

# **Guideline for Installation of Standpipe Well (SW) and Standpipe Piezometer (SP)**

## **1. GENERAL**

Both standpipe well and standpipe piezometer are used to measure ground water levels. The common characteristic is both consist of a standpipe tube with a slotted or a porous tip and normally installed down a borehole. Also, geotextile filter fabric is not usually incorporated in this type of installation. The difference between depends on the filling form/pattern of the borehole.

Standpipe well (SW) is also called observation or open well. It often consists of a PVC tube perforated at its lower end, and inserted into a borehole. The annular space between the perforations and the corresponding borehole wall is normally packed with sand or fine gravel. When using a standpipe well, it is always assuming that a simple groundwater regime exists, and the measured water lever refers to a certain region. The problem is in time this type of installation may result in silting in the pipe and thus reduce the accuracy of the readings.

Standpipe piezometer (SP) is also termed as Casagrande piezometer for focusing on measuring pore water pressure at a certain level. It includes two types of tip: slotted and porous stone.

These guidelines provide the minimum standard of care for installation of SWs and SPs on Alberta Transportation projects. Deviations from these guidelines may be permitted by the Director of Geotechnical and Materials Section, Technical Standards Branch.

These guidelines do not address: the selection of the device materials; the rationale for locating and placing these device; the frequency of monitoring; or other aspects of a properly executed instrumentation monitoring program. It is expected that the staff or consultant responsible for the installation will choose the correct type of SWs and SPs. The depth and location of placement of devices will be determined by site conditions, soil conditions, objectives of the monitoring program and other factors.

## **2. INSTALLATION**

### **Borehole requirements**

Both SWs and SPs are typically installed in a borehole. The requirements of drilling a borehole are in the same fashion for all kinds of the devices.

No slurry or drilling product should be present in the boreholes to contaminate and block the sand filter and the tip filter element. For wash bore drilling, the borehole should be flushed with clean water.

The borehole should be drilled to the target depth.

The guidelines for each of these installation types are discussed below.

### **Backfilling requirements**

#### **For standpipe well:**

- No bentonite seal is allowed other than at the ground surface.
- The whole borehole should be backfilled with clean and washed fine/pea gravel or sand.

#### **For slotted-tip standpipe piezometer:**

- Clean sand should be poured down into the hole for creating a sand pack around the piezometer tip. A weighted cloth measuring tape may be used to check the sand has reached a point 0.6m above the top of the piezometer. The poured sand should be allowed to be well settled.
- Bentonite pellets should be used to form a seal layer of 0.5m thick above the sand pack. The pellets should be allowed to be well expanded to seal off the borehole.
- The rest borehole should be grouted to surface by bentonite-cement grout to prevent vertical migration of water.

#### **For porous-tip standpipe piezometer:**

- The piezometer tip should be covered by a sand-filled screen sock.
- For deeper installation, a lead weight may be placed in the bottom of the sock.
- To counter-act buoyancy, the pipe may be filled full of clean water.
- The backfilling should follow the same fashion as slotted-tip type piezometer.
- The sand filter should be approximately 1m thick and packed well surrounding the porous stone tip to ensure suitable hydraulic response times.

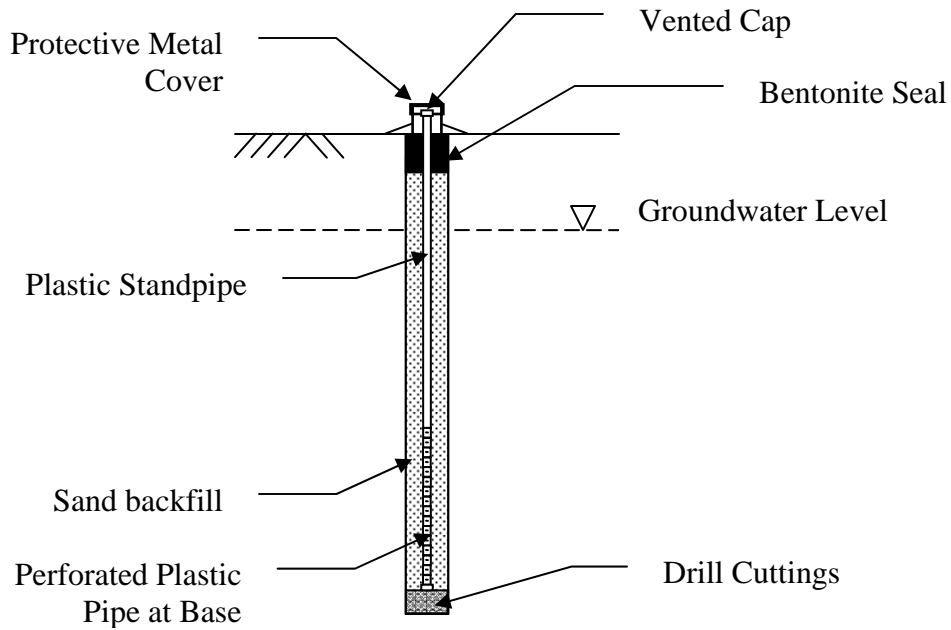
### **Topping requirements**

The top of the borehole shall be sealed with well tamped puddle clay or concrete to prevent the ingress of surface water. The top of standpipe should be covered by an end (screw) cap or wooden plug through which a small hole should be drilled for ventilation purpose, or cut a notch to allow air into the pipe thus allowing the water level to reach its natural head.

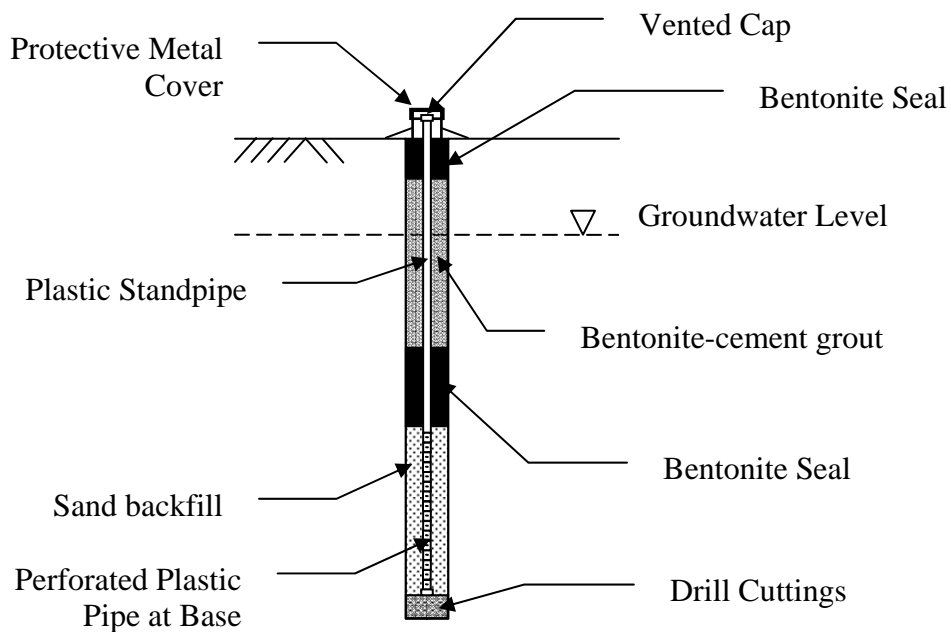
### Common guidelines:

- A tight seal consisting of bentonite-cement grout should be placed at ground to prevent surface water infiltration.
- For all installations, grout or backfilling volumes should be checked and compared with the volume of the drilled borehole over the length to be grouted/backfilled to ensure the sealing condition.
- SWs should only be used to relatively homogenous deposits.
- When taking reading for SWs, straightening the cable before measurement to minimize inaccuracies. Also exercise care since droplets of water on the side of the tube may give false readings occasionally.
- SPs are not suggested to be installed in low permeability soils due to the relatively slow response times, such as relatively impermeable silt or clay stratum.
- SPs with porous stone tip should be used for thinner aquifers or in strata containing high silt content.
- Alternative types of SPs may be driven or pushed into soft soil. Different tips (ceramic and plastic) may be used to suit various ground conditions.
- A Bourdon pressure gauge connected to the top of the standpipe may be used for readings under artesian conditions.
- Both SWs and SPs may be used for in-situ hydraulic conductivity tests.
- Readings may be obtained by either water level (dip) meters or an in-place dedicated pore pressure sensor.
- If casing is used, the piezometer may have to be installed before the casing is removed.
- Peak groundwater levels may be estimated by suspending a series of small “buckets” on a line within the plastic tube of standpipe. The principle is the rising water level will progressively fill each bucket and be retained there, obviously the highest filled bucket indicating the approximate maximum water level. The methodology may require a larger diameter standpipe.
- Winterization. If the water level is shallower than 7 ft, it needs to add antifreeze to the PVC hose, only if reading is expected in winter. The non-freezing solution may be made from 2.5 parts methyl alcohol or methanol, 1 part glycerine and 0.5 parts clean water. In non-artesian cases, a hand pump may be used to add the solution. In the case of an artesian situation, a brass gate valve should be used to help pumping antifreeze in.
- For reading in winter time, 1 cc or 10 drops of sulphuric acid may be added to aide in the operation of the water level indicators.
- For slides monitoring, ideally the sensing tip should be installed just above the basal shear zone of the slide; the sand filter should extend into the shear zone but not passing through it, when considering normally there is a significantly lower groundwater pressures in slide bed than in the slide mass. The readings should provide data on pore water pressure at the slip surface/zone without being damaged by ongoing ground displacement.

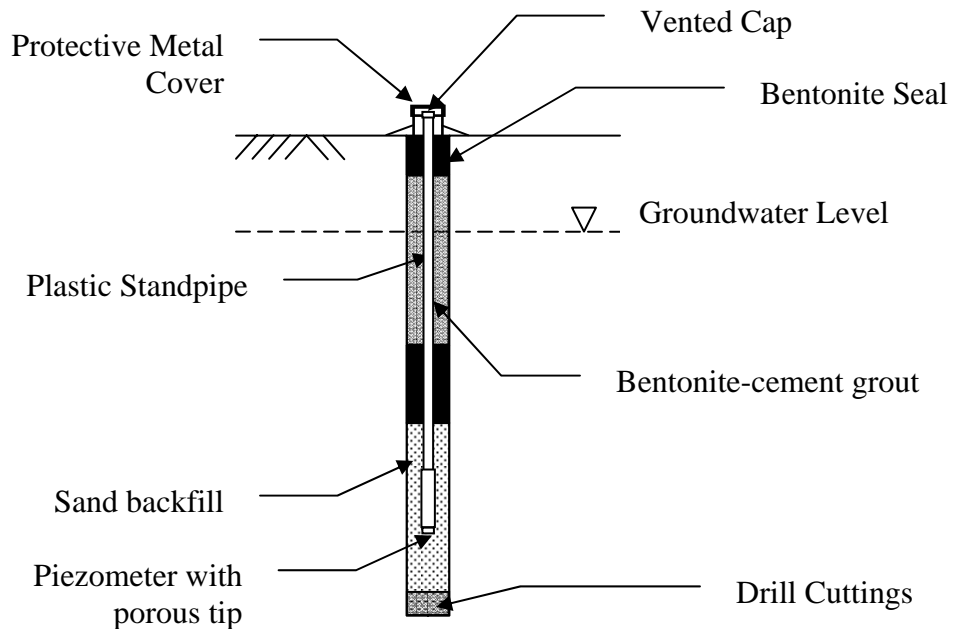
- Standpipe well should not be used for monitoring compartmentalised groundwater regime. For compound slides monitoring, specialized multipoint (either pneumatic or electric) piezometers should be applied.
- Push-in type of standpipe piezometers should be only used for very soft soil, and the well point and the pipe should both be made of steel material.
- Reading taken by a water level (dip) meter/indicator should be measured as a depth from water level to the ground elevation and not the top of the exposed PVC pipe.
- Installation procedures should be recorded on a “Standpipe/Piezometer Installation Data” report form. A diagram should be included indicating depth and type of backfill used.
- For installations on paved road surface, a metal flush-mount monument and cover should be used.
- On active or future construction sites, bollards, barriers, or barricades can be used to create a buffer distance from each installation to protect from impact by construction traffic.
- All instruments should be clearly and permanently labelled with their reference number.



**Figure 1 Typical installation of Standpipe Well**



**Figure 2 Typical installation of Standpipe Piezometer with slotted tip**



**Figure 3 Typical installation of Standpipe Piezometer with porous-tip**