

Figure 2-37 SIHANOUKVILLE Distribution Pipe Rout Plan (9)

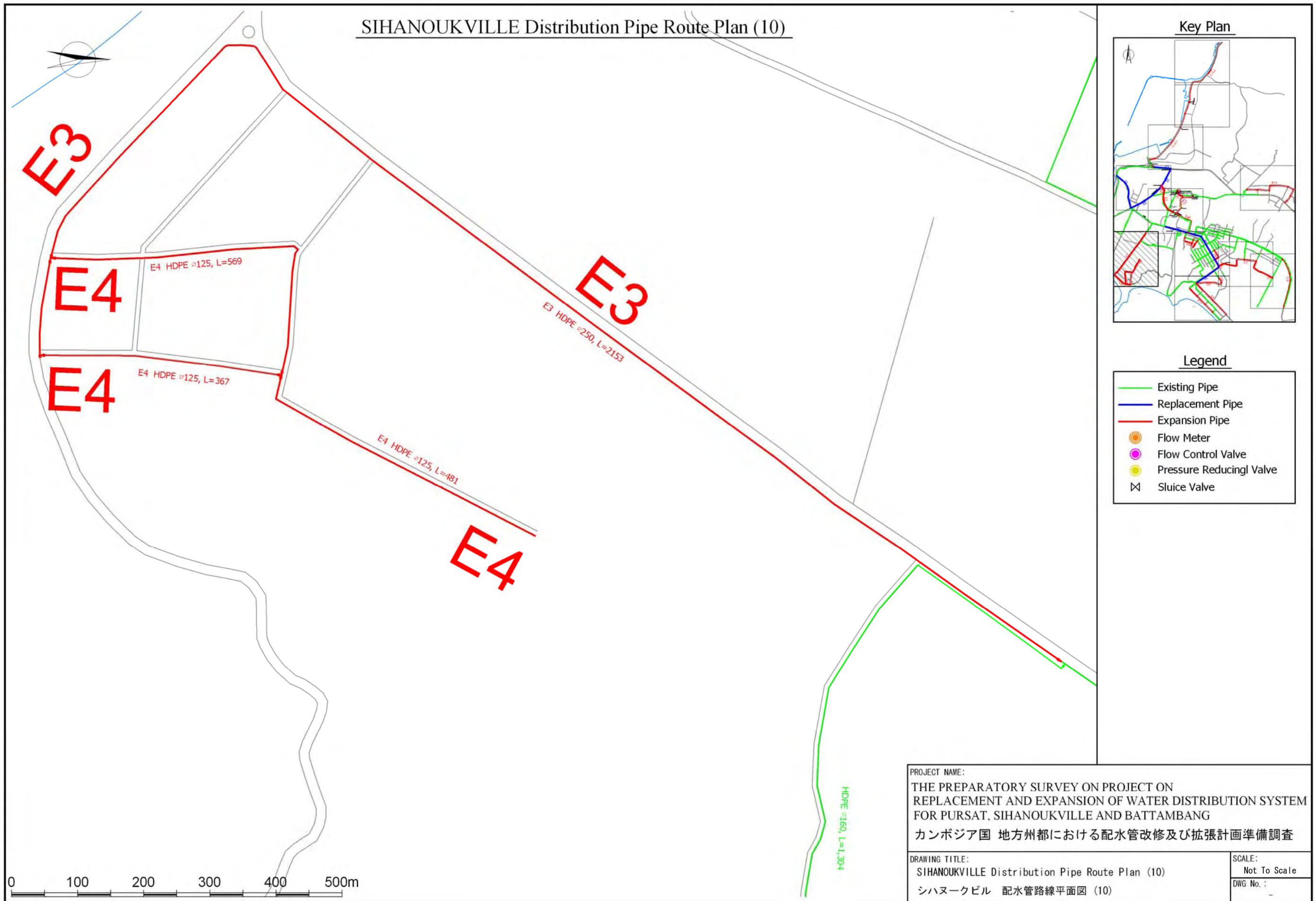


Figure 2-38 SIHANOUKVILLE Distribution Pipe Route Plan (10)

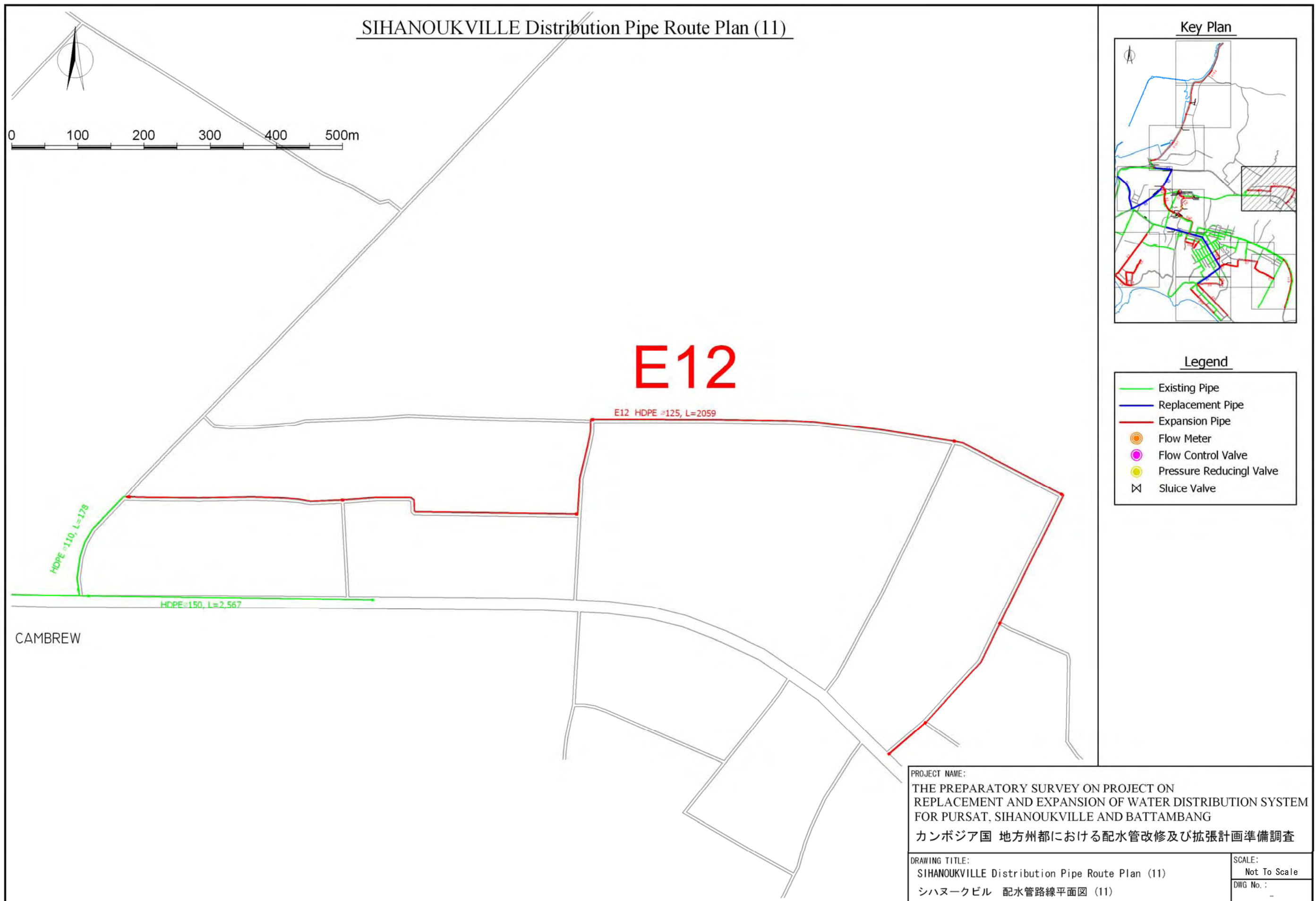
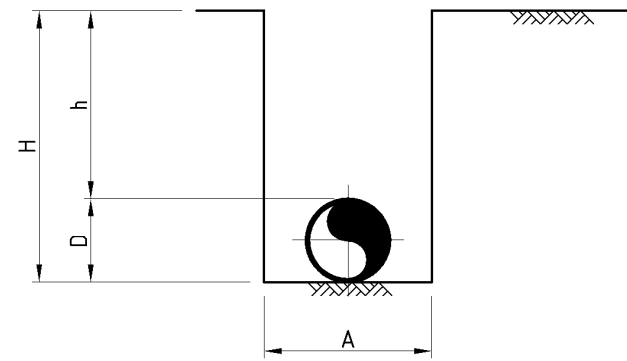
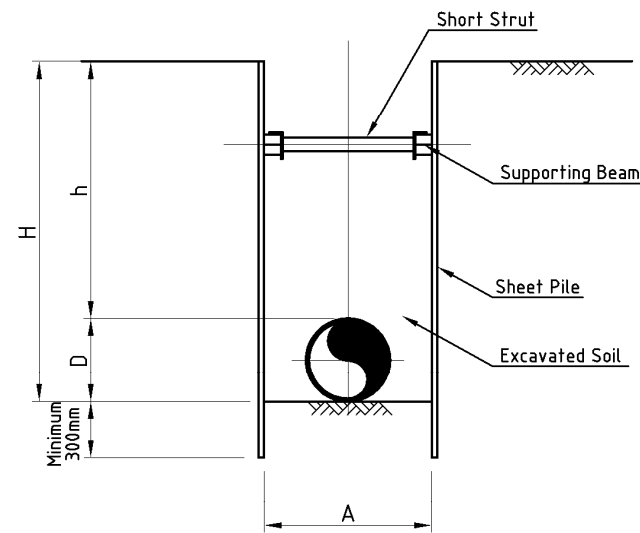


Figure 2-39 SIHANOUKVILLE Distribution Pipe Rout Plan (11)

General Earth Work for Pipe Laying



MACHINE EXCAVATION
NORMAL PART

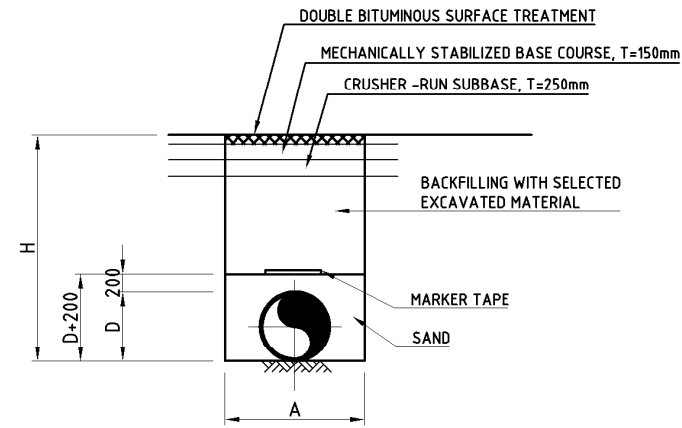


MACHINE EXCAVATION
SHEET PILE PART

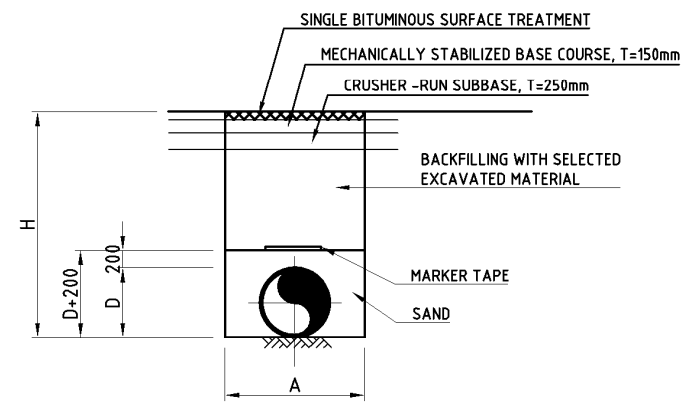
TYPICAL SIZE OF TRENCH EXCAVATION (MACHINE EXCAVATION)

PIPE MATERIAL	NOMINAL PIPE DIAMETER D(mm)	NORMAL PART			SHEET PILE PART		
		TRENCH WIDTH A(m)	DEPTH OF COVER +1 h(m)	EXCAVATION DEPTH H(m)	TRENCH WIDTH A(m)	DEPTH OF COVER +1 h(m)	EXCAVATION DEPTH H(m)
HDPE	50	0.50	0.8	1.05	0.70	-	< 1.60
	75	0.50	0.8	1.10	0.70	-	< 1.60
	100	0.50	0.8	1.15	0.75	-	< 1.60
	150	0.50	0.8	1.20	0.80	-	< 1.60
	200	0.50	0.8	1.25	0.85	-	< 1.60
DIP	250	0.50	1.2	1.30	0.85	-	< 1.60
	300	0.55	1.2	1.35	0.90	-	< 1.60
	350	0.60	1.2	1.40	1.00	-	< 1.60
	400	0.65	1.2	1.45	1.05	-	< 1.60
	500	-	-	-	1.15	1.2	1.75

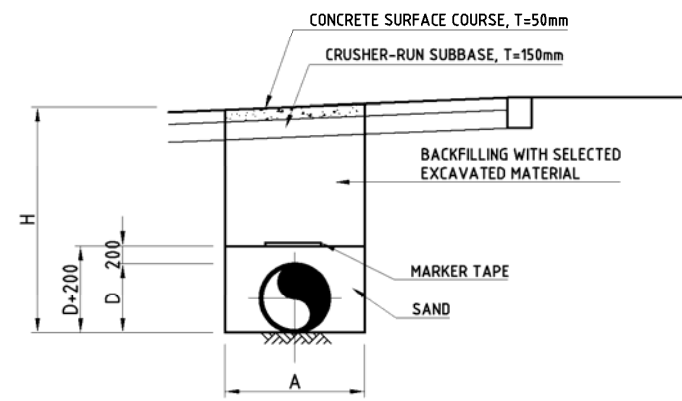
+1 DEPTH OF COVER : DEPEND ON THE SITE CONDITION.



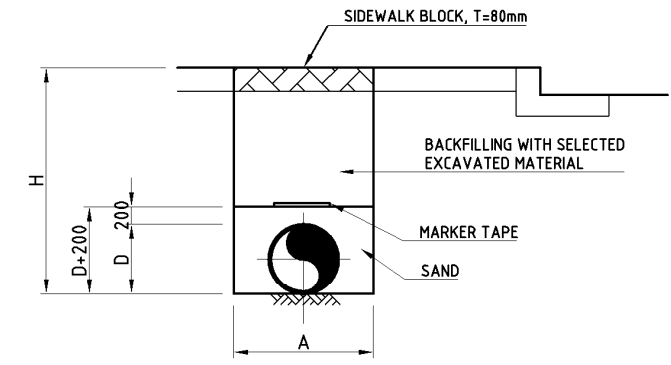
BACKFILL
A. ROADWAY OF THE NATIONAL ROAD



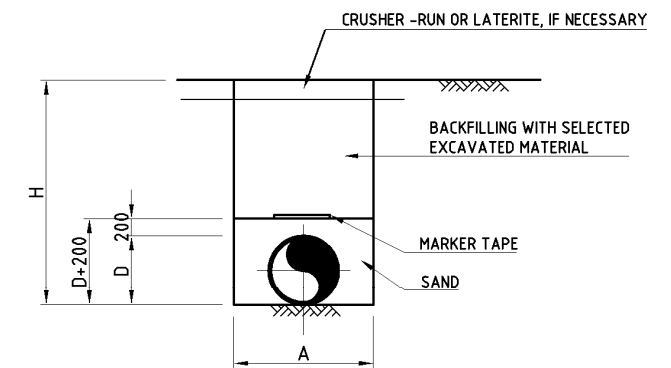
BACKFILL
B1. CITY ROAD (PAVING)
SHOULDER OF THE NATIONAL ROAD



BACKFILL
B2. CONCRETE SURFACE COURSE



BACKFILL
C. SIDEWALK



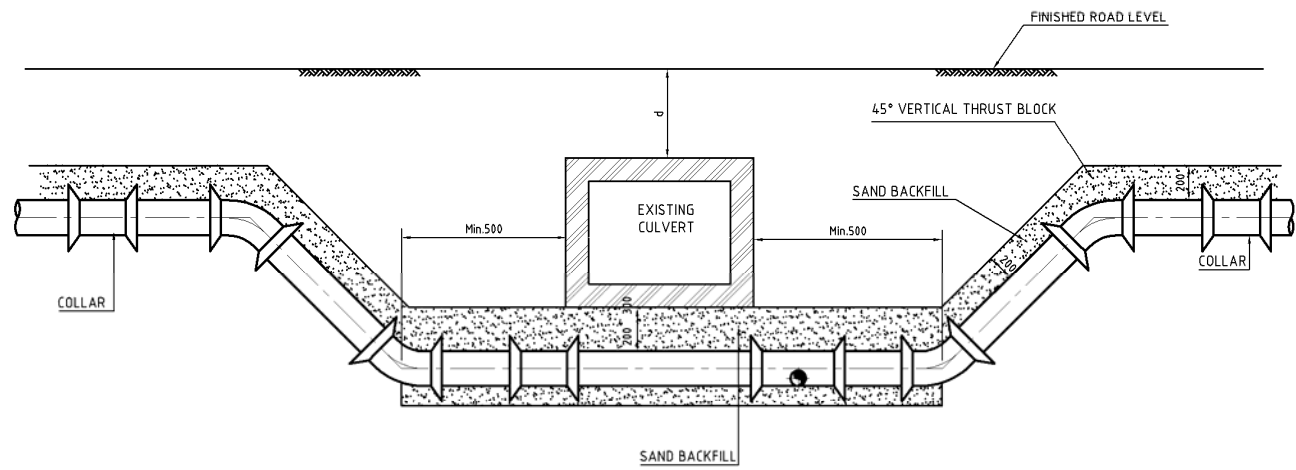
BACKFILL
D. UN-PAVING SURFACE

Notice : The Contractor shall perform the temporary restoration with 3 cm thickness of asphalt paving. The Provincial Bureau of Road Administration will restore the complete road. Cost of the complete restoration was estimated by the Consultants with 5 cm thickness of asphalt paving using Japanese standard unit costs.

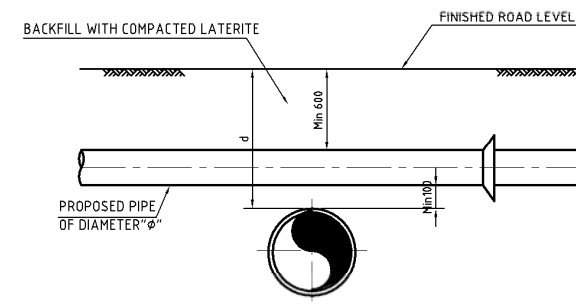
PROJECT NAME: THE PREPARATORY SURVEY ON PROJECT ON REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG カンボジア国 地方州都における配水管改修及び拡張計画準備調査	
DRAWING TITLE: General Earth Work for Pipe Laying 標準掘削断面及び埋め戻し図	SCALE: N. T. S.
	DWG No. : -

Figure 2-40 General Earth Work for Pipe Laying

Typical Drawing for Structure Crossing



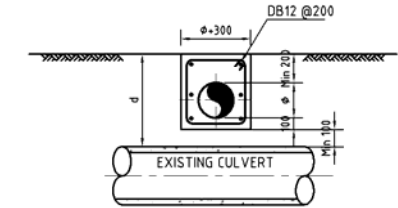
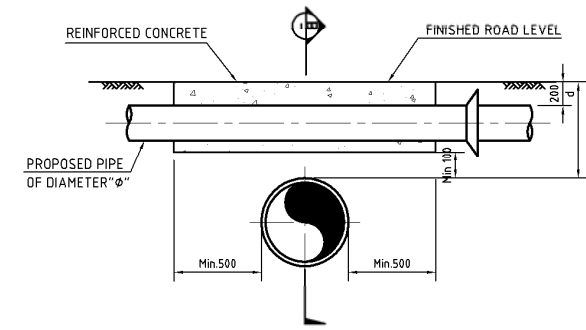
TYPE A : REQUIRED VERTICAL BEND 45°



TYPE C : $d \leq \phi + 700\text{mm}$

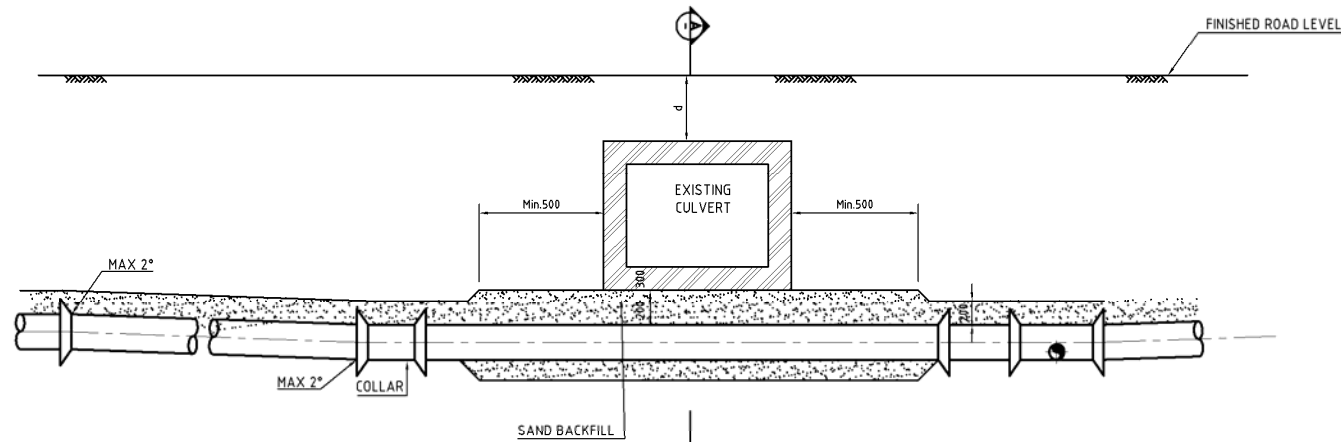
PIPE OVER CROSSING THE CULVERT

APPLICABLE TO ALL TYPES OF CULVERTS



SECTION (B)

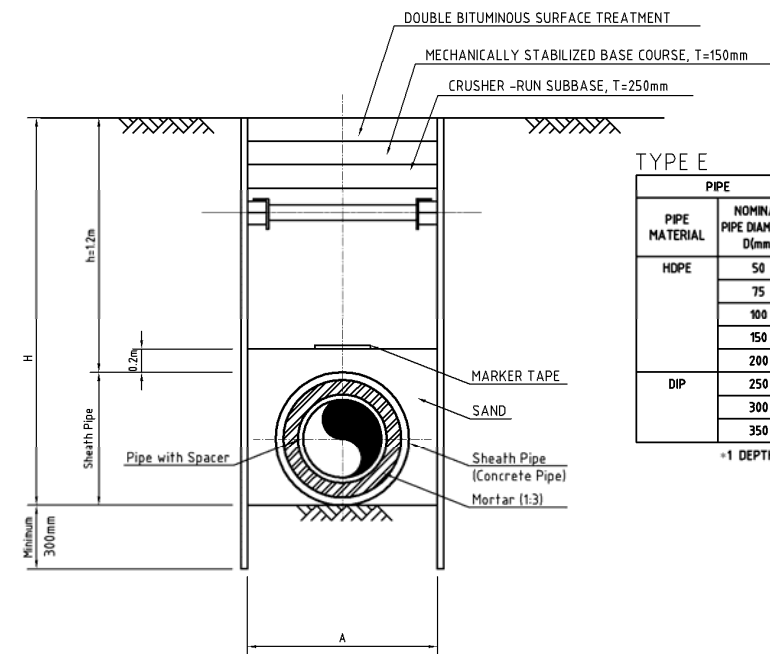
TYPE D : $\phi + 400\text{mm} < d < \phi + 700\text{mm}$



SECTION (A)

TYPE B : WITHIN ALLOWABLE DEFLECTION (MAXIMUM 2°)

PIPE UNDER CROSSING THE CULVERT



TYPE E :

PIPE UNDER CROSSING THE NATIONAL ROAD AND RAIL WAY

TYPE E

PIPE MATERIAL	NOMINAL PIPE DIAMETER D(mm)	SHEATH PIPE		MACHINE EXCAVATION			MACHINE EXCAVATION TYPE
		PIPE MATERIAL	NOMINAL PIPE DIAMETER D(mm)	TRENCH WIDTH A(m)	DEPTH OF COVER +1 h(m)	EXCAVATION DEPTH H(m)	
HDPE	50	CONCRETE PIPE (HP B-Type)	300	0.60	1.2	1.40	NORMAL
	75		300	0.60	1.2	1.45	
	100		350	1.00	1.2	1.60	
	150		400	1.05	1.2	1.70	
	200		450	1.15	1.2	1.75	
DIP	250	600	1.35	1.2	1.90	SHEET PILE	
	300	600	1.35	1.2	1.90		
	350	700	1.45	1.2	2.00		

+1 DEPTH OF COVER : DEPEND ON THE SITE CONDITION.

NOTES :

1. THE SPACE BETWEEN INVERT OF THE CULVERT & BOTTOM OF THE TRENCH IN TYPE A, & B SHALL BE FILLED WITH SAND TO THE FULL TRENCH WIDTH.
2. FOR OVER CROSSING TYPES D, CONCRETE SURROUND THE PIPE SHALL MINIMUM OF 4 Nos. OF 12 mm DEFORMED BARS AT EACH CORNERS & 10mm DEFORMED BARS 200mm INTERVALS WITH CONCRETE COVER OF 40mm. CONCRETE STRENGTH SHALL BE 21N/mm² FOR ALL REINFORCED CONCRETE SECTIONS.
3. IN THE EVENT OF UNDER CROSSING ALL TYPES OF CULVERTS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR USING AN APPROPRIATE SUPPORTING SYSTEM, AS APPROVED BY THE ENGINEER.

PROJECT NAME:

THE PREPARATORY SURVEY ON PROJECT ON REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG
カンボジア国 地方州都における配水管改修及び拡張計画準備調査

DRAWING TITLE:

Typical Drawing for Structure Crossing
構造物横断標準図

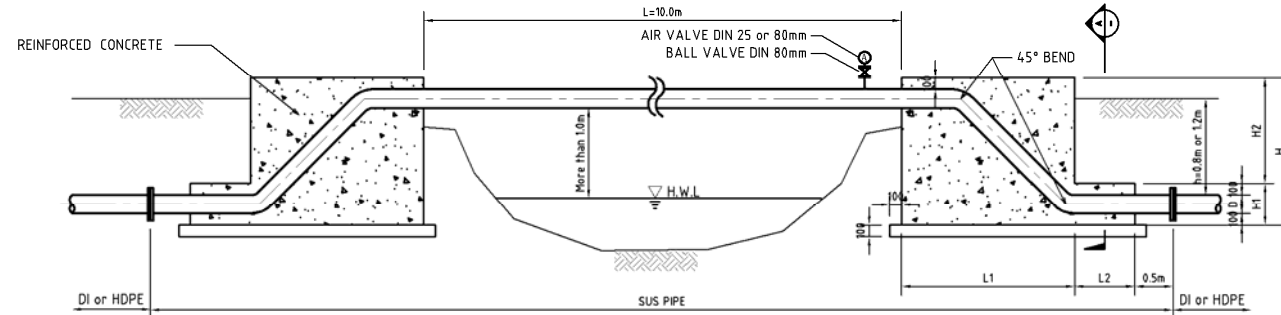
SCALE:

N. T. S

DWG No. :

Figure 2-41 Typical Drawing for Structure Crossing

Typical Drawing for Pipe Bridge and Bridge Mount Rack

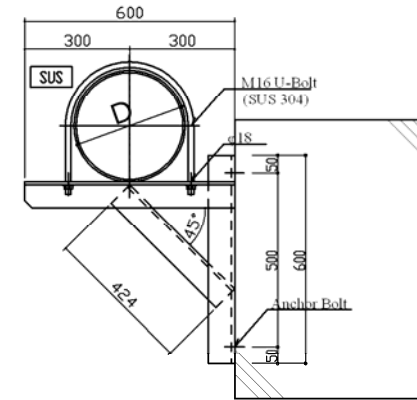
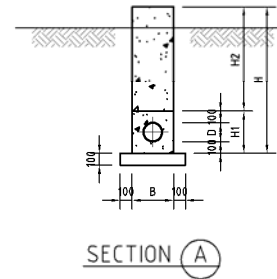


NOMINAL PIPE DIAMETER D(mm)	PIPE MATERIAL	PIPE DEPTH +1 h (m)	PIPE LENGTH (m)	L1 (m)	L2 (m)	H1 / B (m)	H2 (m)	H (m)
50	SUS 304 (JIS G 3459) or (JIS G 3468)	0.80	15.350	1.330	0.500	0.270	0.830	1.100
80		0.80	15.390	1.350	0.500	0.290	0.850	1.140
100		0.80	15.430	1.360	0.500	0.320	0.860	1.180
150		0.80	15.500	1.390	0.500	0.370	0.890	1.260
200		0.80	15.570	1.410	0.500	0.420	0.910	1.330
250		1.20	16.780	1.840	0.500	0.470	1.340	1.810
300		1.20	16.850	1.860	0.500	0.520	1.360	1.880
350		1.20	16.900	1.880	0.500	0.560	1.380	1.940
400		1.20	16.970	1.910	0.500	0.610	1.410	2.020

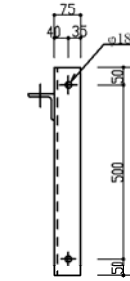
+1 DEPTH OF COVER : DEPEND ON THE SITE CONDITION.

Pipe Bridge

APPLICABLE TO ALL TYPES OF RIVER



L - 75 x 75 x 9
U-Bolt M16xD (SUS)
Anchor Bolt M16 (SUS)



Note : The bracket should be installed in the 2.0m pitch.

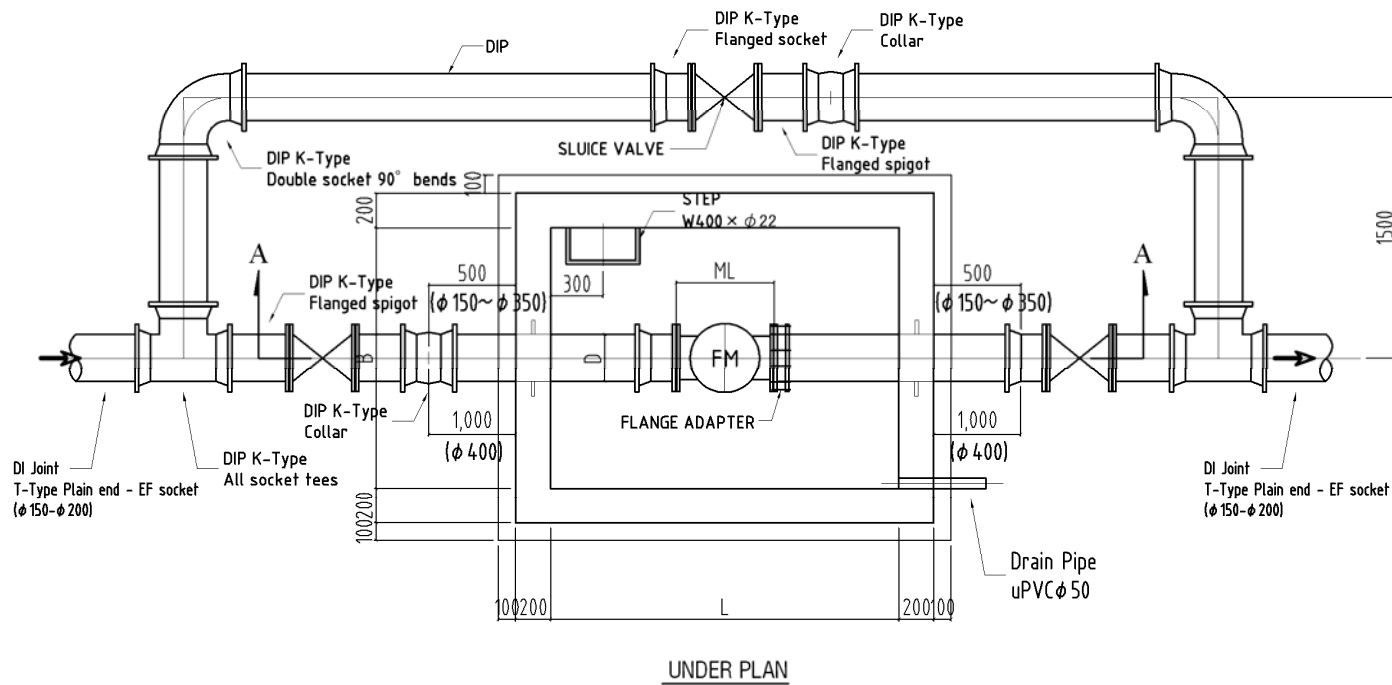
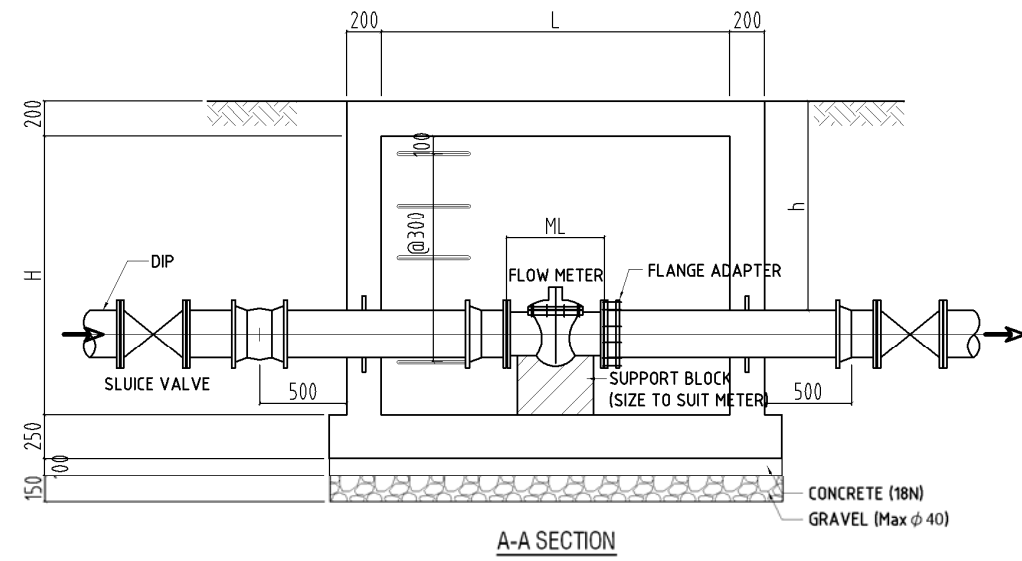
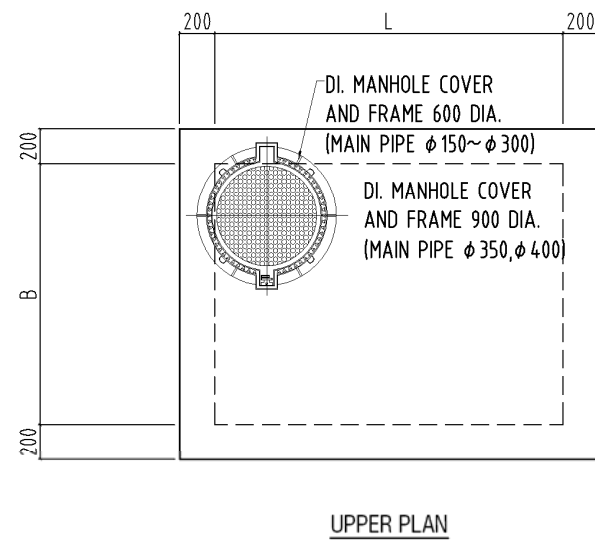
Bridge Mount Rack

APPLICABLE TO ALL TYPES OF BRIDGE

PROJECT NAME: THE PREPARATORY SURVEY ON PROJECT ON REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG カンボジア国 地方州都における配水管改修及び拡張計画準備調査	
DRAWING TITLE: Typical Drawing for Pipe Bridge and Bridge Mount Rack 水管橋及び橋梁添架標準図	SCALE: N. T. S. DWG No. : -

Figure 2-42 Typical Drawing for Pipe Bridge and Bridge Mount Rack

Typical Drawinf for Installation of Distribution Flow Meter



CRITERIA FOR FLOW METER CHAMBER

MAIN PIPE	MAIN PIPE MATERIAL	L (mm)	B (mm)	H (mm)	ML Approximately(mm)
φ 150	HDPE	1700	1200	1200	400
φ 200	(h=800mm)	1700	1200	1200	480
φ 250	DIP	2000	1500	1600	560
φ 300	(h=1200mm)	2000	1500	1600	660
φ 350		2000	1500	1600	700
φ 400		2000	1500	1600	1000

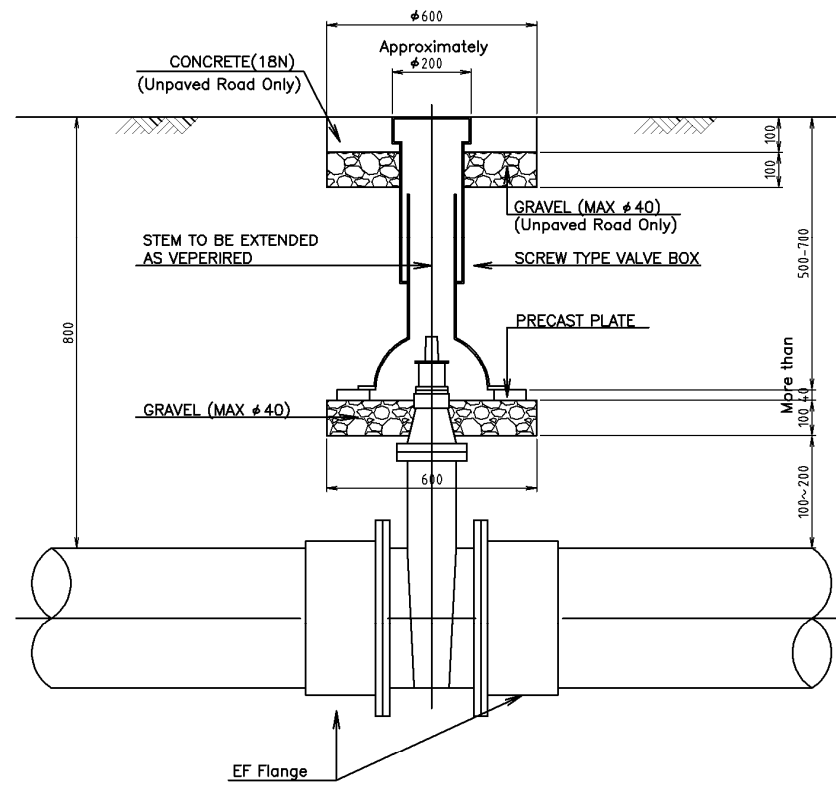
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THE HEIGHT OF THE CHAMBER SHALL BE DECIDED TO SUIT THE SITE.
3. IF THE REGISTER OF THE WATER METER IS MORE THAN 500mm FROM THE SURFACE, AN EXTENDED REGISTER ARRANGEMENT SHALL BE PROVIDED TO THE METER, TO THE APPROVAL OF THE ENGINEER.
4. LENGTHS OF PIPE PIECES SHALL BE TO SUIT SITE. LENGTHS SHALL BE VERIFIED BASED ON THE DIMENSIONS OF VALVES ORDERED.
5. DRAIN PIPE SHALL BE INSTALLED TO uPVC φ50. HOWEVER, DRAIN PIPE IS NOT INSTALLED WHERE GROUND WATER LEVEL IS HIGH.

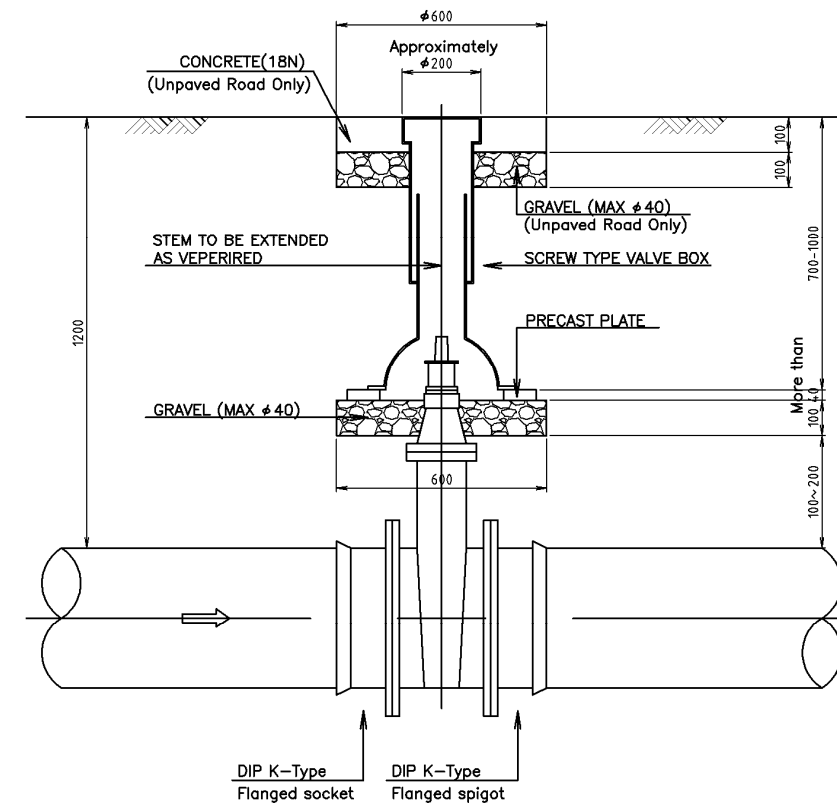
PROJECT NAME: THE PREPARATORY SURVEY ON PROJECT ON REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG カンボジア国 地方州都における配水管改修及び拡張計画準備調査	
DRAWING TITLE: Typical Drawinf for Installation of Distribution Flow Meter 配水流量計設置標準図	SCALE: N. T. S. DWG No. : -

Figure 2-43 Typical Drawing for Installation of Distribution Flow Meter

Typical Drawing for Installation of Sluice Valve



SLUICE VALVE INSTALLATION
(HDPE ϕ 50– ϕ 200mm)



SLUICE VALVE INSTALLATION
(DIP ϕ 250– ϕ 400mm)

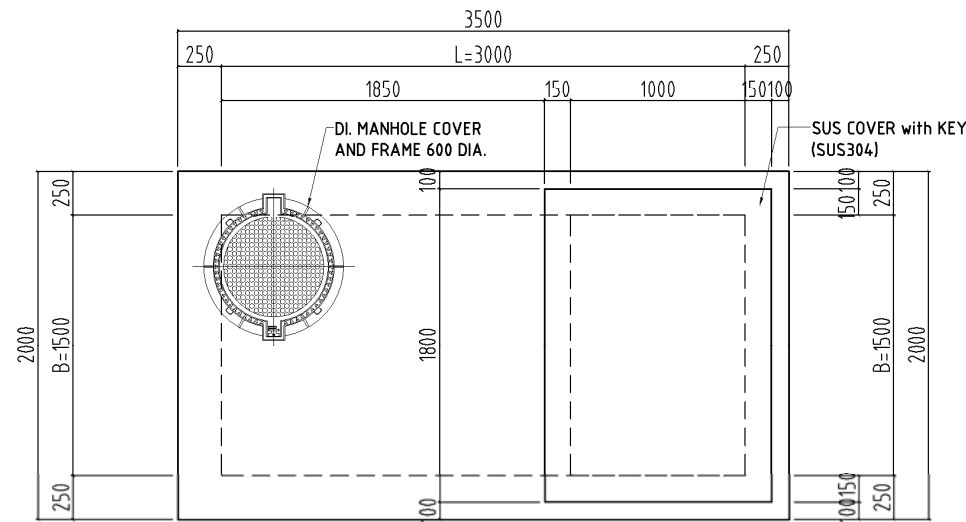
NOTE

1. ALL SLUICE VALVES LESS THAN 400mm DIA WILL HAVE NO CHAMBERS AND WILL BE INSTALLED SEEMILIER TO WASH OUT VALVES HEAVY-DUTY SURFACE BOXES AT THE ROAD LEVEL TO OPERATE THEM.
2. ALL DIMENSIONS ARE IN mm.

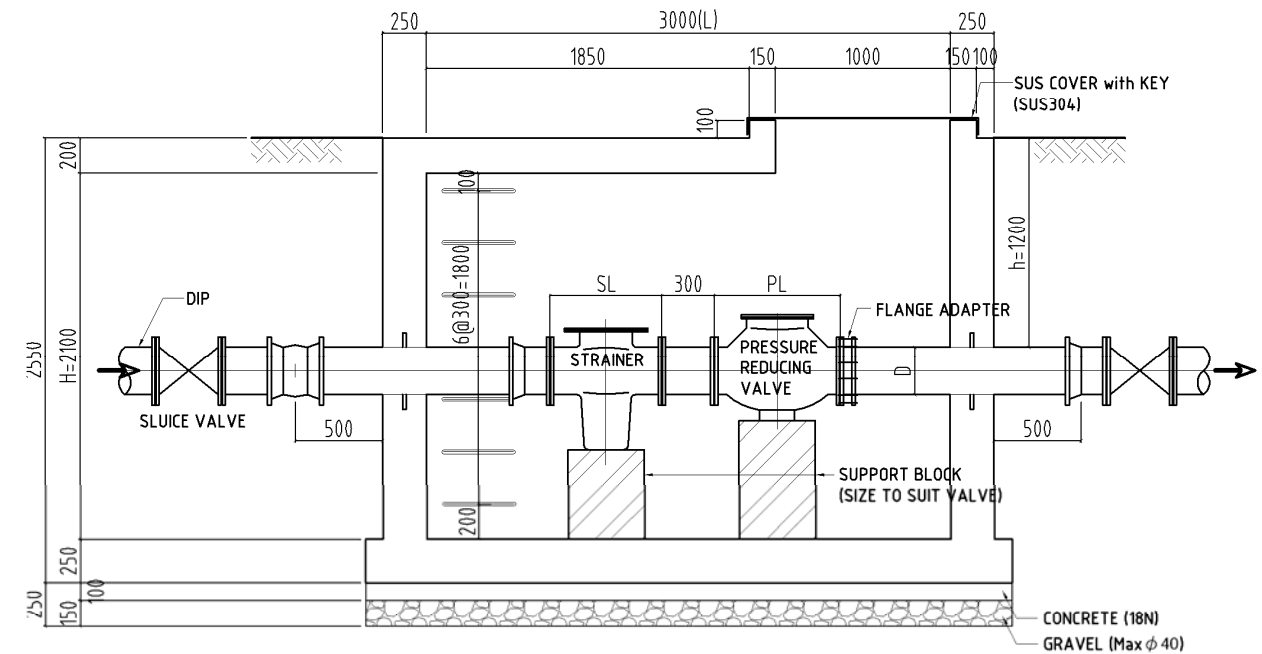
PROJECT NAME: THE PREPARATORY SURVEY ON PROJECT ON REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG カンボジア国 地方州都における配水管改修及び拡張計画準備調査	
DRAWING TITLE: Typical Drawing for Installation of Sluice Valve 仕切弁設置標準図	SCALE: N.T.S DWG No. : -

Figure 2-44 Typical Drawing for Installation of Sluice Valve

Typical Drawinf for Installation of Pressure Reducing Valve



UPPER PLAN



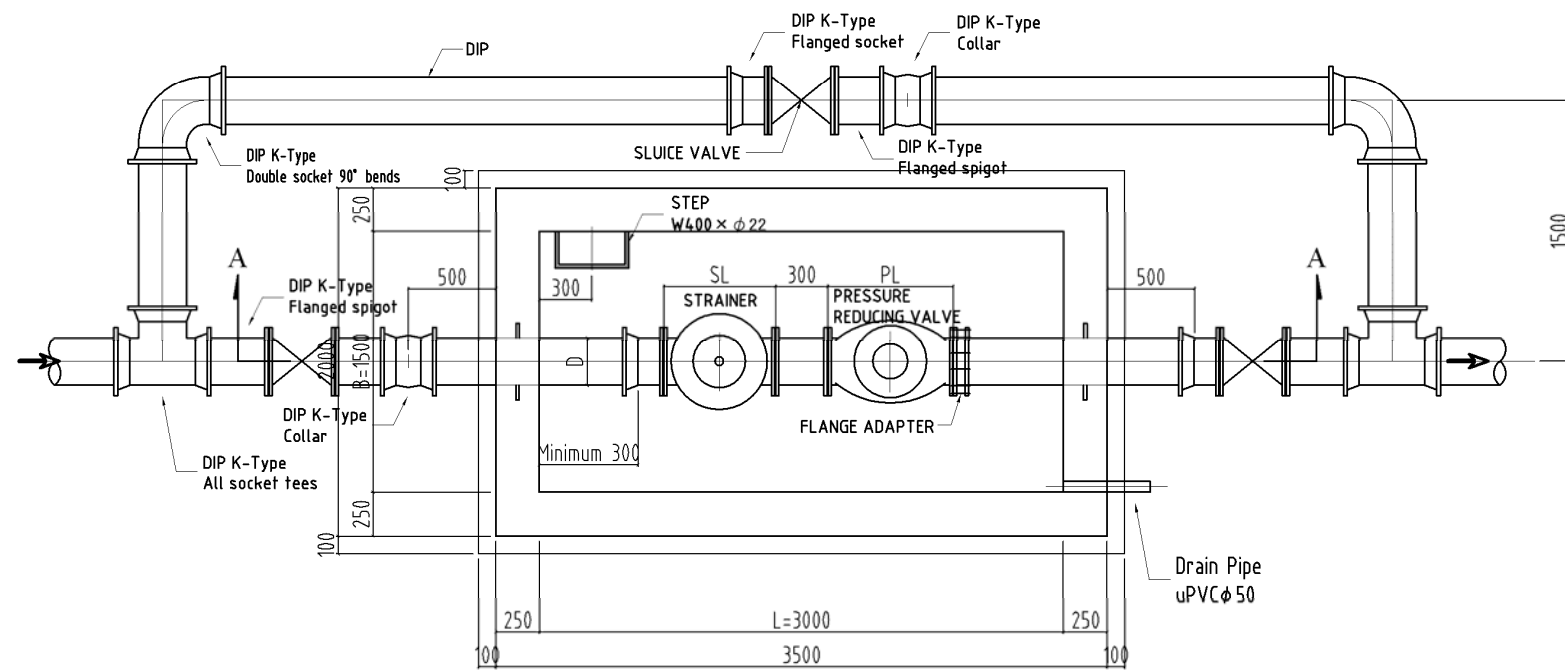
A-A SECTION

CRITERIA FOR PRESSURE REDUCING VALVE CHAMBER

MAIN PIPE	MAIN PIPE MATERIAL	L (mm)	B (mm)	H (mm)	SL (Approximately)(mm)	PL (Approximately)(mm)
φ 250	DIP	3000	1500	2100	600	720
φ 300	(h=1200mm)	3000	1500	2100	700	820
φ 350		3000	1500	2100	800	950
φ 400		3000	1500	2100	900	1050

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THE HEIGHT OF THE CHAMBER SHALL BE DECIDED TO SUIT THE SITE.
3. IF THE REGISTER OF THE WATER METER IS MORE THAN 500mm FROM THE SURFACE, AN EXTENDED REGISTER ARRANGEMENT SHALL BE PROVIDED TO THE METER, TO THE APPROVAL OF THE ENGINEER.
4. LENGTHS OF PIPE PIECES SHALL BE TO SUIT SITE. LENGTHS SHALL BE VERIFIED BASED ON THE DIMENSIONS OF VALVES ORDERED.
5. DRAIN PIPE SHALL BE INSTALLED TO uPVC φ 50. HOWEVER, DRAIN PIPE IS NOT INSTALLED WHERE GROUND WATER LEVEL IS HIGH.

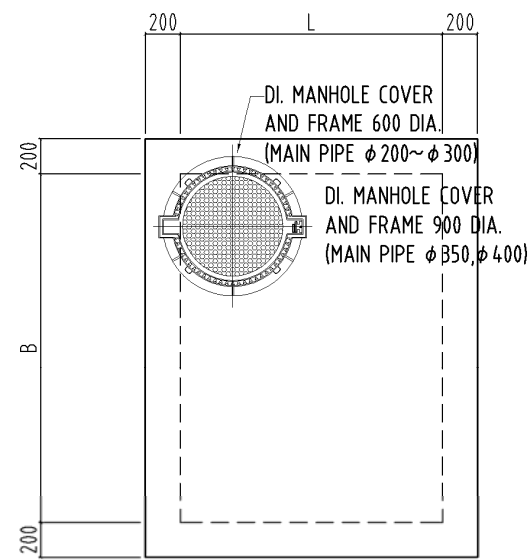


UNDER PLAN

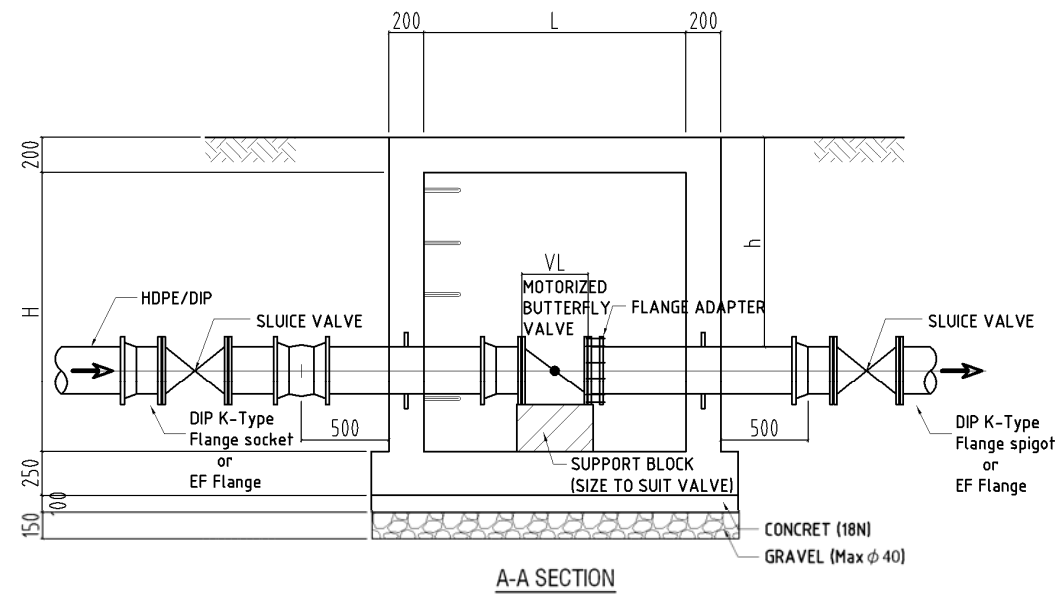
PROJECT NAME: THE PREPARATORY SURVEY ON PROJECT ON REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG カンボジア国 地方州都における配水管改修及び拡張計画準備調査	
DRAWING TITLE: Typical Drawinf for Installation of Pressure Reducing Valve 減圧弁設置標準図	SCALE: N. T. S. DWG No. : -

Figure 2-45 Typical Drawing for Installation of Pressure Reducing Valve

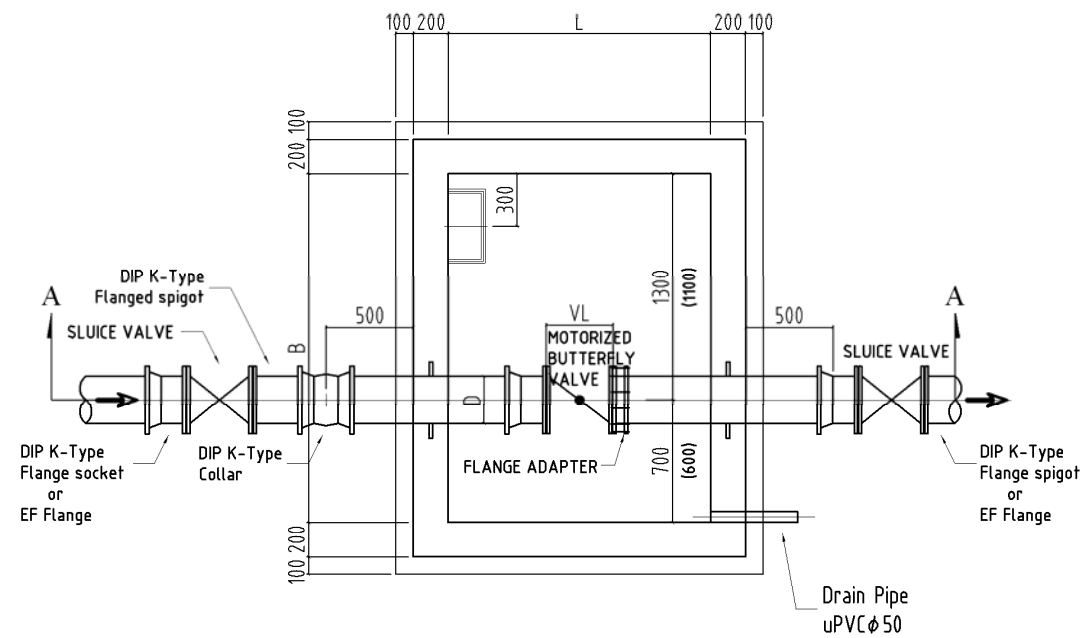
Typical Drawing for Installation of Flow Control Valve



UPPER PLAN



A-A SECTION



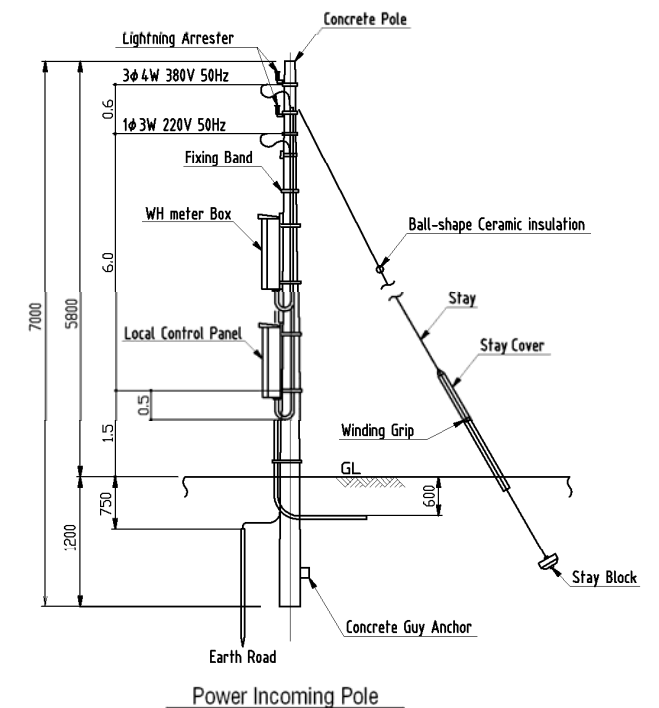
UNDER PLAN

CRITERIA FOR FLOW CONTROL VALVE (BUTTERFLY VALVE) CHAMBER

MAIN PIPE	MAIN PIPE MATERIAL	L (mm)	B (mm)	H (mm)	SHAFT TYPE	VL Approximately (mm)
φ150	HDPE	-	-	-	-	-
φ200	(h=800mm)	1200	1700	1200	Horizontal	300
φ250	DIP	1500	2000	2000	Horizontal	380
φ300	(h=1200mm)	1500	2000	2000	Horizontal	400
φ350		1500	2000	2000	Horizontal	430
φ350		1500	2000	2000	Horizontal	470

NOTES:

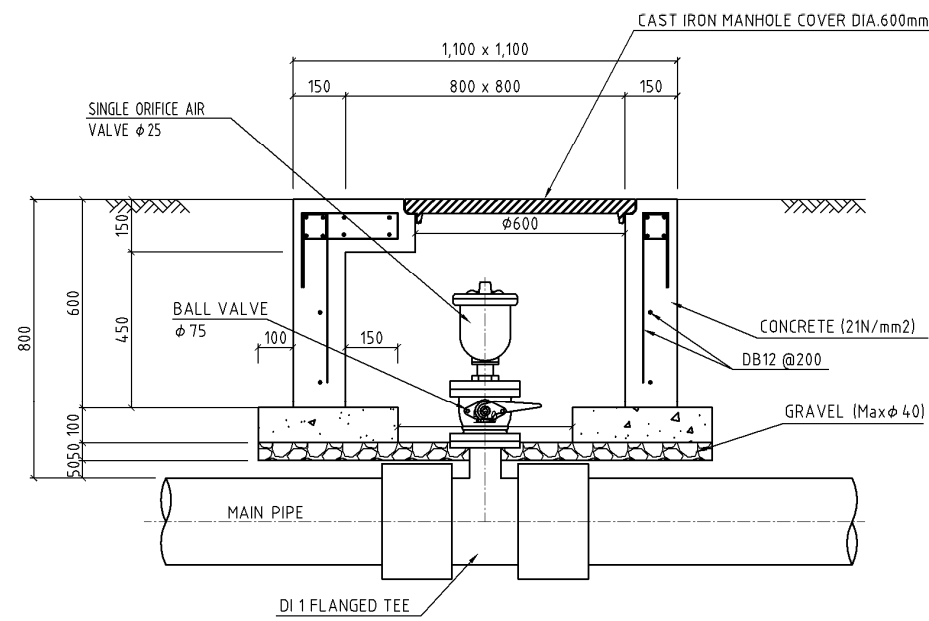
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THE HEIGHT OF THE CHAMBER SHALL BE DECIDED TO SUIT THE SITE.
3. IF THE REGISTER OF THE WATER METER IS MORE THAN 500mm FROM THE SURFACE, AN EXTENDED REGISTER ARRANGEMENT SHALL BE PROVIDED TO THE METER, TO THE APPROVAL OF THE ENGINEER.
4. LENGTHS OF PIPE PIECES SHALL BE TO SUIT SITE. LENGTHS SHALL BE VERIFIED BASED ON THE DIMENSIONS OF VALVES ORDERED.
5. DRAIN PIPE SHALL BE INSTALLED TO uPVC φ50. HOWEVER, DRAIN PIPE IS NOT INSTALLED WHERE GROUND WATER LEVEL IS HIGH.



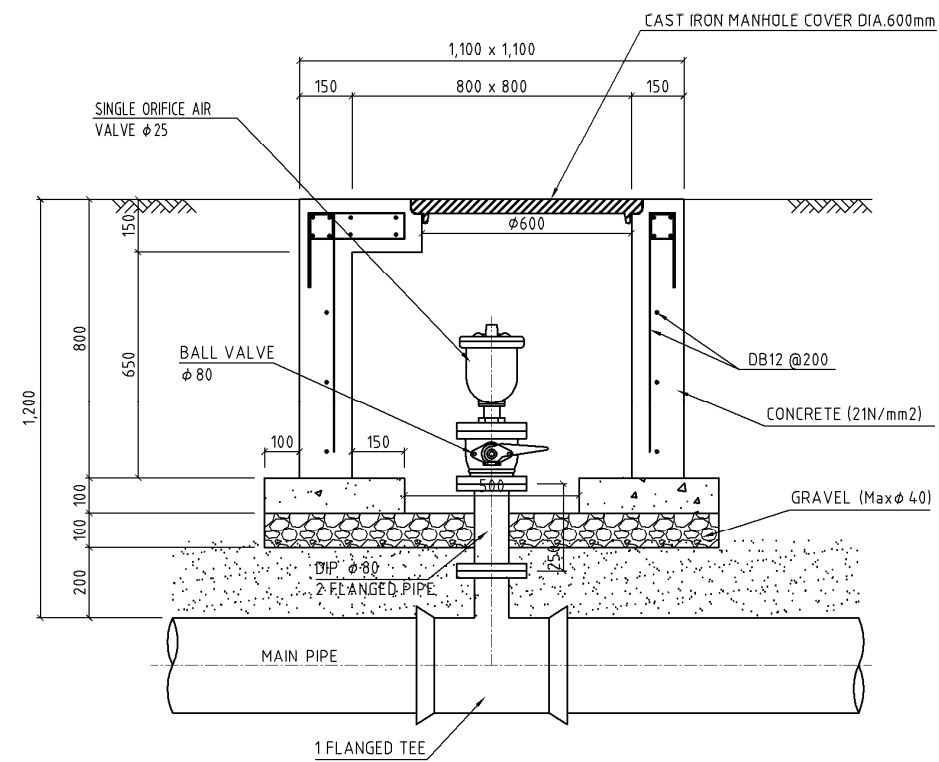
PROJECT NAME: THE PREPARATORY SURVEY ON PROJECT ON REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG カンボジア国 地方州都における配水管改修及び拡張計画準備調査	
DRAWING TITLE: Typical Drawing for Installation of Flow Control Valve 流量調整弁設置標準図	SCALE: N. T. S. DWG No. : -

Figure 2-46 Typical Drawing for Installation of Flow Control Valve

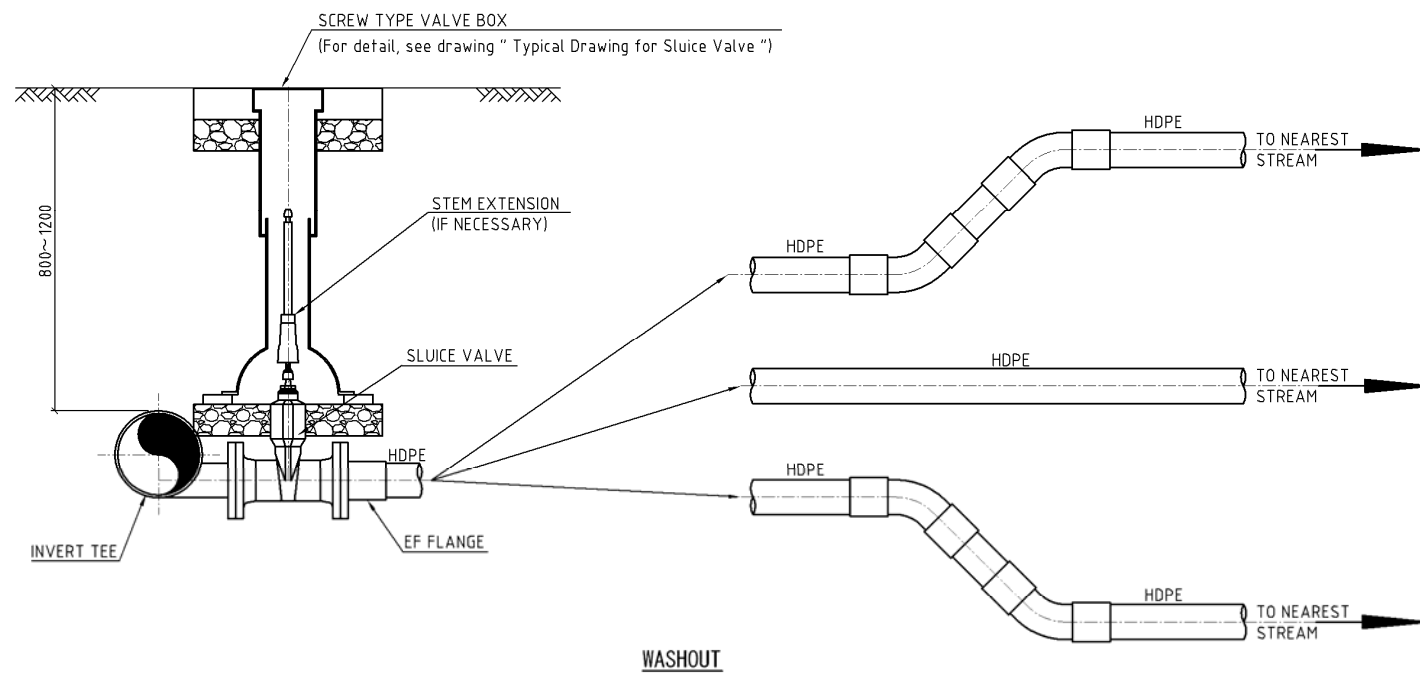
Typical Drawing for Installation of Air Valve and Washout



SINGLE ORIFICE AIR VALVE CHAMBER
MAIN PIPE ≤ φ 200 (HDPE)



SINGLE ORIFICE AIR VALVE CHAMBER
MAIN PIPE φ 250~φ 350 (DIP)



WASHOUT

CRITERIA FOR AIR VALVE AND WASH OUT

MAIN PIPE	MAIN PIPE MATERIAL	BRANCH PIPE for AIR VALVE	BRANCH PIPE for WASH OUT
φ 50	HDPE	φ 75	φ 50
φ 75		φ 75	φ 50
φ 100		φ 75	φ 75
φ 150		φ 75	φ 75
φ 200		φ 75	φ 75
φ 250	DIP	φ 80	φ 75
φ 300		φ 80	φ 75
φ 350		φ 80	φ 100

NOTE

1. THE THICKNESS OF THE BLINDING LAYER SPECIFIED IN THE DRAWING IS FOR NORMAL SOIL TYPES. HOWEVER, IF THE STRUCTURE IS FOUNDED ON VERY WEAK SOIL SUCH AS PEAT, A GROUND STABILIZATION METHOD, AS DIRECTED BY THE ENGINEER, SHALL BE FOLLOWED.
2. THE TOP OF THE AIR VALVE CHAMBER SHOULD BE AT THE SAME LEVEL AS THE ROAD TOP LEVEL.
3. THE VALVE BOXES FOR WASHOUT MAY BE ON THE BANK OF THE ROAD.
4. ALL DIMENSIONS ARE IN mm.

PROJECT NAME:

THE PREPARATORY SURVEY ON PROJECT ON
REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM
FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG
カンボジア国 地方州都における配水管改修及び拡張計画準備調査

DRAWING TITLE:

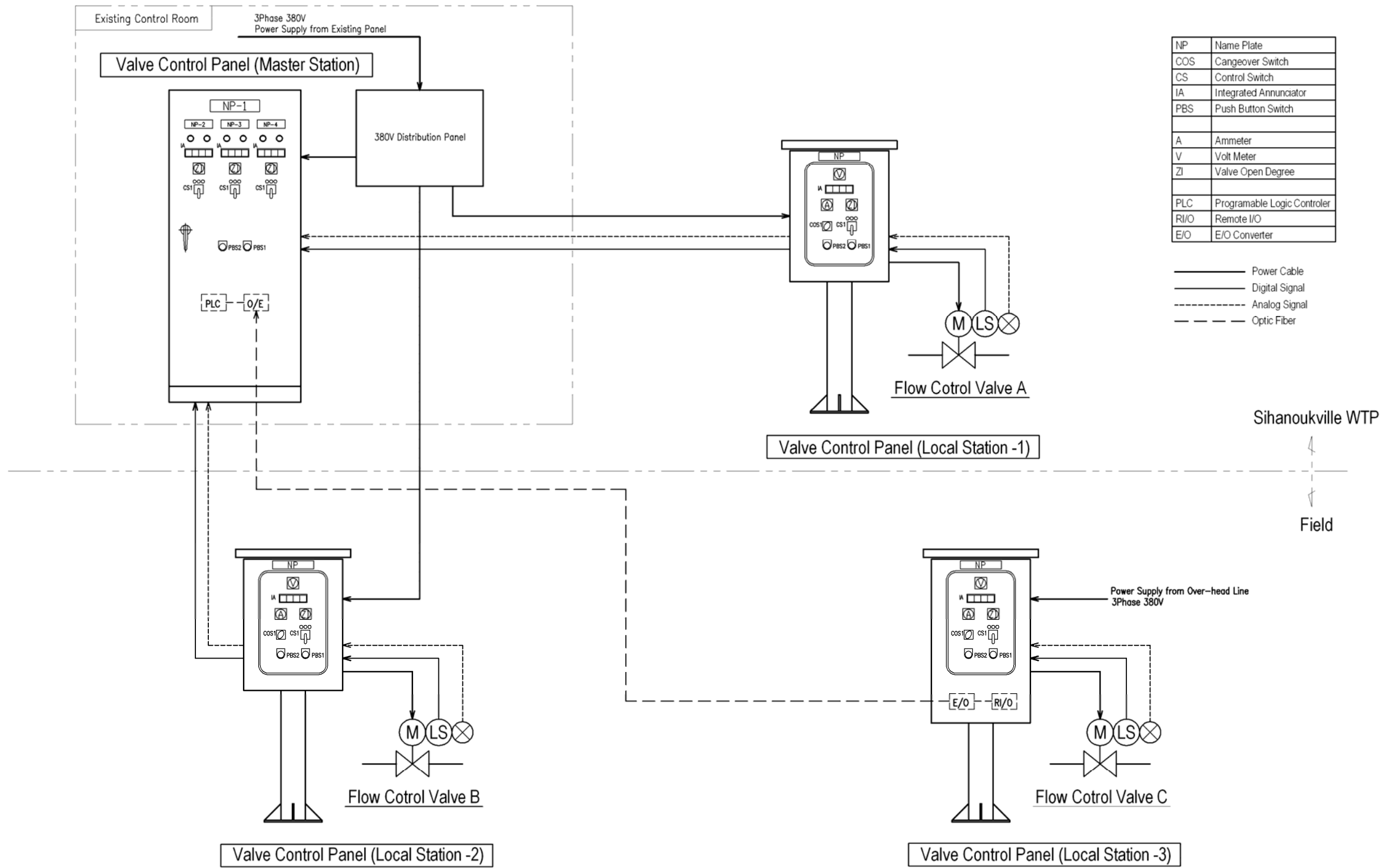
Typical Drawing for Installation of Air Valve and Washout
空気弁及び排水弁設置標準図

SCALE:
N. T. S

DWG No. :
-

Figure 2-47 Typical Drawing for Installation of Air Valve and Washout

Flow Control Valve Control System



NP	Name Plate
COS	Cangeover Switch
CS	Control Switch
IA	Integrated Annunciator
PBS	Push Button Switch
A	Ammeter
V	Volt Meter
ZI	Valve Open Degree
PLC	Programable Logic Controler
R/I/O	Remote I/O
E/O	E/O Converter

——— Power Cable
 ——— Digital Signal
 - - - - - Analog Signal
 - - - - - Optic Fiber

PROJECT NAME:
 THE PREPARATORY SURVEY ON PROJECT ON
 REPLACEMENT AND EXPANSION OF WATER DISTRIBUTION SYSTEM
 FOR PURSAT, SIHANOUKVILLE AND BATTAMBANG
 カンボジア国 地方州都における配水管改修及び拡張計画準備調査

DRAWING TITLE:
 Flow Control Valve Control System
 流量調整弁制御システム図

SCALE:
 Not To Scale
 DWG No. :
 -

Figure 2-48 Flow Control Valve Control System

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

Implementing agency of the Cambodian side is MIME.

PIU (project implementing unit) composed of concerned organizations shall be established and will be in charge of this project consistently on behalf of MIME. Following are major role of PIU.

1. Front desk of MIME for this project,
2. Liaison and coordination with the divisions concerned in internal and external MIME,
3. Arrangement of designing and bidding works as the counterparts of the Japanese Consultant, and
4. Securing the budgets and human resources under responsibility of the Cambodian side.

The Consultant, on behalf of MIME, will undertake the detailed design, bidding procedure and construction supervision in order to proceed with the construction work smoothly and to complete the scope of work within the given construction period. The Consultant will send civil engineers, who will be stationed in each provincial capital, to assist supervision of the whole of the construction work and other engineers as required at the completion time of the major facilities and at the end of the fiscal year.

The main part of the project is to construct a distribution facility at provincial capitals. Underground works may have route adjustment and re-connection works within the downtown area. Therefore, it is considered appropriate that a Japanese civil engineering contractor who has experience in the construction of water supply facilities will undertake the Work. In selecting the contractor, the open bid system will be adopted and the qualification and selection criteria for bidders will be defined during the preparatory work for bidding through negotiation and with confirmation from MIME.

This project is to construct the distribution facility including civil, mechanical and electrical works. During construction works, Japanese Contractor shall dispatch engineers headed by the manager, who will direct the construction works at the site directly so as to secure the quality control. Construction works at project sites will be commenced at the same time, but may have different schedule due to scope of works. Partial completion according to the project progress by waterworks will be scheduled.

2-2-4-2 Implementation Conditions

Following are special conditions for construction.

- Project sites are located at 3 provincial capitals and the project will be commenced at the same time. For strengthening of coordination and corporation among the Cambodian side, the Japanese side and other donors, the communication system shall be established clearly and definitely.
- Project progress needs the many kinds of approvals and permissions from concerned government offices, and coordinating with the concerned organizations through PIU smoothly. The Consultants will well coordinate with PIU for the project promotion.
- Consultant's offices will be located near to the waterworks for well communications with the Cambodian sides. One of the Japanese consultants will be nominated as a chief supervisor to coordinate with PIU.
- Contractor's offices will also be set up at every near the waterworks for well communications with concerned organizations. The contractor will nominate a project deputy and site managers for internal and external communications.
- Interim and completion inspections, to be done by the spot engineers and supervisor depending on the works, will be scheduled according to the progress of each site.
- Because of operating water supply, daily progress will be reflected to the right of use. However, compensation period will be effective upon completion of the final inspection.
- Safety measures shall be secured strictly for traffic conditions of pedestrian and vehicles in the project sites. Especially, open excavated trenches for pipe laying shall be backfilled and temporarily restored within the same day.
- Number of working parties for pipe laying shall not disturb the road traffics. Criteria to design the working scale shall be referred to; (1) downtown area, (2) plumbers to be mobilized by the

waterworks and (3) water for construction works, comprehensively.

- Basically, daytime works will be considered. For security reasons, nighttime works at markets and restaurants will be applied with due approval from the concerned organizations.
 - Top soil at project sites is composed of mainly un-consolidated and collapsible materials. Even if the soil is consolidated, excavation depth exceeds sometime more than 1.5 m according to the underground objects. Necessary earth retaining method will be designed and adopted according to the working site such as the sites with collapsible soil and deep excavation.
 - Construction water shall be required for piping works including cutting, connecting pipes and washing out the dirty water in pipes for cleaning purpose. For saving NRW and shortening working time, necessary gate valves will be installed permanently and dewatering will be considered.
 - Schedule of pipe replacement shall be considered with the time sharing for service pipe re-connection (clamp saddle) to be done by the waterworks. Working schedule of pipe laying will be arranged with due consideration of Cambodian responsibilities and progress.
- Following are special conditions for procurement.
- The first priority of procurement shall be given to the product of Cambodia. Japanese products will have the second priority. In case that the products are not available in Cambodia or Japan, the product from the third countries will be procured. In case of that GSM (global system of mobile) modem and accessories of flow monitoring system are not available in both Cambodia and Japan, the products from the surrounding countries of Cambodia will be prioritized.
 - Materials for service connection will be procured with due consideration of continuous order from the waterworks. Imported materials available in the Cambodian local market will be procured.
 - Packing style of imported materials will be fixed according the site locations. Re-packing will not be considered at Sihanoukville seaport for cost saving.

2-2-4-3 Scope of Works

Basically, construction works are carried out by the Japanese side. Table 2-13 indicates the work sharing between both governments.

Table 2-13 Scope of Project Works

Category	Contents	Cambodia	Japan
Consultancy Services	Project Design: Field Survey, Detailed Design, Bid Documents, etc.		○
	Bidding Support: Publication, P/Q, Bidding, Contract		○
	Construction Supervision: Plan, Approval, Inspection, etc.		○
	Capacity Development: Service Connection, Flow Monitoring		○
Facility Construction	Pipe Laying: Replacement, Expansion, Flow Control, etc.		○
	Re-connection of Service Pipes: Clamp Saddle, etc.	○	
	Monitoring System: Telemetric Monitoring		○
	Completion: Instruction Manuals, Warranty		○
	Inspection: Completion Inspection*, Defect Liability Inspection*	(○) *	○
Procurement	Materials: Clamp Saddle, Water Meter, HDPE, Fittings		○
	Equipment: SF Connectors, Potable Generators		○
	Inspection: Procurement Inspection*, Defect Liability Inspection*	(○) *	○

*Completion Inspection, Defect Liability Inspection: Cambodian side will carry out in cooperation with Japanese side.

2-2-4-4 Consultant Supervision

If the GOJ decides to implement the project based on the result of the basic design study, E/N (the exchange of notes) of GA (grant agreement) for the project will be concluded between GOJ and RGC. After the E/N signing, a contract with a Japanese consultancy firm will be prepared, GOJ will verify the contract, and the consultants will start the project design.

(1) Detailed Design

Upon commencement of the work, the consultants will conduct detailed site survey and topog-

raphical survey. Detailed design report (a part of bid documents) will be prepared for MIME approval through PIU. Project cost will also be estimated for approval from GOJ through JICA. The project design consists 4.0 months of site survey and 1.5 months of detailed analysis in Japan including project cost estimation.

(2) Bidding Works

The consultants will prepare the bid documents for approval from MIME. Publication of P/Q (pre-qualification) will be appeared in a Japanese newspaper for calling of eligible Japanese contractors. The consultants will distribute the bid documents to all candidate bidders.

Bidding will be opened after 45 days from the bid documents distributed with presence of MIME and JICA. The Consultant will assist MIME until the construction agreement signed with successful bidder. The GOJ will verify the said contact and the construction works will be commenced.

The bidding works of following need 5.5 months until the construction contract verified by GOJ.

1. The consultants will receive the P/Q documents from the eligible contractor with 1 week interval from P/Q publication,
2. The consultants will evaluate the received P/Q documents immediately and inform the bidding schedule to the candidate bidders.
3. The consultants, on behalf of MIME, will conduct the bid opening at Tokyo with 45 days interval from the document distribution. MIME and JICA will presence at the bid opening, and the consultants will submit the bidding report to JICA immediately.
4. The consultants, on behalf of MIME, will evaluate the bid documents submitted from the lowest bidder less than the sealing price technically. The consultants will recommend the said bidder to MIME as successful contractor.
5. The consultants will assist MIME to conclude the construction agreement including governmental verification.

(3) Supervisions for Construction and Procurement

Facility construction includes the civil, mechanical and electrical works. The Consultant will dispatch a Japanese civil engineer for each project site, one of whom will be assigned as a chief supervisor. Additionally, national consultants of pipeline and civil works will be employed for assistance to the supervisor at each site. Japanese pipeline engineer will inspect the procurement materials within short period. Project manager will inspect the work completion in each site and inspector will join at the final completion period for confirmation of turn-over documents.

Procurement scheme composes of materials and equipment for service connections. The schedule of supply will affect the schedule of facility construction, because of re-connection of service pipes along the replacement pipes. The consultants will input the project manager and supervisors for early approval.

The Consultant will implement the project with well coordinating to concerned organizations of the Cambodian side, Japanese side (Contractor, JICA, etc.) and others.

(4) Operation Guidance

The contractor will prepare the instruction manuals for operation and repair of the equipment installed by this project. Initial training will be scheduled upon completion of the said facility or equipment by the Contractor.

The Consultant will prepare a plan of technical assistance such as; (a) skills of service pipe connection and (b) managements of flow monitoring system, respectively. As a first activity, the consultants will explain the design concepts and facility functions to the waterworks.

2-2-4-5 Quality Control Plan

The Consultant will instruct the Contractor to carry out analysis/examination related to facility construction as shown in table 2-14 and reflect the results for quality control.

Table 2-14 Test Method of Quality Control

Work Items	Item	Method	Standard
Pipe Materials	Strength/Dimension Appearance/Dimension	Inspection report of manufacture Visual/measuring dimensions Gauge	Criteria of Japan
Plumbing Conditions	Torque Water Leakage	Torque wrench Pressure testing	Criteria of Japan PPWSA's standard
Concrete	Aggregate/ Cement/Water Ready Mixed Concrete Concrete Strength	Physical/Chemical examination Grain size analysis Slump/Air content/Ratio of water and cement Compressive strength test	Criteria of Japan
Reinforced Steel Bar	Strength	Tensile strength Bar arrangement	Criteria of Japan
As Built		Dimension	Criteria of Japan

2-2-4-6 Procurement Plan

Construction materials will be procured in Cambodia as much as possible. Following materials will be procured from Japan or the third countries.

- Materials are not available in local markets, and
- Quality and specification of the local products are not adaptable.

The origin of major materials/equipment to be procured by this project is shown in Table 2-15 and 16.

Table 2-15 Origin of Materials

Descriptions	Items to be procured Item	Procurement from			Remarks
		Cambodia	Japan	Third country	
Service Pipe Material	Clamp Saddle, Ball valve	○			
	Small size service pipe (HDPE)	○			
	Water Meter	○			
HDPE Connector	SF connector, Portable Generator	○			
Ratio (%)		100.0	0.0	0.0	

*SF : Socket Fusion

Table 2-16 Origin of Construction Materials/Construction Machinery

Classification	Items to be procured Descriptions	Procurement from			Remarks
		Cambodia	Japan	Third country	
Pipe Materials	DI (straight pipe, joint)			○	India
	DI (bend pipe, fittings, collar)		○		
	HDPE		○		
	Valves (pressure reducing valve, control valve, gate valve, check valve, air release valve)		○		
	Manhole cover, Valve box		○		
Construction materials	Cement, gravel, Reinforced steel bar, Form	○			
	Fuel (diesel, gasoline, lubricant)	○			
Construction Machinery	Lease (Excavator, crane, Dump truck, etc.)	○			
Communication equipment	Central panel (key station), Flow meter (satellite station)		○		
	Broadband radio (key/satellite station)			○	Vietnam
	PC, Printer		○		
	Ratio (%)	36.8	41.8	21.4	

Construction machines are available to lease from the national contractors in Phnom Penh, costs of which are much cheaper than that from Japan or the third countries.

Distribution pipe materials were designed to select DCIP (ductile cast-iron pipe) and HDPE (high density polyethylene pipe), which have been effective to reduce NRW in PPWSA. Pipes and fittings will be procured from Japan and the third countries.

Service pipe materials including clamp saddle and water meter with some fittings will be procured from the national market in Cambodia with due consideration of sustainable procurement by the WWs in future. Specifications of the said materials are adapted from PPWSA standards.

Materials of Japan products are mainly pipes (DCIP and HDPE) and flow monitoring system including remote control system for SWS. These materials will be transported to Sihanoukville seaport by marine and to the project sites by land.

2-2-4-7 Operational Guidance Plan

Contractor/s shall provide initial operational guidance for the system/equipment such as flow monitoring system, motorized valve control system, pressure reducing valve and HDPE connector to the concerned staffs of respective WWs. Contractor/s shall prepare operation and maintenance manual (handling manual, etc.) and conduct guidance at the site.

Table 2-17 Initial Operational Guidance Plan

System/equipment	Item to be guided	Implementation plan		
		Instructor	Period	Recipient WWs
Flow monitoring system	Operation of the system	Instructor from Manufacturer	3 days	All WWs
Motorized valve remote control system	Operation of the system	Instructor from Manufacturer	3 days	Sihanoukville WWs
Pressure reducing valve	Manner of pressure regulating	Contractor	1 day	Sihanoukville WWs
HDPE connector	Manipulation	Contractor	1 day	All WWs

2-2-4-8 Soft Component (Technical Assistance) Plan

To support smooth startup of facility operation of the Project, the following soft component program is planned. Details are referred to Annex-5

- Technical training on service pipe connection
- Technical training on flow monitoring system

2-2-4-9 Implementation Schedule

It will take 28.0 months from Japanese cabinet approval until the project completion. As of now, the cabinet approval will be scheduled at February 2011, so this project will be completed at the end of July 2013. Post monitoring to be conducted by JICA may be scheduled within the year 2016. Detailed project schedule was planned with 0.5 month period from Japanese cabinet approval until the E/N by both governments, 5.5 months for the project design, 5.5 months for the bid documents preparation and bidding works, and 16.5 months for the facility construction, respectively.

Table 2-18 shows the tentative project schedule.

Table 2-18 Tentative Project Schedule

Project Schedule and Milestones		JFY-2010			JFY-2011								JFY-2012								JFY-2013										
		GY-2011												GY-2012								GY-2013									
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
		Dry			Wet					Dry				Wet				Dry			Wet										
Gov:	Expected Approval by the Japanese Cabinet	▲																													
	Expected Exchange of Notes by both Governments	▲																													
Overall	Project Design (Consultancy Agreement and D/D)	← 5.5 months →																													
	Bidding (Bid Documents and Construction Agreement)	← 5.5 months →																													
	Procurement and Construction	← 16.5 months →																													
Detailed Design	Consultancy Agreement and Verification	▲																													
	Facility Design (detailed design)	[Bar from month 4 to 10]																													
	Approval of the Project Budget	[Bar from month 5 to 10]																													
	Bidding	Documents, Publicity, P/Q, Doc. Distribution	[Bar from month 8 to 10]																												
		Bidding, Evaluation, Construction Agreement	[Bar from month 11 to 14]																												
	Construction Supervision	Plan on Construction Supervision	[Bar from month 14 to 16]																												
		Construction Supervision	[Bar from month 16 to 24]																												
		Spot Inspection	[Bar from month 21 to 22]																												
		Interim Inspection	[Bar from month 22 to 23]																												
		Final Inspection	[Bar from month 25 to 26]																												
A/P, Payment		[Bar from month 26 to 28]																													
Soft Component	Service Pipe Connection	[Bar from month 16 to 17]																													
	Distribution Flow Management	[Bar from month 21 to 22]																													
Common	Construction Agreement and Verification	▲																													
	Plan on Construction, Procurement Order	[Bar from month 14 to 16]																													
	A/P, Payment	[Bar from month 26 to 28]																													
Contractor	Procurement, Construction Materials	[Bar from month 16 to 17]																													
	Pursat	Pipe Laying	[Bar from month 17 to 21]																												
		Final Inspection	[Bar from month 21 to 22]																												
	Battambang	Pipe Laying	[Bar from month 17 to 24]																												
		Interim Inspection	[Bar from month 21 to 22]																												
		Final Inspection	[Bar from month 25 to 26]																												
		Pipe Laying	[Bar from month 17 to 24]																												
	Sihanoukville	Interim Inspection	[Bar from month 21 to 22]																												
		Final Inspection	[Bar from month 25 to 26]																												

2-3 Obligation of Recipient Country

To achieve the objectives of the project and on the basis of the scope of works covered by GOJ, the following obligations shall be undertaken by RGC. Additionally, MINE will be required to incorporate the post monitoring study to be scheduled by JICA.

(1) Ante-project

- To organize the PIU composed of MIME, DIME and WWs concerned,
- To ensure the project budgets for undertaken activities of Cambodian side,

- (c) To proceed the banking arrangement,
- (d) To obtain all the acceptances for public land use,
- (e) To notify all concerned officials of this project,
- (f) To obtain all the permission for pipe laying and construction of pipeline accessories, and
- (g) To collect and accumulate all necessary data for ante-project monitoring.

(2) During Project Implementation

- (a) To fix the banking arrangement and to disburse the cost for A/P (authorization to pay),
- (b) To exempt the levies for Japanese nationals and the taxes for imported materials,
- (c) To bear all the dispatch costs of PIU,
- (d) To act the notification of water supply suspension and the promotion of service connection,
- (e) To ensure the temporal plumbers and to participate the capacity development,
- (d) To re-connect the existing service pipes with functional confirmation of water meter,
- (f) To contract the broadband with telephone provider for telemetric flow monitoring,
- (g) To ensure the new managers and to participate the capacity development for flow monitoring,
- (h) To provide the construction water and the electrical distribution lines, and
- (i) To collect and accumulate all necessary data for project monitoring.

(3) Post-project

- (a) To use the materials for promotion of service connection and to maintain properly the facility,
- (b) To use and manage appropriately of documents for materials and constructed facilities,
- (c) To promote the new service connection for poor families,
- (d) To increase staffs of the WWs and its appropriate arrangement, and
- (e) To collect and accumulate all necessary data for post-project monitoring.

2-4 Project Operation Plan

Water supply administration is under jurisdiction of DPWS-MIME (department of potable water supply, MIME). As for the provincial administration level, the waterworks (or water supply authority) are belonging to subordinate agencies under DIME (department of industry, mines and energy).

2-4-1 Project Operation Plan

In implementation of the project, MIME is required to secure the budget and manpower in order to realize the organizational arrangement proposed below. In this connection, it is strongly recommended to utilize the soft component program to be carried out in the project. The proposed organization and staff number of each waterworks is described below.

(1) Pursat WWs

In target year 2016, the following project effect will be expected.

- Max. Daily Water Supply: 3,400 m³/day to 5,760 m³/day (WTP capacity; 5,760 m³/day)
- No. of Service Connection: 3,600 to about 6,300 (additional 2,700)

To realize the above, it is required to strengthen manpower. At the same time, it is recommendable to improve SPI in order to attain effective operation and management of waterworks. Considering the component of the project, restructuring of the current organization will not be needed. Organization of waterworks will be proposed so as to decrease SPI from current 7.7 to about 6.0. The proposed staff number in target year is 37 in total as shown in Figure 2-49.

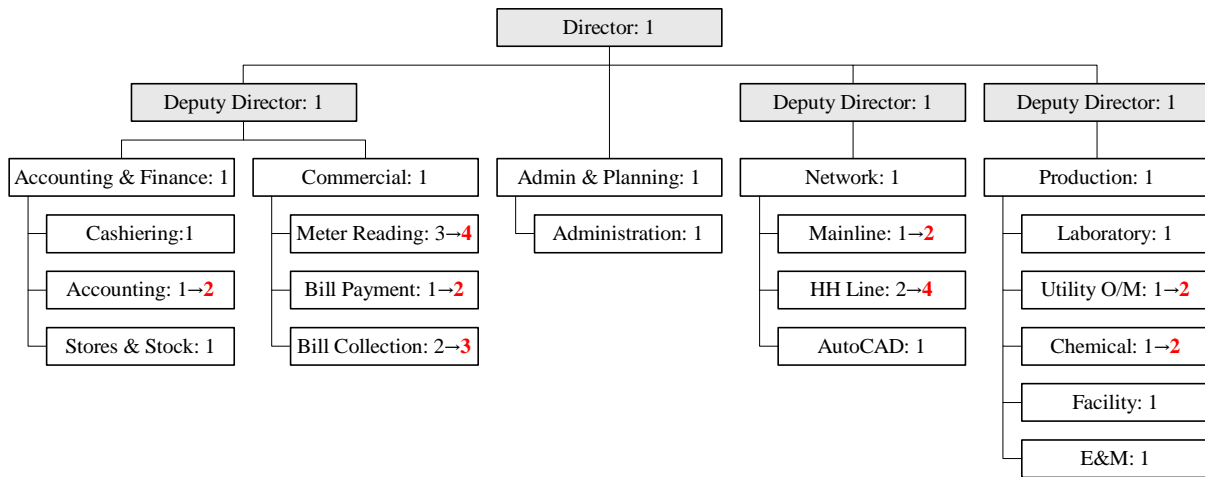


Figure 2-49 Proposed Organization in 2016: Pursat WWs

The staff number by position until target year will be proposed as shown in Table 2-19. By the time of installation of flow monitoring system, additional staff will be needed for Network and Distribution Section which manages the system. Further, according to increase of service connections year by year it is recommended to increase staff number to 37 by target year.

Table 2-19 Proposed Staff Number: Pursat WWs

Position	2009 Actual	2010	2011	2012 Construction	2013	2014	2015	2016 Target
Director	1	1	1	1	1	1	1	1
Deputy Director	3	3	3	3	3	3	3	3
Administration & planning	2	2	2	2	2	2	2	2
Accounting	4	4	4	4	4	4	4	5
Business	7	7	7	7	8	9	10	10
Production	6	6	6	6	6	7	7	8
Network & Distribution	5	5	5	6	6	7	8	8
Total	28	28	28	29	30	33	35	37
Service Connections	3,643	3,843	4,766	4,966	5,166	5,566	5,996	6,316
Max. Daily Water Supply (m ³ /day)	3,400	4,056	4,877	5,059	5,270	5,090*	5,467	5,760

*Maximum daily supply decreases in 2014 due to largely improved NRW in accordance with pipe replacement in the project.

(2) Battambang WWs

In target year 2016, the following project effect will be expected.

- Max. Daily Water Supply: 9,220 m³/day to 11,520 m³/day (WTP capacity; 11,520 m³/day)
- No. of Service Connection: 8,600 to about 11,300 (additional 2,700)

To realize the above, it is required to strengthen manpower of Network and Business Section. Current SPI of 4.4 shows rather small compared to other water works. It is recommendable to further decrease SPI in order to attain effective O/M of waterworks. Considering the component of the project, restructuring of the current organization will not be needed. Organization of waterworks will be proposed so as to decrease SPI from current 4.5 to about 4.0. The proposed staff number in 2016 is 45 in total as shown in Figure 2-50.

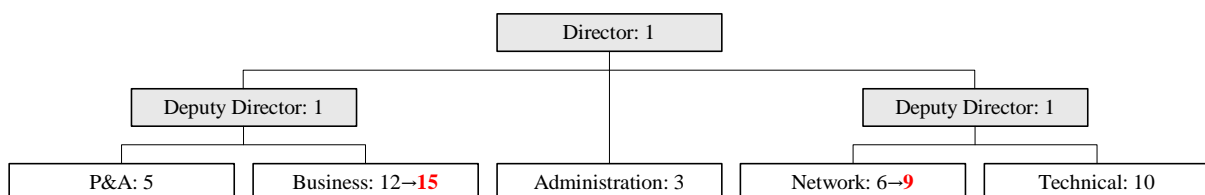


Figure 2-50 Proposed Organization in 2016: Battambang WWs

The staff number by position until target year will be proposed as shown in Table 2-20. By the time of installation of flow monitoring system, additional staff will be needed for Network and Distribution Section which manages the system. Further, according to increase of service connections year by year it is recommended to increase staff number to 45 by target year.

Table 2-20 Proposed Staff Number: Battambang WWs

Position	2009 Actual	2010	2011	2012 Construction	2013 Construction	2014	2015	2016 Target
Director	1	1	1	1	1	1	1	1
Deputy Director	2	2	2	2	2	2	2	2
Administration	3	3	3	3	3	3	3	3
Accounting & Planning	5	5	5	5	5	5	5	5
Business	12	12	12	12	12	13	14	15
Production	10	10	10	10	10	10	10	10
Network	6	6	6	7	8	9	9	9
Total	39	39	39	40	41	43	44	45
Service Connections	8,582	8,682	8,782	8,882	8,982	9,782	10,582	11,282
Max. Daily Water Supply (m ³ /day)	9,215	10,902	11,027	11,153	11,278	10,222*	11,057	11,528

*Maximum daily supply decreases in 2014 due to largely improved NRW in accordance with pipe replacement in the project.

(3) Sihanoukville WS

In target year 2016, the following project effect will be expected.

- Max. Daily Water Supply: 6,200 m³/day to 12,210 m³/day (WTP capacity; 7,680 m³/day, balance: bulk water from ANCO)
- No. of Service Connection: 3,800 to about 8,000 (additional 4,200)

The current staff number of 45 (SPI of 11.7) is rather large compared to other water works at present. Sihanoukville WS can operate and manage water supply with maintaining current organization without adding staffs. Thus, SPI in target year will arrive at 5.6 which is considered to be appropriate. By the time of installation of flow monitoring system, it is necessary to secure the concerned staff; however, it is considered that the current managerial staff of technical office or the staff of Network Section is available to have multi-tasks.

2-4-2 Project Maintenance Plan

(1) Distribution Pipes

In the Project, the deteriorated distribution pipes occurring frequent water leakage will be replaced with new pipe and service area will be expanded by installation of new distribution pipes. Respective water works are required to carry out operation and maintenance of the distribution pipelines in accordance with long term O&M plan. In developing the plan, the following matters are to be duly considered.

- Patrol of pipelines (detection of water leakage, checking road condition of pipeline installed, etc.)
- Mapping/drawings and inventory of pipelines
- Condition/analysis of water supply services including, water flow, water pressure, water quality and others
- Procurement and stock management of distribution pipe material, etc.

(2) Flow Monitoring System

Flow monitoring system has to be adequately operated and managed by the concerned staff in charge of distribution facility. Since the system is introduced to respective water works at the first time, it is important for them to prepare operation and management plan considering the flowing matters and update as required.

- Checking setting condition, operating status, etc.
- Data collection/logging and reporting of various flow data

- Analysis of flow data, verification of unusual flow
- Collaboration with operation of water treatment plant
- Procurement and stock management of spare parts
- Handling for system trouble (including securing manufacturer and relevant agent, etc.)
- Expansion of satellite stations, etc

(3) Material of Service Pipe Connection

Service pipe materials including water meters and fusion connectors to be provided in the Project will be utilized according to application of new customer. Water works are required to carry out appropriate stock management and forecasting number of new service connections.

2-5 Project Cost Estimation

Among the overall project costs, RGC shall bear the costs partially according to the work sharing between both governments. Following are the project cost borne by RGC and O/M cost in post-project, respectively.

2-5-1 Initial Cost

This project shall follow the Implementation rule and regulation (IRR) of Japanese grant-in aid.

(1) Project Cost borne by RGC

Project cost to be borne by the Cambodian side was estimated at US\$ 68,300 as shown in Table 2-21.

Table 2-21 Project Cost borne by RGC

Sharing Items	Project Cost	
	(thousand-Yen)	(thousand-US\$)
(1) Ante-project	0	0
i. Land Acquisition: the rights of use public land	0	0
(2) During the Project Implementation	6,140	68.3
ii. Commission: B/A including A/P formalities	1,370	15.2
iii. Dispatch Cost: PIU activities	1,800	20.0
iv. Construction Cost: service pipe re-connection including some materials	2,900	32.3
v. Entry Cost: broadband communications	70	0.8
Grand total	6,140	68.3

(2) Assumption of Cost Estimation

- Estimation: As of September 2010
- Project Period: Commencement of construction from February 2012 until June 2013

2-5-2 Operation and Maintenance Cost

Table 2-22 presents the estimated annual operation and maintenance cost of respective waterworks. The required cost for operation and maintenance is estimated to be 1,590 to 5,124 million Riel by waterworks. On the other hand, revenue of respective WWs is estimated to be 2,040 to 7,209 million Riel. Thus, the financial statement of respective waterworks is expected to be surplus and it is considered that each waterworks can operate their water supply with sound operation and maintenance after completion of the project.

Table 2-22 Annual Operation and Maintenance Cost (unit: Million Riel)

Item	Pursat		Battambang		Sihanoukville	
	2009 Actual	2016 Target	2009 Actual	2016 Target	2009 Actual	2016 Target
A. Revenue	1,331	2,250	3,176	4,625	2,973	6,342
1) Sales of water	1,046	2,040	3,132	4,289	2,845	5,837
2) Other revenue	285	210	44	336	128	469
B. O&M Expenditure	1,894	1,590	3,652	3,088	3,694	4,055
ANCO Bulk Water Fee	-	-	-	-	0	1,658
1) Salaries and Wages	95	108	191	288	489	475
2) Power and Fuels	516	765	1,021	1,320	702	947
3) Chemicals	3	138	2	505	145	192
4) Spare Parts	558	169	924	365	605	258
5) Repair and maintenance	0	59	0	124	159	94
6) Construction	2	67	404	139	0	234
7) Administration and others	27	124	51	260	910	197
8) Depreciation	693	161	1,058	88	684	55
C. Operation Balance: A-B	-563	659	-476	1,537	-721	2,287
D. Non operation Balance	-15	0	-70	-3	800	0
1) Non operational income	29	0	0	0	833	0
2) Non operational expense	44	0	70	3	33	0
E. Overall Balance w/o tax: C+D	-578	659	-546	1,534	79	2,287

2-6 Other Relevant Issues

Absolute implementation of service pipe connection and pro-poor activity are common issues for the respective waterworks in this basic plan. Expected number of new service connections after project completion in 2013 is described in the above sub-section '2-2-2-2 Material Procurement Plan'.

Among them, this basic plan includes a procurement scheme to provide clamp saddles and water meters in order to promote new service connections for poor households with a condition that Cambodian side has a definite plan of operation for the said pro-poor. Confirmation item is to be authorized as the clear and practicable IRR (implementation rule and regulation). The Japanese side will assist and confirm the progress of Cambodian activities in July 2011 in order to push through this scheme.

Different issues of the subject waterworks are described below based on the condition of this basic plan and with due consideration of urgent crisis under the Japanese Grant in Aid project together with recommendations for smooth project implementation.

(1) Pursat WWs

MEK-WATSAN project under UN-Habitat will be completed in 2011, demand of that is in relation to the distribution flow management of this project. The waterworks should manage the MEK-WATSAN project together with MINE and DIME for recognition of the synergistic effects by both projects. Important notices for this purpose are shown below.

- Boundary Condition: pressure of 0.18 kPa, demand of 343 m³/day (723 HHs)
- Project Management: Coordination to control of pipeline capacity and water demand
- Harmonization: Preparation of clear and practicable IRR for prop-poor

Operation rate of WTP will reach 100 % at 2016 in the basic plan. Out of the additional number of new connection of 2,700 expected to be added from 2009 to 2016, new service connections for 1,350 HHs are to be added in the project, i.e.; 550 HHs along the expansion line and 800 HHs along the replacement and existing line. Among a total of 1,350, water meters (including saddle clamps according to type of distribution pipelines) for 900 HHs will be provided for promotion of new connection of poor households.

After completion of the project, the WWs is expected to promote the replacement of remaining old CI pipes (about 24.3 km) by its own effort and the leakage repair for NRW reduction and increase HHs connection along with practicing pro-poor activities continuously.

(2) Battambang WWs

Present operational rate 80 % of WTP will reach 100 % in 2016. Out of the additional number of new connection of 2,700 expected to be added from 2009 to 2016, new service connections for 2,400 HHs are to be added in the project, i.e.; 2,000 HHs as upper limit along the expansion line considering plant capacity of the existing WTP and 400 HHs along the existing pipelines. Among a total of 2,400, water meters (including saddle clamps according to type of distribution pipelines) for 1,500 HHs will be provided for promotion of new connection of poor households. After completion of the project, the WWs is expected to promote planning of replacement of remaining old GI pipes (about 7.4 km) including water leak survey as well as re-arrangement of distribution network transferred from private water providers and quality control by its own effort in order to realize further NRW reduction and acceleration of new connections with practicing pro-poor activities continuously. In addition, expansion of WTP will be required in order to satisfy to meet actual water demand in future.

(3) Sihanoukville WS

Present water source and capacity of WTP are limited and the contracted amount of bulk water supply from ANCO Brothers is also restricted. Bulk water is supplied from the ANCO WTP using transmission pipeline of 15 km long to present reservoir, branch pipeline from which is connected to the beer brewery. In the target year of 2016, present operational rate 81 % of WTP will reach 100 % and 45 % of MOU (memorandum of understanding: 10,000 m³/day) will be consumed.

Out of the additional number of new connection of 4,200 expected to be added from 2009 to 2016, new service connections for 3,750 HHs are to be added in the project, i.e.; 3,150 HHs along the expansion line and 600 HHs along the replacement and existing line. Among a total of 3,750, water meters (including saddle clamps according to type of distribution pipelines) for 700 HHs will be provided for promotion of new connection of poor households.

After completion of the project, the WWs is expected to promote the replacement of existing service pipes to realize further NRW reduction by its own effort and increase HHs connection together with practicing pro-poor activities continuously.

In addition, for sustainable water supply to meet the water demand after year 2016, the SWS is recommended to prepare the water source development plan with due consideration of supply capacity from ANCO.

Chapter 3 Project Evaluation

3-1 Recommendations

3-1-1 Prerequisite for Implementation of the Project

As a prerequisite for implementation of the project, the following matters will be required for the Cambodian side.

- ① To secure land
- ② To secure financial arrangement for the matters to be borne by the Cambodian side.
- ③ To set up Project Implementation Unit to be formed by MIMW/DIME/Waterworks
- ④ To notice the authorities concerned related to road/bridge/railway, etc. in accordance with installation of the pipelines and obtain necessary permissions and others
- ⑤ To provide primary power receiving equipment in accordance with provision of motorized control valve for Sihanoukville
- ⑥ To participate in trainings for concerned staffs and enforce capacity enhancement rigidly
- ⑦ To ensure re-connection of service connections accompanied by replacement of distribution pipelines
- ⑧ To prepare policy on mitigation measures of connection fee for poor households
- ⑨ To conduct environmental monitoring during construction stage

3-1-2 Prerequisite and External Conditions for Achieving Overall Plan of the Project

To realize and maintain the project effectiveness, the issues which the Cambodian side shall take initiative as a prerequisite are recommended as follow.

- ① To operate and maintain the water distribution system properly
- ② To secure additional staff and proper assignment
- ③ To secure financial arrangement for operation and maintenance continuously
- ④ To promote new service connections
- ⑤ To implement mitigation of connection fee for poor HHs
- ⑥ To install service pipe materials to be procured by the project
- ⑦ To collect water tariff properly
- ⑧ To collect/accumulate data on indicators of project effectiveness continuously

Likewise, the following matters will be raised as external conditions to realize and sustain the project effectiveness.

- ① Large scale of unreasonable weather will not occur.
- ② Social and economic conditions will not change for the worse extremely.

3-2 Project Evaluation

Indicators of project monitoring are referred to Table 2-6, that can access the project effectiveness.

Current WTP capacity is one of the important factors. Expected operation rates of WTP in 2016 are indicated in Table 2-6. Regarding the NRW rate, target figures in 2016 are predicted with some latitude. Under this situation, monitoring indicators in Table 3-1 are examined when the rate of NRW reduction is maximized.

3-2-1 Adequacy of the Project

As for adequacy of the project, the following matters will be raised.

- ① The Project will benefit the people including poverty group in Pursat, Battambang and Sihanoukville and the number of beneficiaries will be large.
- ② The Project will benefit an improvement in water supply through providing water supply fa-

ilities, which is urgently required as well as coincides with BHN.

- ③ Distribution flow monitoring system to be provided in the project will not require excessively advanced type of technology, since PPWSA has been operating the similar system.
- ④ The project will be aligned with sector development targets of Cambodia.
- ⑤ The project is not intended to gain excessive benefit, since operation and maintenance cost is to be covered by water tariff.
- ⑥ The project facilities to be provided under the Grant Aid Program of Japan can be properly operated and maintained in financial and technical with a sound operation of the respective waterworks.
- ⑦ The project will not produce any negative impacts on environment during construction period as well as facility operation and maintenance period after construction.
- ⑧ The project can be implemented under the Grant Aid Program of Japan without any negative issue.
- ⑨ There are advantages of using Japanese technology for providing distribution flow monitoring system, since the system is similar kind of system which was introduced in PPWSA by using Japanese technology.

3-2-2 Effectiveness

As for the project effectiveness, both quantitative and qualitative effectiveness are expected as below.

(1) Quantitative Effectiveness

Indicators to express quantitative effectiveness are shown in Table 3-1.

Table 3-1 Quantitative Effectiveness

Indicator	Water Utility (Output)	Expected Project Effectiveness/ Action	
		Year 2009	Year 2016
Maximum Daily Water Supply	Pursat	3,410 m ³ /day	5,760 m ³ /day
	Battambang	9,220 m ³ /day	11,520 m ³ /day
	Sihanoukville	6,200 m ³ /day	12,210 m ³ /day
NRW Rate*	Pursat	23.1 %	19 % ~ 14 %
	Battambang	27.6 % (20 hrs. water supply) 35.5 % (24 hrs. water supply)	24 hrs. water supply 20 % ~ 13 %
	Sihanoukville	18.9 %	14 % ~ 10 %
Operation Ratio of WTP	Pursat	59 %	100 %
	Battambang	80 %	100 %
	Sihanoukville	81 % (ANCO: 0 %)**	100 % (ANCO: 45 %)
Energy Efficiency	Pursat	Diesel oil consumption: 0.222 L/m ³	0.199 L/m ³
	Battambang	Electric power consumption: 0.609 kWh/m ³	0.453 kWh/m ³
	Sihanoukville	Electric power consumption: 0.704 kWh/m ³	0.634 kWh/m ³
Water Cost Recovery	Pursat	114 %	127 %
	Battambang	149 %	200 %
	Sihanoukville	153 %	162 %
<u>Upper</u> No. of Connection <u>Lower</u> Pop. Served (estimated)	Pursat	About 3,600 connections	About 6,300 connections
		About 18,200 persons	About 31,500 persons
	Battambang	About 8,600 connections	About 11,300 connections
		About 42,900 persons	About 56,400 persons
	Sihanoukville	About 3,845 connections	About 8,045 connections
		About 23,000 persons	About 48,200 persons

* NRW Rate has a range considering the utmost case of NRW improved. Figures of other indicators are those in case that utmost reduction of NRW is considered.

** (ANCO: %) indicates ratio of water supplied from ANCO compared with maximum 10,000m³/day stipulated in MOU (Memorandum of Understanding).

(2) Qualitative Effectiveness

Qualitative effectiveness will be raised as below.

- ① Insufficient water quantity and pressure at faucets will be improved by maintaining water pressure in distribution pipes properly.
- ② NRW ratio will be decreased by reducing water leakage, which will contribute to improvement of management of respective waterworks.

Based on the above, it is evaluated that the adequacy of the project is highly evaluated and effectiveness of the project will be expected.

Appendices

Appendix-1 Member List of the Survey Team

(1) First Field Survey

Name	Assignment	Position
Mr. Fumihiko OKIURA	Team Leader	Director, Water Resources Management Division I, Global Environment Department, JICA
Mr. Masahiro UEKI	Planning Management	Assistant Director, Water Resources Management Division I, Global Environment Department, JICA
Mr. Mobuki ABE	Chief Consultant/Water Supply Planning	NJS Consultants Co., Ltd.
Ms. Consuelo ESTEPA	Operation and Maintenance Planning	
Ms. Yolanda MINGOA	Social and Environmental Considerations	
Mr. Kentato SATO	Pipeline Designing 1/Water Treatment Facility	
Mr. Atsushi TOYAMA	Pipeline Designing 2	
Mr. Nobukatsu SAKIYAMA	Construction and procurement Planning/Cost Estimation	

(2) 2nd Field Survey

Name	Assignment	Position
Mr. Masahiro UEKI	Planning Management	Assistant Director, Water Resources Management Division I, Global Environment Department, JICA
Mr. Mobuki ABE	Chief Consultant/Water Supply Planning	NJS Consultants Co., Ltd.
Ms. Consuelo ESTEPA	Operation and Maintenance Planning	
Mr. Kentato SATO	Pipeline Designing 1/Water 浄 Treatment Facility	
Mr. Atsushi TOYAMA	Pipeline Designing 2	
Mr. Nobukatsu SAKIYAMA	Construction and procurement Planning/Cost Estimation	

(3) Explanation on Draft Report

Name	Assignment	Position
Mr. Fumihiko OKIURA	Team Leader	Director, Global Environment Department, JICA
Mr. Masahiro UEKI	Planning Management	Assistant Director, Global Environment Department, JICA
Mr. Mobuki ABE	Chief Consultant/Water Supply Planning	NJS Consultants Co., Ltd.
Mr. Kentato SATO	Pipeline Designing 1/Water 浄 Treatment Facility	

(4) Explanation on Draft Report (2)

Name	Assignment	Position
Mr. Mobuki ABE	Chief Consultant/Water Supply Planning	NJS Consultants Co., Ltd.

Appendix-2 Survey Schedule

(1) First Field Survey

Days/Date	Weekday	JICA		Consultant					
		Mr. Okiura	Mr. Ueki	Mr. Abe	Ms. Estepa	Ms. Mingoa	Mr. Sato	Mr. Toyama	Mr. Sakiyama
1 7/25	Sun	NTR-BKK-PNH							
2 7/26	Mon	Explanation/discussion on IC R to MIME							
3 7/27	Tue	Discussion with MIME, Visit PPWSA. Discussion with JICA TA Team		Discussion with MIME, JICA TA Team					
4 7/28	Wed	Internal Meeting, Discussion with UN-HABITAT							
5 7/29	Thu	Signing og M/D. Report to JICA Cambodia Office and EOJ						NRT-BKK-PNH	
6 7/30	Fri	Field survey at Pursat and Battambang		Discussion with TA Team				Discussion with TA Team	
7 7/31	Sat	Move for other assignment		Preparation for Field Survey		MNL-PNH		Preparation for Field Survey	
8 8/1	Sun			Move to Pursat		Move to Pursat			
9 8/2	Mon				MNL-BKK-PNH			Field Survey at Pursat (Discussion/site visit)	
10 8/3	Tue			Field Survey (Battambang)	Move to Battambang, Field Survey	Move to Battambang, Field Survey (Discussion/site visit)		Field Survey at Battambang	
11 8/4	Wed							Field Survey at Battambang	
12 8/5	Thu							Field Survet at Kompong Thom	
13 8/6	Fri							Field survet at Konpomp Thom, Move to PNH	
14 8/7	Sat							Arrangement of collected data, Preparation of Field Survey	
15 8/8	Sun							Move to Sihanoukville	
16 8/9	Mon							Field Survet at Sihanoukville (Discussion/site visit)	
17 8/10	Tue							Field Survey at Sihanoukville, Move to PNH	
18 8/11	Wed							Field Survey at Svay Rieng (discussion/site visit), Move to PNH	
19 8/12	Thu							Discussion with JICA TA Team, Examination of collected data	
20 8/13	Fri							Report to JICA Cambodia Office and MIME	
21 8/14	Sat			PNH-BKK				Examination of collected data	PNH-BKK
22 8/15	Sun			-NRT				-NRT	
23 8/16	Mon							Preparation of Report	
24 8/17	Tue				PNH-BKK-MNL			Data information collection	
25 8/18	Wed								
26 8/19	Thu								
27 8/20	Fri							PNH-BKK-MNL	

(2) Second Field Survey

Days/Date	Week day	JICA		Consultant				
		Mr. Ueki	Mr. Abe	Ms. Estepa	Mr. Sato	Mr. Toyama	Mr. Sakiyama	
1	8/29	Sun	NRT-BKK-PNH		NRT-BKK-PNH			
2	8/30	Mon	Explanation/discussion with MIME		Explanation/discussion with MIME			
3	8/31	Tue	Field survey at Sihanoukville		Field survey at Sihanoukville			
4	9/1	Wed	Signing of Technical Notes		Signing of T/N			
5	9/2	Thu	Report to JICA Cambodia Office and EOJ, Move for other assignment	Report to JICA Cambodia office and EOJ	MNL-PNH	Report to JICA cambodis office and EOJ	NRT-BKK-PNH	
6	9/3	Fri	Field Survey at Sihanoukville (Confirmation of toposurvey/social survey, survey on O&M)					
7	9/4	Sat	-do-					
8	9/5	Sun	Move to PNH					
9	9/6	Mon	Preparation of Field Survey for Pursat and Battambang					
10	9/7	Tue	Field Survey at Pursat (Confirmation of toposurvey/social survey, survey on O&M), Move to Battambang					
11	9/8	Wed	Field Survey at battambang (Confirmation of toposurvey/social survey, survey on O&M), Move to Battambang					
12	9/9	Thu	-do-					
13	9/10	Fri	Field Survey at Pursat, Move to PNH					
14	9/11	Sat	Examination of collected data, Preparation of Field Survey					NRT-BKK-PNH
15	9/12	Sun	Internal Meeting					
16	9/13	Mon	Visit to PPWSA	Preparing Report	Visit to PPWSA (Data collection)			
17	9/14	Tue	Examination of collected data	-do-	Move to Sihanoukville		Field survey at Pursat	
18	9/15	Wed	Field Survey at Sihanoukville	-do-	Field survey at Sihanoukville		Field survey at Battambang	
19	9/16	Thu	-do-	-do-	-do-		Field Survey at Pursat	
20	9/17	Fri	-do-	-do-	-do-		Data arrangement	
21	9/18	Sat	Internal meeting					
22	9/19	Sun	Move to Battambang	Preparing Report	Move to Battambang		Move to Sihanoukville	
23	9/20	Mon	Field Survey at Battambang	-do-	Field Survey at Battambang		Field survey at Sihanoukville	
24	9/21	Tue	-do-	-do-	-do-		-do-	
25	9/22	Wed	Field Survey at Pursat	Back to MNL	Field Survey at Pursat		Data collection (telemetry)	
26	9/23	Thu	Report to JICA Cambodia Office and MIME		Report to JICA cambodis office and MIME	Report to JICA Cambodia Office	-do-	
27	9/24	Fri	Data arrangement	Examination of collected data				
28	9/25	Sat	Internal Meeting	Internal Meeting				
29	9/26	Sun	Move to BKK	Move to BKK		Preparation of Site Visit	Data arrangement	
30	9/27	Mon	-NRT	-NRT		Field Survey at Pursat	Data collection (telemetry)	
31	9/28	Tue				-do-	-do-	
32	9/29	Wed				Data arrangement	Data arrangement	
33	9/30	Thu	PNH-BKK					
34	10/1	Fri	-NRT					

(3) Explanation on Draft Report

Days/Date	Weekday	JICA		Consultant	
		Mr. Okiura	Mr. Ueki	Mr. Abe	Mr. Sato
1	1/5	Wed	/		NRT-BKK-PNH
2	1/6	Thu			Explanation/discussion of DFR to MIME, Pursat and Battambang
3	1/7	Fri			Move to PNH
4	1/8	Sat			資料整理
5	1/9	Sun			Move to Sihanoukville
6	1/10	Mon	NRT-BKK-PNH	REP-PNH	Explanation/discussion of DFR to Sihanoukville, Move to PNH
7	1/11	Tue	Explanation/discussion of DFR to MIME		
8	1/12	Wed	Meeting with JICA office Signing of M/D		
9	1/13	Thu	Report to EOJ Move for another project	Report to EOJ and JICA office	Report to EOJ and JICA office Move to BKK
10	1/14	Fri			-NRT

(4) Explanation on Draft Report (2)

Days/Date	Weekday	Consultant	
		Mr. Abe	
1	1/29	Sat	NRT-BKK-PNH
2	1/30	Sun	Move to Sihanoukville
3	1/31	Mon	Explanation/discussion of DFR to Sihanoukville
4	2/1	Tue	Move to PNH Explanation/discussion of DFR to MIME
5	2/2	Wed	Discussion on Technical Notes
6	2/3	Thu	Signing of Technical Notes Report to JICA office Move to BKK
7	2/4	Fri	-NRT

Appendix-3 List of Parties Concerned in the Recipient Country

Organization	Name	Position
Ministry of Industry, Mines and Energy (MIME)	HE. Heng Sokkung	Under Secretary of State
	Mr. Tan Sochea	Director, Dept. of Potable Water Supply
	Mr. Soeung Yuthera	Staff, Dept. of Potable Water Supply
	Mr. Som Sethy	Staff, Dept. of Potable Water Supply
DIME, Pursat	Mr. Mao San	Director
DIME, Battambang	Mr. Chui Cheang	Director
DIME, Sihanoukville	Mr. Prak Chanroern	Director
Pursat Provincial Water Works	Mr. Keo Sara	Director
	Mr. Sieng Sengputhea	Deputy Director
	Mr. Un Chantara	Deputy Director
Battambang Provincial Water Works	Mr. Tauch Choun Saorith	Director
	Ms. Tith Linda	Deputy Director
Sihanoukville Water Supply	Mr. Sim Sitha	Director
	Mr. Ly Seng	Deputy Director
Phnom Penh Water Supply Authority (PPWSA)	Mr. Khut Vuthiarith	Director, Dept. of Production and Distribution
	Mr. Chea Satephoat	Deputy Director of Planning and Project Dept.
	Mr. Chpu Phalla	Manager of Procurement Management Office
	Mr. Pheng Ty	Manager, Distribution Office
UN-HABITAT	Mr. In Sokthoeurn	Staff, MEK-WATSAN Safer Cities Programme, Cambodia Office
	Ms. Joyce Mmaitsi	UNV Project Officer, Lao Office
Embassy of Japan	Mr. Masafumi Kuroki	Ambassador of Japan
	Mr. Naomitsu Kondo	Second Secretary
JICA Cambodia Office	Mr. Yasujiro Suzuki	Chief representative
	Mr. Yukiharu Kobayashi	Senior Representative
	Mr. Hiroyuki Nonaka	Project Formulation Advisor
	Mr. SEAK Pengkeang	Program Officer, Infrastructure Division
The Project on capacity Building for Water Supply System in Cambodia Phase 2	Mr. Hideo Ishii	Chief Advisor
	Ms. Ayako Namura	Human Resource Development/Project Management
	Mr. Satoshi Kiyama	Former Chief Advisor