai Hoc Road |
| 289 | CH | Gia Lai | An Khe, K bang | Road | SPL I | Provincial Road No.669 |
| | | | | | SPL II | Provincial Road No.669(An Khe - K.Bang) |
| 290 | CH | Gia Lai | Ayunpa | Road | SPL III | Ben Mong Bridge |
| 291 | CH | Gia Lai | Phu Thien/ Ia Pa | Road | SPL V | Chu A Thai - Ia - Ieng - Ia Pa Road |
| 292 | CH | Gia Lai | Dak Doa | Road | SPL V | Nam Yang - kon Gang Road |
| 293 | CH | Gia Lai | Chu Prong | Road | SPL V | Province Road 675(Km0-Km20) |
| 294 | CH | Gia Lai | Ia Pa | Road | SPL V | Inter-commune Road of Eastern of Ben |
| 295 | CH | Gia Lai | Duc Co | Electricity | SPL I | Ia-Doom Electric |
| 296 | CH | Gia Lai | Chu Se | Electricity | SPL I | Ia Blang Electric |
| 297 | CH | Gia Lai | Chu Prong | Electricity | SPL I | Ia Bang Electric |
| 298 | CH | Gia Lai | Chu Pah | Electricity | SPL II | Ia Phi Commune Electric Line |
| 299 | CH | Gia Lai | Chu Se | Electricity | SPL II | Ia Hop (Chu Se) Commune Electric Line |
| 300 | CH | Gia Lai | K Bang | Electricity | SPL II | Dakhlo (Kbang) Commune Electric Line |
| 301 | CH | Gia Lai | A Yun Pa | Electricity | SPL II | Chu Drang (Ayunpa) Commune Electric |
| 302 | CH | Gia Lai | Krongpa | Electricity | SPL III | Ea-Dreh Commune Electric Line |
| 303 | CH | Gia Lai | Duc Co | Electricity | SPL III | Eadok Commune Electric Line |
| 304 | CH | Gia Lai | Chu Prong | Electricity | SPL III | Ia Lau Commune Electric Line |
| 305 | CH | Gia Lai | Chu Prong | Electricity | SPL V | La Me Commune Electric Network |
| 306 | CH | Gia Lai | Chu Pah | Water Supply | SPL I | Chu Pah Water Supply System |
| 307 | CH | Gia Lai | Ia Grai | Water Supply | SPL V | Ia Kha Town WSS |
| 308 | CH | Gia Lai | Krongpa | Irrigation | SPL III | Cau hai Pump Station |
| 309 | CH | Gia Lai | Krongpa | Irrigation | SPL III | EaRsai Irrigation |
| 310 | CH | Gia Lai | Dak Doa | Irrigation | SPL V | Dak So Mei Irrigation |
| 311 | NE | Ha Giang | Ha Giang Town | Road | SPL I | Nguyen Thai Hoc Road |
| | | | | | SPL II | Nguyen Thai Hoc Road |
| 312 | NE | Ha Giang | Yen Minh-Meo Vac | Road | SPL I | Yen Minh - Mau Due - Meo Vac Road |
| | | | | | SPL II | Yen Minh - Mau Due - Meo Vac Road |
| 313 | NE | Ha Giang | Ha Giang Town | Road | SPL I | Ha Giang Town - Phu Linh Road |
| 314 | NE | Ha Giang | Ha Giang Town | Road | SPL II | Tran Phu Road |
| 315 | NE | Ha Giang | Bac Quang-Quang Binh | Road | SPL III | Vinh Tuy-Xuang Giang Road |
| 316 | NE | Ha Giang | Vi Xuyen-Bac Quang | Road | SPL IV | Bach Ngoc - Trung Thanh Triway - Dong |
| | | | Vi Xuyen | | SPL IV | Km 27 (NR 2) to Trung Thanh Bach Ngoc |
| 317 | NE | Ha Giang | Vi Xuyen | Road | SPL V | Road from Km21 bridge to crossing Bach |
| 318 | NE | Ha Giang | Vi Xuyen-Bac Quang | Road | SPL V | Upgrade and Pavement road from Trung |
| 319 | NE | Ha Giang | Dong Van-Meo Vac | Electricity | SPL II | Dong Van-Meo Vac Electric Line |
| 320 | NE | Ha Giang | Dong Van | Electricity | SPL II | Ma So-Lung Tao Commune Electric Line |
| 321 | NE | Ha Giang | Ha Giang Town | Electricity | SPL III | Ligh System of Ha Giang Town |
| 322 | NE | Ha Giang | Hoang Su Phi | Electricity | SPL III | Thang Tin Commune Electric Line |
| 323 | NE | Ha Giang | Hoang Su Phi | Electricity | SPL V | Then Chu Phin commune Electric Line |
| 324 | NE | Ha Giang | Bac Quang | Water Supply | SPL I | Bac Quang Water Supply |
| 325 | NE | Ha Giang | Vi Xuyen | Water Supply | SPL IV | Vi Xuyen Water Supply System |
| 326 | NE | Ha Giang | Hoang Su Phi | Water Supply | SPL V | Vinh Quang Town Water Supply System |
| 327 | NE | Ha Giang | Vi Xuyen | Irrigation | SPL V | Khuoi Lam-Khuoi Lac Irrigation System |
| 328 | RRD | Ha Nam | NA | Road | SPL I | Road No.63A |
| 329 | RRD | Ha Nam | NA | Road | SPL I | Road No.64 |
| | | | | | SPL II | Road No.64 |
| 330 | RRD | Ha Nam | NA | Road | SPL I | Road No.57A(485 Road) |
| 331 | RRD | Ha Nam | NA | Road | SPL I | Road No.62 |
| 332 | RRD | Ha Nam | NA | Road | SPL II | Chau Giang Bridge |
| 333 | RRD | Ha Nam | Thanh Liem | Road | SPL II | Road No.484, Thanh Liem |
| 334 | RRD | Ha Nam | NA | Road | SPL II | Road No.63B |
| | | | | | SPL III | Road No.63B |
| 335 | RRD | Ha Nam | Thanh Liem | Road | SPL II | Provincial Road No.9715 |
| | | | | | SPL III | Road No.9715 |
| 336 | RRD | Ha Nam | Binh Luc | Road | SPL III | Road No.63C |
| 337 | RRD | Ha Nam | NA | Electricity | SPL I | Vinh Tru Commune Electric Line |
| 338 | RRD | Ha Nam | Duy Tien | Electricity | SPL I | Hoa Mac Commune Electric Line |
| 339 | RRD | Ha Nam | Vu Ban, | Electricity | SPL I | Vu Ban Commune Electric Line |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 340 | RRD | Ha Nam | Thanh Liem | Electricity | SPL I | Kien Khe Commune Electric Line |
| 341 | RRD | Ha Nam | Binh Luc | Electricity | SPL I | Binh My Commune Electric Line |
| 342 | RRD | Ha Nam | Kim Bang | Electricity | SPL I | Nhat Tan Commune Electric Line |
| 343 | RRD | Ha Nam | Ly Nhan | Electricity | SPL II | Duc Ly Commune Electric |
| 344 | RRD | Ha Nam | Duy Tien | Electricity | SPL II | Chau Son Commune Electric |
| 345 | RRD | Ha Nam | Binh Luc | Electricity | SPL II | Hung Cong Commune Electric |
| 346 | RRD | Ha Nam | Ly Nhan | Electricity | SPL II | Dong Ly Commune Electric |
| 347 | RRD | Ha Nam | Kim Bang | Electricity | SPL II | Thuy Loi Commune Electric |
| 348 | RRD | Ha Noi (Ha Tay) | NA | Road | SPL I | Road No.89A (Da Chong - Che) |
| | | | | | SPL II | Road No.89A |
| 349 | RRD | Ha Noi (Ha Tay) | Phuc Tho | Road | SPL I | Cam Binh - Sen Chieu Road |
| 350 | RRD | Ha Noi (Ha Tay) | Quoc Oai | Road | SPL I | Quoc Oai - Hoa Thach Road |
| | | | | | SPL II | Quoc Oai - Hoa Thach Road |
| 351 | RRD | Ha Noi (Ha Tay) | Phuc Tho | Road | SPL I | Tho Loc Road |
| 352 | RRD | Ha Noi (Ha Tay) | NA | Road | SPL II | Road No.430 |
| 353 | RRD | Ha Noi (Ha Tay) | Dan Phuong | Road | SPL II | Tho An - Dan Phuong Road |
| 354 | RRD | Ha Noi (Ha Tay) | Dan Phuong | Road | SPL II | Provincial Road No.79 |
| | | | | | SPL III | Provincial Road No.79 |
| 355 | RRD | Ha Noi (Ha Tay) | Thanh Oai | Road | SPL III | Dan Hoa-Thanh Van Road |
| 356 | RRD | Ha Noi (Ha Tay) | Quoc Oai | Electricity | SPL I | Phu Man Commune Electric Line |
| 357 | RRD | Ha Noi (Ha Tay) | Son Tay Township | Electricity | SPL I | Duong Lam Commune Electric Line |
| 358 | RRD | Ha Noi (Ha Tay) | Than Uyen | Electricity | SPL I | Van Hoa Commune Electric Line |
| 359 | RRD | Ha Noi (Ha Tay) | Chuong My | Electricity | SPL I | Nam Phuong Tien Commune Electric Line |
| 360 | RRD | Ha Noi (Ha Tay) | Ba Vi | Electricity | SPL II | Ba Vi Commune Electric Line |
| 361 | RRD | Ha Noi (Ha Tay) | Chuong My | Electricity | SPL II | Nam Phuong Tien Commune Electric Line |
| 362 | RRD | Ha Noi (Ha Tay) | Thach That | Electricity | SPL II | Lien Quan Town Electric Line |
| 363 | RRD | Ha Noi (Ha Tay) | Thuong Tin | Electricity | SPL II | Hien Giang Electric Line |
| 364 | RRD | Ha Noi (Ha Tay) | Phu Xuyen | Water Supply | SPL III | Phu Xuyen WSS |
| 365 | NCC | Ha Tinh | NA | Road | SPL I | Provincial Road No.3 |
| 366 | NCC | Ha Tinh | NA | Road | SPL I | Xuan Hai - Xuan Hoi Road |
| 367 | NCC | Ha Tinh | Thach Ha | Road | SPL I | Provincial Road No.7 |
| | | | | | SPL II | Provincial Road No.7 |
| 368 | NCC | Ha Tinh | Huong Son | Road | SPL I | Nam - Son Tien Road |
| | | | | | SPL I | Nam - Son Tien Road |
| | | | | | SPL II | Nam - Son Tien Road |
| 369 | NCC | Ha Tinh | Ha Tinh Town | Road | SPL I | Urban Road 26/3 - Ha Tinh Town |
| 370 | NCC | Ha Tinh | Thach Ha | Road | SPL II | Thach Mon - Thach Dinh Road |
| 371 | NCC | Ha Tinh | Huong Son | Road | SPL III | Son Binh - Son Thuy - Son Mai Road |
| 372 | NCC | Ha Tinh | Cam Xuyen | Road | SPL IV | Cam Thach - Cam Thanh - Cam Binh - |
| 373 | NCC | Ha Tinh | Ky Anh | Road | SPL IV | Lam - Son-Thuong Road |
| 374 | NCC | Ha Tinh | Huong Khe | Road | SPL IV | Provincial Road No.18 |
| 375 | NCC | Ha Tinh | Duc Tho | Road | SPL IV | Road No. 28 |
| 376 | NCC | Ha Tinh | Huong Son | Road | SPL V | Son Phu - Son Phuc - Son An - Son Tien |
| 377 | NCC | Ha Tinh | Hong Linh | Road | SPL V | Road, bridge for Trung Luong cottage |
| 378 | NCC | Ha Tinh | Huong Son | Road | SPL V | Son Tra - Son Long Road |
| 379 | NCC | Ha Tinh | Huong Khe | Electricity | SPL I | Huong Khe Distric Electric Network |
| 380 | NCC | Ha Tinh | Huong Son | Electricity | SPL I | Huong Son Distric Electric Network |
| 381 | NCC | Ha Tinh | Thach Ha | Electricity | SPL I | Thach Ha Distric Electric Network |
| 382 | NCC | Ha Tinh | Thach Ha | Electricity | SPL I | Dai Nai-Ha Tinh Town Electric |
| 383 | NCC | Ha Tinh | Hong Linh | Electricity | SPL I | Hong Linh Electric |
| 384 | NCC | Ha Tinh | Ky Anh | Electricity | SPL I | Ky Tan-Ky Ha Electric |
| 385 | NCC | Ha Tinh | Duc Tho | Electricity | SPL I | Duc Tho Distric Electric Network |
| 386 | NCC | Ha Tinh | Can Loc | Electricity | SPL I | Can Loc Distric Electric Network |
| 387 | NCC | Ha Tinh | Cam Xuyen | Electricity | SPL I | Cam Xuyen Distric Electric Network |
| 388 | NCC | Ha Tinh | Nghi Xuan | Electricity | SPL I | Nghi Xuan Distric Electric Network |
| 389 | NCC | Ha Tinh | Thai Yen | Electricity | SPL I | Thai Yen Distric Electric Network |
| 390 | NCC | Ha Tinh | Huong Khe | Electricity | SPL II | Transformer 10KV Huong Xuan-Huong |
| 391 | NCC | Ha Tinh | Can Loc | Electricity | SPL II | Transformer 10KV Binh Loc-Thinh Loc |
| 392 | NCC | Ha Tinh | NA | Electricity | SPL II | Son Truong Commune Electric Line |
| 393 | NCC | Ha Tinh | Thach Ha | Electricity | SPL II | Thach Vinh Commune Electric Line |
| 394 | NCC | Ha Tinh | Thai Yen | Electricity | SPL II | Thai Yen Distric Electric Network |
| 395 | NCC | Ha Tinh | NA | Electricity | SPL II | Cay Town Electric Network |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 396 | NCC | Ha Tinh | Hong Linh | Electricity | SPL II | Hong Linh Commune Electric Line |
| 397 | NCC | Ha Tinh | Huong Son | Electricity | SPL II | Son Thuy-Le Thuy Commune Electric Line |
| 398 | NCC | Ha Tinh | Nghi Xuan | Electricity | SPL II | Xuan Thanh Commune Electric Line |
| 399 | NCC | Ha Tinh | Huong Son | Electricity | SPL II | Son Mai-Thanh Mai Electric Network |
| 400 | NCC | Ha Tinh | Ky Anh | Electricity | SPL IV | Ky Lam-Ky Thinh Commune Electric |
| 401 | NCC | Ha Tinh | Huong Son | Electricity | SPL IV | Son Bang-Son Thinh Commune Electric |
| 402 | NCC | Ha Tinh | Can Loc | Electricity | SPL IV | Quang Loc-My Loc Commune Electric |
| 403 | NCC | Ha Tinh | Cam Xuyen | Electricity | SPL IV | Cam Nhuong-Cam Due Commune Electric |
| 404 | NCC | Ha Tinh | Thach Ha | Electricity | SPL V | Thach Ha Distric Electric Network |
| 405 | NCC | Ha Tinh | Ky Anh | Water Supply | SPL I | Ky Anh Water Supply System |
| 406 | NCC | Ha Tinh | Ky Anh | Water Supply | SPL III | Vung An WSS |
| | | | | | SPL V | Ky Anh WSS |
| 407 | NCC | Ha Tinh | Vu Quang | Water Supply | SPL III | Vu Quang |
| 408 | NCC | Ha Tinh | Can Loc | Water Supply | SPL IV | Nghen Town WSS |
| 409 | NCC | Ha Tinh | Hong Linh | Water Supply | SPL V | Trung Luong Commune WSS (Pilot |
| 410 | NCC | Ha Tinh | Ky Anh | Irrigation | SPL III | Song Rac Irrigation |
| 411 | NCC | Ha Tinh | Can Loc | Irrigation | SPL IV | An Hung Dam |
| 412 | NCC | Ha Tinh | Huong Son | Irrigation | SPL IV | Cau Ke Dam |
| 413 | NCC | Ha Tinh | Ky Anh | Irrigation | SPL IV | Khe Coi Dam |
| 414 | NCC | Ha Tinh | Cam Xuyen | Irrigation | SPL IV | 19/5 Dam |
| 415 | NCC | Ha Tinh | Duc Tho | Irrigation | SPL IV | Lien Minh-Tung Chau Irrigation System |
| 416 | NCC | Ha Tinh | Huong Khe | Irrigation | SPL V | Huong Long-Huong Binh-Hoa Hai-Phu |
| 417 | RRD | Hai Duong | NA | Road | SPL I | Road No.191 |
| | | | | | SPL II | Road No.191, Tu Ky Road |
| 418 | RRD | Hai Duong | Gia Loc, Ninh Giang | Road | SPL I | Road No.17A (Gia Loc - Ninh Giang) |
| 419 | RRD | Hai Duong | NA | Road | SPL I | Road No.20B |
| 420 | RRD | Hai Duong | Kinh Mon | Road | SPL I | Phung Khac Road |
| | | | | | SPL III | Phung Khac Road |
| 421 | RRD | Hai Duong | Hai Duong City | Road | SPL II | Road in west of Hai Duong City |
| 422 | RRD | Hai Duong | Ninh Giang | Road | SPL II | Road No.210, Tu Giang |
| 423 | RRD | Hai Duong | Hai Duong City | Electricity | SPL I | Hai Duong Town Electric Network |
| 424 | RRD | Hai Duong | Ninh Giang | Electricity | SPL I | Ninh Giang District Electric Network |
| 425 | RRD | Hai Duong | Tu Ky | Electricity | SPL I | Tu Ky District Electric Network |
| 426 | RRD | Hai Duong | Thanh Ha | Electricity | SPL II | Thanh Ha District Electric Line |
| 427 | RRD | Hai Duong | Ninh Giang | Electricity | SPL II | Ninh Giang District Electric Line |
| 428 | RRD | Hai Duong | Binh Giang | Electricity | SPL II | Binh Giang District Electric Line |
| 429 | RRD | Hai Duong | Kinh Mon | Electricity | SPL II | Kinh Mon District Electric Line |
| 430 | RRD | Hai Duong | Hai Duong City | Electricity | SPL II | Light System of Hai Duong City |
| 431 | RRD | Hai Duong | Chi Linh | Water Supply | SPL III | Sao Do WSS |
| 432 | RRD | Hai Phong | Hai Phong City | Road | SPL I | Nguyen Trai Street (Hai Phong City) |
| 433 | RRD | Hai Phong | Kien Thuy, Do Son | Road | SPL I | Road No.401 (Kien Thuy - Do Son) |
| 434 | RRD | Hai Phong | Hai Phong City | Road | SPL I | Lach Tray Street (Hai Phong City) |
| 435 | RRD | Hai Phong | Vinh Bao | Road | SPL I | Road No.17 |
| 436 | RRD | Hai Phong | NA | Road | SPL I | Road No.404 |
| 437 | RRD | Hai Phong | NA | Road | SPL I | Road No.301 |
| 438 | RRD | Hai Phong | Kien Thuy | Road | SPL II | Provincial Road No.402 |
| | | | | | SPL III | Road No.402 |
| 439 | RRD | Hai Phong | Vinh Bao | Road | SPL III | Road No.17B |
| 440 | RRD | Hai Phong | Vinh Bao | Electricity | SPL II | Vinh Bao Town Electric Line |
| 441 | RRD | Hai Phong | Vinh Bao | Water Supply | SPL III | Vinh Bao WSS |
| 442 | MD | Hau Giang | Long My | Road | SPL V | Cao Hot Be Road |
| 443 | MD | Hau Giang | Long My | Electricity | SPL I | Vinh Vien Electric |
| 444 | MD | Hau Giang | Long My | Electricity | SPL II | Vinh Vien Electric |
| 445 | MD | Hau Giang | Long My | Electricity | SPL II | Long Binh Commune Electric Line |
| 446 | MD | Hau Giang | Long My | Electricity | SPL V | Electric Network in Long Phu-Phu Tri- |
| 447 | MD | Hau Giang | Vi Thanh | Water Supply | SPL III | Vi Thanh WSS |
| 448 | NW | Hoa Binh | Da Bac | Road | SPL I | Road No.433 |
| | | | | | SPL II | Road No.433 |
| | | | | | SPL III | Road 433 |
| | | | | | SPL IV | Road 433 |
| | | | | | SPL V | Road 433 (Km55-Km84) |
| 449 | NW | Hoa Binh | Hoa Binh City | Road | SPL I | Urban Road (Hoa Binh Town), 21Roads |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 450 | NW | Hoa Binh | Hoa Binh City | Road | SPL II | Hoa Binh Town Road |
| 451 | NW | Hoa Binh | Tan Lac | Road | SPL V | Tu Ne - Lo Son Road |
| 452 | NW | Hoa Binh | Mai Chau | Electricity | SPL I | Tan My Commune Electric Line |
| 453 | NW | Hoa Binh | NA | Electricity | SPL I | Lac Thinh Commune Electric Line |
| 454 | NW | Hoa Binh | Tan Lac | Electricity | SPL II | Phu Cuong Commune Electric Line |
| 455 | NW | Hoa Binh | Mai Chau | Electricity | SPL II | Tan My Commune Electric Line |
| 456 | NW | Hoa Binh | Luong Son | Electricity | SPL II | Nhan Trach Commune Electric Line |
| 457 | NW | Hoa Binh | Ky Son | Electricity | SPL II | Hop Thinh Commune Electric Line |
| 458 | NW | Hoa Binh | NA | Electricity | SPL II | Lac Thinh Commune Electric Line |
| 459 | NW | Hoa Binh | Tan Lac | Electricity | SPL III | Phu Cuong Commune Electric Line |
| 460 | NW | Hoa Binh | Lac Son | Electricity | SPL III | Van Son Commune Electric Line |
| 461 | NW | Hoa Binh | Kim Boi | Electricity | SPL III | Hop Kim Commune Electric Line |
| 462 | NW | Hoa Binh | Lac Son | Electricity | SPL V | Thien Chi-Lac Son Commune Electric Line |
| 463 | NW | Hoa Binh | Lac Thuy | Irrigation | SPL III | Phu Lao Reservoir |
| 464 | NW | Hoa Binh | Yen Thuy | Irrigation | SPL V | Ngoc Luong Reservoir |
| 465 | RRD | Hung Yen | NA | Road | SPL I | Road No.202 |
| 466 | RRD | Hung Yen | NA | Road | SPL I | Road No.205 |
| 467 | RRD | Hung Yen | An Thi, Tien Lu | Road | SPL I | Road No.200(My Van, An Thi, Tien Lu) |
| 468 | RRD | Hung Yen | Kim Dong, Khoai Chau | Road | SPL II | Road No.208A |
| 469 | RRD | Hung Yen | NA | Road | SPL II | Road No.203B, Cau Cap - Quan Thu Road |
| | | | Phu Cu, Tien Lu | | SPL III | Road No.203B |
| 470 | RRD | Hung Yen | NA | Road | SPL II | Road No.196 |
| 471 | RRD | Hung Yen | NA | Road | SPL II | Road No.195 |
| 472 | RRD | Hung Yen | Kim Dong, Khoai Chau | Road | SPL III | Road No.208 |
| 473 | RRD | Hung Yen | Kim Dong | Road | SPL III | Road No.61 |
| 474 | RRD | Hung Yen | NA | Road | SPL III | Road No.195, 201, 204 |
| 475 | RRD | Hung Yen | An Thi | Electricity | SPL I | An Thi Electric Line |
| 476 | RRD | Hung Yen | Phu Cu | Electricity | SPL I | Phu Cu Electric Line |
| 477 | RRD | Hung Yen | Tien Lu | Electricity | SPL II | Dien Vuong-Tien Lu Electric System |
| 478 | RRD | Hung Yen | Khoai Chau | Electricity | SPL II | Khoai Chau Town Electric Line |
| 479 | RRD | Hung Yen | Kim Dong | Electricity | SPL II | Luong Bang-Kim Dong Electric Network |
| 480 | RRD | Hung Yen | My Hao | Electricity | SPL II | My Hao Commune Electric Line |
| 481 | RRD | Hung Yen | An Thi | Electricity | SPL II | Ha Le-An Thi Electric Network |
| 482 | SCC | Khanh Hoa | Nha Trang | Road | SPL I | Road to Nha Trang Sea Port |
| 483 | SCC | Khanh Hoa | NA | Road | SPL I | Provincial Road No.9 |
| 484 | SCC | Khanh Hoa | Ninh Hoa | Electricity | SPL I | Ninh An Commune Electric |
| 485 | SCC | Khanh Hoa | Dien Khanh | Electricity | SPL I | Suoi Cat Commune Electric |
| 486 | SCC | Khanh Hoa | Ninh Hoa | Electricity | SPL II | Ninh Binh Commune Electric Line |
| 487 | SCC | Khanh Hoa | Dien Khanh | Electricity | SPL II | Dien Lam Commune Electric Line |
| 488 | SCC | Khanh Hoa | NA | Electricity | SPL II | Doc Da Trang Commune Electric Line |
| 489 | SCC | Khanh Hoa | Van Ninh | Electricity | SPL III | Van Thanh Commune Electric Line |
| 490 | SCC | Khanh Hoa | Khanh Vinh | Electricity | SPL III | Khanh Vinh Commune Electric Line |
| 491 | SCC | Khanh Hoa | Nha Trang | Electricity | SPL III | Phuoc Dong Commune Electric Line |
| 492 | MD | Kien Giang | An Bien | Road | SPL I | Nam Ky Khoi Nghia Road |
| 493 | MD | Kien Giang | Rach Gia | Road | SPL I | Urban Road (Ngo Quyen Rd. Rach Gia |
| 494 | MD | Kien Giang | Giong Gieng | Road | SPL II | Ngoc Chuc-Hoa Thuan-Hoa Hung-Hoa Loi |
| 495 | MD | Kien Giang | Tan Hiep | Road | SPL III | Giong Rieng-Go Quao Inter-Commune |
| 496 | MD | Kien Giang | Vinh Thuan | Road | SPL V | Vinh Thuan - Tan Thuan - Minh Thuan |
| 497 | MD | Kien Giang | Phu Quoc | Electricity | SPL I | Duong Dong Electric Line |
| 498 | MD | Kien Giang | Kien Hai | Electricity | SPL I | Lai Son Commune Electric Line |
| 499 | MD | Kien Giang | Phu Quoc | Electricity | SPL II | Duong To-An Thoi Electric Network |
| 500 | MD | Kien Giang | Giong Gieng | Electricity | SPL V | Electric Line and Transformer in buffer |
| 501 | MD | Kien Giang | Giong Gieng | Water Supply | SPL III | Giong Gieng WSS |
| 502 | CH | Kon Tum | Kon Tum town | Road | SPL I | Quang Trung Road |
| 503 | CH | Kon Tum | Ngoc Hoi | Road | SPL I | Ngoc Hoi Township Road |
| 504 | CH | Kon Tum | Kon Plong | Road | SPL I | Road Ngoc Tem |
| | | | Ngoc Hoi | | SPL II | Road to Ngoc Tem Commune |
| | | | Ngoc Hoi | | SPL III | Road to Ngoc Tem Commune |
| 505 | CH | Kon Tum | Ngoc Hoi | Road | SPL V | Inter-commune Road and Dak Ang Bridge |
| 506 | CH | Kon Tum | Dak Glei | Electricity | SPL I | Thuy Dien-Ngoc Linh Electric Network |
| 507 | CH | Kon Tum | Dak Rong | Electricity | SPL I | Dak Mon-Dak Loong Electric Network |
| 508 | CH | Kon Tum | Dac Ha | Electricity | SPL II | Dac Uy (Dac Ha) Electric Network |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 509 | CH | Kon Tum | Dak Ha | Electricity | SPL III | Ngoc Wang Commune Electric Line |
| 510 | CH | Kon Tum | Kon Tum town | Electricity | SPL III | Ia-Chim Commune Electric Line |
| 511 | CH | Kon Tum | Kon Ray | Electricity | SPL III | Dak-koi Commune Electric Line |
| 512 | CH | Kon Tum | Dak To | Electricity | SPL V | Dak Ha Commune Electric Network |
| 513 | CH | Kon Tum | Konplong | Water Supply | SPL III | Kon Plong WSS |
| 514 | CH | Kon Tum | Ngoc Hoi | Water Supply | SPL V | WSS in Bo Y Boder Gate |
| 515 | CH | Kon Tum | Dak Ha | Water Supply | SPL V | Dak Ha Town WSS |
| 516 | CH | Kon Tum | Dak Glei | Irrigation | SPL III | Dakpoko Irrigation |
| 517 | CH | Kon Tum | Sa Thay | Irrigation | SPL V | Dak Sia 1 Irrigation System |
| 518 | NW | Lai Chau | Tam Duong | Road | SPL I | Tam Duong-Ban Giang-Ban Hon Road |
| | | | | | SPL II | Tam Duong-Ban Giang-Ban Hon Road |
| 519 | NW | Lai Chau | Muong Te | Road | SPL III | Bun Nua - Pa Ve Su Road |
| 520 | NW | Lai Chau | Phong Tho | Road | SPL IV | Nam Cay - Sin Cai Road |
| 521 | NW | Lai Chau | Tam Duong | Road | SPL IV | Tam Duong - Then Xin - Ban Man Road |
| 522 | NW | Lai Chau | Phong Tho | Road | SPL V | Dao San - Pa Vay Su Road |
| 523 | NW | Lai Chau | Phong Tho | Road | SPL V | Nam Xe - Sin Suoi Ho Road |
| 524 | NE | Lai Chau | Than Uyen | Electricity | SPL I | Van Hoa Commune Electric Line |
| 525 | NE | Lai Chau | Than Uyen | Electricity | SPL I | Muong Khoa Commune Electric Line |
| 526 | NE | Lai Chau | Than Uyen | Electricity | SPL I | Minh Thanh Commune Electric Line |
| 527 | NW | Lai Chau | Phong Tho | Electricity | SPL I | Binh Lu Electric Network (stage 1 and 2) |
| 528 | NW | Lai Chau | Phong Tho | Electricity | SPL I | Ban Bo Commune Electric Line |
| 529 | NW | Lai Chau | Than Uyen | Electricity | SPL IV | Than Thuoc Commune Electric Line |
| 530 | NW | Lai Chau | Than Uyen | Electricity | SPL V | Nam Can-Bac Ta Electric Network |
| 531 | NW | Lai Chau | Binh Lu | Water Supply | SPL III | Binh Lu Water Supply System |
| 532 | NW | Lai Chau | Than Uyen | Water Supply | SPL IV | Than Uyen WSS |
| 533 | NW | Lai Chau | Phong Tho | Water Supply | SPL V | Phong Tho WSS (West) |
| 534 | NW | Lai Chau | Phong Tho | Water Supply | SPL V | Phong Tho WSS (East) |
| 535 | NW | Lai Chau | Tam Duong | Irrigation | SPL V | Khu Ha Irrigation System |
| 536 | CH | Lam Dong | NA | Road | SPL I | Yersin - Quang Trung - Phan Chu Trinh |
| 537 | CH | Lam Dong | Cat Tien | Road | SPL I | Road No.721(from Madagui to Cat Tien) |
| 538 | CH | Lam Dong | NA | Road | SPL II | Provincial Road No.725 |
| 539 | CH | Lam Dong | Dat Lat City | Road | SPL II | Tran Phu - Hoang Van Thu Road |
| 540 | CH | Lam Dong | Di Linh | Road | SPL II | Hoa Ninh - Hoa Nam Road |
| | | | | | SPL III | Hoa Ninh-Hoa Nam-Dinh Thang Hoa Road |
| 541 | CH | Lam Dong | Lam Ha | Road | SPL V | Tan Van - Phuc Tho Road |
| 542 | CH | Lam Dong | Dam Rong | Road | SPL V | Phi Lieng Center Commune Road |
| 543 | CH | Lam Dong | Lam Ha | Electricity | SPL I | Dinh Van-Phu Son Electric Network |
| 544 | CH | Lam Dong | Cat Tien | Electricity | SPL I | Dong Nai-Gia Vien-Tien Hoang Electric |
| 545 | CH | Lam Dong | Da Terh | Electricity | SPL I | Da The-Trieu Hai Electric |
| 546 | CH | Lam Dong | Bao Loc | Electricity | SPL I | Madagui-Ha Lam-Dam Bri Electric |
| 547 | CH | Lam Dong | Cat Tien | Electricity | SPL II | Phuoc Cat 2 Commune Electric Line |
| 548 | CH | Lam Dong | Cung Re | Electricity | SPL II | Cung Re Commune Electric Line |
| 549 | CH | Lam Dong | Lam Ha | Electricity | SPL II | 22KV Madagui-Da Hoai |
| 550 | CH | Lam Dong | Bao Lam | Electricity | SPL III | Loc Ngai Commune Electric Line 22KV |
| 551 | CH | Lam Dong | Bao Lam | Electricity | SPL III | Loc Tan Commune Electric Line |
| 552 | CH | Lam Dong | Dah Hoai | Electricity | SPL III | Da Ton Commune Electric Line |
| 553 | CH | Lam Dong | Lam Ha | Electricity | SPL V | Da Don Commune Electric Line |
| 554 | CH | Lam Dong | Bao Loc | Water Supply | SPL I | Bao Loc Water Supply System |
| 555 | CH | Lam Dong | Bao Lam | Water Supply | SPL V | Loc Thang Town WSS |
| 556 | CH | Lam Dong | Lam Ha | Irrigation | SPL III | Da-Don Dam |
| 557 | CH | Lam Dong | Lac Duong | Irrigation | SPL V | Bokabang Water Reservoir |
| 558 | NE | Lang Son | Lang Son City | Road | SPL I | Ly Thai To - Chu Van An Road |
| 559 | NE | Lang Son | Trang Dinh | Road | SPL I | That Khe - Quoc Khanh Road (PR No.228) |
| | | | | | SPL II | That Khe - Quoc Khanh Road |
| 560 | NE | Lang Son | Lang Son City | Road | SPL I | Dinh Tien Hoang Road |
| 561 | NE | Lang Son | Van lang | Road | SPL III | Na Sam-Na Hinh Road |
| 562 | NE | Lang Son | Binh Gia | Road | SPL III | Hoa Binh - Binh La Road |
| | | | Van Quan, Van Lang, | Road | SPL IV | Hoa Binh - Binh La - Gia Mien road (Km |
| | | | Van Quan, Binh Gia, | Road | SPL V | Hoa Binh - Binh La - Gia Mien Road |
| 563 | NE | Lang Son | Loc Binh | Road | SPL IV | Provincial Road No.237C |
| 564 | NE | Lang Son | Van Quan | Electricity | SPL I | Dong Giap Electric Network |
| 565 | NE | Lang Son | Chi Lang | Electricity | SPL I | Yen Tich Electric Network |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 566 | NE | Lang Son | Huu Lung | Electricity | SPL II | Hoa Lac-Hoa Son-Tan Thanh Electric Line |
| 567 | NE | Lang Son | Binh Gia | Electricity | SPL II | Binh Gia-Pac Thuong Electric Line |
| 568 | NE | Lang Son | Chi Lang | Electricity | SPL III | Chien ThangTransfomer and Electric Line |
| 569 | NE | Lang Son | Loc Binh | Electricity | SPL III | Southern of Loc Binh Transfomer and |
| 570 | NE | Lang Son | Van lang | Electricity | SPL III | Hoi Hoan Transfomer and Electric Line |
| 571 | NE | Lang Son | Binh Gia, Bac Son | Electricity | SPL V | 0.4KV Electric Line in Binh Gia, Bac Son |
| 572 | NE | Lang Son | Van Lang | Water Supply | SPL V | Na Sam Town WSS |
| 573 | NE | Lang Son | Huu Lung | Irrigation | SPL V | Thien Ky Irrigation System |
| 574 | NE | Lao Cai | Bao Thang, Van Ban | Road | SPL I | Tang Long - Khe Lech Road(PR No.79) |
| | | | Bao Thang | | SPL II | Road No.79, Tang Long - Khe Lech Road |
| | | | Van ban | | SPL III | Provincial Road 79 |
| 575 | NE | Lao Cai | Sa Pa | Road | SPL I | Pho Moi - Sa Pa Road |
| 576 | NE | Lao Cai | Lao Cai | Road | SPL I | Pho Moi - Phong Hai Road |
| | | | | | SPL II | Pho Moi - Phong Hai Road |
| | | | | | SPL III | Pho Moi - Phong Hai Road |
| 577 | NE | Lao Cai | Bao Uyen | Road | SPL III | Bao Ha - Kim Son Road |
| | | | | | SPL IV | Bao Ha - Kim Son Road |
| 578 | NE | Lao Cai | Muong Khuong, Bac | Road | SPL IV | Hoang Lien Son II Road |
| 579 | NE | Lao Cai | Bac Ha | Road | SPL V | Bac Ngam - Bac Ha Road |
| 580 | NE | Lao Cai | Van Bao | Electricity | SPL I | Vo Lao Commune Electric Line |
| 581 | NE | Lao Cai | Bao Yen | Electricity | SPL I | Minh Tan Commune Electric Line |
| 582 | NE | Lao Cai | Bao Yen | Electricity | SPL I | Dien Quan Commune Electric Line |
| 583 | NE | Lao Cai | Bao Thang | Electricity | SPL II | Gia Phu Commune Electric |
| 584 | NE | Lao Cai | Bao Thang | Electricity | SPL II | Ban Phiet Commune Electric |
| 585 | NE | Lao Cai | Lao Cai | Electricity | SPL II | Dong Tuyen Commune Electric |
| 586 | NE | Lao Cai | Muong Khuong | Electricity | SPL II | Ban Lau Commune Electric |
| 587 | NE | Lao Cai | Bao Thang | Electricity | SPL II | Phong Hai Commune Electric |
| 588 | NE | Lao Cai | Bao Thang | Electricity | SPL II | Tang Loong Commune Electric |
| 589 | NE | Lao Cai | Bac Ha | Electricity | SPL III | Bao Nhai Electric Network |
| 590 | NE | Lao Cai | Cam Duong | Electricity | SPL III | Ta Phoi Electric Network |
| 591 | NE | Lao Cai | Bat Xat | Electricity | SPL III | Muon Vi Electric Network |
| 592 | NE | Lao Cai | Van ban | Electricity | SPL IV | Nam Ma Commune Electric Line |
| 593 | NE | Lao Cai | Bao Yen | Electricity | SPL IV | Xuan Hoa Commune Electric Line |
| 594 | NE | Lao Cai | Muong Khuong | Water Supply | SPL III | Muon Khuong Water Supply System |
| 595 | NE | Lao Cai | Bac Ha | Water Supply | SPL IV | Bac Ha WSS |
| 596 | NE | Lao Cai | Bat Xat | Irrigation | SPL IV | Sin Chai Irrigation System |
| 597 | NE | Lao Cai | Muong Khuong | Irrigation | SPL V | Nam Chay Irrigation System |
| 598 | MD | Long An | Tan An | Road | SPL I | Road No.6 (Tan An Town) |
| | | | | | SPL II | Road No.6 (Extension) |
| 599 | MD | Long An | Tan An | Road | SPL I | Road No.5 (Tan An Town) |
| 600 | MD | Long An | Can Duoc | Road | SPL III | Provincial Road 835 Section 1 Go Den - |
| 601 | MD | Long An | Thu Thua | Electricity | SPL I | My An Electric |
| 602 | MD | Long An | Duc Hoa | Electricity | SPL I | An Ninh Tay Electric |
| 603 | MD | Long An | Can Giuoc | Electricity | SPL II | Phuoc Vinh Dong Commune Electric Line |
| 604 | RRD | Nam Dinh | Nam Dinh City | Road | SPL I | Nam Dinh - Quan Vinh Road |
| 605 | RRD | Nam Dinh | NA | Road | SPL I | Bo Song Road |
| | | | | | SPL II | Bo Song Road(Road around Nam Dinh |
| 606 | RRD | Nam Dinh | Y Yen | Road | SPL I | Road No.12A (Y Yen) |
| | | | Vu Ban | | SPL I | Road No.12A (Vu Ban) |
| 607 | RRD | Nam Dinh | Nam Dinh City | Road | SPL I | Urban Road of Nam Dinh Town |
| 608 | RRD | Nam Dinh | NA | Road | SPL I | Provincial Road No.57A |
| 609 | RRD | Nam Dinh | NA | Road | SPL II | Provincial Road No.490 (Old Road No.55) |
| 610 | RRD | Nam Dinh | Vu Ban, Y Yen | Road | SPL II | Road No.12, Vu Ban - Y.Yen Road |
| 611 | RRD | Nam Dinh | NA | Road | SPL II | West Muc River Road |
| 612 | RRD | Nam Dinh | Xuan Truong | Road | SPL II | Road 489 |
| | | | | | SPL III | Province Road 489 |
| 613 | RRD | Nam Dinh | Nam Dinh City | Road | SPL III | Tran Nhan Tong Road (Extension) |
| 614 | RRD | Nam Dinh | Vu Ban, Y Yen | Road | SPL III | Provincial Road No.56 |
| 615 | RRD | Nam Dinh | Nam Truc | Electricity | SPL I | Nam My Commune Electric Line |
| 616 | RRD | Nam Dinh | Vu Ban | Electricity | SPL I | Tam Thanh Commune Electric Line |
| 617 | RRD | Nam Dinh | Giao Thuy | Electricity | SPL I | Hong Thuan Commune Electric Line |
| 618 | RRD | Nam Dinh | NA | Electricity | SPL I | Thinh Long Commune Electric Line |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 619 | RRD | Nam Dinh | Nam Truc | Electricity | SPL I | Nam Thuong-Dong Long Commune |
| 620 | RRD | Nam Dinh | NA | Electricity | SPL I | Yen Trinh Commune Electric Line |
| 621 | RRD | Nam Dinh | Hai Hau | Electricity | SPL I | Hai Trieu Commune Electric Line |
| 622 | RRD | Nam Dinh | Xuan Truong | Electricity | SPL II | Xuan Chau Commune Electric Line |
| 623 | RRD | Nam Dinh | NA | Electricity | SPL II | Hop Hung Commune Electric Line |
| 624 | RRD | Nam Dinh | Hai Hau | Electricity | SPL II | Hai Son Commune Electric Line |
| 625 | RRD | Nam Dinh | Giao Thuy | Electricity | SPL II | Giao Hai Commune Electric Line |
| 626 | RRD | Nam Dinh | Y Yen | Electricity | SPL II | Lam Town Electric Line |
| 627 | RRD | Nam Dinh | Xuan Truong | Electricity | SPL II | Xuan Tien Commune Electric Line |
| 628 | RRD | Nam Dinh | Van Chan | Electricity | SPL II | Tan Thinh Commune Electric Line |
| 629 | RRD | Nam Dinh | Hai Hau | Electricity | SPL II | Hai Minh Commune Electric Line |
| 630 | NCC | Nghe An | Vinh Loc | Road | SPL I | Vinh - Cua Hoi Road (PR No.535) |
| | | | | | SPL II | Vinh - Cua Hoi Road,PR535 (Ascon. Only) |
| 631 | NCC | Nghe An | Nghi Loc | Road | SPL I | Nghi Thu - Cua Lo Road |
| 632 | NCC | Nghe An | Vinh City | Road | SPL I | Le Hong Phong - Nguyen Thai Hoc Road |
| 633 | NCC | Nghe An | Vinh City | Road | SPL I | Tran Hung Dao - Truong Chinh Road |
| | | | | | SPL II | Tran Hung Dao Road |
| 634 | NCC | Nghe An | Vinh City | Road | SPL II | Binh Minh Road |
| 635 | NCC | Nghe An | Quy Chau | Road | SPL III | Quy Chau-Chau Phong Township Road |
| 636 | NCC | Nghe An | Con Cuong | Road | SPL III | Bong Khe-Mon Son Road |
| 637 | NCC | Nghe An | Nghi Loc | Road | SPL III | Nghi Duc-Nghi Thiet Road |
| 638 | NCC | Nghe An | Que Phong | Road | SPL IV | Hanh Dich - Muong Don Road |
| 639 | NCC | Nghe An | Tuong Duong | Road | SPL IV | Ve - Nga My Road |
| 640 | NCC | Nghe An | Thanh Chuong | Road | SPL IV | Song Giang Bridge |
| 641 | NCC | Nghe An | Ky Son | Road | SPL V | Ta Ca - Huu Kien Road |
| 642 | NCC | Nghe An | Anh Son | Road | SPL V | Duc Son - Binh Son commune Road |
| 643 | NCC | Nghe An | Tan Ky | Electricity | SPL I | Giai Xuan Electric Network |
| 644 | NCC | Nghe An | Thanh Chuong | Electricity | SPL I | Thanh Hung Electric Network |
| 645 | NCC | Nghe An | Tan Ky | Electricity | SPL I | Cao Son Electric Network |
| 646 | NCC | Nghe An | Tan Ky | Electricity | SPL II | Nghia Phuc Commune Electric Line |
| 647 | NCC | Nghe An | Thanh Chuong | Electricity | SPL II | Thanh Ngoc Commune Electric Line |
| 648 | NCC | Nghe An | Anh Son | Electricity | SPL II | Vinh Son Commune Electric Line |
| 649 | NCC | Nghe An | Nghi Loc | Electricity | SPL III | Nghi Van Commune Electric Line |
| 650 | NCC | Nghe An | Quang Phong | Electricity | SPL III | Muong Noc Commune Electric Line |
| 651 | NCC | Nghe An | Tuong Duong | Electricity | SPL III | Yen Tinh Commune Electric Line |
| 652 | NCC | Nghe An | Thanh Chuong | Electricity | SPL IV | Thanh An Commune Electric Line |
| 653 | NCC | Nghe An | Con Cuong | Electricity | SPL IV | Thach Ngan Commune Electric Line |
| 654 | NCC | Nghe An | Tan Ky | Electricity | SPL V | Nghia Thanh Commune Electric Line |
| 655 | NCC | Nghe An | Con Cuong | Electricity | SPL V | Binh Chuan Commune Electric Line |
| 656 | NCC | Nghe An | Cua Lo Town | Water Supply | SPL I | Cua Lo Water Supply System |
| 657 | NCC | Nghe An | Nam Dan | Water Supply | SPL IV | Nam Dan WSS |
| 658 | NCC | Nghe An | Yen Thanh | Water Supply | SPL IV | Yen Thanh WSS |
| 659 | NCC | Nghe An | Nghia Dan | Water Supply | SPL V | Nghia Dan WSS |
| 660 | NCC | Nghe An | Hung Nguyen | Irrigation | SPL III | Khe Ngang Reservoir |
| 661 | NCC | Nghe An | Do Luon | Irrigation | SPL IV | Yen Trach-Khe Chet Dam |
| 662 | NCC | Nghe An | Quy Chau | Irrigation | SPL IV | Ke Coc-Khe Nha Irrigation Canal |
| 663 | NCC | Nghe An | Thanh Chuong | Irrigation | SPL IV | Trieu Duong Reservoir |
| 664 | RRD | Ninh Binh | NA | Road | SPL I | Road No.59B |
| | | | | | SPL II | Road No.59B |
| 665 | RRD | Ninh Binh | NA | Road | SPL I | Ba Vuong - Binh Dong Road |
| 666 | RRD | Ninh Binh | NA | Road | SPL I | Thong Nhac Road (Road No.58) |
| | | | | | SPL I | Nhac - Duc Hau Road (Road No.58) |
| 667 | RRD | Ninh Binh | NA | Road | SPL I | Cau Dam - Khanh Thanh Road |
| | | | | | SPL II | Cau Dam - Khanh Thanh Road |
| 668 | RRD | Ninh Binh | NA | Road | SPL I | Thong Nhat Road (Road No.58) |
| 669 | RRD | Ninh Binh | Hoa Lu | Road | SPL I | Ninh Thang - Truong Yen Road |
| 670 | RRD | Ninh Binh | NA | Road | SPL II | Cong Go - Mua Thu Road |
| 671 | RRD | Ninh Binh | NA | Road | SPL II | Qui Hau - Do Muoi Road |
| 672 | RRD | Ninh Binh | Nho Quan | Road | SPL III | Inter Commune Road (Thuong Hoa-Thanh |
| 673 | RRD | Ninh Binh | Gia Vien | Road | SPL III | Road to Vua Dinh Temple |
| 674 | RRD | Ninh Binh | Nho Quan | Road | SPL III | Road No.12C |
| 675 | RRD | Ninh Binh | Yen Mo | Road | SPL V | Khanh Ninh - Long market Road |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 676 | RRD | Ninh Binh | Nho Quan | Electricity | SPL I | Quynh Luu Commune Electric Network |
| 677 | RRD | Ninh Binh | Gia Vien | Electricity | SPL I | Khanh Van Commune Electric Line |
| 678 | RRD | Ninh Binh | Kim Son | Electricity | SPL I | Hung Tien Commune Electric Line |
| 679 | RRD | Ninh Binh | Gia Vien | Electricity | SPL I | Da Han Trade Center Electric Network |
| 680 | RRD | Ninh Binh | Nho Quan | Electricity | SPL II | Xich Tho Commune Electric |
| 681 | RRD | Ninh Binh | Yen Khanh | Electricity | SPL II | Khanh Cu Commune Electric |
| 682 | RRD | Ninh Binh | Hoa Lu | Electricity | SPL II | Ninh Khanh Commune Electric |
| 683 | RRD | Ninh Binh | Kim Son | Electricity | SPL II | Thuong Kiem Commune Electric |
| 684 | RRD | Ninh Binh | Nho Quan | Electricity | SPL II | Quynh Luu Commune Electric Network |
| 685 | RRD | Ninh Binh | Kim Son | Water Supply | SPL I | Kim Son Water Supply System |
| 686 | RRD | Ninh Binh | Nho Quan | Irrigation | SPL V | Dong Dinh Pump Station |
| 687 | SE | Ninh Thuan | Phan Thiet | Road | SPL I | Town Central Road |
| 688 | SE | Ninh Thuan | NA | Road | SPL I | Tri Thuy - Phuong Cuu Road |
| | | | Ninh Hai - Thuan Bac | | SPL V | District No,6 (Tri Thuy - Binh Nghia - |
| 689 | SE | Ninh Thuan | Phan Thiet | Road | SPL II | Town Central Road (Extension) |
| 690 | SE | Ninh Thuan | Phan Thiet | Road | SPL II | Phan Rang-Phap Cham Dike Road |
| 691 | SE | Ninh Thuan | Bac Ai | Road | SPL III | Ninh Binh - Phuoc Binh Road |
| 692 | SE | Ninh Thuan | Bac Ai | Road | SPL IV | Phuoc Dai - Phuoc Trung Road |
| | | | | | SPL V | Phuoc Dai - Phuoc Trung Road |
| 693 | SE | Ninh Thuan | Ninh Son | Electricity | SPL I | Tan Lap-Ma Noi Electric Line |
| 694 | SE | Ninh Thuan | Ninh Hai | Electricity | SPL I | Khanh Hai Electric Line |
| 695 | SE | Ninh Thuan | NA | Electricity | SPL I | Lac Tien-Tu Thien-Son Hai Electric Line |
| 696 | SE | Ninh Thuan | NA | Electricity | SPL I | Hieu Thien-Vu Bon Electric Line |
| 697 | SE | Ninh Thuan | NA | Electricity | SPL II | Phuoc Nam-Nhi Ha-Phuoc Ha Commune |
| 698 | SE | Ninh Thuan | NA | Electricity | SPL II | Lang Me-Xom Bang Commune Electric |
| 699 | SE | Ninh Thuan | NA | Electricity | SPL II | Xom Chieu-Bao An-Cong Thanh-Thanh |
| 700 | SE | Ninh Thuan | Ninh Son | Electricity | SPL III | Ma Noi Commune Electric Line |
| 701 | SE | Ninh Thuan | Ninh Son | Electricity | SPL III | Hoa Son-My Son Commune Electric Line |
| 702 | SE | Ninh Thuan | Ninh Hai | Electricity | SPL III | Binh Son-Dong Hai Commune Electric |
| 703 | SE | Ninh Thuan | Ninh Son | Electricity | SPL V | Luong Son-Lan Son Electric Network |
| 704 | SE | Ninh Thuan | Ninh Hai | Water Supply | SPL V | My Tuong WSS |
| 705 | SE | Ninh Thuan | Ninh Phuoc | Irrigation | SPL III | Ninh Phuoc Irrigation System |
| 706 | SE | Ninh Thuan | Ninh Phuoc | Irrigation | SPL IV | Bau Ngu Reservoir |
| 707 | SE | Ninh Thuan | Ninh Phuoc | Irrigation | SPL V | Ta Ranh Irrigation |
| 708 | NE | Phu Tho | Phu Tho Town | Road | SPL I | Urban Road (Phu Tho Town) |
| 709 | NE | Phu Tho | Viet Tri City | Road | SPL I | Urban Road (Viet Tri City) |
| 710 | NE | Phu Tho | NA | Road | SPL I | Road P2 |
| 711 | NE | Phu Tho | Viet Tri City | Road | SPL II | Urban Road in Viet Tri City |
| 712 | NE | Phu Tho | Phu Tho Town | Road | SPL II | Road in Phu Tho Township |
| 713 | NE | Phu Tho | NA | Road | SPL II | Road P5 |
| 714 | NE | Phu Tho | Tam Nong | Road | SPL II | Provincial Road No.315 |
| | | | | | SPL III | Road 315 |
| | | | | | SPL IV | Provincial Road No.315 |
| 715 | NE | Phu Tho | Thanh Thuy, Thanh Son | Road | SPL IV | Provincial Road No.317 (La Phu - Tinh |
| 716 | NE | Phu Tho | Ha Hoa | Road | SPL IV | Provincial Road No.312 |
| 717 | NE | Phu Tho | Yen Lap | Road | SPL IV | Station 312 - Hung Long Triway Road |
| 718 | NE | Phu Tho | Tam Nong | Road | SPL IV | Te Le Commune Bridge |
| 719 | NE | Phu Tho | Thanh Son | Road | SPL V | Van Mieu - Thuong Cuu Road |
| 720 | NE | Phu Tho | Cam Khe | Road | SPL V | Road to Ngo Xa cottage village |
| 721 | NE | Phu Tho | Yen Lap | Road | SPL V | Xuan An - My Lung Road |
| 722 | NE | Phu Tho | Tam Nong | Electricity | SPL I | Huong Nha Commune Electric Line |
| 723 | NE | Phu Tho | Song Thao | Electricity | SPL I | Tinh Cuong Commune Electric Line |
| 724 | NE | Phu Tho | Viet Tri City | Electricity | SPL I | Van Phu Commune Electric Line |
| 725 | NE | Phu Tho | Phu Tho Town | Electricity | SPL I | Thanh Minh Commune Electric Line |
| 726 | NE | Phu Tho | Tam Nong | Electricity | SPL I | Hong Da Commune Electric Line |
| 727 | NE | Phu Tho | Phong Chau | Electricity | SPL I | Cao Mai Commune Electric Line |
| 728 | NE | Phu Tho | Phong Chau | Electricity | SPL I | Gia Thanh Commune Electric Line |
| 729 | NE | Phu Tho | Doan Hung | Electricity | SPL II | Phuc Lai Commune Electric Line |
| 730 | NE | Phu Tho | Phu Ninh | Electricity | SPL II | Dinh Bo Commune Electric Line |
| 731 | NE | Phu Tho | Song Thao | Electricity | SPL II | Chuong Xa Commune Electric Line |
| 732 | NE | Phu Tho | Ha Hoa | Electricity | SPL II | Phuong Vien Commune Electric Line |
| 733 | NE | Phu Tho | Tam Nong | Electricity | SPL II | Phuong Thinh Commune Electric Line |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 734 | NE | Phu Tho | Phu Ninh | Electricity | SPL II | Phu Nham Commune Electric Line |
| 735 | NE | Phu Tho | Tam Nong | Electricity | SPL II | Trung Nghia Commune Electric Line |
| 736 | NE | Phu Tho | Thanh Thuy | Electricity | SPL IV | Tu Vu Commune Electric Line |
| 737 | NE | Phu Tho | Song Thao | Electricity | SPL IV | Xuong Thinh-Tung Khe Commune Electric |
| 738 | NE | Phu Tho | Thanh Ba | Electricity | SPL IV | Nang Yen Commune Electric Line |
| 739 | NE | Phu Tho | Thanh Son | Electricity | SPL IV | Minh Dai-Thu Cuc Commune Electric Line |
| 740 | NE | Phu Tho | Yen Lap | Electricity | SPL V | Electric Network in 8 Communes in Yen |
| 741 | NE | Phu Tho | Phu Tho Town | Water Supply | SPL I | Phu Tho Water Supply System |
| 742 | NE | Phu Tho | Ha Hoa | Water Supply | SPL III | Ha Hoa WSS |
| 743 | NE | Phu Tho | Thanh Ba | Water Supply | SPL IV | Thanh Ba WSS |
| 744 | NE | Phu Tho | Song Thao | Water Supply | SPL IV | Song Thao WSS |
| 745 | NE | Phu Tho | Thanh Son | Water Supply | SPL V | Thanh Son Town WSS |
| 746 | NE | Phu Tho | Tam Nong | Irrigation | SPL III | Tam Nong Irrigation System |
| 747 | NE | Phu Tho | Thanh Thuy | Irrigation | SPL IV | Phuong Mao Reservoir ( 2nd Stage) |
| 748 | NE | Phu Tho | Thanh Ba | Irrigation | SPL IV | Hoang Hanh PS |
| 749 | NE | Phu Tho | Tam Nong | Irrigation | SPL IV | Hien Quan Irrigation System |
| 750 | NE | Phu Tho | Cam Khe | Irrigation | SPL V | Irrigation and Draiange System in 16 |
| 751 | SCC | Phu Yen | Song Hinh | Road | SPL I | Road No.645 (Provincial Road No.1) |
| | | | | | SPL II | Road No.645 (Provincial Road No.1) |
| 752 | SCC | Phu Yen | Song Cau | Road | SPL II | Tam Giang-My Hai Road |
| | | | | | SPL V | Tam Giang-My Hai Road |
| 753 | SCC | Phu Yen | Song Hinh | Road | SPL IV | Song Hinh Bridge |
| 754 | SCC | Phu Yen | Son Hoa | Road | SPL V | Nga Hai Bridge (Son Nguyen Commune) |
| 755 | SCC | Phu Yen | Song Hinh | Road | SPL V | Road from Hoa An mini - industrial Zone |
| 756 | SCC | Phu Yen | Dong Xuan | Electricity | SPL I | Xuan Phuoc Commune Electric |
| 757 | SCC | Phu Yen | Song Hinh | Electricity | SPL II | Duc Binh Tay Commune Electric Line |
| 758 | SCC | Phu Yen | Son Hoa | Electricity | SPL II | Son Hoa Commune Electric Line |
| 759 | SCC | Phu Yen | Song Cau | Electricity | SPL II | Xuan Tho 2 Commune Electric Line |
| 760 | SCC | Phu Yen | Tuy An | Electricity | SPL II | An Phu-An Chan-An My Commune |
| 761 | SCC | Phu Yen | Tuy Hoa | Electricity | SPL II | Hoai Hoi Commune Electric Line |
| 762 | SCC | Phu Yen | Song Hinh | Electricity | SPL III | Son Gian Commune Electric Line |
| 763 | SCC | Phu Yen | Song Cau | Electricity | SPL III | Xuat Binh Commune Electric Line |
| 764 | SCC | Phu Yen | Song Cau | Electricity | SPL IV | Trung Trinh-Vung Nha-Tu Nham |
| 765 | SCC | Phu Yen | Son Hoa | Water Supply | SPL III | Cung Son-Son Hoa WSS |
| 766 | SCC | Phu Yen | Phu Hoa | Water Supply | SPL IV | Phu Hoa WSS |
| 767 | SCC | Phu Yen | Song Hinh | Irrigation | SPL III | La Bach Irrigation System |
| | | | Phu Hoa | | SPL V | La Bach Reservoir (Stage 2) |
| 768 | SCC | Phu Yen | Song Hinh | Irrigation | SPL IV | Buon Chao Dam |
| 769 | SCC | Phu Yen | Dong Xuan | Irrigation | SPL V | Pump and Irrigation canal of Tan Phuoc, |
| 770 | NCC | Quang Binh | Dong Hoi Town | Road | SPL I | Township Road(Dong Hoi Town) |
| 771 | NCC | Quang Binh | NA | Road | SPL I | Provincial Road No.2 |
| | | | | | SPL II | Provincial Road No.2 |
| 772 | NCC | Quang Binh | NA | Road | SPL I | Road No.F325 Township |
| 773 | NCC | Quang Binh | Dong Hoi Town | Road | SPL II | Dong Hoi Township Road |
| 774 | NCC | Quang Binh | NA | Road | SPL II | Lam Nghiep & Hoi Bridges |
| 775 | NCC | Quang Binh | Dong Hoi | Road | SPL III | Urban Roads in Dong Hoi |
| 776 | NCC | Quang Binh | Quang Ninh | Road | SPL V | Hien - Xuan - An - Van Ninh |
| 777 | NCC | Quang Binh | Quang Trach | Electricity | SPL I | Quang Luu Electric |
| 778 | NCC | Quang Binh | Bo Trach | Electricity | SPL I | Son Loc-Phu Dinh Electric |
| 779 | NCC | Quang Binh | Le Thuy | Electricity | SPL I | Kim Van-Truong Thuy Electric |
| 780 | NCC | Quang Binh | Quang Ninh | Electricity | SPL I | Bac Truong Xuan Electric |
| 781 | NCC | Quang Binh | Quang Trach | Electricity | SPL I | Quang Tung-Quang Chau-Quang Tien |
| 782 | NCC | Quang Binh | Tuyen Hoa | Electricity | SPL I | Mai Phong-Tien Hoa Electric |
| 783 | NCC | Quang Binh | NA | Electricity | SPL II | Kim Thuy-Van Thuy-Truong Thuy Electric |
| 784 | NCC | Quang Binh | Quang Trach | Electricity | SPL II | Transformer 20KV of Quang Tung-Chau |
| 785 | NCC | Quang Binh | Quang Trach | Electricity | SPL II | Quang Luu-Quang Trach Electric Network |
| 786 | NCC | Quang Binh | Minh Hoa | Electricity | SPL III | Dan Hoa Commune Electric Line |
| 787 | NCC | Quang Binh | Minh Hoa | Water Supply | SPL III | Minh Hoa WSS |
| 788 | NCC | Quang Binh | Bo Trach | Water Supply | SPL V | Viet Trung WSS |
| 789 | NCC | Quang Binh | Quang Ninh | Irrigation | SPL III | Upgrade Cam Li Reversoir |
| 790 | SCC | Quang Nam | Dien Ban | Road | SPL I | Road to Dien Nam-Dien Ngoc Industrial |
| 791 | SCC | Quang Nam | Duy Xuyen | Road | SPL I | Kiem Lam - Can Truc Road |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 792 | SCC | Quang Nam | Tan Ky | Road | SPL I | An Ha - Cay Trai An Ha Road |
| 793 | SCC | Quang Nam | Dai Loc | Road | SPL I | An Diem - A So Road |
| | | | | | SPL IV | An Diem - Ka Dang - A So Road |
| 794 | SCC | Quang Nam | NA | Road | SPL II | Tran Quy Cap Road |
| 795 | SCC | Quang Nam | Nui Thanh | Road | SPL II | An Tan - Ky Ha Road |
| 796 | SCC | Quang Nam | Hien | Road | SPL II | Trao - Doc Kien Road |
| 797 | SCC | Quang Nam | Tam Ky | Road | SPL III | National Road No.1-An Ha |
| 798 | SCC | Quang Nam | Phuoc Son | Road | SPL III | Phuoc Chanh - Phuoc Cong Road |
| 799 | SCC | Quang Nam | Dong Giang | Road | SPL IV | Commune road in Ba and Tu communes |
| 800 | SCC | Quang Nam | Tien Phuoc | Road | SPL V | Tien Tho - Tien Hiep Road |
| 801 | SCC | Quang Nam | Thang Binh | Electricity | SPL I | Binh Chanh Electric |
| 802 | SCC | Quang Nam | Dien Quang | Electricity | SPL I | Dien Quang Electric |
| 803 | SCC | Quang Nam | Que Son | Electricity | SPL I | Que Ninh Electric |
| 804 | SCC | Quang Nam | Dien Quang | Electricity | SPL II | Dien Quang Electric |
| 805 | SCC | Quang Nam | Thang Binh | Electricity | SPL II | Binh Duong Commune Electric Line |
| 806 | SCC | Quang Nam | Thang Binh | Electricity | SPL II | Binh Dinh Commune Electric Line |
| 807 | SCC | Quang Nam | Thang Binh | Electricity | SPL III | Binh Dinh Commune Electric Line |
| 808 | SCC | Quang Nam | Dien Ban | Electricity | SPL III | Dien Trung Commune Electric Line |
| 809 | SCC | Quang Nam | Thang Binh | Electricity | SPL III | Binh Lanh Commune Electric Line |
| 810 | SCC | Quang Nam | Thang Binh | Electricity | SPL IV | Binh Quy Commune Electric Line |
| 811 | SCC | Quang Nam | Hiep Duc | Electricity | SPL V | Hiep Duc Electric Network |
| 812 | SCC | Quang Nam | Thang Binh | Water Supply | SPL I | Thanh Binh Water Supply System |
| 813 | SCC | Quang Nam | Duy Xuyen | Water Supply | SPL IV | Nam Phuoc WSS |
| 814 | SCC | Quang Nam | Que Son | Water Supply | SPL V | Dong Phu Pump Station in Que Son and |
| | | | | | SPL V | Dong phu - Que Son WSS (Phase II) |
| 815 | SCC | Quang Nam | Que Son, Thang Binh | Irrigation | SPL V | Ho Viet An Irrigation System |
| 816 | SCC | Quang Ngai | Son Tinh | Road | SPL I | Son Ha - Son Tay Road |
| 817 | SCC | Quang Ngai | Quang Ngai Town | Road | SPL I | La Ha - Thu Xa Road |
| | | | | | SPL II | La Ha - Thu Xa Road |
| 818 | SCC | Quang Ngai | NA | Road | SPL II | Quang Ngai - Co Luy Road |
| 819 | SCC | Quang Ngai | Son Tay | Road | SPL II | Ca Dao Pass |
| 820 | SCC | Quang Ngai | Nghia Hanh, Minh | Road | SPL II | Quang Ngai - Minh Long Road |
| 821 | SCC | Quang Ngai | Tra Bong | Road | SPL IV | Tra Bong - Tra Phong Road |
| 822 | SCC | Quang Ngai | Minh Long, Son Tra | Road | SPL IV | Long Mon - Son Ky Road |
| 823 | SCC | Quang Ngai | Tay Tra | Road | SPL V | Tra Phong - Tra Khe - Tra Bao Road |
| 824 | SCC | Quang Ngai | Minh Long | Road | SPL V | Long Mai - Long Hiep - Thanh An Road |
| 825 | SCC | Quang Ngai | Tu Nghia | Electricity | SPL I | Tu Nghia Electric |
| 826 | SCC | Quang Ngai | Son Tinh | Electricity | SPL I | Tinh Khe Commune Electric |
| 827 | SCC | Quang Ngai | Son Ha | Electricity | SPL I | Son Ha Distric Electric Network |
| 828 | SCC | Quang Ngai | Ly Son | Electricity | SPL II | Ly Son Island District Electric Network |
| 829 | SCC | Quang Ngai | Son Ha | Electricity | SPL II | Son Ha Distric Electric Network |
| 830 | SCC | Quang Ngai | Son Tinh | Electricity | SPL II | Tinh Tho Commune Electric Line |
| 831 | SCC | Quang Ngai | Binh Son | Electricity | SPL II | Binh Khuong Commune Electric Line |
| 832 | SCC | Quang Ngai | Duc Pho | Electricity | SPL II | Pho Cuong Commune Electric Line |
| 833 | SCC | Quang Ngai | Tra Bong | Electricity | SPL II | Tra Bong Commune Electric Line |
| 834 | SCC | Quang Ngai | Duc Pho | Water Supply | SPL III | Duc Pho WSS |
| 835 | SCC | Quang Ngai | Mo Duc | Water Supply | SPL IV | Mo Duc WSS |
| 836 | SCC | Quang Ngai | Son Ha | Irrigation | SPL III | Di Lang Irrigation |
| 837 | SCC | Quang Ngai | Nghia Hanh | Irrigation | SPL IV | Suoi Chi Irrigation System |
| 838 | SCC | Quang Ngai | Mo Duc | Irrigation | SPL IV | Ong Toi Reservoir |
| 839 | SCC | Quang Ngai | Son Ha | Irrigation | SPL V | Xa Dieu Commune Dam |
| 840 | NE | Quang Ninh | Yen Hung | Road | SPL I | Urban Road (Quang Yen Town) |
| 841 | NE | Quang Ninh | Dong Trieu | Road | SPL I | Duc Chinh - An Sinh Road |
| | | | | | SPL II | Duc Chinh - An Sinh Road |
| 842 | NE | Quang Ninh | Binh Lieu | Road | SPL I | Hoanh Mo - Dong Van Road |
| | | | | | SPL II | Hoanh Mo - Dong Van Road |
| | | | | | SPL III | Hoanh Mo-Dong Van Road |
| 843 | NE | Quang Ninh | Quang Uyen | Road | SPL II | Quang Yen Town Road, 5 Streets |
| 844 | NE | Quang Ninh | Quang Uyen | Road | SPL III | Quang Yen Urban Road |
| 845 | NE | Quang Ninh | Ha Long City | Electricity | SPL II | Transformer in Westen of Ha Long City |
| 846 | NE | Quang Ninh | Dong Trieu | Water Supply | SPL I | Dong Trieu Water Supply System |
| 847 | NE | Quang Ninh | Quang ha | Water Supply | SPL III | Quang Ha WSS |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 848 | NCC | Quang Tri | Huong Hoa | Road | SPL I | Ta Rut - La Lay Road |
| | | | | | SPL II | Ta Rut - La Lay Road |
| 849 | NCC | Quang Tri | Dong Ha | Road | SPL I | Dong Ha within City Road |
| 850 | NCC | Quang Tri | NA | Road | SPL I | Provincial Road No.64 |
| | | | | | SPL II | Provincial Road No.64 |
| 851 | NCC | Quang Tri | Vinh Linh | Road | SPL I | Ho Xa - Cap Lai Road |
| | | | | | SPL II | Ho Xa - Cap Lai Road |
| 852 | NCC | Quang Tri | Dakrong | Road | SPL III | Central Road in Dakrong District |
| 853 | NCC | Quang Tri | Dakrong | Road | SPL IV | Ta Rut - A Vao Road |
| 854 | NCC | Quang Tri | Dakrong | Road | SPL IV | Ba Long Bridge |
| 855 | NCC | Quang Tri | Gio Linh | Road | SPL IV | Eastern 75 Provincial Road |
| 856 | NCC | Quang Tri | Gio Linh | Road | SPL IV | Provincial Road No.74 |
| 857 | NCC | Quang Tri | Cam Lo | Road | SPL IV | Provincial Road No.11 |
| 858 | NCC | Quang Tri | Huong Hoa | Road | SPL IV | Acess road to Ba Tang commune |
| 859 | NCC | Quang Tri | Vinh Linh | Road | SPL V | Ho Xa - Vinh Tu - Vinh Thai Road |
| 860 | NCC | Quang Tri | Cam Lo | Road | SPL V | Cam An - Cam Thanh Inter-commune |
| 861 | NCC | Quang Tri | Vinh Linh | Electricity | SPL I | Vinh Tu Commune Electric |
| 862 | NCC | Quang Tri | Cam Lo | Electricity | SPL I | Cam Tuyen Commune Electric |
| 863 | NCC | Quang Tri | Trieu Phong | Electricity | SPL I | Trieu Lang Commune Electric |
| 864 | NCC | Quang Tri | Gio Linh | Electricity | SPL II | Gio Linh Commune Electric Line |
| 865 | NCC | Quang Tri | Huong Hoa | Electricity | SPL II | Huong Hoa Commune Electric Line |
| 866 | NCC | Quang Tri | Gio Linh | Electricity | SPL II | Ba Long Commune Electric Line |
| 867 | NCC | Quang Tri | Gio Linh | Electricity | SPL III | Gio My Commune Electric Line |
| 868 | NCC | Quang Tri | Huong Hoa | Electricity | SPL III | Thanh Commune Electric Line |
| 869 | NCC | Quang Tri | Huong Hoa | Electricity | SPL III | A Tuc Commune Electric Line |
| 870 | NCC | Quang Tri | Trieu Phong | Electricity | SPL IV | Trieu Thuong Commune Electric Line |
| 871 | NCC | Quang Tri | Vinh Linh | Electricity | SPL IV | Electric Network in New Economic area in |
| 872 | NCC | Quang Tri | Huong Hoa | Electricity | SPL IV | Huong Hung Commune Electric Line |
| 873 | NCC | Quang Tri | Vinh Linh-Cam Lo | Electricity | SPL V | Vinh Linh and Cam Lo Electric Line |
| 874 | NCC | Quang Tri | Vinh Linh | Water Supply | SPL I | Ho Xa Water Supply System |
| 875 | NCC | Quang Tri | Huong Hoa | Water Supply | SPL I | Lao Bao Water Supply System |
| 876 | NCC | Quang Tri | Hai Lang | Water Supply | SPL III | Hai Lang WSS |
| 877 | NCC | Quang Tri | Cam Lo | Water Supply | SPL IV | Cam Lo WSS |
| 878 | NCC | Quang Tri | Vinh Linh | Water Supply | SPL IV | Ben Quan WSS |
| 879 | NCC | Quang Tri | Gio Linh | Water Supply | SPL V | Gio Linh Distric WSS |
| 880 | NCC | Quang Tri | Cam Lo | Irrigation | SPL IV | Nghia Hy Reservoir |
| 881 | NCC | Quang Tri | Huong Hoa | Irrigation | SPL IV | Lia Irrigation System |
| 882 | NCC | Quang Tri | Hai Lang | Irrigation | SPL V | Thac Heo Reservoir |
| 883 | MD | Soc Trang | Soc Trang Town | Road | SPL I | Mac Dinh Chi Road |
| 884 | MD | Soc Trang | My Xuyen | Road | SPL II | Provincial Road No.8 |
| 885 | MD | Soc Trang | Long Phu | Road | SPL III | An Thanh 1-An Thanh 3 Road |
| 886 | MD | Soc Trang | My Tu | Road | SPL III | Thuan Hoa - Phu Tam Road |
| | | | | | SPL V | Thuan Hoa - Phu Tam road |
| 887 | MD | Soc Trang | Vinh Chau | Road | SPL IV | District Road No.31 |
| 888 | MD | Soc Trang | Thanh Tri | Road | SPL IV | District Road No.17 |
| 889 | MD | Soc Trang | Nga Nam | Road | SPL V | My Quoi - Roc La Road |
| 890 | MD | Soc Trang | Long Phu | Road | SPL V | District Road No.9 |
| 891 | MD | Soc Trang | Ke Sach | Electricity | SPL I | Cai Tau-Ba Trinh-Trinh Phu Electric |
| 892 | MD | Soc Trang | My Tu | Electricity | SPL I | Ho Dac Kien Electric |
| 893 | MD | Soc Trang | Ke Sach | Electricity | SPL I | An Lac Tay Commune Electric |
| 894 | MD | Soc Trang | Vinh Chau | Electricity | SPL II | Hoa Lac Electric Network |
| 895 | MD | Soc Trang | Thanh Tri | Electricity | SPL III | Vinh Loi Commune Electric Line |
| 896 | MD | Soc Trang | My Xuyen | Electricity | SPL IV | Electric Network in 9 Communes in My |
| 897 | MD | Soc Trang | Ke Sach | Electricity | SPL V | An Lac Tay Commune Electric Line |
| 898 | MD | Soc Trang | My Xuyen | Water Supply | SPL IV | My Xuyen WSS |
| 899 | MD | Soc Trang | Thanh Tri | Water Supply | SPL V | Phu Loc Town WSS |
| 900 | NW | Son La | Son La Town | Road | SPL I | Tinh Uy - Ban Mong Road |
| | | | | | SPL I | Tinh Uy - Ban Mong Road |
| 901 | NW | Son La | Son La Town | Road | SPL I | Quyet Thang - Na Cong Road |
| 902 | NW | Son La | Mai Son, Song Ma | Road | SPL II | Road No.105, Mai Son - Song Ma Road |
| 903 | NW | Son La | Son La Town | Road | SPL III | Inter-commune Road Ban Moong-Muong |

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# Appendix 1.2 Sub-Project (Infrastructure) List

| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 904 | NW | Son La | Moc Chau | Road | SPL III | Van Ho - Xuan Nha Road |
| | | | | | SPL V | Van Ho - Xuan Nha Road |
| 905 | NW | Son La | Moc Chau | Road | SPL IV | Xuan Nha - Tan Xuan Road |
| 906 | NW | Son La | Phu Yen | Road | SPL V | Muong Bang - Dong Nghe Roac |
| 907 | NW | Son La | Son La Town | Electricity | SPL I | Phieng Tam Commune Electric Line |
| 908 | NW | Son La | Thuan Chau | Electricity | SPL I | Phieng Cha Electric Network |
| 909 | NW | Son La | Son La Town | Electricity | SPL II | Chieng Pha Commune Electric Line |
| 910 | NW | Son La | Mai Son | Electricity | SPL II | Co Noi Commune Electric Line |
| 911 | NW | Son La | Son La Town | Electricity | SPL II | Phieng Tam Commune Electric Line |
| 912 | NW | Son La | Son La Town | Electricity | SPL III | Chieng Pha Commune Electric Line |
| 913 | NW | Son La | Son La Town | Electricity | SPL III | Phieng Tam Commune Electric Line |
| 914 | NW | Son La | Thuan Chau | Electricity | SPL III | Chieng Mung-Tong Co-Phieng Tam- |
| 915 | NW | Son La | Mai Son | Electricity | SPL III | Co Noi Commune Electric Line |
| 916 | NW | Son La | Thuan Chau | Electricity | SPL V | Co Ma Commune Electric Line |
| 917 | NW | Son La | Moc Chau | Water Supply | SPL III | Moc Chau Water Supply System |
| 918 | NW | Son La | Sop Cop | Water Supply | SPL V | Sop Cop Town WSS |
| 919 | SE | Tay Ninh | NA | Road | SPL I | Sa Mat-Military Head Quarter of the South |
| 920 | SE | Tay Ninh | Tay Ninh | Road | SPL II | Cau Gia-Binh Minh, Provincial Road No.3 |
| 921 | SE | Tay Ninh | Tan Bien-Tan Chau | Road | SPL II | Road No.792 |
| | | | | | SPL III | Road No.792 (Tan Bien-Tan Chau) |
| 922 | SE | Tay Ninh | Tan Chau | Electricity | SPL I | Tan Hoa-Suoi Ngo Electric Network |
| 923 | SE | Tay Ninh | Tay Ninh | Electricity | SPL II | Binh Minh Commune Electric Line |
| 924 | SE | Tay Ninh | Tan Bien | Electricity | SPL II | Tan Lap Commune Electric Line |
| 925 | SE | Tay Ninh | Trang Bang | Electricity | SPL II | An Thinh Commune Electric Line |
| 926 | SE | Tay Ninh | Go Dau | Water Supply | SPL III | Go Dau WSS |
| 927 | RRD | Thai Binh | NA | Road | SPL I | Road No.224 |
| 928 | RRD | Thai Binh | NA | Road | SPL I | Gia Le - Ben Ho Road |
| 929 | RRD | Thai Binh | Tien Hai | Road | SPL I | Road No.39B - Tien Hai District Section |
| | | | Thai Thuy | | SPL II | Road No.39B |
| | | | | | SPL III | Road No.39B |
| 930 | RRD | Thai Binh | Vu Thu, Hung Ha | Road | SPL II | Road No.223, Vu Thu - Hung Ha Road |
| | | | | | SPL II | Provincial Road No.223 |
| | | | Vu Thu | | SPL III | Road No.223 |
| 931 | RRD | Thai Binh | Vinh Bao | Road | SPL II | Road No.17 |
| 932 | RRD | Thai Binh | Vu Thu | Electricity | SPL I | Vu Thu Electric Network |
| 933 | RRD | Thai Binh | Tien Hai | Electricity | SPL I | Tien Hai Electric Network |
| 934 | RRD | Thai Binh | Kien Xuong | Electricity | SPL I | Kien Xuong Electric Network |
| 935 | RRD | Thai Binh | Tien Hai | Electricity | SPL II | Tien Hai Electric Network |
| 936 | RRD | Thai Binh | Hung Ha | Electricity | SPL II | Hung Ha Electric Network |
| 937 | RRD | Thai Binh | Thai Thuy | Electricity | SPL II | Diem Dien Electric Network |
| 938 | RRD | Thai Binh | Dong Hung | Electricity | SPL II | Dong Hung Electric Network |
| 939 | RRD | Thai Binh | Quynh Coi | Electricity | SPL II | Quynh Coi Electric Network |
| 940 | RRD | Thai Binh | Kien Xuong | Water Supply | SPL III | Kien Xuong WSS |
| 941 | NE | Thai Nguyen | Dinh Hoa | Road | SPL I | Road No.254 Cho Chu - Deo So Road |
| 942 | NE | Thai Nguyen | Thai Nguyen City | Road | SPL I | Road No.74B Phan Dinh Phung Road |
| 943 | NE | Thai Nguyen | Vo Nhai | Road | SPL I | Dinh Ca - Khuon Manh Road |
| 944 | NE | Thai Nguyen | Thai Nguyen City | Road | SPL II | CMT 8 Road |
| | | | | | SPL III | Cach Mang Thang Tam Road |
| 945 | NE | Thai Nguyen | Dinh Hoa | Road | SPL III | Phuc Chu - Bao Linh Road |
| 946 | NE | Thai Nguyen | Dinh Hoa | Road | SPL III | Na Guong - Dong Thinh Road |
| 947 | NE | Thai Nguyen | Dinh Hoa | Road | SPL IV | Tan Duong - Phuong Tien - Trung Hoi |
| 948 | NE | Thai Nguyen | Dai Tu | Road | SPL V | Hung Son - Tan Linh - Phu Lac - Duc |
| 949 | NE | Thai Nguyen | Dai Tu | Road | SPL V | Phuc Luong - Minh Tien Inter-commune |
| 950 | NE | Thai Nguyen | Dinh Hoa | Electricity | SPL I | Dinh Hoa Electric Line |
| 951 | NE | Thai Nguyen | Dong Hy | Electricity | SPL I | Van Han Electric Line |
| 952 | NE | Thai Nguyen | Dinh Hoa | Electricity | SPL II | ATK Area Electric Line |
| 953 | NE | Thai Nguyen | Dai Tu | Electricity | SPL II | Ky Phu Commune Electric Line |
| 954 | NE | Thai Nguyen | Dong Hy | Electricity | SPL II | Van Han Commune Electric Line |
| 955 | NE | Thai Nguyen | Vo Nhai | Electricity | SPL II | Phu Thuong Commune Electric Line |
| 956 | NE | Thai Nguyen | Pho Yen | Electricity | SPL IV | Tan Phu Commune Electric Line |
| 957 | NE | Thai Nguyen | Phu Binh | Electricity | SPL V | Tan Khanh-Phu Binh Commune Electric |

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# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 958 | NE | Thai Nguyen | Dai Tu | Water Supply | SPL IV | Dai Tu WSS |
| 959 | NE | Thai Nguyen | Dong Hy | Water Supply | SPL V | Trai Cau Town WSS |
| 960 | NE | Thai Nguyen | Pho Yen, Phu Binh | Irrigation | SPL IV | Ho Nui Coc Irrigation Canal |
| 961 | NE | Thai Nguyen | Dinh Hoa | Irrigation | SPL IV | Ho Bao Linh irrigation Canal |
| 962 | NE | Thai Nguyen | Dong Hy | Irrigation | SPL V | Minh Lap-Hoa Thuong Irrigation System |
| 963 | NCC | Thanh Hoa | Ha Trung | Road | SPL I | Ha Trung - Ha Lai Road |
| 964 | NCC | Thanh Hoa | Tinh Gia | Road | SPL I | Urban Road Tinh Gia Town |
| 965 | NCC | Thanh Hoa | Quang Xuong | Road | SPL I | Quang Ngoc - Quang Vong - Quang Phuc |
| 966 | NCC | Thanh Hoa | NA | Road | SPL II | Phan Chu Trinh Road |
| 967 | NCC | Thanh Hoa | Quang Xuong | Road | SPL II | Dong Quang-Dong Van-Dong Vinh Road |
| | | | Dong Son | | SPL III | Dong Van-Dong Quang-Dong Vinh Road |
| 968 | NCC | Thanh Hoa | Thieu Hoa | Road | SPL II | Thieu Phu - Thieu Quang Road |
| | | | | | SPL III | Thieu Phu-Thieu Quang Road |
| 969 | NCC | Thanh Hoa | Tinh Gia, Bim Son, Hoang Hoa | Road | SPL II | Tinh Gia - Bim Son - Hoang Hoa Road |
| 970 | NCC | Thanh Hoa | Yen Dinh | Road | SPL II | Dinh Lien - Yen Hung Road |
| | | | | | SPL III | Dinh Lien-Yen Hung Road |
| 971 | NCC | Thanh Hoa | Ha Trung | Road | SPL III | Xuan Thang - Van Xuan Road |
| 972 | NCC | Thanh Hoa | Cam Thuy | Road | SPL IV | Cam Van - Cam Yen - Cam Son Road |
| 973 | NCC | Thanh Hoa | Nhu Thanh | Road | SPL IV | Road from NR 45 to Yen Lac Commune |
| 974 | NCC | Thanh Hoa | NA | Road | SPL V | Road from Do Trap bridge to Hai Ninh |
| 975 | NCC | Thanh Hoa | Quan Hoa | Road | SPL V | Hoi Xuan Town - Phu Nghiem Road |
| 976 | NCC | Thanh Hoa | Ngoc Lac | Electricity | SPL I | My Tan Ngoc Khe Electric Line |
| 977 | NCC | Thanh Hoa | Nhu Xuan | Electricity | SPL I | Hoa Quy Commune Electric Line |
| 978 | NCC | Thanh Hoa | Truong Xuan | Electricity | SPL I | Xuan Cam Electric line |
| 979 | NCC | Thanh Hoa | Thieu Hoa | Electricity | SPL II | Dong Khanh Trade Center Electric Line |
| 980 | NCC | Thanh Hoa | Yen Dinh | Electricity | SPL II | Yen Ninh Commune Electric Line |
| 981 | NCC | Thanh Hoa | Yen Dinh | Electricity | SPL II | Yen Hung Commune Electric Line |
| 982 | NCC | Thanh Hoa | Tinh Gia | Electricity | SPL II | Truong Lam Commune Electric Line |
| 983 | NCC | Thanh Hoa | Cam Thuy | Electricity | SPL II | Cam Long Commune Electric Line |
| 984 | NCC | Thanh Hoa | Tinh Gia | Electricity | SPL II | Dinh Hai Commune Electric Line |
| 985 | NCC | Thanh Hoa | Tho Xuan | Electricity | SPL IV | Quang Phu Commune Electric Line |
| 986 | NCC | Thanh Hoa | Ha Trung | Water Supply | SPL III | Ha Trung WSS |
| 987 | NCC | Thanh Hoa | Nhu Thanh | Water Supply | SPL IV | Nhu Thanh WSS |
| 988 | NCC | Thanh Hoa | Thuong Xuan | Water Supply | SPL IV | Thuong Xuan WSS |
| 989 | NCC | Thanh Hoa | Dong Son | Water Supply | SPL IV | Rung Thong WSS |
| 990 | NCC | Thanh Hoa | Tho Xuan | Water Supply | SPL IV | Tho Xuan WSS |
| 991 | NCC | Thanh Hoa | Hau Loc | Water Supply | SPL V | Hau Loc WSS |
| 992 | NCC | Thanh Hoa | Quang Xuong | Irrigation | SPL III | Quang Xuong Irrigation |
| 993 | NCC | Thanh Hoa | Hau Loc | Irrigation | SPL III | Quang Loc Irrigation |
| 994 | NCC | Thanh Hoa | Thach Thanh | Irrigation | SPL III | Vung Su Reservoir |
| 995 | NCC | Thanh Hoa | Cam Thuy | Irrigation | SPL IV | Duong Coc Reservoir |
| 996 | NCC | Thanh Hoa | Vinh Loc | Irrigation | SPL IV | Ben Da-Nui Trac PS |
| 997 | NCC | Thanh Hoa | Thach Thanh | Irrigation | SPL V | Long Dong Irrigation Canal |
| 998 | NCC | Thua-Thien Hue | NA | Road | SPL I | Provincial Road No.68B |
| | | | | | SPL II | Provincial Road No.68 |
| 999 | NCC | Thua-Thien Hue | NA | Road | SPL I | Provincial Road No.4 |
| | | | | | SPL II | Provincial Road No.4 |
| 1000 | NCC | Thua-Thien Hue | NA | Road | SPL I | Cong Chem - Cua Hau Road |
| | | | | | SPL II | Cong Chem - Cua Hau Road |
| 1001 | NCC | Thua-Thien Hue | Phu Vang | Road | SPL V | Phu Xuan - Phu Da Inter-Commune Road |
| 1002 | NCC | Thua-Thien Hue | Huong Tra | Electricity | SPL I | Hai Duong Commune Electric Network |
| 1003 | NCC | Thua-Thien Hue | Phu Vang | Electricity | SPL I | Phu Dien Commune Electric Network |
| 1004 | NCC | Thua-Thien Hue | Phu Loc | Electricity | SPL I | Loc Vinh Commune Electric Network |
| 1005 | NCC | Thua-Thien Hue | Phu Vang | Electricity | SPL II | Vinh Ha Commune Electric Line |
| 1006 | NCC | Thua-Thien Hue | Huong Thuy | Electricity | SPL II | Duong Hoa War Zone Electric Line |
| 1007 | NCC | Thua-Thien Hue | Phu Vang | Electricity | SPL II | Vinh Thai Commune Electric Line |
| 1008 | NCC | Thua-Thien Hue | Huong Tra | Electricity | SPL II | Binh Dien Commune Electric Line |
| 1009 | NCC | Thua-Thien Hue | Phu Loc | Electricity | SPL II | Vinh My Commune Electric Line |
| 1010 | NCC | Thua-Thien Hue | Phong Dien | Electricity | SPL II | Bac Hien Commune Electric Line |
| 1011 | NCC | Thua-Thien Hue | Phu Loc | Electricity | SPL V | Electric Line in area 3 of Phu Loc Distric |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 1012 | NCC | Thua-Thien Hue | NA | Water Supply | SPL I | Chan My Water Supply System |
| 1013 | NCC | Thua-Thien Hue | Phu Bai | Water Supply | SPL III | Phu Bai WSS |
| 1014 | NCC | Thua-Thien Hue | Nam Dong | Water Supply | SPL V | Khe Tre WSS |
| 1015 | NCC | Thua-Thien Hue | Phong Dien-Quang | Irrigation | SPL III | Phong Chuong-Cua Lac Irrigation Systen |
| 1016 | NCC | Thua-Thien Hue | Phong Dien | Irrigation | SPL V | Dien Hoa-Dien Hai Irrigation System |
| 1017 | MD | Tien Giang | Cho Gao Town | Road | SPL I | Cho Gao Town Road |
| 1018 | MD | Tien Giang | NA | Road | SPL I | Provincial Road No.867(Tan Phuoc-Chau |
| 1019 | MD | Tien Giang | NA | Road | SPL II | Provincial Road No.871 |
| 1020 | MD | Tien Giang | Go Cong | Road | SPL III | Provincial Road No.862 |
| 1021 | MD | Tien Giang | NA | Electricity | SPL I | Phu Tan Electric |
| 1022 | MD | Tien Giang | Tan Thoi | Electricity | SPL I | Tan Thoi Electric |
| 1023 | MD | Tien Giang | NA | Electricity | SPL I | Long Hung Electric |
| 1024 | MD | Tien Giang | NA | Electricity | SPL II | Tan Thoi Commune Electric Line |
| 1025 | MD | Tien Giang | NA | Electricity | SPL II | Thanh My Commune Electric Line |
| 1026 | MD | Tien Giang | NA | Electricity | SPL II | Binh Xuan Commune Electric Line |
| 1027 | MD | Tien Giang | Cai Be | Electricity | SPL III | My Loi A Commune Electric Line |
| 1028 | MD | Tien Giang | Cai Lay | Electricity | SPL III | Tan Hoi Commune Electric Line |
| 1029 | MD | Tien Giang | Chau Thanh | Electricity | SPL III | Diem Hy Commune Electric Line |
| 1030 | MD | Tra Vinh | Tra Vinh Township | Road | SPL I | Urban Road of Tra Vinh Township, 30Rds. |
| 1031 | MD | Tra Vinh | Tra Vinh Township | Road | SPL II | Urban Road of Tra Vinh Township, 28Rds. |
| 1032 | MD | Tra Vinh | Tieu Can | Road | SPL II | Provincial Road No.912 |
| | | | | | SPL III | Provincial Road No.912 |
| | | | | | SPL IV | Provincial Road No.912 |
| 1033 | MD | Tra Vinh | Cau Ngang | Road | SPL III | Thanh Son - Hiep My Dong Road |
| 1034 | MD | Tra Vinh | Cang Long, Chau | Road | SPL IV | District Road No.8 & At Ech Bridge |
| 1035 | MD | Tra Vinh | Cau Ke | Road | SPL IV | Bo Xe and Thanh Phu bridges in Road No. |
| 1036 | MD | Tra Vinh | Cang Long, Tra Cu, Tieu Can | Road | SPL V | Acess roads to center of Huyen Hoi, Kim Son, Tan Hoa, Dai Phuc communes |
| 1037 | MD | Tra Vinh | NA | Electricity | SPL I | Ham Giang Electric Network |
| 1038 | MD | Tra Vinh | NA | Electricity | SPL II | Ham Giang Electric Network |
| 1039 | MD | Tra Vinh | NA | Electricity | SPL III | Cau Quan Commune Electric Line |
| 1040 | MD | Tra Vinh | Duyen Hai | Electricity | SPL III | Long Toan Commune Electric Line |
| 1041 | MD | Tra Vinh | Cau Ke | Electricity | SPL III | Hoa An Commune Electric Line |
| 1042 | MD | Tra Vinh | Cang Long | Electricity | SPL III | My Cam Commune Electric Line |
| 1043 | MD | Tra Vinh | Tieu Can | Water Supply | SPL IV | Cau Quan WSS |
| 1044 | MD | Tra Vinh | Cau Ke | Water Supply | SPL IV | Cau Ke WSS |
| 1045 | MD | Tra Vinh | Cau Ngang | Water Supply | SPL V | Widenning and Upgrading Treament |
| 1046 | MD | Tra Vinh | Cang Long | Irrigation | SPL IV | Khu B1-Lang The Irrigation Canal |
| 1047 | MD | Tra Vinh | Chau Thanh | Irrigation | SPL V | Lang The Irrigation Canal |
| 1048 | NE | Tuyen Quang | Ham Yen-Chiem Hoa | Road | SPL I | Provincial Road 176 (km0-km23.5) |
| | | | Chiem Hoa-Na Hang | | SPL II | Provincial Road 176 (km39-km58.055) |
| | | | | | SPL III | Provincial Road 176 |
| 1049 | NE | Tuyen Quang | Ham Yen | Road | SPL III | Khau Lang - Cao Duong Road |
| 1050 | NE | Tuyen Quang | Chiem Hoa | Road | SPL IV | Phuc Thinh - Trung Ha Road |
| 1051 | NE | Tuyen Quang | Na Hang | Road | SPL IV | Thuong Lam - Lang Can Road |
| 1052 | NE | Tuyen Quang | Chiem Hoa | Road | SPL V | Duc Thinh - Hoa An Road |
| 1053 | NE | Tuyen Quang | Yen Son | Road | SPL V | Tu Quan Quy Quan Road |
| 1054 | NE | Tuyen Quang | Tuyen Quan Town | Electricity | SPL I | Tuyen Quang Town-Dao Vien-Dong Da |
| 1055 | NE | Tuyen Quang | Yen Son | Electricity | SPL I | Trung Son-Trung Yen Electric Network |
| 1056 | NE | Tuyen Quang | Chiem Hoa | Electricity | SPL II | 35KV-Ngoc Hoi-Kien Dai Electric Line |
| 1057 | NE | Tuyen Quang | Chiem Hoa | Electricity | SPL II | 35KV-Quang Linh-Tri Phi-Linh Phu |
| 1058 | NE | Tuyen Quang | Chiem Hoa | Electricity | SPL III | Vinh Quang -Binh Nhan Transfomer and |
| 1059 | NE | Tuyen Quang | Ham Yen | Electricity | SPL III | Tan Yen-Bach Nha Transfomer and |
| 1060 | NE | Tuyen Quang | Son Duong | Electricity | SPL IV | Electric Line and Transfomer in Binh Yen |
| 1061 | NE | Tuyen Quang | Yen Son | Electricity | SPL V | Construction TFS Station in Hung Loi- |
| 1062 | NE | Tuyen Quang | Tuyen Hoa | Irrigation | SPL IV | Minh An Pump Station |
| 1063 | NE | Tuyen Quang | Chiem Hoa | Irrigation | SPL V | Irrigation System in Yen Lap Commune |
| 1064 | MD | Vinh Long | NA | Road | SPL I | Mau Than Road |
| 1065 | MD | Vinh Long | NA | Road | SPL I | Hung Dao Vuong Road |
| 1066 | MD | Vinh Long | Tam Binh, Tra On | Road | SPL II | Provincial Road No.33(Tam Binh-Tra On) |
| 1067 | MD | Vinh Long | Vung Liem, Long Ho | Road | SPL II | Provincial Road No.31(Vung Liem-Long |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

# Appendix 1.2 Sub-Project (Infrastructure) List



| No. for Infrastructure | Region | Province | District | Sector | Phase | Sub-Project |
|---|---|---|---|---|---|---|
| 1068 | MD | Vinh Long | Long Ho | Road | SPL III | Long Ho-Cai Ngang Roac |
| 1069 | MD | Vinh Long | Long Ho | Electricity | SPL I | Phu Duc Electric |
| 1070 | MD | Vinh Long | Binh Minh | Electricity | SPL I | KhanhTiet-Khanh Tu-Thuan An Electric |
| 1071 | MD | Vinh Long | Vung Liem | Electricity | SPL II | Trung An-Aa Kinh Commune Electric Line |
| 1072 | MD | Vinh Long | Vung Liem | Electricity | SPL II | Trung An Phu Cuong Commune Electric |
| 1073 | MD | Vinh Long | Tra On | Water Supply | SPL III | Tra On WSS |
| 1074 | MD | Vinh Long | Tam Binh | Water Supply | SPL V | Cai Ngang WSS |
| 1075 | MD | Vinh Long | Tra On | Irrigation | SPL V | Rach Tra-Thien My Irrigation Canal |
| 1076 | RRD | Vinh Phuc | Vinh Yen City | Road | SPL I | Urban Road (Vinh Yen Town) |
| 1077 | RRD | Vinh Phuc | NA | Road | SPL I | Luc Ha - Tay Thien Road |
| 1078 | RRD | Vinh Phuc | Yen Lac | Road | SPL I | Quan Tien - Lung Ha Road |
| 1079 | RRD | Vinh Phuc | Phuc Yen | Road | SPL I | Road to Hai Ba Trung Temple |
| 1080 | RRD | Vinh Phuc | Vinh Tuong | Road | SPL II | Road No.304(Vu Di - Hoi Thinh) |
| | | | | | SPL III | Road No.304 (Hoi Thinh-Vu Di-Vinh |
| 1081 | RRD | Vinh Phuc | Binh Xuyen | Road | SPL II | Road around Dai Lai Lake |
| 1082 | RRD | Vinh Phuc | Binh Xuyen | Road | SPL II | Trung My - Huong Canh Road |
| | | | | | SPL III | Huong Canh-Trung My Roac |
| 1083 | RRD | Vinh Phuc | Lap Thach | Road | SPL II | Quang Yen - Phu Hau Road |
| 1084 | RRD | Vinh Phuc | Vinh Tuong | Road | SPL II | Vu Di-Tu Trung-Dai Tu Road |
| | | | | | SPL III | Vu Di-Dai Tu Road |
| 1085 | RRD | Vinh Phuc | TC-GB | Road | SPL III | Road No.303B |
| 1086 | RRD | Vinh Phuc | Lap Thach | Road | SPL IV | Ngoc My - Quang Son Roac |
| 1087 | RRD | Vinh Phuc | Binh Xuyen | Road | SPL V | Thien Ke - Trung My - Thanh Lanh dike |
| 1088 | RRD | Vinh Phuc | Lap Thach | Electricity | SPL I | Quang Son Electric Line |
| 1089 | RRD | Vinh Phuc | Lap Thach | Electricity | SPL I | Xuan Hoa Electric Line |
| 1090 | RRD | Vinh Phuc | Yen Lac Town | Electricity | SPL I | Yen Lac Town Electric Line |
| 1091 | RRD | Vinh Phuc | Tam Dao | Electricity | SPL II | Huong Dao Commune Electric Line |
| 1092 | RRD | Vinh Phuc | Vinh Tuong | Electricity | SPL II | NguKiem-VinhThinh Commune Electric |
| 1093 | RRD | Vinh Phuc | Tam Dao | Electricity | SPL II | Bo Ly Commune Electric Line |
| 1094 | RRD | Vinh Phuc | Lap Thach | Electricity | SPL IV | Electric Network in 4 Communes in Lap |
| 1095 | RRD | Vinh Phuc | Tam Duong | Electricity | SPL IV | Electric Network in 6 Communes in Tam |
| 1096 | RRD | Vinh Phuc | Yen Lac | Water Supply | SPL III | Yen Lac WSS |
| 1097 | RRD | Vinh Phuc | Vinh Tuong | Water Supply | SPL V | Vinh Tuong WSS |
| 1098 | RRD | Vinh Phuc | Lap Thach | Irrigation | SPL V | Don Nhan Irrigation System |
| 1099 | NE | Yen Bai | Ha Giang Town | Road | SPL I | Nguyen Thai Hoc Road |
| | | | | | SPL II | Nguyen Thai Hoc Road |
| 1100 | NE | Yen Bai | Tran Yen | Road | SPL I | Yen Bai - Khe Sang Road |
| | | | | | SPL I | Yen Bai - Khe Sang Road |
| | | | | | SPL II | Yen Bai - Khe Sang(Yen Bai - Mau A) |
| | | | | | SPL III | Yen Bai Khe Sang Road |
| | | | | | SPL IV | Yen Bai - Khe Sang Road |
| 1101 | NE | Yen Bai | Tran Yen | Road | SPL II | Huong Ly - Van Phu Roac |
| 1102 | NE | Yen Bai | Tram Tau | Road | SPL II | Van Chan - Tram Tau Road |
| 1103 | NE | Yen Bai | Van Yen | Road | SPL V | Dong An - Phong Du Ha Roac |
| 1104 | NE | Yen Bai | Yen Binh | Road | SPL V | Hoang Thi Road |
| 1105 | NE | Yen Bai | Van Chan | Electricity | SPL I | Nghia Tam Commune Electric Line |
| 1106 | NE | Yen Bai | Van Chan | Electricity | SPL II | Nghia Tam Commune Electric Line |
| 1107 | NE | Yen Bai | Tram Tau | Electricity | SPL III | Phinh Ho Commune Electric Line |
| 1108 | NE | Yen Bai | Tran Yen | Electricity | SPL III | Cuong Thinh Commune Electric Line |
| 1109 | NE | Yen Bai | Tran Yen | Electricity | SPL III | Minh Quan Commune Electric Line |
| 1110 | NE | Yen Bai | Van Chan | Electricity | SPL III | Nghia Loi Commune Electric Line |
| 1111 | NE | Yen Bai | Van Chan | Electricity | SPL III | Tan Thinh Commune Electric Line |
| 1112 | NE | Yen Bai | Luc Yen | Electricity | SPL V | Lam Thuong Electric Network |
| 1113 | NE | Yen Bai | Van Yen | Water Supply | SPL III | Mau A Water Supply System |
| 1114 | NE | Yen Bai | Tram Tau | Water Supply | SPL V | Tram Tam Town WSS |
| 1115 | NE | Yen Bai | Van Chan | Irrigation | SPL V | Khe The Irrigation System |

Region: NE-North East Montainous, NW-North West Mountainaous, RRD-Red River Delta
NCC-North Central Coast, SCC-South Central Coast, CH-Central Highland, SE-South East, MD-Mekong Delta

# Appendix 1.3 Number of Sub-Projects and Infrastructures by Province

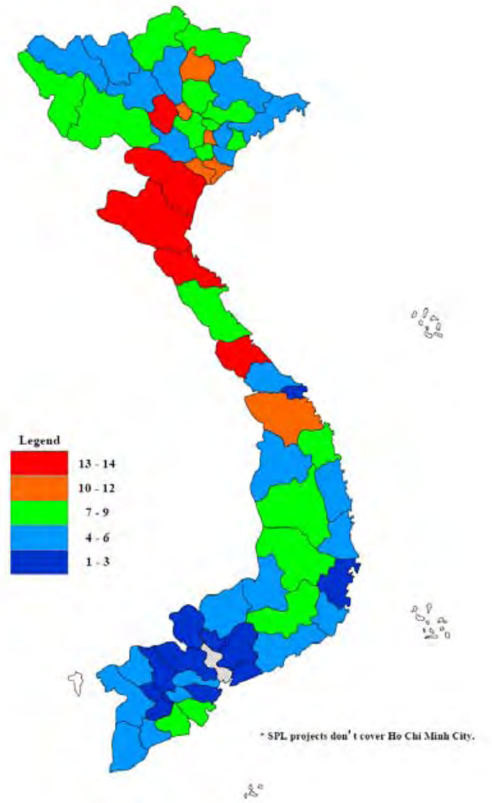
(1/2)

| Province | Road | | Electricity Distribution | | Water Supply | | Irrigation | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | sub-project | infra-structure | sub-project | infra-structure | sub-project | infra-structure | sub-project | infra-structure | sub-project | infra-structure |
| An Giang | 4 | 4 | 16 | 16 | 1 | 1 | 0 | 0 | 21 | 21 |
| Ba Ria Vung Tau | 3 | 2 | 4 | 4 | 0 | 0 | 0 | 0 | 7 | 6 |
| Bac Giang | 10 | 8 | 23 | 23 | 1 | 1 | 1 | 1 | 35 | 33 |
| Bac Kan | 13 | 11 | 5 | 5 | 1 | 1 | 3 | 3 | 22 | 20 |
| Bac Lieu | 5 | 4 | 6 | 6 | 1 | 1 | 1 | 1 | 13 | 12 |
| Bac Ninh | 10 | 9 | 8 | 8 | 1 | 1 | 0 | 0 | 19 | 18 |
| Ben Tre | 5 | 3 | 5 | 5 | 0 | 0 | 0 | 0 | 10 | 8 |
| Binh Dinh | 6 | 6 | 11 | 11 | 1 | 1 | 4 | 4 | 22 | 22 |
| Binh Duong | 1 | 1 | 4 | 4 | 0 | 0 | 0 | 0 | 5 | 5 |
| Binh Phuoc | 7 | 4 | 7 | 7 | 0 | 0 | 0 | 0 | 14 | 11 |
| Binh Thuan | 7 | 5 | 15 | 15 | 0 | 0 | 0 | 0 | 22 | 20 |
| Ca Mau | 6 | 4 | 6 | 6 | 2 | 4 | 1 | 1 | 15 | 15 |
| Can Tho | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 3 |
| Cao Bang | 11 | 8 | 13 | 13 | 0 | 0 | 1 | 1 | 25 | 22 |
| Da Nang | 2 | 2 | 7 | 7 | 0 | 0 | 0 | 0 | 9 | 9 |
| Dac Lak | 10 | 9 | 9 | 9 | 2 | 2 | 5 | 5 | 26 | 25 |
| Dak Nong | 4 | 4 | 4 | 4 | 0 | 0 | 2 | 2 | 10 | 10 |
| Dien Bien | 11 | 7 | 1 | 1 | 3 | 3 | 1 | 1 | 16 | 12 |
| Dong Nai | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| Dong Thap | 4 | 3 | 8 | 8 | 1 | 1 | 1 | 1 | 14 | 13 |
| Gia Lai | 8 | 7 | 11 | 11 | 2 | 2 | 3 | 3 | 24 | 23 |
| Ha Giang | 11 | 8 | 5 | 5 | 3 | 3 | 1 | 1 | 20 | 17 |
| Ha Nam | 12 | 9 | 11 | 11 | 0 | 0 | 0 | 0 | 23 | 20 |
| Ha Noi (Ha Tay) | 11 | 8 | 8 | 8 | 1 | 1 | 0 | 0 | 20 | 17 |
| Ha Tinh | 17 | 14 | 26 | 26 | 6 | 5 | 7 | 7 | 56 | 52 |
| Hai Duong | 8 | 6 | 8 | 8 | 1 | 1 | 0 | 0 | 17 | 15 |
| Hai Phong | 9 | 8 | 1 | 1 | 1 | 1 | 0 | 0 | 11 | 10 |
| Hau Giang | 1 | 1 | 4 | 4 | 1 | 1 | 0 | 0 | 6 | 6 |
| Hoa Binh | 8 | 4 | 11 | 11 | 0 | 0 | 2 | 2 | 21 | 17 |
| Hung Yen | 11 | 10 | 7 | 7 | 0 | 0 | 0 | 0 | 18 | 17 |
| Khanh Hoa | 2 | 2 | 8 | 8 | 0 | 0 | 0 | 0 | 10 | 10 |
| Kien Giang | 5 | 5 | 4 | 4 | 1 | 1 | 0 | 0 | 10 | 10 |
| Kon Tum | 6 | 4 | 7 | 7 | 3 | 3 | 2 | 2 | 18 | 16 |
| Lai Chau | 7 | 6 | 7 | 7 | 3 | 4 | 1 | 1 | 18 | 18 |
| Lam Dong | 8 | 7 | 11 | 11 | 2 | 2 | 2 | 2 | 23 | 22 |
| Lang Son | 9 | 6 | 8 | 8 | 1 | 1 | 1 | 1 | 19 | 16 |
| Lao Cai | 11 | 6 | 14 | 14 | 2 | 2 | 2 | 2 | 29 | 24 |
| Long An | 4 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 7 | 6 |
| Nam Dinh | 14 | 11 | 15 | 15 | 0 | 0 | 0 | 0 | 29 | 26 |
| Nghe An | 15 | 13 | 13 | 13 | 4 | 4 | 4 | 4 | 36 | 34 |
| Ninh Binh | 15 | 12 | 9 | 9 | 1 | 1 | 1 | 1 | 26 | 23 |
| Ninh Thuan | 8 | 6 | 11 | 11 | 1 | 1 | 3 | 3 | 23 | 21 |
| Phu Tho | 16 | 14 | 19 | 19 | 5 | 5 | 5 | 5 | 45 | 43 |
| Phu Yen | 7 | 5 | 9 | 9 | 2 | 2 | 4 | 3 | 22 | 19 |
| Quang Binh | 8 | 7 | 10 | 10 | 2 | 2 | 1 | 1 | 21 | 20 |
| Quang Nam | 12 | 11 | 11 | 11 | 4 | 3 | 1 | 1 | 28 | 26 |
| Quang Ngai | 10 | 9 | 9 | 9 | 2 | 2 | 4 | 4 | 25 | 24 |
| Quang Ninh | 8 | 5 | 1 | 1 | 2 | 2 | 0 | 0 | 11 | 8 |
| Quang Tri | 16 | 13 | 13 | 13 | 6 | 6 | 3 | 3 | 38 | 35 |
| Soc Trang | 9 | 8 | 7 | 7 | 2 | 2 | 0 | 0 | 18 | 17 |
| Son La | 9 | 7 | 10 | 10 | 2 | 2 | 0 | 0 | 21 | 19 |

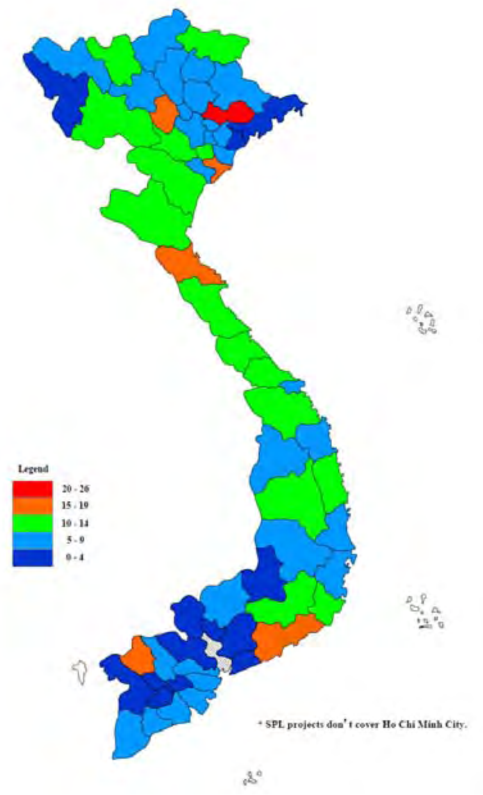
# Appendix 1.3 Number of Sub-Projects and Infrastructures by Province (2/2)

| Province | Road | | Electricity Distribution | | Water Supply | | Irrigation | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | sub-project | infra-structure | sub-project | infra-structure | sub-project | infra-structure | sub-project | infra-structure | sub-project | infra-structure |
| Tay Ninh | 4 | 3 | 4 | 4 | 1 | 1 | 0 | 0 | 9 | 8 |
| Thai Binh | 9 | 5 | 8 | 8 | 1 | 1 | 0 | 0 | 18 | 14 |
| Thai Nguyen | 10 | 9 | 8 | 8 | 2 | 2 | 3 | 3 | 23 | 22 |
| Thanh Hoa | 16 | 13 | 10 | 10 | 6 | 6 | 6 | 6 | 38 | 35 |
| Thua-Thien Hue | 7 | 4 | 10 | 10 | 3 | 3 | 2 | 2 | 22 | 19 |
| Tien Giang | 4 | 4 | 9 | 9 | 0 | 0 | 0 | 0 | 13 | 13 |
| Tra Vinh | 9 | 7 | 6 | 6 | 3 | 3 | 2 | 2 | 20 | 18 |
| Tuyen Quang | 8 | 6 | 8 | 8 | 0 | 0 | 2 | 2 | 18 | 16 |
| Vinh Long | 5 | 5 | 4 | 4 | 2 | 2 | 1 | 1 | 12 | 12 |
| Vinh Phuc | 15 | 12 | 8 | 8 | 2 | 2 | 1 | 1 | 26 | 23 |
| Yen Bai | 11 | 6 | 8 | 8 | 2 | 2 | 1 | 1 | 22 | 17 |
| Total | 518 | 408 | 526 | 526 | 96 | 97 | 85 | 84 | 1225 | 1115 |

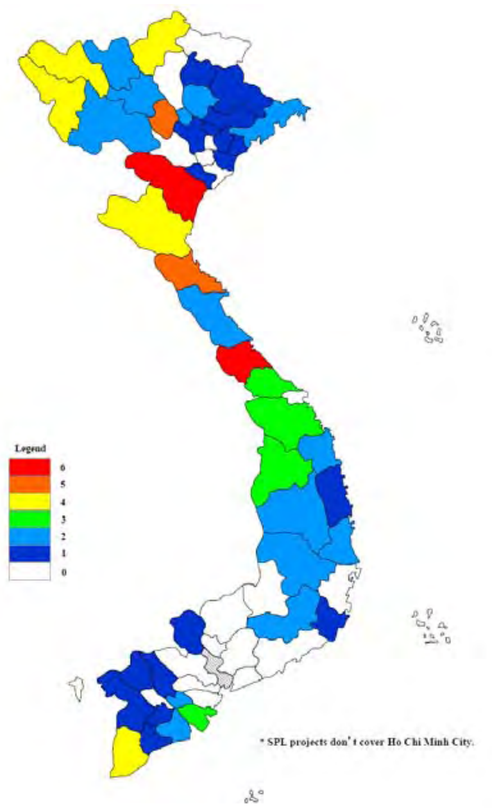
## Appendix 3.1 Distribution of the Number of Infrastructures



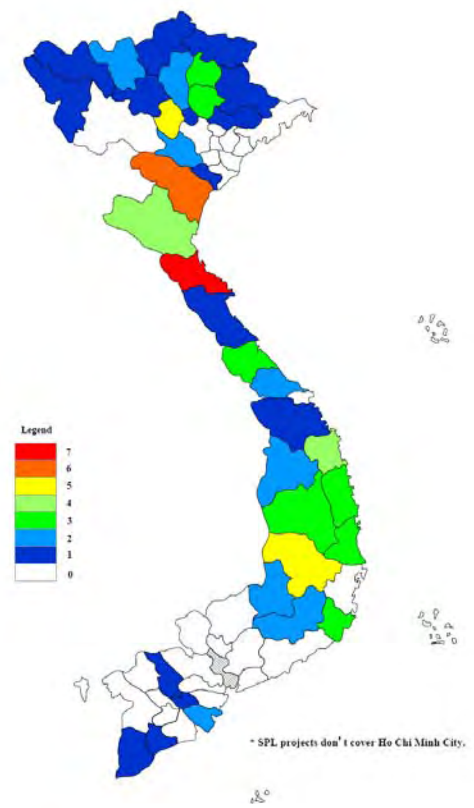

**Road Sector**



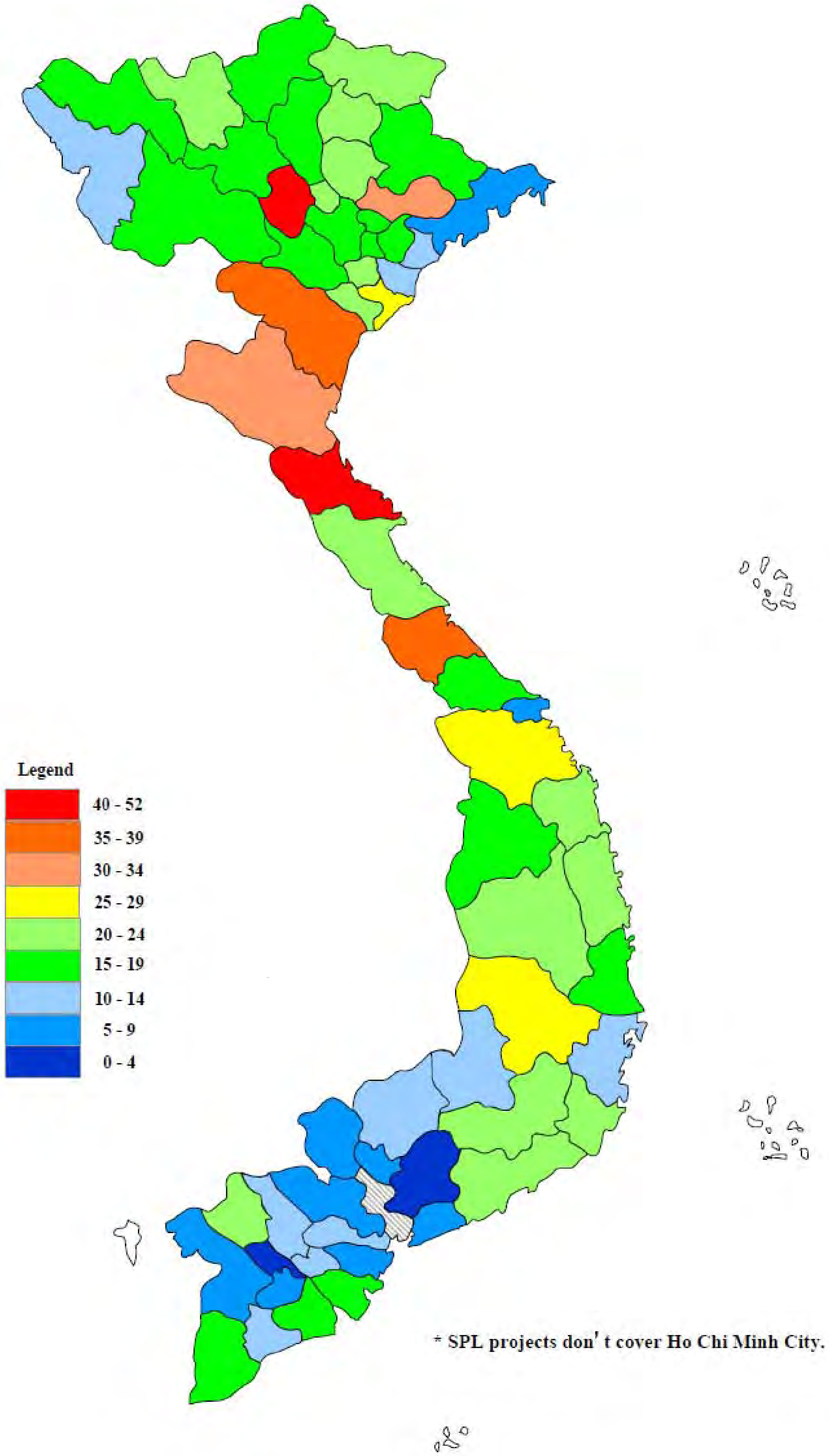

**Power Distribution Sector**




**Water Supply Sector**




**Irrigation Sector**


Legend
40 - 52
35 - 39
30 - 34
25 - 29
20 - 24
15 - 19
10 - 14
5 - 9
0 - 4
* SPL projects don' t cover Ho Chi Minh City.

**All Sector**

# Appendix 3.2 Record of Receiving the Replies to the Questionnaires

(1/3)

| Province | Road Sector | | | | Electricity Sector | | | | Water Supply Sector | | | | Irrigation Sector | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V |
| An Giang | 4 | 4 | 1 | 1 | 16 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Ba Ria V.Tau | 3 | 3 | 1 | 1 | 4 | | 4 | | | | | | 0 | 0 | 0 | 0 |
| Bac Giang | 10 | 7 | 2 | 2 | 23 | 5 | 5 | 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Bac Kan | 13 | 8 | 7 | 7 | 5 | | 3 | | 1 | | 1 | | 3 | | 3 | |
| Bac Lieu | 5 | 5 | 3 | 3 | 6 | | 4 | | 1 | 1 | 1 | 1 | 1 | | 1 | |
| Bac Ninh | 10 | 1 | 2 | 1 | 8 | | 0 | 0 | 1 | | 1 | | 0 | 0 | 0 | 0 |
| Ben Tre | 5 | 2 | 2 | 2 | 5 | 3 | 3 | 3 | | | | | 0 | 0 | 0 | 0 |
| Binh Dinh | 6 | 6 | 1 | 1 | 11 | | 5 | | 1 | 1 | 1 | 1 | 4 | 3 | 4 | 3 |
| Binh Duong | 1 | | 0 | 0 | 4 | | 2 | | | | | | 0 | 0 | 0 | 0 |
| Binh Phuoc | 6 | 5 | 2 | 2 | 7 | 5 | 4 | 4 | | | | | 0 | 0 | 0 | 0 |
| Binh Thuan | 7 | 6 | 2 | 1 | 15 | | 4 | | | | | | 0 | 0 | 0 | 0 |
| Ca Mau | 5 | 2 | 2 | 2 | 6 | 6 | 4 | 4 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Can Tho | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | 0 | 0 | 0 | 0 |
| Cao Bang | 11 | 9 | 7 | 6 | 13 | 13 | 10 | 10 | | | | | 1 | 1 | 1 | 1 |
| Da Nang | 2 | 2 | 0 | 0 | 7 | | 4 | | | | | | 0 | 0 | 0 | 0 |
| Dac Lak | 10 | 10 | 6 | 6 | 9 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 5 | 5 | 5 | 5 |
| Dak Nong | 4 | 4 | 4 | 4 | 4 | | 2 | | | | | | 2 | | 2 | |
| Dien Bien | 11 | 11 | 8 | 8 | 1 | | 0 | 0 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 |
| Dong Nai | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | | | | | 0 | 0 | 0 | 0 |
| Dong Thap | 4 | 4 | 2 | 2 | 8 | | 4 | | 1 | 1 | 1 | 1 | 1 | | 1 | |
| Gia Lai | 7 | 7 | 4 | 4 | 8 | 1 | 4 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 2 |
| Ha Giang | 11 | 3 | 5 | 3 | 5 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |
| Ha Nam | 12 | 4 | 3 | 2 | 11 | | 0 | 0 | | | | | 0 | 0 | 0 | 0 |
| Ha Noi | 12 | | 2 | | 8 | | 0 | 0 | 1 | | 1 | | 0 | 0 | 0 | 0 |
| Ha Tinh | 17 | 17 | 8 | 8 | 26 | | 5 | | 5 | 3 | 4 | 2 | 7 | 1 | 7 | 1 |
| Hai Duong | 8 | 6 | 1 | 1 | 8 | | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

# Appendix 3.2 Record of Receiving the Replies to the Questionnaires

(2/3)

| Province | Road Sector | | | | Electricity Sector | | | | Water Supply Sector | | | | Irrigation Sector | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V |
| Hai Phong | 9 | 9 | 2 | 2 | 1 | | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Hau Giang | 1 | | 1 | | 4 | | 1 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Hoa Binh | 7 | 7 | 3 | 3 | 11 | 4 | 4 | 3 | | | | | 2 | 2 | 2 | 2 |
| Hung Yen | 11 | | 4 | | 7 | | 0 | 0 | | | | | 0 | 0 | 0 | 0 |
| Khanh Hoa | 2 | 2 | 0 | 0 | 8 | | 3 | | | | | | 0 | 0 | 0 | 0 |
| Kien Giang | 5 | 5 | 2 | 2 | 4 | | 1 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Kon Tum | 6 | 6 | 2 | 2 | 6 | | 4 | | 3 | | 3 | | 2 | | 2 | |
| Lai Chau | 7 | 7 | 5 | 5 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 |
| Lam Dong | 8 | 8 | 3 | 3 | 11 | | 4 | | 2 | 2 | 1 | 1 | 2 | 0 | 2 | 1/0 |
| Lang Son | 9 | 9 | 5 | 5 | 8 | 1 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Lao Cai | 11 | 11 | 6 | 6 | 17 | 15 | 5 | 5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Long An | 4 | | 0 | 0 | 3 | | 0 | 0 | | | | | 0 | 0 | 0 | 0 |
| Nam Dinh | 14 | 11 | 3 | 3 | 15 | | 0 | 0 | | | | | 0 | 0 | 0 | 0 |
| Nghe An | 15 | 4 | 8 | 4 | 13 | | 7 | | 4 | 1 | 3 | 1 | 4 | | 4 | |
| Ninh Binh | 15 | 9 | 4 | 3 | 9 | | 0 | 0 | 1 | | 0 | | 1 | | 1 | |
| Ninh Thuan | 8 | 7 | 4 | 4 | 11 | | 4 | | 1 | | 1 | | 3 | 3 | 3 | 3 |
| Phu Tho | 16 | 16 | 9 | 9 | 19 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 |
| Phu Yen | 7 | 7 | 4 | 4 | 9 | 1 | 3 | 1 | 2 | 2 | 2 | 2 | 4 | 1 | 4 | 1 |
| Quang Binh | 8 | 8 | 2 | 2 | 10 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| Quang Nam | 12 | 12 | 5 | 5 | 11 | | 5 | | 4 | | 3 | | 1 | | 1 | |
| Quang Ngai | 10 | 10 | 4 | 4 | 9 | | 0 | | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 |
| Quang Ninh | 8 | 8 | 2 | 2 | 1 | | 0 | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| Quang Tri | 16 | 15 | 9 | 9 | 13 | 8 | 7 | 7 | 6 | 6 | 4 | 4 | 3 | | 3 | |
| Soc Trang | 9 | 5 | 7 | 5 | 7 | 4 | 3 | 3 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 |
| Son La | 9 | | 5 | | 10 | | 5 | | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 |
| Tay Ninh | 4 | | 1 | | 4 | | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

# Appendix 3.2 Record of Receiving the Replies to the Questionnaires



| Province | Road Sector | | | | Electricity Sector | | | | Water Supply Sector | | | | Irrigation Sector | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V | Total.Sub-project.No | Total Rep | Sub-project III-V | Reply III-V |
| Thai Binh | 9 | | 2 | | 8 | | 0 | 0 | 1 | | 1 | | 0 | 0 | 0 | 0 |
| Thai Nguyen | 10 | 7 | 6 | 4 | 8 | | 2 | | 2 | 2 | 2 | 2 | 3 | | 3 | |
| Thanh Hoa | 16 | 6 | 8 | 4 | 10 | | 1 | | 6 | 2 | 6 | 2 | 6 | 2 | 6 | 2 |
| Thua-Thien Hue | 7 | 7 | 1 | 1 | 10 | | 1 | | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 |
| Tien Giang | 4 | 3 | 1 | 1 | 9 | | 3 | | | | | | 0 | | 0 | |
| Tra Vinh | 9 | 7 | 6 | 6 | 6 | | 4 | | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 1 |
| Tuyen Quang | 8 | 6 | 6 | 4 | 8 | | 4 | | | | | | 2 | | 2 | |
| Vinh Long | 5 | 5 | 1 | 1 | 4 | | 0 | | 2 | 2 | 2 | 2 | 1 | | 1 | |
| Vinh Phuc | 15 | | 6 | | 8 | 3 | 0 | 0 | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 1 |
| Yen Bai | 10 | 6 | 4 | 4 | 8 | 6 | 6 | 6 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 |
| **Total** | **512** | | **217** | | **522** | | **166** | | **96** | | **80** | | **85** | | **85** | |
| Replied (No.of project) | 355 | 355 | 175 | 175 | 92 | 92 | 70 | 70 | 71 | 71 | 60 | 60 | 42 | 42 | 42 | 42 |
| Replied (%) | 69.34% | | 80.65% | | 17.62% | | 42.17% | | 73.96% | | 75.00% | | 49.41% | | 49.41% | |

# Appendix 3.3 Questionnaire

## Road Sector

### I. General Information

Name of Liaison with DPI/MPI:______________________.

<table>
<tr><td colspan="2">SPL Phase:</td><td></td><td>Name of the Project:</td><td colspan="2"></td></tr>
<tr><td>Province:</td><td></td><td>District/City:</td><td></td><td>Commune:</td><td></td></tr>
<tr><td>Organization in Charge:</td><td>Project Owner</td><td>Operation, Maintenance and Management</td><td colspan="3">Name of the Organization:<br>- Address:<br>- Tel / Fax:<br>- E-mail:</td></tr>
<tr><td>Date:</td><td colspan="5"></td></tr>
<tr><td>Respondent:</td><td colspan="5"></td></tr>
<tr><td>Cell phone #:</td><td colspan="5"></td></tr>
<tr><td>Year of Construction Works Commencement:</td><td colspan="2"></td><td>Project Owner in the Implementation stage:</td><td colspan="2"></td></tr>
<tr><td>Year of Construction Works Completion:</td><td colspan="2"></td><td>Material Cost (BVND):</td><td colspan="2"></td></tr>
<tr><td>Construction Cost (BVND):</td><td colspan="2"></td><td>Domestic Fund (BVND):</td><td colspan="2"></td></tr>
<tr><td>Total investment Cost (BVND):</td><td colspan="2"></td><td>JBIC Fund (BVND):</td><td colspan="2"></td></tr>
</table>

**II. Questionnaire about Operation and Maintenance (O&M)**

| O&M General: | |
|---|---|
| Date transferred to O&M: | - Day<br>- Month<br>- Year |
| Name of O&M organization: | |
| Type of organization: | Co / Co-operative |

| Capacity of O&M Organization: | |
|---|---|
| Established year : | |
| Total staffs: | |
| Of which; | - Engineers:<br>- Technicians :<br>- Major Equipment: |

| Maintenance: | |
|---|---|
| Major repair item & Date: | |
| Small repair item & Times: | |
| Replaced item: | |

| Maintenance Activities | |
|---|---|
| Having maintenance plan: | Yes/No<br>- Every year<br>- 5 years<br>- Others (……….) |
| Having financial plan for maintenance: | Yes/No |
| Finance resources | Mill Dong |
| Of which: | - State budget % of demand<br>- Own budget % of demand<br>- Others % of demand |

| Difficulties Facing During O&M: | |
|---|---|
| Bottlenecks, \if any: | |
| Majority of type of vehicle: | |
| Availability of public transportation: | |
| No. of traffic accident per year (before) : | |
| No. of traffic accident per year (after): | |
| Environmental issues, if any: | |
| Development condition along the road/bridge: | |

| Operation and Effect Indicator: | |
|---|---|
| Annual Average Daily Traffic (AADT) before the construction | - Total: Passenger Car Unit (PCU)<br>- Year:<br>- Place: |
| Annual Average Daily Traffic (AADT) after the construction | - Total: Passenger Car Unit (PCU)<br>- Year:<br>- Place: |
| Accessibility to Market : | - Time Spent Before / After(hr):<br>- Name of the Market:<br>- Location (From/To): |
| Accessibility to School: | - Time Spent Before / After(hr):<br>- Name of the School:<br>- Location (From/To): |

| Difficulties facing during O&M: |
|---|
| |

| Suggestions: |
|---|
| |

# Electricity Distribution Sector

## I General Information

Name of Liaison with DPI/MPI:________________________________________.

<table>
<tr><td colspan="2">SPL Phase:</td><td colspan="2"></td><td colspan="2">Name of the Project:</td><td colspan="2"></td></tr>
<tr><td>Province:</td><td colspan="2"></td><td>District/City:</td><td colspan="2"></td><td>Commune:</td><td></td></tr>
<tr><td>Project Owner:</td><td colspan="2"></td><td>Operation, Maintenance and Management:</td><td colspan="4">Name of the Organization: ______________<br>- Address:<br>- Tel / Fax:<br>- E-mail:</td></tr>
<tr><td>Date:</td><td colspan="7"></td></tr>
<tr><td>Respondent:</td><td colspan="7"></td></tr>
<tr><td>Cell phone #:</td><td colspan="7"></td></tr>
<tr><td colspan="2">Year of Construction Works Commencement:</td><td colspan="2"></td><td colspan="2">Project Owner in the Implementation stage:</td><td colspan="2"></td></tr>
<tr><td colspan="2">Year of Construction Works Completion:</td><td colspan="2"></td><td colspan="2">Material Cost (BVND):</td><td colspan="2"></td></tr>
<tr><td colspan="2">Construction Cost (BVND):</td><td colspan="2"></td><td colspan="2">Domestic Fund (BVND):</td><td colspan="2"></td></tr>
<tr><td colspan="2">Total investment Cost (BVND):</td><td colspan="2"></td><td colspan="2">JBIC Fund (BVND):</td><td colspan="2"></td></tr>
</table>

## II Differences between Planning and Implementation of the Projects (Only for obvious ones).

| | |
|---|---|
| Contents of the Projects at the time of planning: | |
| Contents of the Projects after implementation: | |
| Reason for the differences: | |
| What would be the obstacles for the projects? , and what would be the reasons for it?: | Obstacles:<br>Reasons: |

### III Overview of the Projects:

Survey only for construction and rehabilitation by JICA loan (excluding existing facilities)

**Substation Construction / Rehabilitation:**

| | | | |
|---|---|---|---|
| Name of substation: | | Primary Voltage: | kV |
| Quantity of Transformer (TR): | units | Secondary Voltage: | kV |
| Capacity of TR: | MVA | Quantity of outgoing feeder (22 -35 kV): | feeders |
| Other works including rehabilitation: | | | |
| What would be the reasons for the lack of capacity after the projects? : | | | |

**Distribution Feeder Construction:**

| | | | |
|---|---|---|---|
| Area: Commercial / Industrial / Residential / Agricultural | | | |
| 22kV Feeder (Over Head; OH): | km | Type of 22 kV OH Feeder Line: | |
| 35 kV Feeder (Under Ground; UG): | km | Type of 35 kV UG Feeder Cable: | |
| Other Medium Voltage Feeder: ……………KV ……………km……………kV ……………km | | | |
| LV Line (OH): | km | Type of LV Line: | |
| LV Cable (UG): | km | Type of LV Cable: | |
| Quantity of Distribution TR: | units | Total Capacity of the TR: | KVA |
| Quantity of Disconnecting SW: | units | Quantity of Load Break SW (LBS): | units |
| Quantity of Arrester: | units | Capacitor Quantity for Power Factor Improvements: | units |
| Quantity of Poles: | poles | Quantity of Watt Hour Meter (WHM): | units |
| Other equipment including rehabilitation: | | | |
| What would be the reasons for the lack of capacity after the projects? : | | | |

## IV Survey on the Effects of the Projects:

| | Effects | |
|---|---|---|
| | Before the projects | After the projects |
| Sales (MVND): | | |
| Consumption (kWH): | | |
| SAIFI (Time / Year・Customer): | | |
| SAIDI (Min / Year・Customer): | | |
| Technical Loss (%): | | |
| Non-technical Loss (%): | | |
| Total Loss (%): | | |
| Electric Rate (%): | | |
| Which contents of the projects affected the areas of development plan? , and what would be the reasons for it? | | |

## V Maintenance:

| | | | | |
|---|---|---|---|---|
| Department for Database: | Department Name: | | Nos. of Members: | persons |
| Department for Maintenance: | Department Name: | | Nos. of Members: | persons |
| Crew for Maintenance: | Nos. of Crews: | | Nos. of Workers per Crew: | workers / crew |
| Working System for Maintenance: | 3 crews per day 2 crews per day 1 crew per day | | | |
| Maintenance plan: | Maintenance Equipment: | | Maintenance Period: | year |
| Record for maintenance / new construction: | Is there any records left on:<br><br>If yes, are the records stored in database? | | ☐ Maintenance<br>☐ New construction<br>Yes / No | |
| Budget for maintenance: | How are the budgets kept for maintenance? | | | |
| Problems for maintenance: | | | | |
| Proposals for improvement: | | | | |

## VI Financial Condition:

| | | | |
|---|---|---|---|
| Tariff | Tariff of the projects are the same as that of EVN? If Not, describe the differences. | | |
| Financial Condition | **Year** | **Revenue** | **Expenditure** |
| | 2009 | | |
| | 2008 | | |
| | 2007 | | |

# Water Supply Sector

## 1. General Information

Name of Liaison with DPI/MPI:________________________________.

| | | | | | |
|---|---|---|---|---|---|
| SPL Phase: | | | Name of the Project: | | |
| Province: | | District/City: | | Commune: | |
| Organization in Charge: | Project Implementation (Project Owner)<br><br>Operation Maintenance and Management | | Name of the Organization: ________________<br>Address:<br>Tel / Fax:<br>E-mail: | | |
| Date: | | | Office Information: | Tel: | |
| Respondent: | | | | Fax: | |
| Cell phone #: | | | | E-mail: | |
| Year of Construction Works Commencement: | | | Project Owner in the Implementation stage: | | |
| Year of Construction Works Completion: | | | Material Cost (BVND): | | |
| Construction Cost (BVND): | | | Domestic Fund (BVND): | | |
| Total investment Cost (BVND): | | | JBIC Fund (BVND): | | |

## 2. General Settings of the Facilities Constructed under SPL

Please provide with the flow diagram of your water supply system starting from the water source to the treated water distribution networks.

### 2-1 Type of Water Source

Please select appropriate ones. Regarding water level, please clarify whether given value is

- "GL- (minus)": in case measured from ground level or
- "EL (Elevation Level)": in case measured from averaged sea water level.

**1) Surface water** (The form below can be used up to two (2) sources)

| Name of river or canal: | | | | |
|---|---|---|---|---|
| | Approximate year when water supply system started to operate | 2009 | Approximate year when water supply system started to operate | 2009 |
| Discharge in dry season: ($m^3$/sec) | | | | |
| Intake volume in dray season: ($m^3$/sec or $m^3$/min) | | | | |
| Flood water level: (EL) | | | | |
| Dry season water level: (EL) | | | | |

**2) Shallow Well** (including Infiltration Well)

（Year of starting operation： Service life (Years)： ）

The form below can be used for the data of five (5) wells.

| Well No: | | | | | | |
|---|---|---|---|---|---|---|
| Depth (m): | | | | | | |
| Diameter（mm): | | | | | | |
| Static water level: (GL- / EL) | Year of construction | | | | | |
| | 2009 | | | | | |
| Dynamic water level at peak pumping: (GL- / EL) | Year of construction | | | | | |
| | 2009 | | | | | |
| Pumping discharge at peak water demand: ($m^3$/min) | Year of construction | | | | | |
| | 2009 | | | | | |
| Average daily operation hours : (hours) | Year of construction | | | | | |
| | 2009 | | | | | |

### 3) Deep Well

（Year of starting operation：                              Service life (Years)：                    ）

The form below can be used for the data of five (5) wells.

| | | | | | | |
|---|---|---|---|---|---|---|
| Well No: | | | | | | |
| Depth (m): | | | | | | |
| Diameter（mm): | | | | | | |
| Static water level: (GL- / EL) | Year of construction | | | | | |
| | 2009 | | | | | |
| Dynamic water level at peak pumping: (GL- / EL) | Year of construction | | | | | |
| | 2009 | | | | | |
| Pumping discharge at peak water demand: ($m^3$/min) | Year of construction | | | | | |
| | 2009 | | | | | |
| Average daily operation hours : (hours） | Year of construction | | | | | |
| | 2009 | | | | | |

**4) Stagnant Water** (Reservoir, Lake, Pond, etc.)

The form below can be used for the data of two (2) water sources.

| | | | | |
|---|---|---|---|---|
| Name of water source: | | | | |
| | Year of starting operation | 2009 | Year of starting operation | 2009 |
| Storage volume in dry season（$m^3$): | | | | |
| Water volume taken in dry seaon ($m^3$/sec): | | | | |
| Flood water level (EL): | | | | |
| Dry season water level (EL): | | | | |

| | | | | |
|---|---|---|---|---|
| Elevation level of intake port bottom (EL): | | | | |

**5) Raw Water Quality at the Planning or Design Stage.**

Please provide the result of water analysis with the name of laboratory and the date of analysis at the planning or design stage of the water supply system. (The copy or filling in the attached form.)

Please fill the blanks which relates to the subproject.

**2-2 Water Storage Facilities**

| | Storage capacity in dry season (Million $m^3$) | Year of construction | Service life (Year) |
|---|---|---|---|
| Dam lake: | | | |
| Lake and pond: | | | |
| Estuary barrage: | | | |
| Detention basin: | | | |
| Pond storage or irrigation pond: | | | |

**2-3 Intake Facilities**

| | Year of construction | Service life (Year) |
|---|---|---|
| Diversion weir: | | |
| Intake tower: | | |
| Head gate: | | |
| Intake conduit: | | |
| Intake crib: | | |
| Infiltration gallery: | | |
| Intake pump: | | |

**1) Intake pump**

(Year of installation :                    Service life (Year) :          )

The form below can be used for the data of intake pump of four (4) types.

| Pump type: | | | | |
|---|---|---|---|---|
| Please select an appropriate one of your intake pump installed and write down the respective abbreviation into cells above: | | | | |
| Type of intake pump: | *ES* - End Suction pump | *SC* – Split Casing pump | *MS* – Multistage pump | |
| | *SM*- Submersible pump | *I L* – In-Line pump | *VC* – Vacuum pump | |
| | *O* - Others | | | |
| Manufacturer: | | | | |
| Model: | | | | |
| Purpose (please select): | ☐ Intake and raw water transmission<br>☐ Priming | ☐ Intake and raw water transmission<br>☐ Priming | ☐ Intake and raw water transmission<br>☐ Priming | ☐ Intake and raw water transmission<br>☐ Priming |
| Number of pumps: | | | | |
| Dis charge (litre/min) : | | | | |
| Pump head (m): | | | | |
| Rotating speed (rpm): | | | | |
| Pump efficiency: | | | | |
| Motor output (kW): | | | | |
| Type of motor (please select): | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible |
| Please select an appropriate one of your intake pump motor starter method applied and write down the respective abbreviation into cells below: | | | | |
| Pump motor starting method: | *D* - Direct-on-line starter | *R* - Reactor | *K* - Kondorfer | |
| | *SD* - Star Delta | *SS* - Soft Starter | | |

| | | | | |
|---|---|---|---|---|
| Pump motor starting method: | | | | |
| Integrated pump-motor efficiency: | | | | |

**2) Foot Valve**：Diameter ________mm、Number of sets _________

Diameter ________mm、Number of sets _________

Diameter ________mm、Number of sets _________

## 2-4 Sedimentation Basin

(Year of construction： Service life (Year)： )

| | | |
|---|---|---|
| Location: | Distance from intake facilities, etc. | |
| Shape, Length and Width: | Approximate size | |
| Number of basins:: | | |
| Maximum flow rate: | $m^3$/day | |
| Construction: | Reinforce concrete, concrete block, etc. | |
| Surface loading :<br>(Flow rate/ Surface area of the basin) | mm/min | |
| Mean velocity: | cm/sec. | |
| Effective depth: | m | |

## 2-5 Raw Water Transmission Facilities

### 1) Raw Water Transmission Canal

(Year of construction： Service life (Year)： )

| | | |
|---|---|---|
| Total Length: | km | |
| Shape, width and depth of cross section: | Approximate size | |
| Mean gradient: | % | |
| Maximum flow rate: | $m^3$/sec | |

| | | |
|---|---|---|
| Construction: | Reinforce concrete, concrete block, etc. | |

**2) Raw Water Transmission Pipeline (Flow by gravity)**

(Year of construction： Service life (Year)： )

In the following form, please write down the data on valves, flow meters, pipes according to respective diameters:

| | | |
|---|---|---|
| Total length : | km | |
| Mean gradient: | % | |
| Maximum flow rate: | $m^3$/sec | |
| Break pressure tank volume: | $m^3$ | |
| Construction of break pressure tank: | reinforced concrete, concrete block, etc. | |
| Number of break pressure tank: | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pressure reducing valve (PV) diameter (mm): | | | | | | | | |
| PV upstream pressure (m): | | | | | | | | |
| PV downstream pressure (m): | | | | | | | | |
| Number of PVs: | | | | | | | | |
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| No. of drainage facilities: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |

Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below:

| | | | | | |
|---|---|---|---|---|---|
| Type of CV: | *B* – Spring | *L* – Lift | *S* - Swing | *D* - Diaphragm | *O* - Others |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |

Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below:

| | | | | |
|---|---|---|---|---|
| Type of FV: | *BU* – Butterfly | *C* – Cone | *BA* – Ball | *N* – Needle |
| | *S* - Sleeve | *A* - Auto | *O* - Others | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |

Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below: Type of FM: *P* – Propeller *V*- Volumetric

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Raw water transmission pipe (RTP) diameter (mm): | | | | | | | | |

Please select an appropriate material of RTP used and write down the respective abbreviation into cells below:

| | | | |
|---|---|---|---|
| Material of RTP: | *S* – Steel | *CS* – Coating Steel | *D* – Ductile cast iron |
| | *G* – Gray cast iron | *C* – Concrete | *VP* – Polyvinyl chloride |
| | *PE* – Polyethylene | *F* – Fiber reinforced plastic mortar pipe | *O* - Others |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Material of pipe: | | | | | | | | |
| Length of raw water transmission pipe（km): | | | | | | | | |

| | |
|---|---|
| Service life of valves (year): | |
| Service life of flow meters (year): | |

| | |
|---|---|
| Service life of pipeline (year): | |

**3) Raw Water Transmission Pipeline (Pump Pressurized)**

(Year of construction： Service life (Year)： )

In the following form, please write down the data on valves, flow meters, pipes according to respective diameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total length : | km | | | | | | | |
| Mean gradient: | % | | | | | | | |
| Elevation of pump discharge pipe center: | m (In case of discharge in open air) | | | | | | | |
| High water level of the tank where pump discharges: | m (In case of discharge in a water tank) | | | | | | | |
| Flow rate: | $m^3$/sec. | | | | | | | |
| Pressure reducing valve (PV) diameter (mm): | | | | | | | | |
| PV upstream pressure (m): | | | | | | | | |
| PV downstream pressure (m): | | | | | | | | |
| Number of PVs: | | | | | | | | |
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| No. of drainage facilities: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of FV: *BU* – Butterfly *C* – Cone *BA* – Ball *N* – Needle *S* - Sleeve *A* - Auto *O* - Others | | | | | | | | |
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below: Type of FM: *P* – Propeller *V*- Volumetric | | | | | | | | |
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Raw water transmission pipe (RTP) diameter (mm): | | | | | | | | |
| Please select an appropriate material of RTP used and write down the respective abbreviation into cells below: | | | | | | | | |
| Material of RTP: *S* – Steel *CS* – Coating Steel *D* – Ductile cast iron *G* – Gray cast iron *C* – Concrete *VP* – Polyvinyl chloride *PE* – Polyethylene *F* – Fiber reinforced plastic mortar pipe *O* - Others | | | | | | | | |
| Material of pipe: | | | | | | | | |
| Length of raw water transmission pipe（km): | | | | | | | | |

| | |
|---|---|
| Service life of valves (year): | |
| Service life of flow meters (year): | |
| Service life of pipeline (year): | |

**4) Raw Water Transmission Pump**

(Year of construction： Service life (Year)： )

The form below can be used for the data of intake pump of four (4) types.

| | | | | |
|---|---|---|---|---|
| Pump type: | | | | |
| Please select an appropriate one of your intake pump installed and write down the respective abbreviation into cells above: | | | | |
| Type of intake pump: | *ES* - End Suction pump | *SC* – Split Casing pump | *MS* – Multistage pump | |
| | *SM*- Submersible pump | *I L* – In-Line pump | *VC* – Vacuum pump | |
| | *O* - Others | | | |
| Manufacturer: | | | | |
| Model: | | | | |
| Purpose (please select): | ☐ Intake and raw water transmission ☐ Priming | ☐ Intake and raw water transmission ☐ Priming | ☐ Intake and raw water transmission ☐ Priming | ☐ Intake and raw water transmission ☐ Priming |
| Number of pumps: | | | | |
| Dis charge (litre/min) : | | | | |
| Pump head (m): | | | | |
| Rotating speed (rpm): | | | | |
| Pump efficiency: | | | | |
| Motor output (kW): | | | | |
| Type of motor (please select): | ☐ Squirrel cage ☐ Wound-rotor ☐ Submersible | ☐ Squirrel cage ☐ Wound-rotor ☐ Submersible | ☐ Squirrel cage ☐ Wound-rotor ☐ Submersible | ☐ Squirrel cage ☐ Wound-rotor ☐ Submersible |
| Please select an appropriate one of your intake pump motor starter method applied and write down the respective abbreviation into cells below: | | | | |
| Pump motor starting method: | *D* - Direct-on-line starter | *R* - Reactor | *K* - Kondorfer | |

| | | | | |
|---|---|---|---|---|
| | *SD* - Star Delta | *SS* - Soft Starter | | |
| Pump motor starting method: | | | | |
| Integrated pump-motor efficiency: | | | | |

**5) Expansion Joints** (Flexible joints, Flange adapters, etc)：

(Year of construction： Service life (Year)： )

| Type (name): | Quantity: | Diameter (mm): | Material: | Year of installation: |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

## 2-6 Raw Water Reservoir or Raw Water Receiving Well

(Year of construction： Service life (Year)： )

Capacity： $m^3$

Depth： m

## 2-7 Chemicals

Please select chemicals used in your water supply system and write down the amount of chemicals used.

**1) Coagulants (flocculants)**

| Please select: (Multiple choices) | ☐ Liquid aluminum sulfate | ☐ Granular aluminum sulfate | ☐ Polyaluminum chloride (PAC) |
|---|---|---|---|
| | ☐ Polymer coagulant | ☐ Others（ ） | |
| Usage: (mg/L) | in the design stage | | |
| | in operation（rainy season) | | |
| | in operation (dry season) | | |

| | | |
|---|---|---|
| Stockpile (volume stocked) | How many day's worth of chemicals?: | days (or kg) |
| Name of city or town where you procured the chemical and the manufacturer of the chemical: | City or Town:<br><br>Manufacturer: | |

**2) Alkali Agent**

| | | |
|---|---|---|
| Please select:<br>(Multiple choices) | ☐ Slaked (hydrated) lime ☐ Soda ash Liquid sodium hydroxide<br>☐ Others（ ） | |
| Usage :<br>(mg/L) | in the design stage | |
| | in operation（rainy season) | |
| | in operation (dry season) | |
| Stockpile (volume stocked): | How many day's worth of chemicals?: days (or kg) | |
| Name of city or town where you procured the chemical and the manufacturer of the chemical: | City or Town:<br><br>Manufacturer: | |

**3) Coagulation Aid**

| | | |
|---|---|---|
| Please select:<br>(Multiple choices) | ☐ sodium silicate ☐ sodium alginate ☐ Others（ ） | |
| Usage:<br>(mg/L) | in the design stage | |
| | in operation（rainy season) | |
| | in operation (dry season) | |
| Stockpile (volume stocked): | How many day's worth of chemicals?: days (or kg) | |
| Name of city or town where you procured the chemical and the manufacturer of the chemical: | City or Town:<br><br>Manufacturer: | |

**2-8 Chemical Feeding Facilities**

(Year of construction： Service life (Year)： )

| | |
|---|---|
| Feeding method:<br>(Please select one) | ☐ Constant rate dripping<br>☐ Pump<br>☐ Injector<br>☐ Others（ ） |
| Type of pump:<br>(Please select one) | ☐ Diaphragm<br>☐ Reciprocate<br>☐ Rotary<br>☐ Others ( ) |
| Pump head (m): | |
| Pump discharge (liter/min): | |
| Pump motor output (kW): | |
| Manufacturer, model, and number of pumps: | |

## 2-9 Chemical Mixing Facilities

(Year of construction： Service life (Year)： )

| | | | |
|---|---|---|---|
| Chemical mixing equipment: | ☐ Flush mixer | ☐ Pump | ☐ Others（ ） |

**1) In the case of Flush Mixer**

| | | | |
|---|---|---|---|
| Type of flush mixer: | ☐ Paddle | ☐ Turbine | ☐ Others ( ) |
| Shaft power of flush mixer: ($kW/m^3/s$) | | | |
| Manufacturer and model of flush mixer: | | | |
| Service life of flush mixer: | | | |

**2) In the case of Pump**

| | |
|---|---|
| Pump head (m): | |
| Pump discharge (litre/min) : | |
| Pump motor output (kW): | |
| Manufacturer and model of pump: | |

**2-10 Coagulation Basin (Flocculation Basin)**

(Year of construction : Service life (Year) : )

| | | | |
|---|---|---|---|
| Length of width and depth (m): | | | |
| Holding time (min): | | | |
| Mixer: | ☐ Mixing device | ☐ Baffle | ☐ Other ( ) |
| Type of flush mixer:<br>(in case mixing device is a flush mixer) | ☐ Paddle | ☐ Turbine | ☐ Others ( ) |
| Shaft power of flush mixer ($kW/m^3/s$) : | | | |
| Manufacturer and model of flush mixer: | | | |

**2-11 sedimentation basin or clarifier**

(Year of construction : Service life (Year) : )

In the following form, please select the type of sedimentation basin in your water supply system and fill the blanks relative to the type, then please provide with the information on valves, flow meters, pipes, etc. used according to respective diameters in the sedimentation basin

| Type of sedimentation basin: | Horizontal-flow | Plate or tube (down-flow) | Plate or tube (up-flow) | Suspended solid contact type |
|---|---|---|---|---|
| Number of basins: | | | | |
| Number of layers: | | | | |
| Slope of plate or tube (degree): | | | | |
| Length and width of a basin (m): | | | | |
| Surface loading :low rate/ surface area of the basin (mm/min): | | | | |
| Effective depth (m): | | | | |

| | | | | |
|---|---|---|---|---|
| Depth for sediments (m): | | | | |
| Mean velocity (m/min): | | | | |
| Weir load: flow rate / length of weir ($m^3$/m): | | | | |
| Holding time (hour): | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: | *B* – Spring | | *L* – Lift | *S* - Swing | *D* - Diaphragm | | *O* - Others | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of FV: | *BU* – Butterfly | | *C* – Cone | | *BA* – Ball | | *N* – Needle | |
| | *S* - Sleeve | | *A* - Auto | | *O* - Others | | | |
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |

| Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below:<br>Type of FM: *P* – Propeller *V*- Volumetric | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Pipe diameter (mm): | | | | | | | | |
| Please select an appropriate material of RTP used and write down the respective abbreviation into cells below:<br>Material of RTP: *S* – Steel *CS* – Coating Steel *D* – Ductile cast iron<br>*G* – Gray cast iron *C* – Concrete *VP* – Polyvinyl chloride<br>*PE* – Polyethylene *F* – Fiber reinforced plastic mortar pipe *O* - Others | | | | | | | | |
| Material of pipe: | | | | | | | | |
| Length of pipe（km): | | | | | | | | |

**2-12 Filter**

(Year of construction： Service life (Year)： )

In the following form, please select the type of filter in your water supply system and reply to inquiries in the left column by writing in the cells of the column of filter type you selected.

| Type of filter: | Rapid | Pressure | Rapid (up-flow) | Multi-stage | Siphon type self-backwashing | Slow |
|---|---|---|---|---|---|---|
| Number of basin: | | | | | | |
| Shape of a basin: | | | | | | |
| Length and width of a basin (m): | | | | | | |
| Filtration rate (m/day): | | | | | | |
| Number of stages: | | | | | | |
| Filter media:<br>In case of up-flow filter, please write down the filter media used and in case of “multi-stage” and other types, if necessary, please select the filter media from following choices and write down the abbreviation of it:<br>*A* – Anthracite *S* - Artificial lightweight sand *G* – Garnet *I* – Ilmenite *O* – Others | | | | | | |
| Filter media: | | | | | | |
| In case of up-flow filtration and multi-stages filtration, please describe the thickness of each filter media. | | | | | | |
| Thickness of sand (cm): | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Thickness of gravel (cm): | | | | | | |
| Underdrain system:<br>Please select one as the underdrain system of filtration basin and write down the abbreviation of it:<br>*W* – Wheeler *P* – Perforated pipe / perforated block *O* – Others | | | | | | |
| Underdrain system: | | | | | | |
| Washing method:<br>Please select appropriate ones (group of following washing methods) as the filter washing system and write down the abbreviation of it<br>*S* – Surface washing *B* – Backwashing *A* – Air washing<br>In case of "siphon type self-backwashing" filter, please select from the following.<br>*A* – Auto backwashing *B* – Backwashing tank | | | | | | |
| Washing method: | | | | | | |
| Washing water supply:<br>Please select and write down the abberviation of water supply method in the cell below:<br>*T* – Elevated tank for backwashing *P* – Backwashing pump | | | | | | |
| Washing water supply: | | | | | | |

**1) Elevated Tank for Backwashing**

(Year of construction : Service life (Year) : )

| | | |
|---|---|---|
| Capacity ($m^3$): | | |
| Height (m): | | |
| Construction: | ☐ | Reinforced concrete |
| | ☐ | Steel |
| | ☐ | Others ( ) |

**2) Backwashing Pump**

(Year of construction : Service life (Year) : )

The form below can be used for the data of backwashing pump of four (4) types

| | | | | |
|---|---|---|---|---|
| Pump type: | | | | |
| Please select an appropriate one of your intake pump installed and write down the respective abbreviation into cells above: | | | | |

| | | | |
|---|---|---|---|
| Type of intake pump: | *ES* - End Suction pump | *SC* – Split Casing pump | *MS* – Multistage pump |
| | *SM*- Submersible pump | *I L* – In-Line pump | *VC* – Vacuum pump |
| | *O* - Others | | |

| | | | | |
|---|---|---|---|---|
| Manufacturer: | | | | |
| Model: | | | | |
| Purpose (please select): | ☐ Back washing<br>☐ Priming | ☐ Back washing<br>☐ Priming | ☐ Back washing<br>☐ Priming | ☐ Back washing<br>☐ Priming |
| Number of pumps: | | | | |
| Dis charge (litre/min) : | | | | |
| Pump head (m): | | | | |
| Rotating speed (rpm): | | | | |
| Pump efficiency: | | | | |
| Motor output (kW): | | | | |
| Type of motor (please select): | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible |

Please select an appropriate one of your intake pump motor starter method applied and write down the respective abbreviation into cells below:

| | | | |
|---|---|---|---|
| Pump motor starting method: | *D* - Direct-on-line starter | *R* - Reactor | *K* - Kondorfer |
| | *SD* - Star Delta | *SS* - Soft Starter | |

| | | | | |
|---|---|---|---|---|
| Pump motor starting method: | | | | |
| Integrated pump-motor efficiency: | | | | |

## 3) Aeration Facilities

(Year of construction : Service life (Year) : )

Please select the type of aeration from below:

☐ Spouting by nozzles

☐ Packed tower

☐ Staged tower

☐ Air injection type

☐ Cascade

**4) Blower for Filter Media Washing and/or Aeration**

(Year of construction :                Service life (Year) :                )

The form below can be used for the data of blower of three (3) types

| | | | |
|---|---|---|---|
| Capacity ($m^3$/hr): | | | |
| Number of blowers: | | | |
| Discharge pressure (kg/$cm^2$): | | | |
| Rotating speed (rpm): | | | |
| Motor output (kW): | | | |

**5) Pipes, Valves, etc**

(Year of construction :                Service life (Year) :                )

In the following form, please write down the data on valves, flow meters, pipes according to respective diameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |

Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below:

| | | | | |
|---|---|---|---|---|
| Type of FV: | *BU* – Butterfly | *C* – Cone | *BA* – Ball | *N* – Needle |
| | *S* - Sleeve | *A* - Auto | *O* - Others | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |

Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below:

Type of FM: *P* – Propeller *V*- Volumetric

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Pipe diameter (mm): | | | | | | | | |

Please select an appropriate material of RTP used and write down the respective abbreviation into cells below:

| | | | |
|---|---|---|---|
| Material of RTP: | *S* – Steel | *CS* – Coating Steel | *D* – Ductile cast iron |
| | *G* – Gray cast iron | *C* – Concrete | *VP* – Polyvinyl chloride |
| | *PE* – Polyethylene | *F* – Fiber reinforced plastic mortar pipe | *O* - Others |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Material of pipe: | | | | | | | | |
| Length of pipe（km): | | | | | | | | |

**6) Expansion joints** (Flexible joints, Flange adapters, etc)：

(Year of construction： Service life (Year)： )

| Type (name) | Quantity | Diameter (mm) | Material | Year of installation |
|---|---|---|---|---|
| | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |

**2-13 Advanced Water Treatment Facilities**

(Year of construction： Service life (Year)： )

In case your water supply system installs advanced water treatment facilities such as membrane filtration, activated carbon treatment, ozone treatment, etc., please explain your system and its flow diagram, and the reason in the box below:

| |
|---|
| |

**2-14 Treated Water (Clean water) Tank**

(Year of construction： Service life (Year)： )

<table>
<tr><td>Shape:</td><td>☐ Rectangular solid<br>☐ Cylinder<br>☐ Others ( )</td><td>Soil cover:</td><td colspan="2">☐ Covered<br>☐ Not covered</td></tr>
<tr><td>Type of installation:</td><td>☐ On the ground<br>☐ Semi-buried<br>☐ Underground</td><td>Construction:</td><td>☐ Reinforced concrete<br>☐ Pre-stressed concrete<br>☐ FRP (fiber reinforced plastic)</td><td>☐ Steel<br>☐ Others<br>( )</td></tr>
<tr><td colspan="2">Number of tanks:</td><td colspan="3"></td></tr>
<tr><td colspan="2">Capacity of respective tanks (m³):</td><td colspan="3"></td></tr>
<tr><td colspan="2">Float valve:</td><td colspan="3">for water level control:<br>☐ Installed（Diameter mm）<br>☐ Not installed</td></tr>
<tr><td colspan="2">Water level control:</td><td colspan="3">In case that a float valve is not installed in the tank, how do you control the water level when it becomes full?</td></tr>
</table>

**1) Pipes, Valves, etc.**

(Year of construction : Service life (Year) : )

In the following form, please write down the data on valves, flow meters, pipes according to respective diameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of FV: *BU* – Butterfly *C* – Cone *BA* – Ball *N* – Needle *S* - Sleeve *A* - Auto *O* - Others | | | | | | | | |
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below:<br>Type of FM: *P* – Propeller *V*- Volumetric | | | | | | | | |
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Pipe diameter (mm): | | | | | | | | |
| Please select an appropriate material of RTP used and write down the respective abbreviation into cells below:<br>Material of RTP: *S* – Steel; *CS* – Coating Steel; *D* – Ductile cast iron; *G* – Gray cast iron; *C* – Concrete; *VP* – Polyvinyl chloride; *PE* – Polyethylene; *F* – Fiber reinforced plastic mortar pipe; *O* - Others | | | | | | | | |
| Material of pipe: | | | | | | | | |
| Length of pipe（km): | | | | | | | | |

**2) Expansion Joints** (Flexible joints, Flange adapters, etc)：

(Year of construction： Service life (Year)： )

| Type (name) | Quantity | Diameter (mm) | Material | Year of installation |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

**2-15 disinfection facilities**

(Year of construction： Service life (Year)： )

Disinfectants（Please select disinfectants used in your water supply system）:

- ☐ Liquefied chlorine (chlorine gas)
- ☐ Sodium hypochlorite
- ☐ Calcium hypochlorite
- ☐ Chlorine dioxide
- ☐ Ozone
- ☐ Ultraviolet rays

- ☐ Others ( )

Injection point or so:

- ☐ From filter to treated water tank
- ☐ Treated water tank
- ☐ From treated water tank to treated water transmission pumps
- ☐ Treated water transmission pumps to distribution tanks
- ☐ Distribution tanks
- ☐ Outlet of distribution tanks
- ☐ Other points ( )

In case your water supply system uses disinfectants other than liquefied chlorine (chlorine gas) and sodium hypochlorite, please describe the outline of your disinfection system.

| |
|---|
| |

**1) Disinfection System of Liquefied Chlorine gas**

(Year of construction： Service life (Year)： )

| | | |
|---|---|---|
| Capacity of chlorine injector (kg/h): | | |
| Number of injectors (chlorinators): | | |
| Water supply pressure (m): | | |
| Water supply flow rate（liter/min): | | |
| Back pressure (m): | | |

**2) Pump for Disinfection Facilities**

(Year of construction： Service life (Year)： )

The form below can be used for the data of backwashing pump of two (2) types

| | | |
|---|---|---|
| Pump type: | | |
| Please select appropriate one of your intake pump installed and write down the abbreviation into the cells above. | | |
| Type of intake pump: ES - End suction pump; SC – Split casing pump; MS – Multistage pump; SM -Submersible pump; I L – In-line pump; VC – Vacuum pump; O - Others | | |
| Manufacturer: | | |
| Model: | | |
| Number of pumps: | | |
| Discharge ($m^3$/min) : | | |
| Pump head (m): | | |
| Rotating speed (rpm): | | |
| Pump efficiency: | | |
| Motor output (kW): | | |

**3) Ancillary Facilities of Disinfection System**

(Year of construction： Service life (Year)： )

| | | | | |
|---|---|---|---|---|
| Standard stock of chlorine: | kg<br>How many day's worth of chlorine: days | | | |
| Capacity of chlorine gas container(kg): | | | | |
| Number of chlorine gas container: | | | | |
| Capacity of plat for scale (kg): | | | | |
| Capacity of hoist crane (ton): | | | | |

| | |
|---|---|
| Chlorine gas leak detector: | ☐ Installed<br>☐ Not installed |
| City or town where you procure chlorine gas: | |
| Manufacturer of chlorine gas: | |
| Code of chlorine gas transportation: | |

**4) Emergency Kit**

| Item | Quantity | Year of purchase |
|---|---|---|
| Cork stopper: | | |
| Aluminum stopper: | | |
| Lead board: | | |
| Rubber board: | | |
| Rubber tape: | | |
| Wire: | | |
| Emergency cap: | | |
| Valve bag nut: | | |
| Seal tape: | | |
| Hammer: | | |
| Spanner: | | |
| Plier: | | |
| Pipe wrench: | | |
| Monkey wrench: | | |
| Handle wire brush: | | |
| Handle: | | |
| Small knife: | | |

| | | |
|---|---|---|
| Tool box: | | |

**5) Disinfection System of Sodium Hypochlorite**

(Year of construction ： Service life (Year) ： )

| | | |
|---|---|---|
| Sodium hypochlorite production equipment:<br>Service life (year): ) | | ☐ Installed<br>☐ Not installed |
| Injection method:<br>(Please select one) | ☐ Constant rate dripping<br>☐ Orifice<br>☐ Injector<br>☐ Dosing pump<br>☐ Others ( ) | |
| City or town where you procure sodium: hypochlorite: | | |
| Manufacturer of sodium hypochlorite gas: | | |
| Mode of sodium chlorine gas transportation: | | |
| Concentration of sodium hypochlorite solution (%): | | |
| Standard stock of sodium hypochlorite ： | liter<br>How many day's worth of chlorine: days | |

**6) Dosing Pump**

(Year of construction ： Service life (Year) ： )

The form below can be used for the data of backwashing pump of two (2) types

| | | | | |
|---|---|---|---|---|
| Pump type: | | | | |
| Please select appropriate one of your intake pump installed and write down the mark of it into cells above: | | | | |
| Type of intake pump: | ES - End suction pump | SC – Split casing pump | MS – Multistage pump | SM – Submersible pump |
| | I L – In-line pump | VC – Vacuum pump | O - Others | |
| Manufacturer: | | | | |

| | | |
|---|---|---|
| Model: | | |
| Number of pumps: | | |
| Discharge ($m^3$/min) : | | |
| Pump head (m): | | |
| Motor output (kW): | | |

**2-16 Treated Water Transmission Facilities**

**1) Treated Water Transmission Pumps**

(Year of construction： Service life (Year)： )

The form below can be used for the data of backwashing pump of four (4) types

| | | | | |
|---|---|---|---|---|
| Pump type: | | | | |

Please select an appropriate one of your intake pump installed and write down the respective abbreviation into cells above:

| | | | |
|---|---|---|---|
| Type of intake pump: | *ES* - End Suction pump | *SC* – Split Casing pump | *MS* – Multistage pump |
| | *SM*- Submersible pump | *I L* – In-Line pump | *VC* – Vacuum pump |
| | *O* - Others | | |

| | | | | |
|---|---|---|---|---|
| Manufacturer: | | | | |
| Model: | | | | |
| Number of pumps: | | | | |
| Dis charge (litre/min) : | | | | |
| Pump head (m): | | | | |
| Rotating speed (rpm): | | | | |
| Pump efficiency: | | | | |
| Motor output (kW): | | | | |
| Type of motor (please select): | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible |

Please select an appropriate one of your intake pump motor starter method applied and write down the respective abbreviation into cells below:

| | | | |
|---|---|---|---|
| Pump motor starting method: | *D* - Direct-on-line starter | *R* - Reactor | *K* - Kondorfer |
| | *SD* - Star Delta | *SS* - Soft Starter | |

| | | | | |
|---|---|---|---|---|
| Pump motor starting method: | | | | |
| Integrated pump-motor efficiency: | | | | |

**2) Pipes, Valves, etc. in the Treated Water Tank and Pumping Station**

In the following form, please write down the data on valves, flow meters, pipes according to the respective diameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below: Type of FM: *P* – Propeller *V*- Volumetric | | | | | | | | |
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Pipe diameter (mm): | | | | | | | | |

| | | | |
|---|---|---|---|
| Please select an appropriate material of RTP used and write down the respective abbreviation into cells below: | | | |
| Material of RTP: | *S* – Steel | *CS* – Coating Steel | *D* – Ductile cast iron |
| | *G* – Gray cast iron | *C* – Concrete | *VP* – Polyvinyl chloride |
| | *PE* – Polyethylene | *F* – Fiber reinforced plastic mortar pipe | *O* - Others |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Material of pipe: | | | | | | | | |
| Length of pipe（km): | | | | | | | | |

**3) Expansion Joints** (Flexible joints, flange adapters, etc)：

(Year of construction： Service life (Year)： )

| Type (name): | Quantity: | Diameter (mm): | Material: | Year of installation: |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

**4) Treated Water Transmission Pipe**

(Year of construction： Service life (Year)： )

| | | |
|---|---|---|
| Total length : | km | |
| Elevation of pump shaft: | m | |
| Elevation of pump discharge pipe center: | m (In case of discharge in open air) | |
| High water level of the tank where pump discharges: | m (In case of discharge in a water tank) | |
| Flow rate: | $m^3$/sec. | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pressure reducing valve (PV) diameter (mm): | | | | | | | | |
| PV upstream pressure (m): | | | | | | | | |
| PV downstream pressure (m): | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number of PVs: | | | | | | | | |
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| No. of drainage: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below: Type of FV: *BU* – Butterfly *C* – Cone *BA* – Ball *N* – Needle *S* - Sleeve *A* - Auto *O* - Others | | | | | | | | |
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below: Type of FM: *P* – Propeller *V*- Volumetric | | | | | | | | |
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |

| Treated water transmission pipe (TTP) diameter (mm): | | | | | | | | |
|---|---|---|---|---|---|---|---|---|

Please select an appropriate material of RTP used and write down the respective abbreviation into cells below:

| | | | |
|---|---|---|---|
| Material of RTP: | *S* – Steel | *CS* – Coating Steel | *D* – Ductile cast iron |
| | *G* – Gray cast iron | *C* – Concrete | *VP* – Polyvinyl chloride |
| | *PE* – Polyethylene | *F* – Fiber reinforced plastic mortar pipe | *O* - Others |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Material of TTP: | | | | | | | | |
| Length of TTP（km): | | | | | | | | |

**2-17 Facilities Against Transient Phenomena**

(Year of installation: Service life (year): )

- Transient phenomena anticipated (Please select):
  - ☐ Water hammer
  - ☐ Water column separation
  - ☐ Both of them
- Counter measure facilities (Please select):
  - ☐ Check valve (backflow prevention valve)
  - ☐ Butterfly valve
  - ☐ Air valve
  - ☐ Balloon (volume: liter)
  - ☐ Surge tank (capacity: m3 / height m)
  - ☐ For pumps（installation of flywheel）
  - ☐ Others（ ）

**2-18 Distribution Facilities**

(Year of construction： Service life (Year)： )

Distribution tank (Year of construction: Service life (Year)： )

| | |
|---|---|
| Shape: | ☐ Rectangular solid<br>☐ Cylinder<br>☐ Others（ ） |
| Type of installation: | ☐ On the ground<br>☐ Semi-buried<br>☐ Underground |
| Soil cover: | ☐ Covered<br>☐ Not covered |
| Construction: | ☐ Reinforced concrete<br>☐ Pre-stressed concrete<br>☐ Steel<br>☐ FRP (fiber reinforced plastic)<br>☐ Others ( ) |
| Number of tanks: | |
| Capacity of respective tanks ($m^3$): | |
| Water volume for fire fighting ($m^3$): | Water volume for fire fighting designed in the capacity of the distribution tanks. |
| Float valve: | For water level control:<br>☐ Installed（Diameter mm）<br>☐ Not installed |
| Water level control: | In case that a float valve is not installed in the tank, how would you control the water level when it becomes full? |

| | |
|---|---|
| | |

**1) Pipes, valves, etc.**

(Year of construction : Service life (Year) : )

In the following form, please write down the data on valves, flow meters, pipes according to respective diameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below: Type of FM: *P* – Propeller *V*- Volumetric | | | | | | | | |
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Pipe diameter (mm): | | | | | | | | |
| Please select an appropriate material of RTP used and write down the respective abbreviation into cells below: Material of RTP: *S* – Steel *CS* – Coating Steel *D* – Ductile cast iron *G* – Gray cast iron *C* – Concrete *VP* – Polyvinyl chloride | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *PE* – Polyethylene | | *F* – Fiber reinforced plastic mortar pipe | | | *O* - Others | | |
| Material of pipe: | | | | | | | | |
| Length of pipe（km): | | | | | | | | |

**2) Expansion Joints** (Flexible joints, flange adapters, etc)：

(Year of construction： Service life (Year)： )

| Type (name) | Quantity | Diameter (mm) | Material | Year of installation |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

**3) Distribution Pipeline (Flow by gravity)**

(Year of construction： Service life (Year)： )

In the following form, please write down the data on valves, flow meters, pipes according to respective diameters:

| | | |
|---|---|---|
| Total length : | km | |
| Mean gradient: | % | |
| Maximum flow rate: | $m^3$/sec<br>(Including for firefighting) | |
| Break pressure tank volume: | $m^3$ | |
| Construction of break pressure tank: | reinforced concrete, concrete block, etc. | |
| Number of break pressure tank: | | |
| Static pressure (m): | | |
| Minimum dynamic pressure to be kept (m) | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pressure reducing valve (PV) diameter (mm): | | | | | | | | |
| PV upstream pressure (m): | | | | | | | | |
| PV downstream pressure (m): | | | | | | | | |
| Number of PVs: | | | | | | | | |
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| No. of drainage facilities: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of FV: *BU* – Butterfly *C* – Cone *BA* – Ball *N* – Needle *S* - Sleeve *A* - Auto *O* - Others | | | | | | | | |
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below: Type of FM: *P* – Propeller *V*- Volumetric | | | | | | | | |
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Distribution pipe (DP) diameter (mm): | | | | | | | | |
| Please select an appropriate material of RTP used and write down the respective abbreviation into cells below: | | | | | | | | |
| Material of RTP: | *S* – Steel | *CS* – Coating Steel | *D* – Ductile cast iron | | | | | |
| | *G* – Gray cast iron | *C* – Concrete | *VP* – Polyvinyl chloride | | | | | |
| | *PE* – Polyethylene | *F* – Fiber reinforced plastic mortar pipe | *O* - Others | | | | | |
| Material of pipe: | | | | | | | | |
| Length of DP（km): | | | | | | | | |

**4) Distribution Pipeline (Pump Pressurized)**

(Year of construction： Service life (Year)： )

In the following form, please write down the data on valves, flow meters, pipes according to respective diameters:

| | | |
|---|---|---|
| Total length : | km | |
| Elevation of pump shaft: | m | |
| Elevation of pump discharge pipe center: | m (in case of discharge in open air) | |
| High water level of the tank where pump discharges: | m (in case of discharge in a water tank) | |
| Maximum flow rate (m/s): | | |
| Minimum dynamic pressure to be kept (m) | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode of distribution pressure control: (Please select) | ☐ Number of distribution pumps<br>☐ Pump rotating speed<br>☐ Frequency inverter<br>☐ Valve<br>☐ Others ( ) | | | | | | | |
| Pressure reducing valve (PV) diameter (mm): | | | | | | | | |
| PV upstream pressure (m): | | | | | | | | |
| PV downstream pressure (m): | | | | | | | | |
| Number of PVs: | | | | | | | | |
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| No. of drainage facilities: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: *B* – Spring | *L* – Lift | *S* - Swing | *D* - Diaphragm | *O* - Others | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of FV: | *BU* – Butterfly | *C* – Cone | *BA* – Ball | *N* – Needle | | | | |
| | *S* - Sleeve | *A* - Auto | *O* - Others | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Flow meter (FM) diameter (mm): | | | | | | | | |

Please select an appropriate type of flow meter used and write down the respective abbreviation into cells below: Type of FM: *P* – Propeller *V*- Volumetric

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type of FM: | | | | | | | | |
| Number of FMs: | | | | | | | | |
| Distribution pipe (DP) diameter (mm): | | | | | | | | |

Please select an appropriate material of RTP used and write down the respective abbreviation into cells below:

| | | | |
|---|---|---|---|
| Material of RTP: | *S* – Steel | *CS* – Coating Steel | *D* – Ductile cast iron |
| | *G* – Gray cast iron | *C* – Concrete | *VP* – Polyvinyl chloride |
| | *PE* – Polyethylene | *F* – Fiber reinforced plastic mortar pipe | *O* - Others |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Material of pipe: | | | | | | | | |
| Length of DP（km): | | | | | | | | |

**5) Distribution and Booster Pumps**

(Year of construction： Service life (year)： )

The form below can be used for the data of intake pump of four (4) types.

| | | | | |
|---|---|---|---|---|
| Pump type: | | | | |

Please select an appropriate one of your intake pump installed and write down the respective abbreviation into cells above:

| | | | |
|---|---|---|---|
| Type of intake pump: | *ES* - End Suction pump | *SC* – Split Casing pump | *MS* – Multistage pump |
| | *SM*- Submersible pump | *I L* – In-Line pump | *VC* – Vacuum pump |
| | *O* - Others | | |

| | | | | |
|---|---|---|---|---|
| Manufacturer: | | | | |

| | | | | |
|---|---|---|---|---|
| Model: | | | | |
| Number of pumps: | | | | |
| Dis charge (litre/min) : | | | | |
| Pump head (m): | | | | |
| Rotating speed (rpm): | | | | |
| Pump efficiency: | | | | |
| Motor output (kW): | | | | |
| Type of motor (please select): | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible | ☐ Squirrel cage<br>☐ Wound-rotor<br>☐ Submersible |

Please select an appropriate one of your intake pump motor starter method applied and write down the respective abbreviation into cells below:

| | | | |
|---|---|---|---|
| Pump motor starting method: | *D* - Direct-on-line starter | *R* - Reactor | *K* - Kondorfer |
| | *SD* - Star Delta | *SS* - Soft Starter | |

| | | | | |
|---|---|---|---|---|
| Pump motor starting method: | | | | |
| Integrated pump-motor efficiency: | | | | |

**6) Expansion Joints** (Flexible joints, flange adapters, etc) :

(Year of construction : Service life (Year) : )

| Type (name) | Quantity | Diameter (mm) | Material | Year of installation |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| | | | | |

## 2-19 Service Pipe

(Year of construction： Service life (Year)： )

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total length (km): | | | | | | | | |
| Minimum dynamic pressure to be kept (m) | | | | | | | | |
| Air valve (AV) diameter (mm): | | | | | | | | |
| Number of AVs: | | | | | | | | |
| No. of drainage facilities: | | | | | | | | |
| Sluice valve (SV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of sluice valve used and write down the respective abbreviation into cells below: Type of SV: *I* –Inside screw type *O* – Outside screw type | | | | | | | | |
| Type of SV: | | | | | | | | |
| Number of SVs: | | | | | | | | |
| Check valve (CV) diameter (mm): | | | | | | | | |
| Please select an appropriate type of check valve (backflow prevention valve) used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of CV: *B* – Spring *L* – Lift *S* - Swing *D* - Diaphragm *O* - Others | | | | | | | | |
| Type of CV: | | | | | | | | |
| Number of CVs: | | | | | | | | |
| Flow control valve (FV) diameter (mm): | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Please select an appropriate type of flow control valve used and write down the respective abbreviation into cells below: | | | | | | | | |
| Type of FV: | *BU* – Butterfly | | *C* – Cone | | *BA* – Ball | | *N* – Needle | |
| | *S* - Sleeve | | *A* - Auto | | *O* - Others | | | |
| Type of FV: | | | | | | | | |
| Number of FVs: | | | | | | | | |
| Diameter of snap (corporation) tap (mm), from distribution pipe to service pipe: | | | | | | | | |
| Number of snap (corporation) tap: | | | | | | | | |
| Water meter diameter (mm) | | | | | | | | |
| Please select an appropriate type of water meter used and write down the respective abbreviation into cells below: Type of water meter: *P* – Propeller *V*- Volumetric | | | | | | | | |
| Type of water meter: | | | | | | | | |
| Number of water meter: | | | | | | | | |
| Service pipe diameter (mm): | | | | | | | | |
| Please select an appropriate material of RTP used and write down the respective abbreviation into cells below: | | | | | | | | |
| Material of RTP: | *S* – Steel | | *CS* – Coating Steel | | *D* – Ductile cast iron | | | |
| | *G* – Gray cast iron | | *C* – Concrete | | *VP* – Polyvinyl chloride | | | |
| | *PE* – Polyethylene | | *F* – Fiber reinforced plastic mortar pipe | | *O* - Others | | | |
| Material service pipe: | | | | | | | | |
| Service pipe length by diameter (km): | | | | | | | | |

## 2-20 Waste Water Treatment Facilities

(Year of construction： Service life (Year)： )

(1) **Treatment Method**: (Please select appropriate ones)

☐ Sun

- ☐ Air drying
- ☐ Mechanical dewatering
- ☐ Dewatering and thermal drying

**(2) Drainage Basin**

| | |
|---|---|
| Capacity ($m^3$): | |
| Number of basins: | |
| Effective depth (m): | |
| Return pump: | ☐ Installed<br>☐ Not installed |
| Sludge withdrawal pump: | ☐ Installed<br>☐ Not installed |
| Mixing device: | ☐ Installed<br>☐ Not installed |
| Supernatant water collecting device: | ☐ Installed<br>☐ Not installed |
| Overflow weir: | ☐ Installed<br>☐ Not installed |

**3) Sludge Basin**

| | |
|---|---|
| Capacity ($m^3$): | |
| Number of basins: | |
| Effective depth (m): | |
| Return pump: | ☐ Installed<br>☐ Not installed |
| Sludge withdrawal pump: | ☐ Installed<br>☐ Not installed |
| Mixing device: | ☐ Installed<br>☐ Not installed |
| Supernatant water collecting device: | ☐ Installed |

| | |
|---|---|
| | ☐ Not installed |
| Overflow weir: | ☐ Installed<br>☐ Not installed |

**4) Sludge Concentration Basin**

| | |
|---|---|
| Capacity ($m^3$): | |
| Number of basins: | |
| Sludge feeding device: | ☐ Installed<br>☐ Not installed |
| Sludge withdrawal pile: | ☐ Installed<br>☐ Not installed |
| Sludge withdrawal pump: | ☐ Installed<br>☐ Not installed |
| Sludge collector: | ☐ Installed<br>☐ Not installed |
| Supernatant water collecting device: | ☐ Installed<br>☐ Not installed |
| Supernatant water pipe: | ☐ Installed<br>☐ Not installed |
| Supernatant water return pipe: | ☐ Installed<br>☐ Not installed |

**5) Sun/Air Drying Bed**

| | |
|---|---|
| Capacity ($m^3$): | |
| Number of beds: | |
| Effective depth (m): | |
| Drainage facilities: | ☐ Installed<br>☐ Not installed |

**6) Dewatering Machine**

| Type: | Press dewaterer | Vacuum dewaterer | Cyclone separator | Pelletizing dewaterer |
|---|---|---|---|---|
| Number of machines: | | | | |

**7) Sludge Final Disposal Site**

| | |
|---|---|
| Site (address): | |
| Transportation mean : | |
| Transportation distance (km): | |
| Disposal charge（VND/$m^3$）: | |

**2-21 Power Receiving and Transformation Installations**

(Year of construction： Service life (Year)： )

| | | | | | |
|---|---|---|---|---|---|
| Capacity of power receiving equipment (kVA): | | | | | |
| Type of transformer: | Please select appropriate ones from choices below and write down the abbreviation of them into the cell below and fill the blank :<br>M – Mold transformer<br>G – Gas insulated transformer<br>O – Oil immersed transformer | | | | |
| Type of transformer: | | | | | |
| Primary voltage (kV): | | | | | |
| Secondary voltage (kV): | | | | | |
| Number of transformers: | | | | | |
| Capacity of engine generator: | | | | | |

**2-22 Laboratory for Water Analysis**

Please write down the number of water analysis apparatuses, devices you have, etc. and their purchase year.

| Apparatuses and Devices | Quantity | Year of purchase |
|---|---|---|
| pH meter: | | |
| Conductivity meter: | | |
| Turbidity meter: | | |
| TOC meter: | | |
| Analytical balance: | | |
| Hot-air sterilizing oven: | | |
| Jar tester: | | |
| Water bath: | | |
| Pure water generator: | | |
| Incubator: | | |
| Stirrer with hot plate: | | |
| Autoclave: | | |
| Residual chlorine measuring kit (DPD method): | | |
| Furnace: | | |

**2-23 Spare parts**

Please write down the number and purchase year of principal spare parts you reserved for pumps and pipelines.

| Spare parts | Specification | Quantity | Year of purchase |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**2-24 maintenance tools**

Please write down the quantity, purchase year, service life of maintenance tools you have.

| Tools | Quantity | Year of purchase | Service life (year) |
|---|---|---|---|
| Hydraulic pressure test pump for pipe works: | | | |
| Portable Arc Welder: | | | |
| Upright Drilling Machine: | | | |
| Lever Puller: | | | |
| Electric Drill: | | | |
| Pipe Threader (Manual Type): | | | |
| Pipe Cutter: | | | |
| Pipe Vise: | | | |
| Hydraulic Pipe Bender: | | | |
| Electric Chain Block with Plain Trolley: | | | |

**1) Vehicles for Maintenance and Repair**

| Type of Vehicle | Displacement (cc) | Riding Capacity | Deadweight (kg) | Year of purchase | Service life (year) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## 2-25 Buildings

Please provide with the information regarding buildings in the water supply station, as for “construction”, please describe as “reinforced concrete”, “steel concrete”, “concrete block”, “timbered (wooden)”, etc.

| Buildings | Quantity | Construction | Total area ($m^2$) | Year of construction | Service life (year) |
|---|---|---|---|---|---|
| Administrative building | | | | | |
| Disinfection facilities | | | | | |
| Laboratory | | | | | |
| Intake pumping station | | | | | |
| Raw water transmission pumping station | | | | | |
| Treated water transmission pumping station | | | | | |
| Distribution pumping station | | | | | |
| Power receiving equipment shelter | | | | | |
| Transformer shelter | | | | | |
| Workshop | | | | | |
| Storage | | | | | |

**2-26 others**

Thank you very much, inquiries regarding the facilities, equipment, etc. of your water supply system are completed. If you have other facilities, equipment, etc., please describe the information, data, etc. of them below:

Attached Form I: Water Analysis Result

Sampling Point and Date: Laboratory: Date of Analysis:

| Category | | Constituents | symbol | unit | Criteria of Health Concerning | Criteria of Acceptability to Consumers | Analysis Result |
|---|---|---|---|---|---|---|---|
| Potential Hazard to Public Health | Bacteriological Parameters | Total coliform bacteria | CT | MPN/100ml | 0 | - | |
| | | Thermotolerant coliform | CF | MPN/100ml | - | - | |
| | | Facal streptococci | ST | MPN/100ml | - | - | |
| | | E-coli | E. Coli | MPN/100ml | - | - | |
| | Toxic Chemicals | arsenic | As | µg/l | 10 | - | |
| | | cadmium | Cd | mg/l | 0.003 | - | |
| | | cyanide | Cn | mg/l | 0.07 | - | |
| | | total mercury | Hg | µg/l | 1 | - | |
| | | lead | Pb | µg/l | 10 | - | |
| | | selenium | Se | µg/l | 10 | - | |
| | | antimony | Sb | µg/l | 18 | - | |
| | | silver | Ag | mg/l | - | - | |
| | | barium | Ba | mg/l | 0.7 | - | |
| | | molybdenum | Mo | mg/l | 0.07 | - | |
| | Health Concerning Chemicals | fluoride | F | mg/l | 1.5 | - | |
| | | nitrate | $NO_3^-$ | mg $NO_3$/l | 50 | - | |
| | | nitrite | $NO_2^-$ | mg $NO_2$/l | 3(short term exposure) 0.2(long term exposure) | - | |
| | | boron | B | mg/l | 0,5 | - | |
| | | nickel | Ni | mg/l | 0,02 | - | |
| | | chromium | Cr | mg/l | 0,05 | - | |
| | | cobalt | Co | mg/l | - | - | |
| | | total chlorine | $Cl^-$ | mg/l | 5 | - | |
| No Direct Consequence to Health | Acceptability to Consumers | color | - | | - | 15 TCU | |
| | | odour | - | dilution | - | - | |
| | | taste | - | dilution | - | - | |
| | | turbidity | - | NTU | - | 5 NTU | |
| | | residue on evaporation | - | mg/l | - | - | |
| | | total dissolved solids | TDS | mg/l | - | 1,000 | |
| | | pH | pH | | - | - | |
| | | Anionic surface active agent | - | mg ABS/l | - | - | |
| | | mineral oils | - | mg/l | - | - | |
| | | phenolic compounds | - | mg/l | - | - | |
| | | hardness | ($CaCO_3$) | °f | - | - | |
| | | calcium | Ca | mg/l | - | - | |
| | | chloride | Cl | mg/l | - | 250 | |
| | | copper | Cu | mg/l | 2 | 1 | |
| | | iron | Fe | mg/l | - | 0.3 | |
| | | magnesium | Mg | mg/l | - | - | |
| | | manganese | Mn | mg/l | 0.4 | 0.1 | |
| | | sulfate | $SO_4$ | mg/l | - | 250 | |
| | | zinc | Zn | mg/l | - | 3 | |
| | | aluminum | Al | mg/l | - | 0.2 | |
| | | sodium | Na | mg/l | - | 200 | |
| | | ammonia | $NH_4$ | mg $NH_4$/l | - | 1.5 | |
| | | residual chlorine | $Cl^-$ | mg/l | - | 0.6-1.0 | |

# 3. Current Situation of Water Supply System

**3-1. Please describe the disasters which affect/affected the water supply system.**

| Year/Month | Damages (BVND) | Causes | Description of damages |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

**3-2. History of water supply suspensions**

Please describe the history of water supply suspensions including planned suspensions caused by reasons except disasters described above.

| Year/Month | Period of water supply suspension | Causes |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

# 4. Popularity of Water Supply (System)

### 4-1. Number of households who subscribe for water supply

1) Number of households who has a connection to the water supply system: _____________.

2) Average members of household: _____________ per household.

### 4-2. Average daily water supply (volume) or consumption by month

Please provide data on average daily water supply (volume) or consumption in the last three years by writing down in the following form or by providing with a copy of water supply records when the Study Team visits your water supply station.

| 2007 | average daily water supply ($m^3$) | 2008 | average daily water supply ($m^3$) | 2009 | average daily water supply ($m^3$) |
|---|---|---|---|---|---|
| Jan | | Jan | | Jan | |
| Feb | | Feb | | Feb | |
| Mar | | Mar | | Mar | |
| Apr | | Apr | | Apr | |
| May | | May | | May | |
| Jun | | Jun | | Jun | |
| Jul | | Jul | | Jul | |
| Aug | | Aug | | Aug | |
| Sep | | Sep | | Sep | |
| Oct | | Oct | | Oct | |
| Nov | | Nov | | Nov | |
| Dec | | Dec | | Dec | |

**4-3. Please provide records on the maximum water supply at every hour in a day (2009 or 2008).**

| Time Period | Water supply ($m^3/h$) | Time Period | Water supply ($m^3/h$) | Time Period | Water supply ($m^3/h$) |
|---|---|---|---|---|---|
| 0:00-1:00 | | 8:00-9:00 | | 16:00-17:00 | |
| 1:00-2:00 | | 9:00-10:00 | | 17:00-18:00 | |
| 2:00-3:00 | | 10:00-11:00 | | 18:00-19:00 | |
| 3:00-4:00 | | 11:00-12:00 | | 19:00-20:00 | |
| 4:00-5:00 | | 12:00-13:00 | | 20:00-21:00 | |
| 5:00-6:00 | | 13:00-14:00 | | 21:00-22:00 | |
| 6:00-7:00 | | 14:00-15:00 | | 22:00-23:00 | |
| 7:00-8:00 | | 15:00-16:00 | | 23:00-0:00 | |

**4-4. water rate system applied**

**1) Please explain the currently applied water rate system:**

Example: Water rate system

| | |
|---|---|
| Fixed rate | To fix monthly water rate of a household based on an assumed water consumption of each household member. Thus this does not reflect the actual water consumption. |
| Metered rate | Designated $1m^3$ unit rate x water consumption by water meter reading. |
| Progressive rate block system | Dividing the water consumption into several blocks and the higher water rate is applied to the block corresponds to higher water consumption block. |
| Regressive rate block system | Inverse system of the progressive rate block system |
| Two parts water rate | Consists of initial rate and the rate based on water consumption |
| Two parts water rate by meter size | Two parts water rate but initial charge varies according to the meter size |

**2) Please show the water rate applied according to the applied water rate system:**

- Fixed rate: VND/person/month
- Metered rate: VND/$m^3$
- Progressive or regressive rate block system:

(Water consumption applied to each block and its water rate and number of consumers of each block in 2009).

| Water consumption block ($m^3$) | Water rate applied (VND/$m^3$) | Number of consumers (households) |
|---|---|---|
| ex : 0 - 10 | ex : 1000 | ex : 432 |
| | | |
| | | |
| | | |

**3) Two parts water rate: Initial rate ________VND:**

Regarding the water rate according to the water consumption, please select an item from 2) (Fixed rate, metered rate or Progressive/Regressive rate block system). Write down a value of proportional water rate as consumption. If you apply water rate block system and fixed rate system to the initial block as an initial rate, please write down “initial rate” in the cell of initial block rate (second column).

**4) Two parts water rate by meter size:**

Regarding the water rate according to the water consumption, please follow the description in 3).

| Water meter size (mm) | Initial rate (VND) | Number of consumers (households) |
|---|---|---|
| ex: 25 | ex: 50,000 | 150 |
| | | |
| | | |
| | | |

**5) Other water rate system**

If you have applied a water rate system other than mentioned above, please explain the system and the applied water rate.

**4-5. operation and effect indicators**

Please write down the values at the design stage and in 2009:

| | Unit | Design stage | 2009 |
|---|---|---|---|
| Number of subscribed households | | | |
| Average number of household | | | |
| Rate of population served<br>(Number of users / Total population in the administrative area) | % | | |
| Capacity of water supply system | $m^3$/day | | |
| Average daily water consumption<br>(Annual water supply / 365) | $m^3$/day | | |
| "Liter/ Capita / Day" of water supply<br>(Average daily water supply / Number of users) | litter/day | | |
| Maximum daily water supplied in a year | $m^3$/day | | |
| Rate of facilities utilization ( Average daily water supply / Capacity of water supply system) | % | | |
| Rate of accounted for water (Water consumption charged / Total water supply) | % | | |
| Monthly operation hours of treated water transmission pump or distribution pump<br>(please circle the selected item) | hours | | |

## 5. Maintenance and Management

Please fill out the following form by filling blanks or select ones from alternatives.

| | | |
|---|---|---|
| 1 | **Completed drawings:**<br>(Ex. drawings on facilities; preferably a drawing just after the end of construction works) | Available / Not available |
| 2 | **Detailed pipeline map:**<br>(Ex. drawing which shows used materials, its diameter, year of installation, location of valves, neighboring buildings and other installations) | Available / Not available |
| 3 | **Rate of pipeline rehabilitation (%):**<br>(Annual rehabilitated pipeline length / Total pipeline length) | |
| 4 | **Organization who certifies flow meters and water meters:** | |
| 5 | **Frequency of flow meter calibration:** | |
| 6 | **Frequency of water meter calibration:** | |
| 7 | **Copy of repair records in 2009:** | |
| 8 | **Repair costs:**<br>in 2007:<br>in 2008:<br>in 2009: | <br>MVND<br>MVND<br>MVND |
| 9 | **Preventive maintenance:**<br>(Ex. maintenance method based on accumulated operation hours and frequency of repairs) | Introduced / Not introduced |
| 10 | **Prioritization of facilities, installations and equipment.** | Introduced / Not introduced |
| 11 | **Prioritization of facilities, installations and equipment for rehabilitation:** | Introduced / Not introduced |
| 12 | **Prepared own fund:**<br>(Ex. earning retention, reserve, etc.) | MVND |
| 13 | **Organization chart with number of staffs in respective divisions:** | |
| 14 | **Assignment of a technical administrator:** | Assigned / Not assigned |
| 15 | **Assignment of a waterworks manager:** | Assigned / Not assigned |
| 16 | **Assignment of a position in charge of facilities, installations, and equipment:** | Assigned / Not assigned |
| 17 | **Assignment of a position in charge of pipeline works:** | Assigned / Not assigned |
| 18 | **Assignment of a position in charge of facilities planning:** | Assigned / Not assigned |

| | | |
|---|---|---|
| 19 | **Please explain the staff training system:** | |
| 20 | Regulation or equivalent on the establishment of water tariff and water rate collection, if any: | |
| 21 | Subscription charge of the person who newly connects the water supply system: | MVND |
| 22 | **Water rate collecting system** | |
| | - Water meter reading: | Automatic / Manual (Number of readers: ) |
| | - Frequency of water meter reading (1/month, 1/2 months, etc.) | Time / month |
| | - Frequency of billing | Time / month |
| | - Mode of bill delivery（by mail, direct distribution, etc.) | |
| | - Water rate collecting mode (by collectors, bank transfer, post office transfer, direct payment to Water Supply Company, automatic withdrawal from an account, etc.) | |
| | - Rate of water rate collection (amount of water rate collected / amount of water rate billed) in 2007 (%). | |
| | - Rate of water rate collection in 2008 (%).<br>- Rate of water rate collection in 2009 (%). | |
| 23 | **Measures against a person who does not pay water rate** | |
| | - As a penalty, water supply should forcibly be stopped. | Agree / Disagree |
| | - Please explain any measures you would take against those who are not paying for their water use (exclude the stoppage of water supply). | |
| | - In case you would stop the water supply, please explain the procedure. | |
| | - Please explain the conditions in which to resume the water supply after stoppage. | |

<table>
<tr><td rowspan="3">24</td><td colspan="2">When did you make the latest revision of the water tariff? :</td><td>(Year / Month)</td></tr>
<tr><td colspan="2">Frequency of the average water tariff revision:</td><td>Every ______ years</td></tr>
<tr><td>Please select the necessary conditions needed to review the water tariff:<br>-</td><td colspan="2">- When the management of the water supply undertaking becomes in red<br>- When rehabilitation of the facilities are planned.<br>- When the water source is to be changed<br>- When the capacity of the water supply facilities are expanded<br>- Others</td></tr>
<tr><td rowspan="12">25</td><td colspan="3">Water surveillance:</td></tr>
<tr><td colspan="3">Please circle water analysis items of daily, weekly, monthly, seasonally, semi-annually and annually found in the attached form II.</td></tr>
<tr><td colspan="3">Please provide with______the latest source water analysis results</td></tr>
<tr><td colspan="3">Please provide with______the latest supplied water analysis results</td></tr>
<tr><td>Please select sampling points of supplied water analysis.</td><td colspan="2">- Tap<br>- Distribution tank<br>- Distribution pipe network<br>- Others</td></tr>
<tr><td>Please explain the change or alternation of the operation, maintenance and management of the water supply system affected by the revision of drinking water quality standards in Vietnam in 2009 or 2010:</td><td colspan="2"></td></tr>
<tr><td>Name, address and telephone number of the laboratory</td><td colspan="2"></td></tr>
<tr><td>Please select a status of the laboratory</td><td colspan="2">- National institute<br>- Provincial institute<br>- Laboratory of provincial water supply undertaking (company)<br>- Your own laboratory<br>- Others</td></tr>
<tr><td>Name of the organizations who are in charge of water quality of residual chlorine, turbidity and color</td><td colspan="2"></td></tr>
<tr><td>Please provide with financial data of your water supply management</td><td colspan="2"></td></tr>
<tr><td>Current assets in 2004 and 2008 (BVND)</td><td colspan="2"></td></tr>
</table>

| | | | |
|---|---|---|---|
| 26 | **Current liabilities in 2004 and 2008 (BVND):** | 2004 | 2008 |
| | Equity capital (total capital – fixed liability) | | |
| | Gross asset | | |
| | Profit | | |
| | Amount of sales (turnover) | | |
| | Please provide with the balance sheet and profit and loss statement in 2004 and 2008 of your water supply management. | | |
| | amount of subsidy you received in 2009 | (MVND) | |

Please select organizations which would receive subsidy? Choose multiple if needed.

- National government
- Provincial government
- District government
- Others (                              )

| | | |
|---|---|---|
| 27 | Please describe the rehabilitation and/or renewal and/or expansion plan for your water supply system. | |
| | Please layout the financial plan (amount and fund source) for the coming five years: | |

| | | | | | |
|---|---|---|---|---|---|
| 28 | 2010 | | 2011 | | |
| | BVND | | BVND | | |
| | Fund source | Fund source | 2012 | 2013 | 2014 |
| | In case of an emergency, if your water supply company is coordinating with other neighboring water supply system, please explain in detail. | | BVND | BVND | BVND |
| | Please write down the section (division) who Process the complaints from consumers: | | Fund source | Fund source | Fund source |
| 29 | Please explain the complaints processing system at nights: | | | | |

| | | |
|---|---|---|
| 30 | Record of the complaints and processing for them | Keep / Do not keep |
| | Construction of database on above | there is database / there is not database<br><br>Available / Not Available |

Attached Form II:Water Surveillance Plan

Please put circle in the cell which correspond to the daily, weekly, monthly, seasonal, semi-annual and annual water analysis parameters.

| Category | | Constituents | symbol | unit | Criteria of Health Concerning | Criteria of Acceptability to | day | week | month | season | semi-annual | annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Potential Hazard to Public Health | Bacteriological Parameters | Total coliform bacteria | CT | MPN/100ml | 0 | - | | | | | | |
| | | Thermotolerant coliform | CF | MPN/100ml | - | - | | | | | | |
| | | Facal streptococci | ST | MPN/100ml | - | - | | | | | | |
| | | E-coli | E. Coli | MPN/100ml | - | - | | | | | | |
| | Toxic Chemicals | arsenic | As | μg/l | 10 | - | | | | | | |
| | | cadmium | Cd | mg/l | 0.003 | - | | | | | | |
| | | cyanide | Cn | mg/l | 0.07 | - | | | | | | |
| | | total mercury | Hg | μg/l | 1 | - | | | | | | |
| | | lead | Pb | μg/l | 10 | - | | | | | | |
| | | selenium | Se | μg/l | 10 | - | | | | | | |
| | | antimony | Sb | μg/l | 18 | - | | | | | | |
| | | silver | Ag | mg/l | - | - | | | | | | |
| | | barium | Ba | mg/l | 0.7 | - | | | | | | |
| | | molybdenum | Mo | mg/l | 0.07 | - | | | | | | |
| | Health Concerning Chemicals | fluoride | F | mg/l | 1.5 | - | | | | | | |
| | | nitrate | $NO_3^-$ | mg $NO_3$/l | 50 | - | | | | | | |
| | | nitrite | $NO_2^-$ | mg $NO_2$/l | 3(short term exposure)<br>0.2(long term exposure) | - | | | | | | |
| | | boron | B | mg/l | 0,5 | - | | | | | | |
| | | nickel | Ni | mg/l | 0,02 | - | | | | | | |
| | | chromium | Cr | mg/l | 0,05 | - | | | | | | |
| | | cobalt | Co | mg/l | - | - | | | | | | |
| | | total chlorine | $Cl^-$ | mg/l | 5 | - | | | | | | |
| No Direct Consequence to Health | Acceptability to Consumers | color | - | | - | 15 TCU | | | | | | |
| | | odour | - | dilution | - | - | | | | | | |
| | | taste | - | dilution | - | - | | | | | | |
| | | turbidity | - | NTU | - | 5 NTU | | | | | | |
| | | residue on evaporation | - | mg/l | - | - | | | | | | |
| | | total dissolved solids | TDS | mg/l | - | 1,000 | | | | | | |
| | | pH | pH | | - | - | | | | | | |
| | | Anionic surface active agent | - | mg ABS/l | - | - | | | | | | |
| | | mineral oils | - | mg/l | - | - | | | | | | |
| | | phenolic compounds | - | mg/l | - | - | | | | | | |
| | | hardness | ($CaCO_3$) | °f | - | - | | | | | | |
| | | calcium | Ca | mg/l | - | - | | | | | | |
| | | chloride | Cl | mg/l | - | 250 | | | | | | |
| | | copper | Cu | mg/l | 2 | 1 | | | | | | |
| | | iron | Fe | mg/l | - | 0.3 | | | | | | |
| | | magnesium | Mg | mg/l | - | - | | | | | | |
| | | manganese | Mn | mg/l | 0.4 | 0.1 | | | | | | |
| | | sulfate | $SO_4$ | mg/l | - | 250 | | | | | | |
| | | zinc | Zn | mg/l | - | 3 | | | | | | |
| | | aluminum | Al | mg/l | - | 0.2 | | | | | | |
| | | sodium | Na | mg/l | - | 200 | | | | | | |
| | | ammonia | $NH_4$ | mg $NH_4$/l | - | 1.5 | | | | | | |
| | | residual chlorine | $Cl^-$ | mg/l | - | 0.6-1.0 | | | | | | |

# 6. Information relative to the Water Supply

**6-1. Issues on public health in the area.**

**6-2. Mal-nutrition rate of under five from 1998 to 2009.**

| 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |

**6-3. If you have already implemented the Assets Management, please provide information on the following questions.**

1) Forms used for the Assets Management (ex. Facility registrations).

2) Flow Diagram of the Assets Management.

## Irrigation Sector

# I. General Information

**Name of Liaison with DPI/MPI: ________________________________ .**

<table>
<tr><td>SPL Phase:</td><td colspan="2"></td><td colspan="2">Name of the Project:</td><td colspan="2"></td></tr>
<tr><td>Province:</td><td></td><td>District/City:</td><td></td><td>Commune:</td><td colspan="2"></td></tr>
<tr><td>Organization in Charge:</td><td colspan="2">please select:<br>☐ Project Implementation (Project Owner)<br>☐ Operation<br>☐ Maintenance and Management</td><td colspan="4">Name of the Organization: ____________________<br>Address:<br>Tel / Fax:<br>E-mail:</td></tr>
<tr><td>Date:</td><td colspan="2"></td><td colspan="2" rowspan="3">Office Information:</td><td colspan="2">Tel:</td></tr>
<tr><td>Respondent:</td><td colspan="2"></td><td colspan="2">Fax:</td></tr>
<tr><td>Cell phone #:</td><td colspan="2"></td><td colspan="2">E-mail:</td></tr>
<tr><td>Year of Construction Works Commencement:</td><td colspan="2"></td><td colspan="2">Project Owner in the Implementation stage:</td><td colspan="2"></td></tr>
<tr><td>Year of Construction Works Completion:</td><td colspan="2"></td><td colspan="2">Material Cost (BVND):</td><td colspan="2"></td></tr>
<tr><td>Construction Cost (BVND):</td><td colspan="2"></td><td colspan="2">Domestic Fund (BVND):</td><td colspan="2"></td></tr>
<tr><td>Total investment Cost (BVND):</td><td colspan="2"></td><td colspan="2">JBIC Fund (BVND):</td><td colspan="2"></td></tr>
</table>

# I. Farming Aspects of the Entire Project

### 1) Land Holders and Tenant Farmers of Beneficiaries of the Entire Project, 2009:

| Tenure System: | Number of Households | Average Farming Area (ha) | Average Number of Lots |
|---|---|---|---|
| Land Holders: | | | |
| Tenant Farmers: | | | |

| Land Holders and Tenant Farmers at the Same Time: | | | |
|---|---|---|---|

**2) Crop Calendar of the Entire Project, 2009:**

**Dry Season** (Month:…………to……………..)

| Crop | Describe Calendar | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Sample) | J | F | M | A | M | J | J | A | S | O | N | D |
| 1. | | | | | | | | | | | | |
| 2. | | | | | | | | | | | | |
| 3. | | | | | | | | | | | | |
| 4. | | | | | | | | | | | | |

Note) Indicate from transplanting/planting to harvesting only (no need to show land preparation)

| Crop | Describe Calendar | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Sample) | J | F | M | A | M | J | J | A | S | O | N | D |
| 1. | | | | | | | | | | | | |
| 2. | | | | | | | | | | | | |
| 3. | | | | | | | | | | | | |
| 4. | | | | | | | | | | | | |

**Wet Season** (Month:…………to……………….)

Note) Indicate from transplanting/planting to harvesting only (no need to show land preparation)

**3) Necessary Technical Support from the Government and Others, 2009:**

| Necessary Support from the Government and Others |
|---|
| 1. |
| 2. |
| 3. |

### 4) Facilities of the Entire Project, 2009:

**Dam & Reservoir (1/2):**

| No | 1 | 2 |
|---|---|---|
| River Name: | | |
| Dam Name: | | |
| Construction Year: | | |
| Basin Area (km2): | | |
| Purpose of Dam (I, F, W, E, O) #1: | | |
| Dam Type (E, R, Cn, Cb, O) #2: | | |
| Dam Height (m): | | |
| Dam Crest Elevation (EL. m): | | |
| Dam Length (m): | | |
| Dam Embankment Volume (m3): | | |
| Total Storage Capacity (m3): | | |
| Capacity for Irrigation (m3): | | |
| Dead (Sand) Capacity (m3): | | |

**Dam & Reservoir (2/2):**

| No | 1 | 2 |
|---|---|---|
| Reservoir Area (ha): | | |
| Design Intake Discharge for Irrigation (m3/s): | | |
| Water Intake Period (M/D to M/D): | | |
| Irrigation Area (ha): | | |
| Full Water Level (EL. m): | | |
| Type of Spillway (S, C, O) #3: | | |
| Total Cost (VND): | | |
| Working Life (Year): | | |

#1: I=Irrigation, F=Flood, W=Water Supply, E=Electricity, O=Other

#2: E=Earth Fill, R=Rock Fill, Cn=Concrete, Cb=Combined, O=Other

#3: S=Side Overflow, C=Chute, O=Other

**5) Headwork:**

| No | 1 | 2 |
|---|---|---|
| River name: | | |
| Average Discharge of River during Dry Season (m3/s): | | |
| Average Discharge of River during Wet Season (m3/s): | | |
| Construction Year: | | |
| Basin Area (km2): | | |
| Weir Materials (C, O) #1: | | |
| Weir Height (m): | | |
| Weir Crest Elevation (EL. m): | | |
| Weir Length (m): | | |
| Design Water Level (EL. m): | | |
| Water Intake Period (M/D to M/D): | | |
| Design Water Intake Discharge (m3/s): | | |
| Irrigation Area (ha): | | |
| Total Cost (VND): | | |
| Working Life (Year): | | |

#1: C=C oncrete, O=Other

**6) Pump Station for Irrigation:**

| No | 1 | 2 | 3 |
|---|---|---|---|
| Water Source (R, U) #1: | | | |
| Installation Year: | | | |
| Water Intake Period (M/D to M/D): | | | |
| Irrigation Area (ha): | | | |
| Motor or Engine (M, E) #2: | | | |
| Power (Unit: HP or KW): | | | |
| Number of Motors/ Engines: | | | |
| Pump Type (H, V, S, O) #3: | | | |
| Pump Diameter (mm): | | | |
| Number of Pumps: | | | |
| Total Pump Head (m): | | | |
| Design Discharge of This Station (lm3/min): | | | |
| Design Annual Operating Hours (hr/year): | | | |

| | | | |
|---|---|---|---|
| Total Cost (VND): | | | |
| Working Life (Year): | | | |

#1: R=River Water, U=Underground Water #2: M=Motor, E=Engine

#3: H=Horizontal, V=Vertical, S=Submerged, O=Other

### 7) Irrigation Canal:

| No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Canal Name: | | | | | | | | | |
| Main or Secondary or Tertiary (M, S, T) #1: | | | | | | | | | |
| Construction Year: | | | | | | | | | |
| Total Length (km): | | | | | | | | | |
| Canal Bed Width (m): | | | | | | | | | |
| Canal Height (m): | | | | | | | | | |
| Side Slope (n) #2: | | | | | | | | | |
| Longitudinal Gradient: | | | | | | | | | |
| Design Discharge of This Cabal Portion (m3/s): | | | | | | | | | |
| Lining Materials (E, B, C, O) #3: | | | | | | | | | |
| Total Cost (VND) #4: | | | | | | | | | |
| Working Life (Year): | | | | | | | | | |

#1: M=Main, S=Secondary, T=Tertiary #2: n as 1:n #3: E=Earth, B=Brick (covered by Mortar), C=Concrete, O=Other

#4: Includes the costs of major attached facilities (like bridges, diversion works, water measurement facilities and regulating structures, etc.), but not includes the costs of dams and reservoirs, headworks, pump stations, aquaducts and siphons.

### 8) Aquaduct:

| No | 1 | 2 |
|---|---|---|
| Canal Name Installed: | | |
| Year of Installation: | | |
| Structure of Aquaduct (R, P, O) #1: | | |
| Open or Closed (O, C) #2: | | |
| Total Width or Outside Diameter (m): | | |
| Total Height or Outside Diameter (m): | | |
| Design Discharge of This Aquaduct ($m^3/s$): | | |
| Total Cost (VND): | | |

| | | |
|---|---|---|
| Working Life (Year): | | |

#1: R=Rectangular, P=Pipe, O=Other #2: O=Open, C=Closed

**9) Siphon:**

| No | 1 | 2 |
|---|---|---|
| Canal Name Installed: | | |
| Year of Installation: | | |
| Structure of Siphon (R, P, O) #1: | | |
| Lowest Elevation of Siphon Bed (EL. m): | | |
| Design Water Level at Inlet (EL. m): | | |
| Design Water Level at Outlet (EL. m): | | |
| Width or Outside Diameter (m): | | |
| Height or Outside Diameter (m): | | |
| Design Discharge of This Siphon ($m^3/s$): | | |
| Total Cost (VND): | | |
| Working Life (Year): | | |

#1: R=Rectangular, P=Pipe, O=Other

**10) On-Farm Facilities by Types:**

| No | 1 | 2 | 3 |
|---|---|---|---|
| Type #1: | | | |
| Year of Installation: | | | |
| Number: | | | |
| Average Design Discharge of This Type (m3/s): | | | |
| Average Cost of This Type (VND): | | | |
| Working Life (Year): | | | |

#1: Type Name Used in the Design, etc.

**11) Drainage Canal:**

| No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Canal Name: | | | | | | | | | |
| Main or Secondary or Tertiary (M, S, T) #1: | | | | | | | | | |
| Construction Year: | | | | | | | | | |
| Drainage Area (ha): | | | | | | | | | |
| Total Length (km): | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Canal Bed Width (m): | | | | | | | | | |
| Canal Height (m): | | | | | | | | | |
| Side Slope (n) #2: | | | | | | | | | |
| Longitudinal Gradient: | | | | | | | | | |
| Design Discharge of This Canal Portion ($m^3/s$): | | | | | | | | | |
| Lining Materials (E, B, C, O) #3: | | | | | | | | | |
| Total Cost (VND) #4: | | | | | | | | | |
| Working Life (Year): | | | | | | | | | |

#1: M=Main, S=Secondary, T=Tertiary

#2: n as 1:n

#3: E=Earth, B=Brick (covered by Mortar), C=Concrete, O=Other

#4: Includes the costs of major attached facilities (like bridges and culverts, etc.), but not includes the costs of pump stations, sluiceways, flood dykes and tide gates.

**12) Drainage Pump Station:**

| No | 1 | 2 |
|---|---|---|
| Name of Outlet River: | | |
| Design Water Level of River (EL. m): | | |
| Year of Installation: | | |
| Motor or Engine (M, E) #1: | | |
| Power (Unit: HP or KW): | | |
| Number of Motors/ Engines: | | |
| Pump Type (H, V, S, O) #2: | | |
| Pump Diameter (mm): | | |
| Number of Pumps: | | |
| Pump Head (m): | | |
| Design Discharge of This Station ($m^3/min$): | | |
| Drainage Area (ha): | | |
| Design Annual Operating Hours (hr/year): | | |
| Total Cost (VND): | | |
| Working Life (Year): | | |

#1: M=Motor, E=Engine

#2: H=Horizontal, V=Vertical, S=Submerged, O=Other

**13) Sluiceway:**

| No | 1 | 2 | 3 |
|---|---|---|---|
| Name of Outlet River: | | | |
| Gate Power Type (M, E, O) #1: | | | |
| Year of Installation: | | | |
| Design Outside Water Level (EL. m): | | | |
| Design Inside Water Level (EL. m): | | | |
| Gate Height (m): | | | |
| Gate Width (m): | | | |
| Number of Gates: | | | |
| Gate Sill Elevation (EL. m): | | | |
| Design Discharge of This Sluiceway ($m^3/s$): | | | |
| Drainage Area (ha): | | | |
| Total Cost (VND): | | | |
| Working Life (Year): | | | |

#1: M=anual, E=Electricity, O=Other

**14) Flood Dyke**:

| No | 1 | 2 | 3 |
|---|---|---|---|
| Name of River Installed: | | | |
| Year of Installation: | | | |
| Design Water Level (EL. m): | | | |
| Length (m): | | | |
| Height (m): | | | |
| Upper Width (m): | | | |
| Bottom Width (m): | | | |
| River Side Slope (n) #1: | | | |
| Inside Slope (n) #1: | | | |
| Protected Area (ha): | | | |
| Total Cost (VND): | | | |
| Working Life (Year): | | | |

#1: n as 1:n

**15) Tide Gate**:

| No | **1** | **2** | **3** |
|---|---|---|---|
| Gate Power Type (M, E, O) #1: | | | |
| Year of Installation: | | | |
| Design Sea Level (EL. m): | | | |
| Design Discharge of This Tide gate ($m^3/s$): | | | |
| Gate Height (m): | | | |
| Gate Width (m): | | | |
| Number of Gates: | | | |
| Gate Sill Elevation (EL. m): | | | |
| Protected Area (ha): | | | |
| Total Cost (VND): | | | |
| Working Life (Year): | | | |

#1: M=manual, E=Electricity, O=Other

**16) Issues of the Major Facilities:**

| Facility | Issues |
|---|---|
| Dam & Reservoir: | |
| Headworks: | |
| Irrigation Pump Station: | |
| Main Irrigation Canal: | |
| Secondary Irrigation Canal: | |
| Tertiary Irrigation Canal: | |
| Aquaduct: | |
| Siphon: | |
| Division Works: | |
| Water Measurement Facility: | |
| Regulating Structure: | |
| On-Farm Facilities: | |
| Main Drainage Canal: | |
| Secondary Drainage Canal: | |
| Tertiary Drainage Canal: | |
| Drainage Pump Station: | |
| Sluiceway: | |
| Flood Dyke: | |
| Tide Gate: | |

**Could you please provide us the following drawings (showing SPL portion)**

| Facility | Required Drawing (As Built Drawing) |
|---|---|
| Entire Project: | General Plan |
| Dam & Reservoir: | Plan and Typical Cross Section |
| Headworks: | Plan and Typical Cross Section |
| Irrigation Pump Station: | Plan and Typical Cross Section |
| Main Irrigation Canal: | Plan, Longitudinal and Cross Section |
| Secondary Irrigation Canal: | Plan and Cross Section |
| Tertiary Irrigation Canal: | Plan and Cross Section |
| Aquaduct: | Plan, Longitudinal and Cross Section |
| Siphon: | Plan, Longitudinal and Cross Section |
| Division Works: | Plan and Cross Section |
| Water Measurement Facility: | Plan and Cross Section |
| Regulating Structure: | Plan and Cross Section |
| On-Farm Facilities: | Plan and Cross Section |
| Drainage Canal: | Plan and Typical Cross Section |
| Drainage Pump Station: | Plan and Typical Cross Section |
| Sluiceway: | Plan and Typical Cross Section |
| Flood Dyke: | Plan and Typical Cross Section |
| Tide Gate: | Plan and Typical Cross Section |

## II. O&M of the Entire Project

**1) Date of Handed over**:

| Date of Handed Over | Handed Over to |
|---|---|
| | |

**2) Water Right:**

- ☐ Check
- ☐ Acquired/
- ☐ Not Acquired/

If Acquired, Registered Quantity ($m^3/s$)………………………………,

Water Intake Period……………………………………….

**3) Organization of O&M of the Facilities, 2009**:

| Facility | O&M Organization |
|---|---|
| Dam & Reservoir: | |
| Headworks: | |
| Irrigation Pump Station: | |
| Main Irrigation Canal: | |
| Secondary Irrigation Canal: | |
| Tertiary Irrigation Canal: | |
| Aquaduct: | |
| Siphon: | |
| Division Works: | |
| Water Measurement Facility: | |
| Regulating Structure: | |
| On-Farm Facilities: | |
| Main Drainage Canal: | |
| Secondary Drainage Canal: | |
| Tertiary Drainage Canal: | |
| Drainage Pump Station: | |
| Sluiceway: | |
| Flood Dyke: | |
| Tide Gate: | |

4) **O&M Organization of the Major Facilities, 2009 (like irrigation management company, enterprise, etc.)**:

| | |
|---|---|
| Name: | |
| Address: | |
| Tel: | |
| Fax: | |
| Email: | |
| Establishment Year: | |
| Function: | |
| Number of Members: | |
| Equipment of this Organization: | |

**Duties/Responsibility of this Organization**

| Duties/Responsibility |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with Organization Chart.

5) **O&M Organization of the On-Farm Facilities, 2009 (like agricultural production cooperative, water user association, etc.)**:

| | |
|---|---|
| Name: | |
| Address: | |
| Tel: | |
| Fax: | |
| Email: | |
| Establishment Year: | |
| Function: | |
| Number of Members: | |
| Equipment of this Organization: | |

**Duties/Responsibility of this Organization**

| Duties/Responsibility |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with Organization Chart

**6) O&M Activities of the Major Facilities, 2009**:

How would you conduct O&M? Please select from the following.

- ☐ O&M Manual
- ☐ Empirical Method
- ☐ Other (………………………)

If you have the O&M Manual, what are its component items?

| Component Items of O&M Manual |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with the O&M Manual.

Do you have O&M Plan? Yes/No

If you have the O&M Plan, what are its component items?

| Component Items of O&M Plan |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with the O&M Plan.

Do you have Operation Record?    Yes/No

If you have the Operation Record, what are its component items?

| Component Items of Operation Record |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with the Operation Record.

Do you have Maintenance Record?    Yes/No

If you have the Maintenance Record, what are its component items?

| Component Items of Maintenance Record |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with the Maintenance Record.

**7) O&M Activities of the On-Farm Facilities, 2009**:

How would you conduct O&M?

- ☐ O&M Manual
- ☐ Empirical Method
- ☐ Other (………………………)

If you have the O&M Manual, what are its component items?

| Component Items of O&M Manual |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with the O&M Manual.

Do you have O&M Plan?    Yes/No

If you have the O&M Plan, what are its component items?

| Component Items of O&M Plan |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with the O&M Plan.

Do you have Operation Record?    Yes/No

If you have the Operation Record, what are its component items?

| Component Items of Operation Record |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with Operation Record.

Do you have Maintenance Record?    Yes/No

If you have the Maintenance Record, what are its component items?

| Component Items of Maintenance Record |
|---|
| 1. |
| 2. |
| 3. |
| 4. |

Please provide us with the Maintenance Record.

**8) Irrigation Water Fee, 2009:**

Irrigation Water Fee (in proportion to area): …………………VND/ha

Exemption Cases of Irrigation Water Fee (in proportion to area): …………………………..……

Irrigation Water Fee (annual): ……………….….…VND/year

Exemption Cases of Irrigation Water Fee (annual): …………………………..……

**<u>Collection Rate of Irrigation Water Fee</u>**

| Year | Collection Rate (%) | Measures against Nonpayment Persons |
|---|---|---|
| 2009 | | |

**9) Finance of O&M Organization of the Major Facilities, 2009**:

**<u>O&M Cost of the Organization (VND)</u>**

| Year | *) Year by Year Operational (Itemize) | Short Term Periodical (Itemize) | Labor Service and Others (Itemize) |
|---|---|---|---|
| 2009 | Total……………. (………………..) | Total……………. (………………..) | Total……………. (………………..) |

*) Year by Year Operational: operation, maintenance, inspection costs; electricity and fuel costs; repairmen and consumable goods

**<u>Amount of Subsidy to the Organization</u>**

| Year | Sources of Subsidy | Subsidy Amount (Unit) |
|---|---|---|
| 2009 | …………… | ………(…….) |

**<u>Annual Revenue and Expenditures of the Organization (Unit………………………….)</u>**

| Year | Annual Revenue (Itemize) | Annual Expenditures (Itemize) |
|---|---|---|
| 2009 | Total……………. (………………..) | Total……………. (………………..) |

**10) Finance of O&M Organization of the On-Farm Facilities, 2009**:

**<u>O&M Cost of the Organization (VND)</u>**

| Year | *) Year by Year Operational (Itemize) | Short Term Periodical (Itemize) | Labor Service and Others (Itemize) |
|---|---|---|---|
| 2009 | Total……………. (………………..) | Total……………. (………………..) | Total……………. (………………..) |

*) Year by Year Operational: operation, maintenance, inspection costs; electricity and fuel costs; repairmen and consumable goods

**<u>Amount of Subsidy to the Organization</u>**

| Year | Sources of Subsidy | Subsidy Amount (Unit) |
|---|---|---|
| 2009 | …………… | ………(…….) |

**Annual Revenue and Expenditures of the Organization (Unit………………………….)**

| Year | Annual Revenue<br>(Itemize) | Annual Expenditures<br>(Itemize) |
|---|---|---|
| 2009 | Total…………….<br>(………………..) | Total…………….<br>(………………..) |

**11) Necessary Support from the Government and Others**:

| Necessary Support from the Government and Others |
|---|
| 1. |
| 2. |
| 3. |

**12) Issues on Farmers' Participation to O&M**:

| Issues on Farmers' Participation |
|---|
| 1. |
| 2. |
| 3. |

**13) Issues between O&M Organizations of the Major Facilities and On-Farm Facilities:**

| Issues on Farmers' Participation |
|---|
| 1. |
| 2. |

## III. Problems and Damages of the Entire Project

**1) Damages Caused by Poor Quality of Construction after Completion**:

| Year/Month of Occur | Damaged Facility | Contents of Damage | Effects of Damage | Applied Countermeasures |
|---|---|---|---|---|
| …./…. | | | | |
| …./…. | | | | |
| …./…. | | | | |
| …./…. | | | | |
| …./…. | | | | |

**2) Problems Relating to On-Farm Development (e.g., mismatching of timing between major facility and on-farm development, water shortage in the downstream, etc.)**:

| Year/Month of Occur | Contents of Problem | Effects of Problems | Applied Countermeasures |
|---|---|---|---|
| 2009/………. | | | |
| 2008/… …… | | | |
| 2007/ ……… | | | |
| 2006/ …….. | | | |
| 2005/………. | | | |

**3) Shortage of Discharge of Water Source River:**

| | Month of Occurrence | Average Discharge around the Occurrence Month (m3/s) | Actual Irrigated Area around the Occurrence Month (ha) |
|---|---|---|---|
| 2009 | | | |
| 2008 | | | |
| 2007 | | | |
| 2006 | | | |
| 2005 | | | |

## 4) Drought Damages:

| Year/Month of Occur | Period of No Rainfall (days) | Damaged Area (ha) | Damage Amount (Unit) |
|---|---|---|---|
| 2009/………. | | | ………(…….) |
| 2008/… …… | | | ………(…….) |
| 2007/… …… | | | ………(…….) |
| 2006/ …….. | | | ………(…….) |
| 2005/ …. | | | ………(…….) |

## 5) Drainage Damages (annual maximum damages, caused by rainfall, not caused by river overflow):

| Year/Month of Occur | Rainfall Amount (Unit) | Inundation Depth (cm) | Inundation Area (ha) | Inundation Period (hour) | Damage Amount (Unit) |
|---|---|---|---|---|---|
| 2009/………. | …. (…..) | | | | ………(…….) |
| 2008/… …… | …. (…..) | | | | ………(…….) |
| 2007/… …… | …. (…..) | | | | ………(…….) |
| 2006/ ….. | …. (…..) | | | | ………(…….) |
| 2005/………. | …. (…..) | | | | ………(…….) |
| ……../…… (Before Project Conditions) | …. (…..) | | | | ………(…….) |

## 6) Flood Damages (annual maximum, caused by river overflow):

| Year/Month of Occur | Rainfall Amount (Unit) | Name of Overflow River | Damage Area (ha) | Damage Amount (Unit) |
|---|---|---|---|---|
| 2009/………. | …. (…..) | | | ………(…….) |
| 2008/ ……… | …. (…..) | | | ………(…….) |
| 2007/ ……… | …. (…..) | | | ………(…….) |
| 2006/……….. | …. (…..) | | | ………(…….) |
| 2005/………. | …. (…..) | | | ………(…….) |

**7) Suffered Problems Caused by Changed Socio-Economic Conditions:**

| Year/Month of Occur | Suffered Facility | Contents of Problem | Effects of Problems | Applied Countermeasures |
|---|---|---|---|---|
| 2009/………. | | | | |
| 2008/… …… | | | | |
| 2007/… …… | | | | |
| 2006/……….. | | | | |
| 2005/………. | | | | |

**8) Suffered Problems Caused by Deteriorated Water Quality:**

| Year/Month of Occur | Suffered Facility | Contents of Problem | Effects of Problems | Applied Countermeasures |
|---|---|---|---|---|
| 2009/………. | | | | |
| 2008/…… … | | | | |
| 2007/…… … | | | | |
| 2006/……….. | | | | |
| 2005/………. | | | | |

## IV. Realization of the Expected Results of the Entire Project

1) **Characteristics of Year 2009 from the View Points of Agricultural Production:** Check/Good Harvest/Average Harvest/Bad Harvest/

2) **Beneficial Area of the Entire Project (ha):**

| Condition | Beneficial Area |
|---|---|
| By F/S: | |
| By D/D: | |
| Actual,2009: | |

3) **Beneficiaries of the Entire Project:**

| Item | By F/S | By D/D | Actual,2009 |
|---|---|---|---|
| Number of Farmers: | | | |
| Number of Farm Households: | | | |

4) **Planted and Harvested Areas (ha):**

**Dry Season**

| Crop | By F/S | By D/D | Actual Planted,2009 | Actual Harvested,2009 |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

**Wet Season**

| Crop | By F/S | By D/D | Actual Planted,2009 | Actual Harvested,2009 |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

5) **Cropping Intensity (%):**

| Without Project Conditions | By F/S | By D/D | Actual,2009 |
|---|---|---|---|
| | | | |

### 6) Production Volume (ton/year):

**Dry Season**

| Crop | By F/S | By D/D | Actual,2009 |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |

**Wet Season**

| Crop | By F/S | By D/D | Actual,2009 |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |

### 7) Yield (ton/ha):

**Dry Season**

| Crop | Without Project Conditions | By F/S | By D/D | Actual,2009 |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

**Wet Season**

| Crop | Without Project Conditions | By F/S | By D/D | Actual,2009 |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

### 8) Drainage Plan:

| Condition | Allowable Inundation Depth (cm) | Allowable Inundation Period (hr) | Considered Crop |
|---|---|---|---|
| By F/S | | | |
| By D/D | | | |
| Actual, 2009 | | | |

**9) Typical Farm Household Economy (Unit: VND/year/household):**

**By F/S**

| Farm Area (ha/household) | Annual Income (Itemize) | Annual Expenditures (Itemize) |
|---|---|---|
| ………… | ………………..<br>(…………………….) | ………………..<br>(…………………….) |

**By D/D**

| Farm Area (ha/household) | Annual Income (Itemize) | Annual Expenditures (Itemize) |
|---|---|---|
| ………… | ………………..<br>(…………………….) | ………………..<br>(…………………….) |

**Actual, 2009**

| Farm Area (ha/household) | Annual Income (Itemize) | Annual Expenditures (Itemize) |
|---|---|---|
| ………… | ………………..<br>(…………………….) | ………………..<br>(…………………….) |

**Without Project Conditions**

| Farm Area (ha/household) | Annual Income (Itemize) | Annual Expenditures (Itemize) |
|---|---|---|
| ………… | ………………..<br>(…………………….) | ………………..<br>(…………………….) |

**10) Facilities that do not Realize the Expected Results:**

| Facilities | Causes | Effects | Applied Countermeasures |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |

# Appendix 3.4 Progress Record of the Survey

(1/2)

| Province | Road Sector | | Electricity Sector | | Water Supply Sector | | Irrigation Sector | |
|---|---|---|---|---|---|---|---|---|
| | No. of Sub-project | Progress | No. of Sub-project | Progress | No. of Sub-project | Progress | No. of Sub-project | Progress |
| An Giang | 4 | 6/22 | 16 | 7/2 | 1 | 5/17 | | |
| Ba Ria Vung Tau | 3 | 5/29 | 4 | 5/10 | | | | |
| Bac Giang | 10 | 7/23 | 23 | 6/18 | 1 | 9/3 | 1 | 9/13 |
| Bac Kan | 13 | 6/16 | 5 | 7/1 | 1 | 8/19 | 3 | 8/19 |
| Bac Lieu | 5 | 7/2 | 6 | 6/26 | 1 | 5/11 | 1 | 5/6 |
| Bac Ninh | 10 | 5/16 | 8 | 6/15 | 1 | 8/25 | | |
| Ben Tre | 5 | 6/19 | 5 | 6/30 | | | | |
| Binh Dinh | 6 | 6/15 | 11 | 7/28 | 1 | 7/12 | 4 | 6/8 |
| Binh Duong | 1 | 5/31 | 4 | 5/6 | | | | |
| Binh Phuoc | 7 | 5/20 | 7 | 5/7 | | | | |
| Binh Thuan | 7 | 5/10 | 15 | 5/14 | | | | |
| Ca Mau | 6 | 6/30 | 6 | 7/8 | 2 | 5/12 | 1 | 5/5 |
| Can Tho | 4 | 6/15 | 0 | | | | | |
| Cao Bang | 11 | 6/17 | 13 | 5/15 | | | 1 | 8/18 |
| Da Nang | 2 | 5/31 | 7 | 7/12 | | | | |
| Dac Lak | 10 | 7/9 | 9 | 8/19 | 2 | 7/16 | 5 | 5/27 |
| Dak Nong | 4 | 7/1 | 4 | 8/20 | | | 2 | 5/29 |
| Dien Bien | 11 | 5/15 | 1 | 8/2 | 3 | 7/28,29 | 1 | 8/6 |
| Dong Nai | 2 | 5/22 | 0 | | | | | |
| Dong Thap | 4 | 7/9 | 8 | 7/1 | 1 | 5/5 | 1 | 5/13 |
| Gia Lai | 7 | 7/12 | 8 | 8/17 | 2 | 7/15 | 3 | 6/11 |
| Ha Giang | 11 | 5/7 | 5 | 6/23 | 3 | 8/16,17 | 1 | 8/16 |
| Ha Nam | 12 | 6/7 | 11 | 6/3 | | | | |
| Ha Noi (inculding former HaTay) | 12 | 7/29 | 8 | 8/20 | 1 | 9/7 | | |
| Ha Tinh | 17 | 5/9 | 26 | 8/6 | 6 | 6/2,3 | 7 | 7/20 |
| Hai Duong | 7 | 5/6 | 8 | 6/25 | 1 | 8/25 | | |
| Hai Phong | 9 | 5/15 | 1 | 8/13 | 1 | 8/30 | | |
| Hau Giang | 1 | 6/28 | 4 | 6/8 | 1 | 5/13 | | |
| Hoa Binh | 8 | 5/11 | 11 | 5/18 | | | 2 | 8/2 |
| Hung Yen | 11 | 5/12 | 7 | 6/8 | | | | |
| Khanh Hoa | 2 | 6/27 | 8 | 8/3 | | | | |
| Kien Giang | 5 | 6/28 | 4 | 6/16 | 1 | 5/14 | | |
| Kon Tum | 6 | 7/27 | 6 | 8/13 | 3 | 7/13,14 | 2 | 6/15 |
| Lai Chau | 7 | 5/13 | 4 | 8/4 | 3 | 8/2,3 | 1 | 8/10 |
| Lam Dong | 8 | 6/30 | 11 | 7/31 | 2 | 7/19 | 2 | 5/19 |
| Lang Son | 9 | 7/12 | 8 | 8/17 | 1 | 8/24 | 1 | 9/15 |
| Lao Cai | 11 | 5/9 | 17 | 7/15 | 2 | 8/12,13 | 2 | 8/13 |
| Long An | 4 | 6/8 | 3 | 5/20 | | | | |
| Nam Dinh | 14 | 6/15 | 15 | 6/11 | | | | |
| Nghe An | 15 | 7/24 | 13 | 7/31 | 4 | 5/31,6/1 | 4 | 7/23 |
| Ninh Binh | 15 | 6/30 | 9 | 6/2 | 1 | 8/31 | 1 | 7/30 |
| Ninh Thuan | 8 | 5/6 | 11 | 5/19 | 1 | 7/20 | 3 | 5/17 |
| Phu Tho | 16 | 5/10 | 19 | 5/20 | 5 | 8/6,9,10 | 5 | 8/4 |
| Phu Yen | 7 | 6/20 | 9 | 7/30 | 2 | 7/7 | 4 | 6/3 |

## Appendix 3.4 Progress Record of the Survey

(2/2)

| Province | Road Sector | | Electricity Sector | | Water Supply Sector | | Irrigation Sector | |
|---|---|---|---|---|---|---|---|---|
| | No. of Sub-project | Progress | No. of Sub-project | Progress | No. of Sub-project | Progress | No. of Sub-project | Progress |
| Quang Binh | 8 | 5/14 | 10 | 8/10 | 2 | 6/4 | 1 | 7/15 |
| Quang Nam | 12 | 6/5 | 11 | 7/19 | 4 | 6/14,15 | 1 | 7/8 |
| Quang Ngai | 10 | 6/10 | 9 | 7/24 | 2 | 7/8,9 | 4 | 7/7 |
| Quang Ninh | 8 | 7/26 | 1 | 8/18 | 2 | 8/26,27 | | |
| Quang Tri | 16 | 5/22 | 13 | 8/13 | 6 | 6/7,8 | 3 | 7/14 |
| Soc Trang | 9 | 6/24 | 7 | 6/23 | 2 | 5/10 | | |
| Son La | 9 | 5/7 | 10 | 8/1 | 2 | 7/26,27 | | |
| Tay Ninh | 4 | 6/3 | 4 | 5/5 | 1 | 5/19 | | |
| Thai Binh | 9 | 5/21 | 8 | 6/9 | 1 | 8/30 | | |
| Thai Nguyen | 10 | 6/15 | 8 | 8/16 | 2 | 8/18 | 3 | 9/12 |
| Thanh Hoa | 16 | 7/9 | 10 | 7/24 | 6 | 5/24,26 | 6 | 7/29 |
| Thua-Thien Hue | 7 | 5/29 | 10 | 7/15 | 3 | 6/9,10 | 2 | 7/12 |
| Tien Giang | 4 | 6/9 | 9 | 6/24 | | | | |
| Tra Vinh | 9 | 6/25 | 6 | 6/11 | 3 | 5/6 | 2 | 5/11 |
| Tuyen Quang | 8 | 6/7 | 8 | 6/25 | | | 2 | 9/8 |
| Vinh Long | 5 | 6/12 | 4 | 6/10 | 2 | 5/7 | 1 | 5/12 |
| Vinh Phuc | 15 | 5/20 | 8 | 8/13 | 2 | 9/6 | 1 | 9/10 |
| Yen Bai | 11 | 5/17 | 8 | 5/25 | 2 | 8/4,5 | 1 | 8/5 |
| **Total** | **517** | | **522** | | **96** | | **85** | |
| Completed (No. of project) | 517 | | 522 | | 96 | | 85 | |
| Completed (%) | 100% | | 100% | | 100% | | 100% | |

# Water Supply Sector

# Appendix ws.3.1 List of Water Supply Systems Constructed under Sector Project Loan from Phase I to V

| Province | Phase | Name of WSS | Progress Rate of Construction Worsk | District | Water Source | Capacity ($m^3$/day) | Startup Year | Project Owner | Operation, Maintenance and Management Organization |
|---|---|---|---|---|---|---|---|---|---|
| An Giang | SPL III | Tri Ton WSS | 100 | Tri Ton | surface water | 2000 | 2005 | | Branch of PWSC |
| Bac Giang | SPL V | An Chau Town WSS | 100 | Son Dong | stagnant water | 950 | 2010/01 | SPMU of District | Water Supply Station of District |
| Bac Kan | SPL IV | Yen Han WSS | 100 | Cho Moi | surface water | 278 | 2005/10 | | Commune Peoples' Committee for Water Supply |
| Bac Lieu | SPL V | Ngan Dua WSS | 100 | Hong Dan | groundwater | 1800 | 2009/08 | | PCERWAS under DARD |
| Bac Ninh | SPL III | Luong Tai WSS | 100 | Luong Tai | surface water | 2500 | 2006/09 | | Branch of PWSC |
| Binh Dinh | SPL V | Phu Phong Town WSS | 100 | Tay Son | infiltration | 2000 | 2009/06 | | Water Supply and Sewage Project Management Board of Tay Son District |
| Ca Mau | SPL V | Song Doc WSS (South) | 80 | Tram Van Thoi | groundwater | 2000 | | PWSC | |
| Ca Mau | SPL V | Song Doc WSS (North) | 80 | Tram Van Thoi | groundwater | 4000 | | PWSC | |
| Ca Mau | SPL V | Cai Doi Vam Town WSS (South) | 0 | Phu Tan | groundwater | 2000 | | PWSC | |
| Ca Mau | SPL V | Cai Doi Vam Town WSS (North) | 0 | Phu Tan | groundwater | 2000 | | PWSC | |
| Dac Lak | SPL I | Buon Ho WSS | 100 | Krong Buk | groundwater | 3000 | 2003 | DPC | PWSC |
| Dac Lak | SPL IV | Quang Phu WSS | 100 | Cu M'Gar | groundwater | 3000 | 2009/04 | PWSC | PWSC |
| Dien Bien | SPL III | Tuan Giao WSS | 100 | Tuan Giao | spring | 2500 | 2006/09 | | Tuan Giao Water Treatment Plant belongs to Provincial Irrigation Service and Construction Ltd. Co. under PPC |
| Dien Bien | SPL IV | Tua Chua WSS | 100 | Tua Chua | spring | 2000 | 2008/06 | DPMU | Water Supply Station of PWSC |
| Dien Bien | SPL V | Muong Cha WSS | 100 | Muong Cha | surface water | 1000 | 2010/05 | DPMU | Water Supply Team under the control of PWSC |
| Dong Thap | SPL V | An Long WSS | 98 | Tam Nong | surface water | 2000 | | PWSC | |
| Gia Lai | SPL I | Chu Pah WSS | 100 | Chu Pah | groundwater | 1970 | 2000 | DPC | Chu Pah Station of Water Supply and Urban Services belongs to DPC |
| Gia Lai | SPL V | Ia Kha Town WSS | 95 | Ia Grai | groundwater | 1200 | | DPMU | Urban Works Management Team |
| Ha Giang | SPL I | Bac Quang WSS | 100 | Bac Quang | surface water | 2000 | 2003/02 | SPMU | Bac Quang District Water Supply and Sewerage Center belongs to DPC |
| Ha Giang | SPL IV | Vi Xuyen WSS | 100 | Vi Xuyen | surface water | 2000 | 2007/12 | PMU of District | Vi Xuyen District Water Supply and Sewerage Service Center belongs to DPC |
| Ha Giang | SPL V | Vinh Quang Town WSS | 95 | Hoang Su Phi | surface water | 1500 | | SPMU of District | Water Supply Management Center under DPC |
| Ha Noi (Including former Ha Tay) | SPL III | Phu Xuyen WSS | 100 | Phu Xuyen | groundwater | 2000 | 2008 | SPMU | Phy Xuyen Irrigation Enterprise under NHUE River Irrigation Ltd., Co. belongs to Ha Noi city |
| Ha Tinh | SPL I | Ky Anh WSS | 100 | Ky Anh | stagnant water | 3000 | 2002 | MB | Vung An Economic Zone Water Supply Center |
| Ha Tinh | SPL III | Vung An WSS | 100 | Ky Anh | stagnant water | 9000 | 2009/12 | MB | Vung An Economic Zone Water Supply Center |
| Ha Tinh | SPL III | Vu Quang | 100 | Vu Quang | surface water | 2000 | 2006/11 | | Branch of PWSC |
| Ha Tinh | SPL IV | Nghen Town WSS | 100 | Can Loc | surface water | 3000 | 2009/03 | | WS center under the control of DPC (it will be transfered to PWSC on 1st July, 2010) |
| Ha Tinh | SPL V | Trung Luong Commune WSS (Pilot Sub-project) | 80 | Hong Linh | stagnant water | 2000 | | PMB of Town | |
| Hai Duong | SPL III | Sao Do WSS | 100 | Chi Linh | groundwater | 4000 | 2006/01 | | Water Supply Enterprise No.4 belongs to PWSC. |
| Hai Phong | SPL III | Vinh Bao WSS | 100 | Vinh Bao | surface water | 2500 | 2006/02 | SPMU of DPC | Branch of PWSC (Hai Phong Water Supply Limitted Company) |
| Hau Giang | SPL III | Vi Thanh WSS | 100 | Vi Thanh | surface water | 16000 | 2002 | | Hau Giang Public Facilites of Water Supply and Sewage Company |
| Kien Giang | SPL III | Giong Gieng WSS | 100 | Giong Gieng | surface water | 2400 | 2003 | | Branch of PWSC |
| Kon Tum | SPL III | Kon Plong WSS | 100 | Konplong | surface water | 1000 | 2005/12 | SPMU | DPC |
| Kon Tum | SPL V | Dak Ha Town WSS | 0 | Dak Ha | stagnant water | 4200 | | | |
| Kon Tum | SPL V | WSS in Bo Y Boder Gate | 50 | Ngoc Hoi | surface water | 2000 | | SPMU | |
| Lai Chau | SPL III | Tam Duong (Binh Lu) WSS | 100 | Binh Lu | surface water | 1000 | 2007/06 | PWSC | Branch of PWSC |
| Lai Chau | SPL IV | Than Uyen WSS | 100 | Than Uyen | surface water | 1000 | 2004 | | Branch of PWSC |
| Lai Chau | SPL V | Phong Tho WSS (WEST) | 95 | Phong Tho | surface water | 1000 | 2009/02 | PWSC | Branch of PWSC |
| Lai Chau | SPL V | Phong Tho WSS (EAST) | 85 | Phong Tho | surface water | 300 | | PWSC | Branch of PWSC |
| Lam Dong | SPL I | Bao Loc WSS | 100 | Bao Loc | groundwater | 7500 | 2003 | | Bao Loc Water Supply Joint Stock Company |
| Lam Dong | SPL V | Loc Thang Town WSS | 100 | Bao Lam | groundwater | 3400 | 2010/01 | | Branch of PWSC |
| Lang Son | SPL V | Na Sam Town WSS | 98 | Van lang | surface water | 1200 | | PWSC | Branch of PWSC |
| Lao Cai | SPL III | Muon Khuong WSS | 100 | Muong Khuong | surface water | 1500 | 2006/03 | SPMU of District | WS Enterprise of Muong Khuong (Branch of PWSC) |
| Lao Cai | SPL IV | Bac Ha WSS | 100 | Bac Ha | surface water | 1500 | 2007/07 | SPMU of District | WS Enterprise of Bac Ha (Branch of PWSC) |
| Nghe An | SPL I | Cua Lo WSS | 100 | Cua Lo Town | groundwater | 3000 | 2002 | | WSC established in 1998 by decision of PPC through Town PC |
| Nghe An | SPL IV | Yen Thanh WSS | 100 | Yen Thanh | surface water | 2000 | 2008/12 | | DPC |
| Nghe An | SPL IV | Nam Dan WSS | 100 | Nam Dan | surface water | 2000 | 2009/06 | | PWSC |
| Nghe An | SPL V | Nghia Dan WSS (THAI HOA) | 98 | Nghia Dan | surface water | 4000 | 2009/09 | MB of Town | |
| Ninh Binh | SPL I | Kim Son WSS | 100 | Kim Son | surface water | 3000 | 2003 | | Branch of PWS Ltd., Co. |
| Ninh Thuan | SPL V | My Tuong WSS | 100 | Ninh Hai | stagnant water | 1103 | 2009/09 | PCERWAS | Water Supply Station of CERWAS (Center for Rural Water Supply and Sanitation) |

# Appendix ws.3.1 List of Water Supply Systems Constructed under Sector Project Loan from Phase I to V

| Province | Phase | Name of WSS | Progress Rate of Construction Worsk | District | Water Source | Capacity ($m^3$/day) | Startup Year | Project Owner | Operation, Maintenance and Management Organization |
|---|---|---|---|---|---|---|---|---|---|
| Phu Tho | SPL I | Phu Tho WSS | 100 | Phu Tho Town | surface water | 10000 | 2001 | | Phu Tho Water Supply Enterprise belongs to Phu Tho Water Supply Joint Stock Company |
| Phu Tho | SPL III | Ha Hoa WSS | 100 | Ha Hoa | surface water | 3000 | 2009/03 | SPMU of District | Public Works Management Board of District |
| Phu Tho | SPL IV | SONG THAO WSS | 100 | CAM KHE | surface water | 2000 | 2009/07 | | Cam Khe Water Supply Enterprise (Branch of PWSC) |
| Phu Tho | SPL IV | Thanh Ba WSS | 100 | Thanh Ba | another WSS | 2000 | 2009/12 | | Thanh Ba WS Enterprise (Branch of PWSC) |
| Phu Tho | SPL V | Thanh Son Town WSS | 96 | Thanh Son | surface water | 3000 | | SPMU of District | Public Works MB belongs to Town which belongs to DPC |
| Phu Yen | SPL III | Cung Son-Son Hoa WSS | 100 | Son Hoa | surface water | 2000 | 2005 | PWSC | Water Supply Station of PWSC |
| Phu Yen | SPL IV | Phu Hoa WSS | 100 | Phu Hoa | infiltration | 2000 | 2007 | PWSC | Water Supply Station of PWSC |
| Quang Binh | SPL III | Minh Hoa WSS | 100 | Minh Hoa | surface water | 2000 | 2005/06 | | Water Treatment Plant under PWSC |
| Quang Binh | SPL V | Viet Trung WSS | 90 | Bo Trach | surface water | 1000 | | PWSC | |
| Quang Nam | SPL I | Thang Binh WSS | 100 | Thang Binh | surface water | 2500 | 2004 | | Branch of Quang Nam Water Supply and Sewage Construction Company |
| Quang Nam | SPL IV | Nam Phuoc WSS | 100 | Duy Xuyen | surface water and groundwater | 3000 | 2009/02 | | Branch of Quang Nam Water Supply and Sewage Construction Company |
| Quang Nam | SPL V | Dong phu - Que Son WSS (Phase II) | 0 | Que Son | stagnant water | 1500 | | Quang Nam Urban Evnironment Company | |
| Quang Ngai | SPL III | Duc Pho WSS | 100 | Duc Pho | groundwater | 2000 | 2007/02 | DPC | Water Supply Plant of PWSC |
| Quang Ngai | SPL IV | Mo Duc WSS | 95 | Mo Duc | groundwater | 1000 | | PWSC | Water Supply Plant of PWSC |
| Quang Ninh | SPL I | Dong Trieu WSS | 100 | Dong Trieu | groundwater | 2000 | 2001 | | Mao Khe Water Supply Enterprise belongs to PWSC (Branch of PWSC) |
| Quang Ninh | SPL III | HAI HA WSS | 100 | Quang ha | surface water | 3000 | 2008/01 | SPMU of District | Mong Cai Water Supply Enterprise belongs to PWSC (Branch of PWSC) |
| Quang Tri | SPL I | Lao Bao WSS | 100 | Huong Hoa | surface water | 3000 | 2001/01 | | Branch of PWSC |
| Quang Tri | SPL I | Ho Xa WSS | 100 | Vinh Linh | groundwater | 2000 | 2000 | | Branch of PWSC |
| Quang Tri | SPL III | Hai Lang WSS | 100 | Hai Lang | surface water | 2500 | 2006/09 | | Branch of PWSC |
| Quang Tri | SPL IV | Cam Lo WSS | 100 | Cam Lo | surface water | 2000 | 2008/06 | | Branch of PWSC |
| Quang Tri | SPL IV | Ben Quan WSS | 100 | Vinh Linh | surface water | 2000 | 2008/09 | | Branch of PWSC |
| Quang Tri | SPL V | Gio Linh District WSS | 100 | Gio Linh | groundwater | 15000 | 2005 | | Branch of PWSC |
| Soc Trang | SPL IV | My Xuyen WSS | 100 | My Xuyen | groundwater | 4000 | 2008 | | Branch of PWSC |
| Soc Trang | SPL V | Phu Loc Town WSS | 100 | Thanh Tri | groundwater | 3000 | 2008 | | Branch of PWSC |
| Son La | SPL III | Moc Chau WSS | 100 | Moc Chau | surface water | 1500 | 2005/01 | | Branch of PWS Joint Stock Company |
| Son La | SPL V | Sop Cop Town WSS | 100 | Sop Cop | surface water | 1750 | 2010/04 | SPMU | WSB of Son La PWSC |
| Tay Ninh | SPL III | Go Dau WSS | 100 | Go Dau | groundwater | 5000 | 2005 | | Branch of Tay Ninh water supply and sewage company |
| Thai Binh | SPL III | Kien Xuong WSS | 100 | Kien Xuong | surface water | 2000 | 2006/07 | SPMU of District | Branch of PWS Ltd., Co. |
| Thai Nguyen | SPL IV | DAI TU WSS | 100 | DAI TU | surface water | 2500 | 2010/01 | | Dai Tu Water Supply Enterprise (Branch of PWSC) |
| Thai Nguyen | SPL V | TRAI CAU Town WSS | 100 | Dong Hy | groundwater | 960 | 2009/04 | | Trai Cau Water Supply Enterprise (Branch of PWSC) |
| Thanh Hoa | SPL III | Ha Trung WSS | 100 | Ha Trung | groundwater | 2000 | 2006 | DPC | Town MB |
| Thanh Hoa | SPL IV | Tho Xuan WSS | 90 | Tho Xuan | groundwater | 1500 | | | |
| Thanh Hoa | SPL IV | Rung Thong WSS (Dong Son) | 100 | Dong Son | another WSS | 5000 | 2008/09 | | PWSC |
| Thanh Hoa | SPL IV | Nhu Thanh WSS | 100 | Nhu Thanh | surface water | 1500 | 2009/12 | | water supply station (enterprise will be establish in the near future) |
| Thanh Hoa | SPL IV | Thuong Xuan WSS | 100 | Thuong Xuan | groundwater | 1500 | 2008/12 | | electricity and water team belongs to Commercial and Industry Department of DPC |
| Thanh Hoa | SPL V | Hau Loc WSS | 100 | Hau Loc | surface water | 2000 | 2008/04 | | Town PC |
| Thua-Thien Hue | SPL I | Chan My WSS | 100 | NA | surface water | 6000 | 2000 | | Cham My team of Phu Bai branch of PWSC |
| Thua-Thien Hue | SPL III | Phu Bai WSS | 100 | Phu Bai | groundwater | 5000 | 2007/07 | | Phu Bai Branch of PWSC |
| Thua-Thien Hue | SPL V | Khe Tre WSS | 100 | Nam Dong | surface water | 2000 | 2009/04 | | Khe Tre Team of Phu Bai branch of PWSC |
| Tra Vinh | SPL IV | Cau Quan WSS | 100 | Tieu Can | groundwater | 720 | 2003 | | Branch of PWSC |
| Tra Vinh | SPL IV | Cau Ke WSS | 100 | Cau Ke | groundwater | 1200 | 2003 | | Branch of PWSC |
| Tra Vinh | SPL V | Widenning and Upgrading Treament Station in My Long-Cau Ngang District | 75 | Cau Ngang | groundwater | 4200 | | PWSC | |
| Vinh Long | SPL III | Tra On WSS | 100 | Tra On | surface water | 2500 | 2006 | | Branch of PWSC |
| Vinh Long | SPL V | Cai Ngang WSS | 95 | Tam Binh | surface water | 1500 | | PWSC | |
| Vinh Phuc | SPL III | Yen Lac WSS | 100 | Yen Lac | groundwater | 3000 | 2002 | | Branch of PWS Joint Stock Company |
| Vinh Phuc | SPL V | Vinh Tuong WSS | 98 | Vinh Tuong | groundwater | 2000 | | SPMU (Industrial and Commerce Division of DPC) | not decided yet |
| Yen Bai | SPL III | Mau A WSS | 100 | Van Yen | surface water | 2000 | 2007/02 | | Dai Loi Limitted Company (100% owned by PPC) |
| Yen Bai | SPL V | Tram Tam Town WSS | 97 | Tram Tau | surface water | 1500 | | | Market and Public Service Management Board of DPC |

## Appendix ws.4.1 Laboratory

| Province | Phase | Water Supply System | Parameters can be Analyzed | Devices for Water Analysis |
|---|---|---|---|---|
| An Giang | SPL III | Tri Ton WSS | Residual , Turbidity, pH | pH Meter, Turbidity Meter, Residual Chlorine Meter, Jar Tester, Electronic Balance, Glassware |
| Bac Ninh | SPL III | Luong Tai WSS | Residual Chlorine | Residual Chlorine Meter |
| Ha Giang | SPL IV | Vi Xuyen WSS | Turbidity, Color | Turbidity Meter, pH Meter, Residual Chlorine Meter, ColoriMeter |
| Ha Tinh | SPL I | Ky Anh WSS | pH, turbidity, Residual Chlorine | pH Meter, Turbitidy Meter, Residual Chlorine Meter, Jar Tester, Glassware |
| Ha Tinh | SPL III | Vung An WSS | pH, Turbidity, Color, Residual Chlorine | pH Meter, Turbidity Meter, Color Comparison Tube, Jar Tester, Residual Chlorine Measuring Kit, Analytical Balance |
| Ha Tinh | SPL IV | Nghen Town WSS | Turbidity, Iron, pH, Residual Chlorine, Anmonium, Total Chlorine, Chromium, Color, Copper, Nickel, Nitrate, Nitrite, Dissolved Oxygen, pH, Phosphate, Silver, Zinc, Iodine | Turbidity Meter, Iron Meter, Ionic Electrometry Device |
| Hau Giang | SPL III | Vi Thanh WSS | pH, Turbidity, Color, Residual Chlorine | pH Meter, Turbidity Meter, Color Comparison Tube, Jar Tester, Residual Chlorine Measuring Kit, Analytical Balance, Glassware |
| Kien Giang | SPL III | Giong Gieng WSS | pH, Residual Chlorine | pH Meter, Residual Chlorine Meter, Jar Tester |
| Lam Dong | SPL I | Bao Loc WSS | Fe, pH, Turbidity, Residual Chlorine | Iron Meter, pH Meter, Turbidity Meter, Residual Chlorine Meter |
| Nghe An | SPL IV | Nam Dan WSS | Residual Chlorine, pH, Turbidity | Residual Chlorine Meter, pH Meter, Turbidity Meter, Jar Tester |
| Phu Tho | SPL I | Phu Tho WSS | Turbidity, pH, Nitrate, Nitrite, Salinity, Iron dioxide, Anmonium, Ferric oxide, Hardness, Permanganic Acid Consumption, Taste and Odor, Copper, Sulfate, Fluoride, Arsenic, Lead, Zinc, Nickel, Residual Chlorine, Phenol, Color | pH Meter, Turbidity Meter, Jar Tester, Residual Chlorine Measuring Kit, Analytical Balance, Conductivity Meter, Autoclave, Pure water generator, Hot Air Sterilizing Oven, Glassware |
| Phu Tho | SPL III | Ha Hoa WSS | pH, Turbidity, other Parameters | turbidity Meter, pH Meter, water bath, incubator, even Balance, Thermostatic Oven, Electronic Balance, Glassware, Reagents |
| Phu Tho | SPL IV | Song Thao WSS | N/I | N/I |
| Phu Yen | SPL III | Cung Son-Son Hoa WSS | Turbidity, pH, Color, Taste & odour, Residual Chlorin, and other 14 Parameters | Turbidity Meter, pH Meter, Color Meter, Residual Chlorine Meters, Ionic Electrometry Device, Glassware |
| Quang Binh | SPL III | Minh Hoa WSS | pH, Turbidity, Residual Chlorine | pH Meter, Turbidity Meter, Residual Chlorine Meter |
| Quang Nam | SPL IV | Nam Phuoc WSS | Conductivity, Total Dissolved Solid, Iron, Aluminum, Bromine, Free Chlorine, Total Chlorine, Chromium, Chlorine dioxide, Color, Copper, Cyanide, Fluoride, Ca Hardness, Mg Hardness, Iodine, Manganese, Molybdenum, Nickel, Nitrate, Nitrite, Dissolved Oxygen, pH, Phosphate, Silica, Zinc | Ionic Electrometry Device, Electro Conductivity/ TDS Meter, Iron Meter |
| Quang Tri | SPL I | Lao Bao WSS | Jar Test | Jar Tester |
| Son La | SPL III | Moc Chau WSS | Residual Chlorine, Turbidity, pH | Residual Chlorine Meter, Turbidity Meter, pH Meter, Jar Tester, Glassware |
| Tay Ninh | SPL III | Go Dau WSS | pH, residual chlorine, iron | Potable Water Analysis Kit |
| Thua-Thien Hue | SPL I | Chan My WSS | Cl-, pH, Turbidity | Residual Chlorine Meter, pH Meter, Turbidity Meter |
| Thua-Thien Hue | SPL III | Phu Bai WSS | Residual Chlorine, pH, Turbidity | Residual Chlorine Meter, pH Meter, Turbidity Meter |
| Thua-Thien Hue | SPL V | Khe Tre WSS | Turbidity, Residual Chlorine, pH | Turbidity Meter, Residual Chlorine Meter, pH Meter |

**N/I: no information**

# Appendix ws.4.2 Rate of Facility Utilization

(1/3)

| Province | Phase | WSS | progress (%) | Startup Year | Capacity (A) ($m^3$/day) | Average Daily Wate Supply (B) ($m^3$/day) | Rate of Facility Utilization (B)/(A) |
|---|---|---|---|---|---|---|---|
| An Giang | SPL III | Tri Ton WSS | 100 | 2005 | 2000 | 3500 | 1.75 |
| Bac Giang | SPL V | An Chau Town WSS | 100 | 2010/01 | 950 | 300 | 0.32 |
| Bac Kan | SPL IV | Yen Han WSS | 100 | 2005/10 | 278 | | |
| Bac Lieu | SPL V | Ngan Dua WSS | 100 | 2009/08 | 1800 | 600 | 0.33 |
| Bac Ninh | SPL III | Luong Tai WSS | 100 | 2006/09 | 2500 | 1200 | 0.48 |
| Binh Dinh | SPL V | Phu Phong Town WSS | 100 | 2009/06 | 2000 | 150 | 0.08 |
| Ca Mau | SPL V | Song Doc WSS (South) | 80 | | 2000 | | |
| Ca Mau | SPL V | Song Doc WSS (North) | 80 | | 4000 | | |
| Ca Mau | SPL V | Cai Doi Vam Town WSS (South) | 0 | | 2000 | | |
| Ca Mau | SPL V | Cai Doi Vam Town WSS (North) | 0 | | 2000 | | |
| Dac Lak | SPL I | Buon Ho WSS | 100 | 2003 | 3000 | 2000 | 0.67 |
| Dac Lak | SPL IV | Quang Phu WSS | 100 | 2009/04 | 3000 | 1000 | 0.33 |
| Dien Bien | SPL III | Tuan Giao WSS | 100 | 2006/09 | 2500 | 2400 | 0.96 |
| Dien Bien | SPL IV | Tua Chua WSS | 100 | 2008/06 | 2000 | 1250 | 0.63 |
| Dien Bien | SPL V | Muong Cha WSS | 100 | 2010/05 | 1000 | 150 | 0.15 |
| Dong Thap | SPL V | An Long WSS | 98 | | 2000 | | |
| Gia Lai | SPL I | Chu Pah WSS | 100 | 2000 | 1970 | 280 | 0.14 |
| Gia Lai | SPL V | Ia Kha Town WSS | 95 | | 1200 | | |
| Ha Giang | SPL I | Bac Quang WSS | 100 | 2003/02 | 2000 | 1500 | 0.75 |
| Ha Giang | SPL IV | Vi Xuyen WSS | 100 | 2007/12 | 2000 | 1550 | 0.78 |
| Ha Giang | SPL V | Vinh Quang Town WSS | 95 | | 1500 | | |
| Ha Noi (Including former Ha Tay) | SPL III | Phu Xuyen WSS | 100 | 2008 | 2000 | 870 | 0.44 |
| Ha Tinh | SPL I | Ky Anh WSS | 100 | 2002 | 3000 | 2200 | 0.73 |
| Ha Tinh | SPL III | Vu Quang | 100 | 2006/11 | 2000 | 200 | 0.10 |
| Ha Tinh | SPL III | Vung An WSS | 100 | 2009/12 | 9000 | 5000 | 0.56 |
| Ha Tinh | SPL IV | Nghen Town WSS | 100 | 2009/03 | 3000 | 1400 | 0.47 |
| Ha Tinh | SPL V | Trung Luong Commune WSS (Pilot Subproject) | 80 | | 2000 | | |
| Hai Duong | SPL III | Sao Do WSS | 100 | 2006/01 | 4000 | 1700 | 0.43 |
| Hai Phong | SPL III | Vinh Bao WSS | 100 | 2006/02 | 2500 | 2000 | 0.80 |
| Hau Giang | SPL III | Vi Thanh WSS | 100 | 2002 | 16000 | 9000 | 0.56 |
| Kien Giang | SPL III | Giong Gieng WSS | 100 | 2003 | 2400 | 1500 | 0.63 |
| Kon Tum | SPL III | Kon Plong WSS | 100 | 2005/12 | 1000 | 450 | 0.45 |
| Kon Tum | SPL V | Dak Ha Town WSS | 0 | | 4200 | | |
| Kon Tum | SPL V | WSS in Bo Y Boder Gate | 50 | | 2000 | | |
| Lai Chau | SPL IV | Than Uyen WSS | 100 | 2004 | 1000 | 1000 | 1.00 |
| Lai Chau | SPL III | Tam Duong (Binh Lu) WSS | 100 | 2007/06 | 1000 | 750 | 0.75 |
| Lai Chau | SPL V | Phong Tho WSS (WEST) | 95 | 2009/02 | 1000 | 550 | 0.55 |
| Lai Chau | SPL V | Phong Tho WSS (EAST) | 85 | | 300 | | |
| Lam Dong | SPL I | Bao Loc WSS | 100 | 2003 | 7500 | 6500 | 0.87 |
| Lam Dong | SPL V | Loc Thang Town WSS | 100 | 2010/01 | 3400 | 1700 | 0.50 |
| Lang Son | SPL V | Na Sam Town WSS | 98 | | 1200 | | |
| Lao Cai | SPL III | Muong Khuong WSS | 100 | 2006/03 | 1500 | 750 | 0.50 |
| Lao Cai | SPL IV | Bac Ha WSS | 100 | 2007/07 | 1500 | 675 | 0.45 |

# Appendix ws.4.2 Rate of Facility Utilization



| Province | Phase | WSS | progress (%) | Startup Year | Capacity (A) ($m^3$/day) | Average Daily Wate Supply (B) ($m^3$/day) | Rate of Facility Utilization (B)/(A) |
|---|---|---|---|---|---|---|---|
| Nghe An | SPL I | Cua Lo WSS | 100 | 2002 | 3000 | 2600 | 0.87 |
| Nghe An | SPL IV | Yen Thanh WSS | 100 | 2008/12 | 2000 | 750 | 0.38 |
| Nghe An | SPL V | Nghia Dan WSS (Thai Hoa) | 98 | 2009/09 | 4000 | 700 | 0.18 |
| Nghe An | SPL IV | Nam Dan WSS | 100 | 2009/06 | 2000 | 500 | 0.25 |
| Ninh Binh | SPL I | Kim Son WSS | 100 | 2003 | 3000 | 1000 | 0.33 |
| Ninh Thuan | SPL V | My Tuong WSS | 100 | 2009/09 | 1103 | 400 | 0.36 |
| Phu Tho | SPL I | Phu Tho WSS | 100 | 2001 | 10000 | 8000 | 0.80 |
| Phu Tho | SPL IV | SONG THAO WSS | 100 | 2009/07 | 2000 | 550 | 0.28 |
| Phu Tho | SPL IV | Thanh Ba WSS | 100 | 2009/12 | 2000 | 650 | 0.33 |
| Phu Tho | SPL III | Ha Hoa WSS | 100 | 2009/03 | 3000 | 1650 | 0.55 |
| Phu Tho | SPL V | Thanh Son Town WSS | 96 | | 3000 | | |
| Phu Yen | SPL III | Cung Son-Son Hoa WSS | 100 | 2005 | 2000 | 1200 | 0.60 |
| Phu Yen | SPL IV | Phu Hoa WSS | 100 | 2007 | 2000 | 200 | 0.10 |
| Quang Binh | SPL III | Minh Hoa WSS | 100 | 2005/06 | 2000 | 1500 | 0.75 |
| Quang Binh | SPL V | Viet Trung WSS | 90 | | 1000 | | |
| Quang Nam | SPL I | Thang Binh WSS | 100 | 2004 | 2500 | 1900 | 0.76 |
| Quang Nam | SPL IV | Nam Phuoc WSS | 100 | 2009/02 | 3000 | 400 | 0.13 |
| Quang Nam | SPL V | Dong phu - Que Son WSS (Phase II) | 0 | | 1500 | | |
| Quang Ngai | SPL III | Duc Pho WSS | 100 | 2007/02 | 2000 | 800 | 0.40 |
| Quang Ngai | SPL IV | Mo Duc WSS | 95 | | 1000 | | |
| Quang Ninh | SPL I | Dong Trieu WSS | 100 | 2001 | 2000 | 1900 | 0.95 |
| Quang Ninh | SPL III | HAI HA WSS | 100 | 2008/01 | 3000 | 300 | 0.10 |
| Quang Tri | SPL I | Ho Xa WSS | 100 | 2000 | 2000 | 1132 | 0.57 |
| Quang Tri | SPL I | Lao Bao WSS | 100 | 2001/01 | 3000 | 3000 | 1.00 |
| Quang Tri | SPL V | Gio Linh District WSS | 100 | 2005 | 15000 | 7000 | 0.47 |
| Quang Tri | SPL III | Hai Lang WSS | 100 | 2006/09 | 2500 | 400 | 0.16 |
| Quang Tri | SPL IV | Cam Lo WSS | 100 | 2008/06 | 2000 | 250 | 0.13 |
| Quang Tri | SPL IV | Ben Quan WSS | 100 | 2008/09 | 2000 | 1000 | 0.50 |
| Soc Trang | SPL V | Phu Loc Town WSS | 100 | 2008 | 3000 | 1500 | 0.50 |
| Soc Trang | SPL IV | My Xuyen WSS | 100 | 2008 | 4000 | 4500 | 1.13 |
| Son La | SPL III | Moc Chau WSS | 100 | 2005/01 | 1500 | 2000 | 1.33 |
| Son La | SPL V | Sop Cop Town WSS | 100 | 2010/04 | 1750 | 300 | 0.17 |
| Tay Ninh | SPL III | Go Dau WSS | 100 | 2005 | 5000 | 3000 | 0.60 |
| Thai Binh | SPL III | Kien Xuong WSS | 100 | 2006/07 | 2000 | 650 | 0.33 |
| Thai Nguyen | SPL V | TRAI CAU Town WSS | 100 | 2009/04 | 960 | 150 | 0.16 |
| Thai Nguyen | SPL IV | DAI TU WSS | 100 | 2010/01 | 2500 | 300 | 0.12 |
| Thanh Hoa | SPL III | Ha Trung WSS | 100 | 2006 | 2000 | 1100 | 0.55 |
| Thanh Hoa | SPL IV | Rung Thong WSS (Dong Son) | 100 | 2008/09 | 5000 | 1000 | 0.20 |
| Thanh Hoa | SPL V | Hau Loc WSS | 100 | 2008/04 | 2000 | 300 | 0.15 |
| Thanh Hoa | SPL IV | Thuong Xuan WSS | 100 | 2008/12 | 1500 | | |
| Thanh Hoa | SPL IV | Nhu Thanh WSS | 100 | 2009/12 | 1500 | 120 | 0.08 |
| Thanh Hoa | SPL IV | Tho Xuan WSS | 90 | | 1500 | | |
| Thua-Thien Hue | SPL I | Chan My WSS | 100 | 2000 | 6000 | 2000 | 0.33 |
| Thua-Thien Hue | SPL III | Phu Bai WSS | 100 | 2007/07 | 5000 | 2500 | 0.50 |
| Thua-Thien Hue | SPL V | Khe Tre WSS | 100 | 2009/04 | 2000 | 650 | 0.33 |

# Appendix ws.4.2 Rate of Facility Utilization



| Province | Phase | WSS | progress (%) | Startup Year | Capacity (A) ($m^3$/day) | Average Daily Wate Supply (B) ($m^3$/day) | Rate of Facility Utilization (B)/(A) |
|---|---|---|---|---|---|---|---|
| Tra Vinh | SPL IV | Cau Quan WSS | 100 | 2003 | 720 | 360 | 0.50 |
| Tra Vinh | SPL IV | Cau Ke WSS | 100 | 2003 | 1200 | 480 | 0.40 |
| Tra Vinh | SPL V | Widenning and Upgrading Treament Station in My Long-Cau Ngang District | 75 | | 4200 | | |
| Vinh Long | SPL III | Tra On WSS | 100 | 2006 | 2500 | 1390 | 0.56 |
| Vinh Long | SPL V | Cai Ngang WSS | 95 | | 1500 | | |
| Vinh Phuc | SPL III | Yen Lac WSS | 100 | 2002 | 3000 | 400 | 0.13 |
| Vinh Phuc | SPL V | Vinh Tuong WSS | 98 | | 2000 | | |
| Yen Bai | SPL III | Mau A WSS | 100 | 2007/02 | 2000 | 700 | 0.35 |
| Yen Bai | SPL V | Tram Tam Town WSS | 97 | | 1500 | | |

# Appendix ws.5.1 UnAccounted-for Water

| Province | Phase | WSS | capacity ($m^3$/day) | Startup Year | Average Daily Water Supply in 2009 ($m^3$/day) | UFW (%) |
|---|---|---|---|---|---|---|
| An Giang | SPL III | Tri Ton WSS | 2000 | 2005 | 3500 | 27.3 |
| Bac Giang | SPL V | An Chau Town WSS | 950 | 2010 | 300 | 40.0 |
| Bac Lieu | SPL V | Ngan Dua WSS | 1800 | 2009 | 600 | 0.0 |
| Bac Ninh | SPL III | Luong Tai WSS | 2500 | 2006 | 1200 | 30.8 |
| Binh Dinh | SPL V | Phu Phong Town WSS | 2000 | 2009 | 150 | 10.0 |
| Dac Lak | SPL IV | Quang Phu WSS | 3000 | 2009 | 1000 | 30.0 |
| Dac Lak | SPL I | Buon Ho WSS | 3000 | 2003 | 2000 | 12.0 |
| Dien Bien | SPL III | Tuan Giao WSS | 2500 | 2006 | 2400 | 54.0 |
| Dien Bien | SPL IV | Tua Chua WSS | 2000 | 2008 | 1250 | 20.0 |
| Gia Lai | SPL I | Chu Pah WSS | 1970 | 2000 | 280 | 17.5 |
| Ha Giang | SPL IV | Vi Xuyen WSS | 2000 | 2007 | 1550 | 29.0 |
| Ha Giang | SPL I | Bac Quang WSS | 2000 | 2003 | 1500 | 29.0 |
| Hai Duong | SPL III | Sao Do WSS | 4000 | 2006 | 1700 | 12.0 |
| Hai Phong | SPL III | Vinh Bao WSS | 2500 | 2006 | 2000 | 19.0 |
| Hau Giang | SPL III | Vi Thanh WSS | 16000 | 2002 | 9000 | 32.0 |
| Kon Tum | SPL III | Kon Plong WSS | 1000 | 2005 | 450 | 30.0 |
| Lai Chau | SPL IV | Than Uyen WSS | 1000 | 2004 | 1000 | 25.0 |
| Lai Chau | SPL III | Tam Duong (Binh Lu) WSS | 1000 | 2007 | 750 | 24.0 |
| Lam Dong | SPL I | Bao Loc WSS | 7500 | 2003 | 6500 | 21.0 |
| Lam Dong | SPL V | Loc Thang Town WSS | 3400 | 2010 | 1700 | 20.0 |
| Lao Cai | SPL IV | Bac Ha WSS | 1500 | 2007 | 675 | 20.0 |
| Lao Cai | SPL III | Muong Khuong WSS | 1500 | 2006 | 750 | 16.0 |
| Ninh Binh | SPL I | Kim Son WSS | 3000 | 2003 | 1000 | 18.0 |
| Ninh Thuan | SPL V | My Tuong WSS | 1103 | 2009 | 400 | 3.0 |
| Phu Tho | SPL IV | Thanh Ba WSS | 2000 | 2009 | 650 | 23.0 |
| Phu Tho | SPL IV | SONG THAO WSS | 2000 | 2009 | 550 | 20.0 |
| Phu Tho | SPL I | Phu Tho WSS | 10000 | 2001 | 8000 | 19.0 |
| Phu Tho | SPL III | Ha Hoa WSS | 3000 | 2009 | 1650 | 16.5 |
| Phu Yen | SPL III | Cung Son-Son Hoa WSS | 2000 | 2005 | 1200 | 22.0 |
| Phu Yen | SPL IV | Phu Hoa WSS | 2000 | 2007 | 200 | 20.0 |
| Quang Binh | SPL III | Minh Hoa WSS | 2000 | 2005 | 1500 | 22.0 |
| Quang Nam | SPL IV | Nam Phuoc WSS | 3000 | 2009 | 400 | 40.0 |
| Quang Nam | SPL I | Thang Binh WSS | 2500 | 2004 | 1900 | 30.0 |
| Quang Ngai | SPL III | Duc Pho WSS | 2000 | 2007 | 800 | 20.0 |
| Quang Ninh | SPL III | HAI HA WSS | 3000 | 2008 | 300 | 5.5 |
| Quang Tri | SPL V | Gio Linh District WSS | 15000 | 2005 | 7000 | 25.0 |
| Quang Tri | SPL III | Hai Lang WSS | 2500 | 2006 | 400 | 12.7 |
| Quang Tri | SPL IV | Ben Quan WSS | 2000 | 2008 | 1000 | 10.0 |
| Quang Tri | SPL IV | Cam Lo WSS | 2000 | 2008 | 250 | 0.0 |
| Soc Trang | SPL IV | My Xuyen WSS | 4000 | 2008 | 4500 | 16.4 |
| Son La | SPL III | Moc Chau WSS | 1500 | 2005 | 2000 | 24.0 |
| Son La | SPL V | Sop Cop Town WSS | 1750 | 2010 | 300 | 20.0 |
| Tay Ninh | SPL III | Go Dau WSS | 5000 | 2005 | 3000 | 5.5 |
| Thai Binh | SPL III | Kien Xuong WSS | 2000 | 2006 | 650 | 10.0 |
| Thai Nguyen | SPL V | TRAI CAU Town WSS | 960 | 2009 | 150 | 15.0 |
| Thai Nguyen | SPL IV | DAI TU WSS | 2500 | 2010 | 300 | 11.0 |
| Thanh Hoa | SPL III | Ha Trung WSS | 2000 | 2006 | 1100 | 50.0 |
| Vinh Long | SPL III | Tra On WSS | 2500 | 2006 | 1390 | 20.5 |
| Vinh Phuc | SPL III | Yen Lac WSS | 3000 | 2002 | 400 | 20.0 |
| Yen Bai | SPL III | Mau A WSS | 2000 | 2007 | 700 | 15.0 |

# Appendix ws.5.2 Comparison of Reference Values in Drinking Water Standards Set by Ministry of Health



| No. | Parameter | Unit | 1329/2002BYT/QD | | QCVN 01_2009 | |
|---|---|---|---|---|---|---|
| | | | Value | surveillance furequency | Value | surveillance frequency |
| 1.0 | Colour | TCU | 15.0 | A | 15.0 | A |
| 2 | Odour | Threshold | Odourless | A | Odourless | A |
| 3 | Turbidity | NTU | 2 | A | 2 | A |
| 4 | pH | mg/l | 6.5-8.5 | A | 6.0-8.5 | A |
| 5 | Hardness | mg/l/$^0$dH | 300 | A | 300 | A |
| 6 | TDS | mg/l | 1000 | B | 1000 | B |
| 7 | Aluminium | mg/l | 0.2 | B | 0.2 | B |
| 8 | Ammonium ($NH_4^+$) | mg/l | 1.5 | B | 3 | B |
| 9 | Antimony | mg/l | 0.005 | C | 0.005 | C |
| 10 | Arsenic | mg/l | 0.01 | B | 0.01 | B |
| 11 | Barium | mg/l | 0.7 | C | 0.7 | C |
| 12 | Boron | mg/l | 0.3 | C | 0.3 | C |
| 13 | Cadmium | mg/l | 0.003 | C | 0.003 | C |
| 14 | Chloride | mg/l | 250 | A | 250/300(1) | A |
| 15 | Chromium | mg/l | 0.05 | C | 0.05 | C |
| 16 | Copper | mg/l | 2 | C | 1 | C |
| 17 | Cyanide | mg/l | 0.07 | C | 0.07 | C |
| 18 | Fluoride | mg/l | 0.7-1.5 | B | 1.5 | B |
| 19 | Sulphide (dissolved) | mg/l | 0.05 | B | 0.05 | B |
| 20 | Iron | mg/l | 0.5 | A | 0.3 | A |
| 21 | Lead | mg/l | 0.01 | B | 0.01 | B |
| 22 | Manganese | mg/l | 0.5 | A | 0.3 | A |
| 23 | Mercury | mg/l | 0.001 | B | 0.001 | B |
| 24 | Molybdenum | mg/l | 0.07 | C | 0.07 | C |
| 25 | Nickel | mg/l | 0.02 | C | 0.02 | C |
| 26 | Nitrate | mg/l | 50 | A | 50 | A |
| 27 | Nitrite | mg/l | 3 | A | 3 | A |
| 28 | Selenium | mg/l | 0.01 | C | 0.01 | C |
| 29 | Sodium | mg/l | 200 | B | 200 | B |
| 30 | Sulfate | mg/l | 250 | A | 250 | A |
| 31 | Zinc | mg/l | 3 | C | 3 | C |
| 32 | Potassium Permanganate | mg/l | 2 | A | 2 | A |
| 33 | Carbon tetrachloride | mg/l | | | 0.002 | C |
| 34 | Dichloromethane | mg/l | | | 0.02 | C |
| 35 | 1,2-Dichloroethane | mg/l | | | 0.03 | C |
| 36 | 1,1,1-Trichloroethane | mg/l | | | 2 | C |
| 37 | Vinyl chloride | mg/l | | | 0.005 | C |
| 38 | 1,2-Dichloroethene | mg/l | | | 0.05 | C |
| 39 | Trichloroethene | mg/l | | | 0.07 | C |
| 40 | Tetrachloroethene | mg/l | | | 0.04 | C |
| | Phenol and derivatives of Phenol | mg/l | | | 0.001 | B |
| 41 | Benzene | mg/l | | | 0.01 | B |
| 42 | Toluene | mg/l | | | 0.7 | C |
| 43 | Xylene | mg/l | | | 0.5 | C |
| 44 | Ethylbenzene | mg/l | | | 0.3 | C |
| 45 | Styrene | mg/l | | | 0.02 | C |
| 46 | Benzo(a)pyrene | mg/l | | | 0.0007 | B |
| 47 | Monochlorobenzene | mg/l | | | 0.3 | B |
| 48 | 1,2-Dichlorobenzene | mg/l | | | 1 | C |
| 49 | 1,4-Dichlorobenzene | mg/l | | | 0.3 | C |
| 50 | Trichlorobenzenes | mg/l | | | 0.02 | C |
| 51 | Di(2-ethylhexyl)adipate | mg/l | | | 0.08 | C |
| 52 | Di(2-ethylhexyl)phthalate | mg/l | | | 0.008 | C |
| 53 | Acrylamide | mg/l | | | 0.0005 | C |
| 54 | Epichlorohydrin | mg/l | | | 0.0004 | C |
| 55 | Hexachlorobutadiene | mg/l | | | 0.0006 | C |
| 56 | Edetic acid | mg/l | | | - | |
| 57 | Nitrilotriacetic acid | mg/l | | | - | |
| 58 | Tributyltin oxide | mg/l | | | - | |
| 59 | Alachlor | mg/l | | | 0.02 | C |
| 60 | Aldicarb | mg/l | | | 0.01 | C |
| 61 | Aldrin and dieldrin | mg/l | | | 0.00003 | C |
| 62 | Atrazine | mg/l | | | 0.002 | C |
| 63 | Bentazone | mg/l | | | 0.03 | C |
| 64 | Carbofuran | mg/l | | | 0.005 | C |
| 65 | Chlordane | mg/l | | | 0.0002 | C |
| 66 | Chlorotoluron | mg/l | | | 0.03 | C |

# Appendix ws.5.2 Comparison of Reference Values in Drinking Water Standards Set by Ministry of Health



| No. | Parameter | Unit | 1329/2002BYT/QD | | QCVN 01_2009 | |
|---|---|---|---|---|---|---|
| | | | Value | surveillance furequency | Value | surveillance frequency |
| 67 | DDT and metabolites | mg/l | | | 0.002 | C |
| 68 | 1,2-Dibromo-3-chloropropane | mg/l | | | 0.001 | C |
| 69 | 2,4-D | mg/l | | | 0.03 | C |
| 70 | 1,2-Dichloropropane | mg/l | | | 0.02 | C |
| 71 | 1,3-Dichloropropene | mg/l | | | 0.02 | C |
| 72 | Heptachlor and heptachlor epoxide | mg/l | | | 0.00003 | C |
| 73 | Hexachlorobenzene | mg/l | | | 0.001 | C |
| 74 | Isoproturon | mg/l | | | 0.009 | C |
| 75 | Lindane | mg/l | | | 0.002 | C |
| 76 | MCPA | mg/l | | | 0.002 | C |
| 77 | Methoxychlor | mg/l | | | 0.02 | C |
| 78 | Metolachlor | mg/l | | | 0.01 | C |
| 79 | Molinate | mg/l | | | 0.006 | C |
| 80 | Pendimethalin | mg/l | | | 0.02 | C |
| 81 | Pentachlorophenol | mg/l | | | 0.009 | C |
| 82 | Permethrin | mg/l | | | 0.02 | C |
| 83 | Propanil | mg/l | | | 0.02 | C |
| 84 | Pyridate | mg/l | | | - | |
| 85 | Simazine | mg/l | | | 0.02 | C |
| 86 | Trifuralin | mg/l | | | 0.02 | C |
| 87 | 2,4 DB | mg/l | | | 0.09 | C |
| 88 | Dichlorprop (2,4-DP) | mg/l | | | 0.1 | C |
| 89 | Fenoprop | mg/l | | | 0.009 | C |
| 90 | Mecoprop | mg/l | | | 0.01 | C |
| 91 | 2,4,5-T | mg/l | | | 0.009 | C |
| 92 | Monochloramine | mg/l | | | 0.003 | B |
| 93 | Chlorine | mg/l | | | 0,3-0,5 | A |
| 94 | Bromate | mg/l | | | 0.025 | C |
| 95 | Chlorite and chlorate | mg/l | | | 0.2 | C |
| 96 | 2,4,6-trichlorophenol | mg/l | | | 0.2 | C |
| 97 | Formaldehyde | mg/l | | | 0.9 | C |
| 98 | Bromoform (trihalomethane) | mg/l | | | 0.1 | C |
| 99 | Dibromochloromethane | mg/l | | | 0.1 | C |
| 100 | Bromodichloromethane | mg/l | | | 0.06 | C |
| 101 | Chloroform (trihalomethane) | mg/l | | | 0.2 | C |
| 102 | Dichloroacetic acid | mg/l | | | 0.05 | C |
| 103 | Trichloroacetic acid | mg/l | | | 0.1 | C |
| 104 | Chloral hydrate (trichloroacetaldehyde) | mg/l | | | 0.01 | C |
| 105 | Dichloroacetonitrile | mg/l | | | 0.09 | C |
| 106 | Dibromoacetonitrile | mg/l | | | 0.1 | C |
| 107 | Trichloroacetonitrile | mg/l | | | 0.001 | C |
| 108 | Cyanogen chloride | mg/l | | | 0.07 | C |
| 109 | Gross alpha activity | Bq/l | | | 0.11 | B |
| 110 | Gross beta activity | Bq/l | | | 1.1 | B |
| 111 | Thermotolerant coliform bacteria | /100 ml | 0 | | 0 | A |
| 112 | E.coli | /100 ml | 0 | | 0 | A |
| 113 | ***Phosphorus*** | mg/l | | | | |
| 114 | ***Iodine*** | mg/l | | | | |
| 115 | ***Calcium*** | mg/l | | | | |
| 116 | ***Residual chlorine (plant or booster)*** | mg/l | | | | |
| 117 | ***Residual chlorine (end of network)*** | mg/l | | | | |
| | | | | | | |

note

Drinkig Water Quality Standards

1329/2002BYT/QD: National Technical Regulation on Drinking Water Quality, 1329 /2002/BYT/QĐ, 2002, Ministry of Health

QCVN01-2009: National Technical Regulation on Drinking Water Quality, QCVN 01: 2009/BYT, 2009, Ministry of Health

(1): 300mg/l can be applied to the areas of sea coast and island

Surveillance frequency stipulated in 1329/2002/BYT/QD:

A: once a week (water treatment plant) or once a month (Health care organisation at Provincial and District level).

B: parameters need to be tested by Local health organisation before supplying water and period is once a year (or in specific request) at the same time with other parameters in group A.

C: parameters can be only analysied by Central Institutes, Regional Institutes or some Preventive Health center of City/ province a should be monitorred once for 2 years (if possible) or when Regional/ Central health organisations have specific requirement.

Surveillance frequency in QCVN 01_2009

A: at least one (1) time per week to be done by water providers and at least one (1) time per month by functional agencies

B: at lest one (1) time per six (6) months to be done by water providers and functional agencies

C: at least one (1) time per two (2) years to be done by water providers and by functional agencies

The value shown in light blue colored cells are revised ones of those stipulated in 1329/2002BYT/QD

## Appendix ws.5.3 Water Quality Control of Water Supply Systems

| Progress | Province | Phase | WSS | Water Source | Water Provider | | | | Control Agency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water |
| 100 | An Giang | SPL III | Tri Ton WSS | surface water | WSB | N/I | residual chlorine, turbidity, pH | N/I | PPHC | N/I | residual chlorine, turbidity, pH, jar tester, NH3-, NH2- | N/I |
| 100 | Bac Giang | SPL V | An Chau Town WSS | stagnant water | N/A | N/A | N/A | N/A | DPHC | 6 months | N/I | N/I |
| 100 | Bac Kan | SPL IV | Yen Han WSS | surface water | N/A | N/A | N/A | N/A | N/I | N/I | N/I | N/I |
| 100 | Bac Lieu | SPL V | Ngan Dua WSS | groundwater | N/A | N/A | N/A | N/A | PPHC | no-notice inspection | N/I | N/I |
| 100 | Bac Ninh | SPL III | Luong Tai WSS | surface water | PPHC / PWSC / WSB | 0.5-1 month / 1 week / everyday | pH, turbidity, hardness, chloride, dissolved oxygen, residual chlorine, nitrate, nitrite, sulfate, iron, manganese, ammonium, total coliform, thermotolerant coliform / pH, turbidity, iron, manganese, nitrite, nitrate, hardness, residual chlorine, dissolved oxygen, total alkarinity /residual chlorine | pH, turbidity, iron, ammonium, hardness, nitrite, nitrate, sulfate, dissolved oxygen, manganese, arsenic, total coliform, thermotolerant coliform / N/I / N/A | N/I | N/I | N/I | N/I |
| 100 | Binh Dinh | SPL V | Phu Phong Town WSS | infiltration | N/I | N/I | N/I | N/I | PPHC | 3 months and at random (no-notice) | total coliform, E-coli, taste, color, calcium, magnesium, sodium+potassium, total iron, sulphate, chloride, carbonic acid, hydroxyl group (OH), hardness, pH, total dissolved solid | pH, hardness, mineral, total iron, nitrite, nitrate, arsenic, mercury, lead, cyanide, aluminum, manganese, phenol, total coliform, feacal coliform |
| 100 | Dac Lak | SPL IV | Quang Phu WSS | groundwater | PWSC | 1 week | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, residual chlorine, total iron, manganese, dissolved oxygen, total dissolved solid, fuloride | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, total iron, manganese, dissolved oxygen, total dissolved solid, fuloride | PPHC | N/I | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, residual chlorine, total iron, manganese, dissolved oxygen, E-coli, total coliform, total dissolved solid, fuloride | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, total iron, manganese, dissolved oxygen, E-coli, total coliform, total dissolved solid, fuloride |
| 100 | Dac Lak | SPL I | Buon Ho WSS | groundwater | PWSC | 1 week | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, residual chlorine, total iron, manganese, dissolved oxygen, total dissolved solid, fuloride | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, total iron, manganese, dissolved oxygen, total dissolved solid, fuloride | PPHC | no-notice inspection | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, residual chlorine, total iron, manganese, dissolved oxygen, E-coli, total coliform, total dissolved solid, fuloride | pH, turbidity, taste and odor, color, hardness, cloride, sulphate, nitrate, nitrite, total iron, manganese, dissolved oxygen, E-coli, total coliform, total dissolved solid, fuloride |
| 100 | Dien Bien | SPL III | Tuan Giao WSS | spring | N/A | N/A | N/A | N/A | PPHC | 3 months | turbidity, hardness, pH, micro-biological parameters, residual chlorine | N/I |
| 100 | Dien Bien | SPL V | Muong Cha WSS | surface water | PWSC | 1 month | N/I | N/I | N/I | N/I | N/I | N/I |
| 100 | Dien Bien | SPL IV | Tua Chua WSS | spring | PWSC | 2months to 1 year (changeable) | N/I | N/I | PPHC | several times/ year but not regularly | N/I | N/I |
| 100 | Gia Lai | SPL I | Chu Pah WSS | groundwater | PPHC | 4 months | pH, taste and odor, iron, hardness, chloride, dissolved oxygen, ammonium, nitrite, sulphate, manganese, nitrate, fluoride, total dissolved oxygen, arsenic, lead, mercury, copper, zinc, cadmium, total coliform, E-coli | pH, taste and odor, iron, hardness, chloride, dissolved oxygen, ammonium, nitrite, sulphate, manganese, nitrate, fluoride, total dissolved oxygen, total coliform, E-coli | N/I | N/I | N/I | N/I |
| 100 | Ha Giang | SPL IV | Vi Xuyen WSS | surface water | DWSU | every day | turbidity, color | N/I | PPHC | 1 month | N/I | N/I |
| 100 | Ha Giang | SPL I | Bac Quang WSS | surface water | N/A | N/A | N/A | N/A | DPHC / PPHC | 1 month / 3 months | total coliform, E-coli, and others (N/I) | N/I |

PPHC: Provincial Preventive Health Center, DPHC: District Provincial Health Center, PWSC: Provincial Water Supply Company, WSB: Branch of PWSC, DWSU: Disrtict Water Supply Undertaking
N/A: Not Applied QCVN01, N/I: No Information

## Appendix ws.5.3 Water Quality Control of Water Supply Systems

| Progress | Province | Phase | WSS | Water Source | Water Provider | | | | Control Agency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water |
| 100 | Ha Noi (Including former Ha Tay) | SPL III | Phu Xuyen WSS | groundwater | N/A | N/A | N/A | N/A | N/I | N/I | N/I | N/I |
| 100 | Ha Tinh | SPL I | Ky Anh WSS | stagnant water | PPHC | every week | pH, residual chlorine | N/I | N/I | N/I | N/I | N/I |
| 100 | Ha Tinh | SPL III | Vung An WSS | stagnant water | PPHC | every week | pH, residual chlorine | N/I | N/I | N/I | N/I | N/I |
| 100 | Ha Tinh | SPL III | Vu Quang | surface water | PPHC | 1 month | hardness, pH, iron, nitrite, nitrate, residual chlorine, sulfate, dissolved oxygen, chloride, coliform, E-coli | N/I | N/I | N/I | N/I | N/I |
| 100 | Ha Tinh | SPL IV | Nghen Town WSS | surface water | WSB | everyday | turbidity, Iron, pH, residual chlorine | N/I | PPHC | 1 month | pH, residual chlorine, total dissolved solid, nitrate, nitrite, sulfate, iron, hardness, chloride, dissolved oxygen, coliform, E-coli | N/I |
| 100 | Hai Duong | SPL III | Sao Do WSS | groundwater | PWSC | 1 week | taste and odor, pH, temperature, turbidity, color, hardness, total alkarinity, salinity, dissolved oxygen, iron, manganese, sulfate, ammonium, nitrite, nitrate, residual chlorine | taste and odor, pH, temperature, turbidity, color, hardness, total alkarinity, salinity, dissolved oxygen, iron, manganese, sulfate, ammonium, nitrite, nitrate | PPHC | 4-6 months | microbes and others | microbes and others |
| 100 | Hai Phong | SPL III | Vinh Bao WSS | surface water | WSB / PWSC | every one hour / one week | residual chlorine, salinity, pH, turbidity (after treatment), conductivity, consumption of potassium permanganate / color, taste and odor, temperature, turbidity, pH, hardness, chloride, dissolved oxygen, residual chlorine, tootal coliform, thermotolerant coliform, total dissolved solid, ammonium, manganese, nitrate, nitrite, iron | salinity, pH, turbidity (after treatment), conductivity, consumption of potassium permanganate / color, taste and odor, temperature, turbidity, pH, hardness, chloride, dissolved oxygen, tootal coliform, thermotolerant coliform, total dissolved solid, ammonium, manganese, nitrate, nitrite, iron | DPHC | 3 months | residual chlorine, microbes | N/I |
| 100 | Hau Giang | SPL III | Vi Thanh WSS | surface water | PWSC | everyday | residual chlorine, Turbidity, pH | N/I | PPHC | no-notice inspection | N/I | N/I |
| 100 | Kien Giang | SPL III | Giong Gieng WSS | surface water | WSB | everyday | pH, residual chlorine | N/I | PPHC | 1 year | N/I | N/I |
| 100 | Kon Tum | SPL III | Kon Plong WSS | surface water | N/A | N/A | N/A | N/A | PPHC and Department of Environment / Resources of the Province | 6 months / 1 year | coliform, E-coli, pH, nitrate, nitrite, ammonium, dissolved oxygen, iron, hardness, color, arsenic / arsenic | coliform, E-coli, pH, nitrate, nitrite, ammonium, dissolved oxygen, iron, hardness, color, arsenic / arsenic |
| 95 | Lai Chau | SPL V | Phong Tho WSS (WEST) | surface water | PWSC | 2/week | hardness, calcium, magnesium, dissolved oxygen, chemical oxygen demand (COD), pH, residual chlorine, nitrate, nitrite, turbidity | hardness, calcium, magnesium, dissolved oxygen, chemical oxygen demand (COD), pH, nitrate, nitrite, turbidity | PPHC | N/I | microbes, turbidity, color, taste and odor, pH, total hardness, alkarinity, total dissolved solid, dissolved oxygen, suspended solids, cromium, lead, mercury, zinc, alminum | microbes, turbidity, color, taste and odor, pH, total hardness, alkarinity, total dissolved solid, dissolved oxygen, suspended solids, cromium, lead, mercury, zinc, alminum |
| 100 | Lai Chau | SPL IV | Than Uyen WSS | surface water | PWSC | 2/week | hardness, calcium, magnesium, dissolved oxygen, chemical oxygen demand (COD), pH, residual chlorine, nitrate, nitrite, turbidity | hardness, calcium, magnesium, dissolved oxygen, chemical oxygen demand (COD), pH, nitrate, nitrite, turbidity | PPHC | N/I | microbes, turbidity, color, taste and odor, pH, total hardness, alkarinity, total dissolved solid, dissolved oxygen, suspended solids, cromium, lead, mercury, zinc, alminum | microbes, turbidity, color, taste and odor, pH, total hardness, alkarinity, total dissolved solid, dissolved oxygen, suspended solids, cromium, lead, mercury, zinc, alminum |

PPHC: Provincial Preventive Health Center, DPHC: District Provincial Health Center, PWSC: Provincial Water Supply Company, WSB: Branch of PWSC, DWSU: Disrtict Water Supply Undertaking
N/A: Not Applied QCVN01, N/I: No Information

## Appendix ws.5.3 Water Quality Control of Water Supply Systems

| Progress | Province | Phase | WSS | Water Source | Water Provider: Organization in Charge of Water Analysis | Water Provider: Frequency of Water Analysis | Water Provider: Parameters on Treated Water | Water Provider: Parameters on Raw Water | Control Agency: Organization in Charge of Water Analysis | Control Agency: Frequency of Water Analysis | Control Agency: Parameters on Treated Water | Control Agency: Parameters on Raw Water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | Lai Chau | SPL III | Tam Duong (Binh Lu) WSS | surface water | PWSC | 2/week | hardness, calcium, magnesium, dissolved oxygen, chemical oxygen demand (COD), pH, residual chlorine, nitrate, nitrite, turbidity | hardness, calcium, magnesium, dissolved oxygen, chemical oxygen demand (COD), pH, nitrate, nitrite, turbidity | PPHC | N/I | microbes, turbidity, color, taste and odor, pH, total hardness, alkarinity, total dissolved solid, dissolved oxygen, suspended solids, cromium, lead, mercury, zinc, alminum | microbes, turbidity, color, taste and odor, pH, total hardness, alkarinity, total dissolved solid, dissolved oxygen, suspended solids, cromium, lead, mercury, zinc, alminum |
| 100 | Lam Dong | SPL I | Bao Loc WSS | groundwater | WSC / PPHC | 2 week / 1 month | Fe, pH, Turbidity, residual chlorine / (PPHC) color, turbidity, pH, hardness, iron, sulfate, manganese, nitrate, nitrite, residual chlorine, dissolved oxygen, total coliform, E-coli | Fe, pH, Turbidity, residual chlorine / (PPHC) color, turbidity, pH, hardness, iron, sulfate, manganese, nitrate, nitrite, dissolved oxygen, total coliform, E-coli | N/I | N/I | N/I | N/I |
| 100 | Lam Dong | SPL V | Loc Thang Town WSS | groundwater | PWSC | N/I | N/I | N/I | PPHC | N/I | N/I | N/I |
| 100 | Lao Cai | SPL IV | Bac Ha WSS | surface water | PWSC | 1 week | pH, turbidity, taste and odor, color, residual chlorine, chloride, iron, aluminum, sulfate, hardness, dissolved oxygen, total dissolved solid, manganese, ammonium, nitrate, nitrite | N/I | PPHC | 3 months | taste and odor, residual chlorine, hardness, dissolved oxygen, iron, nitrate, nitrite, chloride, ammonium, sulphate, total coliform, feacal coliform | N/I |
| 100 | Lao Cai | SPL III | Muong Khuong WSS | surface water | PWSC | week | pH, turbidity, taste and odor, color, residual chlorine, | N/I | PPHC | 3 months | taste and odor, residual chlorine, hardness, dissolved | N/I |
| 98 | Nghe An | SPL V | Nghia Dan WSS (THAI HOA) | surface water | N/A | N/A | N/A | N/A | PPHC | 2 weeks | N/I | N/I |
| 100 | Nghe An | SPL I | Cua Lo WSS | groundwater | N/A | N/A | N/A | N/A | PPHC | 6 months (no-notice inspection) | coliform, E-coli, taste and odor, pH, ammonium, nitrate, nitrite, iron, chloride, | coliform, E-coli, taste and odor, pH, ammonium, nitrate, nitrite, iron, chloride, |
| 100 | Nghe An | SPL IV | Yen Thanh WSS | surface water | N/A | N/A | N/A | N/A | PPHC | 12 months (no-notice inspection) | N/I | N/I |
| 100 | Nghe An | SPL IV | Nam Dan WSS | surface water | WSB | 3/day | residual chlorine, pH, turbidity | N/I | PPHC | 1 month (no-notice inspection) | N/I | N/I |
| 100 | Ninh Binh | SPL I | Kim Son WSS | surface water | PWSC / PPHC with DPHC | everyday / every month | Turbidity, residual chlorine, pH / coliform bacteria, fecal coliform bacteria, nitrate, nitrite, ammonium, salinity, ferric oxide (Fe2O3), color, residual chlorine, pH, Hardness, | N/I | N/I | N/I | N/I | N/I |
| 100 | Ninh Thuan | SPL V | My Tuong WSS | stagnant water | Water Supply Station | 0.5 - 1 month | N/I | N/I | PPHC | 1-3 months | N/I | N/I |
| 100 | Phu Tho | SPL IV | SONG THAO WSS | surface water | WSB / PPHC | every hour /1 month or longer period | turbidity, residual chlorine / turbidity, ph, nitrate, nitrite, salinity, iron dioxide, ammonium, ferric oxide, hardness, permanganic acid consumption, taste and odor, copper, sulfate, fluoride, arsenic, lead, zinc, nickel, residual chlorine, phenol, color | turbidity, residual chlorine / turbidity, ph, nitrate, nitrite, salinity, iron dioxide, ammonium, ferric oxide, hardness, permanganic acid consumption, taste and odor, copper, sulfate, fluoride, arsenic, lead, zinc, nickel, phenol, color | N/I | N/I | N/I | N/I |

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N/A: Not Applied QCVN01, N/I: No Information

## Appendix ws.5.3 Water Quality Control of Water Supply Systems



| Progress | Province | Phase | WSS | Water Source | Water Provider | | | | Control Agency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water |
| 100 | Phu Tho | SPL I | Phu Tho WSS | surface water | WSC / PPHC | every hour | turbidity, residual chlorine / turbidity, ph, nitrate, nitrite, salinity, iron dioxide, ammonium, ferric oxide, hardness, permanganic acid consumption, taste and odor, copper, sulfate, fluoride, arsenic, lead, zinc, nickel, residual chlorine, phenol, color | turbidity, residual chlorine / turbidity, ph, nitrate, nitrite, salinity, iron dioxide, ammonium, ferric oxide, hardness, permanganic acid consumption, taste and odor, copper, sulfate, fluoride, arsenic, lead, zinc, nickel, phenol, color | N/I | N/I | N/I | N/I |
| 100 | Phu Tho | SPL IV | Thanh Ba WSS | another WSS | PWSC | 3/month | turbidity, ph, nitrate, nitrite, salinity, iron dioxide, ammonium, hardness, permanganic acid consumption, taste and odor, sulfate, arsenic, lead, residual chlorine, color, manganese, cyanide, iron trivalent, alkalinity | turbidity, ph, nitrate, nitrite, salinity, iron dioxide, ammonium, hardness, permanganic acid consumption, taste and odor, sulfate, arsenic, lead, color, manganese, cyanide, iron trivalent, alkalinity | PPHC | no-notice inspection | N/I | N/I |
| 100 | Phu Tho | SPL III | Ha Hoa WSS | surface water | DWSU | everyday | residual chlorine is not included | N/I | PPHC | 4 months | N/I | N/I |
| 100 | Phu Yen | SPL IV | Phu Hoa WSS | infiltration | PWSC | every day | Turbidity, Color, Taste, Residual Chlorine | Turbidity, Color, Taste, Nitrate, Nitrite, Hardness, Iron, Manganese, Sulfate | PPHC | 1 week | Turbidity, Color, Taste, Residual Chlorine, Nitrate, Nitrite, Hardness, Iron, Manganese, Sulfate | Turbidity, Color, Taste, Nitrate, Nitrite, Hardness, Iron, Manganese, Sulfate |
| 100 | Phu Yen | SPL III | Cung Son-Son Hoa WSS | surface water | Cung Son WSS and Neighbouring WSS's laboratories | every day | Turbidity, pH, Color, Taste & odour, Residual Chlorine, 14 parameters | Turbidity, pH, Color, Taste & odour, 8 parameters | PPHC | no-notice inspection | N/I | N/I |
| 100 | Quang Binh | SPL III | Minh Hoa WSS | surface water | PPHC | every day | pH, Turbidity, residual chlorine, microbes | N/I | PPHC | 2 /month | microbes | microbes |
| 100 | Quang Nam | SPL IV | Nam Phuoc WSS | surface water and groundwater | WSB | every day | pH, Turbidity, residual chlorine, salinity, Dissolved Oxygen | N/I | PPHC | 0.5 to 1 month | N/I | N/I |
| 100 | Quang Nam | SPL I | Thang Binh WSS | surface water | N/A | N/A | N/A | N/A | PPHC | 0.5 to 1 month | N/I | N/I |
| 100 | Quang Ngai | SPL III | Duc Pho WSS | groundwater | PPHC | 1-3 / month | N/I | N/I | N/I | N/I | N/I | N/I |
| 100 | Quang Ninh | SPL I | Dong Trieu WSS | groundwater | PPHC / PWSC | 1 month / N/I | N/I | pH, Turbidity, Nitrate, Dissolved Oxygen, Total Iron, Chloride, Hardness, Nitrate, Color, Sulfate, Manganese, Taste and Odor | N/I | N/I | N/I | N/I |
| 100 | Quang Ninh | SPL III | HAI HA WSS | surface water | PPHC / PWSC | every month | N/I | N/I | N/I | N/I | N/I | N/I |
| 100 | Quang Tri | SPL III | Hai Lang WSS | surface water | PWSC | everyday | pH, residual chlorine, Turbidity | N/I | joint team of PPHC and provincial food safty department. | 1 month (no-notice inspection) | N/I | N/I |
| 100 | Quang Tri | SPL IV | Cam Lo WSS | surface water | PWSC | everyday | pH, residual chlorine, Turbidity | N/I | joint team of PPHC and provincial food safty department. | 1 month (no-notice inspection) | N/I | N/I |

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N/A: Not Applied QCVN01, N/I: No Information

## Appendix ws.5.3 Water Quality Control of Water Supply Systems

| Progress | Province | Phase | WSS | Water Source | Water Provider | | | | Control Agency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water |
| 100 | Quang Tri | SPL I | Lao Bao WSS | surface water | PWSC | everyday | pH, residual chlorine, Turbidity | N/I | joint team of PPHC and provincial food safty department. | 1 month (no-notice inspection) | N/I | N/I |
| 100 | Quang Tri | SPL I | Ho Xa WSS | groundwater | PWSC | everyday | pH, residual chlorine, Turbidity | N/I | joint team of PPHC and provincial food safty department. | 1 month (no-notice inspection) | N/I | N/I |
| 100 | Quang Tri | SPL V | Gio Linh District WSS | groundwater | PWSC | everyday | pH, residual chlorine, Turbidity | N/I | joint team of PPHC and provincial food safty department. | 1 month (no-notice inspection) | N/I | N/I |
| 100 | Quang Tri | SPL IV | Ben Quan WSS | surface water | PWSC | everyday | pH, residual chlorine, Turbidity | N/I | joint team of PPHC and provincial food safty department. | 1 month (no-notice inspection) | N/I | N/I |
| 100 | Soc Trang | SPL V | Phu Loc Town WSS | groundwater | PWSC | week | N/I | N/I | PPHC | N/I | N/I | color, taste and odor, turbidity, residual chlorine, dissolved oxygen, iron, sulfate, coliform, E-coli |
| 100 | Soc Trang | SPL IV | My Xuyen WSS | groundwater | PWSC | 1 week | N/I | N/I | PPHC | N/I | N/I | color, taste and odor, turbidity, residual chlorine, dissolved oxygen, iron, sulfate, coliform, E-coli |
| 100 | Son La | SPL V | Sop Cop Town WSS | surface water | N/A | N/A | N/A | N/A | DPHC, PPHC | DPHC: 1 month, PPHC: 3-6months (PPHC) | PWSC keeps | PWSC keeps |
| 100 | Son La | SPL III | Moc Chau WSS | surface water | WSB / DPHC and PPHC | 1 week / 6months to 12months | residual chlorin, turbidity, pH / color, taste, odor, pH, residual chlorine, iron | turbidity, pH / color, taste, odor, pH, iron | N/I | N/I | N/I | N/I |
| 100 | Tay Ninh | SPL III | Go Dau WSS | groundwater | WSB / PPHC | everyday / 1 month | pH, residual chlorine, iron | N/I | N/I | N/I | N/I | N/I |
| 100 | Thai Binh | SPL III | Kien Xuong WSS | surface water | WSB / PPHC | everyday / 1 month | pH, turbidity, residual chlorine / N/A | pH, turbidity, residual chlorine / N/A | N/I | N/I | N/I | N/I |
| 100 | Thai Nguyen | SPL IV | DAI TU WSS | surface water | PWSC / PPHC | 1 week | N/I | N/I | PPHC | 1 month | color, odor, turbidity, pH, hardness, chloride, iron, manganese, nitrate, nitrite, sulphate, potassium permanganate consumption, residual chlorine | N/I |
| 100 | Thai Nguyen | SPL V | TRAI CAU Town WSS | groundwater | PWSC | 1 week | redisual chlorine, turbidity, pH, total dissolved solid, electric conductivity, ammonium, iron, manganese | color, turbidity, pH, total dissolved solid, electric conductivity, ammonium, iron, manganese | PPHC | 1 month | N/I | N/I |
| 100 | Thanh Hoa | SPL IV | Rung Thong WSS (Dong Son) | another WSS | PWSC | N/I | residual chlorine | N/I | N/I | N/I | N/I | N/I |
| 100 | Thanh Hoa | SPL V | Hau Loc WSS | surface water | N/A | N/A | N/A | N/A | PPHC | 1 month and 3 months | not available | N/I |
| 100 | Thanh Hoa | SPL IV | Nhu Thanh WSS | surface water | center of products quality inspection under department of | N/I | N/I | N/I | N/I | N/I | N/I | N/I |
| 100 | Thanh Hoa | SPL IV | Thuong Xuan WSS | groundwater | N/A | N/A | N/A | N/A | PPHC | 3 months and no-notice | N/I | N/I |
| 100 | Thanh Hoa | SPL III | Ha Trung WSS | groundwater | N/A | N/A | N/A | N/A | PPHC | not so frequent | N/I | N/I |

PPHC: Provincial Preventive Health Center, DPHC: District Provincial Health Center, PWSC: Provincial Water Supply Company, WSB: Branch of PWSC, DWSU: Disrtict Water Supply Undertaking
N/A: Not Applied QCVN01, N/I: No Information

## Appendix ws.5.3 Water Quality Control of Water Supply Systems

| Progress | Province | Phase | WSS | Water Source | Water Provider | | | | Control Agency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water | Organization in Charge of Water Analysis | Frequency of Water Analysis | Parameters on Treated Water | Parameters on Raw Water |
| 100 | Thua-Thien Hue | SPL III | Phu Bai WSS | groundwater | PWSC | 2-3 days | residual chlorine, pH, turbidity | N/I | PPHC | N/I | N/I | N/I |
| 100 | Thua-Thien Hue | SPL I | Chan My WSS | surface water | PWSC | 1 week | residual chlorine, pH, Turbidity | N/I | N/I | N/I | N/I | N/I |
| 100 | Thua-Thien Hue | SPL V | Khe Tre WSS | surface water | PWSC | 1 week | iron, manganese, turbidity, pH, residual chlorine | N/I | N/I | N/I | N/I | N/I |
| 100 | Tra Vinh | SPL IV | Cau Quan WSS | groundwater | PWSC | N/I | N/I | N/I | N/I | N/I | N/I | N/I |
| 100 | Tra Vinh | SPL IV | Cau Ke WSS | groundwater | PWSC | N/I | N/I | N/I | N/I | N/I | N/I | N/I |
| 100 | Vinh Long | SPL III | Tra On WSS | surface water | PWSC | N/I | turbidity, residual chlorine, pH | N/I | N/I | N/I | N/I | N/I |
| 100 | Vinh Phuc | SPL III | Yen Lac WSS | groundwater | PWSC | 1 week | N/I | N/I | PPHC | 14days | N/I | N/I |
| 100 | Yen Bai | SPL III | Mau A WSS | surface water | PPHC | 12 months for raw water, 3 months for treated water | follow the drinking water quality standards | follow the drinking water quality standards | N/I | N/I | N/I | N/I |

PPHC: Provincial Preventive Health Center, DPHC: District Provincial Health Center, PWSC: Provincial Water Supply Company, WSB: Branch of PWSC, DWSU: Disrtict Water Supply Undertaking
N/A: Not Applied QCVN01, N/I: No Information

# Appendix ws.5.4 Water Tariff of Water Supply Systems



| Start-up year | Phase | Province | WSS | Water Tariff | | | | | collection rate | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | domestic | industry | Officese | Services | Public Institution | | |
| 2005 | SPL III | An Giang | Tri Ton WSS | 3700 | 8000 | | | | | |
| 2010/01 | SPL V | Bac Giang | An Chau Town WSS | 3500 | | | | | 50 | Water with high turbidity in 2010/08 can not be paid |
| 2005/10 | SPL IV | Bac Kan | Yen Han WSS | 500 | | | | | 100 | |
| 2009/08 | SPL V | Bac Lieu | Ngan Dua WSS | 2900 | | | | | 98 | |
| 2006/09 | SPL III | Bac Ninh | Luong Tai WSS | 2500 | 5000 | 3500 | 5000 | 3500 | 100 | |
| Progressive rate system is applied to the domestic category. | | | | $<10m^3$ | $10\text{-}20m^3$ | $>20m^3$ | | | | |
| | | | | 2500 | 3000 | 3500 | | | | |
| 2009/06 | SPL V | Binh Dinh | Phu Phong Town WSS | 3400 | 4500 | 4000 | 5000 | 4000 | 0 | Under Commissioning |
| 2009/04 | SPL IV | Dac Lak | Quang Phu WSS | 2500 | 4500 | | 3800 | 8000 | 100 | |
| 2003 | SPL I | Dac Lak | Buon Ho WSS | 2500 | 4500 | | 3800 | 8000 | 100 | |
| 2006/09 | SPL III | Dien Bien | Tuan Giao WSS | 3400 | | | | | 100 | |
| 2010/05 | SPL V | Dien Bien | Muong Cha WSS | 4673 | | | | | 100 | |
| 2008/06 | SPL IV | Dien Bien | Tua Chua WSS | 4450 | | | | | 100 | |
| 2000 | SPL I | Gia Lai | Chu Pah WSS | 2000 | 3000 | 3000 | | | 80 | |
| 2007/12 | SPL IV | Ha Giang | Vi Xuyen WSS | 2900 | 8700 | 3500 | 8700 | 3500 | 100 | |
| 2003/02 | SPL I | Ha Giang | Bac Quang WSS | 2900 | 3300 | 3300 | 3300 | 3300 | 100 | |
| 2008 | SPL III | Ha Noi (Including former Ha Tay) | Phu Xuyen WSS | 4800 | 6000 | 4800 | 8000 | 4000 | | |
| Progressive rate system is applied to the domestic category. | | | | $<16m^3$ | $16\text{-}20m^3$ | $20\text{-}35m^3$ | $>35m^3$ | | | |
| | | | | 3300 | 4000 | 4800 | 8000 | | | |
| 2002 | SPL I | Ha Tinh | Ky Anh WSS | 2800 | | | | | | |
| 2009/12 | SPL III | Ha Tinh | Vung An WSS | 2800 | | | | | | |
| 2006/11 | SPL III | Ha Tinh | Vu Quang WSS | 2500 | | | | | 95 | |
| 2009/03 | SPL IV | Ha Tinh | Nghen Town WSS | 3200 | | | | | | |
| 2006/01 | SPL III | Hai Duong | Sao Do WSS | 4500 | 8500 | 8500 | 10500 | 6900 | 100 | |
| Progressive rate system is applied to the domestic category. | | | | $<=30m^3$ | $>30m^3$ | | | | | |
| | | | | 4500 | 5400 | | | | | |
| 2006/02 | SPL III | Hai Phong | Vinh Bao WSS | 4540 | 9780 | | 9780 | 9780 | 99 | |
| 2002 | SPL III | Hau Giang | Vi Thanh WSS | | | | | | 98 | |
| 2003 | SPL III | Kien Giang | Giong Gieng WSS | 4800 | | | | | 98 | |
| 2005/12 | SPL III | Kon Tum | Kon Plong WSS | 3000 | | 5000 | 4000 | 5000 | 100 | |
| 2009/02 | SPL V | Lai Chau | Phong Tho WSS (WEST) | 1800 | 5000 | 3500 | 5000 | 3500 | 100 | |
| 2004 | SPL IV | Lai Chau | Than Uyen WSS | 2500 | 5500 | 4500 | 6500 | 4500 | 100 | |
| 2007/06 | SPL III | Lai Chau | Tam Duong (Binh Lu) WSS | 1800 | 5000 | 3500 | 5000 | 3500 | 100 | |
| 2003 | SPL I | Lam Dong | Bao Loc WSS | 3300 | 7400 | 6000 | 14800 | 6000 | 100 | |
| Progressive rate system is applied to the domestic category. | | | | $<=4m^3$ | $4\text{-}6m^3$ | $>6m^3$ | | | | |
| | | | | 3300 | 4700 | 5700 | | | | |
| 2010/01 | SPL V | Lam Dong | Loc Thang Town WSS | 3300 | 7400 | | 14800 | 4500 | | |
| Progressive rate system is applied to the domestic category. | | | | $<=4m^3$ | $4\text{-}6m^3$ | $>6m^3$ | | | | |
| | | | | 3300 | 4700 | 5700 | | | | |
| 2007/07 | SPL IV | Lao Cai | Bac Ha WSS | 4800 | | | 8200 | | 95 | |
| Progressive rate system is applied to the domestic category. | | | | $<2.5m^3$ | $2.5\text{-}5m^3$ | $>5m^3$ | | | | |
| | | | | 4000 | 5500 | 6200 | | | | |
| 2006/03 | SPL III | Lao Cai | Muong Khuong WSS | 4800 | | | 8200 | | 95 | |
| Progressive rate system is applied to the domestic category. | | | | $<2.5m^3$ | $2.5\text{-}5m^3$ | $>5m^3$ | | | | |
| | | | | 4000 | 5500 | 6200 | | | | |

# Appendix ws.5.4 Water Tariff of Water Supply Systems



| Start-up year | Phase | Province | WSS | Water Tariff | | | | | collection rate | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | domestic | industry | Officese | Services | Public Institution | | |
| 2009/09 | SPL V | Nghe An | Nghia Dan WSS (THAI HOA) | 4500 | | | | | | |
| 2002 | SPL I | Nghe An | Cua Lo WSS | 4300 | | | | | | |
| 2008/12 | SPL IV | Nghe An | Yen Thanh WSS | 3500 | | | | | | |
| 2009/06 | SPL IV | Nghe An | Nam Dan WSS | 4500 | | | | | | |
| 2003 | SPL I | Ninh Binh | Kim Son WSS | 4500 | 12000 | 7000 | 12000 | 7000 | 100 | |
| 2009/09 | SPL V | Ninh Thuan | My Tuong WSS | 3700 | | | 4500 | | 100 | |
| 2009/03 | SPL III | Phu Tho | Ha Hoa WSS | 3000 | 4800 | | 4800 | 4800 | 100 | |
| 2009/07 | SPL IV | Phu Tho | SONG THAO | 4714 | 7800 | | 11500 | 7019 | | |
| Conncction charge is paid separetely by a consumer | | | Urban | 5238 | | | 11500 | | | |
| | | | Rural | 4714 | | | | | | |
| Conection charge is included in the water rate | | | Urban | 6914 | | | 13252 | | | |
| | | | Rural | 6390 | | | | | | |
| 2001 | SPL I | Phu Tho | Phu Tho WSS | | 7800 | | 11500 | 7019 | 100 | |
| Conncction charge is paid separetely by a consumer | | | Urban | 5238 | | | 11500 | | | |
| | | | Rural | 4714 | | | | | | |
| Conection charge is included in the water rate | | | Urban | 6914 | | | 13252 | | | |
| | | | Rural | 6390 | | | | | | |
| 2009/12 | SPL IV | Phu Tho | Thanh Ba WSS | 4714 | 7800 | | 11500 | 7019 | | |
| Conncction charge is paid separetely by a consumer | | | Urban | 5238 | | | 11500 | | | |
| | | | Rural | 4714 | | | | | | |
| Conection charge is included in the water rate | | | Urban | 6914 | | | 13252 | | | |
| | | | Rural | 6390 | | | | | | |
| 2007 | SPL IV | Phu Yen | Phu Hoa WSS | 3000 | 5000 | | 6000 | 4000 | 85 | |
| Progressive rate system is applied to the domestic category. | | | | <=20m$^3$ | >20m$^3$ | | | | | |
| | | | | 3000 | 4000 | | | | | |
| 2005 | SPL III | Phu Yen | Cung Son-Son Hoa WSS | 3000 | 5000 | | 6000 | 4000 | 85 | |
| Progressive rate system is applied to the domestic category. | | | | <=20m$^3$ | >20m$^3$ | | | | | |
| | | | | 3000 | 4000 | | | | | |
| 2005/06 | SPL III | Quang Binh | Minh Hoa WSS | 4000 | | | | | | |
| 2009/02 | SPL IV | Quang Nam | Nam Phuoc WSS | 4000 | | | | | | |
| 2004 | SPL I | Quang Nam | Thang Binh WSS | 4000 | | | | | | |
| 2007/02 | SPL III | Quang Ngai | Duc Pho WSS | | | | | | | |
| 2001 | SPL I | Quang Ninh | Dong Trieu WSS | 4000 | 6800 | 6800 | 9800 | 6800 | 100 | |
| 2008/01 | SPL III | Quang Ninh | HAI HA WSS | 4000 | 6800 | 6800 | 9800 | 6800 | 100 | |
| 2006/09 | SPL III | Quang Tri | Hai Lang WSS | 4100 | | | | | | |
| 2008/06 | SPL IV | Quang Tri | Cam Lo WSS | 4100 | | | | | | |
| 2001/01 | SPL I | Quang Tri | Lao Bao WSS | 4100 | | | | | | |
| 2000 | SPL I | Quang Tri | Ho Xa WSS | 4100 | | | | | | |
| 2005 | SPL V | Quang Tri | Gio Linh District WSS | 4100 | | | | | | |
| 2008/09 | SPL IV | Quang Tri | Ben Quan WSS | 4100 | | | | | | |
| 2008 | SPL IV | Soc Trang | My Xuyen WSS | | | | | | 98 | |
| 2010/04 | SPL V | Son La | Sop Cop Town WSS | 3500 | | | | | 100 | |
| 2005/01 | SPL III | Son La | Moc Chau WSS | 4200 | | | | | 100 | |
| 2005 | SPL III | Tay Ninh | Go Dau WSS | 4000 | | | | | 100 | |
| 2006/07 | SPL III | Thai Binh | Kien Xuong WSS | 4500 | 6300 | 5500 | 6300 | | 100 | |

## Appendix ws.5.4 Water Tariff of Water Supply Systems



| Start-up year | Phase | Province | WSS | Water Tariff | | | | | collection rate | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | domestic | industry | Officese | Services | Public Institution | | |
| 2010/01 | SPL IV | Thai Nguyen | DAI TU WSS | 4000 | 7000 | 5000 | 7000 | 5000 | 100 | |
| 2009/04 | SPL V | Thai Nguyen | TRAI CAU Town WSS | 4800 | | 6000 | | 6000 | 100 | |
| 2008/04 | SPL V | Thanh Hoa | Hau Loc WSS | 4000 | | | | | | |
| 2009/12 | SPL IV | Thanh Hoa | Nhu Thanh WSS | 5000 | | | | | | |
| 2008/12 | SPL IV | Thanh Hoa | Thuong Xuan WSS | | | | | | | |
| 2006 | SPL III | Thanh Hoa | Ha Trung WSS | 2850 | | | | | | |
| 2007/07 | SPL III | Thua-Thien Hue | Phu Bai WSS | 3500 | | | | | | |
| 2000 | SPL I | Thua-Thien Hue | Chan My WSS | 3500 | | | | | | |
| 2009/04 | SPL V | Thua-Thien Hue | Khe Tre WSS | 3500 | | | | | | |
| 2003 | SPL IV | Tra Vinh | Cau Quan WSS | 4000 | | | | | | |
| 2003 | SPL IV | Tra Vinh | Cau Ke WSS | 4000 | | | | | | |
| 2002 | SPL III | Vinh Phuc | Yen Lac WSS | 4500 | | | | | 100 | |
| 2007/02 | SPL III | Yen Bai | Mau A WSS | 3000 | | | | | 100 | |

# Appendix ws.5.5 Current Coverage and Per Capita Consumptio of Water Supply Systems



| Start-up | Province | Phase | WSS | Coverage based on Consumer Households (%) | Coverage reported by WSS (%) | Current Per Capita Consumption (liters) |
|---|---|---|---|---|---|---|
| 2005 | An Giang | SPL III | Tri Ton WSS | | 95 | 115 |
| 2010/01 | Bac Giang | SPL V | An Chau Town WSS | 10 | | 83 |
| 2005/10 | Bac Kan | SPL IV | Yen Han WSS | 85.2 | 88.2 | |
| 2009/08 | Bac Lieu | SPL V | Ngan Dua WSS | | | 255 |
| 2006/09 | Bac Ninh | SPL III | Luong Tai WSS | 63.8 | 60 | 145 |
| 2009/06 | Binh Dinh | SPL V | Phu Phong Town WSS | 21.4 | | 62 |
| 2003 | Dac Lak | SPL I | Buon Ho WSS | 51.7 | 42 | 129 |
| 2009/04 | Dac Lak | SPL IV | Quang Phu WSS | 29.6 | | 250 |
| 2006/09 | Dien Bien | SPL III | Tuan Giao WSS | 61.9 | 67.5 | 287 |
| 2008/06 | Dien Bien | SPL IV | Tua Chua WSS | 83.3 | 100 | 250 |
| 2010/05 | Dien Bien | SPL V | Muong Cha WSS | 52.5 | | 79 |
| 2000 | Gia Lai | SPL I | Chu Pah WSS | 80.4 | | 189 |
| 2003/02 | Ha Giang | SPL I | Bac Quang WSS | 76.1 | 80 | 176 |
| 2007/12 | Ha Giang | SPL IV | Vi Xuyen WSS | 66.7 | 80 | 277 |
| 2008 | Ha Noi (Including former Ha Tay) | SPL III | Phu Xuyen WSS | 30.7 | 30 | 256 |
| 2002 | Ha Tinh | SPL I | Ky Anh WSS | 77.9 | | 161 |
| 2006/11 | Ha Tinh | SPL III | Vu Quang | 27.1 | | 308 |
| 2009/12 | Ha Tinh | SPL III | Vung An WSS | 44.4 | | 500 |
| 2009/03 | Ha Tinh | SPL IV | Nghen Town WSS | 47.5 | | |
| 2006/01 | Hai Duong | SPL III | Sao Do WSS | 50 | 40 | 131 |
| 2006/02 | Hai Phong | SPL III | Vinh Bao WSS | 95 | 95 | 126 |
| 2002 | Hau Giang | SPL III | Vi Thanh WSS | 90 | 80 | 161 |
| 2003 | Kien Giang | SPL III | Giong Gieng WSS | | | 244 |
| 2005/12 | Kon Tum | SPL III | Kon Plong WSS | | | 346 |
| 2004 | Lai Chau | SPL IV | Than Uyen WSS | 93.5 | 84 | 171 |
| 2007/06 | Lai Chau | SPL III | Tam Duong (Binh Lu) WSS | 33.8 | 80 | 278 |
| 2009/02 | Lai Chau | SPL V | Phong Tho WSS (WEST) | 60 | | 153 |
| 2003 | Lam Dong | SPL I | Bao Loc WSS | 46 | 29.1 | 148 |
| 2010/01 | Lam Dong | SPL V | Loc Thang Town WSS | 30 | 30 | 135 |
| 2006/03 | Lao Cai | SPL III | Muong Khuong WSS | | 90 | 150 |
| 2007/07 | Lao Cai | SPL IV | Bac Ha WSS | | 85 | 119 |
| 2002 | Nghe An | SPL I | Cua Lo WSS | | | |
| 2008/12 | Nghe An | SPL IV | Yen Thanh WSS | 59.3 | | 107 |
| 2009/09 | Nghe An | SPL V | Nghia Dan WSS (THAI HOA) | 33.3 | | 44 |
| 2009/06 | Nghe An | SPL IV | Nam Dan WSS | 51.6 | | 156 |
| 2003 | Ninh Binh | SPL I | Kim Son WSS | 70 | 80 | 89 |
| 2009/09 | Ninh Thuan | SPL V | My Tuong WSS | 12 | 50 | 148 |
| 2001 | Phu Tho | SPL I | Phu Tho WSS | 46.7 | 42.9 | 267 |

Coverage based on consumer households (hh)=hh connceted with WSS/Totan hh in the service area x 100
Current Per Capita Consumption = Average water supply / (hh connected with WSS x average member of hh or poulation served)

## Appendix ws.5.5 Current Coverage and Per Capita Consumptio of Water Supply Systems



| Start-up | Province | Phase | WSS | Coverage based on Consumer Households (%) | Coverage reported by WSS (%) | Current Per Capita Consumption (liters) |
|---|---|---|---|---|---|---|
| 2009/07 | Phu Tho | SPL IV | SONG THAO WSS | 38.5 | 33 | 68 |
| 2009/12 | Phu Tho | SPL IV | Thanh Ba WSS | 15.7 | 37.5 | 72 |
| 2009/03 | Phu Tho | SPL III | Ha Hoa WSS | 13.5 | 55 | 189 |
| 2005 | Phu Yen | SPL III | Cung Son-Son Hoa WSS | 72 | 68.8 | 126 |
| 2007 | Phu Yen | SPL IV | Phu Hoa WSS | 40 | 60 | 333 |
| 2005/06 | Quang Binh | SPL III | Minh Hoa WSS | 75 | | 125 |
| 2004 | Quang Nam | SPL I | Thang Binh WSS | 43.3 | | 204 |
| 2009/02 | Quang Nam | SPL IV | Nam Phuoc WSS | 16.7 | | 95 |
| 2007/02 | Quang Ngai | SPL III | Duc Pho WSS | 50 | | 178 |
| 2001 | Quang Ninh | SPL I | Dong Trieu WSS | | 75 | |
| 2008/01 | Quang Ninh | SPL III | HAI HA WSS | 48.6 | 50 | 74 |
| 2000 | Quang Tri | SPL I | Ho Xa WSS | 60 | | 135 |
| 2001/01 | Quang Tri | SPL I | Lao Bao WSS | 54 | | 222 |
| 2005 | Quang Tri | SPL V | Gio Linh District WSS | 36.4 | | |
| 2006/09 | Quang Tri | SPL III | Hai Lang WSS | 10.2 | | 103 |
| 2008/06 | Quang Tri | SPL IV | Cam Lo WSS | 25 | | 125 |
| 2008/09 | Quang Tri | SPL IV | Ben Quan WSS | 28.9 | | 962 |
| 2008 | Soc Trang | SPL V | Phu Loc Town WSS | | | |
| 2008 | Soc Trang | SPL IV | My Xuyen WSS | | 95 | 210 |
| 2005/01 | Son La | SPL III | Moc Chau WSS | 85.7 | 95 | |
| 2010/04 | Son La | SPL V | Sop Cop Town WSS | 50 | 50 | 122 |
| 2005 | Tay Ninh | SPL III | Go Dau WSS | | | 469 |
| 2006/07 | Thai Binh | SPL III | Kien Xuong WSS | 52.9 | 45 | 123 |
| 2009/04 | Thai Nguyen | SPL V | TRAI CAU Town WSS | 50 | 30 | 67 |
| 2010/01 | Thai Nguyen | SPL IV | DAI TU WSS | 25 | 30 | 150 |
| 2006 | Thanh Hoa | SPL III | Ha Trung WSS | 65.4 | | 210 |
| 2008/09 | Thanh Hoa | SPL IV | Rung Thong WSS (Dong Son) | 31.7 | | 105 |
| 2008/04 | Thanh Hoa | SPL V | Hau Loc WSS | 71.4 | | |
| 2008/12 | Thanh Hoa | SPL IV | Thuong Xuan WSS | | | |
| 2009/12 | Thanh Hoa | SPL IV | Nhu Thanh WSS | 42 | | 57 |
| 2000 | Thua-Thien Hue | SPL I | Chan My WSS | 50 | | 267 |
| 2007/07 | Thua-Thien Hue | SPL III | Phu Bai WSS | 90.9 | | 50 |
| 2009/04 | Thua-Thien Hue | SPL V | Khe Tre WSS | 70 | | 186 |
| 2003 | Tra Vinh | SPL IV | Cau Quan WSS | | | |
| 2003 | Tra Vinh | SPL IV | Cau Ke WSS | | | |
| 2006 | Vinh Long | SPL III | Tra On WSS | 77 | | |
| 2002 | Vinh Phuc | SPL III | Yen Lac WSS | 6.7 | | 250 |
| 2007/02 | Yen Bai | SPL III | Mau A WSS | 60 | 50 | 88 |

Coverage based on consumer households (hh)=hh connceted with WSS/Totan hh in the service area x 100
Current Per Capita Consumption = Average water supply / (hh connected with WSS x average member of hh or poulation served)

# Appendix ws.5.6 Operation, Maintenance and Management Organization Structure of Water Supply Systems

(1/5)

| Start-up | Province | Phase | WSS | OM/M organization | Capacity (m3/day) | Water Source | Number of Staff | Remarks | Organization: Director / Team Leader | Vice Director / Team Leader | Technician | Accountant | Operation | Distribution Control | Bill Collection | Contruction | Administration | Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | An Giang | SPL III | Tri Ton WSS | WSB | 2000 | surface water | 38 | | | | | | | | | | | |
| 2010/01 | Bac Giang | SPL V | An Chau Town WSS | DWSU | 950 | stagnant water | 5 | team leader, accoutant, three (3) for bill collection, opertion and distribution pipelines control | 1 | | | 1 | 3 | | | | | |
| 2005/10 | Bac Kan | SPL IV | Yen Han WSS | CPC | 278 | surface water | 10 | Vice chairman of CPC is responsible person. One team of three members (one person is the leader) takes charge of one system. | 1 | 3 | | | 6 | | | | | |
| 2009/08 | Bac Lieu | SPL V | Ngan Dua WSS | PCERWAS | 1800 | groundwater | 3 | 3 with assistance by the CERWAS | | | | | 3 | | | | | |
| 2006/09 | Bac Ninh | SPL III | Luong Tai WSS | WSB | 2500 | surface water | 15 | responsible person (it is not called as director), vice responsible person, technician, four (4) operators, three (3) for meter reading and bill collection, two (2) for distribution pipelines control, two (2) for installation, one (1) staff in the administration | 1 | 1 | 1 | | 4 | 2 | 3 | 2 | 1 | |
| 2009/06 | Binh Dinh | SPL V | Phu Phong Town WSS | DWSU | 2000 | infiltration | 7 | 1 head 3 for operation and 3 for bill collection | 1 | | | | 3 | | | | | |
| 2009/04 | Dac Lak | SPL IV | Quang Phu WSS | WSB | 3000 | groundwater | 9 | 1 leader (manager), 1 sub-leader (technician), 3 accountant for accounting, money keeping and bill collection and 4 operators | 1 | 1 | | 3 | 4 | | 1 | | | |
| 2003 | Dac Lak | SPL I | Buon Ho WSS | WSB | 3000 | groundwater | 12 | 1 leader (manager), 1 sub-leader, 2 technicians, 2 accountants, 6 operators for pumps, distribution pipeline network, bill collection, etc. | 1 | 1 | 2 | 2 | 6 | | | | | |
| 2006/09 | Dien Bien | SPL III | Tuan Giao WSS | PWSU | 2500 | spring | 18 | Management Board: 3 (managere, vice manager, technician) Network control including bill collection: 7, operation of treatment plant: 4, repair and house connection: 4 regarding accounting, OM/M org. entrusts it to PWSC. (Current water charge is new and it can afford to pay for the cost of accounting but it is not executed.) | 1 | 1 | 1 | | 4 | 7 | | 4 | | |
| 2010/05 | Dien Bien | SPL V | Muong Cha WSS | WSB | 1000 | surface water | 6 | Team Leader, 3 operators and 2 staffs for network control and bill collection | 1 | | | | 3 | 2 | | | | |
| 2008/06 | Dien Bien | SPL IV | Tua Chua WSS | WSB | 2000 | spring | 8 | 1 leader, 3 operator, 2 network control, 2 bill collection besides 8, there 2 watchmen on a contract basis | 1 | | | | 3 | 2 | 2 | | 2 | |
| 2000 | Gia Lai | SPL I | Chu Pah WSS | DWSU | 1970 | groundwater | 3 | 1 responsible person in charge of cost estimation of house connection, 2 workers for OM/M, house connection works and bill collection. Though WSS necessitates 4 workers but it can not afford to pay for them. | 1 | | | | 2 | | | | | |
| 2007/12 | Ha Giang | SPL IV | Vi Xuyen WSS | DWSU | 2000 | surface water | 25 | Water sector: 18, Sewerage and other sectors: 7, Water Sector; five (5) administration, four (4) operators, three (3) for network control, three (3) for bill collection and three (3) for installation and repair | 1 | | | | 4 | 3 | 3 | 3 | 5 | |
| 2003/02 | Ha Giang | SPL I | Bac Quang WSS | DWSU | 2000 | surface water | 15 | four (4) for office (director and three (3) staffs), three (3) operatos, five (5) for installation and construction (hh conection) and three (3) for bill collection | 1 | | | | 3 | | 3 | 5 | 3 | |

Note: Figure in parentheses means the number of staffs who work for another tasks concurrently.

## Appendix ws.5.6 Operation, Maintenance and Management Organization Structure of Water Supply Systems



| Start-up | Province | Phase | WSS | OM/M organization | Capacity (m3/day) | Water Source | Number of Staff | Remarks | Organization: Director / Team Leader | Vice Director / Team Leader | Technician | Accountant | Operation | Distribution Control | Bill Collection | Contruction | Administration | Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | Ha Noi (Including former Ha Tay) | SPL III | Phu Xuyen WSS | PWSU | 2000 | groundwater | 11 | team leader, technician, accountant and administrative matters, and eight (8) staffs with two (2) shifts (4 x 2) | 1 | | 1 | 1 | | 8 | | | | |
| 2002 | Ha Tinh | SPL I | Ky Anh WSS | Economic Zone Water Supply Center | 3000 | stagnant water | 51 | 51 with Vung An | | | | | | | | | | |
| 2009/12 | Ha Tinh | SPL III | Vung An WSS | Economic Zone Water Supply Center | 9000 | stagnant water | 51 | 51 with Ky Anh | | | | | | | | | | |
| 2006/11 | Ha Tinh | SPL III | Vu Quang | WSB | 2000 | surface water | 4 | one (1) director, two (2) operators and one (1) watchman | 1 | | | | | 2 | | | 1 | |
| 2009/03 | Ha Tinh | SPL IV | Nghen Town WSS | DWSU | 3000 | surface water | 22 | | | | | | | | | | | |
| 2006/01 | Hai Duong | SPL III | Sao Do WSS | WSB | 4000 | groundwater | 30 | a director, two (2) vice directors, two (2) technicians, an accounant, a storekeeper and chashier, a driver, five (5) operators for SAO DO, five (5) distribution pipelines controll and bill collection for SAO DO, eight (8) and four (4) for other two WSSs. | 1 | 2 | 2 | 1 | 5 | 5 | | | 2 | |
| 2006/02 | Hai Phong | SPL III | Vinh Bao WSS | WSB | 2500 | surface water | 26 | director, vice director, an accountant, four (4) staffs of administration, five (5) for construction, network repair and house connection, seven (7) for meter reading and bill collection and one (1) for laboratory | 1 | 1 | | 1 | | (5) | 7 | (5) | 4 | 1 |
| 2005/12 | Kon Tum | SPL III | Kon Plong WSS | DWSU | 1000 | surface water | 5 | 1 leader 4 staffs for OM/M and bill collecting | 1 | | | | | 4 | | | | |
| 2009/02 | Lai Chau | SPL V | Phong Tho WSS (WEST) | WSB | 1000 | surface water | 7 | one leader, two for network and bill collection and four operator staff will be increased later. | 1 | | | | 4 | 2 | | | | |
| 2004 | Lai Chau | SPL IV | Than Uyen WSS | WSB | 1000 | surface water | 14 | one director, one vice director, one accountant, one storage keeper, six installation, pipeline network control, bill collection, four operators for treatment | 1 | 1 | | 1 | 4 | | 6 | | 1 | |
| 2007/06 | Lai Chau | SPL III | Tam Duong (Binh Lu) WSS | WSB | 1000 | surface water | 5 | one leader, one bill collection, one network control and repair and two operator and hh connections | 1 | | | | (2) | 1 | 1 | (2) | | |
| 2010/01 | Lam Dong | SPL V | Loc Thang Town WSS | WSB | 3400 | groundwater | 18 | 1 direcctor, 1 technician, 1 accountant, 5 for bill collection, 8 for operation and 2 for house connections. | 1 | | 1 | 1 | | 8 | 5 | 2 | | |
| 2007/07 | Lao Cai | SPL IV | Bac Ha WSS | WSB | 1500 | surface water | 13 | one director, one vice director, one accountant, six operators and four in charge of distribution network and bill collection | 1 | 1 | | 1 | 6 | 4 | | | | |
| 2006/03 | Lao Cai | SPL III | Muong Khuong WSS | WSB | 1500 | surface water | 12 | one (1) director, one (1) vice director, accountant, five (5) operators, three (3) for network control and hh connection, and one (1) for bill collection | 1 | 1 | | 1 | 5 | (3) | 1 | (3) | | |
| 2009/09 | Nghe An | SPL V | Nghia Dan WSS (THAI HOA) | N/I | 4000 | surface water | 19 | 19: 16 worked for project implementation and still they have salary from town | | | | | | | | | | |

Note: Figure in parentheses means the number of staffs who work for another tasks concurrently.

## Appendix ws.5.6 Operation, Maintenance and Management Organization Structure of Water Supply Systems



| Start-up | Province | Phase | WSS | OM/M organization | Capacity (m3/day) | Water Source | Number of Staff | Remarks | Organization: Director / Team Leader | Vice Director / Team Leader | Technician | Accountant | Operation | Distribution Control | Bill Collection | Contruction | Administration | Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 | Nghe An | SPL I | Cua Lo WSS | Company | 3000 | groundwater | 50 | 8 operators in which 5 for raw water PS and 3 for WTP, 7 for Administration in which one (1) director, one (1) vice director, one (1) chief accountant with two (2) staffs, , 6 for customers section, 6 for bill collection, 7 for pipe installation, 2 for service, one (1) driver and 10 for producing bottled water. (3 shifts per 8 hours) | 1 | 1 | | 1 | 8 | (7) | 6 | (7) | 21 | |
| 2008/12 | Nghe An | SPL IV | Yen Thanh WSS | DWSU | 2000 | surface water | 16 | 16 in which two (2) are part-timer, six (6) for administration, three (3) for electricity and seven (7) for operation | | | | | 10 | | | | 6 | |
| 2009/06 | Nghe An | SPL IV | Nam Dan WSS | WSB | 2000 | surface water | 9 | three (3) belongs to MB and six (6) operators | 3 | | | | 6 | | | | | |
| 2003 | Ninh Binh | SPL I | Kim Son WSS | WSB | 3000 | surface water | 14 | director, operation team (leader and six (6) operators), installation team (leader and two (2) staffs), two (2) for bill collection, one (1) for general affairs (documentation on house connection, stock of chemicals, etc.) | 1 | 2 | | | 6 | | 2 | 2 | 1 | |
| 2009/09 | Ninh Thuan | SPL V | My Tuong WSS | PCERWAS | 1103 | stagnant water | 3 | 1 team leader, 2 operators for all works (house connections, bill collection, OM/M). CERWAS has 32 water supply stations. | 1 | | | | 2 | | | | | |
| 2009/03 | Phu Tho | SPL III | Ha Hoa WSS | DWSU | 3000 | surface water | 26 | head, vice head, four (4) for administration of Management Board (MB), five (5) operators, five (5) for laboratory, six (6) for network control and hhs connections, two (2) for bill collection and two (2) watchmen. | 1 | 1 | | | 5 | (6) | 2 | (6) | 6 | 5 |
| 2009/07 | Phu Tho | SPL IV | SONG THAO WSS | WSB | 2000 | surface water | 12 | director, technician, person for personnel affairs and bill colleciton (meter reading), watchman, three (3) operators, four (4) for construction works and person for distribuiton pipelines | 1 | | 1 | | 3 | (4) | 1 | (4) | 1 | |
| 2001 | Phu Tho | SPL I | Phu Tho WSS | WSB | 10000 | surface water | 59 | 59 (administration: 11 (driver, watchmen, Management Board, accountant, storage keeper, technician), Operation: 15, Treatment and Laboratory: 8, network control: 9, Construction & Installation: 7, Bill Collectio: 9) | | | 1 | 1 | (23) | 9 | 9 | 7 | 9 | (23) |
| 2009/12 | Phu Tho | SPL IV | Thanh Ba WSS | WSB | 2000 | another WSS | 22 | director, technician, person for service (in the office), two (2) for bill collection, two (2) watchmen, six (6) for construction & installation and nine (9) operator (pump and distribution pipelines) | 1 | | 1 | | 9 | | 2 | 6 | 2 | |
| 2007 | Phu Yen | SPL IV | Phu Hoa WSS | WSB | 2000 | infiltration | 7 | Station leader:1, Pipeline service: 2, Pumping station:2, Treatment area:2 | 1 | | | | 4 | 2 | | | | |
| 2005 | Phu Yen | SPL III | Cung Son-Son Hoa WSS | WSB | 2000 | surface water | 11 | Station leader: 1 , Vice leader: 1, Technician: 1, Pipeline service: 2, Pumping station: 2, Treatment area: 2, Water analysis:1, Bill collection:1 | 1 | 1 | 1 | | 4 | 2 | 1 | | | 1 |
| 2005/06 | Quang Binh | SPL III | Minh Hoa WSS | WSB | 2000 | surface water | 6 | | | | | | | | | | | |
| 2009/02 | Quang Nam | SPL IV | Nam Phuoc WSS | WSB | 3000 | surface water and groundwater | 14 | | | | | | | | | | | |

Note: Figure in parentheses means the number of staffs who work for another tasks concurrently.

## Appendix ws.5.6 Operation, Maintenance and Management Organization Structure of Water Supply Systems

| Start-up | Province | Phase | WSS | OM/M organization | Capacity (m3/day) | Water Source | Number of Staff | Remarks | Organization | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Director / Team Leader | Vice Director / Team Leader | Technician | Accountant | Operation | Distribution Control | Bill Collection | Contruction | Administration | Laboratory |
| 2004 | Quang Nam | SPL I | Thang Binh WSS | WSB | 2500 | surface water | 16 | | | | | | | | | | | |
| 2007/02 | Quang Ngai | SPL III | Duc Pho WSS | WSB | 2000 | groundwater | 8 | 1 leader, 1 sub-leader, 6 staffs | 1 | 1 | | | 6 | | | | | |
| 2001 | Quang Ninh | SPL I | Dong Trieu WSS | WSB | 2000 | groundwater | 23 | head, vice head, 14 operatiors for WTP and two (2) wells, two (2) for bill collection, five (5) for distribution pipelines control | 1 | 1 | | | 16 | 5 | 2 | | | |
| Jan-08 | Quang Ninh | SPL III | HAI HA WSS | WSB | 3000 | surface water | 9 | Team leader, Vice leader and seven (7) staffs. Mong Cai Water Supply Enterprise has 60 staffs. (Preparation of bill is made by PWSC for all the WSSs in the province.) | 1 | 1 | | | 7 | | | | | |
| 2006/09 | Quang Tri | SPL III | Hai Lang WSS | WSB | 2500 | surface water | 11 | | | | | | | | | | | |
| 2008/06 | Quang Tri | SPL IV | Cam Lo WSS | WSB | 2000 | surface water | 15 | | | | | | | | | | | |
| 2001/01 | Quang Tri | SPL I | Lao Bao WSS | WSB | 3000 | surface water | 18 | | | | | | | | | | | |
| 2000 | Quang Tri | SPL I | Ho Xa WSS | WSB | 2000 | groundwater | 15 | | | | | | | | | | | |
| 2008/09 | Quang Tri | SPL IV | Ben Quan WSS | WSB | 2000 | surface water | 8 | | | | | | | | | | | |
| 2010/04 | Son La | SPL V | Sop Cop Town WSS | WSB | 1750 | surface water | 6 | 1 director, 2 operators, 2 for network control, 1 bill collection | 1 | | | | 2 | 2 | 1 | | | |
| 2005/01 | Son La | SPL III | Moc Chau WSS | WSB | 1500 | surface water | 10 | 1 director, 2 pump operator, 7 pipeline control and bill collection. Director and/or one staff for pipeline network control and bill collection takes charge of monthly financial reporting. | 1 | | | | 2 | 7 | | | | |
| 2005 | Tay Ninh | SPL III | Go Dau WSS | WSB | 5000 | groundwater | 10 | | | | | | | | | | | |
| 2006/07 | Thai Binh | SPL III | Kien Xuong WSS | WSB | 2000 | surface water | 17 | director, assitant director, three (3) for distribution pipelines, 10 for operation (five (5) for bill collection, three (3) operators, one (1) accountant and one (1) store keeper & cashier | 1 | 1 | | 1 | 3 | 3 | 5 | | 1 | |
| 2010/01 | Thai Nguyen | SPL IV | DAI TU WSS | WSB | 2500 | surface water | 12 | director, ecomist, technician, nine (9) staffs for every tasks (Now, administration checks the ability of staffs who shifted from the organization managed by PMU.) | 1 | | 1 | 1 | 9 | | | | | |
| 2009/04 | Thai Nguyen | SPL V | TRAI CAU Town WSS | WSB | 960 | groundwater | 11 | director, technician, five (5) operators, two (2) persons for repair and installation of distribution pipelines and two (2) for bill collection | 1 | | 1 | | 5 | | 2 | 2 | | |
| 2008/04 | Thanh Hoa | SPL V | Hau Loc WSS | DWSU | 2000 | surface water | 8 | | | | | | | | | | | |
| 2009/12 | Thanh Hoa | SPL IV | Nhu Thanh WSS | DWSU | 1500 | surface water | 6 | 2 pesons from DPC | | | | | | | | | | |
| 2006 | Thanh Hoa | SPL III | Ha Trung WSS | DWSU | 2000 | groundwater | 15 | | | | | | | | | | | |

Note: Figure in parentheses means the number of staffs who work for another tasks concurrently.

## Appendix ws.5.6 Operation, Maintenance and Management Organization Structure of Water Supply Systems

| Start-up | Province | Phase | WSS | OM/M organization | Capacity (m3/day) | Water Source | Number of Staff | Remarks | Organization: Director / Team Leader | Vice Director / Team Leader | Technician | Accountant | Operation | Distribution Control | Bill Collection | Contruction | Administration | Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007/07 | Thua-Thien Hue | SPL III | Phu Bai WSS | WSB | 5000 | groundwater | 28 | 7 + 21 common to PHU BAI, KHE TRE and CHANG MAI for water rate collection, etc. | | | | | | | | | | |
| 2000 | Thua-Thien Hue | SPL I | Chan My WSS | WSB | 6000 | surface water | 30 | 9 + 21 common to PHU BAI, KHE TRE and CHANG MAI for water rate collection, etc. | | | | | | | | | | |
| 2009/04 | Thua-Thien Hue | SPL V | Khe Tre WSS | WSB | 2000 | surface water | 26 | 5 + 21 common to PHU BAI, KHE TRE and CHANG MAI for water rate collection, etc. | | | | | | | | | | |
| 2002 | Vinh Phuc | SPL III | Yen Lac WSS | WSB | 3000 | groundwater | 12 | director, five (5) technical and business (bill collection etc.), two (2) for finance and four (4) for construction | 1 | | | | 5 | | | 4 | 2 | |
| 2007/02 | Yen Bai | SPL III | Mau A WSS | Company | 2000 | surface water | 10 | 1 team leader, 1 sub-team leader, 4 operators for treatment plant, 4 pipelines contraol and bill collection (Company has 25 personnel of 1 director, 1 vice director, 2 personnel and financial department, 4 technicians, 7 for management of agriculture works and 10 for water supply. (Fuctions of the Company are exploitation and management of irrigation, water supply, consulting and design, and contruction. | 1 | 1 | | | 4 | 4 | | | | |

Note: Figure in parentheses means the number of staffs who work for another tasks concurrently.

# Appendix ws.6.1 Performance of Water Supply Systems

(1/2)

| Province | Phase | WSS | Startup Year | Capacity (A) ($m^3$/day) | Average Daily Wate Supply (B) ($m^3$/day) | Rate of Facility Utilization (B)/(A) (%) | years from start-up year | assumed target rate of (C) (D) (%) | Difference (C)-(D) (%) |
|---|---|---|---|---|---|---|---|---|---|
| An Giang | SPL III | Tri Ton | 2005 | 2000 | 3500 | 175.0 | 6 | 68 | 107.0 |
| Bac Giang | SPL V | An Chau Town | 2010 | 950 | 300 | 31.6 | 1 | 53 | -21.4 |
| Bac Kan | SPL IV | Yen Han | 2005 | 278 | | 0.0 | 6 | 68 | -68.0 |
| Bac Lieu | SPL V | Ngan Dua | 2009 | 1800 | 600 | 33.3 | 2 | 56 | -22.7 |
| Bac Ninh | SPL III | Luong Tai | 2006 | 2500 | 1200 | 48.0 | 5 | 65 | -17.0 |
| Binh Dinh | SPL V | Phu Phong Town | 2009 | 2000 | 150 | 7.5 | 2 | 56 | -48.5 |
| Dac Lak | SPL I | Buon Ho | 2003 | 3000 | 2000 | 66.7 | 8 | 74 | -7.3 |
| Dac Lak | SPL IV | Quang Phu | 2009 | 3000 | 1000 | 33.3 | 2 | 56 | -22.7 |
| Dien Bien | SPL III | Tuan Giao | 2006 | 2500 | 2400 | 96.0 | 5 | 65 | 31.0 |
| Dien Bien | SPL IV | Tua Chua | 2008 | 2000 | 1250 | 62.5 | 3 | 59 | 3.5 |
| Dien Bien | SPL V | Muong Cha | 2010 | 1000 | 150 | 15.0 | 1 | 53 | -38.0 |
| Gia Lai | SPL I | Chu Pah | 2000 | 1970 | 280 | 14.2 | 11 | 83 | -68.8 |
| Ha Giang | SPL I | Bac Quang | 2003 | 2000 | 1500 | 75.0 | 8 | 74 | 1.0 |
| Ha Giang | SPL IV | Vi Xuyen | 2007 | 2000 | 1550 | 77.5 | 4 | 62 | 15.5 |
| Ha Noi (Ha Tay) | SPL III | Phu Xuyen | 2008 | 2000 | 870 | 43.5 | 3 | 59 | -15.5 |
| Ha Tinh | SPL I | Ky Anh | 2002 | 3000 | 2200 | 73.3 | 9 | 77 | -3.7 |
| Ha Tinh | SPL III | Vu Quang | 2006 | 2000 | 200 | 10.0 | 5 | 65 | -55.0 |
| Ha Tinh | SPL III | Vung An | 2009 | 9000 | 5000 | 55.6 | 2 | 56 | -0.4 |
| Ha Tinh | SPL IV | Nghen Town | 2009 | 3000 | 1400 | 46.7 | 2 | 56 | -9.3 |
| Hai Duong | SPL III | Sao Do | 2006 | 4000 | 1700 | 42.5 | 5 | 65 | -22.5 |
| Hai Phong | SPL III | Vinh Bao | 2006 | 2500 | 2000 | 80.0 | 5 | 65 | 15.0 |
| Hau Giang | SPL III | Vi Thanh | 2002 | 16000 | 9000 | 56.3 | 9 | 77 | -20.7 |
| Kien Giang | SPL III | Giong Gieng | 2003 | 2400 | 1500 | 62.5 | 8 | 74 | -11.5 |
| Kon Tum | SPL III | Kon Plong | 2005 | 1000 | 450 | 45.0 | 6 | 68 | -23.0 |
| Lai Chau | SPL IV | Than Uyen | 2004 | 1000 | 1000 | 100.0 | 7 | 71 | 29.0 |
| Lai Chau | SPL III | Tam Duong (Binh Lu) | 2007 | 1000 | 750 | 75.0 | 4 | 62 | 13.0 |
| Lai Chau | SPL V | Phong Tho (WEST) | 2009 | 1000 | 550 | 55.0 | 2 | 56 | -1.0 |
| Lam Dong | SPL I | Bao Loc | 2003 | 7500 | 6500 | 86.7 | 8 | 74 | 12.7 |
| Lam Dong | SPL V | Loc Thang Town | 2010 | 3400 | 1700 | 50.0 | 1 | 53 | -3.0 |
| Lao Cai | SPL III | Muong Khuong | 2006 | 1500 | 750 | 50.0 | 5 | 65 | -15.0 |
| Lao Cai | SPL IV | Bac Ha | 2007 | 1500 | 675 | 45.0 | 4 | 62 | -17.0 |
| Nghe An | SPL I | Cua Lo | 2002 | 3000 | 2600 | 86.7 | 9 | 77 | 9.7 |
| Nghe An | SPL IV | Yen Thanh | 2008 | 2000 | 750 | 37.5 | 3 | 59 | -21.5 |
| Nghe An | SPL V | Nghia Dan (Thai Hoa) | 2009 | 4000 | 700 | 17.5 | 2 | 56 | -38.5 |
| Nghe An | SPL IV | Nam Dan | 2009 | 2000 | 500 | 25.0 | 2 | 56 | -31.0 |
| Ninh Binh | SPL I | Kim Son | 2003 | 3000 | 1000 | 33.3 | 8 | 74 | -40.7 |
| Ninh Thuan | SPL V | My Tuong | 2009 | 1103 | 400 | 36.3 | 2 | 56 | -19.7 |
| Phu Tho | SPL I | Phu Tho | 2001 | 10000 | 8000 | 80.0 | 10 | 80 | 0.0 |
| Phu Tho | SPL IV | Song Thao | 2009 | 2000 | 550 | 27.5 | 2 | 56 | -28.5 |
| Phu Tho | SPL IV | Thanh Ba | 2009 | 2000 | 650 | 32.5 | 2 | 56 | -23.5 |
| Phu Tho | SPL III | Ha Hoa | 2009 | 3000 | 1650 | 55.0 | 2 | 56 | -1.0 |
| Phu Yen | SPL III | Cung Son - Son Hoa | 2005 | 2000 | 1200 | 60.0 | 6 | 68 | -8.0 |

# Appendix ws.6.1 Performance of Water Supply Systems

(2/2)

| Province | Phase | WSS | Startup Year | Capacity (A) ($m^3$/day) | Average Daily Wate Supply (B) ($m^3$/day) | Rate of Facility Utilization (B)/(A) (%) | years from start-up year | assumed target rate of (C) (D) (%) | Difference (C)-(D) (%) |
|---|---|---|---|---|---|---|---|---|---|
| Phu Yen | SPL IV | Phu Hoa | 2007 | 2000 | 200 | 10.0 | 4 | 62 | -52.0 |
| Quang Binh | SPL III | Minh Hoa | 2005 | 2000 | 1500 | 75.0 | 6 | 68 | 7.0 |
| Quang Nam | SPL I | Thang Binh | 2004 | 2500 | 1900 | 76.0 | 7 | 71 | 5.0 |
| Quang Nam | SPL IV | Nam Phuoc | 2009 | 3000 | 400 | 13.3 | 2 | 56 | -42.7 |
| Quang Ngai | SPL III | Duc Pho | 2007 | 2000 | 800 | 40.0 | 4 | 62 | -22.0 |
| Quang Ninh | SPL I | Dong Trieu | 2001 | 2000 | 1900 | 95.0 | 10 | 80 | 15.0 |
| Quang Ninh | SPL III | Hai Ha | 2008 | 3000 | 300 | 10.0 | 3 | 59 | -49.0 |
| Quang Tri | SPL I | Ho Xa | 2000 | 2000 | 1132 | 56.6 | 11 | 83 | -26.4 |
| Quang Tri | SPL I | Lao Bao | 2001 | 3000 | 3000 | 100.0 | 10 | 80 | 20.0 |
| Quang Tri | SPL V | Gio Linh District | 2005 | 15000 | 7000 | 46.7 | 6 | 68 | -21.3 |
| Quang Tri | SPL III | Hai Lang | 2006 | 2500 | 400 | 16.0 | 5 | 65 | -49.0 |
| Quang Tri | SPL IV | Cam Lo | 2008 | 2000 | 250 | 12.5 | 3 | 59 | -46.5 |
| Quang Tri | SPL IV | Ben Quan | 2008 | 2000 | 1000 | 50.0 | 3 | 59 | -9.0 |
| Soc Trang | SPL V | Phu Loc Town | 2008 | 3000 | 1500 | 50.0 | 3 | 59 | -9.0 |
| Soc Trang | SPL IV | My Xuyen | 2008 | 4000 | 4500 | 112.5 | 3 | 59 | 53.5 |
| Son La | SPL III | Moc Chau | 2005 | 1500 | 2000 | 133.3 | 6 | 68 | 65.3 |
| Son La | SPL V | Sop Cop Town | 2010 | 1750 | 300 | 17.1 | 1 | 53 | -35.9 |
| Tay Ninh | SPL III | Go Dau | 2005 | 5000 | 3000 | 60.0 | 6 | 68 | -8.0 |
| Thai Binh | SPL III | Kien Xuong | 2006 | 2000 | 650 | 32.5 | 5 | 65 | -32.5 |
| Thai Nguyen | SPL V | Trai Cau Town | 2009 | 960 | 150 | 15.6 | 2 | 56 | -40.4 |
| Thai Nguyen | SPL IV | Dai Tu | 2010 | 2500 | 300 | 12.0 | 1 | 53 | -41.0 |
| Thanh Hoa | SPL III | Ha Trung | 2006 | 2000 | 1100 | 55.0 | 5 | 65 | -10.0 |
| Thanh Hoa | SPL IV | Rung Thong (Dong Son) | 2008 | 5000 | 1000 | 20.0 | 3 | 59 | -39.0 |
| Thanh Hoa | SPL V | Hau Loc | 2008 | 2000 | 300 | 15.0 | 3 | 59 | -44.0 |
| Thanh Hoa | SPL IV | Thuong Xuan | 2008 | 1500 | | 0.0 | 3 | 59 | -59.0 |
| Thanh Hoa | SPL IV | Nhu Thanh | 2009 | 1500 | 120 | 8.0 | 2 | 56 | -48.0 |
| Thua-Thien Hue | SPL I | Chan My | 2000 | 6000 | 2000 | 33.3 | 11 | 83 | -49.7 |
| Thua-Thien Hue | SPL III | Phu Bai | 2007 | 5000 | 2500 | 50.0 | 4 | 62 | -12.0 |
| Thua-Thien Hue | SPL V | Khe Tre | 2009 | 2000 | 650 | 32.5 | 2 | 56 | -23.5 |
| Tra Vinh | SPL IV | Cau Quan | 2003 | 720 | 360 | 50.0 | 8 | 74 | -24.0 |
| Tra Vinh | SPL IV | Cau Ke | 2003 | 1200 | 480 | 40.0 | 8 | 74 | -34.0 |
| Vinh Long | SPL III | Tra On | 2006 | 2500 | 1390 | 55.6 | 5 | 65 | -9.4 |
| Vinh Phuc | SPL III | Yen Lac | 2002 | 3000 | 400 | 13.3 | 9 | 77 | -63.7 |
| Yen Bai | SPL III | Mau A | 2007 | 2000 | 700 | 35.0 | 4 | 62 | -27.0 |

# Irrigation Sector

## Appendix ir.4.1 Outline of Facilities

(1/2)

| Province | SPL | Facility Name (Informality) | Project Owner 1) | Main Purose 2) | Major Facility of Project 3) | Major Facility under SPL 3) | Construction Year 1) | Present Condition 4) |
|---|---|---|---|---|---|---|---|---|
| Bac Giang | V | Khuon Than | IMC | I | Dam, Canal | Canal | 2007-2009 | Completed |
| Bac Kan | IV | Phieng Luong | DPC | I,W | Intake, Canal, Tank, Pipe | Intake, Canal, Tank, Pipe | 2006-2007 | Completed |
| Bac Kan | IV | Cho Don District | DARD | I | Dam, Canal | Dam, Canal | 2005-2007 | Completed |
| Bac Kan | V | Cho Moi | DARD | I | Dam, Canal | Dam, Canal | 2009-2010 | Completed |
| Bac Lieu | V | 30/4 Area of C.P. | DARD | Is | Canal | Canal | 2007-2009 | Completed |
| Binh Dinh | III | Tan An-Dap Da | DARD | I | Dam, PS, Canal | Dam | 2000-2002 | Completed |
| Binh Dinh | V | Tam Son | DPC | I | Dam, Canal | Dam, Canal | 2008-2009 | Completed |
| Binh Dinh | V | Suoi So | DPC | I | Dam, Canal | Dam | 2008-2009 | Completed |
| Binh Dinh | V | Chi Hoa2 | DPC | I | Dam, Canal | Dam | 2011-2011 | D/D |
| Ca Mau | V | Lung Ranh | DARD | Ir | Sluiceway | Sluiceway | 2006-2007 | Completed |
| Cao Bang | V | Luong Thong | DPC | I | Dam, Canal | Dam, Canal | 2006-2010 | Completed |
| Dak Lac | III | Buon Chua | DARD | I | PS, Canal | PS | 2001-2003 | Completed |
| Dak Lac | III | Ea Yeng | DPC | I | Dam, Canal | Dam, Canal | 2001-2001 | Completed |
| Dak Lac | III | Nam Kar | DARD | I | Dam, Canal | Dam | 2000-2002 | Completed |
| Dak Lac | IV | Ea Bin | DARD (D) DPC (C) | I | Dam, Canal | Dam, Canal | 2003-2003 (D) 2007-2010 (C) | Completed |
| Dak Lac | V | Ho Ke | DPC | I | Dam, Canal | Dam, Canal | 2010-2010 | Construction |
| Dak Nong | III | Dak Mam | PPC | I | Dam, Canal | Dam, Canal | 2003-2004 | Completed |
| Dak Nong | V | Electric P.S. | PPC | I | PS, Canal | PS, Canal | 2007-2009 | Completed |
| Dien Bien | V | Huoi Un | DARD | I | Dam, Canal | Dam, Canal | 2009-2010 | Construction |
| Dong Thap | V | Upgrade Tam Nong | DPC | I | Canal | Canal | 2008-2009 | Completed |
| Gia Lai | III | Cau Hai | DPC | I | PS, Canal | PS, Canal | 2001-2002 | Completed |
| Gia Lai | III | EaRsai | DARD | I | Dam, Canal | Dam, Canal | 2001-2001 | Completed |
| Gia Lai | V | Eaur | DPC | I | Dam, Canal | Dam, Canal | 2010-2011 | Construction |
| Ha Giang | V | Khuoi Lam-Khuoi Lac | DPC | I | Dam, Canal | Dam, Canal | 2008-2010 | Completed |
| Ha Tinh | III | Song Rac | IMC | I | Dam, Canal | Canal | 2001-2002 | Completed |
| Ha Tinh | IV | An Hung | DPC | I | Dam, Canal | Dam, Canal | 2003-2004 | Completed |
| Ha Tinh | IV | Cau Ke | DPC | I | Dam, Canal | Dam | 2004-2005 | Completed |
| Ha Tinh | IV | Khe Coi | DPC | I | Dam, Canal | Dam, Canal | 2004-2004 | Completed (portion not yet constructed) |
| Ha Tinh | IV | 19/5 | DPC | I | Dam, PS, Canal, Dyke | Dam, Canal, Dyke | 2003-2003 | Completed |
| Ha Tinh | IV | Lien Minh-Tung Chau | DPC | I | PS, Canal, Gate | PS, Canal, Gate | 2004-2004 | Completed |
| Ha Tinh | V | Huong Long… | DPC | I | Dam, Canal | Canal | 2006-2009 | Completed |
| Hoa Binh | III | Phu Lao | IMC | I | Dam, Canal | Dam, Canal | 2000-2002 | Completed |
| Hoa Binh | V | Ngoc Luong | IMC | I | Dam, Canal Dyke | Dam, Canal Dyke | 2009-2010 | Completed |
| Kon Tum | III | Dakpoko | DPC | F | RBP | RBP | 2001-2002 | Completed |
| Kon Tum | V | Dak Sia1 | DPC | I | Dam, Canal | Dam | 2008-2009 (D) 2010-2011 (C) | Completed |
| Lai Chau | V | Khun Ha | DPC | I | Dam, Canal | Dam, Canal | 2007-2010 | Construction |
| Lam Dong | III | Da-Don | DARD | I | Dam, Canal | Canal | 2000-2003 | Completed |
| Lam Dong | V | Bo Kabang | DARD | I | Dam, Canal | Dam, Canal | 2006-2007 | Completed |
| Lang Son | V | Thien Ky | DPC | I | Dam, Canal | Dam, Canal | 2007-2008 | Completed |
| Lao Cai | IV | Sin Chai | DPC | I | Dam, Canal | Dam, Canal | 2003-2004 | Completed |
| Lao Cai | V | Nam Chay Irrigation | DARD | I | Dam, Canal | Dam, Canal | 2007-2008 | Completed |
| Nghe An | III | Khe Ngang | DPC | I | Dam, Canal | Dam, Canal | 2005-2006 | Completed |
| Nghe An | IV | Yen Trach-Khe Chet | DPC | I | Dam, Canal | Dam, Canal | 2003-2004 | Completed |
| Nghe An | IV | Ke Coc-Khe Nha | DPC | I | Dam, Canal | Canal | 2007-2007 | Completed |
| Nghe An | IV | Trieu Duong | DPC | I | Dam, Canal | Dam, Canal | 2008-2010 | Construction |
| Ninh Binh | V | Dong Dinh | DPC | D,I | PS, Canal, Dyke | PS, Canal | 2007-2009 | Completed |
| Ninh Thuan | III | Ninh Phuoc | DARD | F | RI | RI | 2003-2004 | Completed |
| Ninh Thuan | IV | Bau Ngu | DARD | I | Dam, Canal | Dam, Canal | 2005-2006 | Completed |
| Ninh Thuan | V | Ta Ranh | DARD | I, W | Dam, Canal, Water Tower | Dam | 2008-2010 | Completed |
| Phu Tho | III | Tam Nong | DPC | I | PS, Canal | PS, Canal | 2000-2001 | Completed |
| Phu Tho | IV | Phuong Mao ( 2nd S.) | DPC | I | Dam, Canal | Dam, Canal | 2000-2005 | Completed |
| Phu Tho | IV | Hoang Hanh | DPC | D,I | PS, Canal, Dyke | PS, Canal, Dyke | 2004-2005 | Completed |
| Phu Tho | IV | Hien Quan | DPC | I,D | PS, Canal | PS, Canal | 2000-2002 | Completed |
| Phu Tho | V | 16 Communes | DPC | D,I | PS, Canal, Sluiceway, Dyke | PS, Canal, Sluiceway, Dyke | 2009-2010 | Construction |

# Appendix ir.4.1 Outline of Facilities



| Province | SPL | Facility Name (Informality) | Project Owner[1)] | Main Purose[2)] | Major Facility of Project[3)] | Major Facility under SPL[3)] | Construction Year[1)] | Present Condition[4)] |
|---|---|---|---|---|---|---|---|---|
| Phu Yen | III | La Bach | DARD | I | Dam, Canal | Dam, Canal | 2005-2010 | Construction |
| Phu Yen | IV | Buon Chao | DPC | I | Dam, Canal | Dam, Canal | 2003-2004 | Completed |
| Phu Yen | V | La Bach (2) | DARD | I | Dam, Canal | Dam, Canal | 2005-2010 | Construction |
| Phu Yen | V | Pump and I. Canal | DPC | I | PS, Canal | PS, Canal | 2010-2010 | D/D |
| Quang Binh | III | Upgrade Cam Li | IMC | I | Dam, Canal | Canal | 2001-2003 | Completed |
| Quang Nam | V | Ho Viet An | PPC | I | Dam, Canal | Canal | 2008-2009 | Completed |
| Quang Ngai | III | Di Lang Irrigatior | DARD | I | Dam, Canal | Dam, Canal | 2002-2008 | Completed |
| Quang Ngai | IV | Suoi Chi | DARD | I | Dam, Canal | Canal | 2005-2006 | Completed |
| Quang Ngai | IV | Ong Toi | DARD | I | Dam, Canal | Dam | 2004-2005 | Completed |
| Quang Ngai | V | Xa Dieu Commune | DARD | I | Dam, Canal | Dam, Canal | 2009-2010 | Completed |
| Quang Tri | IV | Nghia Hy | DARD | I | Dam, Canal | Dam, Canal | 2004-2004 | Completed |
| Quang Tri | IV | Lia | DARD | I | Dam, Canal | Dam, Canal | 2006-2007 | Completed |
| Quang Tri | V | Thac Heo | DARD | I | Dam, Canal | Dam, Canal | 2008-2008 | Completed |
| Thai Nguyen | IV | Ho Nui Coc | DARD | I | Canal | Canal | 2004-2007 | Completed |
| Thai Nguyen | IV | Ho Bao Linh | DARD | I | Dam, PS, Canal, Dyke | Dam, PS, Canal, Dyke | 2003-2009 | Completed |
| Thai Nguyen | V | Minh Lap-Hoa Thuong | DPC | I | PS, Canal | PS, Canal | 2007-2010 | Construction |
| Thanh Hoa | III | Quang Xuong | DPC | I | Headrace, PS, Canal | Headrace, Canal | 2001-2001 | Completed |
| Thanh Hoa | III | Quang Loc | DPC | I | PS, Canal | PS, Canal | 2000-2001 | Completed |
| Thanh Hoa | III | Vung Su | DARD | I | Dam, Canal | Dam | 2000-2002 | Completed |
| Thanh Hoa | IV | Duong Coc | IMC | I | Dam, Canal | Canal | 2004-2005 | Completed |
| Thanh Hoa | IV | Ben Da-Nui Trac | DPC | I | PS, Canal | PS, Canal | 2004-2006 | Completed |
| Thanh Hoa | V | Long Dong | IMC | I | PS, Canal | PS, Canal | 2008-2009 | Completed |
| Thua-Thien | III | Phong Chuong-Cua Lac | IMC | I | Dam, PS, Canal, Bridge | Dam, PS, Canal, Bridge | 2000-2003 | Completed |
| Thua-Thien | V | Dien Hoa-Dien Hai | DPC | I,D | PS, Canal, Gate | PS, Canal, Gate | 2007-2010 | Completed |
| Tra Vinh | IV | Khu B1-Lang The | DARD | I | Canal | Canal | 2003-2006 | Completed |
| Tra Vinh | V | Lang The | DARD | I | Canal | Canal | 2009-2010 | Construction |
| Tuyen Quang | IV | Minh An | DPC | I | PS, Canal | PS, Canal | 2004-2005 | Completed |
| Tuyen Quang | V | Yen Lap Commune | DPC | I | Dam, PS, Canal | Dam, PS, Canal | 2008-2008 | Completed |
| Vinh Long | V | Rach T.-Thien My | DARD | I, D | RI | RI | 2008-2008 | Completed |
| Vinh Phuc | V | Don Nhan | DPC | I | Dam, PS, Canal | Dam, PS, Canal | 2007-2010 | Completed |
| Yen Bai | V | Khe The | DARD | I | Dam, Canal | Dam, Canal | 2007-2009 | Completed |

Note:

1) IMC=Irrigation Management Company, (D)=Dam (Including Head Works), (C)=Canal

2) I=Irrigation, D=Drainage, W=Water Supply, F=Flood Control, Is=Sea Water Utilization for Fishponds, Ir=Rain Water Storage for Irrigation ar

3) PS=Pump Station, RI=River Improvement, RBP=Riverbank Protection

4) As of 13 September 2010

# Appendix ir.4.2 Outline of Major Facility Components Constructed under SPL

| Province | Facility Name (Informality) | Major Facility under SPL[1)] | No. of Dam[2)] | Dam Type[3)] | Dam Height (m)[3)] | Dam Length (m)[3)] | Reservoir Storage Capacity (MCM) | Canal Length (km)[4)] | Major Canal Type[4) 5)] | Purpose of PS (No.)[6)] | Pump Capacity (m3/hr), No. and Type[6) 7)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bac Giang | Khuon | Canal | - | - | - | - | - | 32.2 (I) | B (I) | - | - |
| Bac Kan | Phieng Luong | Intake, Canal, Tank, Pipe | - | - | - | - | - | 2.2 (I) | Cf (I) | - | - |
| Bac Kan | Cho Don District | Dam, Canal | 5 | H | 1.4-3.2 | 13.6-54 | - | 16.1 (I) | Cf (I) | - | - |
| Bac Kan | Cho Moi | Dam, Canal | 11 | 2 (E), 9 (H) | 6.5-20.4 (E), 1.0-2.0 | 30.5-73.5(E), 5- | 0.4 (1 Reservoir) | 10.4 (I) | Cf (I) | - | - |
| Bac Lieu | 30/4 Area of C.P. | Canal | - | - | - | - | - | 76.5 (I cum D) | E (I cum D) | - | - |
| Binh Dinh | Tan An-Dap Da | Dam | 5 | H (4), R (1) | 2.0-3.2 | 18-220 | - | - | - | - | - |
| Binh Dinh | Tam Son | Dam, Canal | 1 | E | 11.5 | 605 | 1.1 | 2.5 (I) | Cf (I) | - | - |
| Binh Dinh | Suoi So | Dam | 1 | E | 10.2 | 1,352 | 1.6 | - | - | - | - |
| Binh Dinh | Chi Hoa2 | Dam | 1 | E | 10 | 590 | 0.6 | - | - | - | - |
| Ca Mau | Lung Ranh | Sluiceway (5.5m x 5.5m x 1no.) | - | - | - | - | - | - | - | - | - |
| Cao Bang | Luong Thong | Dam, Canal | 1 | H | 1.4 | 8 | - | 4.2 (I) | Cf (I) | - | - |
| Dak Lac | Buon Chua | PS | - | - | - | - | - | - | - | I (1) | 1,100, 4 nos. (H)/ |
| Dak Lac | Ea Yeng | Dam, Canal | 1 | E | 10 | 420 | 0.9 | 1.5 (I) | Cb (I) | - | - |
| Dak Lac | Nam Kar | Dam | 1 | E | 13.5 | 165 | 1 | - | - | - | - |
| Dak Lac | Ea Bin | Dam, Canal | 1 | E | 13 | 218 | 1.4 | 3.4 (I) | Cb (I) | - | - |
| Dak Lac | Ho Ke | Dam, Canal | 1 | E | 11.5 | 245 | 1.6 | 7.9 (I) | Cf (I) | - | - |
| Dak Nong | Dak Mam | Dam, Canal | 1 | E | 6 | 80 | 0.6 | 8.0 (I) | Cb (I) | - | - |

# Appendix ir.4.2 Outline of Major Facility Components Constructed under SPL

| Province | Facility Name (Informality) | Major Facility under SPL[1)] | No. of Dam[2)] | Dam Type[3)] | Dam Height (m)[3)] | Dam Length (m)[3)] | Reservoir Storage Capacity (MCM) | Canal Length (km)[4)] | Major Canal Type[4) 5)] | Purpose of PS (No.)[6)] | Pump Capacity (m3/hr), No. and Type[6) 7)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dak Nong | Electric P.S. | PS, Canal | - | - | - | - | - | 22.0 (I) | Cf (I) | I (3) | 1,500, 3 nos. (H)/<br>1,500, 3 nos. (H)/<br>1,500, 3 nos. (H)/ |
| Dien Bien | Huoi Un | Dam, Canal | 2 | H | 2.5-7.4 | 3.0-18 | - | 15.2 (I) | Cf (I) | - | - |
| Dong Thap | Upgrade Tam Nong | Canal | - | - | - | - | - | 55.7<br>(I cum D) | E<br>(I cum D) | - | - |
| Gia Lai | Cau Hai | PS, Canal | - | - | - | - | - | 0.7 (I) | Cf (I) | I (1) | 450, 3 nos. (S)/ |
| Gia Lai | EaRsai | Dam, Canal | 1 | H | 4 | 55 | - | 6.3 (I) | Cf (I) | - | - |
| Gia Lai | Eaur | Dam, Canal | 1 | H | 3.6 | 10 | - | 2.1 (I) | Cf (I) | - | - |
| Ha Giang | Khuoi Lam-Khuoi Lac | Dam, Canal | 1 | H | 6 | 40.4 | - | 5.7 (I) | Cf (I) | - | - |
| Ha Tinh | Song Rac | Canal | - | - | - | - | - | 11.7 (I) | B, S, Ct (I) | - | - |
| Ha Tinh | An Hung | Dam, Canal | 1 | E | 25 | 460 | 1.1 | 3.8 (I) | Cf (I) | - | - |
| Ha Tinh | Cau Ke | Dam | 1 | E | 34.5 | 193.5 | 0.8 | - | - | - | - |
| Ha Tinh | Khe Coi | Dam, Canal | 1 | E | 10 | 400 | 0.7 | 2.0 (I) | B (I) | - | - |
| Ha Tinh | 19/5 | Dam, Canal, Dyke | 1 | E | 4 | 450 | 2.5 | 1.3 (I) | B (I) | - | - |
| Ha Tinh | Lien Minh-Tung Chau | PS, Canal, Gate | - | - | - | - | - | 14.8 (I) | Cf (I) | I (5) | 1,200, 2 nos. (H)/<br>800, 1 no. (H)/<br>800, 1 no. (H)/<br>800, 1 no. (H)/<br>800, 1 no. (H)/ |
| Ha Tinh | Huong | Canal | - | - | - | - | - | 80 (I) | E, Cf (I) | - | - |
| Hoa Binh | Phu Lao | Dam, Canal | 11 | E | 7.0-10.5 | 43-125 | 1.9<br>(1 Reservoir) | 18.4 (I) | Cf, B, E (I) | - | - |
| Hoa Binh | Ngoc Luong | Dam, Canal Dyke | 1 | E | 6 | 1,300 | 1.8 | 2.7 (I) | B (I) | - | - |

# Appendix ir.4.2 Outline of Major Facility Components Constructed under SPL

| Province | Facility Name (Informality) | Major Facility under SPL[1)] | No. of Dam[2)] | Dam Type[3)] | Dam Height (m)[3)] | Dam Length (m)[3)] | Reservoir Storage Capacity (MCM) | Canal Length (km)[4)] | Major Canal Type[4) 5)] | Purpose of PS (No.)[6)] | Pump Capacity (m3/hr), No. and Type[6) 7)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kon Tum | Dakpoko | RBP (1.2km) | - | - | - | - | - | - | - | - | - |
| Kon Tum | Dak Sia1 | Dam | 1 | E | 14 | 135 | 0.5 | - | - | - | - |
| Lai Chau | Khun Ha | Dam, Canal | 1 | H | 4.2 | 45 | - | 6.4 (I) | Cf (I) | - | - |
| Lam Dong | Da-Don | Canal | - | - | - | - | - | 20.4 (I) | U (I) | - | - |
| Lam Dong | Bo Kabang | Dam, Canal | 1 | E | 14.8 | 275 | 1.3 | 4.4 (I) | Cf (I) | - | - |
| Lang Son | Thien Ky | Dam, Canal | 2 | E | 12.0-19.0 | 45-72 | 0.12-1.1 | 7.0 (I) | Cf (I) | - | - |
| Lao Cai | Sin Chai | Dam, Canal | 3 | H | 0.9-2.0 | 5.0-8.0 | - | 11.4 (I) | Cf, E (I) | - | - |
| Lao Cai | Nam Chay Irrigation | Dam, Canal | 1 | H | 1.8 | 6.5 | - | 8.1 (I) | Cf (I) | - | - |
| Nghe An | Khe Ngang | Dam, Canal | 1 | E | 11 | 534 | 1.1 | 4.0 (I) | Cf, E (I) | - | - |
| Nghe An | Yen Trach-Khe Chet | Dam, Canal | 3 | E | 3.0-6.0 | 62-271 | 0.03-1.8 (2 Reservoirs) | 2.0 (I) | E, Cf (I) | - | - |
| Nghe An | Ke Coc-Khe Nha | Canal | - | - | - | - | - | 7.0 (I) | Cf (I) | - | - |
| Nghe An | Trieu Duong | Dam, Canal | 1 | E | 14 | 329 | 1.7 | 10.0 (I) | Cf (I) | - | - |
| Ninh Binh | Dong Dinh | PS, Canal | - | - | - | - | - | 1.4 (D) | E (D) | D (1) | 4,000, 6 nos. (V)/ |
| Ninh Thuan | Ninh Phuoc | RI(40km) | - | - | - | - | - | - | - | - | - |
| Ninh Thuan | Bau Ngu | Dam, Canal | 1 | E | 14.9 | 688 | 1.4 | 7.3 (I), 0.1 (D) | Cf (I), E (D) | - | - |
| Ninh | Ta Ranh | Dam | 1 | E | 8.8 | 930 | 1 | - | - | - | - |

# Appendix ir.4.2 Outline of Major Facility Components Constructed under SPL

| Province | Facility Name (Informality) | Major Facility under SPL[1)] | No. of Dam[2)] | Dam Type[3)] | Dam Height (m)[3)] | Dam Length (m)[3)] | Reservoir Storage Capacity (MCM) | Canal Length (km)[4)] | Major Canal Type[4) 5)] | Purpose of PS (No.)[6)] | Pump Capacity (m3/hr), No. and Type[6) 7)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Phu Tho | Tam Nong | PS, Canal | - | - | - | - | - | 35.5 (I) | B (I) | I (2) | 1,000, 4 nos. (H)/<br>410, 2 nos. (H)/<br>1,000, 3 nos. (H) |
| Phu Tho | Phuong Mao ( 2nd S.) | Dam, Canal | 1 | E | 43.8 | 424 | 8 | 87 (I) | B, Cb (I) | - | - |
| Phu Tho | Hoang Hanh | PS, Canal, Dyke | - | - | - | - | - | 3.4 (D)<br>6.5 (I) | E (D)<br>B (I) | I cum D (2) | 2,500, 6 nos. (V)<br>1,000, 4 nos. (H)/<br>1,500, 1 no. (V)/ |
| Phu Tho | Hien Quan | PS, Canal | - | - | - | - | - | 28.4 (I) | Cb, B (I) | I (6), D (1) | <u>(I)</u><br><u>700, 2 nos. (V)/</u><br><u>1,000, 6 nos. (V)/</u><br><u>700, 2 nos. (V)/</u><br><u>270, 2 nos. (V)/</u><br><u>400, 1 no. (V)/</u><br><u>400, 1 no. (V)/</u><br><br><u>(D)</u><br><u>4,000, 4 nos. (H)/</u> |
| Phu Tho | 16 Communes | PS, Canal, Sluiceway, Dyke | - | - | - | - | - | 1.6 (I)<br>17.6 (D) | B (I)<br>E (D) | I (3) | 190, 3 nos. (V)/<br>190, 2 nos. (V)/<br>190, 2 nos. (V)/ |
| Phu Yen | La Bach | Dam, Canal | 1 | E | 20 | 605 | 2.6 | 4.0 (I) | E (I) | - | - |
| Phu Yen | Buon Chao | Dam, Canal | 1 | C | 10 | 30 | 56 | 0.1 (I) | Cf (I) | - | - |
| Phu Yen | La Bach (2) | Dam, Canal | 1 | E | 20 | 605 | 2.6 | 4.0 (I) | E (I) | - | - |

# Appendix ir.4.2 Outline of Major Facility Components Constructed under SPL

| Province | Facility Name (Informality) | Major Facility under SPL[1)] | No. of Dam[2)] | Dam Type[3)] | Dam Height (m)[3)] | Dam Length (m)[3)] | Reservoir Storage Capacity (MCM) | Canal Length (km)[4)] | Major Canal Type[4) 5)] | Purpose of PS (No.)[6)] | Pump Capacity (m3/hr), No. and Type[6) 7)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Phu Yen | Pump and I. Canal | PS, Canal | - | - | - | - | - | D/D | D/D | I (1) | 1,400, 2 nos. (H)/ |
| Quang Binh | Upgrade Cam Li | Canal | - | - | - | - | - | 21 (I) | Cf (I) | - | - |
| Quang Nam | Ho Viet An | Canal | - | - | - | - | - | 32.8 (I) | Cf (I) | - | - |
| Quang Ngai | Di Lang Irrigation | Dam, Canal | 1 | E | 38 | 220 | 9 | 24.4 (I) | Cb, Cf (I) | - | - |
| Quang Ngai | Suoi Chi | Canal | - | - | - | - | - | 11.5 (I) | Cb, Cf (I) | - | - |
| Quang Ngai | Ong Toi | Dam | 1 | E | 9 | 1,010 | 1.4 | - | - | - | - |
| Quang Ngai | Xa Dieu Commune | Dam, Canal | 1 | H | 7 | 101 | - | 8.0 (I) | Cf (I) | - | - |
| Quang Tri | Nghia Hy | Dam, Canal | 2 | E | 11.0-14.0 | 977-1,034 | 3.5 | 4.5 (I) | Cf (I) | - | - |
| Quang Tri | Lia | Dam, Canal | 1 | E | 8.6 | 385 | 1 | 3.0 (I) | Cf, Cb (I) | - | - |
| Quang Tri | Thac Heo | Dam, Canal | 2 | E | 8.7-8.8 | 260-315 | 1.5<br>(1 Reservoir) | 2.8 (I) | Cf (I) | - | - |
| Thai Nguyen | Ho Nui Coc | Canal | - | - | - | - | - | 424 (I) | B, Cb (I) | - | - |
| Thai Nguyen | Ho Bao Linh | Dam, PS, Canal, Dyke | 3 | H | 1.5-2.5 | 9-31 | - | 22.8 (I) | Cf, B (I) | I (2) | 270, 1 no. (H)/<br>270, 1 no. (H)/ |
| Thai Nguyen | Minh Lap-Hoa Thuong | PS, Canal | - | - | - | - | - | 8.5 (I) | B (I) | I (2) | 360, 3 nos. (S)/<br>420, 3 nos. (S)/ |

# Appendix ir.4.2 Outline of Major Facility Components Constructed under SPL

| Province | Facility Name (Informality) | Major Facility under SPL[1] | No. of Dam[2] | Dam Type[3] | Dam Height (m)[3] | Dam Length (m)[3] | Reservoir Storage Capacity (MCM) | Canal Length (km)[4] | Major Canal Type[4) 5)] | Purpose of PS (No.)[6] | Pump Capacity (m3/hr), No. and Type[6) 7)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Thanh Hoa | Quang Xuong | Headrace, Canal | - | - | - | - | - | 10.8 (I) | Cb, B (I) | - | - |
| Thanh Hoa | Quang Loc | PS, Canal | - | - | - | - | - | 3.5 (I) | B, Cb (I) | I (2) | 1,120, 2 nos. (H)/<br>1,120, 2 nos. (H)/ |
| Thanh Hoa | Vung Su | Dam | 1 | E | 25 | 101 | 1.8 | - | - | - | - |
| Thanh Hoa | Duong Coc | Canal | - | - | - | - | - | 11.6 (I) | Cb, S (I) | - | - |
| Thanh Hoa | Ben Da-Nui Trac | PS, Canal | - | - | - | - | - | 10.7 (I) | B (I) | I (2) | 470, 2 nos. (H)/<br>470, 3 nos. (H)/ |
| Thanh Hoa | Long Dong | PS, Canal | - | - | - | - | - | 12.0 (I) | Cf, Cb, Ct (I) | I (2) | 986, 6 nos. (H)/<br>1,400, 1 no. (H),<br>600, 1 no. (H)/ |
| Thua-Thien Hue | Phong Chuong-Cua Lac | Dam, PS, Canal, Bridge | 1 | M | 2.6 | 2,163 | 0 | 57.5 (I) | Cb, Cf (I) | I (1) | 600, 2 nos. (H)/ |
| Thua-Thien Hue | Dien Hoa-Dien Hai | PS, Canal, Gate | - | - | - | - | - | 5.6 (I) | Cf (I) | I (1)<br>D (8) | (I)<br>1,500, 3 nos (V)/<br><br>(D)<br>290, 1 no. (H)/<br>290, 1 no. (H)/<br>290, 1 no. (H)/<br>290, 1 no. (H)/<br>400, 1 no. (H)/<br>400, 1 no. (H)/<br>400, 1 no. (H)/<br>290, 1 no. (H)/ |
| Tra Vinh | Khu B1-Lang The | Canal | - | - | - | - | - | 36 (I) | E (I) | - | - |
| Tra Vinh | Lang The | Canal | - | - | - | - | - | 2.6<br>(I cum D) | E<br>(I cum D) | - | - |

# Appendix ir.4.2 Outline of Major Facility Components Constructed under SPL

| Province | Facility Name (Informality) | Major Facility under SPL[1)] | No. of Dam[2)] | Dam Type[3)] | Dam Height (m)[3)] | Dam Length (m)[3)] | Reservoir Storage Capacity (MCM) | Canal Length (km)[4)] | Major Canal Type[4) 5)] | Purpose of PS (No.)[6)] | Pump Capacity (m3/hr), No. and Type[6) 7)] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tuyen Quang | Minh An | PS, Canal | - | - | - | - | - | 1.6 (I) | S (I) | I (1) | 227, 1 no. (S)/ |
| Tuyen Quang | Yen Lap Commune | Dam, PS, Canal | 8 | H | 0.5-3.5 | 6.0-17 | - | 8.0 (I) | Cf (I) | I (1) | 108, 1 no. (S)/ |
| Vinh Long | Rach T.-Thien My | RI(13.1km) | - | - | - | - | - | - | - | - | - |
| Vinh Phuc | Don Nhan | Dam, PS, Canal | 1 | E | 3.2 | 91 | 0.1 | 12.2 (I) | B (I) | I (3) | 300, 1 no. (V)/<br>470, 3 nos. (V)/<br>470, 1 no. (V)/ |
| Yen Bai | Khe The | Dam, Canal | 1 | H | 3 | 27 | - | 5.6 (I) | Cf (I) | - | - |

Note:
1) PS=Pump Station, RI=River Improvement, RBP=Riverbank Protection
2) Dam includes Head Works. Secondary dam is counted independently.
3) E=Earth Fill Dam, C=Concrete Dam, H=Head Works (Concrete Weir), M=Head Works (Earth Weir Protected with Concrete, etc.), R=Rubber Dam
4) I=Irrigation Canal, D=Drainage Canal, I cum D=Irrigation cum Drainage Canal
5) F=Concrete Flume, B=Brick (with Mortar Lining), S=Stone (Masonry), Cb=Concrete Block (Trapezoidal), U=U-Shape (Concrete), Ct=Concrete Lining (Trapezoidal), E=Earth Lining
6) I=Irrigation, D=Drainage, I cum D=Irrigation cum Drainage
7) H=Horizontal , V=Vertical, Submergible

# Appendix ir.4.3 Facility Utilization Data

(1/5)

| Province | SPL | Facility Name | Present Condition | Irrigation Beneficial Area (ha)1) | Ratio of Irrigated Cultivation Area to Irigation Beneficial Area(%)2) | Number of Beneficial Person (person)3) | Major Crops | Yield of Paddy (t/ha/crop) |
|---|---|---|---|---|---|---|---|---|
| Bac Giang | V | Khuon Than | Completed | 1,974 | 100 | 25,000 | Paddy, Maize, Sweet Potato | 4.5-5.0 |
| Bac Kan | IV | Phieng Luong | Completed | 45 | 100 | 1,000 | Paddy | nd |
| Bac Kan | IV | Cho Don District | Completed | 231 | 100 | 2,650 | Paddy | 4.7 |
| Bac Kan | V | Cho Moi | Completed | 278 | 100 | 3,000 | Paddy | 4.9 |
| Bac Lieu | V | 30/4 Area of C.P. | Completed | 10,900 (F) | 100 | 8,000 | Shrimp, Fish, Crab | 3.0 (Industrial) 0.5 (Semi- |
| Binh Dinh | III | Tan An-Dap Da | Completed | 18,020 | 100 | 310,000 | Paddy | 5.2-6.0 |
| Binh Dinh | V | Tam Son | Completed | 150 | 100 | 800 | Paddy, Groundnut, Maize | 5 |
| Binh Dinh | V | Suoi So | Completed | 300 | 100 | 3,500 | Paddy, Melon, Vegetables | 4.0-5.0 |
| Binh Dinh | V | Chi Hoa2 | D/D | 95 | - | 2,800 | Paddy, Groundnut, | 5.5-6.0 |
| Ca Mau | V | Lung Ranh | Completed | 2.2 | 100 | 3,000 | Paddy | 3.7-4.0 |
| Cao Bang | V | Luong Thong | Completed | 70 | 100 | 1,000 | Paddy, Bean, Maize | 4 |
| Dak Lac | III | Buon Chua | Completed | 221 | 100 | 1,110 | Paddy | 3.5 |
| Dak Lac | III | Ea Yeng | Completed | 50 | 92 | 1,250 | Paddy | 4.5 |
| Dak Lac | III | Nam Kar | Completed | 100 | 100 | 400 | Paddy | 3.5-4.0 |
| Dak Lac | IV | Ea Bin | Completed | 250 | 100 | 350 | Coffee, Paddy | 4 |
| Dak Lac | V | Ho Ke | Construction | 160 | - | 1,800 | Paddy | 8.0-10.0 |
| Dak Nong | III | Dak Mam | Completed | 300 | 100 | 3,000 | Paddy | 7 |
| Dak Nong | V | Electric | Completed | 600 | 100 | 3,000 | Paddy | 7.5 |
| Dien Bien | V | Huoi Un | Construction | 174 | - | 450 | Paddy | 4.5-5.0 (planned) |
| Dong Thap | V | Upgrade Tam Nong | Completed | 8,484 | 100 | 16,000 | Paddy | 5.0-7.0 |
| Gia Lai | III | Cau Hai | Completed | 150 | 100 | 1,300 | Tobacco, Paddy | 4.5 |
| Gia Lai | III | EaRsai | Completed | 53 | 100 | 880 | Paddy | 5.5 |
| Gia Lai | V | Eaur | Construction | 95 | - | 980 | Paddy | 5.5 (planned) |

# Appendix ir.4.3 Facility Utilization Data

(2/5)

| Province | SPL | Facility Name | Present Condition | Irrigation Beneficial Area (ha)[1)] | Ratio of Irrigated Cultivation Area to Irigation Beneficial Area(%)[2)] | Number of Beneficial Person (person)[3)] | Major Crops | Yield of Paddy (t/ha/crop) |
|---|---|---|---|---|---|---|---|---|
| Ha Giang | V | Khuoi Lam-Khuoi Lac | Completed | 148 | 100 | 450 | Paddy | 6.0 (planned) |
| Ha Tinh | III | Song Rac | Completed | 1,490 | 90 | 15,500 * | Paddy, Groundnut, Maize | 5 |
| Ha Tinh | IV | An Hung | Completed | 219 | 90 | 5,600 | Paddy, Groundnut, Maize | 4 |
| Ha Tinh | IV | Cau Ke | Completed | 125 | 100 | 3,500 | Paddy, Groundnut, Maize | 5.5 |
| Ha Tinh | IV | Khe Coi | Completed (portion not yet constructed) | 80 | 88 | 4,000 | Paddy, Groundnut, Sweet Potato | 4.5-5.0 |
| Ha Tinh | IV | 19/5 | Completed | 650 | 100 | 9,300 | Paddy, Vegetables, Sweet Potato | 4.5 |
| Ha Tinh | IV | Lien Minh-Tung Chau | Completed | 400 | 100 | 11,800 | Paddy, Bean | 5.6-5.8 |
| Ha Tinh | V | Huong Long | Completed | 2,700 | 100 | 45,400 | Paddy, Maize, Groundnut | 3.6 |
| Hoa Binh | III | Phu Lao | Completed | 440 | 100 | 6,000 | Paddy | 6 |
| Hoa Binh | V | Ngoc Luong | Completed | 550 | 100 | 6,800 | Paddy, Maize, Groundnut | 6 |
| Kon Tum | III | Dakpoko | Completed | nd | - | 1,800 | nd | nd |
| Kon Tum | V | Dak Sia1 | Completed | 95 | - | 600 | Paddy | 5 |
| Lai Chau | V | Khun Ha | Construction | 200 | - | 1,200 | Paddy, Maize, Bean | 5.0 (planned) |
| Lam Dong | III | Da-Don | Completed | 2,200 | 100 | 3,000 | Paddy, Coffee | 4 |
| Lam Dong | V | Bo Kabang | Completed | 145 | 100 | 1,230 | Paddy | 6 |
| Lang Son | V | Thien Ky | Completed | 146 | 100 | 1,432 | Paddy, Maize, Tobacco | 4.6 |
| Lao Cai | IV | Sin Chai | Completed | 130 | 100 | 1,050 | Paddy, Maize, Bean | 5 |

# Appendix ir.4.3 Facility Utilization Data

(3/5)

| Province | SPL | Facility Name | Present Condition | Irrigation Beneficial Area (ha)1) | Ratio of Irrigated Cultivation Area to Irigation Beneficial Area(%)2) | Number of Beneficial Person (person)3) | Major Crops | Yield of Paddy (t/ha/crop) |
|---|---|---|---|---|---|---|---|---|
| Lao Cai | V | Nam Chay Irrigation | Completed | 80 | 100 | 720 | Paddy, Maize, Tobacco | 4 |
| Nghe An | III | Khe Ngang | Completed | 160 | 100 | 2,700 | Paddy, Maize, Sweet Potato | 5.8 |
| Nghe An | IV | Yen Trach-Khe Chet | Completed | 170 | 100 | 1,500 | Paddy, Maize, Groundnut | 5 |
| Nghe An | IV | Ke Coc-Khe Nha | Completed | 652 | 100 | 9,435 | Paddy, Maize, Groundnut | 5.2 |
| Nghe An | IV | Trieu Duong | Construction | 200 | - | 1,700 | Paddy, Groundnut , Sesame | 5.8 |
| Ninh Binh | V | Dong Dinh | Completed | 800 (I), 800 (D) | 100 | 2,298 | Paddy, Maize, Sweet Potato | 6 |
| Ninh | III | Ninh | Completed | nd | - | nd | nd | nd |
| Ninh | IV | Bau Ngu | Completed | 450 | 100 | 700 | Paddy | 7 |
| Ninh | V | Ta Ranh | Completed | 100 | - | nd | Paddy | nd |
| Phu Tho | III | Tam Nong | Completed | 1,500 | 100 | 14,100 | Paddy | 5.0-5.2 |
| Phu Tho | IV | Phuong Mao ( 2nd S.) | Completed | 928 | 100 | 17,489 | Paddy | 5.6 |
| Phu Tho | IV | Hoang Hanh | Completed | 840 (D), 514 (I) | 100 | 10,000 | Paddy | 5.3 |
| Phu Tho | IV | Hien Quan | Completed | 350 (I), 1,855 (D) | 100 | 14,200 | Paddy | 5.5 |
| Phu Tho | V | 16 Communes | Construction | 2,500 (I+D) | - | 58,800 | Paddy | 5.5 |
| Phu Yen | III | La Bach | Construction | 278 | - | 400 | Sugarcane, Paddy | nd |
| Phu Yen | IV | Buon Chao | Completed | 29 | 100 | 400 | Paddy, Sugarcane | 5 |
| Phu Yen | V | La Bach(2) | Construction | 278 | - | 400 | Sugarcane, Paddy | nd |
| Phu Yen | V | Pump and I. Canal | D/D | 147 | - | 1,800 | Maize, Green Pea, Paddy | nd |

# Appendix ir.4.3 Facility Utilization Data

(4/5)

| Province | SPL | Facility Name | Present Condition | Irrigation Beneficial Area (ha)[1] | Ratio of Irrigated Cultivation Area to Irigation Beneficial Area(%)[2] | Number of Beneficial Person (person)[3] | Major Crops | Yield of Paddy (t/ha/crop) |
|---|---|---|---|---|---|---|---|---|
| Quang Binh | III | Upgrade Cam Li | Completed | 3,200 | 100 | 3,000 | Paddy, Water Melon, Vegetables | 5.5 |
| Quang Nam | V | Ho Viet An | Completed | 450 | 100 | 21,900 | Paddy, Sesame, Bean | 4.5 |
| Quang Ngai | III | Di Lang Irrigation | Completed | 650 | 100 | 5,200 | Paddy, Sugarcane | 3.8 |
| Quang Ngai | IV | Suoi Chi | Completed | 230 | 100 | 1,240 | Paddy, Maize, Sugarcane | 6.1 |
| Quang Ngai | IV | Ong Toi | Completed | 170 | 100 | 5,200 | Paddy | 5 |
| Quang Ngai | V | Xa Dieu Commune | Completed | 300 | 100 | 6,350 | Paddy | nd |
| Quang Tri | IV | Nghia Hy | Completed | 165 | 100 | 3,200 | Paddy, Maize, Groundnut | 5 |
| Quang Tri | IV | Lia | Completed | 92 | 100 | 770 | Paddy, Maize | 4 |
| Quang Tri | V | Thac Heo | Completed | 90 | 100 | 500 | Paddy | 5 |
| Thai Nguyen | IV | Ho Nui Coc | Completed | 14,500 | 100 | 100,000 | Paddy, Tea, Sweet Potato | 4.5 |
| Thai Nguyen | IV | Ho Bao Linh | Completed | 850 | 100 | 12,000 | Paddy, Maize, Sweet Potato | 4.8 |
| Thai Nguyen | V | Minh Lap-Hoa Thuong | Construction | 516 | - | 4,800 | Paddy, Tea, Maize | 5.2 (planned) |
| Thanh Hoa | III | Quang Xuong | Completed | 1,023 | 80 | 3,500 | Paddy, Groundnut, Maize | 6 |
| Thanh Hoa | III | Quang Loc | Completed | 220 | 100 | 4,620 | Paddy, Groundnut, Maize | 5.5-6.0 |
| Thanh Hoa | III | Vung Su | Completed | 491 | 100 | 4,500 | Paddy, Maize, Sugarcane | 6.5 |
| Thanh Hoa | IV | Duong Coc | Completed | 700 | 100 | 24,000 | Paddy, Maize, Sweet Potato | 6 |

# Appendix ir.4.3 Facility Utilization Data

(5/5)

| Province | SPL | Facility Name | Present Condition | Irrigation Beneficial Area (ha)[1) ] | Ratio of Irrigated Cultivation Area to Irigation Beneficial Area(%)[2)] | Number of Beneficial Person (person)[3)] | Major Crops | Yield of Paddy (t/ha/crop) |
|---|---|---|---|---|---|---|---|---|
| Thanh Hoa | IV | Ben Da-Nui Trac | Completed | 370 | 100 | 3,400 | Paddy, Maize, Sweet Potato | 6.9 |
| Thanh Hoa | V | Long Dong | Completed | 652 | 100 | 12,000 | Paddy, Sweet Potato, Maize | 7 |
| Thua-Thien Hue | III | Phong Chuong-Cua Lac | Completed | 5,950 | 100 | 68,700 * | Paddy, Bean, Vegetables | 5.0-5.5 |
| Thua-Thien Hue | V | Dien Hoa-Dien Hai | Completed | 360 (I), 109 (D), | 100 | 21,300 | Paddy, Fishery | 5 |
| Tra Vinh | IV | Khu B1-Lang The | Completed | 4,900 | 100 | 24,040 | Paddy, Vegetables | 5.5 |
| Tra Vinh | V | Lang The | Construction | 3,300 | 100 | 31,500 | Paddy | 4.9 |
| Tuyen Quang | IV | Minh An | Completed | 42 | 100 | 520 | Paddy, Bean, Maize | 5.5 |
| Tuyen Quang | V | Yen Lap Commune | Completed | 125 | 100 | 3,200 | Paddy, Vegetables, Bean | 6.1 |
| Vinh Long | V | Rach T.-Thien My | Completed | 1,500 | 100 | 22,000 | Paddy, Pineapple, Orange | 6.9-7.0 |
| Vinh Phuc | V | Don Nhan | Completed | 661 | 100 | 3,530 | Paddy, Maize, Sweet Potato | 4.4 |
| Yen Bai | V | Khe The | Completed | 170 | 100 | 6,000 | Paddy | 5.0-6.0 |

Note:
1) I or Figures Only=Irigation Beneficial Area, D=Drainage Beneficial Area
(Includes Drainage Basin Area in Some Cases), F=Fishery BeneficialArea
2) Drainage beneficial areas are not considered.
3) *: Estimated by the Survey Team

# Appendix ir.5.1 Operation, Maintenance and Management Organization and System (1/5)

| Province | SPL | Facility Name (Informality) | Beneficial Area (ha)1) | OM/M Organization (Number of Total Personnel)2) | Existence of O&M Plan3) | Existence of O&M Record3) | Number of Persons of OM/M Post (persons) | Annual OM/M Cost (MVND)4) | Major Repair Cost and Year (MVND) |
|---|---|---|---|---|---|---|---|---|---|
| Bac Giang | V | Khuon Than | 1,974 | IMC (23) | Y | N | 7 | 140 | 0 |
| Bac Kan | IV | Phieng Luong | 45 | IMC (264) | Y | Y | 22 | 550 for 70 Schemes | 0 |
| Bac Kan | IV | Cho Don District | 231 | IMC (264) | Y | Y | 32 | 1,500 for 127 Schemes* | 0 |
| Bac Kan | V | Cho Moi | 278 | IMC (264) | Y | Y | 41 | 1,600 for 90 Schemes** | 0 |
| Bac Lieu | V | 30/4 Area of C.P. | 10,900 (F) | DPC (20) | Y | N | 0 | 0 | 0 |
| Binh Dinh | III | Tan An-Dap Da | 18,020 | IMC (262) | Y | Y | 7 | 409 | 0 |
| Binh Dinh | V | Tam Son | 150 | FO (5) | ud | Y | 1 | 80 | 0 |
| Binh Dinh | V | Suoi So | 300 | FO (10), FO (10) | N | Y | 6 | 250 | 0 |
| Binh Dinh | V | Chi Hoa2 | 95 | ud | ud | ud | ud | ud | ud |
| Ca Mau | V | Lung Ranh | 2.2 | DARD (60) | Y | N | 1 | 100 | 0 |
| Cao Bang | V | Luong Thong | 70 | CPC (9) | ud | N | 2 | ud | ud |
| Dak Lac | III | Buon Chua | 221 | FO (9) | N | Y | 9 for 4 Schemes | 200 for 4 Schemes | 0 |
| Dak Lac | III | Ea Yeng | 50 | FO (5) | Y | N | 5 for 2 Schemes | 217 for 2 Schemes | 0 |
| Dak Lac | III | Nam Kar | 100 | FO (3) | N | N | 3 | 65 | 0 |
| Dak Lac | IV | Ea Bin | 250 | FO (4-5) | ud | ud | ud | ud | ud |
| Dak Lac | V | Ho Ke | 160 | ud | ud | ud | ud | ud | ud |

# Appendix ir.5.1 Operation, Maintenance and Management Organization and System (2/5)

| Province | SPL | Facility Name (Informality) | Beneficial Area (ha)1) | OM/M Organization (Number of Total Personnel)2) | Existence of O&M Plan3) | Existence of O&M Record3) | Number of Persons of OM/M Post (persons) | Annual OM/M Cost (MVND)4) | Major Repair Cost and Year (MVND) |
|---|---|---|---|---|---|---|---|---|---|
| Dak Nong | III | Dak Mam | 300 | FO (5) | N | Y | 1 | 150 | 0 |
| Dak Nong | V | Electric P.S. | 600 | FO (11) | Y | Y | 7 | 1,050 | 0 |
| Dien Bien | V | Huoi Un | 174 | ud | ud | ud | ud | ud | ud |
| Dong Thap | V | Upgrade Tam Nong | 8,484 | DPC (27) | Y | Y | 7 | 13 (Whole Province) | 0 |
| Gia Lai | III | Cau Hai | 150 | DPC (17) | Y | Y | 4 | 20 | 0 |
| Gia Lai | III | EaRsai | 53 | DPC (17) | Y | Y | 4 | 35 | 0 |
| Gia Lai | V | Eaur | 95 | DPC (40) | ud | ud | ud | ud | ud |
| Ha Giang | V | Khuoi Lam-Khuoi Lac | 148 | CPC (18) | Y | Y | 14 | 10 (Planned) | 0 |
| Ha Tinh | III | Song Rac | 1,490 | IMC (100) | Y | Y | 85 for 8 Schemes | 9,500 for 8 Schemes | 31,000 (2010) |
| Ha Tinh | IV | An Hung | 219 | IMC (120) | Y | Y | 3 | 80 | 0 |
| Ha Tinh | IV | Cau Ke | 125 | IMC (30) | Y | Y | 3 | 60 | 15,000 (2010-11) |
| Ha Tinh | IV | Khe Coi | 80 | FO (7) | Y | Y | 4 | 55 | 28 (2008) |
| Ha Tinh | IV | 19/5 | 650 | CPC (36) | Y | Y | 17 | 50 | 0 |
| Ha Tinh | IV | Lien Minh-Tung Chau | 400 | FO (25),<br>FO (25),<br>FO (25),<br>FO (25) | N | N | 52 | 65 | 4 (2007) |
| Ha Tinh | V | Huong Long… | 2,700 | IMC (32) | Y | Y | 13 | 530 | 0 |
| Hoa Binh | III | Phu Lao | 440 | IMC (152) | Y | Y | 3 | 90 | 0 |
| Hoa Binh | V | Ngoc Luong | 550 | IMC (152) | Y | Y | 3 | 90 | 0 |
| Kon Tum | III | Dakpoko | nd | CPC (20) | N | N | 0 | 0 | 0 |

# Appendix ir.5.1 Operation, Maintenance and Management Organization and System (3/5)

| Province | SPL | Facility Name (Informality) | Beneficial Area (ha)[1)] | OM/M Organization (Number of Total Personnel)[2)] | Existence of O&M Plan[3)] | Existence of O&M Record[3)] | Number of Persons of OM/M Post (persons) | Annual OM/M Cost (MVND)[4)] | Major Repair Cost and Year (MVND) |
|---|---|---|---|---|---|---|---|---|---|
| Kon Tum | V | Dak Sia1 | 95 | IMC (65) | ud | ud | ud | ud | ud |
| Lai Chau | V | Khun Ha | 200 | ud | ud | ud | ud | ud | ud |
| Lam Dong | III | Da-Don | 2,200 | Center, DARD (148) | Y | Y | 20 | 312 | 0 |
| Lam Dong | V | Bo Kabang | 145 | Center, DARD (148) | Y | Y | 2 | 31 | 0 |
| Lang Son | V | Thien Ky | 146 | IMC (272) | Y | Y | 1 | 30 | 0 |
| Lao Cai | IV | Sin Chai | 130 | CPC (12) | Y | N | 4 | 60 | 0 |
| Lao Cai | V | Nam Chay Irrigation | 80 | CPC (7) | N | N | 5 | 60 | 0 |
| Nghe An | III | Khe Ngang | 160 | CPC (20) | Y | Y | 5 | 30 | 340 (2008) |
| Nghe An | IV | Yen Trach-Khe Chet | 170 | FO (47) | Y | Y | 4 | 200 | 400 (2006) |
| Nghe An | IV | Ke Coc-Khe Nha | 652 | DPC (78) | Y | Y | 6 | 2,300 (Whole District) | 0 |
| Nghe An | IV | Trieu Duong | 200 | ud | ud | ud | ud | ud | ud |
| Ninh Binh | V | Dong Dinh | 800 (I), 800 (D) | IMC (778) | Y | Y | 4 | 800 | 0 |
| Ninh Thuan | III | Ninh Phuoc | nd | IMC (200) | N | N | 0 | 0 | 0 |
| Ninh Thuan | IV | Bau Ngu | 450 | IMC (200) | Y | Y | 2 | 10 | 0 |
| Ninh Thuan | V | Ta Ranh | 100 | IMC (200) | ud | ud | ud | ud | ud |
| Phu Tho | III | Tam Nong | 1,500 | IMC (427) | Y | Y | 17 | 1,900 | 0 |
| Phu Tho | IV | Phuong Mao ( 2nd S.) | 928 | IMC (427) | Y | Y | 6 | 600 | 300 (2008) |
| Phu Tho | IV | Hoang Hanh | 840 (D), 514 (I) | IMC (427) | Y | Y | 13 | 1,000 | 0 |
| Phu Tho | IV | Hien Quan | 350 (I), 1,855 (D) | IMC (427) | Y | Y | 9 | 1,700 | 0 |

# Appendix ir.5.1 Operation, Maintenance and Management Organization and System (4/5)

| Province | SPL | Facility Name (Informality) | Beneficial Area (ha)[1)] | OM/M Organization (Number of Total Personnel)[2)] | Existence of O&M Plan[3)] | Existence of O&M Record[3)] | Number of Persons of OM/M Post (persons) | Annual OM/M Cost (MVND)[4)] | Major Repair Cost and Year (MVND) |
|---|---|---|---|---|---|---|---|---|---|
| Phu Tho | V | 16 Communes | 2,500 (I+D) | ud | ud | ud | ud | ud | ud |
| Phu Yen | III | La Bach | 278 | DPC (23) | ud | ud | ud | ud | ud |
| Phu Yen | IV | Buon Chao | 29 | FO (2) | N | Y | 2 | 70 | 65 (2009) |
| Phu Yen | V | La Bach(2) | 278 | DPC (23) | ud | ud | ud | ud | ud |
| Phu Yen | V | Pump and I. C | 147 | ud | ud | ud | ud | ud | ud |
| Quang Binh | III | Upgrade Cam Li | 3,200 | IMC (200) | Y | Y | 34 | 2 | ud |
| Quang Nam | V | Ho Viet An | 450 | IMC (315) | Y | Y | 69 (Whole Province) | 7,000 (Whole Province) | 0 |
| Quang Ngai | III | Di Lang Irrigation | 650 | IMC (257), DPC (106), Town PC (25) | Y | N | 10 | 405 | 73 (2010) |
| Quang Ngai | IV | Suoi Chi | 230 | CPC (24) | N | N | 5 | 80 | 0 |
| Quang Ngai | IV | Ong Toi | 170 | IMC (257) | Y | N | 24 per 3 projects | 10 | 0 |
| Quang Ngai | V | Xa Dieu Commune | 300 | CPC (21) | N | N | ud | ud | ud |
| Quang Tri | IV | Nghia Hy | 165 | IMC (300) | Y | Y | 3 | 115 | 0 |
| Quang Tri | IV | Lia | 92 | DPC (22), CPC (22) | Y | Y | 5 | 3.4 | 0 |
| Quang Tri | V | Thac Heo | 90 | DPC (100), CPC (30) | Y | Y | 3 | 82 | 0 |
| Thai Nguyen | IV | Ho Nui Coc | 14,500 | IMC (186) | Y | Y | 60 | 9,300 | 0 |
| Thai Nguyen | IV | Ho Bao Linh | 850 | IMC (186) | Y | Y | 14 | 300 | 0 |

# Appendix ir.5.1 Operation, Maintenance and Management Organization and System (5/5)

| Province | SPL | Facility Name (Informality) | Beneficial Area (ha)1) | OM/M Organization (Number of Total Personnel)2) | Existence of O&M Plan3) | Existence of O&M Record3) | Number of Persons of OM/M Post (persons) | Annual OM/M Cost (MVND)4) | Major Repair Cost and Year (MVND) |
|---|---|---|---|---|---|---|---|---|---|
| Thai Nguyen | V | Minh Lap-Hoa Thuong | 516 | ud | ud | ud | ud | ud | ud |
| Thanh Hoa | III | Quang Xuong | 1,023 | IMC (980) | Y | Y | 3 | 130 | 0 |
| Thanh Hoa | III | Quang Loc | 220 | IMC (575) | Y | Y | 5 | 80 | 0 |
| Thanh Hoa | III | Vung Su | 491 | IMC (980) | Y | Y | 6 | 700 | 700 (2008) |
| Thanh Hoa | IV | Duong Coc | 700 | IMC (980) | Y | Y | 11 | 350 | 14,000 (2009) |
| Thanh Hoa | IV | Ben Da-Nui Trac | 370 | FO (45) | Y | Y | 15 | 268 | 0 |
| Thanh Hoa | V | Long Dong | 652 | IMC (980) | Y | Y | 9 | 400 | 0 |
| Thua-Thien Hue | III | Phong Chuong-Cua Lac | 5,950 | IMC (150) for 2 Areas, FO (9) for 1 Area | N | Y | 18 | 3,000 (IMC for Whole Province), 50 | 1,000 (2009) |
| Thua-Thien Hue | V | Dien Hoa-Dien Hai | 360 (I), 109 (D), 49 (F) | DPC (30) | ud | ud | ud | ud | ud |
| Tra Vinh | IV | Khu B1-Lang The | 4,900 | IMC (106) | Y | N | 1 | 2 | 0 |
| Tra Vinh | V | Lang The | 3,300 | IMC (106) | ud | ud | ud | ud | ud |
| Tuyen Quang | IV | Minh An | 42 | FO (7) | Y | N | 5 | 80-90 | 0 |
| Tuyen Quang | V | Yen Lap Commune | 125 | FO (22) | Y | Y | 20 | 180 | 0 |
| Vinh Long | V | Rach T.-Thien My | 1,500 | DPC (24) | Y | Y | 1 | 0 | 0 |
| Vinh Phuc | V | Don Nhan | 661 | ud | ud | ud | ud | ud | ud |
| Yen Bai | V | Khe The | 170 | ud | ud | ud | ud | ud | ud |

Note:
1) I or Figures Only=Irigation Beneficial Area, D=Drainage Beneficial Area
(Includes Drainage Basin Area in Some Cases), F=Fishery BeneficialArea
2) IMC=Irrigation Management Company, FO=Farmers' Organization
3) Y=Existence, N=No Schedule to Prepare
4) *=This sub-project is counted for 6 schemes, and **= counted for 14 schemes.
Common: ud=under design stage

# Appendix ir.5.2 Names of Operation, Maintenance and Management Organization and Post



| Province | SPL | Facility Name (Informality) | Name of OM/M Organization | Name of OM/M Post | Remarks |
|---|---|---|---|---|---|
| Bac Giang | V | Khuon Than | Luc Ngan Irrigation Project Exploiting Company of Bac Giang PPC | Khuon Than and Lang Thun Irrigation Management Groups | 5 Companies in Province |
| Bac Kan | IV | Phieng Luong | Irrigation Project Exploiting Company of Bac Kan PPC | Pac Nam Station | |
| Bac Kan | IV | Cho Don District | Irrigation Project Exploiting Company of Bac Kan PPC | Cho Don Station | |
| Bac Kan | V | Cho Moi | Irrigation Project Exploiting Company of Bac Kan PPC | Cho Moi Station | |
| Bac Lieu | V | 30/4 Area of C.P. | Hoa Binh DPC | Agriculture and Rural Development Division | |
| Binh Dinh | III | Tan An-Dap Da | Irrigation Management Ltd. Company of Binh Dinh PPC | An Nhon Branch | |
| Binh Dinh | V | Tam Son | Cat Lam Agricultural Cooperative | Cat Lam Agricultural Cooperative | |
| Binh Dinh | V | Suoi So | My Phong Agricultural Cooperatives | My Phong Agricultural Cooperative | |
| Binh Dinh | V | Chi Hoa2 | ud | ud | |
| Ca Mau | V | Lung Ranh | DARD | Water Resources Division | |
| Cao Bang | V | Luong Thong | Luong Thong CPC | Agriculture, Forestry and Construction Division | |
| Dak Lac | III | Buon Chua | Yang Tao Water Users' Cooperative | Yang Tao Water Users' Cooperative | |
| Dak Lac | III | Ea Yeng | Ea Yeng Water Users' Cooperative | Ea Yeng Water Users' Cooperative | |
| Dak Lac | III | Nam Kar | Nam Kar Water Users' Cooperative | Nam Kar Water Users' Cooperative | |
| Dak Lac | IV | Ea Bin | Ea Bhok Water Users' Cooperative | Ea Bhok Water Users' Cooperative | |
| Dak Lac | V | Ho Ke | ud | ud | |

# Appendix ir.5.2 Names of Operation, Maintenance and Management Organization and Post



| Province | SPL | Facility Name (Informality) | Name of OM/M Organization | Name of OM/M Post | Remarks |
|---|---|---|---|---|---|
| Dak Nong | III | Dak Mam | Nam Da Water Users' Cooperative | Nam Da Water Users' Cooperative | |
| Dak Nong | V | Electric P.S. | Choah Village Water Users' Cooperative | Choah Village Water Users' Cooperative | |
| Dien Bien | V | Huoi Un | ud | ud | |
| Dong Thap | V | Upgrade Tam Nong | Tam Nong DPC | Agriculture and Rural Development Division | |
| Gia Lai | III | Cau Hai | Krongpa DPC | Irrigation and Agriculture Station | |
| Gia Lai | III | EaRsai | Krongpa DPC | Irrigation and Agriculture Station | |
| Gia Lai | V | Eaur | Krongpa DPC | Agriculture Management Station | |
| Ha Giang | V | Khuoi Lam-Khuoi Lac | Trung Thanh CPC | O&M Team | No IMC in Province |
| Ha Tinh | III | Song Rac | Song Rac Irrigation Project Exploiting Company of Ha Tinh PPC | Song Rac Branch | 3 Province Owned and 4 District Owned Companies in Province |
| Ha Tinh | IV | An Hung | Irrigation Project Exploiting Company of Can Loc DPC | An Hung Station | |
| Ha Tinh | IV | Cau Ke | Irrigation Management and Exploitation Company of Huong Son DPC | Cay Truong Station | |
| Ha Tinh | IV | Khe Coi | Xuan Thang Farmers’ Cooperation | O&M Team | |
| Ha Tinh | IV | 19/5 | Cam Phuc CPC | Water Service Team | |
| Ha Tinh | IV | Lien Minh-Tung Chau | Thong Nhat, Dai Minh, Duc Ninh and Duc Chau Farmers' Cooperations | Thong Nhat, Dai Minh, Duc Ninh and Duc Chau Farmers' Cooperations | |
| Ha Tinh | V | Huong Long… | Huong Khe Irrigation Project Construction, Management and Exploitation Company of Ha Tinh PPC | Tiem River Station | |

# Appendix ir.5.2 Names of Operation, Maintenance and Management Organization and Post



| Province | SPL | Facility Name (Informality) | Name of OM/M Organization | Name of OM/M Post | Remarks |
|---|---|---|---|---|---|
| Hoa Binh | III | Phu Lao | Irrigation Project Exploiting Company of Hoa Binh PPC | Lac Thuy Branch | |
| Hoa Binh | V | Ngoc Luong | Irrigation Project Exploiting Company of Hoa Binh PPC | Yen Thuy Branch | |
| Kon Tum | III | Dakpoko | Dak Glei CPC | none | |
| Kon Tum | V | Dak Sia1 | Irrigation Exploitation Company of Kon Tum PPC | Sa Thay Team | |
| Lai Chau | V | Khun Ha | ud | ud | |
| Lam Dong | III | Da-Don | Center for Management and Operation, DARD | Lam Ha Station | |
| Lam Dong | V | Bo Kabang | Center for Management and Operation, DARD | Don Duong Station | |
| Lang Son | V | Thien Ky | Irrigation Project Exploiting Company of Lang Son PPC | Huu Lung Branch | |
| Lao Cai | IV | Sin Chai | Den Thang CPC | Chairman, Irrigation Officer, Village Leaders | |
| Lao Cai | V | Nam Chay Irrigation | Nam Chay CPC | Irrigation Project Management Unit | |
| Nghe An | III | Khe Ngang | Hung Yen Bac CPC | Service Team | |
| Nghe An | IV | Yen Trach-Khe Chet | Thai Son Cooperation for Agriculture Services | Water Service Station | |
| Nghe An | IV | Ke Coc-Khe Nha | Quy Chau DPC | Agriculture and Irrigation Station | |
| Nghe An | IV | Trieu Duong | ud | ud | |
| Ninh Binh | V | Dong Dinh | Irrigation Project Exploiting One Member Company of Ninh Binh PPC | Nho Quan Branch | |

## Appendix ir.5.2 Names of Operation, Maintenance and Management Organization and Post



| Province | SPL | Facility Name (Informality) | Name of OM/M Organization | Name of OM/M Post | Remarks |
|---|---|---|---|---|---|
| Ninh Thuan | III | Ninh Phuoc | Irrigation Works Dyploying Company of Ninh Thuan PPC | none | |
| Ninh Thuan | IV | Bau Ngu | Irrigation Works Dyploying Company of Ninh Thuan PPC | Ninh Phuoc Station | |
| Ninh Thuan | V | Ta Ranh | Irrigation Works Dyploying Company of Ninh Thuan PPC | Ninh Phuoc Station | |
| Phu Tho | III | Tam Nong | Irrigation Exploiting One Member Company of Phu Tho PPC | Tam Nong Irrigation Station | |
| Phu Tho | IV | Phuong Mao (2nd S.) | Irrigation Exploiting One Member Company of Phu Tho PPC | Thanh Thuy Irrigation Station | |
| Phu Tho | IV | Hoang Hanh | Irrigation Exploiting One Member Company of Phu Tho PPC | Thanh Ba Irrigation Station | |
| Phu Tho | IV | Hien Quan | Irrigation Exploiting One Member Company of Phu Tho PPC | Tam Nong Irrigation Station | |
| Phu Tho | V | 16 Communes | ud | ud | |
| Phu Yen | III | La Bach | Song Hinh DPC | Agricultural Division | |
| Phu Yen | IV | Buon Chao | Buon Chao Agricultural Water Association | Buon Chao Team | District owned |
| Phu Yen | V | La Bach(2) | Song Hinh DPC | Agricultural Division | |
| Phu Yen | V | Pump and I. C | ud | ud | |
| Quang Binh | III | Upgrade Cam Li | Irrigation Project Exploiting Company of Quang Binh PPC | Cam Li Station | |
| Quang Nam | V | Ho Viet An | Irrigation Exploiting Company of Quang Nam PPC | Que Son Branch, and Thang Binh Branch | |

# Appendix ir.5.2 Names of Operation, Maintenance and Management Organization and Post



| Province | SPL | Facility Name (Informality) | Name of OM/M Organization | Name of OM/M Post | Remarks |
|---|---|---|---|---|---|
| Quang Ngai | III | Di Lang Irrigation | Irrigation Exploiting Company of Quang Ngai PPC (Dam) and Son Ha DPC, and Di Lang Town PC (Canal) | Station 7 (Dam) and O&M Teams (Canal) | |
| Quang Ngai | IV | Suoi Chi | Hanh Tindong CPC | O&M Team | |
| Quang Ngai | IV | Ong Toi | Irrigation Exploiting Company of Quang Ngai PPC | Station No.5 | |
| Quang Ngai | V | Xa Dieu | Son Ha CPC | ud | |
| Quang Tri | IV | Nghia Hy | Irrigation Project Exploiting Company of Quang Tri PPC | Gio Cam Ha Station | |
| Quang Tri | IV | Lia | Huong Hoa DPC and A Tuc CPC | OM Team of A Tuc CPC | |
| Quang Tri | V | Thac Heo | Hai Lang DPC and Hai Lam CPC | OM Team of Hai Lam CPC | |
| Thai Nguyen | IV | Ho Nui Coc | Developing of Irrigation Limited Liability Company of Thai Nguyen PPC | Ho Nui Coc Branch | |
| Thai Nguyen | IV | Ho Bao Linh | Developing of Irrigation Limited Liability Company of Thai Nguyen PPC | Dinh Hoa Station | |
| Thai Nguyen | V | Minh Lap-Hoa Thuong | ud | ud | |
| Thanh Hoa | III | Quang Xuong | Song Chu Irrigation Project Exploiting Ltd. Company of Thanh Hoa PPC | Quang Xuong Branch | |
| Thanh Hoa | III | Quang Loc | Bac Song Ma Irrigation and Agriculture Company of Thanh Hoa PPC | Hau Loc Branch | |
| Thanh Hoa | III | Vung Su | Song Chu Irrigation Project Exploiting Ltd. Company of Thanh Hoa PPC | Thach Thanh Branch, Irrigation Group | |

# Appendix ir.5.2 Names of Operation, Maintenance and Management Organization and Post



| Province | SPL | Facility Name (Informality) | Name of OM/M Organization | Name of OM/M Post | Remarks |
|---|---|---|---|---|---|
| Thanh Hoa | IV | Duong Coc | Song Chu Irrigation Project Exploiting Ltd. Company of Thanh Hoa PPC | Cam Thuy Branch | |
| Thanh Hoa | IV | Ben Da-Nui Trac | Vinh Long-1 Farmers' Organization | Electricity Team, and Maintenance of Irrigation and Road Team | |
| Thanh Hoa | V | Long Dong | Song Chu Irrigation Project Exploiting Ltd. Company of Thanh Hoa PPC | Thach Thanh Branch, Pumping Group, and Technical and Electricity Group | |
| Thua-Thien Hue | III | Phong Chuong-Cua Lac | My Phu Farmers' Organization (1 Area) and Company for Management and Exploiting of Irrigation Project of Thua-Thien Hue PPC (2 Areas) | My Phu Pump Station (1 Area) and Cua Lac Station and Phong Chaong Station (2 Areas) | |
| Thua-Thien Hue | V | Dien Hoa-Dien Hai | Phong Dien DPC | ud | |
| Tra Vinh | IV | Khu B1-Lang The | Management and Opeartion of Irrigation Schemes of Tra Vinh PPC and Cang Long DPC | Cang Long Branch | |
| Tra Vinh | V | Lang The | Management and Opeartion of Irrigation Schemes of Tra Vinh PPC and Chau Thanh DPC | Chau Thanh Branch | |
| Tuyen Quang | IV | Minh An | Farmers' Organization in Ngoc Hoi Commune | Farmers' Organization in Ngoc Hoi Commune | |
| Tuyen Quang | V | Yen Lap Commune | Farmers' Organization in Yep Lap Commune | Farmers' Organization in Yep Lap Commune | |
| Vinh Long | V | Rach T.-Thien My | Tra On DPC | Agricultural and Rural Development Division | |
| Vinh Phuc | V | Don Nhan | ud | ud | |
| Yen Bai | V | Khe The | ud | ud | |

Common: ud=not yet decided

# Database

# Appendix db.9.1 Opinions expressed in the group discussion and responses to the questionnaire

The themes of the group discussion

(1) How to use the database

(2) What to expect from the database

(3) The best way to use the database continuously

(4) Expected problems associated with OM/M of the database

(5) Suggestions for effective use of the database

Questionnaire

(6) Name of the affiliated organization

(7) Type of job (managerial, technical, administrative, etc.)

(8) Age

(9) Sex

(10) Evaluation of the level of understanding of the database

(11) Issues difficult to understand on the database

(12) Things required for the use of the database

(13) Comments and suggestions after using the database

(The numbers in the parentheses correspond to the numbers of the themes in the group discussion and the question numbers in the questionnaire. They are followed by the consecutive numbers given to individual opinions/responses.)

**Opinions on the database operation**

Establishment of an institutional framework for the database operation

(2) - 20 To establish standards for the database use so that all staff can use it without difficulty

(2) - 23 Prompt collection and update of data and information to meet demands

(3) - 3 Establishment of regulations on the OM/M

(3) - 16 Organizations and institutions concerned should know how to operate the database.

(4) - 4 The provincial and central governments have issued no regulation on the responsibility to make record of infrastructure.

(4) - 8 Insufficient communication between PPC and OM/M organizations.

(4) - 9 Lack of official link between DPI and the OM/M organizations

(4) - 10 The central government to provide local governments with guidance on how to use the database

(4) - 15 The central or local government has to issue decisions because of insufficient information on the

database use by DPIs

(5) - 1 Issuance of regulations on the OM/M by the central government

(5) - 8 MPI is required to issue circulars on the database.

(5) - 10 Issuance of regulations on the maintenance and management by the central government

(5) - 12 Guidance to the OM/M organizations on collection of data for the database is required.

(5) - 14 Issuance of decisions, laws, ordinances and documents on the operation and maintenance

(5) - 15 MPI issued an order on a similar system on monitoring reports of ODA projects (Decision No. 803/2007/QD-BKH, July 30th, 2007).

(12) - 5 Assistance from PPCs, DPCs and the OM/M organizations and coordination with these organizations

(12) - 6 Establishment of regulations on the OM/M by the central and local governments

(12) - 13 Development of a framework for regulations

(12) - 14 Exchange of information between, DPIs, JICA experts on database and MPI

(13) - 2 It is necessary to have decisions of the central government on *e.g.* deadline for submission and responsibilities of organizations concerned, which allow local government to use the database.

(13) - 10 There is a need to clearly define roles of MPI throughout the year and those of the OM/M organizations for each term.

(13) - 12 Establishment of consistent regulations of the central government on the management by local governments

(13) - 14 Free access to the database and Information provision for many people

(13) - 16 For better use of the database, the organizations concerned should ensure transmission of information and exchange of opinions on implementation methods amongst themselves. In addition, the database must be updated without fail.

(13) - 20 MPI should issue circular on management, reporting, monitoring and supervision/evaluation of SPLs.

(13) - 23 Consistent instructions and regulations from the local governments to the central government in order to standardize the management

(13) - 25 Issuance of decisions by PMU and DPIs on the database operation and appointment of people in charge in the organizations concerned

(13) - 31 Clearly defined regulations on dates of update and locations to store information will be required after the commencement of the use of this database. Which organization should provide the first information?

(13) - 35 Organizations such as PPC to issue regulations and circular letters on the database

<u>Budgetary measures and human resources</u>

(3) - 1 Provision of equipment and budget to the organizations concerned

(3) - 11 Provision of budget and personnel to the organizations concerned

(4) - 1 Shortage of personnel, budget and equipment

(4) - 2 Shortage of staff with skill and experience

| | |
|---|---|
| (4) - 5 | It is difficult to collect data for update because of the shortage of human resources. |
| (4) - 6 | Insufficient budget to conduct necessary training |
| (4) - 16 | Office LAN has not been installed. |
| (4) - 17 | Staff and training for them |
| (4) - 18 | Equipment and tools |
| (5) - 2 | Provision for required operational budget |
| (5) - 4 | Provision of required equipment |
| (5) - 6 | Consideration for the costs of data collection and input them in the databases |
| (5) - 17 | Expenses for the operation |
| (5) - 18 | Selection of full-time staff to facilitate progress of works. |
| (5) - 19 | Provision of equipment and personnel |
| (12) - 1 | Computers |
| (12) - 2 | Working staff |
| (12) - 3 | Budget required for the work |
| (12) - 8 | Computers, connection to the Internet, installation of office LAN and provision of hardware and software including purchase of Microsoft Excel |
| (12) - 9 | Workers |
| (12) - 10 | Expenses including allowances to the people in charge |
| (12) - 20 | Required workers (managers and those who enter data) |
| (12) - 21 | Machines and software (desk-top and lap-top computers, access to the Internet, installation of office LAN, digital cameras, Microsoft Excel, etc.) |
| (12) - 23 | Expenses including allowances to the people in charge |
| (13) - 5 | Budget for field surveys for the database and system update will be required. |
| (13) - 9 | It is necessary to have people who can take responsibility of correspondence for the database operations and measures against problems. |

<u>Guarantee of maintenance and update of the database</u>

| | |
|---|---|
| (2) - 4 | Continuous maintenance and update of the database |
| (3) - 8 | Update of input data without delay |
| (3) - 10 | Accumulation of data |
| (3) - 12 | Collection of information for update |
| (3) - 13 | The database will have to be updated and maintained regularly by the OM/M organizations |
| (3) - 15 | Long-term use |
| (3) - 17 | Input and update of new information without delay |
| (4) - 3 | Difficulty in collecting input data |
| (4) - 13 | Information on updated version of the databases |
| (5) - 11 | Provision of passwords for the access to the database |
| (5) - 21 | Data update by local staff |
| (12) - 15 | Accuracy and confidentiality of information |

(12) - 18 Update of input data

(12) - 19 Preparation and submission of input data by local management organizations such as DPCs and SPMU

(12) - 1 Problems associated with updating the database. May the past data be lost when the current database is updated, since new data will replace past data?

(13) - 7 It is not practical to enter a large quantity of data in the database because of a long time required for data collection.

(13) - 8 Since some sectors have complicated ways to enter data, it will be difficult to update such data.

(13) - 22 The database will have to be updated regularly without delay.

(13) - 32 After the commencement of the use of this database, information in the database will have to be updated (every quarter, month or fiscal year) if there is additional information on the project concerned.

Need to train personnel concerned

(3) - 2 Training and workshops for the staff

(3) - 5 Implementation of training and workshops for the staff

(3) - 14 Training and workshops for the staff

(4) - 7 Training for the OM/M staff

(4) - 14 Training for the organizations concerned

(5) - 3 Implementation of further training for the database

(5) - 5 Implementation of further training on the database

(5) - 16 Further training on the database to the staff of the organizations concerned

(12) - 4 Workshops and training

(12) - 7 Training for the staff of the organizations concerned including water supply companies, DOT, EVN and DARD

(12) - 11 Workshops and training

(12) - 22 Workshops and training for those who operate the database

(13) - 3 There is a need to implement training courses frequently in order to evaluate effects and validity of this system.

(13) - 18 It is better to have longer time to learn how to operate this database.

(13) - 19 PMU should prepare a plan to develop capacity to manage SPL Projects of provinces.

(13) - 21 JICA’s assistance to staff of the OM/M organizations in database operation and data input

(13) - 24 Training for the staff of the SPMUs on data update and collection

Information sharing among personnel concerned

(1) - 10 Information sharing between the central and local governments

(1) - 11 Information sharing between PMU and DPIs

(1) - 14 Information dissemination to others including successors

(1) - 17 The database makes it easy to provide explanation to newly-assigned personnel

| | |
|---|---|
| (2) - 1 | Transmission of data from fields to the central government to be made without delay |
| (2) - 2 | Transmission without delay of information and instructions |
| (2) - 3 | Application of this database to all sub-projects |
| (2) - 7 | Use of this database in all organizations |
| (2) - 18 | Sub-project information to be easily provided to newly-assigned staff |
| (3) - 6 | Establishment of a close cooperative relationship between PMU, DPI and the OM/M organizations |
| (3) - 7 | Establishment of a close cooperative relationship between the local and central governments |
| (5) - 13 | To connect the database to the Internet |
| (12) - 16 | Transmission of information from local governments to the central government and accuracy of the information |
| (13) - 36 | After the use of the database has commenced, data required for the management and operation should be made available. |

**Purposes of the database use**

<u>Assistance to management works</u>

| | |
|---|---|
| (1) - 3 | To be used to explain sub-projects |
| (1) - 9 | To be used as a tool for sub-project management |
| (1) - 15 | To be used when a sub-project report has to be prepared in a short time |
| (1) - 18 | To be used in sub-project management |
| (1) - 22 | To be used for the management staff |
| (1) - 23 | To enter data continuously |
| (2) - 6 | Collection of information on the management |
| (2) - 9 | To make the management easier |
| (2) - 13 | Collection of management data |
| (2) - 17 | To learn and understand the management |
| (2) - 22 | The database to be applicable and of help to the management works. |
| (5) - 20 | Sub-project monitoring |
| (13) - 27 | Entered data should be integrated in project evaluation reports required for the achievement of effects after the termination of the investment. |
| (13) - 29 | The database is useful for monitoring, evaluation and preparing reports. |

<u>Assistance to the operation, maintenance and management (OM/M)</u>

| | |
|---|---|
| (1) - 5 | To be used for repair and maintenance |
| (1) - 6 | To be used for the operation and management. |
| (1) - 20 | Technical data will be used for the operation and maintenance. |
| (1) - 21 | To be used for field staff concerned. |
| (2) - 8 | To be used for future SPL Projects |
| (2) - 11 | Saving of time and costs for OM/M of the project |

| | |
|---|---|
| (2) - 12 | To provide assistance to the OM/M works. |
| (2) - 21 | Confirmation of details of data by staff of the OM/M organizations |

Assistance to project implementation

| | |
|---|---|
| (1) - 1 | The information to be used in SPL Projects. |
| (1) - 2 | The data in the database will be used in other investment projects |
| (1) - 4 | To be used in similar provincial projects |
| (1) - 12 | To be used in similar provincial undertakings |
| (3) - 4 | Improvement of understanding and knowledge of the construction |
| (13) - 13 | Application of the database to other projects including SPL Projects, harmonization with other databases |
| (13) - 34 | The coming SPL Projects (SPL VI, VII, etc.) should be managed and operated with this system. |

Assistance to project formulation

| | |
|---|---|
| (2) - 10 | Assistance in planning of similar projects |

**Opinions on database construction**

Request to make the database easy and simple to use

| | |
|---|---|
| (2) - 19 | Updated data should be entered in the database without delay and made available in a simple way. |
| (3) - 9 | The database should be easy to operate so that staff of local governments can operate it. |
| (5) - 9 | Users will be confused if the volume of the database is too large. |
| (13) - 4 | The database has to be revised for the improvement its quality with frequent verification of its contents by organizations concerned in the central and local governments. There is a need to make the database of the water-supply sector easy to understand by preparing forms, models and guidance materials. |
| (13) - 30 | Data whose acquisition requires much time and labor should better be removed from the database. |

Improvement of the database

| | |
|---|---|
| (13) - 6 | In order to collect views from database users, workshops will have to be held frequently. |
| (13) - 11 | Improvement of the following functions: Automatic printing, automatic saving and copying, simplification of the search function and simplification of the input sheet so that it includes only the major standards |
| (13) - 15 | Detailed explanation to organizations, including PPCs and the OM/M organizations, which continuously use the system |

Application of the database to other projects

| | |
|---|---|
| (2) - 16 | Application of the database to other projects |
| (13) - 17 | This database should be used for management of other projects in different sectors |
| (13) - 26 | The database can be used for not only SPL Projects but also other provincial projects. |

Integration with other databases

(13) - 37 Study on synchronization and integration between the AMT (Aligned Monitoring Tool) system and the database in accordance with the Decision No. 803/2007/QD-BKH on Reporting ODA Projects issued by MPI

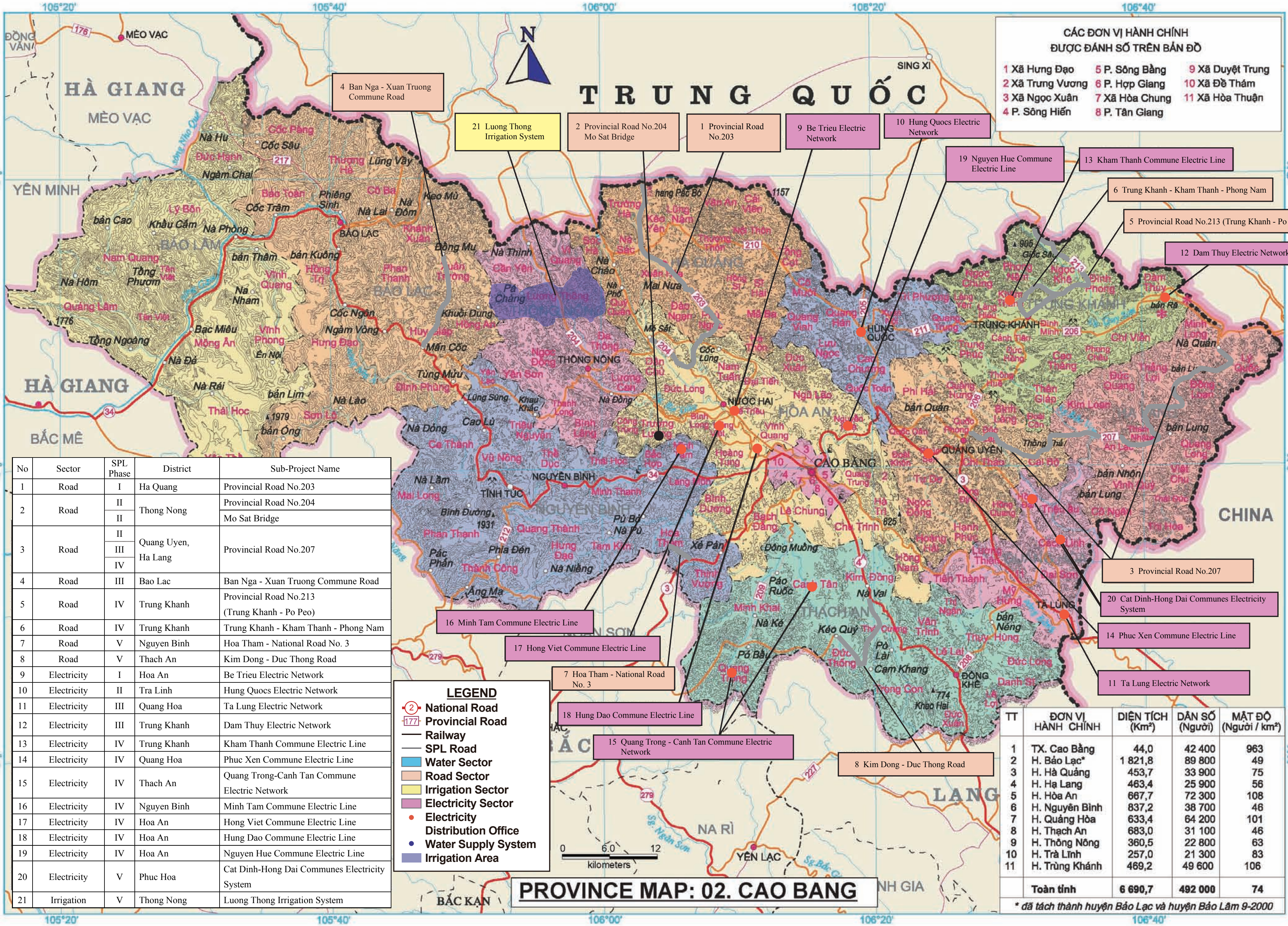
# SPL Infrastructure Map

| | | | |
|---|---|---|---|
| 01: | Ha Giang | 02: | Cao Bang |
| 03: | Lao Cai | 04: | Tuyen Quang |
| 05: | Bac Kan | 06: | Lang Son |
| 07: | Yen Bai | 08: | Thai Nguyen |
| 09: | Phu Tho | 10: | Bac Giang |
| 11: | Quang Ninh | 12: | Lai Chau |
| 13: | Dien Bien | 14: | Son La |
| 15: | Hoa Binh | 16: | Vinh Phuc |
| 17: | Bac Ninh | 18: | Ha Noi |
| 19: | Hai Duong | 20: | Hung Yen |
| 21: | Hai Phong | 22: | Thani Binh |
| 23: | Ha Nam | 24: | Nam Dinh |
| 25: | Ninh Binh | 26: | Thanh Hoa |
| 27: | Nghe An | 28: | Ha Tinh |
| 29: | Quang Binh | 30: | Quang Tri |
| 31: | Thua -Thien Hue | 32: | Da Nang |
| 33: | Quang Nam | 34: | Quang Ngai |
| 35: | Binh Dinh | 36: | Phu Yen |
| 37: | Khanh Hoa | 38: | Kon Tum |
| 39: | Gia Lai | 40: | Dak Lak |
| 41: | Dak Nong | 42: | Lam Dong |
| 43: | Ninh Thuan | 44: | Binh Thuan |
| 45: | Binh Phuoc | 46: | Dong Nai |
| 47: | Ba Ria Vung Tau | 48: | Binh Duong |
| 49: | Tay Ninh | 50: | Long An |
| 51: | Tien Giang | 52: | Ben Tre |
| 53: | Dong Thap | 54: | Vinh Long |
| 55: | Tra Vinh | 56: | An Giang |
| 57: | Can Tho | 58: | Hau Giang |
| 59: | Soc Trang | 60: | Kien Giang |
| 61: | Bac Lieu | 62: | Ca Mau |

| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I | NA | Road No.63A |
| 2 | Road | I<br>II | NA | Road No.64 |
| 3 | Road | I | NA | Road No.57A |
| 4 | Road | I | NA | Road No.62 |
| 5 | Road | II | NA | Chau Giang Bridge |
| 6 | Road | II | Thanh Liem | Road No.484, Thanh Liem |
| 7 | Road | II<br>III | NA | Road No.63B |
| 8 | Road | II<br>III | Thanh Liem | Provincial Road No.9715 |
| 9 | Road | III | Binh Luc | Road No.63C |
| 10 | Electricity | I | NA | Vinh Tru Commune Electric Line |
| 11 | Electricity | I | Duy Tien | Hoa Mac Commune Electric Line |
| 12 | Electricity | I | Vu Ban, | Vu Ban Commune Electric Line |
| 13 | Electricity | I | Thanh Liem | Kien Khe Commune Electric Line |
| 14 | Electricity | I | Binh Luc | Binh My Commune Electric Line |
| 15 | Electricity | I | Kim Bang | Nhat Tan Commune Electric Line |
| 16 | Electricity | II | Ly Nhan | Duc Ly Commune Electric |
| 17 | Electricity | II | Duy Tien | Chau Son Commune Electric |
| 18 | Electricity | II | Binh Luc | Hung Cong Commune Electric |
| 19 | Electricity | II | Ly Nhan | Dong Ly Commune Electric |
| 20 | Electricity | II | Kim Bang | Thuy Loi Commune Electric |


# PROVINCE MAP: 01. HA GIANG

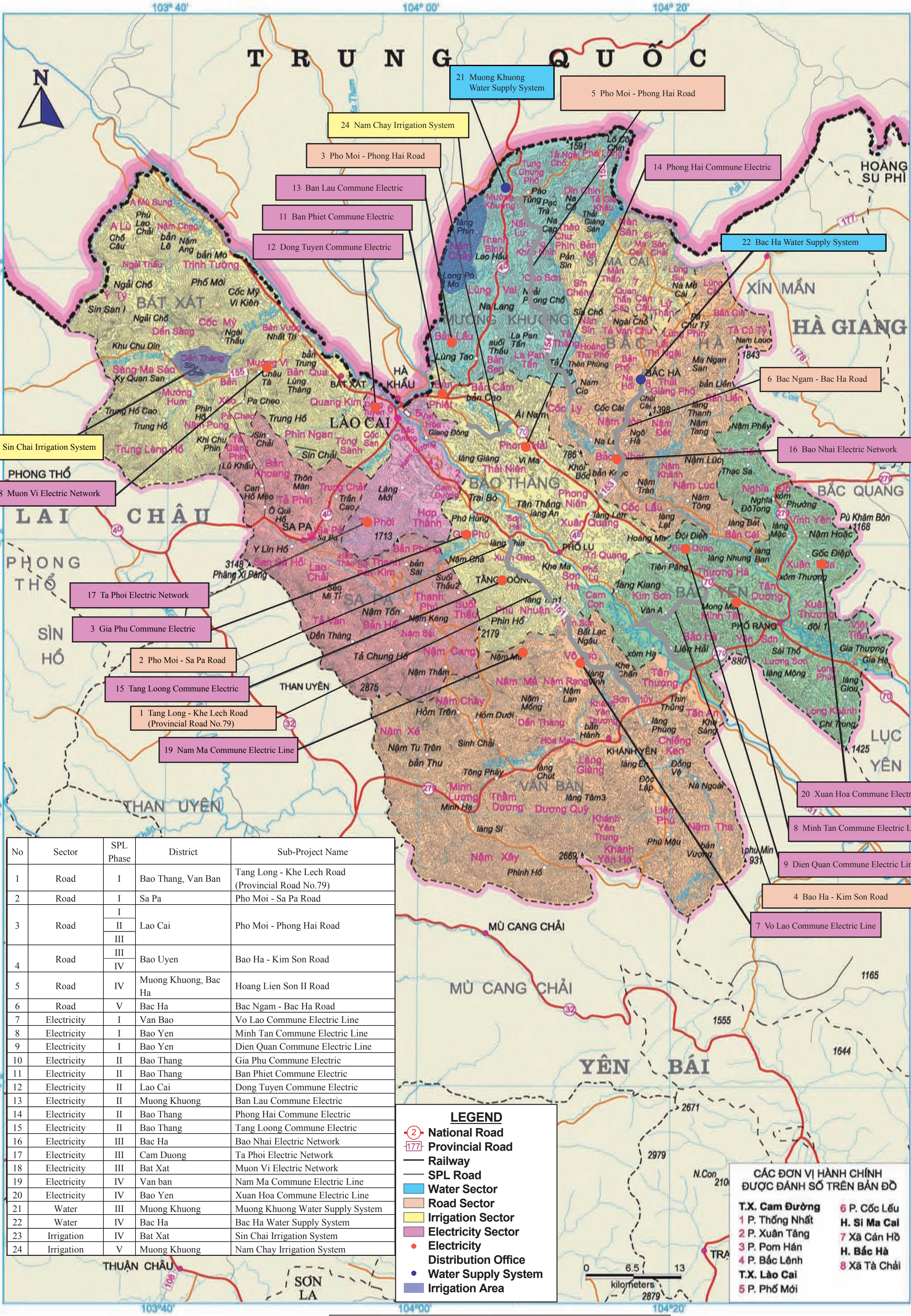
# PROVINCE MAP: 02. CAO BANG




| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I | Ha Quang | Provincial Road No.203 |
| 2 | Road | II | Thong Nong | Provincial Road No.204 |
| | | II | | Mo Sat Bridge |
| 3 | Road | II | Quang Uyen, Ha Lang | Provincial Road No.207 |
| | | III | | |
| | | IV | | |
| 4 | Road | III | Bao Lac | Ban Nga - Xuan Truong Commune Road |
| 5 | Road | IV | Trung Khanh | Provincial Road No.213 (Trung Khanh - Po Peo) |
| 6 | Road | IV | Trung Khanh | Trung Khanh - Kham Thanh - Phong Nam |
| 7 | Road | V | Nguyen Binh | Hoa Tham - National Road No. 3 |
| 8 | Road | V | Thach An | Kim Dong - Duc Thong Road |
| 9 | Electricity | I | Hoa An | Be Trieu Electric Network |
| 10 | Electricity | II | Tra Linh | Hung Quocs Electric Network |
| 11 | Electricity | III | Quang Hoa | Ta Lung Electric Network |
| 12 | Electricity | III | Trung Khanh | Dam Thuy Electric Network |
| 13 | Electricity | IV | Trung Khanh | Kham Thanh Commune Electric Line |
| 14 | Electricity | IV | Quang Hoa | Phuc Xen Commune Electric Line |
| 15 | Electricity | IV | Thach An | Quang Trong-Canh Tan Commune Electric Network |
| 16 | Electricity | IV | Nguyen Binh | Minh Tam Commune Electric Line |
| 17 | Electricity | IV | Hoa An | Hong Viet Commune Electric Line |
| 18 | Electricity | IV | Hoa An | Hung Dao Commune Electric Line |
| 19 | Electricity | IV | Hoa An | Nguyen Hue Commune Electric Line |
| 20 | Electricity | V | Phuc Hoa | Cat Dinh-Hong Dai Communes Electricity System |
| 21 | Irrigation | V | Thong Nong | Luong Thong Irrigation System |

| TT | ĐƠN VỊ HÀNH CHÍNH | DIỆN TÍCH (Km²) | DÂN SỐ (Người) | MẬT ĐỘ (Người / km²) |
|---|---|---|---|---|
| 1 | TX. Cao Bằng | 44,0 | 42 400 | 963 |
| 2 | H. Bảo Lạc* | 1 821,8 | 89 800 | 49 |
| 3 | H. Hà Quảng | 453,7 | 33 900 | 75 |
| 4 | H. Hạ Lang | 463,4 | 25 900 | 56 |
| 5 | H. Hòa An | 667,7 | 72 300 | 108 |
| 6 | H. Nguyên Bình | 837,2 | 38 700 | 46 |
| 7 | H. Quảng Hòa | 633,4 | 64 200 | 101 |
| 8 | H. Thạch An | 683,0 | 31 100 | 46 |
| 9 | H. Thông Nông | 360,5 | 22 800 | 63 |
| 10 | H. Trà Lĩnh | 257,0 | 21 300 | 83 |
| 11 | H. Trùng Khánh | 469,2 | 49 600 | 106 |
| | **Toàn tỉnh** | **6 690,7** | **492 000** | **74** |

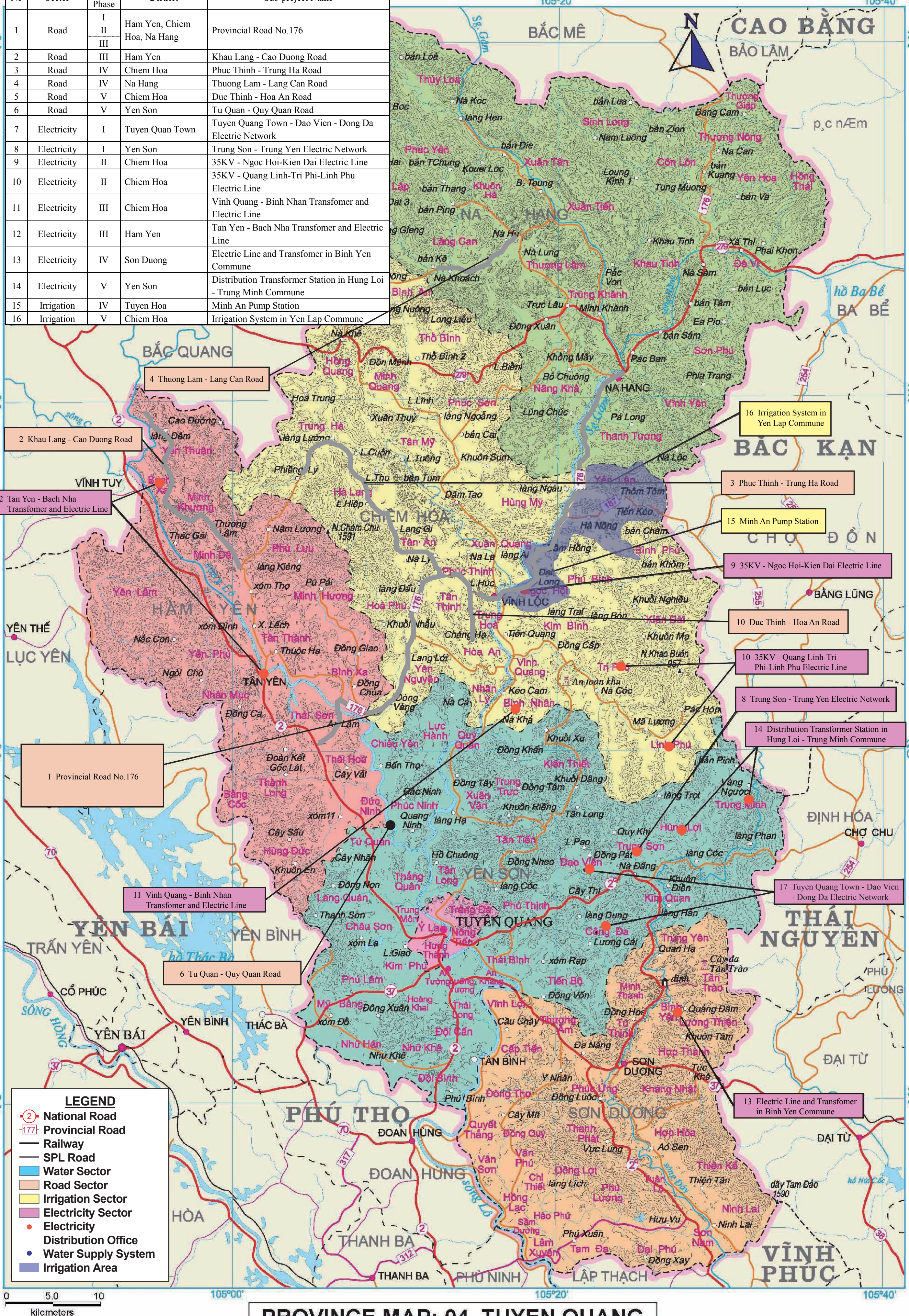
** đã tách thành huyện Bảo Lạc và huyện Bảo Lâm 9-2000*




| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I | Bao Thang, Van Ban | Tang Long - Khe Lech Road (Provincial Road No.79) |
| 2 | Road | I | Sa Pa | Pho Moi - Sa Pa Road |
| 3 | Road | I<br>II<br>III | Lao Cai | Pho Moi - Phong Hai Road |
| 4 | Road | III<br>IV | Bao Uyen | Bao Ha - Kim Son Road |
| 5 | Road | IV | Muong Khuong, Bac Ha | Hoang Lien Son II Road |
| 6 | Road | V | Bac Ha | Bac Ngam - Bac Ha Road |
| 7 | Electricity | I | Van Bao | Vo Lao Commune Electric Line |
| 8 | Electricity | I | Bao Yen | Minh Tan Commune Electric Line |
| 9 | Electricity | I | Bao Yen | Dien Quan Commune Electric Line |
| 10 | Electricity | II | Bao Thang | Gia Phu Commune Electric |
| 11 | Electricity | II | Bao Thang | Ban Phiet Commune Electric |
| 12 | Electricity | II | Lao Cai | Dong Tuyen Commune Electric |
| 13 | Electricity | II | Muong Khuong | Ban Lau Commune Electric |
| 14 | Electricity | II | Bao Thang | Phong Hai Commune Electric |
| 15 | Electricity | II | Bao Thang | Tang Loong Commune Electric |
| 16 | Electricity | III | Bac Ha | Bao Nhai Electric Network |
| 17 | Electricity | III | Cam Duong | Ta Phoi Electric Network |
| 18 | Electricity | III | Bat Xat | Muon Vi Electric Network |
| 19 | Electricity | IV | Van ban | Nam Ma Commune Electric Line |
| 20 | Electricity | IV | Bao Yen | Xuan Hoa Commune Electric Line |
| 21 | Water | III | Muong Khuong | Muong Khuong Water Supply System |
| 22 | Water | IV | Bac Ha | Bac Ha Water Supply System |
| 23 | Irrigation | IV | Bat Xat | Sin Chai Irrigation System |
| 24 | Irrigation | V | Muong Khuong | Nam Chay Irrigation System |

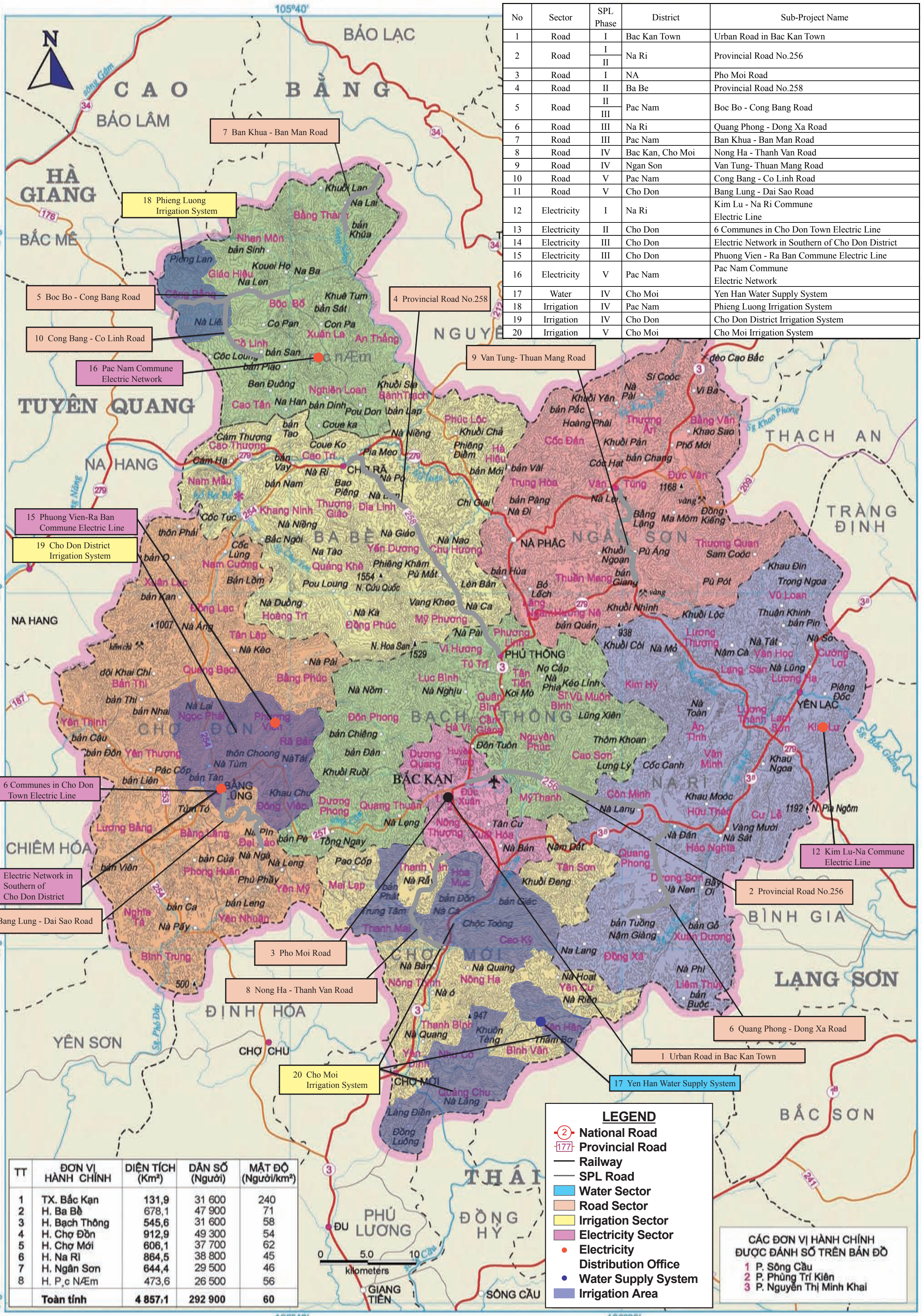
# PROVINCE MAP: 03. LAO CAI

| No | Sector | SPL Phase | District | Sub-project Name |
|---|---|---|---|---|
| 1 | Road | I<br>II<br>III | Ham Yen, Chiem Hoa, Na Hang | Provincial Road No.176 |
| 2 | Road | III | Ham Yen | Khau Lang - Cao Duong Road |
| 3 | Road | IV | Chiem Hoa | Phuc Thinh - Trung Ha Road |
| 4 | Road | IV | Na Hang | Thuong Lam - Lang Can Road |
| 5 | Road | V | Chiem Hoa | Duc Thinh - Hoa An Road |
| 6 | Road | V | Yen Son | Tu Quan - Quy Quan Road |
| 7 | Electricity | I | Tuyen Quan Town | Tuyen Quang Town - Dao Vien - Dong Da Electric Network |
| 8 | Electricity | I | Yen Son | Trung Son - Trung Yen Electric Network |
| 9 | Electricity | II | Chiem Hoa | 35KV - Ngoc Hoi-Kien Dai Electric Line |
| 10 | Electricity | II | Chiem Hoa | 35KV - Quang Linh-Tri Phi-Linh Phu Electric Line |
| 11 | Electricity | III | Chiem Hoa | Vinh Quang - Binh Nhan Transfomer and Electric Line |
| 12 | Electricity | III | Ham Yen | Tan Yen - Bach Nha Transfomer and Electric Line |
| 13 | Electricity | IV | Son Duong | Electric Line and Transfomer in Binh Yen Commune |
| 14 | Electricity | V | Yen Son | Distribution Transformer Station in Hung Loi - Trung Minh Commune |
| 15 | Irrigation | IV | Tuyen Hoa | Minh An Pump Station |
| 16 | Irrigation | V | Chiem Hoa | Irrigation System in Yen Lap Commune |




# PROVINCE MAP: 04. TUYEN QUANG

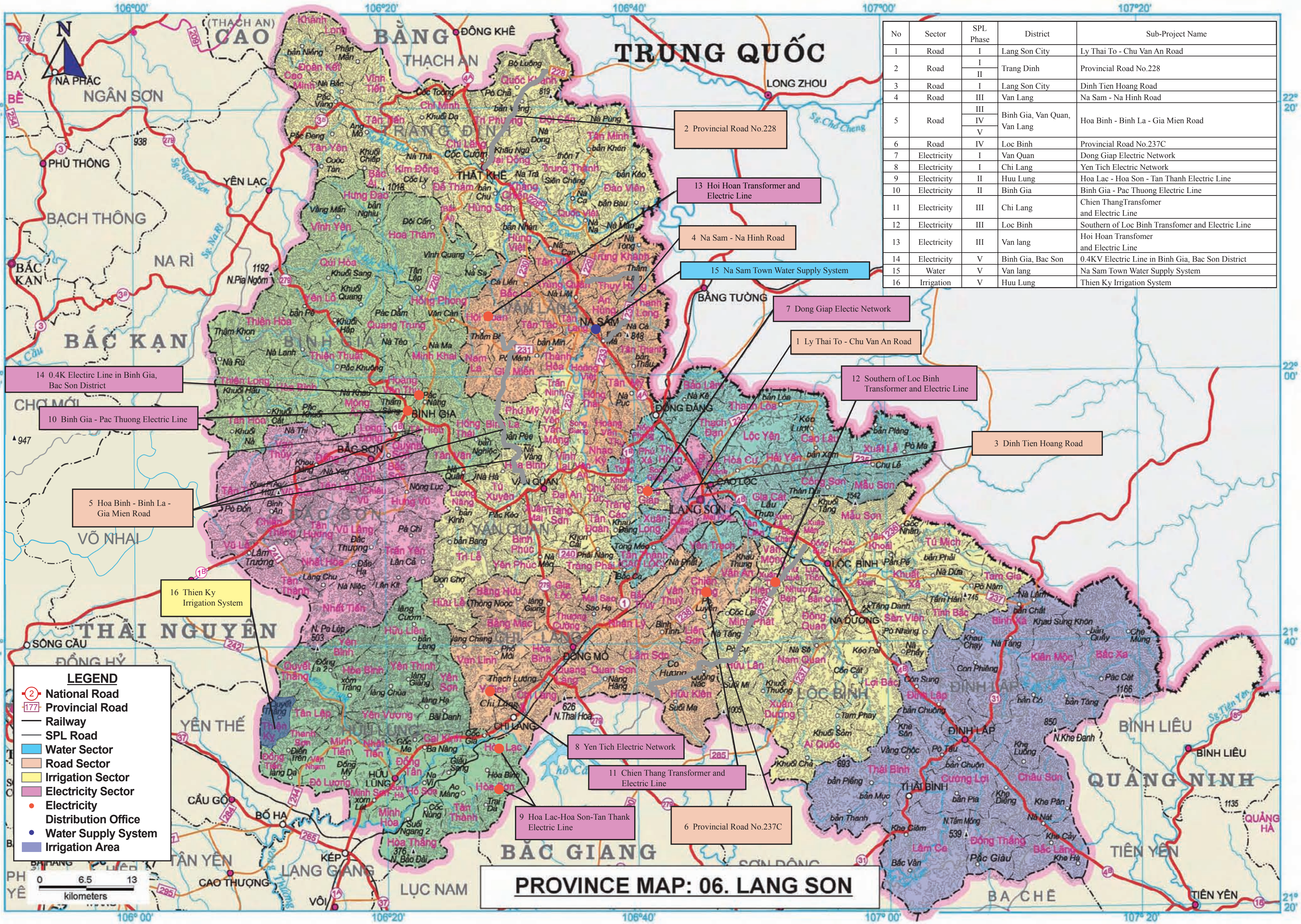
| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I | Bac Kan Town | Urban Road in Bac Kan Town |
| 2 | Road | I<br>II | Na Ri | Provincial Road No.256 |
| 3 | Road | I | NA | Pho Moi Road |
| 4 | Road | II | Ba Be | Provincial Road No.258 |
| 5 | Road | II<br>III | Pac Nam | Boc Bo - Cong Bang Road |
| 6 | Road | III | Na Ri | Quang Phong - Dong Xa Road |
| 7 | Road | III | Pac Nam | Ban Khua - Ban Man Road |
| 8 | Road | IV | Bac Kan, Cho Moi | Nong Ha - Thanh Van Road |
| 9 | Road | IV | Ngan Son | Van Tung- Thuan Mang Road |
| 10 | Road | V | Pac Nam | Cong Bang - Co Linh Road |
| 11 | Road | V | Cho Don | Bang Lung - Dai Sao Road |
| 12 | Electricity | I | Na Ri | Kim Lu - Na Ri Commune Electric Line |
| 13 | Electricity | II | Cho Don | 6 Communes in Cho Don Town Electric Line |
| 14 | Electricity | III | Cho Don | Electric Network in Southern of Cho Don District |
| 15 | Electricity | III | Cho Don | Phuong Vien - Ra Ban Commune Electric Line |
| 16 | Electricity | V | Pac Nam | Pac Nam Commune Electric Network |
| 17 | Water | IV | Cho Moi | Yen Han Water Supply System |
| 18 | Irrigation | IV | Pac Nam | Phieng Luong Irrigation System |
| 19 | Irrigation | IV | Cho Don | Cho Don District Irrigation System |
| 20 | Irrigation | V | Cho Moi | Cho Moi Irrigation System |




| TT | ĐƠN VỊ HÀNH CHÍNH | DIỆN TÍCH (Km²) | DÂN SỐ (Người) | MẬT ĐỘ (Người/km²) |
|---|---|---|---|---|
| 1 | TX. Bắc Kạn | 131,9 | 31 600 | 240 |
| 2 | H. Ba Bể | 678,1 | 47 900 | 71 |
| 3 | H. Bạch Thông | 545,6 | 31 600 | 58 |
| 4 | H. Chợ Đồn | 912,9 | 49 300 | 54 |
| 5 | H. Chợ Mới | 606,1 | 37 700 | 62 |
| 6 | H. Na Rì | 864,5 | 38 800 | 45 |
| 7 | H. Ngân Sơn | 644,4 | 29 500 | 46 |
| 8 | H. P,c NÆm | 473,6 | 26 500 | 56 |
| | Toàn tỉnh | 4 857,1 | 292 900 | 60 |

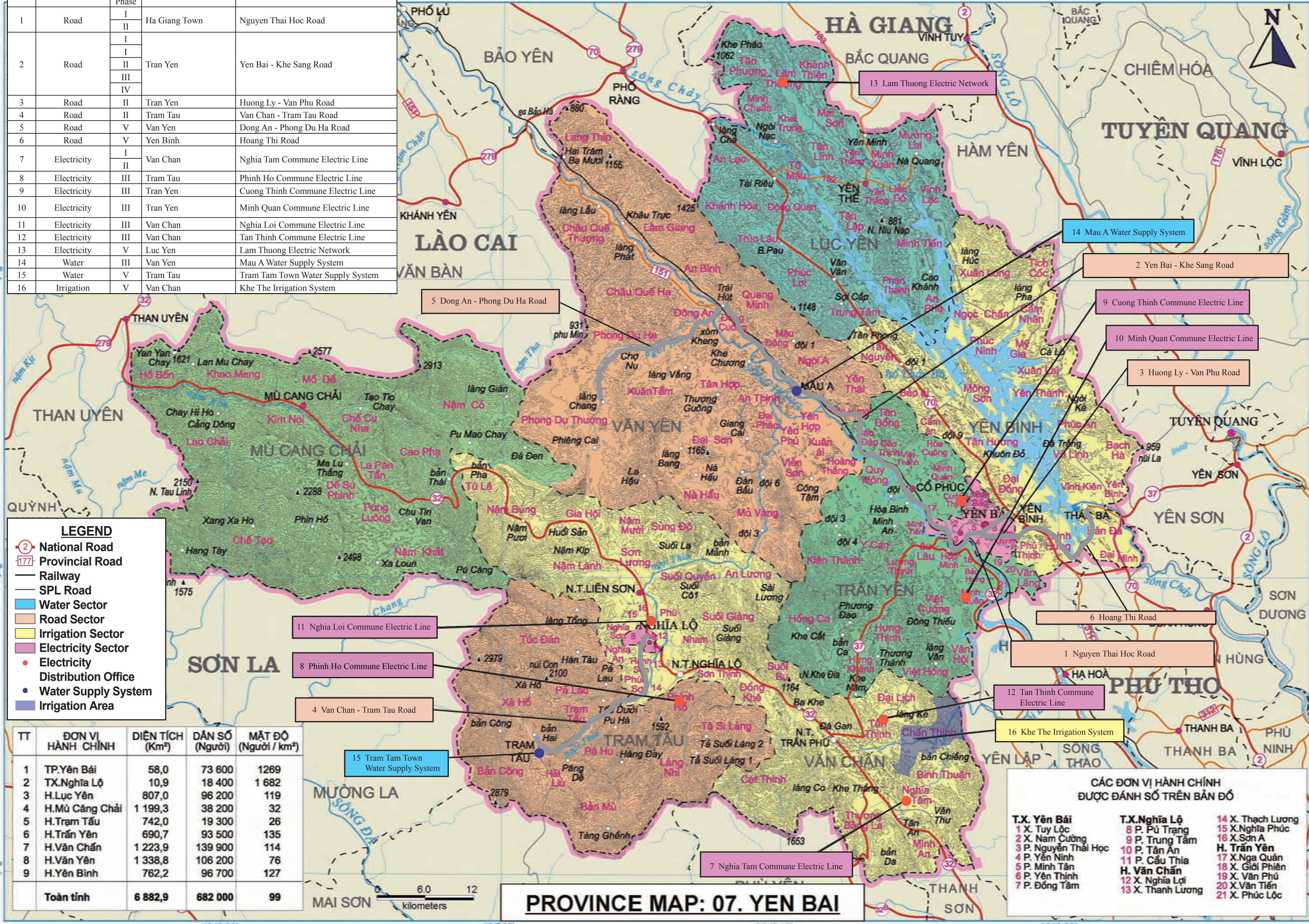
**PROVINCE MAP: 05. BAC KAN**

# PROVINCE MAP: 06. LANG SON




| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I | Lang Son City | Ly Thai To - Chu Van An Road |
| 2 | Road | I<br>II | Trang Dinh | Provincial Road No.228 |
| 3 | Road | I | Lang Son City | Dinh Tien Hoang Road |
| 4 | Road | III | Van Lang | Na Sam - Na Hinh Road |
| 5 | Road | III<br>IV<br>V | Binh Gia, Van Quan, Van Lang | Hoa Binh - Binh La - Gia Mien Road |
| 6 | Road | IV | Loc Binh | Provincial Road No.237C |
| 7 | Electricity | I | Van Quan | Dong Giap Electric Network |
| 8 | Electricity | I | Chi Lang | Yen Tich Electric Network |
| 9 | Electricity | II | Huu Lung | Hoa Lac - Hoa Son - Tan Thanh Electric Line |
| 10 | Electricity | II | Binh Gia | Binh Gia - Pac Thuong Electric Line |
| 11 | Electricity | III | Chi Lang | Chien ThangTransfomer and Electric Line |
| 12 | Electricity | III | Loc Binh | Southern of Loc Binh Transfomer and Electric Line |
| 13 | Electricity | III | Van lang | Hoi Hoan Transfomer and Electric Line |
| 14 | Electricity | V | Binh Gia, Bac Son | 0.4KV Electric Line in Binh Gia, Bac Son District |
| 15 | Water | V | Van lang | Na Sam Town Water Supply System |
| 16 | Irrigation | V | Huu Lung | Thien Ky Irrigation System |

| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I<br>II | Ha Giang Town | Nguyen Thai Hoc Road |
| 2 | Road | I<br>I<br>II<br>III<br>IV | Tran Yen | Yen Bai - Khe Sang Road |
| 3 | Road | II | Tran Yen | Huong Ly - Van Phu Road |
| 4 | Road | II | Tram Tau | Van Chan - Tram Tau Road |
| 5 | Road | V | Van Yen | Dong An - Phong Du Ha Road |
| 6 | Road | V | Yen Binh | Hoang Thi Road |
| 7 | Electricity | I<br>II | Van Chan | Nghia Tam Commune Electric Line |
| 8 | Electricity | III | Tram Tau | Phinh Ho Commune Electric Line |
| 9 | Electricity | III | Tran Yen | Cuong Thinh Commune Electric Line |
| 10 | Electricity | III | Tran Yen | Minh Quan Commune Electric Line |
| 11 | Electricity | III | Van Chan | Nghia Loi Commune Electric Line |
| 12 | Electricity | III | Van Chan | Tan Thinh Commune Electric Line |
| 13 | Electricity | V | Luc Yen | Lam Thuong Electric Network |
| 14 | Water | III | Van Yen | Mau A Water Supply System |
| 15 | Water | V | Tram Tau | Tram Tam Town Water Supply System |
| 16 | Irrigation | V | Van Chan | Khe The Irrigation System |

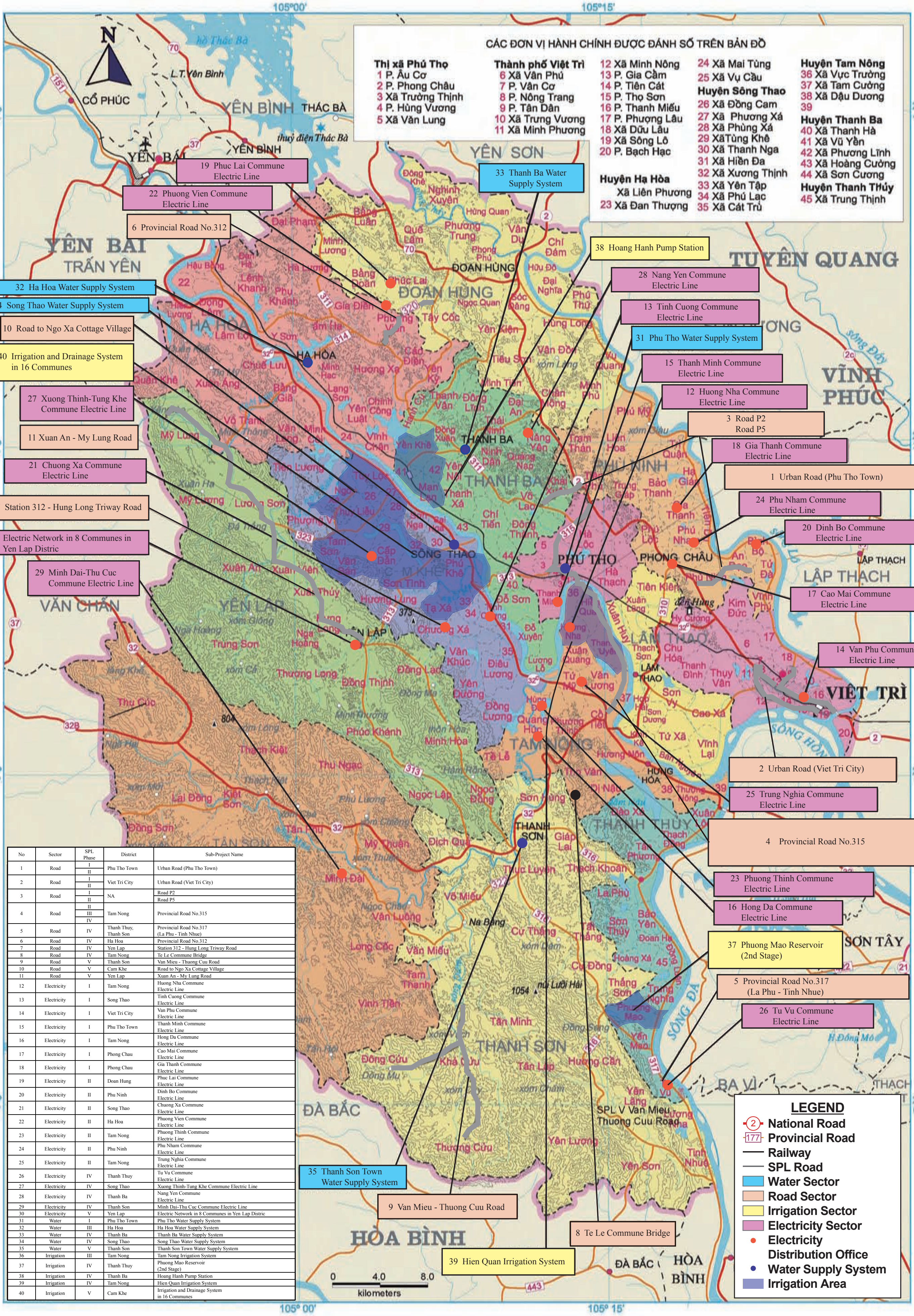



| TT | ĐƠN VỊ HÀNH CHÍNH | DIỆN TÍCH (Km²) | DÂN SỐ (Người) | MẬT ĐỘ (Người / km²) |
|---|---|---|---|---|
| 1 | TP.Yên Bái | 58,0 | 73 600 | 1269 |
| 2 | TX.Nghĩa Lộ | 10,9 | 18 400 | 1 682 |
| 3 | H.Lục Yên | 807,0 | 96 200 | 119 |
| 4 | H.Mù Căng Chải | 1 199,3 | 38 200 | 32 |
| 5 | H.Trạm Tấu | 742,0 | 19 300 | 26 |
| 6 | H.Trấn Yên | 690,7 | 93 500 | 135 |
| 7 | H.Văn Chấn | 1 223,9 | 139 900 | 114 |
| 8 | H.Văn Yên | 1 338,8 | 106 200 | 76 |
| 9 | H.Yên Bình | 762,2 | 96 700 | 127 |
| | **Toàn tỉnh** | **6 882,9** | **682 000** | **99** |

# PROVINCE MAP: 07. YEN BAI

| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I | Dinh Hoa | Provincial Road No.254 (Cho Chu - Deo So Road) |
| 2 | Road | I | Thai Nguyen City | Road No.74B ( Phan Dinh Phung Road) |
| 3 | Road | I | Vo Nhai | Dinh Ca - Khuon Manh Road |
| 4 | Road | II | Thai Nguyen City | CMT 8 Road |
| | | III | | Cach Mang Thang Tam Road |
| 5 | Road | III | Dinh Hoa | Phuc Chu - Bao Linh Road |
| 6 | Road | III | Dinh Hoa | Na Guong - Dong Thinh Road |
| 7 | Road | IV | Dinh Hoa | Tan Duong - Phuong Tien - Trung Hoi Road |
| 8 | Road | V | Dai Tu | Hung Son - Tan Linh - Phu Lac - Duc Luong Road |
| 9 | Road | V | Dai Tu | Phuc Luong - Minh Tien Inter-Commune Road |
| 10 | Electricity | I | Dinh Hoa | Dinh Hoa Electric Line |
| 11 | Electricity | I<br>II | Dong Hy | Van Han Commune Electric Line |
| 12 | Electricity | II | Dinh Hoa | ATK Area Electric Line |
| 13 | Electricity | II | Dai Tu | Ky Phu Commune Electric Line |
| 14 | Electricity | II | Vo Nhai | Phu Thuong Commune Electric Line |
| 15 | Electricity | IV | Pho Yen | Tan Phu Commune Electric Line |
| 16 | Electricity | V | Phu Binh | Tan Khanh-Phu Binh Commune Electric Network |
| 17 | Water | IV | Dai Tu | Dai Tu Water Supply System |
| 18 | Water | IV | Dong Hy | Trai Cau Town Water Supply System |
| 19 | Irrigation | IV | Pho Yen, Phu Binh | Ho Nui Coc Irrigation Canal |
| 20 | Irrigation | IV | Dinh Hoa | Ho Bao Linh Irrigation Canal |
| 21 | Irrigation | V | Dong Hy | Minh Lap - Hoa Thuong Irrigation System |

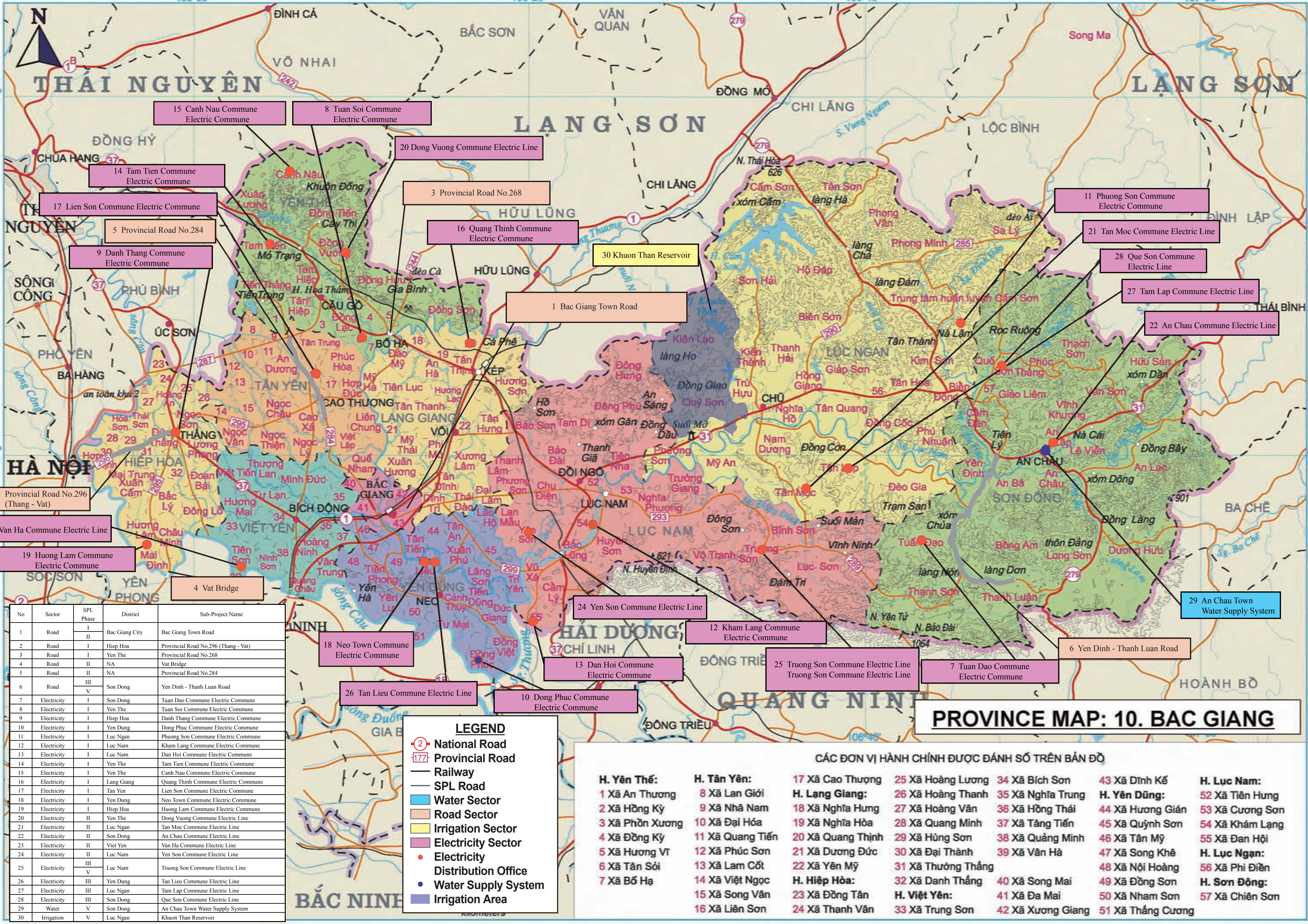

# PROVINCE MAP: 08. THAI NGUYEN




| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I<br>II | Phu Tho Town | Urban Road (Phu Tho Town) |
| 2 | Road | I<br>II | Viet Tri City | Urban Road (Viet Tri City) |
| 3 | Road | I<br>II | NA | Road P2<br>Road P5 |
| 4 | Road | II<br>III<br>IV | Tam Nong | Provincial Road No.315 |
| 5 | Road | IV | Thanh Thuy, Thanh Son | Provincial Road No.317 (La Phu - Tinh Nhue) |
| 6 | Road | IV | Ha Hoa | Provincial Road No.312 |
| 7 | Road | IV | Yen Lap | Station 312 - Hung Long Triway Road |
| 8 | Road | IV | Tam Nong | Te Le Commune Bridge |
| 9 | Road | V | Thanh Son | Van Mieu - Thuong Cuu Road |
| 10 | Road | V | Cam Khe | Road to Ngo Xa Cottage Village |
| 11 | Road | V | Yen Lap | Xuan An - My Lung Road |
| 12 | Electricity | I | Tam Nong | Huong Nha Commune Electric Line |
| 13 | Electricity | I | Song Thao | Tinh Cuong Commune Electric Line |
| 14 | Electricity | I | Viet Tri City | Van Phu Commune Electric Line |
| 15 | Electricity | I | Phu Tho Town | Thanh Minh Commune Electric Line |
| 16 | Electricity | I | Tam Nong | Hong Da Commune Electric Line |
| 17 | Electricity | I | Phong Chau | Cao Mai Commune Electric Line |
| 18 | Electricity | I | Phong Chau | Gia Thanh Commune Electric Line |
| 19 | Electricity | II | Doan Hung | Phuc Lai Commune Electric Line |
| 20 | Electricity | II | Phu Ninh | Dinh Bo Commune Electric Line |
| 21 | Electricity | II | Song Thao | Chuong Xa Commune Electric Line |
| 22 | Electricity | II | Ha Hoa | Phuong Vien Commune Electric Line |
| 23 | Electricity | II | Tam Nong | Phuong Thinh Commune Electric Line |
| 24 | Electricity | II | Phu Ninh | Phu Nham Commune Electric Line |
| 25 | Electricity | II | Tam Nong | Trung Nghia Commune Electric Line |
| 26 | Electricity | IV | Thanh Thuy | Tu Vu Commune Electric Line |
| 27 | Electricity | IV | Song Thao | Xuong Thinh-Tung Khe Commune Electric Line |
| 28 | Electricity | IV | Thanh Ba | Nang Yen Commune Electric Line |
| 29 | Electricity | IV | Thanh Son | Minh Dai-Thu Cuc Commune Electric Line |
| 30 | Electricity | V | Yen Lap | Electric Network in 8 Communes in Yen Lap Distric |
| 31 | Water | I | Phu Tho Town | Phu Tho Water Supply System |
| 32 | Water | III | Ha Hoa | Ha Hoa Water Supply System |
| 33 | Water | IV | Thanh Ba | Thanh Ba Water Supply System |
| 34 | Water | IV | Song Thao | Song Thao Water Supply System |
| 35 | Water | V | Thanh Son | Thanh Son Town Water Supply System |
| 36 | Irrigation | III | Tam Nong | Tam Nong Irrigation System |
| 37 | Irrigation | IV | Thanh Thuy | Phuong Mao Reservoir (2nd Stage) |
| 38 | Irrigation | IV | Thanh Ba | Hoang Hanh Pump Station |
| 39 | Irrigation | IV | Tam Nong | Hien Quan Irrigation System |
| 40 | Irrigation | V | Cam Khe | Irrigation and Drainage System in 16 Communes |

PROVINCE MAP: 09. PHU THO

# PROVINCE MAP: 10. BAC GIANG




| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I<br>II | Bac Giang City | Bac Giang Town Road |
| 2 | Road | I | Hiep Hoa | Provincial Road No.296 (Thang - Vat) |
| 3 | Road | I | Yen The | Provincial Road No.268 |
| 4 | Road | II | NA | Vat Bridge |
| 5 | Road | II | NA | Provincial Road No.284 |
| 6 | Road | III<br>V | Son Dong | Yen Dinh - Thanh Luan Road |
| 7 | Electricity | I | Son Dong | Tuan Dao Commune Electric Commune |
| 8 | Electricity | I | Yen The | Tuan Soi Commune Electric Commune |
| 9 | Electricity | I | Hiep Hoa | Danh Thang Commune Electric Commune |
| 10 | Electricity | I | Yen Dung | Dong Phuc Commune Electric Commune |
| 11 | Electricity | I | Luc Ngan | Phuong Son Commune Electric Commune |
| 12 | Electricity | I | Luc Nam | Kham Lang Commune Electric Commune |
| 13 | Electricity | I | Luc Nam | Dan Hoi Commune Electric Commune |
| 14 | Electricity | I | Yen The | Tam Tien Commune Electric Commune |
| 15 | Electricity | I | Yen The | Canh Nau Commune Electric Commune |
| 16 | Electricity | I | Lang Giang | Quang Thinh Commune Electric Commune |
| 17 | Electricity | I | Tan Yen | Lien Son Commune Electric Commune |
| 18 | Electricity | I | Yen Dung | Neo Town Commune Electric Commune |
| 19 | Electricity | I | Hiep Hoa | Huong Lam Commune Electric Commune |
| 20 | Electricity | II | Yen The | Dong Vuong Commune Electric Line |
| 21 | Electricity | II | Luc Ngan | Tan Moc Commune Electric Line |
| 22 | Electricity | II | Son Dong | An Chau Commune Electric Line |
| 23 | Electricity | II | Viet Yen | Van Ha Commune Electric Line |
| 24 | Electricity | II | Luc Nam | Yen Son Commune Electric Line |
| 25 | Electricity | III<br>V | Luc Nam | Truong Son Commune Electric Line |
| 26 | Electricity | III | Yen Dung | Tan Lieu Commune Electric Line |
| 27 | Electricity | III | Luc Ngan | Tam Lap Commune Electric Line |
| 28 | Electricity | III | Son Dong | Que Son Commune Electric Line |
| 29 | Water | V | Son Dong | An Chau Town Water Supply System |
| 30 | Irrigation | V | Luc Ngan | Khuon Than Reservoir |

## LEGEND

- National Road
- Provincial Road
- Railway
- SPL Road
- Water Sector
- Road Sector
- Irrigation Sector
- Electricity Sector
- Electricity Distribution Office
- Water Supply System
- Irrigation Area

## CÁC ĐƠN VỊ HÀNH CHÍNH ĐƯỢC ĐÁNH SỐ TRÊN BẢN ĐỒ

**H. Yên Thế:**
1 Xã An Thượng
2 Xã Hồng Kỳ
3 Xã Phồn Xương
4 Xã Đồng Kỳ
5 Xã Hương Vĩ
6 Xã Tân Sỏi
7 Xã Bố Hạ

**H. Tân Yên:**
8 Xã Lan Giới
9 Xã Nhã Nam
10 Xã Đại Hóa
11 Xã Quang Tiến
12 Xã Phúc Sơn
13 Xã Lam Cốt
14 Xã Việt Ngọc
15 Xã Song Vân
16 Xã Liên Sơn
17 Xã Cao Thượng

**H. Lạng Giang:**
18 Xã Nghĩa Hưng
19 Xã Nghĩa Hòa
20 Xã Quang Thịnh
21 Xã Dương Đức
22 Xã Yên Mỹ
25 Xã Hoàng Lương
26 Xã Hoàng Thanh
27 Xã Hoàng Vân
28 Xã Quang Minh
29 Xã Hùng Sơn
30 Xã Đại Thành
31 Xã Thưởng Thắng
32 Xã Danh Thắng

**H. Hiệp Hòa:**
23 Xã Đồng Tân
24 Xã Thanh Vân

**H. Việt Yên:**
33 Xã Trung Sơn
34 Xã Bích Sơn
35 Xã Nghĩa Trung
36 Xã Hồng Thái
37 Xã Tăng Tiến
38 Xã Quảng Minh
39 Xã Vân Hà
40 Xã Song Mai
41 Xã Đa Mai
42 Xã Xương Giang
43 Xã Dĩnh Kế

**H. Yên Dũng:**
44 Xã Hương Gián
45 Xã Quỳnh Sơn
46 Xã Tân Mỹ
47 Xã Song Khê
48 Xã Nội Hoàng
49 Xã Đồng Sơn
50 Xã Nham Sơn
51 Xã Thắng Cương

**H. Lục Nam:**
52 Xã Tiên Hưng
53 Xã Cương Sơn
54 Xã Khám Lạng
55 Xã Đan Hội

**H. Lục Ngạn:**
56 Xã Phi Điền

**H. Sơn Động:**
57 Xã Chiên Sơn


| No | Sector | SPL Phase | District | Sub-Project Name |
|---|---|---|---|---|
| 1 | Road | I<br>II<br>III | Yen Hung | Urban Road<br>(Quang Yen Town) |
| 2 | Road | I<br>II | Dong Trieu | Duc Chinh - An Sinh Road |
| 3 | Road | I<br>II<br>III | Binh Lieu | Hoanh Mo - Dong Van Road |
| 4 | Electricity | II | Ha Long City | Transformer in Westen of<br>Ha Long City |
| 5 | Water | I | Dong Trieu | Dong Trieu Water Supply System |
| 6 | Water | III | Quang Ha | Quang Ha Water Supply System |