

6. Observation of the water storage state by the subsurface dam

Unlike a surface dam, a subsurface dam does not allow direct observation of water storage. It can only be estimated from the groundwater level observed using facilities set up for this purpose.

This chapter describes the observation of groundwater level and other parameters carried out during this project, as well as the water storage state estimated from the results of the observations.

6-1 Facilities for observation of water storage state (facilities for groundwater observation)

Table 6.1 shows the features of the facilities for the observation of the water storage state (facilities for groundwater observation) set up in this project. The distribution of these facilities is shown in Fig. 6.1.

Five of these facilities were equipped with hand pumps for water supply to the villagers (3 pumps of which were still active in March 2003).

(1) Observation wells of the all-strainer type

This is an observation well formed using a plastic pipe with strainers (screens allowing the inflow of water) over all its length deeper than the 5.5 m below the ground surface, installed in a borehole (Fig.6.2-A).

Before the construction of the subsurface dam, 5 wells of this type with automatic water level recorders were installed at the dam site and points on its extension to carry out continuous observation of the groundwater level. After these wells were removed for the construction of the dam, 9 wells of the same type were set up again, 4 of which were across the fossil valley about 200 m upstream of the dam and the rest of which were set up at other places. Five of these wells were equipped with automatic water level recorders.

(2) Large-diameter wells

This is a dug large-diameter well (internal diameter is 1.8 m) whose structure is similar to those prevailing as water-supply facilities in Burkina Faso. In this project, the height of the rim of the well was set at 2 m above the ground surface, and the rim was surrounded by concrete to protect the well from river floods.

At about 100 m upstream and about 50 m downstream of the subsurface dam, “large-diameter wells” (OW-1, -2) were respectively installed for visual and comparative observation of the water storage state by the subsurface dam. On the reservoir area of the “small-scale surface dam with water gates” (see Section 7.(3)), 4 “large-diameter wells” (NP-1 to 4) were also installed for observation purposes. The water-pumping wells set up as a part of the “water-pumping station operated by solar energy” (see Section 7.(1)) were of the same type.

(3) Sets of piezometers of different depths

When there is perched water above the "main" groundwater, the “observation wells of the all-strainer type” mentioned above do not show correctly the “main” groundwater level because of the significant influence of the perched water. The presence of such perched water around the subsurface dam site of this project was suggested by observation during the

excavation and the subsequent observation of groundwater using “wells of the all-strainer type”. To examine the presence of perched water and to observe the “main” groundwater level, sets of piezometers, whose structure is shown in Fig. 6.2-B, were installed at 4 points (PA to PD).

This is an installation consisting of 4 plastic pipes, each of which has a strainer only at its bottom end, and is buried at different depths from each other. The water level in each pipe reflects the level (and the pressure) of the groundwater at the depth of its bottom end.

Table 6.1: Features of the facilities for groundwater observation set up in this project

Type	Number of observation points	Depth to bottom	Distance from subsurface dam	Observation method	Observation period (years)*	Notes	
Observation wells of all-strainer type	B-2-3	15 m	At the subsurface dam site	Continuous observation by an automatic water level recorder	From October 1996 to November 1997	Removed with the start of construction of the subsurface dam	
	B-2-4	15 m					
	B-2-5	30 m					
	B-2-6	15 m					
	B-2-7	20 m					
	B-U-1	20 m	About 3.5 km upstream	Automatic recorder	1997-2003	The recorder was removed in 2002.	
	P-1	20 m	About 1.2 km upstream	Automatic recorder	1998-2003	The recorder was removed in 2002.	
	P-2	20 m	About 650 m upstream	Manual sounder	2001-2003		
	P-3	20 m	About 200 m upstream	Manual sounder	1997-2003		
	P-4	20 m	About 200 m upstream	Automatic recorder	1998-2003	The recorder was removed in 2002.	
	P-5	20 m	About 200 m upstream	Automatic recorder	1998-2003	The recorder was removed in 2002.	
	P-6	20 m	About 200 m upstream	Manual sounder	1997-2003		
	P-7	60 m	About 200 m upstream	Manual sounder	1998-2003	A hand pump was installed.	
P-8	20 m	About 400 m downstream	Automatic recorder	1998-2003	The recorder was removed in 2002.		
Wells of large diameter	NP-1	8 m	About 5 km upstream	Manual sounder	2000-2003	A hand pump was installed.	
	NP-2	8 m	About 4 km upstream	Manual sounder	2000-2003	A hand pump was installed.	
	NP-3	10 m	About 3.5 km upstream	Manual sounder	2000-2003	A hand pump was installed.	
	NP-4	10 m	About 2.5 km upstream	Manual sounder	2000-2003	A hand pump was installed.	
	OW-1	10 m	About 100 m upstream	Manual sounder	1998-2003		
	OW-2	9 m	About 50 m downstream	Manual sounder	1998-2003		
	KP-1	20 m	About 150 m upstream	Manual sounder	1998-2003	These were pumping wells for water-supply facilities operated by solar energy. Most of the water levels observed were thus variable.	
	KP-2	18 m	About 100 m upstream	Manual sounder	1998-2003		
	KP-3	20 m	About 50 m upstream	Manual sounder	1998-2003		
	Sets of piezometers of different depths	PA	1	7.0 m	About 3.5 km upstream	Manual sounder	2000-2003
2			4.7 m				
3			3.0 m				
4			0.6 m				
PB		1	5.2 m	About 1.2 km upstream	Manual sounder	2000-2003	Installed near P-1
		2	3.9 m				
		3	2.5 m				
		4	1.0 m				
PC		1	6.6 m	About 125 m upstream	Manual sounder	2000-2003	Installed between KP-1 and OW-1
		2	4.5 m				
		3	3.1 m				
		4	1.5 m				
PD	1	6.4 m	About 50 m downstream	Manual sounder	2000-2003	Installed near OW-2	
	2	4.8 m					
	3	3.4 m					
	4	0.9 m					

* The end of the observation period of 2003 was February to March.

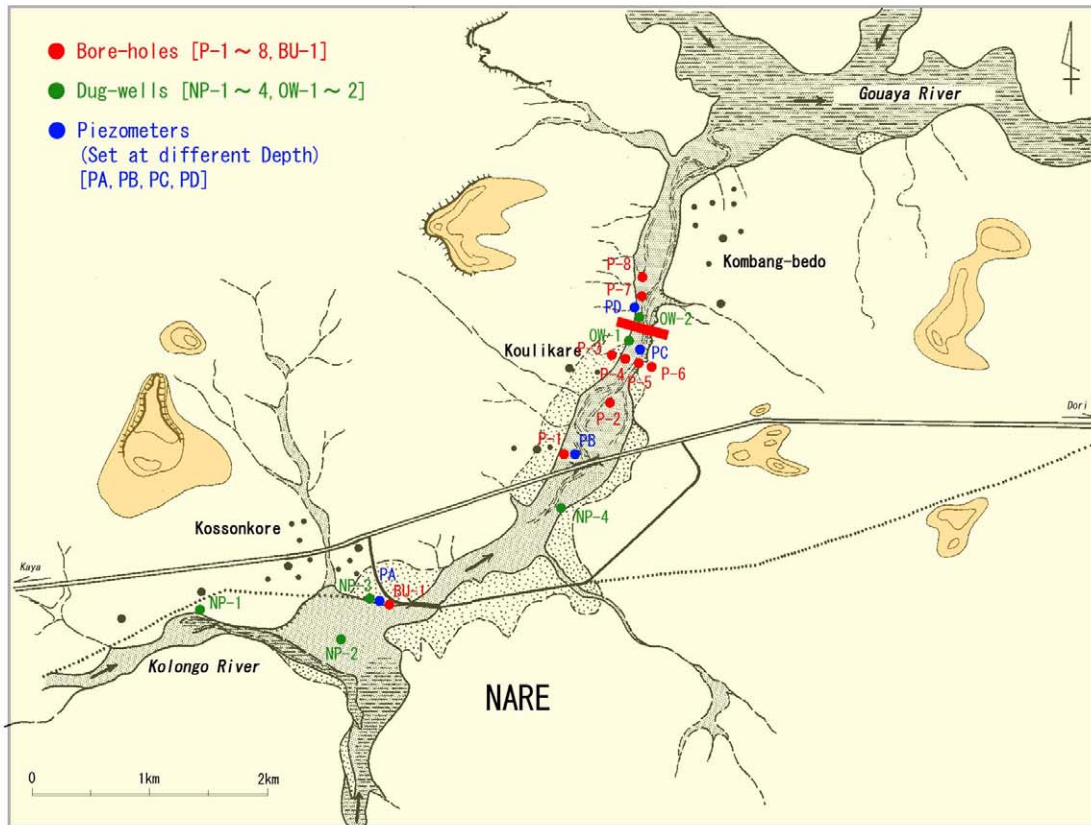


Fig. 6.1: Schematic diagram of the distribution of facilities for groundwater observation

- Bore-holes: Observation wells of the all-strainer type
- Dug-wells: Large-diameter wells
- Piezometers: Sets of piezometers of different depths

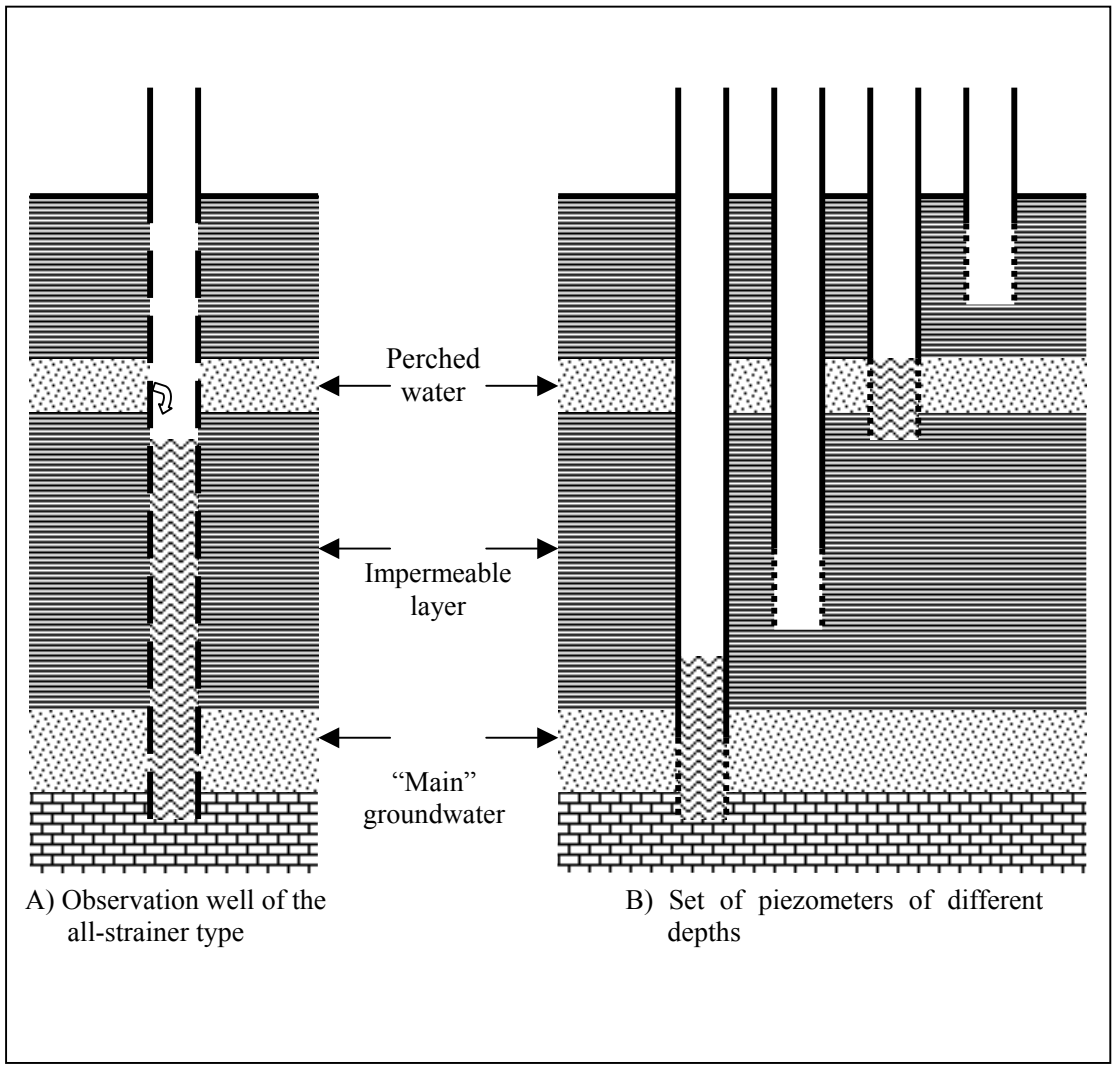


Fig. 6.2: Structure of two types of groundwater observation well