6-4 Analysis of seasonal fluctuation in the reserved water level

As described in the preceding chapter, although the reserved water level by the subsurface dam rises during the rainy season, it cannot be maintained. It falls considerably once the dry season starts.

"Water leakages" from the reservoir area are a possible cause of this fall in the reserved water level. However, the obvious difference, as shown in Fig. 6.3, of the groundwater level between the upstream and downstream sides of the dam proved that the water shut-off ability of the dam body was sufficient. Therefore, there might be water leakage to the basement rock.

On the other hand, perched water was observed in the "fossil valley sediment" during the excavation. The groundwater level observed in the “well of the all-strainer type” is influenced by perched water, and thus does not precisely represent the "main" groundwater level.

To determine the behavior of the perched water, “sets of piezometers of different depths” with the structure shown in Fig 6.1-B were installed at 4 points (3 of which were in the reservoir area (PA, PB and PC), and 1 of which was about 50 m downstream of the dam (PD)).

The results of the observation confirmed the presence of at least two perched aquifers in the “upper stratum of the fossil valley” that composed the reservoir layer of the subsurface dam. The existence of such two perched aquifers was confirmed in all three observation wells in the reservoir area (PA, PB and PC), and was thus considered to be a common feature of the fossil valley sediment in this area. In neither of the two perched aquifers was there perched water between the end of the dry season and the beginning of the rainy season. During the period in which river water flowed down the Kolongo River and the flood plain was covered with water, the perched water reappeared. With the disappearance of river water, the level of the perched water lowered, and almost disappeared in the middle of the dry season.

As for the "main" groundwater, its level (represented by the lowest water level observed using a “set of piezometers of different depths”) started to rise with a certain delay compared with the reappearance of the perched water, and its rising speed was lower than that of the perched water. The highest level of the “main” groundwater in a year was lower than the groundwater level observed using “wells of the all-strainer type” in the same season.

This means that the seasonal fluctuation in the groundwater level observed using "wells of the all-strainer type" was over-estimated compared with that of the "main" groundwater because of the presence of perched water.

Therefore, it is important to take the following into account in assessing the effectiveness of the subsurface dam for water storage from the results of the observation by the “sets of piezometers of different depths” and “wells of the all-strainer type”:

1) When there is perched water, the rise in groundwater level observed using a “well of the all-strainer type” during the rainy season does not always represent the rise in the reserved water level by the subsurface dam.

2) During the latter half of the dry season, in which the perched water disappears, the

groundwater level observed using a “well of the all-strainer type” can be regarded as the real reserved water level (the “main” groundwater level).

3) The “main” groundwater level is shown by the lowest level observed using a “set of piezometers of different depths”.

4) When there is perched water, the seasonal fluctuation in groundwater level observed using a “well of the all-strainer type” is probably over-estimated compared with the “main” groundwater level.

However, not only the groundwater level observed using the “wells of the all-strainer type”, but also the lowest level observed using the “sets of piezometers of different depths” showed a fall in the dry season. It is thus certain that there is water leakage to the basement rock. The amount of water leakage probably closely corresponds to the fall in the lowest level observed using “sets of piezometers of different depths”.

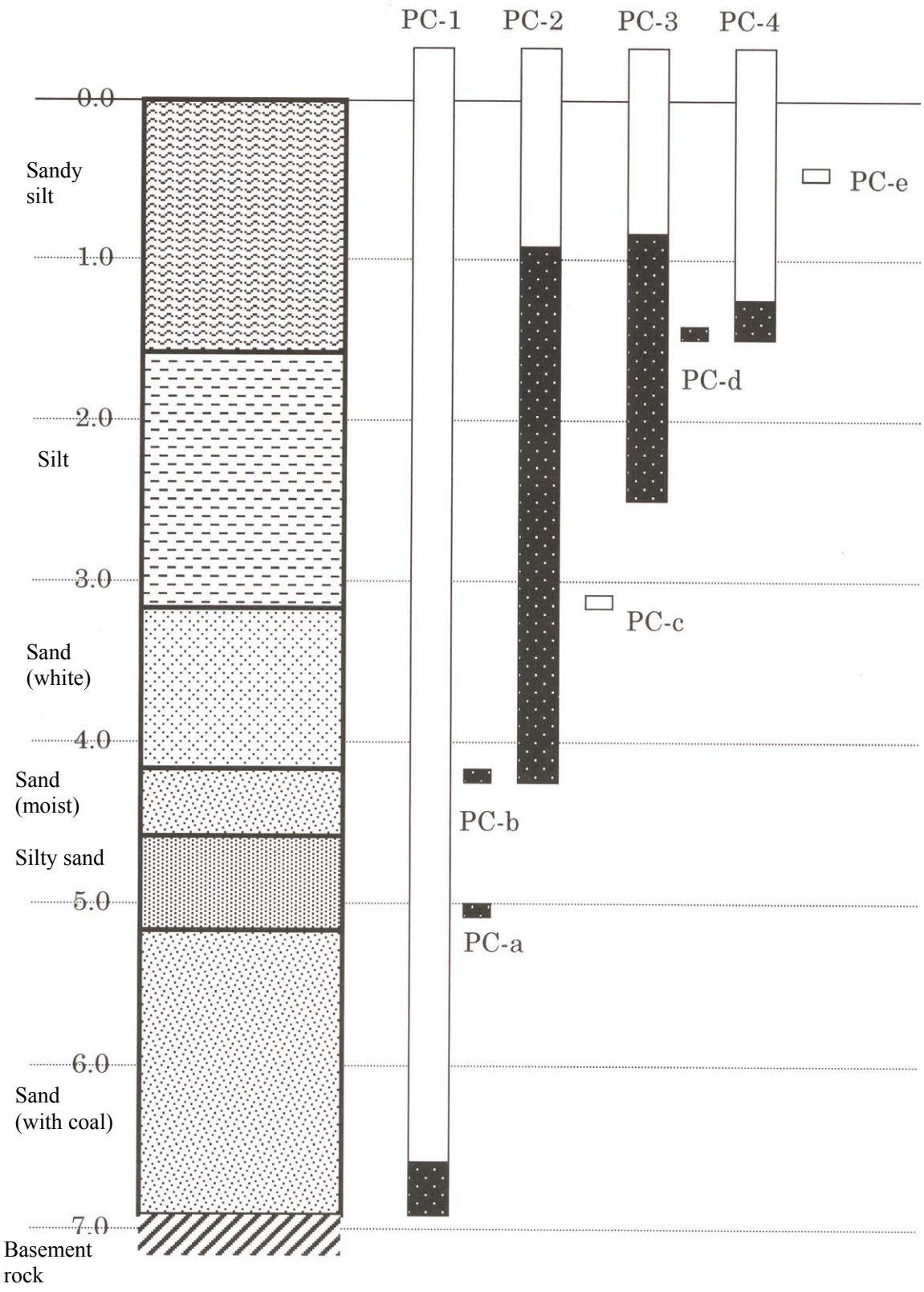

Fig. 6.6: Results of observation using "set of piezometers of different depths " (at observation well PC) (20 July 2000)