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ENVIRONMENT OF DEPOSITION OF THE UPPER 300 METERS OF SEDIMENTS OF THE RAFT RIVER KGRA

by

K. S. KENNEDY

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Kevin Kennedy

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Checked by:

Dennis Goldman

Dennis Goldman, Supervisor
Geology/Hydrology

Approved by:

C. A. Allen

C. A. Allen, Manager
Biological & Earth
Science Branch

ABSTRACT

The valley fill sediments of the Raft River KGRA in southern Idaho are over 300 meters of unconsolidated quartzose silts and sands, tuff, quartzite, and rhyolite gravels with ages from Miocene to present. These sediments are the result of coalescing alluvial fans which form at the bases of the surrounding Jim Sage, Raft River, and Black Pine Mountains. The meandering Raft River cuts through these coalesced fans in the center of the valley and contributes to deposition as well as erosion. Several landslides from the mountains and minor loess deposits add to the valley sediments as well. The number of sediment sources and the various transport mediums do not allow lithologic correlation of the upper 300 meters of sediments of the Raft River KGRA.

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GENERAL GEOLOGY

Anderson (1931) describes the Raft River valley as a "vast aggregated alluvial plain from 16 to 25 kilometers wide, enclosed by the Black Pine and Sublette ranges on the east, the Raft River range on the south, the Jim Sage on the west and open to the Snake River Plain on the north." Anderson goes on to describe the origin of the valley as "entirely structural" and that the floor of the valley has been raised to its present level by the debris from the surrounding ranges.

The mountain ranges that surround the KGRA vary in composition. The Black Pine mountains to the east are composed of Paleozoic limestones and sandstones. The Raft River Range to the south is a gneiss dome complex mantled by paleozoic sediments. Those rocks that make up the Jim Sage mountains to the west of the KGRA are of the Salt Lake formation that were raised to the present level by faulting.

The sediments of the Raft River KGRA, located in the upper reaches of the lower Raft River valley are an unsorted mixture of silts, sands, clays, tuffs, and gravels formally labeled the "Raft Formation", with ages ranging from Miocene to the present, and cut by the meandering Raft River. These sediments result from a variety of depositional environments imposed upon each other and show indications of three magnetic reversals, the latest occurring approximately 770,000 years ago (Harry Covington, personnal comm.).

METHODS OF STUDY

The sediments of the Raft River KGRA were analyzed from well cuttings of the seven monitor wells using a binocular dissecting microscope and the previously completed lithologic descriptions (Harry Covington, Denver USGS) from the seven deep wells. (Figure 2)

No field work was completed for this report. All structural and historical geology data were obtained from previous reports.

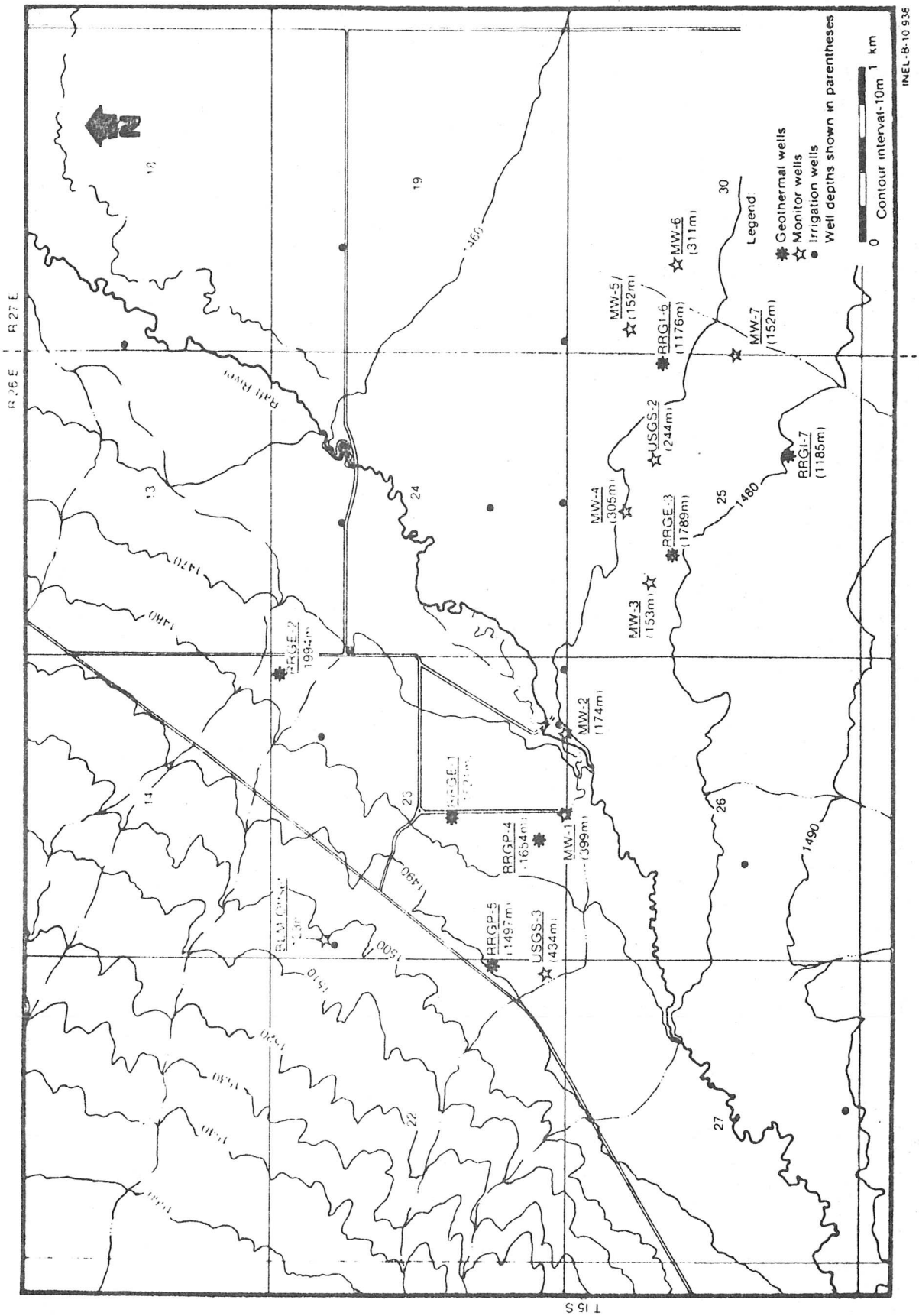

Figure 2. Raft River KGRA site map.

According to Reinec & Singh (1975) "favorable conditions for deposition and preservation of alluvial fan deposits exist where several alluvial fans exist beside each other coalescing in a tectonically active area, i.e., actively sinking basins. Open fault plains are developed along such mountain chains, the mountains are being elevated and the alluvial fans are sinking. In such cases, thick deposits of alluvial fans are produced and preserved as marginal facies of the basin of deposition." This is indeed the case at Raft River.

Another major sedimentary feature is the deposits of the meandering Raft River which cuts the alluvial fans in the center of the valley. The Raft River's present flow ranges from 2.7 to 2060 cfs with an average of 16.7 cfs throughout the year in the area of the Narrows near the south end of the Jim Sage range. The River today is hardly more than a small stream but was apparently at one time a rather formidable river. Described by an early immigrant in 1853 "as two rods wide (10 meters) and three feet deep" the Raft River was a muddy torrent that needed to be forded on rafts, hence the name Raft River (Sudweeks, 1941).

As apparent from the well lithologies, deposits from this river exist throughout the valley at various depths. Air photos show meandering of large extent from the Black Pines Mountains on the east to the Jim Sage Range on the west. The major depositional features from meandering channels are point bars, which result from channel action and are seen in the cuttings from the wells.

The Raft River derives its sedimentary load from the surrounding ranges and the sediments it cuts through. Deposits in the valley indicate a close source, possibly the City of the Rocks

Other sediment transport methods, such as landslides, wind, and glaciers, are less significant than those methods forming alluvial

The east-west trending Raft River Range; the southern boundary of the KGRA, is a precambrian gneiss dome mantled by paleozoic quartzites and marbles. The range is 40 kilometers along the east-west axis with its west end merging with the Dove Creek Mountains. The east end of the range merges with the south end of the Black Pine Mountains.

The Jim Sage Range borders the west side of the KGRA and is "a tilted block mountain at the east base of the Albion Range" (Anderson, 1931). The range is primarily composed of rhyolitic lava flows overlying the Salt Lake Formation tuffs and other volcanics. Its total length is 87 kilometers, terminating to the south just 5 kilometers from the Utah border and to the north just beyond the Albion Range where it plunges beneath the Snake River Plain. The highest peak is 2500 meters which is more than 915 meters above the valley floor. Some glacial evidence is found in the higher elevations and numerous landslides have occurred.

The Jim Sage Range is the primary sediment source to the KGRA. The lower reaches of the slopes are almost entirely covered with coalescing alluvial fans of tuff, rhyolite gravels and quartz sands that reach to the Raft River in the center of the valley.

Thus the Raft River valley is a sedimentary mass of coalescing alluvial fans from three separate mountain ranges. Detrital grains of quartz, tuff, quartzite, rhyolites, silt and clays from the surrounding ranges are deposited in a random mixture reaching depths in the center of the valley of over 305 meters.

The Raft River cuts through this mass of interfingering alluvial fans and deposits its own load of sediments. The Raft River's major source of sediments is the City of the Rocks. This area is a rapidly decomposing mass of huge granite monoliths and spires which provide an abundant source of arkosic sands to Circle Creek which drains the area. Circle Creek flows into the Raft River less than 24 kilometers from the Raft River KGRA.

Occurring simultaneously with the thrust-faulting was the emplacement of the Idaho Batholith to the north and its regional outlier forming the City of Rocks just west of the area (Cunningham, 1971). Anderson (1952) relates structural activity in the area to the Idaho Batholith. Plutons were emplaced and remobilized at this time at the Raft River KGRA (Anderson, 1931). The Raft River Range to the south is mapped as a mantled gneiss dome (Compton, 1972)[1].

With the beginning of the Miocene period (25-20 my), during and perhaps as a result of the pluton emplacement, volcanic activity began in th area. Extensive ash deposits and rhyolite flows occurred in the area of the Jim Sage Range which provided the material for the Salt Lake Formation. The Jim Sage Range is composed entirely of Salt Lake Formation tuffs and rhyolite and capped by rhyolite flows.

Another major physiographic province that is represented in the Raft River KGRA is the Basin and Range structure of Miocene Age (25-10 my). Basin and Range structure is characterized by the extensive block-faulting in Utah, Nevada, New Mexico, and Arizona which forms "peculiar short, sub-parallel ranges and intervening desert basins whose appearance on a map suggested to Major Dutton 'an army of caterpillars crawling northward out of Mexico'" (King, 1959).

The Raft River Basin appears to be on the northern most extremity of the Basin and Range province and does show possible features caused by the forces forming the province.

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[1] Hyndman (1972) describes mantled gneiss domes as "dome-shaped cores of old crystalline rocks that are interpreted as having been metamorphosed, recrystallized, or partly melted and as having intruded their overlying stratified mantle rock." (Limestones, marbles and sandstones in the case of the Raft River Range.)

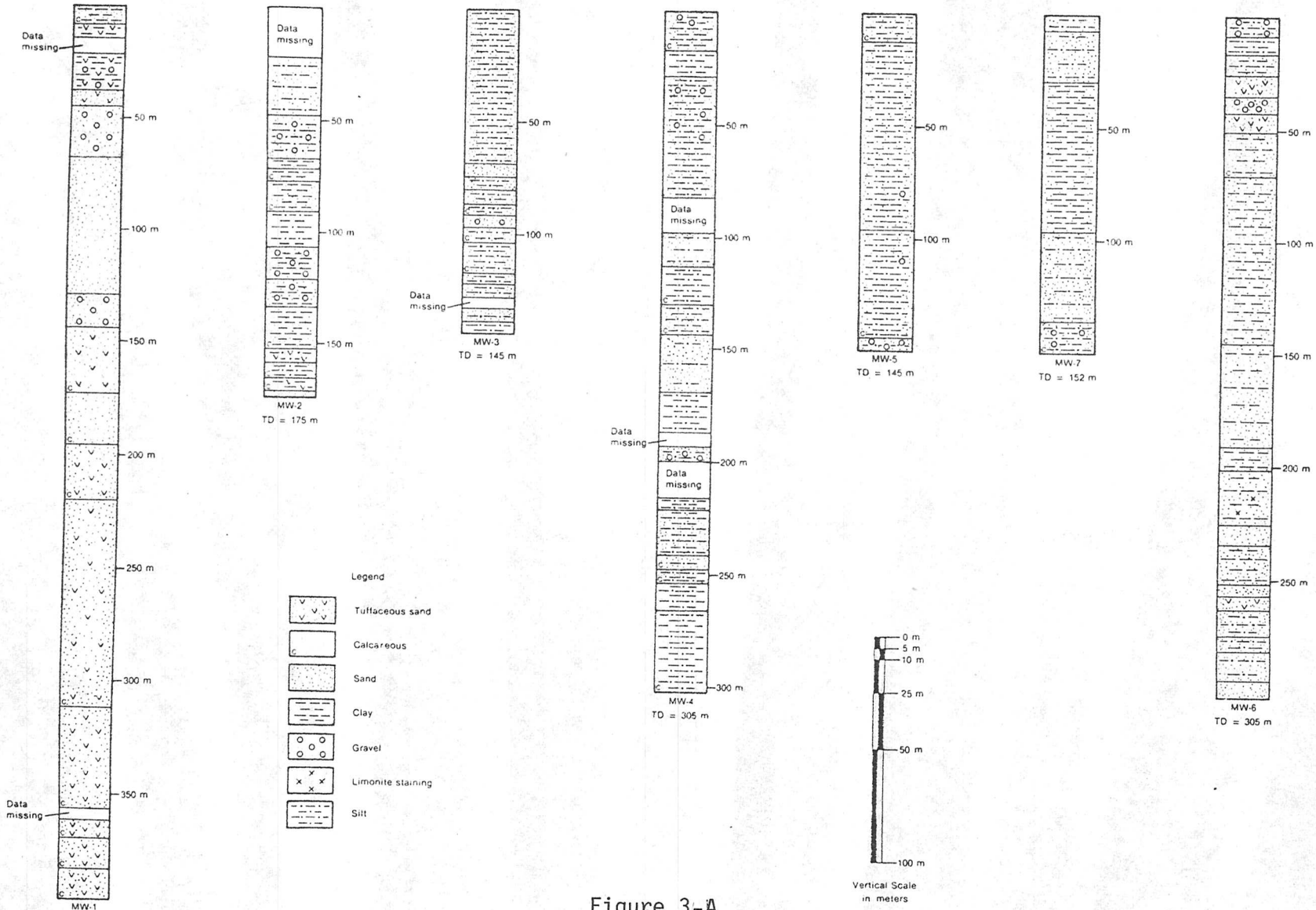

Figure 3-A
Lithologies of the seven Raft River monitor wells

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Such deposits indicate a long period of valley stability in which the flow regime of the Raft River was constant. In the course of geologic time, such stabilities are entirely possible within the processes of an actively sinking basin.

APPENDIX A

APPENDIX B

55m-64m	Same as above. Sand content 35-45%.
64-91.5m	Sand - silt to coarse-grained, subrounded to very angular, clear to yellow quartz, gray to brown quartzite, and light gray tuffs. Minor magnetite (2%). Silt 10%.
91.5-100.5m	Sand - very fine to medium-grained, subangular to very angular, clear to white quartz. Minor gray quartzite (10%). Minor biotite (1%). Minor magnetite (1%).
100.5-119m	Sand - fine to very coarse-grained, subrounded to angular, clear to white quartz, light to dark gray quartzite, light gray tuff. Minor biotite (1%). Minor limonite staining.
119-128m	Sand - fine to coarse-grained, subrounded to angular, clear to white quartz, light to dark gray quartzite, light gray tuff. Minor biotite (1%). Limonite staining and pyrite (1%).
128-146.5m	Very Coarse-Grained Sand - fine to very coarse-grained, subrounded to angular, frosted clear to white quartz, light to dark gray quartzite, light gray tuff. Minor muscovite and biotite (1%). Minor limonite staining.
146.5-174m	Calcareous Tuffaceous Sand - fine to very coarse-grained, subrounded to angular, frosted clear to white quartz, gray quartzite and light gray tuff. Tuff 20-30%. Minor limonite staining.
174m-198m	Calcareous Sand - fine to very coarse-grained, subrounded to angular, frosted clear to white quartz,

Quartz, quartzite, and tuff pebbles up to 10 mm (10%). White, non-calcareous clay (75-80%).

73-79m Gravely, Slightly Calcareous Clay - minor silt and sand (15-25%). Light gray calcareous clay (65-75%).

79-91.5m Sandy Calcareous Clay - silt to coarse-grained, rounded to subangular, clear to white quartz, light to dark gray quartzite, and light gray tuff sand (30-40%). Quartz, quartzite, and tuff pebbles up to 5 mm (10%). Light gray calcareous clay 50-60%.

91.5-103.5m Argillaceous Silt - silt to medium-grained, rounded to subangular, clear to white quartz and light to dark gray quartzite. Sand 60-70%. Pebbles of quartz and quartzite up to 5 mm (10%). Dark gray calcareous clay 20-30%. Minor biotite (1%).

103.5-109.5m Same as above.

109.5-116m Argillaceous Silt, Sand, and Gravel - silt to coarse-grained, rounded to subangular, clear to white quartz, light gray tuff, gray to green quartzite sand 40-60%. Light green to gray to black quartz and quartzite pebbles up to 12 mm in size (20-25%). Light gray calcareous clay (20-30%). Minor biotite (1%). Limonite staining.

116-122m Same as above. Pebble size only 3 mm.

122-134m Argillaceous Silty Sand and Gravel - silt to very coarse-grained, subrounded to angular, clear to white quartz, gray to black quartzite and light gray tuff sand (65-75%). Quartzite pebbles up to 5 mm (10%). Slightly calcareous light gray clay

387-399m	Calcareous Sandy Tuff - same as above. Sand content 30-40%. Tuff 60-70%.

RAFT RIVER MONITOR WELL #2
SE 1/4, SE 1/4, Sec 23, T15S, R26E
FIGURE 4-B

0-23.5m	Data not available.
23.5-49m	Silty Sand - fine to very coarse-grained, subrounded to angular, clear to orange quartz, white to dark gray quartzite. Minor biotite and muscovite (2%) and magnetite (2%). Silt 5-20%. Pebbles up to 1 cm of quartz, quartzite, and granitic rock fragments (5%).
49-55m	Silty to Sandy Calcareous Clay - sand is silty to very coarse-grained, rounded to angular, clear to white quartz, light gray quartzite and tuff (20-30%) sand. Minor biotite (2%), feldspar (2%). Pebbles of granitic rock fragments of quartz, quartzite, and tuff (10-20%) up to 10 mm in size. Very light brown calcareous clay (50-70%).
55-61m	Same as above.
61-67m	Silty calcareous clay with minor sand and gravel. Silt to very coarse-grained, subrounded to angular, clear to white quartz, quartzite and light gray to green tuff sand (15-25%). Pebbles of quartz, quartzite, and tuff up to 10 mm in size (10%). Gray, slightly calcareous clay (65-75%).
67-73m	Gravely Non-Calcereous Clay - minor silt and sand. Silt to very coarse-grained, subrounded to angular, clear to white quartz, light gray quartzite and gray-green tuff sand (10-15%).

61-67m Same as above.

67-73m Sand - very fine to coarse-grained, subrounded to very angular, clear to orange quartz and light to dark gray quartzite. Minor biotite (1%). Minor magnetite (2%).

73-79m Silty Sand - Same as above. Silt to very coarse-grained, content 20%.

79-85.5m Sandy Silt - subrounded to very angular, clear to orange quartzose silt. Fine to very coarse-grained, subrounded to angular quartz and quartzite sand. Sand content 20%. Minor biotite (1%). Minor magnetite (2%).

85.5-91.5m Calcareous Sandy Silt - silt to very coarse-grained (up to 8 mm), subrounded to angular, clear to yellow quartz and light to dark gray quartzite sand (30-40%). Quartzose silt 60-70%. Minor biotite and magnetite (1%).

91.5-97.5m Sand - silt to coarse-grained (up to 5 mm), subrounded to angular, clear to yellow quartz, light gray quartzite. Minor biotite (1%). Minor limonite staining.

97.5-103.5m Calcareous Silty Sand - silt to coarse-grained (up to 5 mm), subrounded to subangular, clear to white quartz, gray quartzite. Minor biotite (1%). Silt 15-20%.

103.5 - 116m Calcareous Sandy Silt - silt to medium grained, subrounded to subangular, clear to white quartz and gray quartzite (10-20%). Minor magnetite and biotite (1%). Quartzose silt 80-90%.

85.5-103.5m Data missing.

103.5-109.5m Silty Sand - silt to coarse-grained (up to 5 mm), subrounded to angular, clear to white quartz, yellow to gray quartzite sand (90%). Quartzose silt (10%). Minor biotite and magnetite (1%). Minor limonite sand.

109.5-116m Same as above. Silt content 20-30%.

116-134m Calcareous Silt - quartzose silt.

134-146.5m Calcareous Sandy Silt - very fine to very coarse-grained (up to 10 mm) subrounded to angular, clear to white quartz and gray quartzite sand (25-35%). Quartzose silt 65-75%.

146.5-164.5m Silty Sand - Quartzose Silt 20%. Very fine to very coarse-grained (up to 5 mm), subrounded to angular, clear to white quartz, and gray quartzite sand (80%). Minor magnetite and biotite (1%).

164.5-170.5m Same as above - pebbles up to 10 mm.

170.5-189m Silt - quartzose silt.

189-195m Data missing.

195-201m Pebbly Sandy Silt - fine to very coarse-grained, subrounded to angular, clear to white quartz, light gray to brown quartzite and gray to light green tuff sand and pebbles (25-35%). Quartzose silt 65-75%. Minor biotite (1%).

201-219.5m Data missing.

to dark gray quartzite, light gray tuffs. Minor biotite and magnetite (2%). Quartzose silt 20-30%.

RAFT RIVER MONITOR WELL #6
SE 1/4, NW 1/4, Sec 30, T15S, R30E
FIGURE 4-F

0-9m	Silty Sand - silt to coarse-grained, subrounded to very angular, clear to yellow quartz, light gray to reddish brown quartzite. Silt 20-30%. Minor biote (2%). Quartzite pebbles (5-10%) up to 25 mm.
9-18m	Silt - silty, subrounded to angular, clear to orange quartz. Minor biote (2%).
18-27.5m	Silty Sand - silt to coarse-grained, subrounded to very angular, clear to yellow quartz. Light gray quartzite. Minor biote (5%). Silt 20-30%.
27.5-36.5m	Tuffaceous Sand - fine to very coarse-grained, subrounded to angular, clear to yellow quartz, light gray to black quartzite, light gray tuffs. Tuffs 30-40%.
36.5-45.5m	Gravely Sand - fine-grained to very coarse-grained sand to gravel, subrounded to angular, clear to yellow quartz, light gray to dark gray quartzite. Minor tuff, biotite, and muscovite. Gravel 20-25%.
45.5-55m	Tuffaceous Sand - fine to very coarse-grained, subrounded to angular, clear to yellow quartz, light gray to brown quartzite, light gray tuffs. Minor biotite (2%). Tuff grains 25-35%.

234.5-253m	Argillaceous Sand - same as above. Clay content 10-20%.
253-259m	Sand - fine to coarse-grained, subrounded to very angular, clear to yellow quartz, light gray to black quartzite, white tuff. Minor biotite (2%).
259-265m	Tuffaceous Sand - fine to coarse-grained, rounded to angular, clear to yellow quartz, light gray to black quartzite, light gray tuff (10-25%). Minor biotite (2%).
265-277.5m	Silty Sand - silt to coarse-grained, subrounded to angular, clear to black quartz, white to brown quartzite, light gray tuff. Minor biotite (2%). Silt 20-30%.
277.5-286.5	Very Argillaceous Sand - very fine-grained, rounded to subangular, clear to yellow to black quartz. Minor biotite and magnetite (2-3%). Light gray tuff 35-45%.
286-298.5m	Argillaceous Sand - fine-grained, subrounded to very angular, clear to yellow quartz. Minor biotite and magnetite (2-3%). Gray clay 20%.
298.5-305m	Sand - medium to coarse-grained, subrounded to very angular, clear to white quartz, white to green to black quartzite and gray tuff.

RAFT RIVER MONITOR WELL #7
NE 1/4, SW 1/4, Sec 30, T15S, R27E
FIGURE 4-G

0-6m	Sandy Silt - silt to coarse-grained (up to 4 mm), subrounded to angular, clear to yellow quartz, gray quartzite sand = 20-30%. Quartzose silt = 70-80%. Minor (1%) biotite and magnetic.

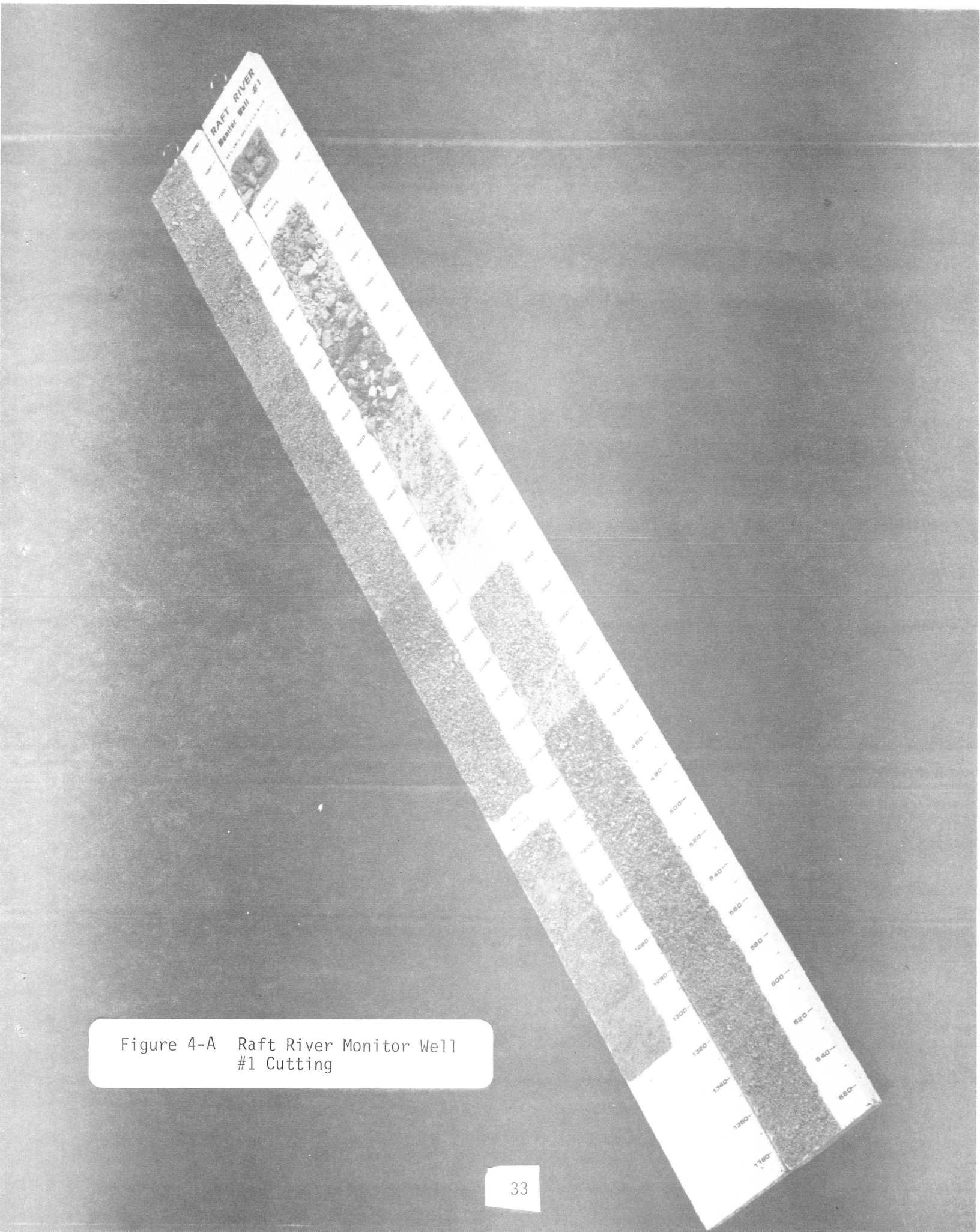

Figure 4-A Raft River Monitor Well #1 Cutting

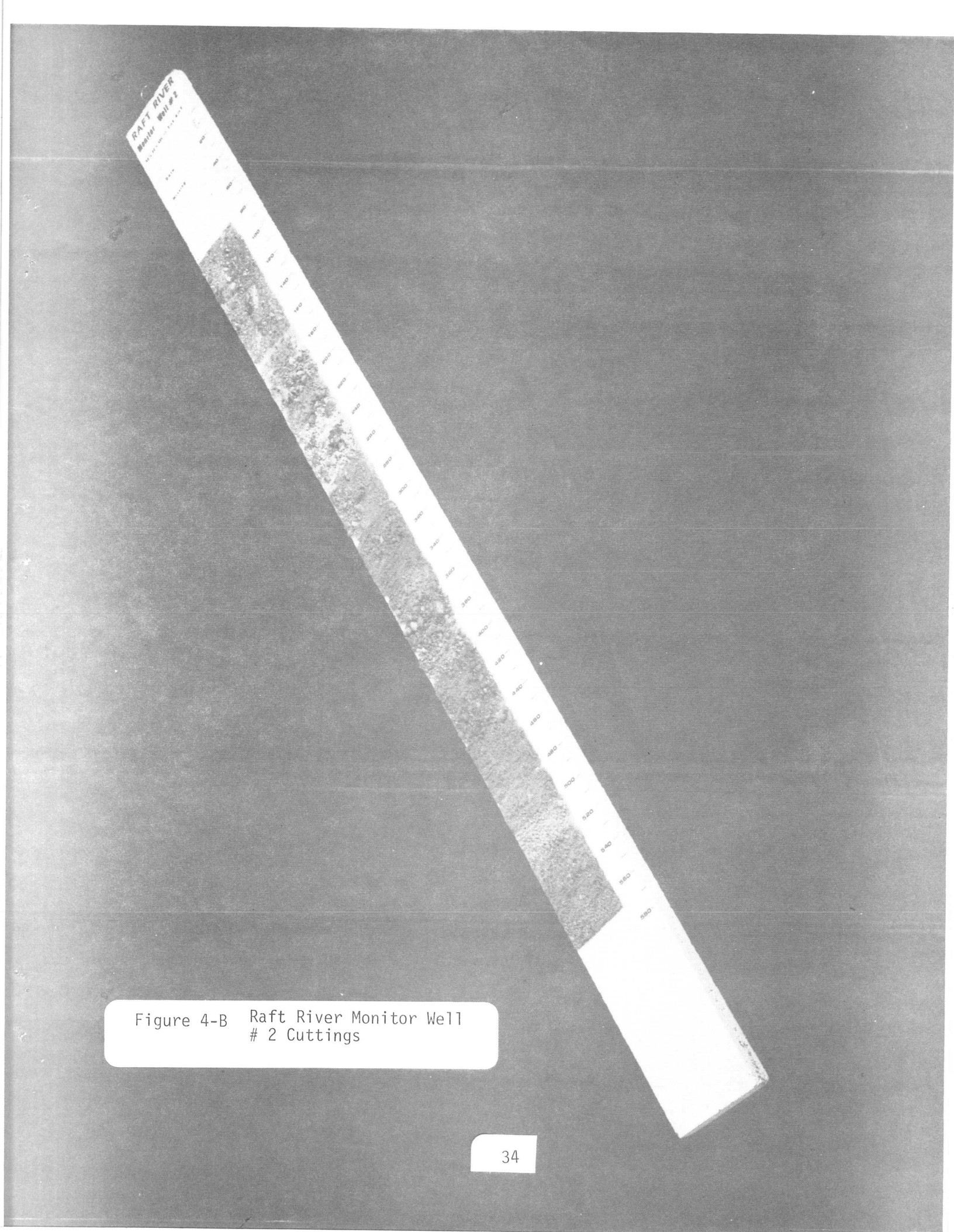

Figure 4-B Raft River Monitor Well # 2 Cuttings

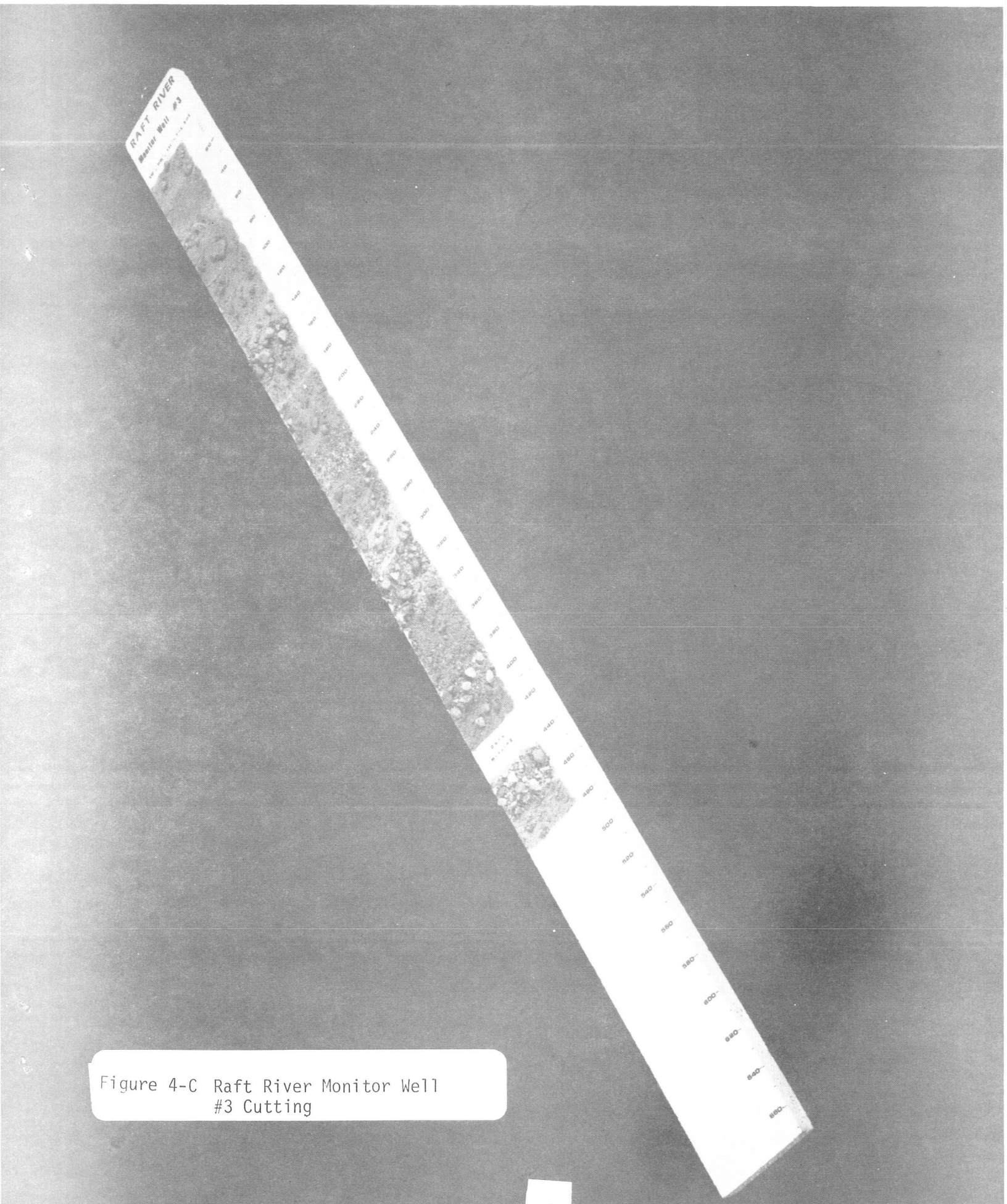

Figure 4-C Raft River Monitor Well #3 Cutting

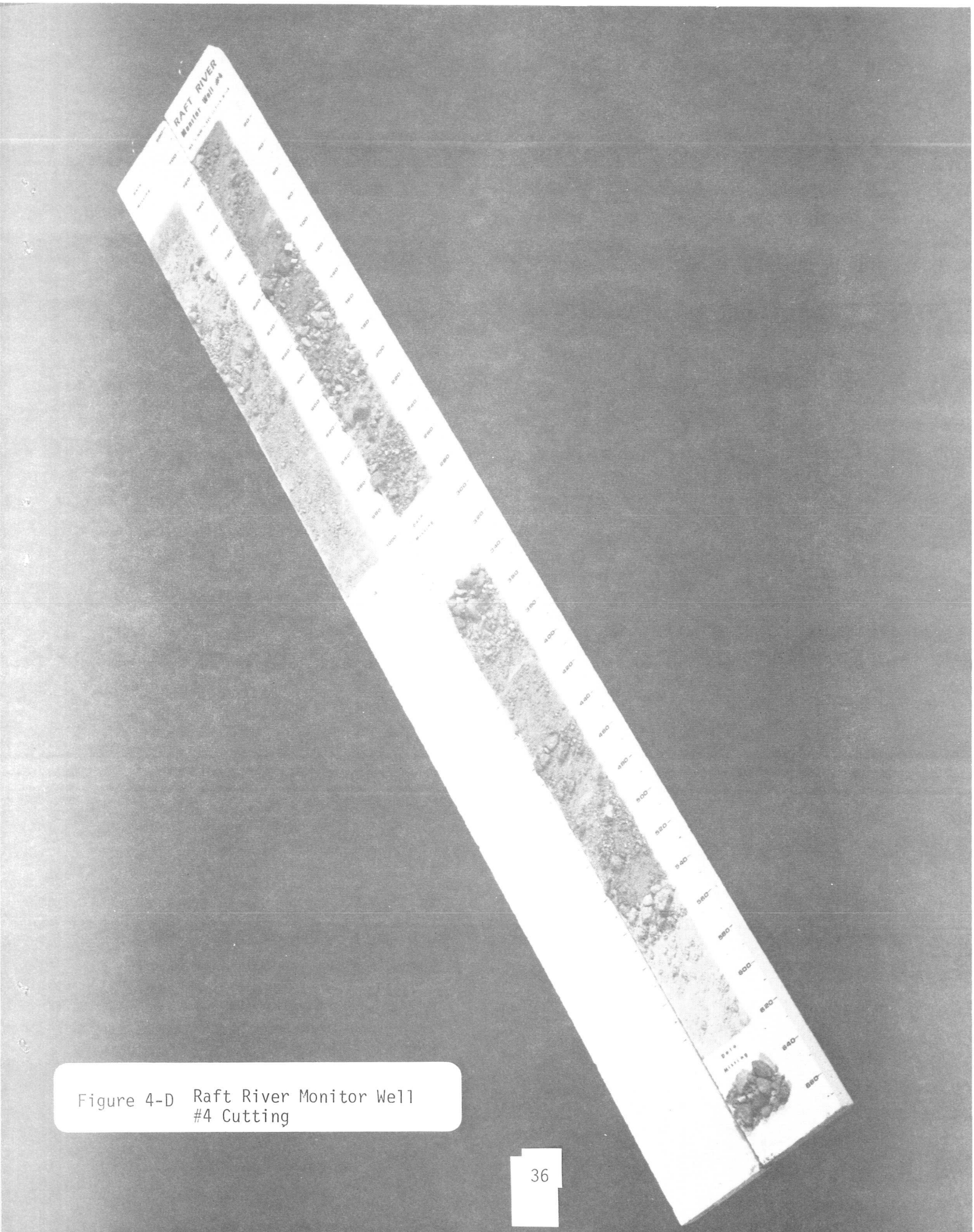

Figure 4-D Raft River Monitor Well #4 Cutting

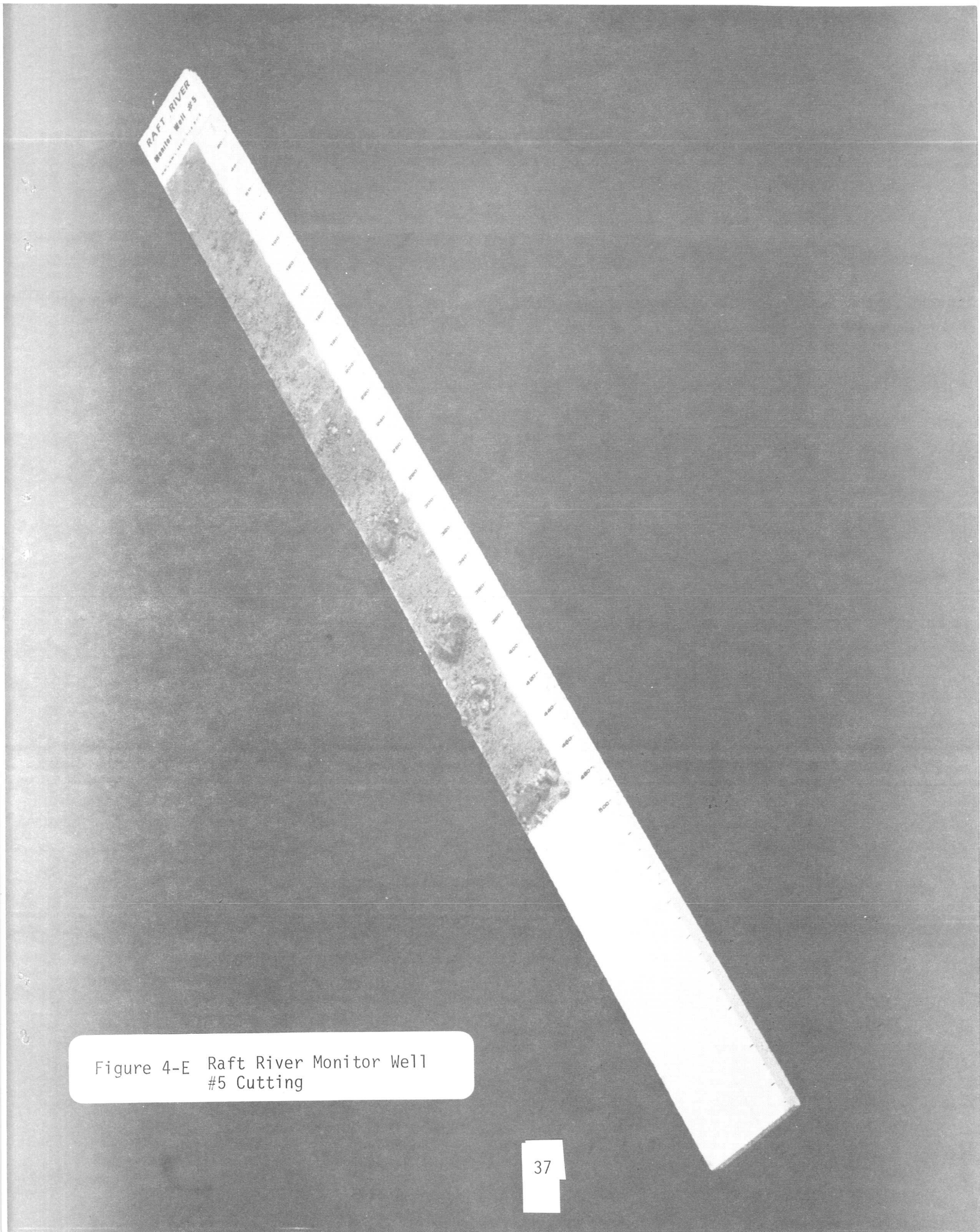

Figure 4-E Raft River Monitor Well #5 Cutting

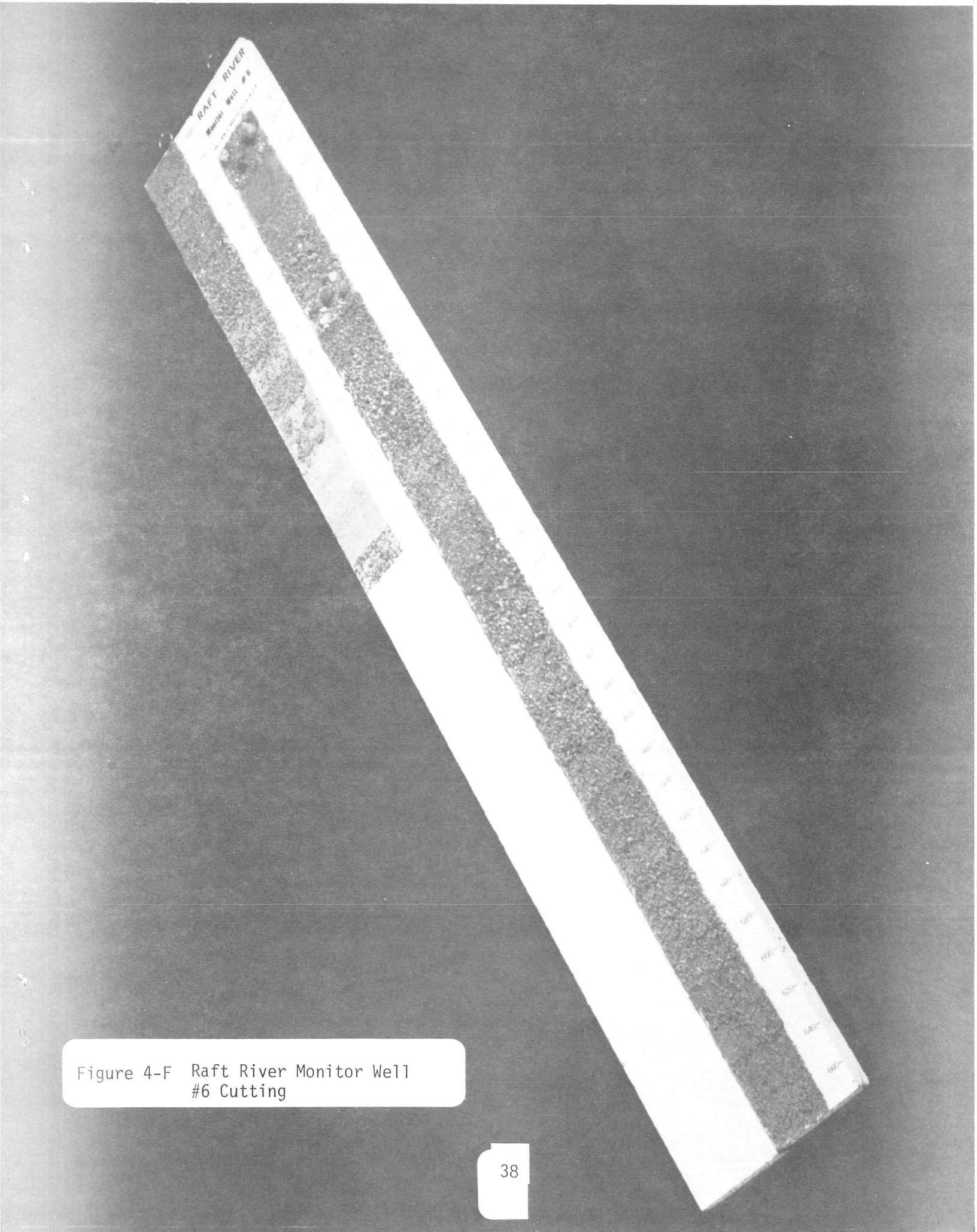

Figure 4-F Raft River Monitor Well #6 Cutting

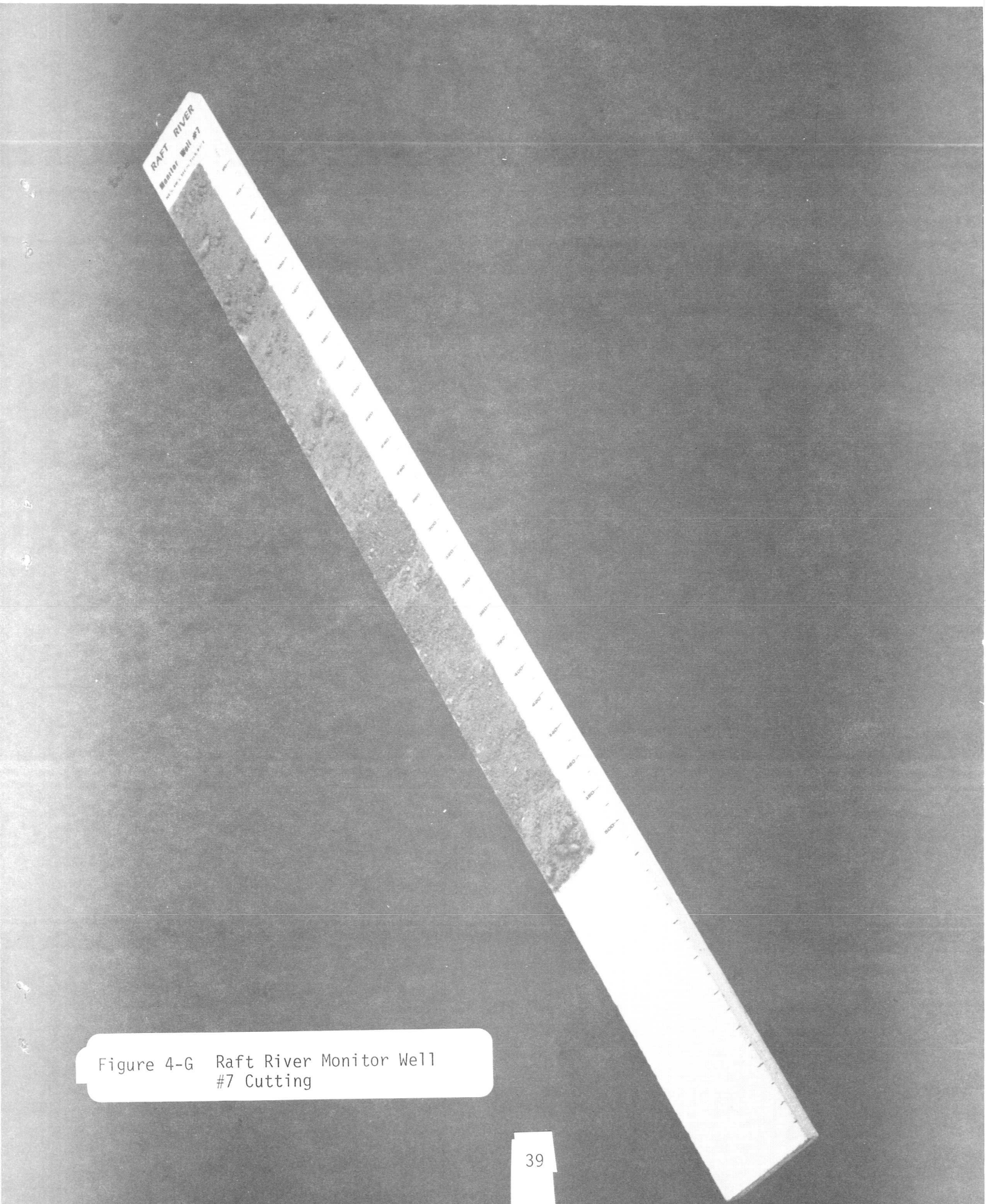

Figure 4-G Raft River Monitor Well #7 Cutting