CHAPTER 3 SITE RECONNAISSANCE

3.1 Objective of Site Reconnaissance

The objective of site reconnaissance for micro-hydro is to investigate plant sites and supply area in order to evaluate the feasibility of projects and get information for electrification planning. One of the most important activities in site reconnaissance is to measure water discharge and head that could be utilized for micro-hydro generation. Investigations of intake site, waterway route, powerhouse site and transmission route etc. are also conducted to assess the feasibility of project sites.

Power demand survey is also important in the planning of the electrification system. Socio-economic data such as number of households and public facilities in supply area, availability of local industries that will use electricity, solvency of local people for electricity, and the acceptability of local people to the electrification scheme are gathered during the reconnaissance survey.

3.2 Preparation for Site Reconnaissance

To achieve effective and fruitful site reconnaissance, it is important to conduct preparation such as gathering of available information, and devise a sufficient plan and schedule of survey activities in advance.

3.2.1 Information gathering and preparation

As advance information, 1/50,000 topographic maps are prepared to check the topography of the target site and villages, the catchment area, village's distribution and access road. More accurate information on site accessibility could be collected by contacting local people concerned.
Copies of 1/50,000 topographic maps and route maps enlarged by 200 to 400% are prepared for the fieldwork.
Check list and interview sheet are also prepared for each site reconnaissance.

3.2.2 Planning of preliminary site reconnaissance

Although it may be required to deviate from original plan and schedule in accordance

with site conditions, it is important to make a sufficient plan and schedule for site reconnaissance activities in advance. It is also necessary to coordinate with local officials concerned to insure safety and successful conduct of the reconnaissance activities. Since most micro-hydro sites are located in mountainous and isolated areas, it requires longer time to conduct site reconnaissance activities. Therefore, sufficient schedule should be considered to have enough time for the fieldwork. Also, measurement and other activities for site reconnaissance should be taken into account. A checklist or interview sheet should be prepared beforehand to efficiently perform necessary activities of site reconnaissance.

3.2.3 Necessary equipment for preliminary site reconnaissance

Necessary equipment for preliminary site reconnaissance depends on purpose and accuracy and site conditions. Basic equipment is as follows:

Table 3.2.1 Check sheet of basic equipment for site reconnaissance as an example

Equipment			Equipment		
Map, Sheet	○	Route map	Equipment	○	Altimeter
	○	Topographic map		○	GPS (portable type)
	○	Reconnaissance schedule		○	Camera, film
	○	Check list		○	Current meter
	○	Interview sheet		○	Distance meter, measuring tape
		Geological map		○	Hand level
		Aerial photograph		○	Convex scale (2-3m)
		Related reports			Hammer
					Clinometer
Stationary	○	Field notebook			Knife
	○	Scale			Scoop
	○	Pencil		○	Torch, flashlight
	○	Eraser			Sampling baggage
	○	Color pencil			Label
		Section paper		○	Compass
					Stop watch
					Battery

Notes: ○: necessary equipment for preliminary site reconnaissance

3.3 Survey for Outline the Project Site

First at the site reconnaissance, a survey is conducted on the following items at the site of power generating facilities and around the power demand area.

(1) Access conditions

The equipment and machinery used for the construction and operation of a Micro-hydro power plant are smaller and lighter than those used for an ordinary hydropower plant and it may be possible in some cases that such equipment and machinery can be brought to the site either manually or using simple vehicles.

Given the small scale of the power generation of a Micro-hydro power plant by definition, careful consideration is required for the use of a transportation method other than the use of an existing road or vehicle since construction of a new access road could be a factor which considerably reduces the economy of a project. Moreover, in the case of a mountainous area, there may be abandoned roads (previously used for the hauling of cut trees, etc.) which are difficult to find because they have been covered by vegetation and it is important to interview local residents on the existence of such roads.

(2) Situation of existing systems and future plans

Even for a project site at which the development of an individual system is assumed, a survey should be conducted on the tail end location, route and voltage, etc. of the existing system and also on the availability of extension and rehabilitation plans for the said system.

(3) Situation of river water use

The existence of facilities using river water, the water volume and any relevant future plans regarding a river from which a planned hydropower plant will draw water should be surveyed. The subject river section for water utilization should be determined taking not only the assumed recession section but also the possibility of a change of the water intake position and the waterway route at the project formulation stage into consideration.

When a fall or steep valley is to be used for power generation, local information on the use of such a fall or valley should be obtained together with a survey on the relevant

legal regulations.

(4) Existence of other development plans/projects

A survey should be conducted on the existence of other development plans/projects in terms of roads, farmland, housing and tourism, etc. which may affect the planned project site and/or its surrounding area.

(5) Civil structures in adjacent area and materials used

Many civil structures for a small-scale hydropower plant are similar to those of irrigation facilities and road drainage facilities, the materials for which are often obtained near the planned project site.

As the use of constructors, human resources and local materials involved in these civil structures is important from the viewpoint of reducing the construction cost, contributing to the local economy and ensuring easy maintenance and repair, a survey should be conducted on similar civil structures in the adjacent area of a project site to obtain useful reference materials for project planning and design.

(6) Presence of natural topographical features and existing structures usable for power generation

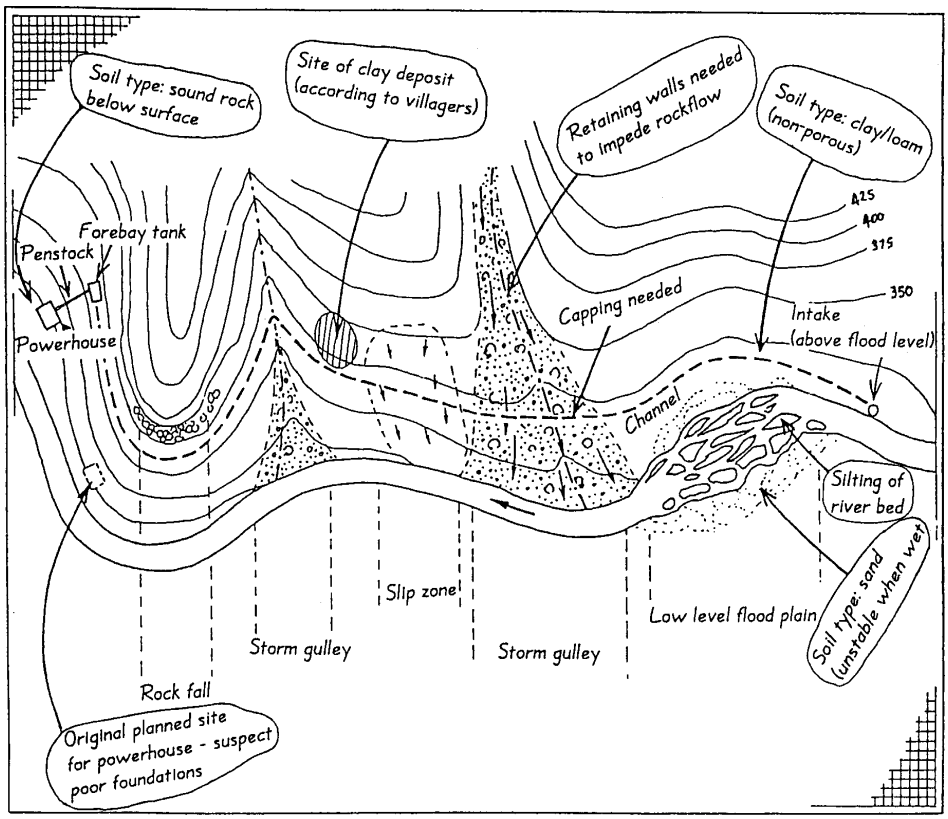
When an existing irrigation channel or similar is used (including widening and/or reinforcement) as a waterway for power station, it is necessary to check the cross-section, gradient and current water conveyance volume, etc. of such a channel.

(7) Existence of important ground features and vegetation

Even a small-scale hydropower plant necessitates some alteration of the local topography. When important ground features and/or vegetation exist along the planned route of the waterway, they must be carefully dealt with. For this purpose, their locations and conditions, etc. should be sketched for discussions with such related persons as the landowner(s) and representatives of the local government.

3.4 Clarification of geological conditions affecting stability of main civil structures

The survey on ground stability, especially that of the surface layer, is required for the construction of a small-scale hydropower plant due to (i) the exposed structure of most of the main civil structures, and (ii) the rooting of the waterway on a sloping hillside. The investigation results should be reproduced in the form of sketch drawings (refer to Fig 3.4.1) for reference purposes when determining the basic structure of each civil structure.



The geological study. The sketch should be based on maps, interviews, photographs and your own site observations. Use squared paper when visiting the site to help you draw to scale – costing of the channel and comparing the costs of different channel and works locations is then much easier.

Fig.3.4.1 A geological sketch based on site observations

3.5 Survey on Locations of Civil Structures

As it is insufficient to establish a waterway route based on an existing topographical map and other relevant information for the planning of a Micro-hydro power plant, field reconnaissance by the planner is important. The findings of this field reconnaissance will largely determine the success or failure of a project.

The items to be checked during this survey are roughly listed below. It is necessary to repeat the field reconnaissance in line with the progress of the planning and design. When uncertainties emerge, particularly at the design stage, field verification is essential.

Moreover, in this survey, the planner must keep the expected demand in mind. Therefore this survey should be conducted on a parallel with the demand survey.

It is important to not only select suitable locations for such individual facilities as the intake weir and waterway, etc. but also to carefully examine the locations of their tie-in sites.

For the development of micro-hydro, the maximum use of natural topographical features is important from the viewpoint of cost reduction. It is, therefore, necessary to conduct the survey based on a full understanding of the items discussed in “Chapter 4,4.3 Selection of Location for Main Civil Structures”.

3.6 Measurement of River Flow

In the case where the estimated river flow at a project site is reasonably reliable because it is based on data provided by a nearby gauging station, there is no special need for measuring of the discharge.

When such data is difficult to obtain. Any stoppage of power generation due to a reduced water flow volume significantly affects users in the case of a micro-hydro, making it essential to check the discharge at the time of low water level. It is, therefore, preferable to measure the river discharge in a dry season by a simple method to confirm the appropriateness of the estimated flow duration. Should measuring of the discharge be found to be necessary, the observation period must be carefully determined based on past rainfall records and other relevant information.

It is also necessary to check and evaluate the observation results in connection with the character (for example, drought year or wet year) of the year of observation based on past rainfall records, etc.

The stream flow measuring method, frequency and water level observation unit can be simplified in the following manner to reduce the survey cost.

(1) Flow measuring method

A stream flow measuring method which is appropriate for the river conditions can be adopted. [Reference 3-1: Simple method of stream flow measuring]

(2) Frequency of stream flow measuring

In principle, stream flow measuring should be conducted at least three times a year to analyze the relation between the water level and the discharge in the range below the assumed maximum discharge.

(3) Water level observation unit

A staff gauge should be set up at a point near the flow observation point where visual water level observation can be easily carried out.

3.7 Measurement of head

The head between the intake point and the headtank and the head between the headtank and the outlet point should be measured. At the initial planning stage, however, it may be sufficient to measure the head between the planned headtank location and the outlet level.

While a surveying level can be used for the purpose of measuring, a simpler head measuring method may be sufficient. [Reference 3-2: Simple methods of head measuring]

3.8 Demand survey

3.8.1 Demand survey method

There can be many types of power demand facilities for small-scale hydropower generation in response to the characteristics of the subject area for development. For development plan preparation, accurate understanding of the likely power demand facilities in the subject area for development is essential.

What is important to ensure the efficiency and practicality of a demand survey is to estimate a slightly higher demand level than the assumed scale of power generation in view of adequately responding to the scale of development and seasonal fluctuations of the power demand.

3.8.2 Demand survey items

The demand survey items are described below. When there is more than one power demand facility, each facility should be surveyed.

(1) Location

The suitable route and distance, etc. to each power demand facility should be surveyed to examine the optimal transmission and distribution lines.

(2) Owners

The opinions and intentions of the owners of power demand facilities regarding the introduction of a new power supply source should be clarified.

(3) Types and required quality of equipment

The situation of power use by equipment (for motive power, heating, lighting and electrical control, etc.) and the required level of accuracy (in terms of the allowable voltage fluctuation and frequency fluctuation) should be surveyed.

(4) Equipment capacity, etc.

The equipment capacity, power consumption level and electricity tariff (or estimated electricity tariff in the case of planning) should be surveyed.

(5) Period of use

Any seasonal or daily fluctuation of power use and the range of fluctuation should be surveyed.

(6) Year of installation and service life

The year (date) of installation of each power demand equipment and its service life or planned period of use should be surveyed.

(7) Likely problems associated with power cut

The likely problems and financial losses associated with a power cut to power demand facilities should be surveyed.

3.9 Surveying

The surveying for the following design should be conducted after identification of the waterway route.

It is needed to implement hereunder in implementation stage.
In the case of the waterway and access road, etc., route surveying (centre line and cross-section surveying) may be sufficient for planning and design purposes and should be effective from the viewpoint of cost reduction, particularly when the required surveying length is long. These routes must, however, be carefully determined based on the results of the field reconnaissance conducted by the planner(s).

Following matter is implem ented, if it is needed.
A proper understanding of the local topography is important for the planning of a small-scale hydropower plant as most of the main civil structures have an exposed structure. Topographical surveying is particularly required for such structures as the intake facility, head tank and generating station, etc., each of which covers a wide area, to improve their design accuracy. In general, the accuracy of the topographical surveying around civil structures tends to be in the range of 1/100 – 1/200 for small to medium-scale hydropower plants. However, topographical surveying accuracy in the region of 1/500 should, in principle, be sufficient for independent micro-hydro scheme because an error in topographical surveying hardly affects the work volume for small structures.

[Ref. 3-1 Simple method of stream flow measuring]

1. Using electromagnetic current meter

Generally, current meter used for measurement of river flow is screw type. But nowadays, an electromagnetic current meter that doesn't have rotating parts is on the market. This is suitable for measurement of river flow in a small-scale hydro site. It is lightweight, and can measure even in shallow river.

In case of survey for small-scale hydropower development, a simple method such as follows suffices for measurement using electromagnetic current meter.

(1) Three-points measuring method ・・・・ $V_m = 0.25 \times (V_{0.2} + 2V_{0.6} + V_{0.8})$

(2) Two-points measuring method ・・・・ $V_m = 0.50 \times (V_{0.2} + V_{0.8})$

(3) One-point measuring method ・・・・・ $V_m = V_{0.6}$

(4) Surface measuring method ・・・・・・ $V_m = 0.8 \times V_s$

where, V_m: Mean velocity Vs: Surface velocity

$V_{0.2}$: Velocity at the depth of 20% below the water surface

$V_{0.6}$: Velocity at the depth of 60% below the water surface

$V_{0.8}$: Velocity at the depth of 80% below the water surface

Following precautions should be taken when selecting the point of stream flow measurement.

(1) No irregular wave and whirlpools at the surface.

(2) No subsurface flow, back-flow, and stagnation.

(3) No irregular change of water level.

No crossing-over of streamline.

During measurement, the riverbed should be cleaned if necessary.

2. Float measuring method

Basically, a float measuring method applies during floods when measurement with current meter is not possible. It is applicable when development sites are not decided, or a current meter is not available.

(1) Measuring method

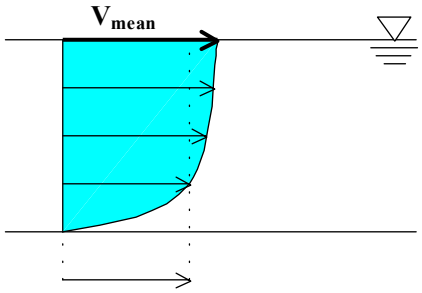
1) Measuring should be implemented at the place where the axis of streambed is straight and the cross section of river is almost uniform.
2) Flowing distance of floats should be more than the river width.
3) Setting transverse lines at the upstream and downstream perpendicular to the axis of streambed.
   Flow-down distance (upstream and downstream lines) = L
4) Measuring the cross sectional areas at the upper and lower transverse lines to make average value of the cross sectional areas of flow (A_{mean}).
   Additional measuring should be made at the middle section of two lines if the cross section of river is not uniform.
5) Floats are dropped upstream of the upper transverse line, and the time required for floats to flow from the upper to the lower transverse lines is measured.
6) Measuring should be implemented several times at the different blocks dividing the river in the transverse direction (more than three blocks)

(2) Stream flow calculation formula

$V_m = C \times V_{mean}$

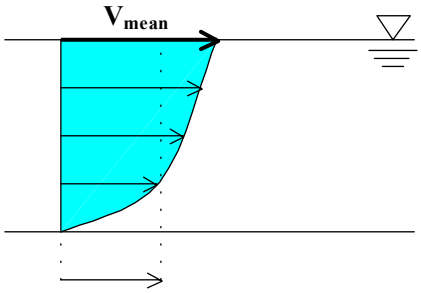
C: (1) Concrete channel in which cross section is uniform = 0.85
   (2) Small stream where a riverbed is smooth = 0.65
   (3) Shallow flow (about 0.5m) = 0.45
   (4) Shallow and riverbed is not flat = 0.25

(1)



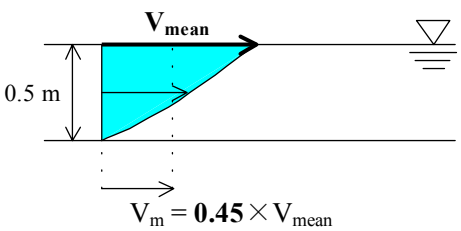
$V_m = \mathbf{0.85} \times V_{mean}$

(2)



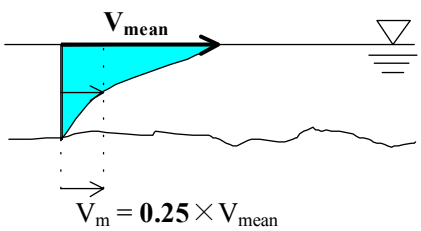
$V_m = \mathbf{0.65} \times V_{mean}$

(3)

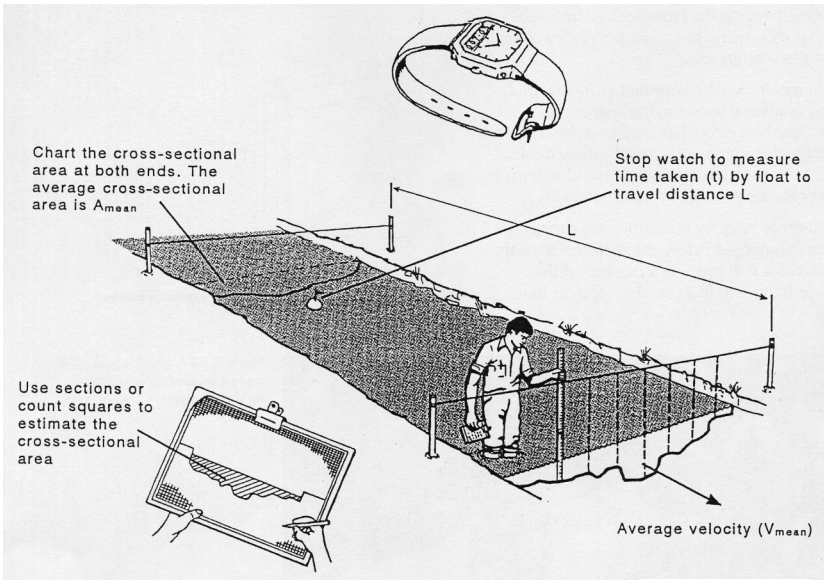


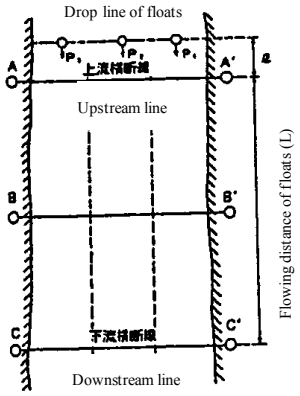
$V_m = \mathbf{0.45} \times V_{mean}$

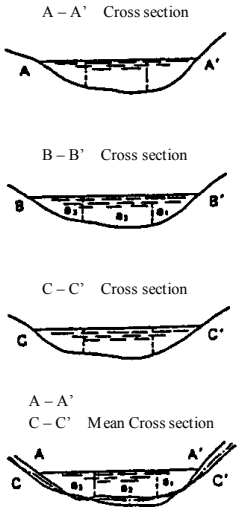
(4)



$V_m = \mathbf{0.25} \times V_{mean}$

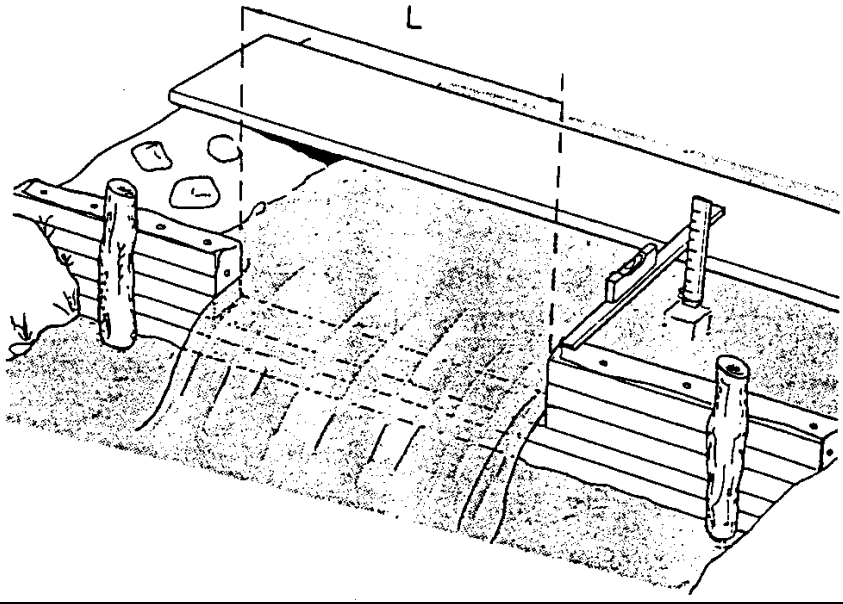






3. Weir measuring method

The discharge is small and use of current meter or float measuring method is impossible, the weir as shown in the following figure is built and discharge is measured by measuring the overflow depth at the river.



In this method, the stream flow can be obtained by following formula.

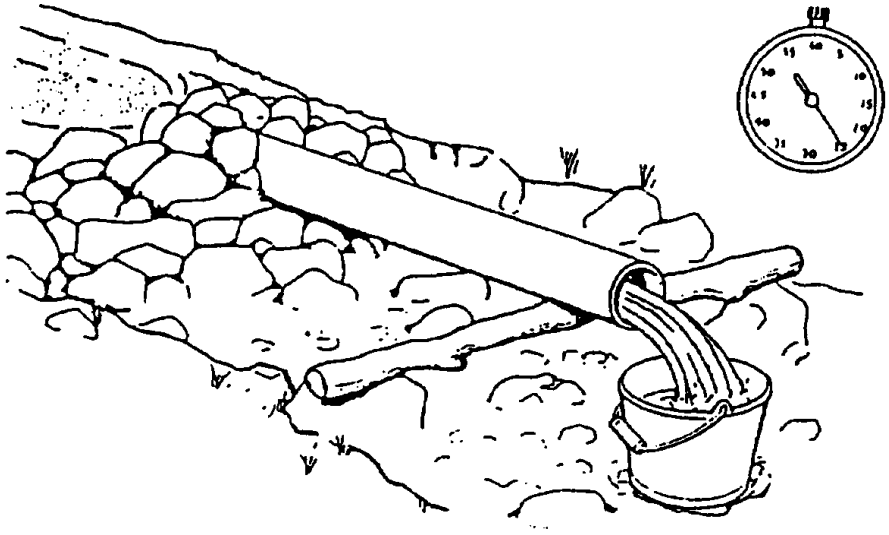
$$Q = C \cdot L \cdot h^{1.5}$$

$$C = 1.838 \left(1 + \frac{0.0012}{h} \right) \left(1 - \frac{(h/L)^{1/2}}{10} \right)$$

Q : Discharge (m^3/s) C : Discharge coefficient L : Opening width of weir (m)
h : Overflow depth (m)

4. Other

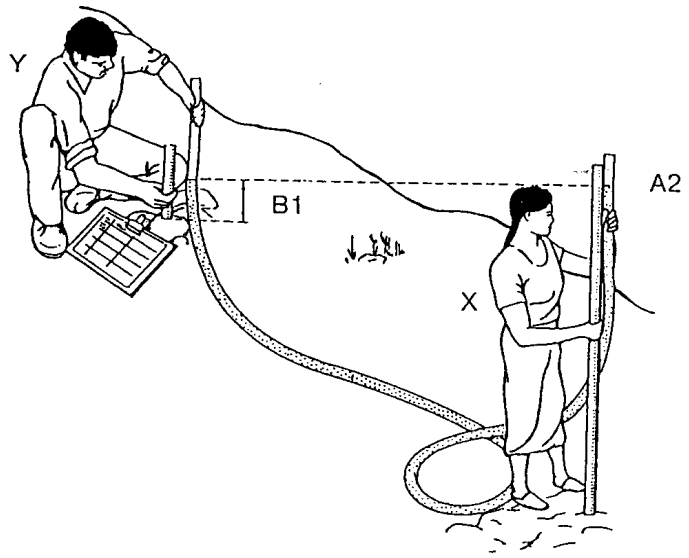
The following methods are applicable when measuring smaller stream flow.



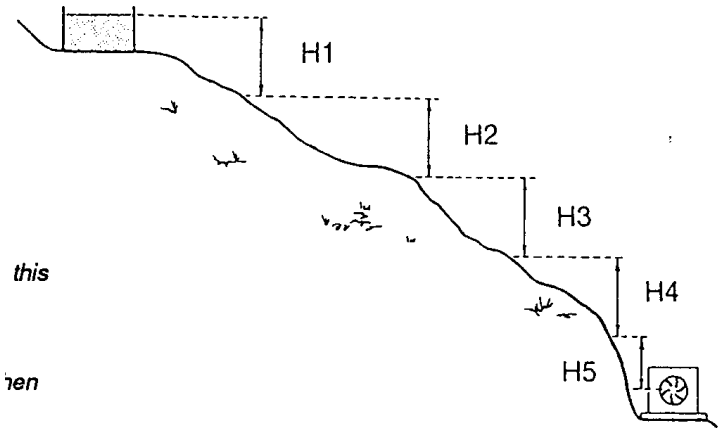
[Ref. 3-2 Simple method of head measuring]

1. Using clear hose method

The following figure shows this method. The method is useful for low head sites, since it is cheap and reasonably accurate. To get the head of two points, measure the difference of water level of the water-filled clear hose at two points. Even someboly who does not have survey work skills can apply this method.



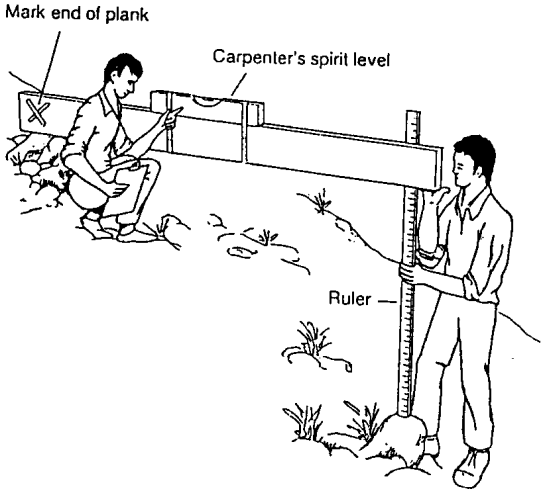
Head=H1+H2+H3+H4+H5



2. Spirit level and plank method

The following figure shows the principle of this method. A horizontal sighting is established by a carpenter's spirit level placed on a reliably straight and inflexible plank of wood.

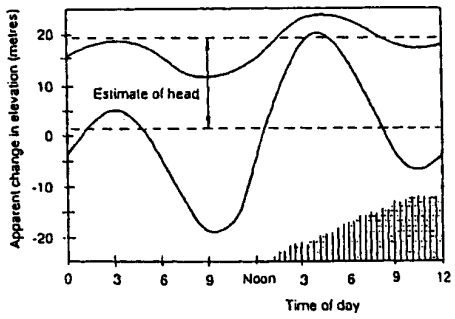
A method simpler than this is named the Pole survey. The Pole survey method uses a tape measure instead of a wooden plank and a spirit level.A, leveling rod is fixed perpendicularly, then a tape measure is moved up and down with a leveling rod. The reading value of the leveling rod of the position at which the reading value of the tape measure decreases most is the height difference between points.



3. Using altimeter method

The principle of the altimeter is that it measures atmospheric pressure. This method is useful in case of long survey distance or bad visibility. However, several measurements are required as shown in the following figure, since in one measurement, accuracy is not expectable by changes during the day in temperature, atmospheric pressure and humidity.

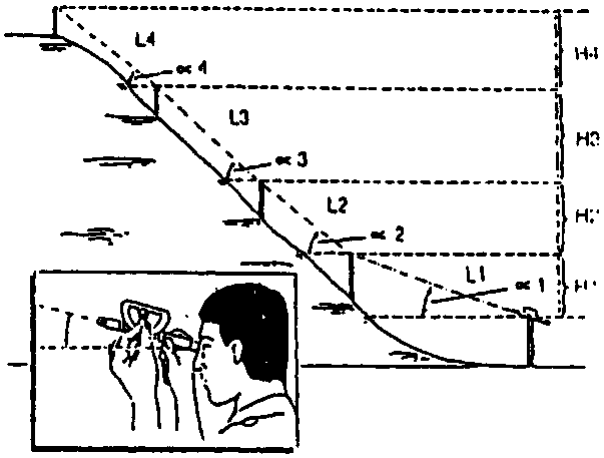
Forebay		Powerhouse	
Reading	Time	Reading	Time
1000	10.15	900	10.20
1010	10.50	915	10.55
1015	12.00	930	12.30
1015	1.00	940	1.30



4. Using sighting meters etc. method

Hand-held sighting meters measure the angle of inclination of a slope (they are often called clinometers or Abney levels). A head is calculated by the following formula using a vertical angle that is measured by a hand-held sighting meter, and a hypotenuse measured by a tape measure.

$H = L \times \sin\theta$ H: Head L: Hypotenuse θ : Vertical angle



Field-note of Topographic surveying

Place date

Observing point	Survey point	Distance (m)	Azimuth (°)	Vertical interval	Remarks
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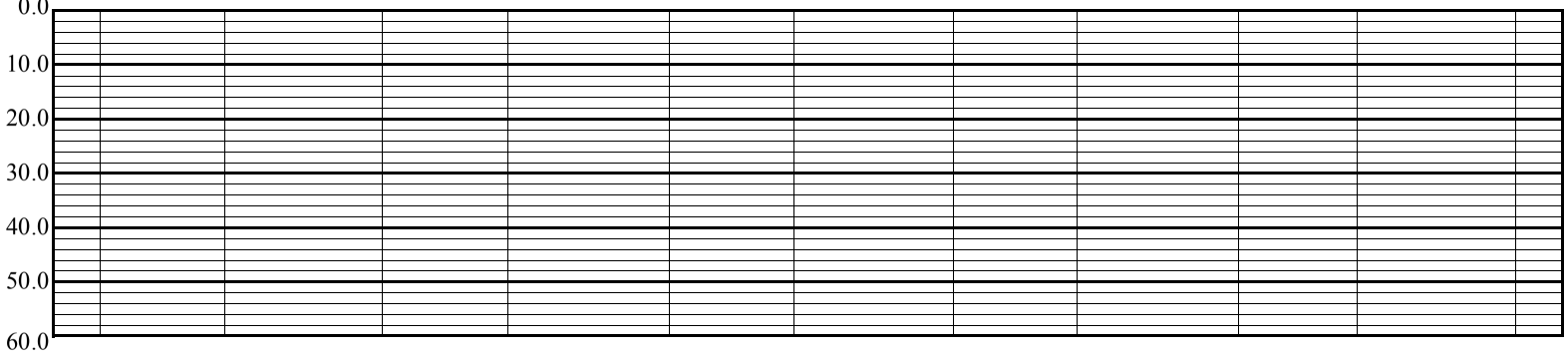
Sketch

Survey sheet of discharge

Place of survey　　date　　time　:　　water level

No.	1	2	3	4	5	6	7	8	9	10	11	Remarks
Distance from left bank												
Depth of river												
Area of flow section												
Depth at point and velocity (cm, cm/s)		Water depth / Discharge		Water depth / Discharge		Water depth / Discharge		Water depth / Discharge		Water depth / Discharge		
Average of Velocity (cm/s)												
dischage(l/s)												

Cross-Section of river



[Reference 3-3 Sample of form sheet for PLTMH (Micro Hydro Electric Power Plant) survey]

Province	**MICRO-HYDRO POWER PROJECT**	Date
Location	**Survey Location of PLTMH Potential**	Surveyor

1. General Data of Region

1.1 Province	
1.2 Regency	
1.3 Municipality	
1.4 Village	
1.5 Orchard	

2. Accessibility

2.1 From Regency to the Municipality	
2.1.1 Distance	km (*map information,informal, data*)
2.1.2 Road condition	□ asphalt: km □ rocks: km □ soil: km
	□ others: km
2.1.3 Trip time	
2.1.4 Transportation Mode	□ public vehicle/bus □ motorcycle
	□ ship/ferry □others:.....

Note :
(Explain the trip route, raod condition (good-bad-danger, etc), transportation mode, where to change the vehicle (route) and other information that needed to get the complete description how to get to the location)

2.2 From Municipality to Village	
2.2.1 Distance	km (*map information, informal, data*)
2.2.2 Road condition	□ asphaltl: km □ rocks: km □ soil: km
	□ others: km
2.2.3 Trip time	
2.2.4 Transportation mode	□ public vehicle/bus □ motorcycle
	□ ship/ferry □others :.....

Catatan :
(Explain the trip route, road condition (good-bad-danger, etc), transportation mode, where to change the vehicle (route) and other information that needed to get the complete description how to get to the location)

2.3 Village to PLTMH location	
2.3.1 Distance	km (*map information, informal, data*)
2.3.2 Road condition	□ asphalt: km □ rock: km □ soil: km
	□ others: km
2.3.3 Trip time	
2.3.4 Transportation mode	□ public vehicle/bus □ motorcycle
	□ ship/ferry □others:.....

Notes :
(Explain the trip route, road condition (good-bad-danger, etc), transportation mode, where to change the vehicle (route) and other information that needed to get the complete description how to get to the location)

3. Demography Location of MHP Potential (*datasource of demography in village, orchard, RW)*

3.1 Total population	person
3.2 Total Family Head	family head
3.3 Total house	house
3.4 Living source	
3.5 Population Distribution *	□ spread □ centralized □ grouping □ .....
3.6 Income per month	(in average)
3.7 Public Organization	□ BPD □ farmer group □ praying
	□ □ □
3.8 Cooperatives	□ □

**population distribution is described in village map (draft)*

4. **Village Infrastructure** *(make village situation map: information in village office, mappin gwith GPS and supporting equipment)*

4.1 Distance to the neasrest PLN lines	km *(measure with GPS & the available equipment)*
4.2 Public Facility	
4.2.1 School	□ Elementary School□ Junior High School □ Senior High School □ Other: .....
4.2.2 House of Worship	□ mosque □ church □ other .....
4.2.3 Health Services	□ local government clinic □ others: .....
4.2.4 Govenment Office	□ village □ municipality □ other .....
Others	
4.3 Limit of Village	
4.3.1 North	
4.3.2 South	
4.3.3 West	
4.3.4 East	
4.4 Productive Business	
4.4.1 Market	□ none □ exist □ daily □ weekly
4.4.2 Small industry (*type & total*)	
4.4.3 Others	
4.5 Economy Potential (*farming,planting,fishery,etc.)*	

Notes:
(inform the type of PLTMH utilization form for productive/economy business in accordance with local potential)

5. Location of HEPP

5.1 Location	
5.2 River	
5.3 Status of Land Ownership	□ private □ village □ donated land□ other: .....
5.4 Location condition	□ heavy area □ in forest □ near □ strategic
	value: 1 2 3 4 5 6 7 8 9 10

1. *very bad, far, heavy area, difficult access for construction so that it need supporting equipment for goods*
2. *far > 2 km,quite heavy area, need supporting equipment to transfer the goods to the location*
3. *far > 2 km, narrow trail, turn around, quite heavy area, not need supporting equipment for bring the goods*
4. *medium 1-2 km, quite heavy area, goods access need supporting equipment*
5. *medium 1-2 km, access for construction is quite heavy but still can be reach without supporting equipment for goods*
6. *long distance >2 km,access for goods and person is ease.*
7. *medium distance 1-2 km, access for goods and people quite easy, vehicle only half distance*
8. *near < 1 km,can be reach easily without vehicle*
9. *near < 1 km, road to the location & access for goods is easy, vehicle only half distance*
10. *near < 1 km, road to the location is easy (vehicle can be in to near location)*

6. Hidrology	
6.1 Riverstream, main river	
6.2 River/irrigation tunnel	
6.3 Average measured discharge	m^3/s (*use current meter, dam or float*)
6.4 Input discharge	m^3/s (*assumptioned minimum discharge along the year*)
6.5 Geodetic head	m (*measurement by using pressure gauge, clinometer*)
6.6 Hydro power potential	kW (*based on discharge in point 6.4*)
6.7 Generated electric power potential	kW (*electric power potential that produced by PLTMH system*)
6.8 River width	m (*using GPS, meter, other supporting equipment)*
6.9 Important information *Periodically flood, garbage, rocks* *Water supply along the year* *Utilization for farming/irrigation*	(*explained)*

7. Lay-out of MHP System (*make lay-out of MHP system, transmission & distribution lines and map in A3 size*)	
7.1 Civil Construction Component	
7.1.1 Dam/reservoir	□ available □ not available
Length	m (*if available)*
Type	□ concertina □ permanent (*facultatif, if availabl,*)
Basic River	□ sedimentary rock □ hard soil □ other: .....
7.1.2 Intake	□ available □ not available
Side Intake	(*facultatif*)
Direct Intake	(*facultatif*)
Other Type:	(*facultatif*)
7.1.3 Feeding Channel	□ available □ not available
Open Channel	m condition/type of land:
Water bridge	m
Closed channel	m condition/type of land:
Land/sediment/rocks	□ many □ little □ other: .....
7.1.4 Sedimentation & Stilling vessel	
Local land condition	□ fertile□ sedimentary rock□ soft □ other: .....
7.1.5 Penstok	
Penstok length	m
Penstok slope	^{0} (*decree*) (*use clinometer, make draft*)
7.2 Transmision and distribution line	(*bdescribed lines map and village map in A3*)
Length	m (*use GPS, clino, compass, meter and supporting equipment*)

Notes:
(*track condition from intake to generator house, such as riverbank stepness, the density of tree, big rock barrier, etc)*

8. General Condition of Geology in Construction Track	
8.1 Land Condition	□ sand □ fertile □ soft □ other: .....
8.2 Rocks Condition	□ limestone □ sedimentary rock □ other: .....
8.3 Natural disaster record (*landslide,flood, land movement, typhoon, rockslide, etc)*	

9. Resouces		
9.1 Construction material stock		
9.1.1 Rock	□ local □ material shop □ others:	
9.1.2 Sand	□ local □ material shop □ others:	
9.1.3 Others:	*Local area, municipality, regency, etc*:	
(c*ement, construction material*)	Distance: km	transportation : .....
9.2 Labours		
9.2.1 Availability	□ Carpentry □ craftman □ other:	
9.2.2 Salary	□ daily, Rp □ weekly, Rp □ monthly, Rp	
Notes:		
9.3 Energy source and utilization (*information from more than 5 person, make an explanation*)		
9.3.1 Existing generator		
Hydro/waterwheel/turbine	□ quantity □ status □ capacity: kW	
Diesel	□ quantity □ status □ capacity: kW	
Solar power	□ quantity □ status □ capacity: kW	
9.3.2 Illumination per house/family head		
Petromax	□ quantity □ oil consumption: liter/ day	
Wall lamp	□ quantity □ oil consumption: liter/ day	
9.3.3 Minyak tanah	□ Rp. /ltr □ oil consumption: liter/ day	
9.3.4 Fire woods	□ □ consumption: Rp /week(month)	
9.3.5 Average cost per family head per month for illumination Rp. .....(*information from the community adn the calculation)*		

10. Electric Power Energy Demand		
10.1 Electric power energy consumption		
10.1.1 Housing (per family head)		
Illumination	Watt (*total lamp x watt*)	
Home appliances	Watt (*radio + TV B&W= 50 W, colorr TV: 100W*)	
10.1.2 Productive Business	□ type: □ quantity □ total: kW	
	□ type: □ quantity □ total: kW	
	□ type: □ quantity □ total: kW	
10.1.3 Public facility (*localgovernment clinic, office, illumination, house of worship, school*)	□ type: □ quantity □ total: kW	
	□ type: □ quantity □ total: kW	
	□ type: □ quantity □ total: kW	
10.2 Demand per Family head	Watt	
10.3 Total potential consumer	Family head/connection	
Notes (*important additonal information*):		

[Ref.3-4 Questionnaire for Households of Non-Electrified Villages]

Household number			

Name of Respondent	
Sub unit of village	
Desa (village)	

Circle the final result of the visit to this household
1. Completed
2. No household member at home or no competent respondent at home at time of visit
3. Postponed
4. Refused
5. Other (specify)

Interviewer's name	
Date	
Time interview began	
Time interview completed	

Data input by		**Final Check by**	

1. FAMILY PROFILE

1. Number of family members (only living together in the same house)

Male adults at 20 yrs or over	_____	persons
Female adults at 20 yrs or over	_____	persons
Children less than 20 yrs old	_____	persons
Total	_____	**persons**

2. Number of school going children

University student	_____	persons
High school student	_____	persons
Junior high school student	_____	persons
Elementary school student	_____	persons
Total	_____	**persons**

3. How many of your family are earning income in the village in the village? _____ persons

4. How many of your family members are living in other town to work? _____ persons

5. Is your household headed by male or female?

	Tick (✓)
Male	
Female	

6. Which organization does any of your family belong to

KUD[1] _____ Persons
LKMD[2] _____ Persons
Other (specify) _____ Persons

7. How many of your family members graduated from (upper) high school? _____ persons

2. Housing

8. How many rooms does your house have? _____ rooms (including kitchen)

9. What is floor space of your house? _____ m2

10. What type of roof is used for the house?

Type of roof	Tick (✓)
Tiled roof	
Tin roof	
Thatched roof (straw, palm leaf)	

3. Economic aspects

3-1. Household income

11. How much is your family earning from agriculture?

Type of crops	Average amount of production per cropping (kg)	Times of cropping per year	Average farm gate price (Rp.)	Approximate annual earning (Rp.)	Average annual cost (Rp.)	Subsistence/ cash crop
Rice						Subsistence/cash crop
						Subsistence/cash crop
						Subsistence/cash crop
						Subsistence/cash crop
						Subsistence/cash crop

12. Earnings from Fishery

Type of fish	Annual average earning (Rp.)	Annual average cost (Rp.)	Subsistence/cash
			Subsistence/cash
			Subsistence/cash
			Subsistence/cash
			Subsistence/cash

13. What kind of income sources does your family have? Insert the amount of earning of the last month in each category by each income earner.

Income source \ Income earner	1st income earner	2nd income earner	3rd income earner	4th income earner	5th income earner
Salaries/wages					
Pension					

[1] KUD: Village Unit Cooperatives
[2] LKMD: Village Resilience Boards

Handicraft					
Other cottage industry					
Shops/restaurant					
Services (e.g. hair-dress, car/bike garage)					
Money transfer from outside the village					
Others (Specify:)					
Total					
LIVING PLACE					

3-2. Household Expenditure

14. How much did your household spend on each item for the last month?

Rp./month

No.	Item of expenditure	Amount	Remarks
1	Food		Incl. drinks.
2	Clothing		Incl. personal goods as sandals/cosmetics.
3	Housing		Housing loan repayment/house rent, etc.
4	Inputs for business		Equipment & raw materials, if any.
5	Utilities		Water, gas, electricity, fuel, & sanitation.
6	Tax		If you pay income or property tax.
7	Education		Incl. enrolment fee, books, uniforms, etc.
8	Transportation		Incl. oils for your own cars/bikes.
9	Health care		Medical treatment, medicines.
10	Others		Other costs not specified in the above.
Total			

15. How much did your household spend on the utility except energy for the last month?

Rp./month

No.	Item of expenditure	Amount	Remarks
1	Potable water		For cooking, drinking & washing.
2	Irrigation water		Agricultural use.
3	Sanitation		Waste water & solid waste, toilet, etc.
4	Others		Other costs not specified in the above.
Total			

16. How much did your household spend on the energy-related item for the last month?

Rp./month

No.	Item of expenditure	Amount	Remarks
1	Electricity		Distributed electricity by lines
2	Gas		Purchase cost.
3	Solar power		Operation & maintenance cost for facilities
4	Kerosene		Purchase cost. Do not include for car, bike, & tractor, but include for lamps.

5	Diesel oil		Purchase cost for diesel generator
6	Coal		Purchase cost
7	Charcoal		Purchase cost
8	Fuel wood		Purchase cost
9	Dry batteries		Purchase cost
10	Candles		Purchase cost
11	Matches		Purchase cost
12	Car battery charging		Charging cost per time
13	Others		Other costs not specified in the above.
Total			

17. If your village is to be electrified and your house is to be connected with electricity distribution systems, all of your existing costs for lightening and heating as mentioned above may be saved. In this case, how much monthly charge are you willing to pay for new electricity services?

Range (Rp./month)	1,000 ～ 2,000	2,000 ～ 3,000	3,000 ～ 4,000	4,000 ～ 5,000	5,000 ～ 10,000	10,000 ～ 20,000	20,000 ～ 30,000	30,000 ～ 40,000	40,000 ～ 50,000	More than 50,000 (specify:)
Tick (✓)										Rp.

4. Energy related property

18. Do you have following equipment for lightening and/or heating?

Kind of equipment	a) Generator	b) Kerosene lamp	c) Gas burning cooking appliance	d) Car battery	e) Others (Specify:)
Number					( )

19. What kind of electrical appliances does your household currently use?
[ ] Bulb/fluorescent light _____ units
[ ] TV-set _____ units
[ ] Radio & cassette recorder set _____ units
[ ] Refrigerator _____ units
[ ] Air conditioner _____ units
[ ] Other, specify _____ _____ units

20. What kind of electrical appliances does your household currently use for productive activities?
[ ] Sawmill machine
[ ] Rice milling machine
[ ] Rice dryer
[ ] Irrigation pump
[ ] Others, specify _____

5. Needs for electricity

5-1. Priority needs

21. Could you give your priority order on the followings needs?

	Priority	Example
Water supply		1
Education		2

Health care		3
Sanitation (toilet, solid waste, drainage, etc.)		7
Electrification		4
Irrigation		6
Road improvement		5
Others (specify)		

5-2. Effort to have access to electricity

22. Has your household ever attempted to have access to electricity?
[ ] yes → go to Question 23.
[ ] no → go to Question 30.

23. What type of electricity generation did your household plan to have access to?
[ ] Diesel generator set
[ ] Solar home system
[ ] Wind power
[ ] Micro hydropower
[ ] Biomass
[ ] Other, specify _____

24. Specify the reason for selecting the type of electricity generation.

_____

25. Did your household succeed in having access to electricity?
[ ] yes → go to Question 26.
[ ] no → go to Question 27.

26. Is your generating system functioning as expected?
[ ] yes → go to Question 28.
[ ] no → go to Question 29.

27. If your household did not succeed in having access to electricity, explain the reason for the failure.

_____

28. What positive impact could your household receive from electricity? Explain.

_____

29. What problems did your household encounter regarding generating facility?

Problem	Tick (✓)
Expensive cost for fuel	
Unable to fix breakdown	
Insufficient electric power to meet the demand	
Other (specify)	

5-3. Purpose of using electricity

30. If you can have access to electricity, what kind of electrical appliances and how many appliances do you want to use?
[ ] Bulb/fluorescent light _____ units

[ ] TV-set _____ units
[ ] Radio & cassette recorder set _____ units
[ ] Refrigerator _____ units
[ ] Air conditioner _____ units
[ ] Other, specify _____ _____ units

31. What facility/equipment do you want to utse electricity for productive activities?
[ ] Sawmill machine
[ ] Rice milling machine
[ ] Rice dryer
[ ] Irrigation pump
[ ] Others, specify _____

32. What public facilities do you think should have access to electricity?
[ ] School
[ ] Mosque/church
[ ] Clinic/health center
[ ] Water pump for drinking water
[ ] Others, specify _____

5-4. Electrification by the organization other than PLN

33. Who/what organization do you think would be the most appropriate for the installation of the electricity supply system?
[ ] Central government/ministry
[ ] Provincial government
[ ] District government
[ ] KUD
[ ] LKMD
[ ] NGO
[ ] Private contractor
[ ] Village members (including village head)
[ ] Others, specify_____
[ ] Don't know

34. Do you and/or your family member volunteer to participate in working for the construction without any cash reward if the generating facility is to be installed in the village?
[ ] yes [ ] no

35. Who/what organization should be responsible for operation and maintenance of the system?
[ ] Central government/ministry
[ ] Provincial government
[ ] District government
[ ] KUD
[ ] LKMD
[ ] NGO
[ ] Private contractor
[ ] Village members (including village head)
[ ] Others, specify_____
[ ] Don't know

36. Do you and/or your family member want to participate in working for operation and maintenance?

[ ] yes [ ] no

37. Who/what organization should be responsible for billing and collection of charges for electricity?
[ ] Central government/ministry
[ ] Provincial government
[ ] District government
[ ] KUD
[ ] LKMD
[ ] NGO
[ ] Private contractor
[ ] Village members (including village head)
[ ] Others, specify_____
[ ] Don't know

38. How should the electricity tariff be decided?
[ ] Same level as PLN's tariff system
[ ] Based on consultation with and consensus of villagers
[ ] Free of charge
[ ] Other, specify_____