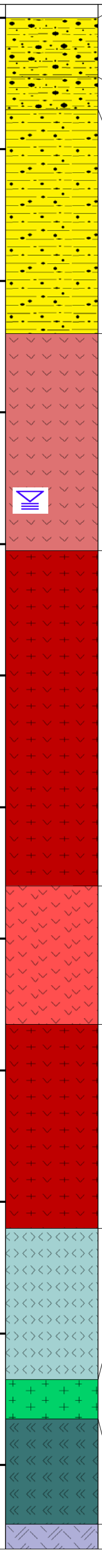
Nye County Early Warning Drilling Program

Summary Lithologic Log

BOREHOLE ID: NC-EWDP-28P



LITHOLOGY

DESCRIPTION

(0 to 45 feet [ft]) INTERBEDDED WELL-GRADED SAND WITH SILT, CLAY AND GRAVEL (SW-SM/SC) AND SILTY, CLAYEY SAND WITH GRAVEL (SM/SC):
The interval consists of layers of well-graded sand with silt, clay and gravel (SW-SM/SC) up to 12.5 ft thick interbedded with layers of silty, clayey sand with gravel (SM/SC) up to 7.5 ft thick. A thin layer of well-graded sand with gravel (SW) occurs from 42.5 to 45 ft. Fines display no plasticity. Gravel clasts are volcanic in origin, subangular from 0 to 17.5 ft, and subrounded from 17.5 to 45 ft. Sediment color is reddish brown (5YR 4/4). No cementation is observed. Sediments react strongly to 10 percent (%) hydrochloric acid (HCl). Samples are dry from 0 to 12.5 and 20 to 45 ft, and moist from 12.5 to 20 ft.

(45 to 70 ft) WELL-GRADED SAND WITH SILT, CLAY AND GRAVEL (SW-SM/SC):
The interval consists primarily of layers of well-graded sand with silt, clay and gravel (SW-SM/SC). Fines display no plasticity. Gravel clasts are volcanic in origin and subrounded to subangular. Sediment color is reddish brown (5YR 4/4). No cementation is observed. Sediments react strongly with 10% HCl. All samples are dry.

(70 to 240 ft) SILTY, CLAYEY SAND WITH GRAVEL (SM/SC):
The Interval consists primarily of silty, clayey sand with gravel (SM/SC). A uniform layer of silty, clayey sand without gravel (SM/SC) occurs from 97.5 to 117.5 ft. Fines display no to high plasticity. Gravel clasts are volcanic in origin and typically rounded to subangular. Sediment colors range from predominantly reddish brown (5YR 4/4) to yellowish red (5YR 5/6), light reddish brown (5YR 6/4), yellowish brown (10YR 5/4), dark grayish brown (10YR 4/2), very pale brown (10YR 7/4), and light brownish gray (10YR 6/2). No cementation is observed. Sediments typically react strongly to 10% HCl; however, a zone of weak reaction to 10% HCl is observed from 232.5 to 237.5 ft. All samples are dry.

(240 to 405 ft) ASH-FLOW TUFF (AMMONIA TANKS TUFF):
The tuff colors are highly variable and range from pale yellowish brown (10YR 6/2) to grayish orange (10YR 7/4), very pale orange (10YR 8/2), light gray (N7), light brownish gray (5YR 6/1), pinkish gray (5YR 8/1), and pale yellowish brown (10YR 6/2). The tuff is non to weakly welded, displays vitric textures from 240 to 300 ft, and is devitrified from 300 to 405 ft. The tuff has an open/porous matrix and contains 5 to 10% pinkish gray (5YR 8/1) and light gray (N8) pumice clasts up to 1 centimeter (cm) in diameter; 1% dark grayish red (10R 3/4) lithic clasts up to 1 cm in diameter from 240 to 300 ft; and no observed lithic clasts from 300 to 405 ft. The unit also contains 15 to 20% feldspar phenocrysts up to 0.5 millimeter (mm) long, with sanidine predominating, including chatoyant sanidine; 5% quartz phenocrysts up to 0.5 mm in diameter, a few displaying bipyramidal crystal habits, and up to 1% mafic minerals up to 1 mm long. Most samples display a weak reaction to 10% HCl. Samples are wet from 320 to 380 ft, due to injection water, and moist from 380 to 405 ft. Below 405 ft, all samples are wet. The unit lies in sharp contact with a possible paleosol developed on the underlying tuff.

(405 to 660 ft) ASH-FLOW TUFF (POST-RAINIER MESA TUFF):
The tuff is predominantly light brown (5YR 6/4) to moderate reddish orange (10R 6/6), displays nonwelded textures, is vitric from 405 to 500 ft, and is devitrified from 500 to 660 ft. The tuff has an open/porous matrix and contains 20 to 30% grayish orange pink (10R 8/2) and yellowish gray (5Y 8/1) pumice clasts 2 to 5 mm in diameter; 15% moderate brown (5YR 3/4) to moderate reddish brown (10R 4/6) to dark reddish brown (10R 3/4) lithic fragments 2 to 5 mm in diameter; 15 to 20% feldspar phenocrysts, predominantly sanidine, up to 0.5 mm long; less than 5% quartz phenocrysts up to 0.5 mm in diameter; and 1% mafic minerals up to 0.5 mm long. Samples display a weak reaction to 10% HCl from 405 to 420, 500 to 580, and 610 to 630 ft. Several dark yellowish orange (10YR 6/6) and moderate reddish orange (10R 6/6) horizons are present at 405 to 415, 575 to 590, and 630 to 645 ft, which appear weathered and oxidized, display well-sorted clasts, have some clay alteration especially from 575 to 590 ft, and could represent paleosols. The unit contains large, grayish black (N2) lithic clasts up to 2 cm in diameter from 600 to 625 ft. The unit lies in sharp contact with a possible paleosol developed in the underlying tuff.

(660 to 765 ft) ASH-FLOW TUFF (RAINIER MESA TUFF):
The tuff is grayish red (10R 4/2) to grayish orange pink (5YR 7/2), and light brownish gray (5YR 6/1), and is nonwelded and devitrified. The tuff has an open/porous matrix and contains 1% yellowish gray (5Y 8/1) pumice clasts up to 2 mm in diameter; less than 2% grayish black (N2) lithic fragments up to 2 mm in diameter; 15 to 30% feldspar phenocrysts, predominantly sanidine, up to 2 mm long that decrease to 3% at the base from 720 to 765 ft; 5% quartz up to 1 mm in diameter that includes bipyramidal quartz; and 1% mafic minerals. No reaction to 10% HCl is observed. The top of the unit from 660 to 665 ft contains a possible paleosol that is clayey and grayish red (10R 4/2). A well-sorted pumice fallout is present from 690 to 700 ft, with 50 to 60% pumice. The unit lies in sharp contact with a possible paleosol in the underlying ash-flow tuff.

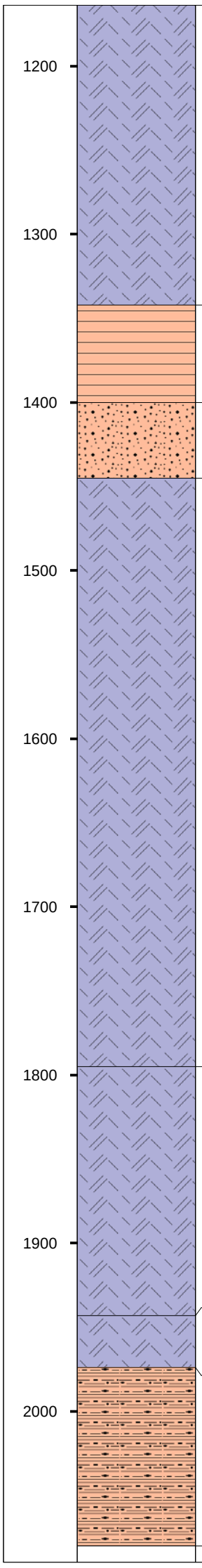
(765 to 920 ft) ASH-FLOW TUFF (POST-TIVA CANYON TUFF):
The tuff is very pale orange (10YR 8/2), nonwelded, and devitrified. The tuff has an open/porous matrix and contains 1% moderate orange pink (10R 7/4) to moderate reddish orange (10R 6/6) pumice clasts up to 2 mm in diameter; 1% grayish black (N2) and dark reddish brown (10R 3/4) lithic clasts up to 1 cm in diameter from 765 to 835 ft that increase to 5% from 835 ft to the base of the unit at 920 ft; 1 to 3% feldspar phenocrysts generally 1 mm long; 5% quartz phenocrysts less than 1 mm in diameter; and 1% mafic minerals. No reaction to 10% HCl is observed. The upper 10 ft of the unit contains a deeply weathered pale reddish purple (5RP 6/2) clay-rich zone that is possibly a paleosol. The unit lies in sharp contact with the underlying tuff.

(920 to 1,035 ft) ASH-FLOW TUFF (TIVA CANYON TUFF):
The tuff is moderate brown (5YR 3/4) to a slightly lighter moderate brown (5YR 4/4), light brown (5YR 5/6), moderate yellowish brown (10YR 5/4), and grayish red (5R 4/2). The unit is densely welded and devitrified, has a dense/nonporous matrix, and contains 1 to 2% very light gray (N8) to white (N9) pumice clasts up to 1 mm in diameter. The unit is lithic-poor and contains 1 to 2% feldspar phenocrysts 1 to 3 mm long; less than 1% mafic minerals; and no quartz phenocrysts. No reaction to 10% HCl is observed. From 985 to 1,000 ft there are silica coatings (i.e., drusy quartz) on smooth planar fractures imparting a sparkling texture to the rock. The unit lies in sharp contact with the underlying tuff.

(1,035 to 1,065 ft) ASH-FALL TUFF (PRE-TIVA CANYON TUFF):
The tuff is moderate yellowish brown (10YR 5/4), nonwelded, and devitrified. It has an open/porous matrix and contains 10% grayish yellow (5Y 8/4) to light greenish gray (5GY 8/1) pumice up to 8 mm in diameter and 15% light brown (5YR 5/6) lithic clasts up to 3 mm in diameter. The unit is generally phenocryst-poor and contains 1 to 2% feldspar phenocrysts up to 0.5 mm long, no quartz phenocrysts, and no mafic minerals. No reaction to 10% HCl is observed. The top of the unit from 1,035 to 1,040 ft is orange (10R 6/6), oxidized and weathered, and possibly represents a paleosol. The tuff unit is weakly oxidized and possibly reworked. The base of the unit is in sharp contact with the underlying tuff.

(1,065 to 1,145 ft) ASH-FLOW TUFF (TOPOPAH SPRING TUFF):
The tuff is moderate yellowish brown (10YR 5/4) to light brown (5YR 5/6) to grayish red (5R 4/2). The unit is moderately welded from 1,065 to 1,100 ft, densely welded from 1,100 to 1,145 ft, devitrified throughout, and weakly argillic and weathered below 1,115 ft. The tuff is pumice- and lithic-poor and contains 1 to 2% feldspar phenocrysts up to 0.5 mm long; no observed quartz phenocrysts; and 1% mafic minerals. No reaction to 10% HCl is observed. A poorly developed vitric zone is present from 1,120 to 1,130 ft and contains black feldspar-porphyritic glass. The unit is in unconformable contact with the underlying weathered tuff.

(1,145 to 1,342 ft) ASH-FLOW TUFF (PRE-TRAM TUFF):
The tuff colors range from grayish orange (10YR 7/4) to grayish orange pink (10R 8/2), pale greenish yellow (10Y 8/2), light brown (5YR 6/4), pinkish gray (5YR 8/1), dusky



red (5R 3/4) and grayish yellow (5Y 8/4). The unit is non to weakly welded, devitrified, and moderately to highly weathered to clay. Zeolitic alteration is also present locally. The unit contains 30 to 50% white (N9) to pinkish gray (5YR 8/1) pumice clasts that range in size from 5 to 10 mm, 1 to 15% reddish brown (10R 4/6) and light brown (5YR 5/6) lithic clasts up to 1 cm in diameter, 1 to 2% feldspar phenocrysts up to 0.5 mm long, no quartz, and a trace of mafic minerals. Samples react weakly to 10% HCl below 1,195 ft. The base of the unit lies in sharp contact with the underlying sedimentary rock.

(1,342 to 1,400 ft) CALCAREOUS MUDSTONE:
The mudstone is olive gray (5Y 4/1) to olive black (5Y 2/1). The top of the mudstone has a 17-ft-thick section of bedded, fine-grained, reddish brown (10R 4/6) sandstone that grades upward into finely laminated, dusky red (5R 3/4), cherty siltstone. The mudstone is soft, finely laminated, and displays thin, 1-mm fissile partings. The unit is weakly indurated and reacts strongly to 10% HCl. Trace amounts of pyrite are noted in samples from 1,345 to 1,350 ft. The unit lies in sharp contact with the underlying sandstone.

(1,400 to 1,445 ft) CALCAREOUS SANDSTONE:
The sandstone is homogeneous, tuffaceous, and fine-grained. The colors range from olive gray (5Y 5/2) to yellowish gray (5Y 6/1), and the unit is capped with a thin, 3-ft, finely laminated siltstone bed that is pale yellowish brown (10YR 6/2). The base of the unit from 1,430 to 1,445 ft is clayey and may represent altered ash beds. The unit is moderately well indurated and reacts strongly with 10% HCl. The unit lies in sharp contact with the underlying tuff.

(1,445 to 1,795 ft) ASH-FALL TUFF (PRE-TRAM TUFF):
The tuff is light bluish gray (5B 7/1) to greenish gray (5GY 6/1), nonwelded, and devitrified. The top of the tuff is marked by a thin, less than 1-ft thick bed of dark olive gray (5Y 3/2) cherty-textured ash. The tuff matrix is generally dense/nonporous and appears weathered, with weathering decreasing from 1,575 ft to the base of the unit. The unit contains 1% pinkish gray (5YR 8/1) pumice up to 1 mm long from 1,445 to 1,465 ft; 1 to 2% white (N9) pumice up to 3 mm long from 1,595 to 1,720 ft; 1 to 2% light bluish gray (5B 7/1) pumice up to 2 mm long from 1,720 to 1,795 ft; 1 to 25% predominantly moderate red (5R 4/6) lithic clasts or oxidation spotting up to 1 cm in diameter from 1,445 to 1,730 ft; 1 to 2% yellowish green (10 GY 4/4) and gray (N3) lithic clasts up to 3 mm long; and 1 to 5 % light gray (N8) and pale blue (5B 7/2) quartz phenocrysts up to 1 mm in diameter from 1,595 to 1,795 ft. The tuff is feldspar- and mafic-poor. The unit contains several laminated or bedded horizons toward the base of the unit from 1,720 to 1,795 ft. Samples of tuff react weakly to 10% HCl. The presence of laminated/bedded horizons, variability of pumice and phenocryst content, weathered appearance, and association with siltstone and mudstone indicate that the tuff was likely deposited in a subaqueous, lacustrine environment. The unit lies in sharp contact with the siliceous horizon of the underlying ash-flow tuff.

(1,795 to 1,943 ft) ASH-FLOW TUFF (PRE-TRAM TUFF):
The tuff is pale green (10G 6/2), weakly welded, and devitrified. The unit contains 1 to 3% yellowish gray (5Y 8/1) to very pale orange (10YR 8/2) pumice clasts up to 3 mm long from 1,825 to 1,860 ft; 1 to 20% variably colored lithic clasts up to 3 mm long which are concentrated from 1,810 to 1,860 ft; 1% light gray quartz phenocrysts up to 3 mm in diameter from 1,920 to 1,940 ft. The tuff matrix is dense/nonporous and appears weathered from 1,795 to 1,905 ft. The tuff has a variable content of distinctive brilliant green (5G 6/6) glass shards and blebs up to 5 mm long. The top of the unit, from 1,795 to 1,810 ft, is weathered, silicified, and contains fragments, or layers, of very light gray (N8) and brownish gray (5YR 4/1) chert with finely disseminated pyrite. A highly altered and bleached zone is present from 1,810 to 1,830 ft, and a bleached, white, strongly zeolitized zone is present from 1,855 to 1,870 ft. Fine-grained pyrite also occurs toward the base of the unit from 1,890 to 1,943 ft. Samples of tuff react weakly to 10% HCl. Overall, this unit shares a similar depositional history with the overlying tuff. The unit appears to be a thick homogeneous ash-fall or ash-flow tuff with a cherty, pyritic, bedded top that was deposited in a subaqueous, lacustrine environment. The tuff is likely a unit of the Lithic Ridge Tuff. The unit lies in sharp contact with the underlying clay unit.

(1,943 to 1,974 ft) ARGILLIZED PYROCLASTIC TUFF (?):
The altered tuff is light bluish gray (5B 7/1) and composed of clay with high plasticity. The unit is nonwelded and appears to be highly weathered or altered. The unit has a dense/nonporous matrix. The unit appears to be aphyric and pumice-poor. The base of the unit from 1,960 to 1,974 ft contains 3 to 5% reddish brown (10R 7/4 - 5YR 6/4) lithic clasts up to 5 mm in diameter. The unit reacts weakly to 10% HCl. The unit lies in sharp contact with the underlying claystone.

(1,974-2,080 ft Total Depth) INTERBEDDED CLAYSTONE AND SILTSTONE:
The unit is composed of an upper section of cherty and silty claystone underlain by homogenous claystone. The uppermost unit, from 1,974 to 1,980 ft, consists of grayish orange (10YR 7/4) chert and silty claystone with up to 2% pyrite in fractures. The unit grades downward from 1,980 to 2,005 ft, into locally laminated olive brown (5Y 2/1) claystones and siltstone. Below 2,005 ft, thinly laminated, brown (5Y 4/1 to 5YR 2/1) mudstone is present. Locally, mudstones contain green clay beds as well as thin, colorless gypsum beds with trace pyrite below 2,070 ft. The mudstones react weakly to 10% HCl and give off a fetid odor, indicating deposition in euxinic environment.