CHAPTER 5 FEASIBILITY STUDY ON PRIORITY PROJECT

5.1 Definition of Priority Project for Feasibility Study

The Stage 1 Project is identified as the priority project for urgent implementation in the Master Plan and the Stage 1 Project thus will be covered in the Feasibility Study.

Target year of the Stage 1 will be year 2006. Key parameters of the Stage 1 are shown in Table 5.1.1. Relation of the system capacity of the Stage 1 and future water demand is show on Figure 4.5.1.

Table 5.1.1 Key Parameters in Year 2006 : Stage 1

Description	Figures in Year 2006
Population in Service Area	39,244
Service Ratio	65 %
Served Population	25,508
Domestic Water Demand (Daily Average)	3,061 m^3/day
Tourism Water Demand (Daily Average)	2,060 m^3/day
Special Water Demand (Daily Average)	156 m^3/day
Total Water Demand (Daily Average)	5,277 m^3/day
Total Water Demand (Daily Maximum)	8,352 m^3/day
Number of Domestic Connection	4,475
Total Number of Connection	4,797

Scope of works of the Stage 1 are as shown below.

- Construction of 10 wells
- Installation of well connecting pipes
- Construction of receiving well
- Construction of clear water reservoir
- Installation of disinfection facilities
- Construction of distribution pumping station
- Installation of distribution pipelines
- Installation of service mains
- Rehabilitation of existing distribution pipeline
- Installation of house connections

5.2 Additional Topographic Surveys

A topographic survey was carried out in the proposed distribution trunk main route, distribution center, and other related locations. This would contribute to preliminary design of the water supply facilities. The work was completed by using local contractors. The work consists of Route Survey of 15 km along

pipeline route, topographic mapping survey for 3 places, leveling survey for 20 points, and establishing 8 new benchmarks.

5.3 The Stage 1 Project

(1) Future Water Supply Facilities

Future water supply system flow, which will use groundwater as its source, is shown in Figure 5.3.1. Disinfected groundwater will be stored in the clear water reservoir to buffer hourly peak water demand. Method of water distribution is direct pumping, hence new additional elevated tank will not be constructed.

(2) Production Facilities

1) Well Field

Ten wells to be constructed under the Stage 1 will be located along the National Road No. 6 at 400 m intervals. Plan of the well field is shown in Figure 5.3.2.

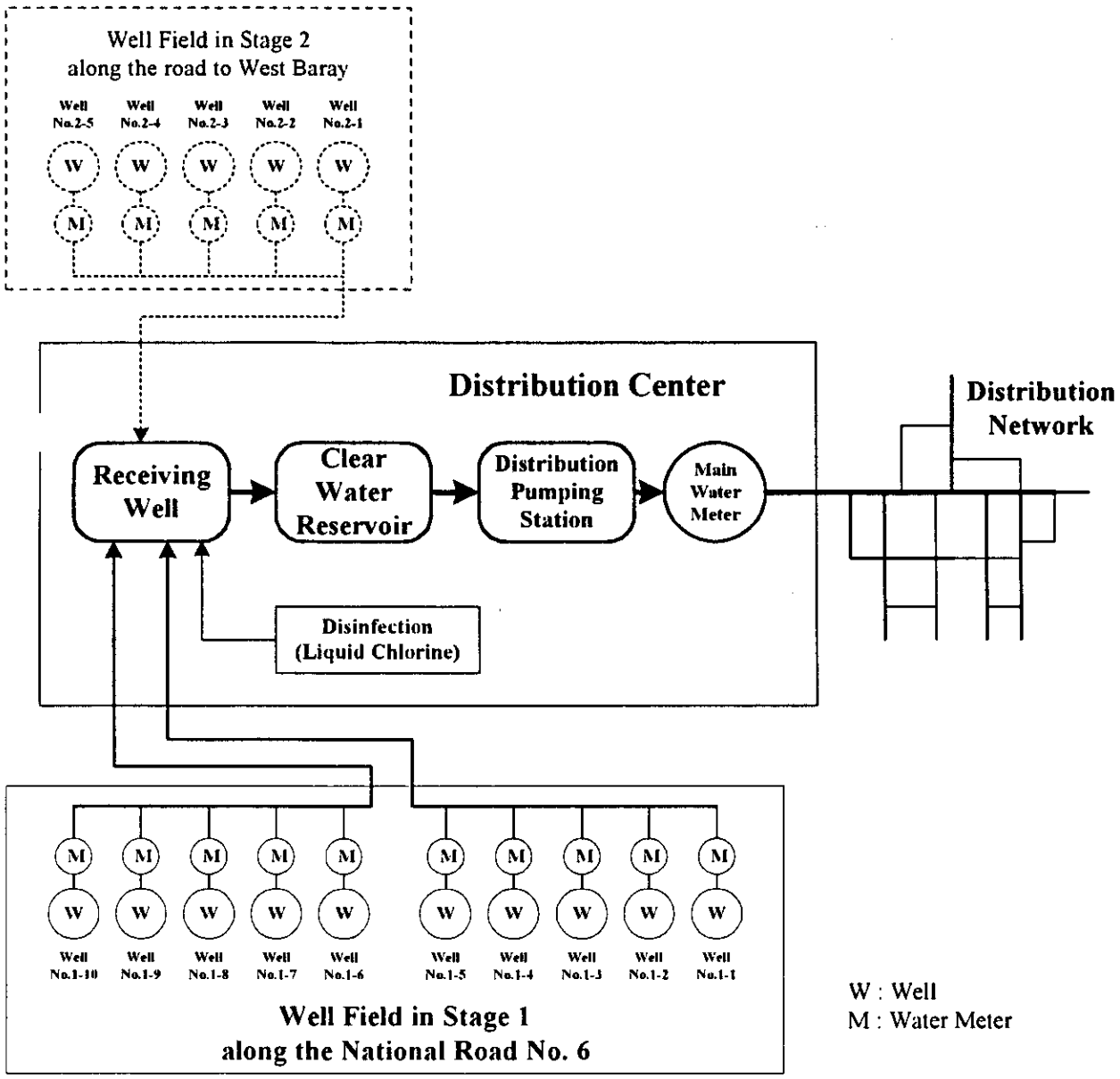
From the consideration of safe yield from each well within 5 m drawdown and from the critical state of well, it was found out that each well should have a capacity of 800 m^3/day. A computer simulation for this condition confirmed that there would be no impact on surrounding wells and Angkor heritage. Because of the different drawdown in different wells, three kinds of well design are made from the viewpoints of safety and reliable steady pumping. The design is covered for all seasons even for lowest ground water level.

2) Well Connecting Pipe

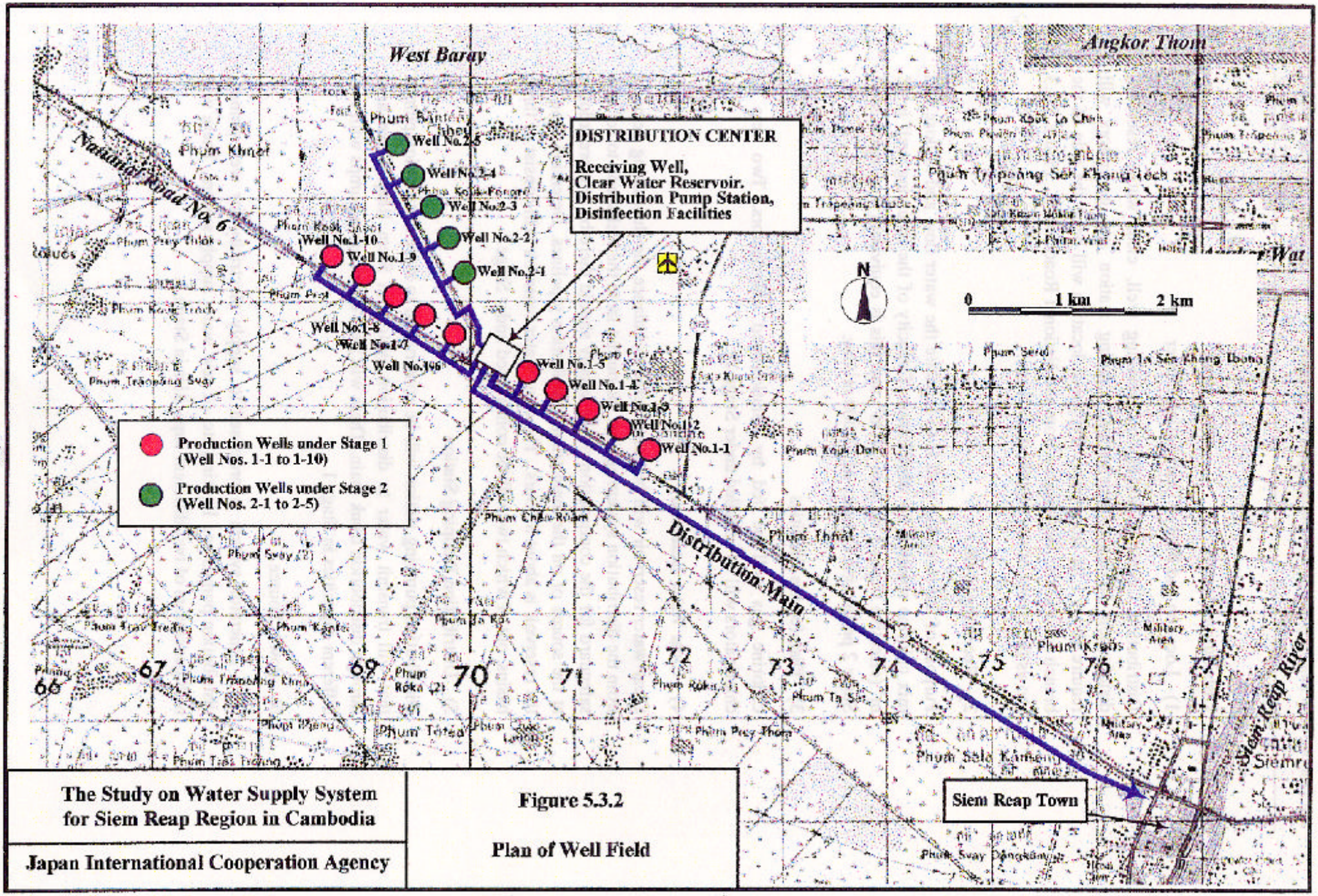
Every five wells are connected by one connecting pipe of which diameter is 150 mm to 250 mm. Ductile Cast Iron Pipe (DIP) will be recommended for the material of the connecting pipe because of its reliability and easy installation work specially in rainy season.

3) Well Submergible Pump

Specifications of well submergible pumps are designed from the head loss in the well connecting pipes and level of groundwater. There will be two types of submergible pumps.



The Study on Water Supply System for Siem Reap Region in Cambodia	Figure 5.3.1 Water Supply System Flow
Japan International Cooperation Agency	



The Study on Water Supply System for Siem Reap Region in Cambodia

Japan International Cooperation Agency

Figure 5.3.2

Plan of Well Field

(3) Distribution Center

1) Location and Plan of Distribution Center

Distribution Center consisting of receiving well, clear water reservoir, disinfection facilities, distribution pumping station and generators will require about 1 ha land space. Proposed location will be at the side of the branch road to the West Baray from the National Road No. 6. Figure 5.3.3 shows the layout of the Distribution Center.

2) Receiving Well

Purpose of the receiving well is to regulate the water flow and to dose and mix chlorine solution for disinfection. Capacity of the receiving well is 42 m^3 (effective depth 3 m, area 14 m^2) and this is equivalent to 5 minutes of Stage 2 production capacity of 12,000 m^3/day.

3) Disinfection Facilities

Chlorine gas will be fed by solution-feed chlorinators. Two sets of chlorinators will be installed under Stage 1.

4) Clear Water Reservoir

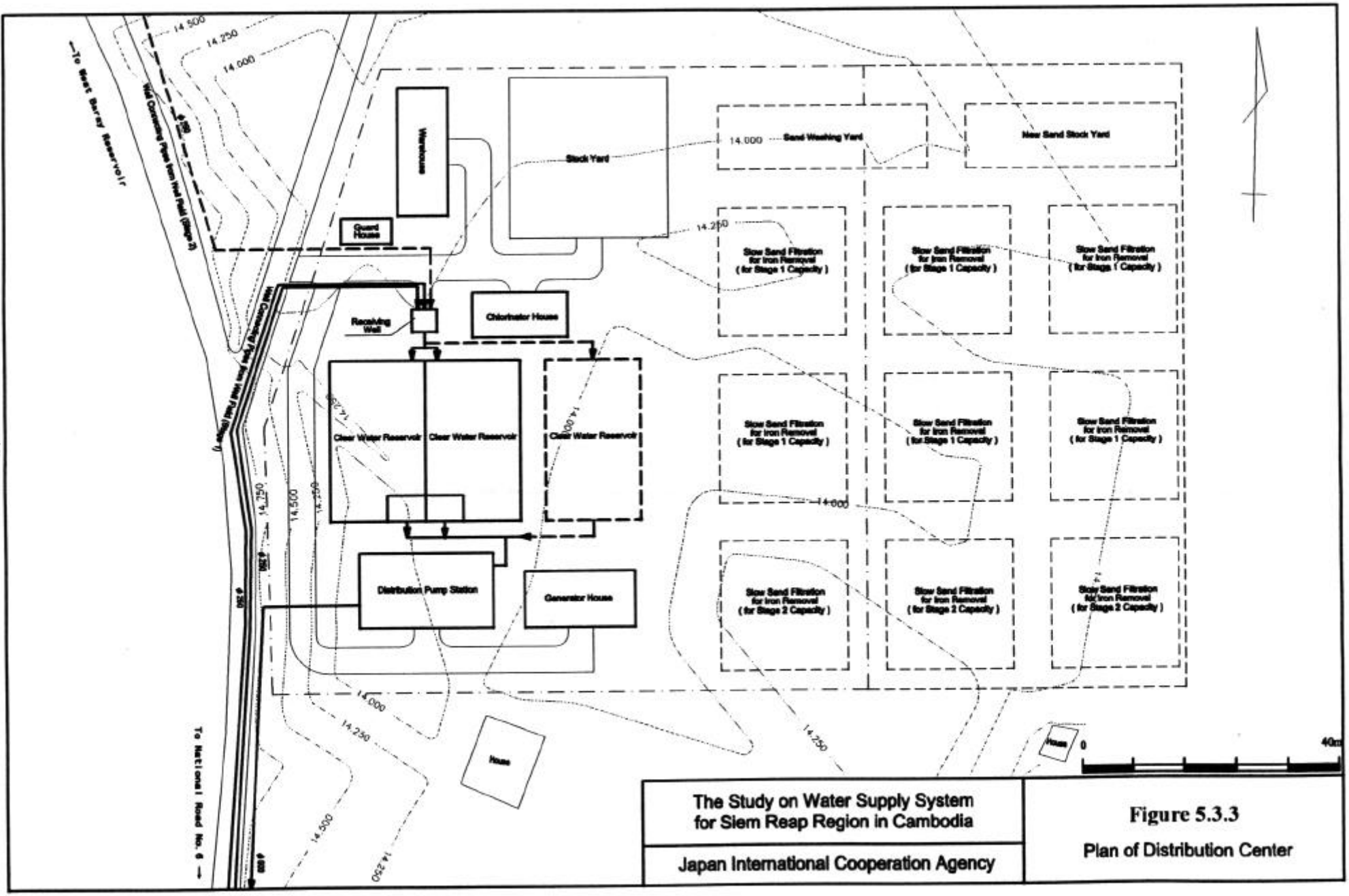
Clear water reservoir will be constructed to balance the fluctuating demand from the distribution system against the output from the wells, and to act as a safeguard for the continuation of the supply should there be any breakdown at the source or on the main trunk distribution pipelines. Detention time of the reservoir is about 8 hours. The clear water reservoir will consist of three basins, out of which two will be constructed under Stage 1

5) Distribution Pumping Station

Distribution pumping station will be constructed to store distribution pumps that will transmit water to distribution system in Siem Reap Town area through distribution trunk main. There will be 7 distribution pumps with two different capacities in Stage 1.

6) Power Source

Own generator system is proposed to supply electricity for well pumps, distribution pumps and lighting etc. of new water supply system. There will be 8 generators of two different capacities in Stage 1.



The Study on Water Supply System for Siem Reap Region in Cambodia

Japan International Cooperation Agency

Figure 5.3.3

Plan of Distribution Center

(4) Distribution System

1) Hydraulic Network Analysis

From the distribution pumping station, water will be transmitted to the town through distribution trunk main which will be installed along the National Road No. 6. Hotels, which are located along the National Road No. 6, will be supplied from branches on the trunk main.

According to the future land use plan, new hotel development project will take place in the northeast part of the town. Water supply system for the new hotel development area will be a separate system from the town water supply, but water will be supplied from Siem Reap Waterworks.

Water transmitted by the trunk main will be distributed to entire service area. Planned Stage 1 distribution network is shown on Figure 5.3.4. For the trunk main with diameter more than 200 mm DIP is recommended while for the secondary main with diameter less than 150 m PVC or PE is recommendable.

2) Meter District

It is recommended to introduce a Meter District System (MDS) for the proposed distribution network. By introducing the MDS, the Waterworks can evaluate the effectiveness of water supply or level of UFW in each meter district. Proposed four-districts MDS with required valves and meters are presented in the Study. Estimated water consumption in each meter district during peak hour period in Year 2006 is also presented.

It is recommended that tapping for connection is allowed only from distribution pipe of 150 mm diameter or smaller. It will require parallel pipe installation along with larger diameter to install connection. Required length of service main will be calculated from the length of distribution trunk main more than 200 mm, which is 6.2 km in total.

Number of house connection will increase from the commencement of water supply service under the Stage 1 Project and expected to reach around 4,800 by 2006.

(2) Operation and Maintenance

Periodic maintenance is recommended for the wells every 5 years. The most frequent problem is an iron incrustation in the screen caused by the dissolved iron hydroxide in low pH groundwater. First rehabilitation of the wells is recommended during the construction of Stage 2. Rehabilitation will be done by an air jetting or swabbing method. Deposited fine sand will be removed from the bottom of the well by the jetting method. In order to keep the impellers from getting corroded, periodic monitoring is proposed.