1. **SCOPE**

1.1. **Description**

This method describes the installation and monitoring procedures for standpipe piezometers used to measure ground water levels. The height to which the water rises in the hose is a direct measure of the water pressure of the soil at the depth the piezometer tip is installed.

Two types of standpipe piezometers are used - slotted (open) and porous stone. The latter is smaller and is used in smaller specific zones or in material containing a high silt content.

1.2. **Application**

Standpipe piezometers are used for long term monitoring of ground water tables in proposed cut and fill areas. They are also useful in determining whether there is an upward or downward gradient of water.

1.3. **Units of Measure**

Readings are taken in meters from ground surface. In the case of installations in artesian conditions, the readings are taken directly from the pressure gauge.

2. **APPARATUS AND MATERIALS**

2.1. **Slotted**

2.1.1. **Equipment Required**

- Hacksaw.
- Flat screwdriver.
- Water level meter.
- Measuring tape, weighted at the end.
2.1.2. Materials Required

Either rigid P.V.C. or A.B.S. Plastic Pipe can be used for construction. The procedure and assembly are the same.

-A 500 mm length of plastic pipe (38 mm I.D. Schedule 40 CSA).
-(1) 38 mm end cup.
-(1) 38 mm coupling
-(1) Insert coupling 19 mm x 38 mm.

-Compatible glue. ABS glue may be used to join a combination of the two products.
-(2) 19 mm x 19 mm insert adapter.
-(2) stainless steel gear clamps with a range of 17 - 38 mm.
-(1) 19 mm insert adapter end cap.

-Piezometer hose - 19 mm I.D. 517 kPa potable polyethylene pipe.
-Fine clean sand (100% passing 5 mm and <5% passing 71 µm). A 20 litre pail will fill a 150 mm diameter borehole to a depth of 1.5 m.
-Approximately 9 kg of bentonite pellets.
-A 19 mm conduit pipe bracket.
-Bourdon pressure gauge (necessary only for artesian conditions).
-100 X 100 mm X 2 m wood post.
-Non-freeze solution (for winter applications - see section 3.1.1).
2.2. **Porous Stone**

2.2.1. **Equipment Required**

- Hacksaw.
- Flat screwdriver
- Cloth tape, weighted at the end.
- Water level meter.

2.2.2. **Materials Required**

Either rigid PVC or A.B.S. plastic pipe can be used for construction. The procedure and assembly are the same.

- A 150 mm length plastic pipe (38 mm I.D. Schedule 40 CSA).
- A 150 mm length of porous tube 25 mm I.D. 8 mm wall thickness (Norton Part # D3550010B mix P2120 or equivalent).
- (1) 38 mm end cup.
- (1) 38 mm coupling.
- Insert coupling 38 mm x 19 mm.
- Compatible glue.
- (1) nylon screen sock 300 mm long by 100 mm in diameter (may be made from window screening).
- Fine clean sand (100% passing 5 mm and <5% passing 71 µm). A 10 litre pail should be sufficient.
- (2) 19 mm x 19 mm insert adapters.
- (1) 19 mm end cap.
- (2) stainless steel gear clamps with a range of 17-38 mm.
- Approximately 9 kg of bentonite pellets.
- Piezometer hose - 19 mm I.D. 517 Kpa (75 p.s.i.) potable polyethylene pipe.
- Electrical tape and a conduit pipe bracket.

3. PROCEDURE

3.1. Description of Preparation

3.1.1. Slotted

Using a hack saw, cut a slot one third of the way into and perpendicular to the 38 mm plastic pipe, 75 mm from one end. Continue to cut slots 50 mm apart along the entire length except for 75 mm from the other end. Turn the pipe over and cut the same kind of slots starting at 100 mm from each end. The result should be alternating slots 25 mm apart (Figure 240-7-1).

Glue an end cap at one end and a coupling with a 38 x 19 mm insert coupling at the other end.

Allow the glue to harden.

Screw in the 19 x 19 mm insert adapter.

The remaining assembly is done during installation.

3.1.2. Porous Stone

Cut out a section 38 mm x 85 mm midway down the 150 mm length of pipe. Cut out an identical piece on the opposite side (Figure 240-7-2).

Glue an end cap at one end and the 38 mm coupling at the other.

Place the 150 mm length of porous stone into the assembled pipe and glue in the 38 mm x 19 mm insert coupling. The porous stone is now incased but exposed from the sides via the slots.

Allow the glue to harden.

Screw a 19 mm insert adapter into the end.

The remaining assembly is done during installation.
3.2. **Installation**

3.2.1. **Installation - Slotted**

The borehole is drilled to the depth at which the piezometer is to be installed. The hole is cleaned out to remove all disturbed material and a thin wall tube sample taken. In the case of washbore drilling the hole should be flushed with clean water.

If casing is used, the piezometer may have to be installed before the casing is removed.

Slide the piezometer hose and clamp over the 19 mm insert and tighten the clamp.

Measure the hose and piezometer to the required length. An additional metre is required above ground surface for convenient monitoring.

Install a second 19 mm insert adapter to the top end of the hose and secure with a clamp.

To counter-act buoyancy, fill the hose with clean water, place an end cap on the top adapter and lower the piezometer to the bottom of the hole. For deep piezometers, it may be necessary to cut the hose long enough so that clean water can be continuously pumped through the piezometer while it is being lowered. This allows the jetting action to help the piezometer pass through parts of the hole where bridging has taken place.

Pour clean sand down the hole to create a sand pack around the piezometer. Use a weighted cloth measuring tape to check that the sand has reached a point 0.6 m above the top of the piezometer.

Pour bentonite pellets down the hole to form a layer 0.5 m thick above the sand pack. Use a weighted cloth tape to determine the proper layer thickness.

Allow the material to settle and the pellets to expand to seal off the hole. In the case of an auger hole, pour some water down to wet the pellets.

The hole can be grouted to surface if required by the Engineer (refer to STP 240-19, grouting procedures).

Remove the end cap and replace it with one that has a hole drilled through it or cut a notch in the hose to allow air into the hose thus allowing the water level to reach its natural head.
3.2.2. Installation - Porous Stone

The bore hole is drilled to a depth at which the piezometer is to be installed. The hole is cleaned out to remove all disturbed material and a thin wall tube sample taken. In the case of washbore drilling, the borehole should be flushed with clean water.

If casing is used, the piezometer may have to be installed before the casing is removed.

Slide the piezometer hose and clamp over the 19 mm insert and tighten the clamp.

Place the screen sock over the piezometer and fill it with clean sand. Wrap the top of the sock around the hose and tape it securely with the electrical tape. In deeper holes, a lead weight should be placed in the bottom of the sock to make the piezometer heavier.

Measure the hose and piezometer to the required length. An additional meter is required above ground surface for convenient monitoring.

Install a second 19 mm insert adapter into the top end of the hose and secure with a clamp.
To counter-act buoyancy, fill the hose with clean water, place an end cap on the adapter and lower the piezometer to the bottom of the hole.

Pour clean sand down the hole to create a sand pack around the piezometer. Use a weighted cloth measuring tape to see that the sand has reached a point 0.5 m above the top of the piezometer (Figure 240-7-3).

Pour bentonite pellets down the hole. Use a weighted cloth tape to determine when a layer 0.6 m thick is in place above the sand pack.

Allow the material to settle and the pellets to expand in order to seal off the hole. In the case of an auger hole, pour some water down to wet the pellets.

The hole can be grouted to surface if required by the Engineer (refer to STP 240-19, grouting procedure).
Remove the end cap and replace it with one that has a hole drilled through it or cut a notch in the hose to allow air into the hose, thus allowing the water level to reach its natural head.

Where artesian pressure is higher than the top of the piezometer, a Bourdon pressure gauge must be installed.

Mark the piezometer number on a post and place it in the hole. Attach the hose to the post using a clamp or bracket.

### 3.3. Winterization

Piezometers with natural head within 1.5 m of the surface will require non-freezing solution made from 2 1/2 parts methyl alcohol or methanol, 1 part glycerine and 1/2 parts clean water. 1 cc or 10 drops of sulphuric acid is added to aide in the operation of the water level meter.

In non-artesian cases an 8 mm tube 5 - 6 m in length is attached to a hand pump and the free end lowered into the piezometer hose. The solution is rapidly pumped in, displacing the water.

In the case of an artesian situation, a 6.3 mm brass gate valve is installed. The valve is closed and before the gauge is screwed in, the hand pump tube is connected using a compression fitting. The valve is opened slowly as pumping begins. The pump forces back the water into the zone below and replaces it with the solution. The valve is then closed and the compression fitting removed. The gauge is inverted. A syringe loaded with non-freeze is used to fill the gauge and remove any trapped air bubbles. The valve is opened slightly to allow leakage while the gauge is screwed in. Once the gauge is in place the valve is fully opened.
4. **REPORTING RESULTS**

   Installation procedures should be recorded on a "Piezometer Installation Data" report form (Figure 240-7-4). The same information can be noted on the "FIELD BOREHOLE LOG" report form. A diagram should be included indicating depth and type of backfill used.

   Readings in an open piezometer hose are taken using a water level meter. The probe is lowered down the tube until it contacts the water, completing an electric circuit as indicated on the gauge. Hold the cable at the point at which it touches the top of the piezometer hose, then pull the cable out and extend it along the outside of the hose to ground level. The depth is then recorded at the top of the piezometer hose using the markers on the outside of the cable attached to the probe. This results in water depths that are recorded from ground elevation and not the top of the exposed piezometer hose.

   A piezometer with a gauge is read directly (kPa or p.s.i.)

   Readings are taken periodically (as directed by the Engineer) and submitted to Materials Section of the Technical Standards and Policies Branch.

5. **REFERENCES**

   Canadian Standards Association A119 7M.

   Methods of Sampling and Testing, American Association of State Highway and Transportation Officials 1986
PIEZOMETER INSTALLATION DATA

D.S. __________ PROJ. __________________________
PIEZ. No. _______ PIEZ. TYPE __________________
DATE INSTALLED _____________________________
STATION ________________________
INSTALLED BY _____________________________

HEIGHT OF PIPE ABOVE GROUND _____ m ELEV. _____ m
NATURAL GROUND ELEVATION _______ m
DEPTH TO TOP OF BENETONITE SEAL _______ m ELEV. _____ m
DEPTH TO TOP OF SAND _______ m ELEV. _____ m
DEPTH TO TIP _______ m ELEV. _____ m
DEPTH TO BOTTOM OF BOREHOLE _______ m ELEV. _____ m

TIP DIMENSIONS ________________________
SAND BAG DIMENSIONS ______________________
GAUGE TYPE _____________________________
GAUGE BOX AT STATION ______________________
NATURAL GROUND ELEV. AT GAUGE BOX _______ m
HEIGHT OF CENTERLINE OF GAUGE CONNECTION _______ m
GREUTED _______ YES _______ NO (IF YES, DESCRIBE BELOW)
WINTERIZED _______ YES _______ NO

REMARKS ____________________
____________________________________
____________________________________
____________________________________
____________________________________
____________________________________

FIGURE 240-7-4
# APPROVAL SHEET

New _X_ Revision ___ Date of Previous Document ___ - ___

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Prepared and Recommended by **George Wasyliw**  
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Approval Recommended by **A.R. Gerbrandt**  
Dir., Technical Standards & Policies Br.  Date  - -

Approved by **D.G. Metz**  
Assistant Deputy Minister, Infrastructure  Date  __94-03-18__

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