

# Appendix C

## Groundwater Data

Details of vibrating wire (VW) piezometers installed during the SR 710 North Study are shown in this appendix. The VW piezometers were attached to 0.5-inch-diameter polyvinyl chloride (PVC) pipes to place the piezometers at specific depths. The annular space around the VW piezometers was backfilled with No. 3 clean sand. The area above the sand was sealed with bentonite pellets and/or chips. The remaining area to ground surface was filled with cement grout. Each piezometer was completed with a locking cap and traffic-rated well box. The groundwater levels were recorded at 12-hour intervals. The recorded graphs with groundwater elevations versus time are presented in this appendix.

Details of typical piezometer installation during the SR 710 Tunnel Technical Study (CH2M HILL, 2010) are shown in Figure C-1. The piezometers were constructed using 2-inch-diameter PVC Schedule 80 pipe set in the borehole. The bottom of the pipe was slotted and capped; the annular space around the slotted pipe was backfilled with Monterey No. 3 clean sand. Approximately 100 feet of screen interval was used in each piezometer, 25 feet below the invert and 25 feet above the crown of the anticipated tunnel (CH2M HILL, 2010). The area above the sand was sealed with bentonite chips, the remaining annulus was filled with bentonite grout; the annulus within the upper 8 feet was filled with cement grout. Each piezometer was completed with a locking cap and traffic-rated well box, except at boring location R-09-Z3B2, which had a locking cap but no well box where standpipe was used because of grassland at the surface.

TABLE C-1  
Piezometer and Groundwater Summary

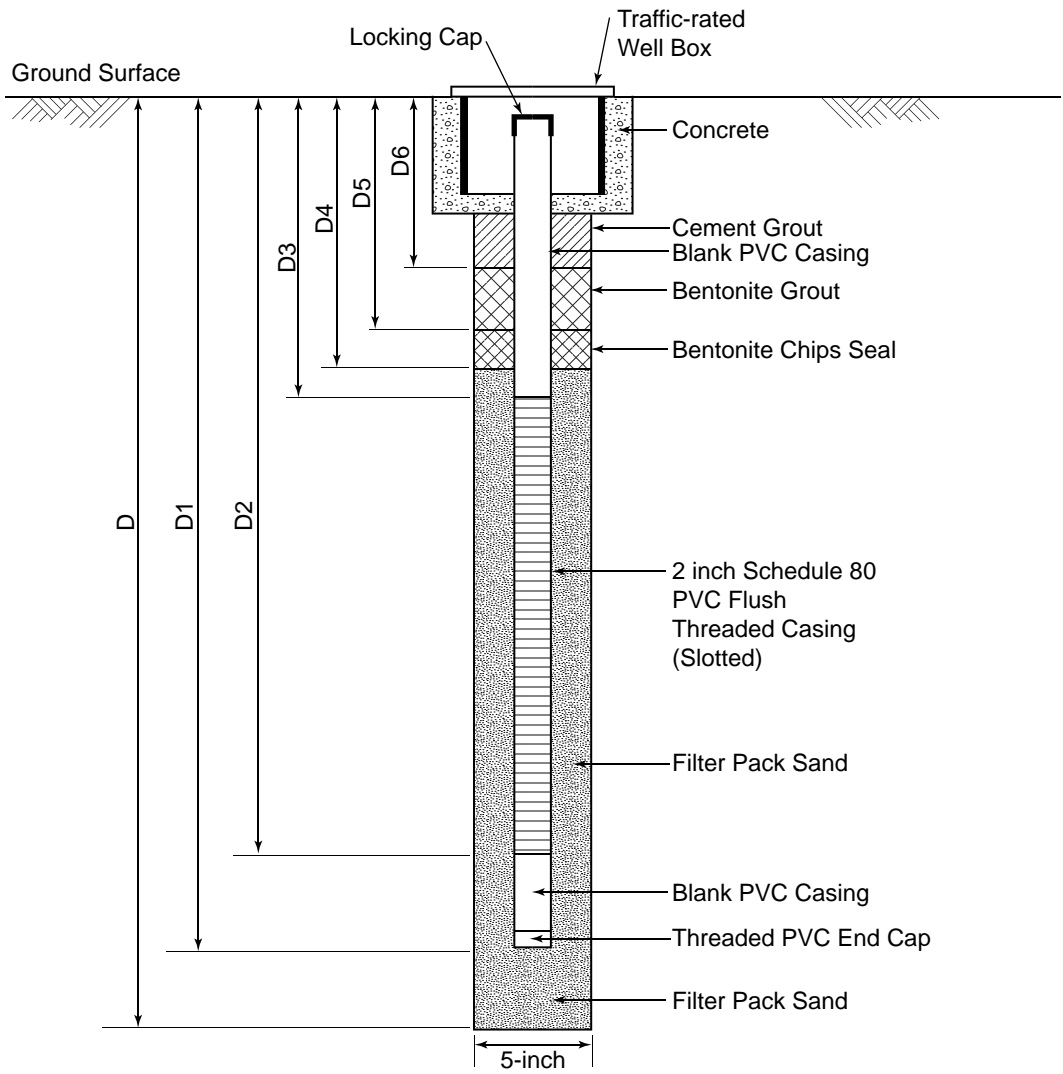
Boring Designation	Piezometer Type	Ground Surface Elevation <sup>a</sup> (feet)	Depth of Piezometer (feet)	Groundwater Level <sup>a</sup> (Elevation in feet)			
				July 2009	March 2013 <sup>b</sup> (During Drilling)	March 2013	September 2013
R-09-Z1B8	Stand Pipe	419.6	200	394.6	---	396.2	395.7
R-09-Z2B5	Stand Pipe	452.4	277	441.6	---	440.7	---
R-09-Z3B2	Stand Pipe	781.4	275	637.0	---	672.9	674.4
R-09-Z3B3	Stand Pipe	802.0	276	666.0	---	673.6	674.8
R-09-Z3B6	Stand Pipe	750.0	324	698.8	---	697.8	---
R-09-Z3B8	Stand Pipe	594.3	275	NA	---	563.1	562.6
R-09-Z3B12	Stand Pipe	501.0	240	488.2	---	487.3	486.7
R-09-Z4B4	Stand Pipe	454.4	275	408.1	---	387.9	378.1
RC-13-004	Vibrating Wire	393.4	36.7	NA	383.9	379.2	378.2
RC-13-005	Vibrating Wire	425.0	124.5	NA	372.5	389.4	388.1
RC-13-007	Vibrating Wire	493.1	52	NA	448.1	449.7	449.0
RC-13-007	Vibrating Wire	493.1	200	NA	448.1	451.6	449.4
RC-13-009	Vibrating Wire	650.9	100	NA	558.9	552.5	551.0
RC-13-009	Vibrating Wire	650.9	199.5	NA	558.9	548.1	546.5
O-13-010	Vibrating Wire	693.5	196	NA	542.5	675.5	676.8
A-13-020	Vibrating Wire	799.9	147	NA	675.9	544.7	543.7

Notes:

<sup>a</sup> Elevations are based on NAVD 88.

<sup>b</sup> See boring records in Appendixes A.1 and A.2.

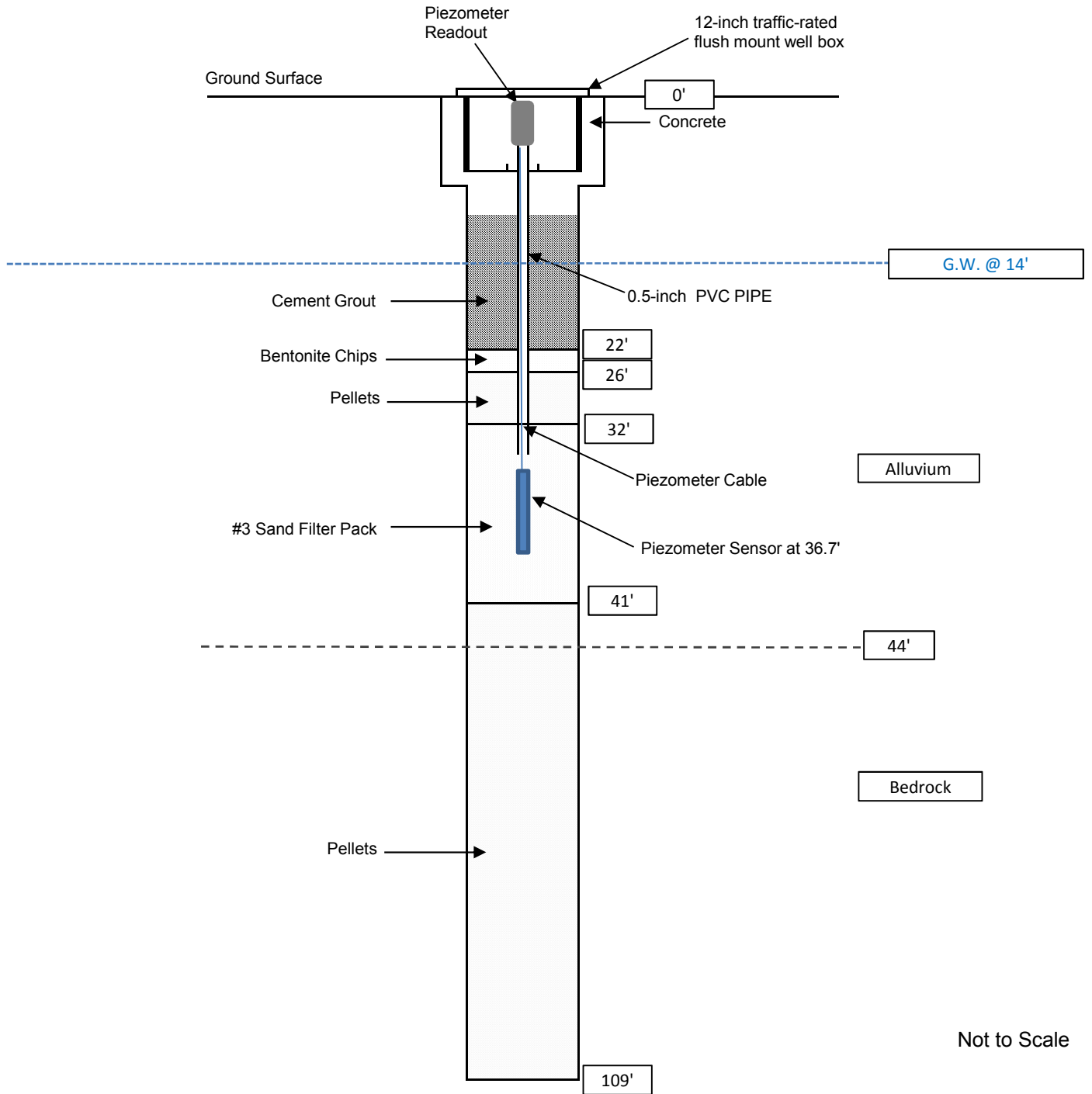
NA – not applicable; NM – not measured (rotary wash boring)



Total Depth (D)	200 - 525 ft
Total Depth of Casing (D1)	185 - 510 ft
Depth to Bottom of Well Screen (D2)	175 - 500 ft
Depth to Top of Well Screen (D3)	75 - 400 ft
Depth to Bottom of Top Seal (D4)	70 - 395 ft
Depth to Top of Top Seal (D5)	65 - 390 ft
Depth to Bottom of Cement Grout (D6)	8 ft
Well Casing Diameter	2-inch
Well Screen Slot Size	0.020-inch
Filter Pack Sand Type	Monterey No. 3
Bentonite Seal Type	Medium Chips
Groundwater (G.W.) data shown on the details was recorded the day of well construction	

NOT TO SCALE

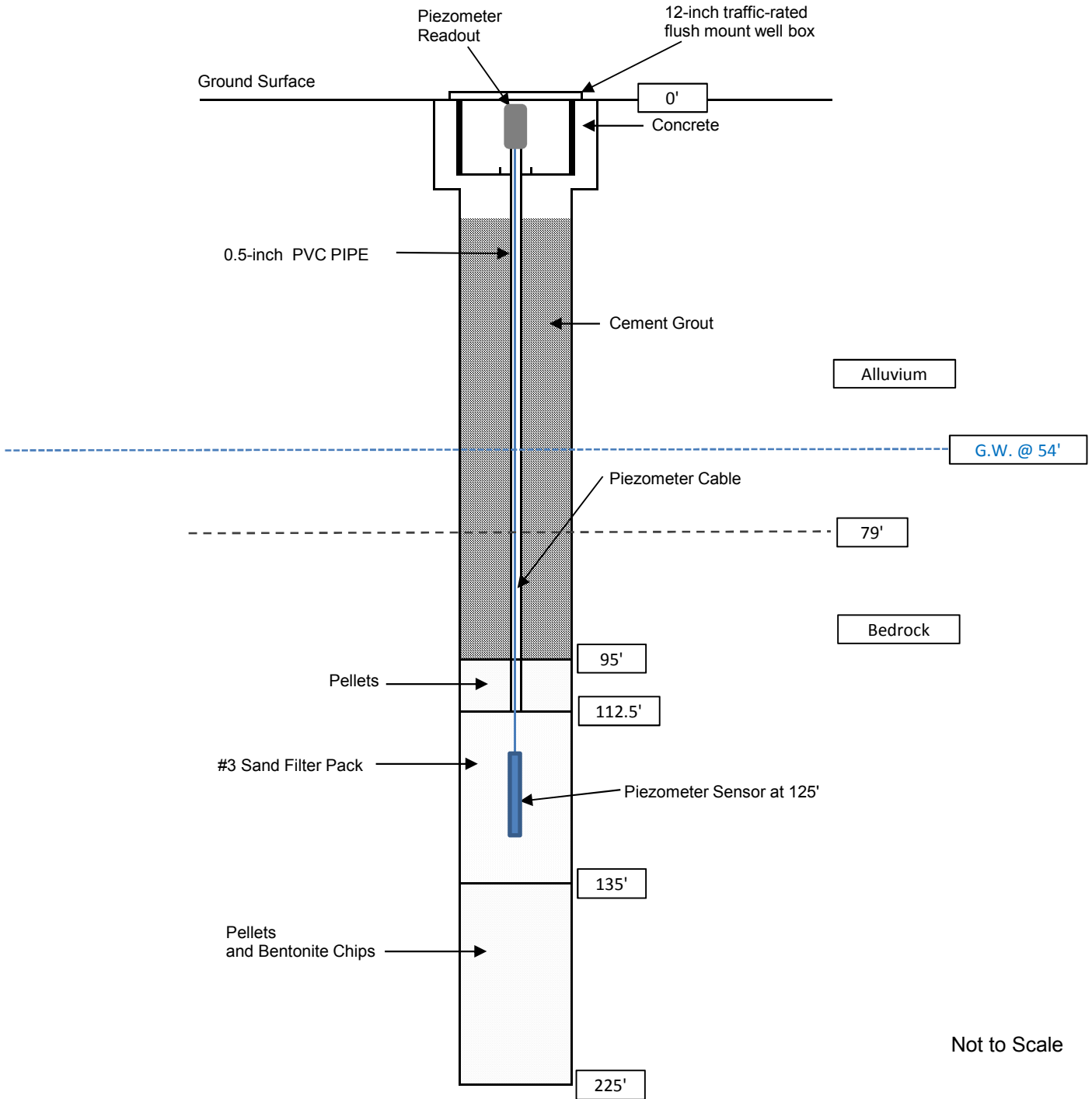
FIGURE C-1  
TYPICAL PIEZOMETER CONSTRUCTION DETAILS  
SR-710 TUNNEL TECHNICAL STUDY



Not to Scale

FIGURE C-2 PIEZOMETER INSTALLATION DETAIL (RC-13-004)

**SR 710 NORTH STUDY**



Not to Scale

FIGURE C-3 PIEZOMETER INSTALLATION DETAIL (RC-13-005)

**SR 710 NORTH STUDY**

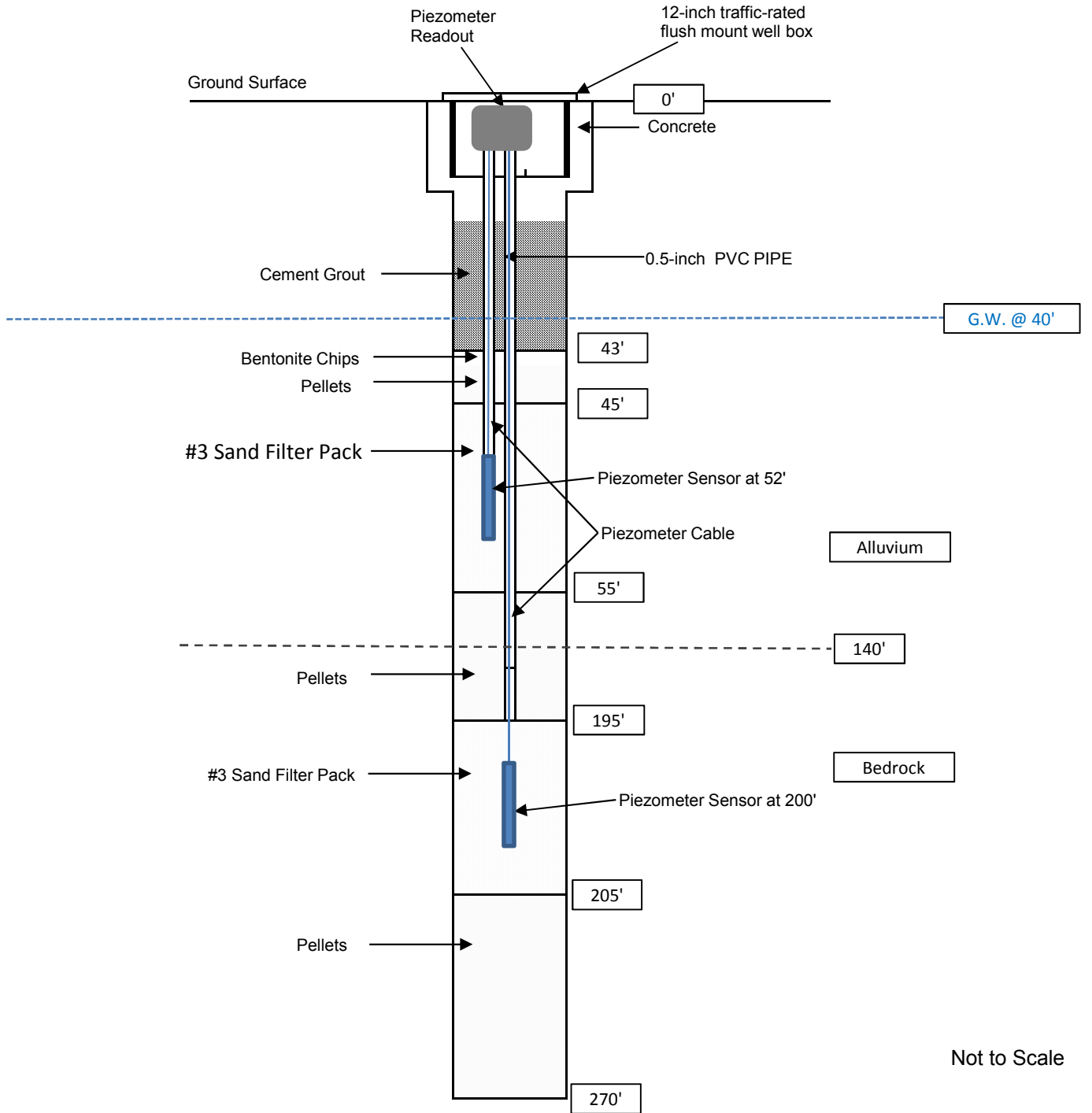
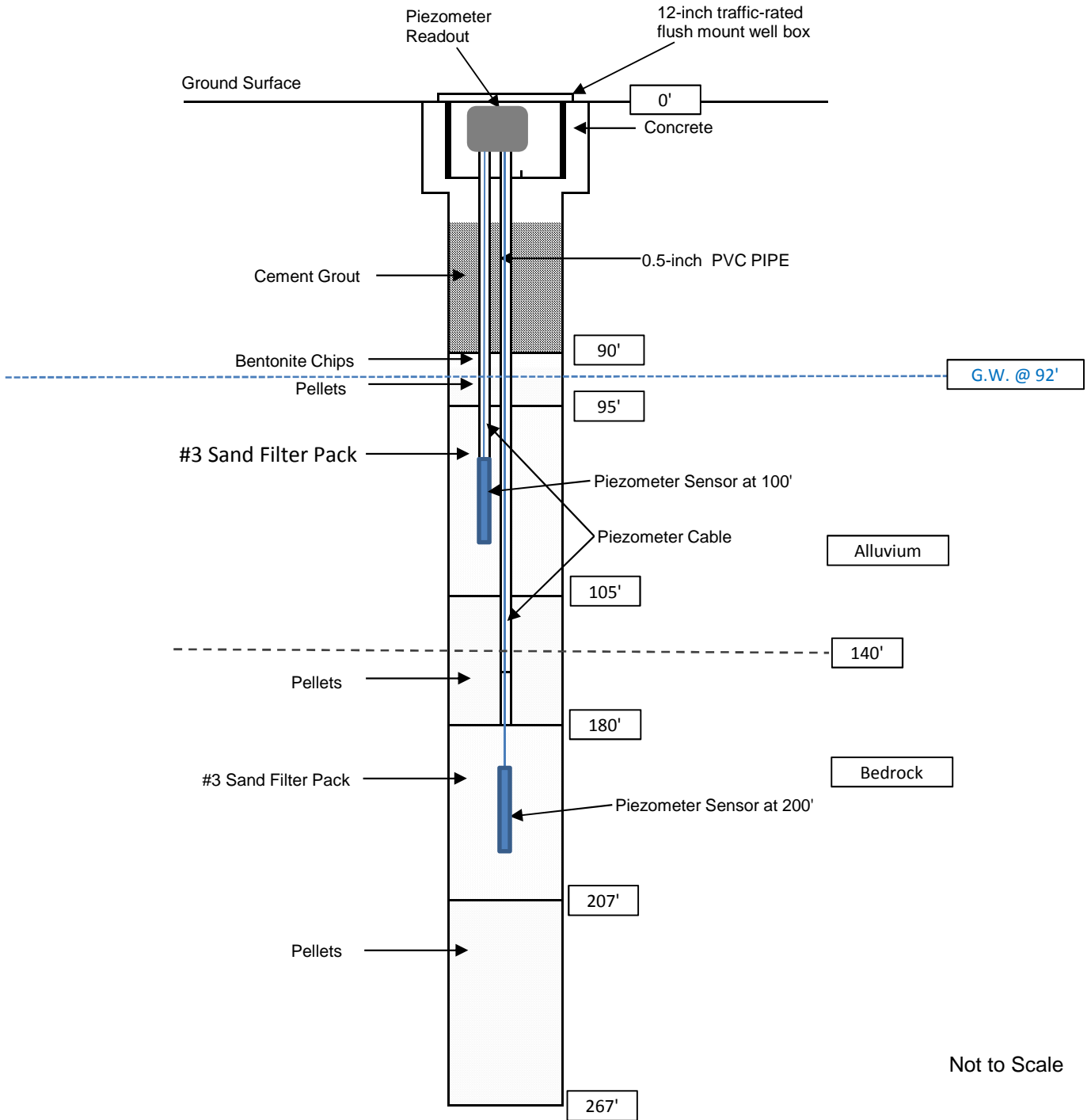


FIGURE C-4 PIEZOMETER INSTALLATION DETAIL (RC-13-007)

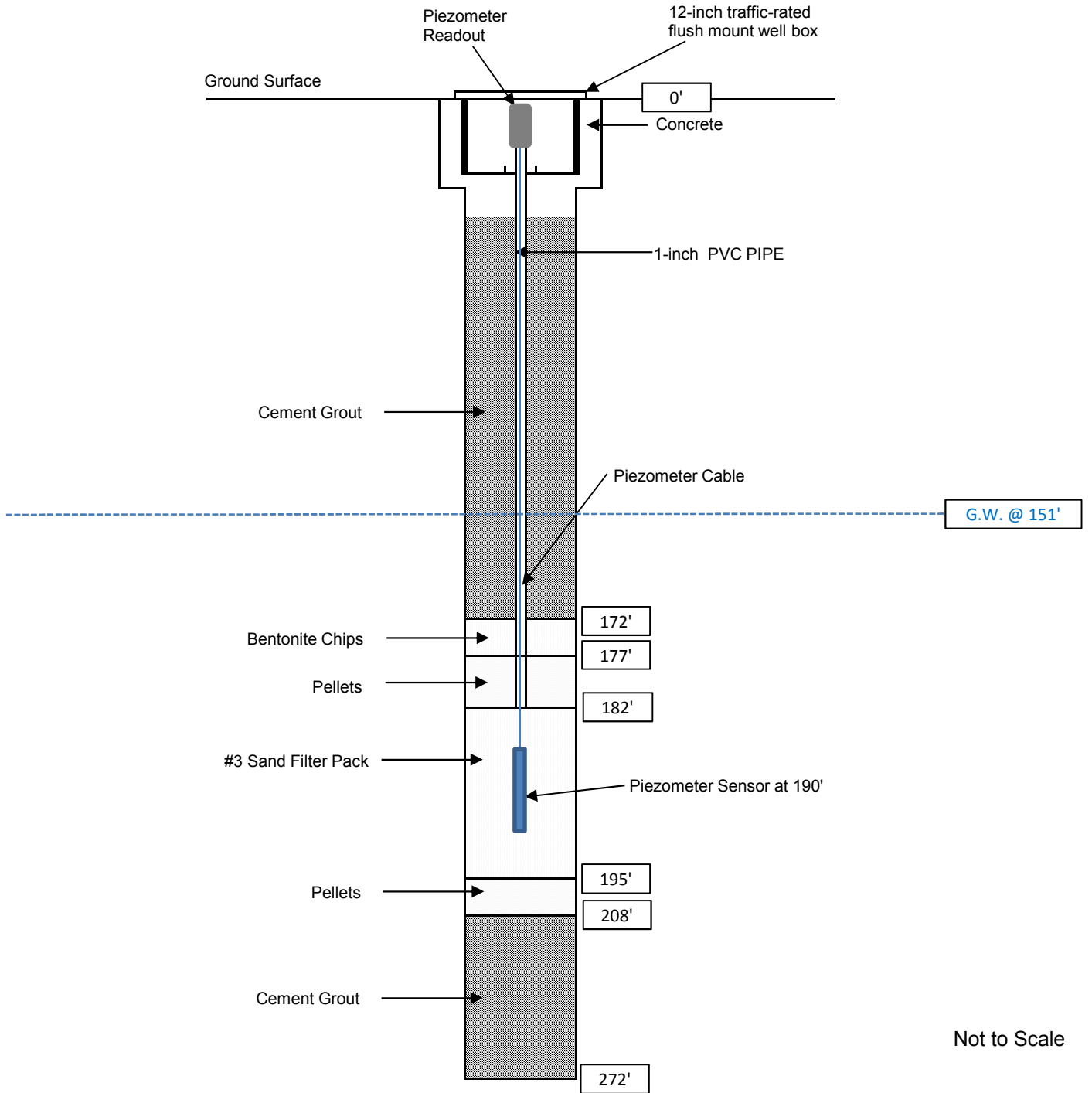
**SR 710 NORTH STUDY**



Not to Scale

FIGURE C-4 PIEZOMETER INSTALLATION DETAIL (RC-13-009)

**SR 710 NORTH STUDY**



Not to Scale

FIGURE C-6 PIEZOMETER INSTALLATION DETAIL (O-13-010)

**SR 710 NORTH STUDY**

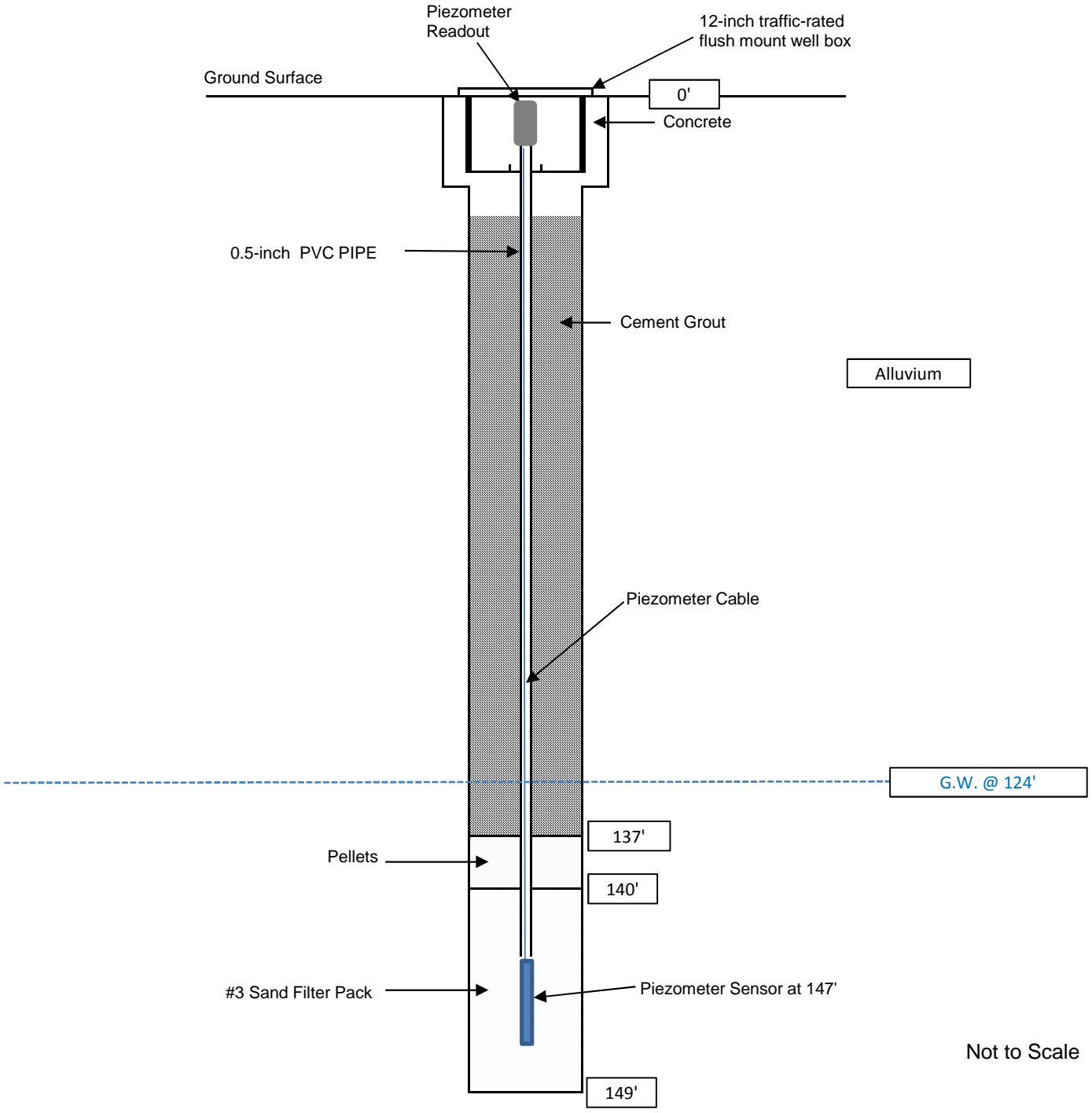


FIGURE C-6 PIEZOMETER INSTALLATION DETAIL (A-13-020)

**SR 710 NORTH STUDY**



The sudden groundwater level drops in the early monitoring times were caused by the drilling fluid during the coring and piezometer installation. Thus, these parts of the data were not considered until the groundwater was stabilized to the static level.

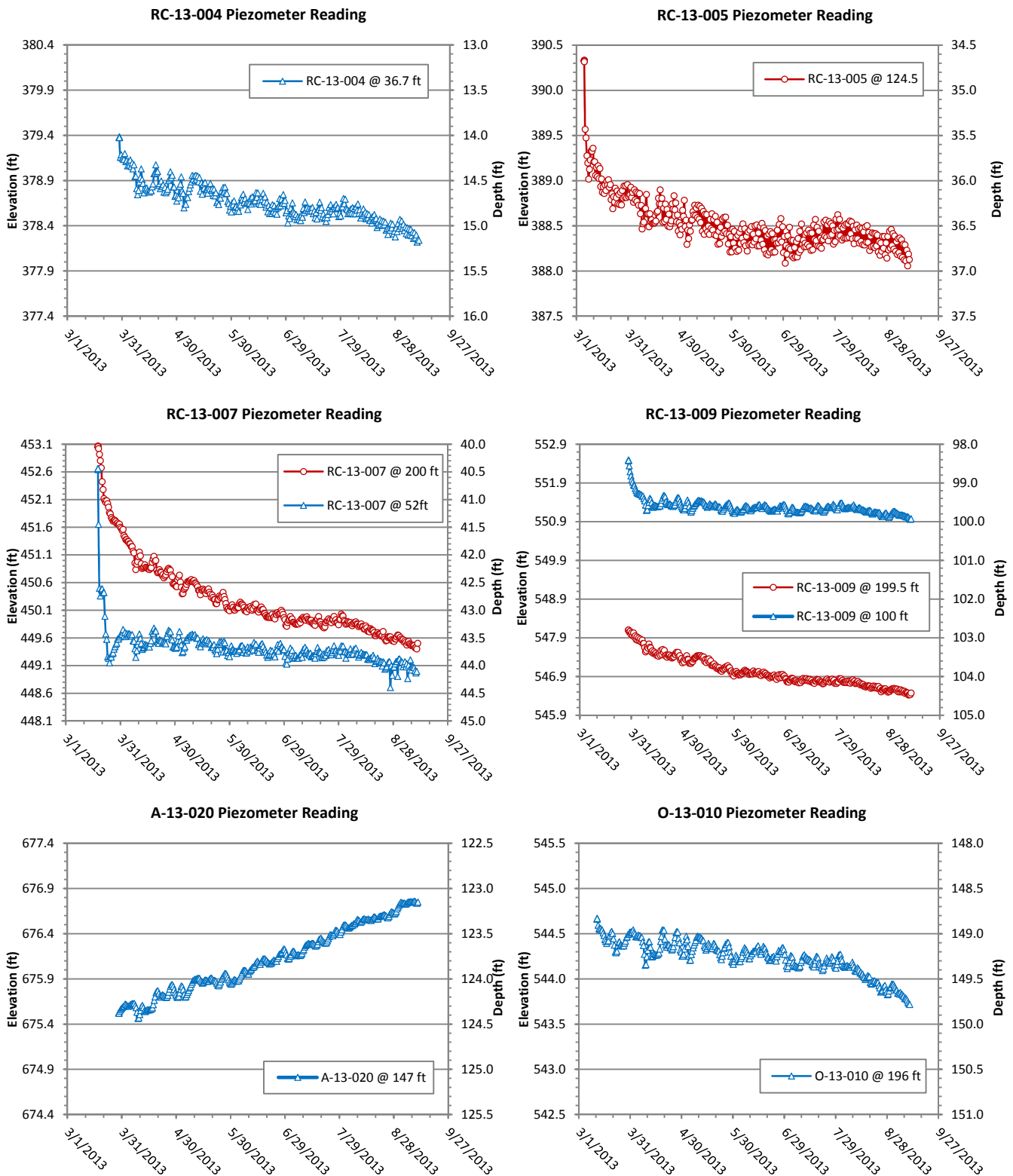


Figure C-8. Groundwater Levels monitored from Piezometers