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## 6.0 Evaluation of Postmining Geomorphologic and Hydrologic Characteristics

The geomorphologic and hydrologic characteristics of two separate segments of Robinson Fork, a mined segment and an unmined segment, were evaluated in the field. A distance of approximately 2.4 linear miles separates the two segments. The locations of these study segments and their relationship to the current limits of longwall mining are depicted in Sheet 1. As indicated in Sheet 1, the mined study segment is located approximately 1.3 linear miles south of the limits of mining and the unmined segment is located approximately 1.1 linear miles north of the limits of mining. Selection of the unmined study segment was based on physical and surrounding land use characteristics that were comparable with the mined segment so that meaningful comparisons could be made to compensate for gaps in the available historic data. All geomorphologic and hydrologic studies that were conducted within the mined segment were duplicated in the unmined segment.

As requested by the BMR, geomorphologic and hydrologic field work, as well as subsequent data evaluation, was performed in accordance with the techniques detailed in the publication "*Applied River Morphology*" (Rosgen, 1996). Field activities were conducted by a professional geologist and a professional engineer licensed to practice in the Commonwealth of Pennsylvania. Field assistance was provided by a staff scientist with geologic training. Also, geomorphologic and hydrologic field data was evaluated by, or under the direct supervision of, the professional geologist.

The geomorphologic and hydrologic work was conducted along 2,068 feet of channel in the mined study segment and along 3,011 feet in the unmined segment. As detailed in Chapter 1.0, the study areas for the geomorphologic/hydrologic evaluation and the biological assessment generally coincided although the lengths of channel surveyed for these two investigative phases were slightly different.

This chapter initially provides a broad geomorphic and hydrologic description of the current stream valley and channel in accordance with the Level I classification procedures described by Rosgen. Detailed information regarding current geomorphic and hydrologic characteristics within the mined and unmined study segments are then provided based on Rosgen's Level II stream classification system. Aside from presenting the results for these studies, the following sections also provide definitions of technical terms, reasons for employing the various methods, and summaries of the method techniques.

Copies of field log book records and field maps are maintained in the BMR Harrisburg, Pennsylvania offices. Photographs of pertinent channel and bank features are presented in Appendix A.

## 6.1 Broad Assessment of Post-Mining Geomorphologic and Hydrologic Conditions

This section provides a description of the landforms within the Robinson Fork watershed and the expected stream type typically associated with these landforms. According to Rosgen, stream channel types can be correlated with the array of fluvial and morphological features occurring within a particular valley type and category of landforms through the demonstration of associations involving the general features of dimension, pattern, longitudinal profile, and materials. The broad assessment was based on geomorphic features interpreted from topographic maps, geologic maps, soil maps, and field mapping.

### 6.1.1 Identification of Structural Groundwater and Surface Water Control Features

Chapter 4.0 of this study provides a detailed examination of geological controls that could affect groundwater and surface water within the Robinson Fork watershed. No faults or fractures that show displacement are manifested at the surface within the study area. Low-amplitude folds warp bedrock beneath the stream. This warping produced two primary vertical (or steeply dipping) joint sets within the study area. A third set of joints is also present beneath the valley floor, parallel to the bedding planes of the bedrock. This joint set is due to unloading during valley development. Lineament studies and VLF surveys confirm the existence of these fractures. A set of fractures identified during the VLF survey along the mined segment of Robinson Fork did not correspond to mapped lineaments; however, it did coincide with the location of a panel gate.

### 6.1.2 Classification of Valley Slope Materials

Slope materials consist of residual soils, colluvium, and bedrock. Residual soils formed from the in-place weathering of bedrock. Colluvium is poorly sorted debris that has accumulated at the base of slopes; in depressions; or along small streams through gravity, soil creep, and local wash. It consists largely of material that has rolled, slid, or fallen down the slope under the influence of gravity. Where slopes are steep or the overlying soil cover has been removed, bedrock outcrops are visible. Bedrock slopes are more prevalent in the mined section of the study area.

The USGS performed a mapping project within Washington County in 1978 to delineate landslide deposits. According to the USGS information, landslide deposits cover between 30 to 60 percent of the study area. The map also depicts the location of landslides (recent and historic). The valley walls for Robinson Fork and its tributaries are the location for numerous landslide areas. Some of these areas may still be active.

### 6.1.3 Determination of Valley Morphology and Type

A relationship exists between valley type and the category of stream(s) with which they are usually associated. In Rosgen's 1996 publication, 11 valley types are defined along with the type of stream(s) generally found within each type of valley. The most suitable valley type description provided by Rosgen that is applicable to Robinson Fork is Valley Type VIII. This valley type is usually associated with streams that are slightly entrenched and have meandering channels and a developed riffle/pool bed form.

### 6.1.4 Delineation of Robinson Fork Watershed

A description of the Robinson Fork watershed was previously provided in Chapter 4.0.

### 6.1.5 Classification of Channel Morphology

Channel morphology is defined as the shape of a stream channel from both a planimetric (channel pattern) and cross-sectional (channel shape) perspective. Channel patterns for the mined and unmined study segments were established through field surveying techniques. Specifically, a measuring tape and Brunton<sup>®</sup> compass were used to produce a refined planimetric image of the channel within each of the study segments (Sheets 10 and 11). The centerline of the channel was used to ascertain the total channel length of each study segment and channel bearings were determined for significant, as well as subtle, changes in course. Channel shape information was also obtained through field surveying methods utilizing a standard surveyor's level/tripod and stadia rod, and a tape measure. A total of 13 stream cross-sectional transects were completed which included 6 along the mined segment (A-A' through F-F'), 6 along the unmined segment (G-G' through L-L'), and 1 along a tributary associated with the unmined segment (M-M'). Sheets 10 and 11 indicate the locations of these transects. The six cross-sectional transects within each of the two study segments represent two riffles, two runs, and two pooled areas.

#### 6.1.5.1 Mined Segment

##### 6.1.5.1.1 Channel Pattern

The channel pattern within the mined segment is classified as single channel and slightly meandering. Sinuosity within this segment was calculated to be 1.04. This type of channel pattern is typical for Valley Type VIII as described in Section 6.1.3.

##### 6.1.5.1.2 Channel Shape

Lateral channel morphology for the riffle section transects surveyed within the mined segment (B-B' and F-F') is characterized by a wide, shallow channel with associated well-developed floodplains. A riffle section is typically selected for characterizing bankfull channel dimensions for riffle/pool-type systems

because it is generally free to adjust its boundaries in response to frequent flows and does not have excessive deposition or constrictions. Stream cross-sections for the mined segment are depicted in Sheet 12.

#### 6.1.5.2 Unmined Segment

##### 6.1.5.2.1 Channel Pattern

Similar to the mined study segment, the channel pattern within the unmined segment is classified as single channel and meandering. Meanders are more prevalent, however, within the unmined segment (sinuosity equals 1.23). As indicated in Section 6.1.3, this type of channel pattern is typical for Valley Type VIII.

##### 6.1.5.2.2 Channel Shape

Lateral channel morphology for the riffle section transects surveyed within the unmined study segment (I-I' and L-L') is comparable to the mined segment and is characterized by a wide, shallow channel with associated well-developed floodplains. One exception is that, overall, bankfull channel widths within the unmined study segment are narrower. Riffle sections were selected for characterizing bankfull channel dimensions based on the reasons specified in Section 6.1.5.1.2. Stream cross-sections for the unmined segment are depicted in Sheet 13.

#### 6.1.6 General Characteristics of Channel and Valley Morphology

General attributes of channel and valley morphology are quantifiable properties including channel slope, valley slope, and meander geometry (sinuosity, wavelength, amplitude, belt width, and radius of curvature). Channel slope and valley slope represent the difference in vertical elevation over a particular horizontal length. Channel sinuosity is defined as the ratio of stream channel length to down-valley distance. Wavelength, amplitude, belt width, and radius of curvature are meander specific qualities for which the methods of measurement are provided in Appendix B.

Estimates for valley slope were based on the direct measurement of elevational contours indicated on the USGS topographic quadrangle map. Channel slope was derived from longitudinal channel profiles that were field surveyed using a standard surveyor's level/tripod and stadia rod. Meander geometry was determined from the planimetric maps (Sheets 10 and 11) that were developed from field measurements as described in Section 6.1.5.

### 6.1.6.1 Mined Segment

#### 6.1.6.1.1 Valley Slope

Valley slope within the mined study segment was estimated to be approximately 0.5 percent. According to this value, the stream valley within this segment is classified as low gradient.

#### 6.1.6.1.2 Channel Slope

Based on slope measurements along the channel thalweg (i.e., a longitudinal line connecting the deepest parts of a channel), the mined segment of Robinson Fork can be described as a low gradient stream. The overall channel slope within this segment was determined to be 0.63 percent as depicted in Sheet 10.

#### 6.1.6.1.3 Meander Geometry

Values for meander geometry measurements obtained within the mined study segment are as follows:

- wavelength – ranged from 77 to 1,629 feet
- amplitude – ranged from 34 to 297 feet
- belt width – ranged from 79 to 338 feet
- radius of curvature – ranged from 33.2 to 791.0 feet

Additionally, the value for sinuosity within the mined segment was determined to be 1.04.

### 6.1.6.2 Unmined Segment

#### 6.1.6.2.1 Valley Slope

Valley slope within the unmined study segment was determined to be approximately 0.35 percent which is slightly lower than the slope estimated for the mined segment. The stream valley within this segment may therefore be classified as low gradient.

#### 6.1.6.2.2 Channel Slope

Based on slope measurements along the channel thalweg, the unmined study segment of Robinson Fork can be described as a low gradient stream. The overall channel slope within this segment was determined to be 0.38 percent which is lower than the slope calculated for the mined segment. Channel slope for the unmined segment is depicted in Sheet 11.

#### 6.1.6.2.3 Meander Geometry

Values for meander geometry measurements obtained within the unmined study segment are as follows:

- wavelength - ranged from 70 to 323 feet
- amplitude - ranged from 32 to 143 feet
- belt width - ranged from 56 to 162 feet
- radius of curvature - ranged from 13.8 to 118.2 feet

Based on visual comparisons of Sheets 10 and 11, it is obvious that the unmined segment is more sinuous than the mined segment. This is confirmed by the higher value for sinuosity of 1.23 calculated for the unmined segment.

## 6.2 Level I Stream Classification

Specific objectives of the Stream Classification System developed by Rosgen (1996) include the following:

- (1) Predict a rivers behavior from its appearance.
- (2) Develop specific hydraulic and sediment relationships for a given stream type and its state.
- (3) Provide a mechanism to apply site-specific data to stream reaches having similar characteristics.
- (4) Provide a consistent frame of reference for communicating stream morphology and condition.

The classification system consists of four levels of increasing sensitivity and detail (Levels I through IV), and incorporates six general stream types (A through G).

According to an evaluation of general geomorphologic characteristics and stream parameters for the mined and unmined segments, a Level I Stream Classification Type was assigned to each segment. The Level I stream classification serves four primary inventory functions:

- (1) Provide for the preliminary integration of basin characteristics, valley types, and landforms with stream system morphology.
- (2) Provide a consistent, basic framework for organizing stream information and communicating the aspects of river morphology.
- (3) Assist in defining priorities for conducting more detailed assessments and/or companion inventories.
- (4) Correlate similar general level inventories such as fisheries habitat, river boating categories, and riparian habitat with companion stream inventories.

Level I classification criteria consist primarily of channel slope, channel shape, and channel patterns as well as geomorphic watershed features. According to the information discussed in Chapter 6.1, the mined and unmined study segments were classified as Stream Type C. In general, the “C” stream types are located in narrow to wide valleys formed from alluvial deposition. Primary morphological features of the C type stream include a sinuous low relief channel, a well developed floodplain, and characteristic point bars within the active channel. Specific information regarding the category of C type stream that applies to the mined and unmined study areas is provided by the Level II classification discussion in Section 6.4.

### 6.3 Detailed Evaluation of Post-Mining Geomorphologic and Hydrologic Conditions

A detailed assessment of geomorphologic and hydrologic characteristics within the mined and unmined study segments was conducted to assist in determining potential changes that may have occurred due to longwall mining operations. As previously stated, a distance of approximately 2.4 linear miles separates the two segments (Sheet 1). The mined study segment is located approximately 1.3 linear miles south of the limits of mining and the unmined segment is located approximately 1.1 linear miles north of the limits of mining. The mined study segment is approximately 2,068 feet in channel length whereas channel length for the unmined segment is approximately 3,011 feet. Differing channel lengths between the two study segments is primarily the result of sinuosity rather than linear valley length. Selection of the unmined study segment was based on physical and surrounding land use characteristics that were comparable with the mined segment so that meaningful comparisons of current conditions could be made and so that information for the unmined segment could be used to compensate for gaps in the historic data.

The detailed assessment of post-mining geomorphologic and hydrologic conditions ultimately resulted in a Level II stream type classification according to the system defined by Rosgen. Level II stream types are characterized through field measurements from specific channel reaches and fluvial features within the stream valley whereas the broad Level I classification, as described in Sections 6.1 and 6.2, is derived primarily on the basis of the valley landforms and channel dimensions observable on aerial photographs and maps. In contrast to the broad Level I classification, the Level II process is based on more refined criteria in order to resolve specific issues regarding sediment supply, stream sensitivity to disturbance, potential for natural recovery, channel response to changes in flow regime, and habitat potential. These items, which are critical for interpreting substantial variation in stream condition and response to disturbance, are not entirely evident at the Level I classification. In accordance with the detailed requirements of Level II stream classification, data for the post-mining geomorphologic and hydrologic

evaluation within the mined and unmined study segments were obtained directly through field surveying and mapping.

### 6.3.1 Postmining Geomorphology

This section contains detailed information regarding current geomorphic features within the mined study segment and within the unmined segment. Geomorphic data has been presented within the context of Rosgen's Level II stream classification criteria.

#### 6.3.1.1 Identification and Mapping of Bedform Features

Typically, a stream exhibits various bedform features that possess distinct physical and hydrologic properties. For a stream such as Robinson Fork, these bedforms are typically comprised of runs, riffles, glides, and pools. Definitions for these terms are provided in the following list:

- *Run* – A run is a nonturbulent section of channel associated with relatively swift water velocity. The channel slope is relatively low with a definite thalweg, and pavement materials are usually comprised of gravel, cobbles, or boulders. Also, a run section maintains a uniform channel form with no major obstructions and is moderately shallow.
- *Riffle* – A riffle is moderately turbulent with little to no whitewater and is typically elevated at points of channel constriction. Channel materials generally consist of pebbles and cobbles that are partially or totally submerged. The slope of a riffle section is usually less than 4 percent and the channel profile is straight to convex.
- *Glide* – A glide is a nonturbulent section of channel typically associated with low to moderate water velocity, channel pavement materials consisting of sand, pebbles, and cobbles, and a slope of 1 percent or less. Normally, glides are associated with a wide channel lacking a definite thalweg, are situated at the transition between a pool and a riffle, have no major flow obstructions, and are moderately shallow.
- *Pool* – A pool is characterized by very low slope and water velocity and usually occurs along meanders. Pools are normally associated with large-scale channel obstructions, are concave in shape, and exhibit depths greater than runs, riffles, or glides.

Dividing the channel by bedform type was essential for delineating potential changes in physical stream characteristics due to disturbance. The initial field program activity consisted of mapping bedform units for the mined and unmined study segments along the entire channel length of each segment. The beginning and end-points of each bedform unit were flagged for reference as required for conducting the subsequent field studies.

The number and types of bedforms mapped for the geomorphic field studies do not necessarily correlate with the channel units identified for the biological assessment work (Chapter 8.0) primarily because of the differing methodologies used and data objectives. Channel units as defined by Peterson and Rabeni (2001) also consist of runs, riffles, glides, pools, etc. as do bedforms, but are oriented toward work conducted at the subreach level for invertebrate and fish habitat evaluations. Specifically, the technique used to define bedforms for the geomorphic/hydrologic work relied on physical attributes including water depth, velocities, and turbulence at the reach level whereas the subreach differentiation of channel units also considered biological and statistical components at a finer scale. The number of bedforms mapped also differed from the amount of channel units identified due to the differing lengths of channel surveyed for the geomorphologic/hydrologic and biologic assessment phases as indicated in Chapter 1.0. In addition, bedforms could not have been correlated with channel units because of a large-magnitude precipitation event that occurred between the period of biologic and geomorphologic work. As a consequence of the precipitation event, some channel units were modified or transformed.

The locations of bedform units for the mined and unmined study segments that were mapped during the geomorphologic fieldwork are indicated in Sheets 10 and 11. Although the field delineation of channel units was critical for the in-stream habitat work, mapping was not essential and, therefore, are not depicted on the drawings. Photographs of the bedforms for each of the study segments are contained in Appendix A.

#### 6.3.1.1.1 Mined Segment

A total of 14 distinct bedform units were mapped within the mined study segment including 4 runs (MSRR2, MSRR3, MSRR4, and MSRR5); 5 riffles (MSR2, MSR3, MSR5, MSR6, and MSR7); 1 glide (MSG1); and 4 pools (MSP1, MSP2, MSP3, and MSP5). Specific information regarding bedform dimensions and proportions is provided in Section 6.3.2.2.4.

#### 6.3.1.1.2 Unmined Segment

The unmined study segment contains substantially more bedform units (46) in comparison to the mined segment. It must be considered, however, that approximately 950 feet of additional channel was mapped within the unmined segment because of increased meandering. Bedform units mapped within the unmined study segment consisted of 15 runs (RR1 through RR15), 11 riffles (R1 through R11), 4 glides (G1 through G4), and 16 pools (P1 through P16). Information regarding bedform dimensions and proportions is provided in Section 6.3.2.2.4.

### 6.3.1.2 Delineation of Flood-Prone Areas

The approximate extent of flood-prone areas was based on measurements obtained from cross-sectional Transects A-A' through L-L' during entrenchment ration determinations. Flood-prone area widths surveyed along these transects served as control points for floodplain delineation. Upon plotting these points on a base map, elevation contours were evaluated to complete the delineation of flood-prone areas. Flood-prone areas for the mined and unmined segments are similar and are associated with floodplains that are well defined and extensive adjacent to banks opposite the hill slope. Areas susceptible to flooding for the mined and unmined stream segments are depicted in Sheets 14 and 15, respectively.

### 6.3.1.3 Description of Bank Materials and Dimensions

Bank materials relates to the classification of unconsolidated sediments and/or bedrock of which the stream bank is composed. Bank dimensions consist of the height of the bank as measured from the thalweg and the slope of the bank measured in degrees from horizontal. These studies are essential for evaluating bank stability.

Lithologic descriptions for bank materials were generated using a grain-size chart, a hand-lens, and a trowel. Bank height was determined using a standard 6-foot rule in conjunction with a hand level and slope was determined using a clinometer that was affixed to a planar surface to compensate for subtle irregularities. Bank materials, height, and slope were determined at approximate 50-foot intervals along the entire length of channel within the mined and unmined study segments.

#### 6.3.1.3.1 Mined Segment

Bank materials within the mined study segment consist predominantly of unconsolidated colluvial and alluvial soils with subordinate outcroppings of bedrock. The colluvial soil consists mainly of hybrid materials reflecting various mixtures of clay, silt, and sand with some fragments of weathered bedrock. The alluvial material is more coarse and contains a greater percentage of sand, pebbles, and cobbles. Submerged and subaerial bedrock outcrops are comprised primarily of very thin to thinly bedded, very fine to fine grained, competent sandstone and infrequent outcrops of weathered shale.

Bank heights within the mined segment range from 1.5 feet along the west bank of Pool MSP3 to 5.9 feet along the east bank of Pool MSP5. The average bank height within the mined study segment is approximately 3.7 feet based on a total of 86 measurements.

Bank slopes within the mined segment range from 14 degrees (west bank of Riffle MSR2) to 90 degrees (west bank of Pool MSP1, east bank of Riffle MSR3, west bank of Run MSRR3, west bank of Run

MSRR5, east bank of Riffle MSR6, east and west banks of Pool MSP5, and east and west banks of Riffle MSR7). The average bank slope is approximately 49 degrees according to a total of 105 measurements.

Detailed bank material, bank height, and bank slope data specific to each 50 foot interval evaluated are indicated in Table 6-1. Locations of the interval transects are depicted in Sheet 16. Additionally, Sheet 17 illustrates the locations of bedrock outcrops and associated lithologies. Areas of bank instability based on this information and field observations is discussed in Section 6.3.1.4 and Chapter 8.0.

#### 6.3.1.3.2 Unmined Segment

Similar to the mined segment, bank materials within the unmined study segment consist predominantly of unconsolidated colluvial and alluvial soils with subordinate outcroppings of bedrock. The colluvial soil consists mainly of hybrid materials reflecting various mixtures of clay, silt, and sand. The alluvial material is similar to the colluvium and is finer than that observed within the mined segment. Submerged and subaerial bedrock bank outcroppings are substantially less conspicuous within the unmined study segment. Bedrock outcrops within the unmined segment consist of very thin to thinly bedded, very fine to fine grained, competent sandstone and siltstone.

Bank heights within the unmined segment range from 1.9 feet along the east bank of Run RR3 to 6.5 feet along the west bank of Pool P11. The average bank height within the unmined study segment is approximately 3.9 feet based on a total of 112 measurements.

Bank slopes within the unmined segment range from 6 degrees (west bank of Run RR13) to 90 degrees (east and/or west bank of 27 transects). The average bank slope is approximately 50 degrees according to a total of 191 measurements.

Detailed bank material, bank height, and bank slope data specific to each 50 foot interval evaluated are indicated in Table 6-2. Locations of the interval transects are depicted in Sheet 16. Additionally, Sheet 17 illustrates the locations of bedrock outcrops and associated lithologies. Areas of bank instability, based on this information and field observations, is discussed in Section 6.3.1.4 and Chapter 8.0.

#### 6.3.1.4 Stream Bank Stability

Although bank erosion is a natural process, there are several factors that control the lateral migration rates of a stream channel. These factors include: 1) bank height versus bankfull depth; 2) the ratio of riparian vegetation rooting to stream bank height; 3) rooting density; 4) composition of stream bank materials; 5)

stream bank angle; 6) bank material stratigraphy; and 7) degree of bank protection by vegetation and debris.

In general, Sheet 17 indicates that both the mined and unmined study segments exhibit problem areas of bank instability. Aside from vegetative factors, there are some areas within the mined segment that are highly susceptible to bank erosion. For example, a measured portion along the cut bank within Pool MSP5 exhibited a bank height versus bankfull depth ratio of approximately 2.1, a slope of 90 degrees, and was associated with fine-grained material, although stratification was negligible. Similarly, within the unmined segment, there are portions of stream bank that are potentially vulnerable to accelerated erosion. Measurements obtained along the east bank of Pool P3, for instance, indicate a bank height versus bankfull depth ratio of approximately 1.8, a slope of 90 degrees, and a fine particle size with some stratification.

Bank stability, including vegetative factors and classification by a numeric ranking system, is further discussed in Chapter 8.0. Areas of bank instability are depicted in Sheet 17.

#### 6.3.1.5 Bank and Channel Aggradation

Aggradation is defined as the process of building up a surface; in this case, by deposition of sediment load. Channel aggradational features were identified, mapped, and measured within the mined and unmined study segments to assess whether longwall mining activities resulted in notable changes in depositional processes. Depositional features were mapped in the field and the dimensions were obtained directly with a tape measure. These activities were conducted along the entire channel length for the mined and unmined study segments. The spatial distribution of aggradational features for the mined and unmined study segments is depicted to scale in Sheet 17. Selected photographs of these features are provided in Appendix A.

##### 6.3.1.5.1 Mined Segment

Eight prominent areas of sediment deposition were mapped within the mined study segment which consist primarily of point bar type deposits. These areas constitute: 1) one mouth bar at the confluence of Robinson Fork and an unnamed tributary at the southern end of the mined segment; 2) five areas of point bar type deposition; 3) one channel bar; 4) and one flanking bar. The surfaces of most bars were composed primarily of coarse materials (cobbles, pebbles, and sand) and one bar was formed almost entirely of vegetative detritus. The point, flanking, and mouth bar deposition are associated with an aggrading stream bank whereas the channel bar reflects in stream deposition.

#### 6.3.1.5.2 Unmined Segment

Sediment deposition was mapped for 21 distinct areas within the unmined study segment. These areas mainly represented point bar type deposits with lesser amounts of channel and flanking bars. Specifically, the mapped areas included the following: 1) 15 areas of point bar type deposition; 2) 4 channel bars; and 3) 2 flanking bars. The surfaces of most bars were composed primarily of coarse materials (cobbles, pebbles, and sand). The point and flanking bar deposition reflects an aggrading stream bank whereas the channel bar is related to in stream deposition.

#### 6.3.1.6 Bank and Channel Degradation

Degradation within a fluvial context refers to the removal of material through erosion and transportation by flowing water. Bank and channel degradational features were identified, mapped, and measured within the mined and unmined study segments to assess potential changes in erosional processes that may have resulted from longwall mining activities. Erosional features were mapped in the field and the dimensions were obtained directly with a tape measure. These activities were conducted along the entire channel length for the mined and unmined study segments. The spatial distribution of degradational features for the mined and unmined study segments is depicted to scale in Sheet 17. Selected photographs of these features are provided in Appendix A.

##### 6.3.1.6.1 Mined Segment

Four distinct areas of bank erosion were identified within the mined study segment. Degradation consists of bank undercutting that is likely occurring during periods of elevated discharge. A cumulative length of approximately 640 feet of the east and west channel bank has been subject to erosional undercutting. In addition to bank erosion, three elevated stage erosional back channels are developed within the mined segment. The back channels are approximately 65, 190, and 260 feet in length. The back channel that is 260 feet in length is located along the east bank of Pool MSP1 and is separated from the main channel by an intervening “bar” that is vegetated including large trees. Because of the growth of mature trees, this bar possibly represents a portion of the former stream bank that was incorporated into the channel due to the widening of Pool MSP1. Also, it is highly likely that this bar is inundated during episodes of elevated channel stage because of the presence of alluvial surface materials.

##### 6.3.1.6.2 Unmined Segment

Bank erosion was identified for 15 distinct areas within the unmined study segment and is primarily associated with meander cut banks. Degradation consisted of bank undercutting and/or slumping that is likely attributed to periods of elevated discharge. A cumulative length of approximately 1,160 feet of the east and west channel bank has been affected by erosional undercutting and/or slumping. In addition to

bank erosion, two elevated stage erosional back channels are developed within the unmined segment. The back channels are approximately 37 and 40 feet in length.

#### 6.3.1.7 Channel Cross-Sectional Morphology

Cross-sectional morphology is a lateral representation of the channel shape that is beneficial for calculating total and wetted channel areas and for determining the degree of channel entrenchment within the parent valley. Lateral channel morphology was determined through the completion of cross-sectional transects that were oriented perpendicular to the channel extended to the bankfull stage elevations. Transect measurements were conducted using field surveying methods that employed a standard surveyor's level/tripod and stadia rod, and a tape measure. A total of 13 stream cross-sectional transects were completed which included 6 along the mined segment (A-A' through F-F'), 6 along the unmined segment (G-G' through L-L'), and one along a tributary associated with the unmined segment (M-M'). The tributary was surveyed to compensate for its flow contribution in the surface water discharge calculations. In order to provide a comprehensive assessment of cross-sectional channel morphologies, two run, two riffle, and two pool sections were surveyed within each of the mined and unmined study segments. Locations for the cross-sectional transects along Robinson Fork were selected according to the identification of bedform units that were physically representative of the mined and unmined study segments. The tributary transect was located near the confluence with Robinson Fork to provide an accurate determination of discharge contribution. Cross-sectional profiles for the mined and unmined segments are depicted in Sheets 12 and 13 respectively.

##### 6.3.1.7.1 Mined Segment

As expected, cross sectional morphologies within the mined study segment indicate that the pool sections attain the greatest water depth with the riffles and runs being much more shallow. Maximum channel depths for the surveyed sections (thalweg to bankfull) indicate depths of approximately 4.4 feet (Pool MSP1), 2.6 feet (Pool MSP3), 4.1 feet (Riffle MSR2), 4.2 feet (Riffle MSR7), 3.9 feet (Run MSRR2), and 4.3 feet (Run MSRR4). Lateral channel bottom morphology within the pool sections exhibits a well-defined concave shape whereas the riffles and runs display a subtly concave, to flat, to slightly convex (Riffle MSR7) shape.

##### 6.3.1.7.2 Unmined Segment

Comparable to the cross-sectional morphologies within the mined study segment, the lateral channel profiles within the unmined segment indicate that pool sections attain the greatest water depth with the riffles and runs being shallower. Maximum channel depths for the surveyed sections (thalweg to bankfull) indicate depths of approximately 2.8 feet (Pool P1), 3.0 feet (Pool P4), 3.7 feet (Riffle R6), 3.5

feet (Riffle R10), 3.1 feet (Run RR4), and 3.6 feet (Run RR12). Lateral channel bottom morphology within the pool sections exhibits a well-defined concave shape whereas the riffles and runs display a more subtle concave, to flat, to slightly convex (Riffle R10) shape. As reflected in the channel cross-sections (Sheets 12 and 13) and the planimetric channel views (Sheets 10 and 11), the overall bankfull channel widths are narrower within the unmined segment which is possibly attributed to the unmined segment's position closer to the headwaters of Robinson Fork. Bankfull channel widths for the mined and unmined study segments are provided in Tables 6-1 and 6-2, respectively.

#### 6.3.1.8 Morphology of Longitudinal Channel Profile

A longitudinal stream profile is a survey along the length of the stream channel that provides information regarding differences in elevation for the channel bottom and water surface between surveyed points. Differences in elevation are then used to calculate slopes for the channel bottom and water surface. Longitudinal profiles for the channel bottom (thalweg) and water surface were completed along the entire length of the mined and unmined study segments.

The methods used for conducting the longitudinal profile measurements consisted of using a surveyor's level/tripod and stadia rod to determine differences in elevation along with a measuring tape to determine distances between surveyed points. Several survey stations were used within each study segment which were selected dependent upon the particular bedform unit(s) to be surveyed, vegetative and topographic obstructions, and distance as related to sighting accuracy. Select pools, riffles, and runs were surveyed individually to determine specific slopes for these bedforms whereas other units were integrated for surveying purposes. All surveying activities were conducted in-stream and distances were measured relative to the channel centerline. Surveying stations are indicated in Sheets 10 and 11. Also during the longitudinal surveying work, bankfull widths (Tables 6-1 and 6-2) were measured at intervals of approximately 50 feet or less and channel directional bearings were obtained. Additionally, Global Positioning System coordinates were periodically reviewed for confirming station positions.

##### 6.3.1.8.1 Mined Segment

The average downstream water surface slope for riffle segments surveyed individually was 0.75 percent with a maximum of 0.95 percent (Riffle Sections MSR2 and MSR3). An average water surface slope of 0.48 percent was measured for individual run and glide sections with a maximum of 0.90 percent (Run MSRR4). Pool sections surveyed separately exhibited the lowest water surface slope with an average of 0.02 percent and a maximum slope of 0.03 percent (Pool MSP3). The overall downstream water surface slope within the mined study segment was 0.44 percent.

The average downstream slope of the channel bottom (thalweg) for individual riffle sections decreased at 0.72 percent with a maximum decrease of 0.88 percent (Riffle Sections MSR2 and MSR3). The bottom slope for Run MSRR4 decreased downstream at 0.60 percent whereas the Run MSRR2, Run MSRR3, and Glide MSG1 section increased downstream (0.41 percent). Pool segments had an average downstream bottom slope of 0.69 percent with a maximum of 1.67 percent (Pool MSP1). An overall downstream channel bottom slope of 0.63 percent was determined for the mined study segment.

The water surface and channel bottom slopes are representative of a low gradient stream. Longitudinal profiles for the mined segment are depicted in Sheet 10.

#### 6.3.1.8.2 Unmined Segment

The average downstream water surface slope for riffle segments surveyed individually was 1.14 percent with a maximum of 2.04 percent (Riffle Section R2). An average water surface slope of 0.15 percent was measured for individual run and glide sections with a maximum of 0.45 percent (Run RR6). Pool sections surveyed separately exhibited the lowest water surface slope with an average of less than 0.10 percent and a maximum slope of 0.09 percent (Pool P3). The overall downstream water surface slope within the unmined study segment was 0.37 percent.

The average downstream slope of the channel bottom for individual riffle sections decreased at 1.54 percent with a maximum decrease of 2.68 percent (Riffle Section R2). The bottom slope for Riffle R5 increased slightly downstream (0.07 percent). For individual runs and glides, the average downstream bottom slope decreased at 0.57 percent. Runs RR1 and RR12 were associated with downstream increases in channel bottom slope of 0.04 and 0.23 percent, respectively. Pool P3 has a downstream bottom slope decrease of 0.08 percent whereas Pools P4, P8, and P14 exhibit respective downstream slope increases of 0.18, 0.35, and 0.84 percent. An overall downstream channel bottom slope of 0.38 percent was determined for the unmined study segment.

The water surface and channel bottom slopes are representative of a low gradient stream. Longitudinal profiles for the unmined segment are depicted in Sheet 11.

#### 6.3.1.9 Mean Stream Depth and Maximum Stream Depth

For Level II stream classification purposes, mean stream depth refers to the depth of the stream channel cross section, at bankfull stage elevation, measured in a riffle section. Maximum stream depth refers to the depth of the bankfull channel cross-section (distance between the bankfull stage and thalweg elevations) in a riffle section (Rosgen, 1998). Mean and Maximum stream depths were calculated for

riffle sections because this type of section is generally free to adjust its boundaries in response to frequent flows and does not have excessive deposition or constrictions. Mean and Maximum depths were determined along two riffle section transects within the mined study segment (B-B' and F-F') and two riffle transects within the unmined study segment (I-I' and L-L'). The locations of these transects are indicated in Sheets 10 and 11. Calculations for mean stream depth are contained in Appendix B. Maximum stream depth was determined from the cross-sectional profile data (Sheets 12 and 13). This section also provides water depth information that was collected during the hydrologic field studies. Water depth information is presented in Tables 6-1 and 6-2.

#### 6.3.1.9.1 Mined Segment

Mean stream depths calculated for the mined study segment ranged from 3.29 (F-F') to 4.03 (B-B') feet with an average of 3.66 feet. Values for maximum stream depth ranged from 4.1 feet (B-B') to 4.2 feet (F-F') with an average of 4.15 feet. The average maximum water depth (thalweg) within the mined segment was 1.05 feet. Maximum water depths specific to bedform units averaged: pools 1.84 feet; runs/glides 0.63 feet; and riffles 0.51 feet. Water depth measurements were performed on August 1 and 2, 2001.

#### 6.3.1.9.2 Unmined Segment

Mean stream depths calculated for the unmined study segment ranged from 2.98 (L-L') to 3.00 (I-I') feet with an average of 2.99 feet. Values for maximum stream depth ranged from 3.5 feet (L-L') to 3.7 feet (I-I') with an average of 3.6 feet. The average maximum water depth (thalweg) within the unmined segment was 0.72 feet. Maximum water depths specific to bedform units averaged: pools 1.04 feet; runs/glides 0.60 feet; and riffles 0.62 feet. Water depth measurements were performed on August 3, 6, and 7, 2001.

#### 6.3.1.10 Channel Sediment Thicknesses

Channel sediment thickness within the mined and unmined study segments was measured at intervals of 50 feet or less to assist in determining whether longwall mining operations have affected depositional processes. Sediment thickness was measured using an incremented steel pipe that was driven with a sledge-hammer to refusal. Measurements were initially obtained from the top of sediment to the water surface to allow sediment thickness to be determined relative to the water surface. Channel sediment thickness data are presented in Tables 6-1 and 6-2. Stations at which sediment thickness was measured are depicted in Sheet 16.

#### 6.3.1.10.1 Mined Segment

For the general bedform units, sediment thicknesses ranged from less than 0.05 to 2.35 feet (riffles), less than 0.05 to 2.94 feet (runs/glides), and 0.27 to 3.88 feet (pools). Average sediment thicknesses were 0.92 feet (riffles), 0.95 feet (runs/glides), and 1.5 feet (pools).

#### 6.3.1.10.2 Unmined Segment

Sediment thicknesses within the general bedform units ranged from 0.08 to 2.74 feet (riffles), 0.01 to 3.25 feet (runs/glides), and 0.10 to 2.57 feet (pools). Average sediment thicknesses were 1.08 feet (riffles), 1.13 feet (runs/glides), and 1.16 feet (pools).

#### 6.3.1.11 Description of Channel Materials

The general composition of channel pavement materials was mapped at intervals of 50 feet or less within the mined and unmined study segments to provide a fundamental indication of particle size range and distribution. Survey stations are indicated in Sheet 16 and general channel materials data are provided in Tables 6-1 and 6-2. Specific grain-size distribution information was obtained from the pebble count activities that are discussed in Section 6.3.1.12.

As part of the description of channel materials, three core samples of channel subpavement were obtained within Pool MSP3 and Run MSRR4 (mined study segment) and from Pool P2 (unmined segment). Due to difficulty in penetrating the substrate materials, coring at additional locations was not conducted. The locations and descriptions for core samples are indicated in Sheet 17. Subpavement materials for Run MSRR4 and Pool P2 exhibit varying percentages of pebbles, sand, silt, and clay. Subpavement materials at the core location within Pool MSP3 consist of gray silt and clay with some black organic material within the 0- to 1-foot depth interval and from a depth of 1 to 2 feet, a yellowish-brown silty to sandy clay with some pebbles and black organic material is present. The core sample obtained from Pool MSP3 reflects a change from an intermediate to a low energy flow regime (Run MSRR4 to Pool MSP3). The gray to black coloration of the silt and clay from 0 to 1 foot within Pool MSP3 is likely imparted from slowly decaying vegetative matter deposited with this layer and may be associated with reducing, or anoxic, conditions typical of the pool bedform low energy flow environment.

#### 6.3.1.12 Pebble Count

Channel bed and bank materials influence the cross-sectional form, plan-view, and longitudinal profile of streams, determine the extent of sediment transport, and furnish the means of resistance to hydraulic stress. Also, for interpreting the biological function and stability of streams, an evaluation of the types and distribution of channel materials is crucial (Rosgen, 1996). In order to quantitatively characterize

channel bed materials, a pebble count was conducted according to the modified Wolman Method (Wolman, 1954; Rosgen, 1993a).

The modified Wolman Method represents a systematic approach to particle sampling based on the frequency (cumulative areal percentage) of bedform unit types that occur within a particular section of stream. The method recommends evaluating an area that is approximately 20 to 30 bankfull channel widths in length (or two meander wavelengths), a minimum of 10 sampling transects along this length, and a minimum of 10 samples along each transect. Because the mined and unmined segments were greater than 20 to 30 bankfull channel widths in length, the recommended method length was increased to apply to the longitudinal extent of each study segment. Specifically, the cumulative areas for riffles, runs/glides, and pools were determined and then divided by the total stream area to obtain overall areal percentages for each of these types of bedforms. Because the method specifies a minimum of 10 transects within a length of 20 to 30 bankfull-widths, the number of 30 bankfull-width lengths contained within the mined and unmined study segments was determined using the measured mean bankfull width for each segment. The number of 30 bankfull-width lengths multiplied by 10, therefore, equaled the number of pebble count transects completed within the mined and unmined study segments. The amount of transects assigned to a particular type of bedform unit was distributed on a proportional basis according to the cumulative percentage of area for each type of unit. Additionally, the 10 sampling locations along each transect were proportionally selected (evenly spaced) based on the transect-specific bankfull channel width, and samples were collected using the “first blind-touch” method.

Raw pebble count field data is presented in Tables 6-3 and 6-4 . Cumulative percent plots of the pebble count data are provided in Sheet 18. The locations of pebble count transects indicated on Sheet 19.

#### 6.3.1.12.1 Mined Segment

Along the mined study segment, 20 transects perpendicular to the channel (PT1 through PT20) were completed that resulted in the collection and measurement of 200 particle samples. Seven transects were located within riffle sections, 6 transects were completed within runs/glides, and 7 transects were located along pool sections. Sheet 18 indicates that the  $D_{50}$  particle size (50 percent of the sampled population is equal to or finer than the representative particle diameter) for the entire mined study segment is equivalent to 21.1 millimeters (medium gravel). The  $D_{50}$  particle sizes for individual bedform units is 53.7 millimeters (very coarse gravel) for riffle sections, 21.6 millimeters (medium gravel) for run/glide sections, and 3.1 millimeters (very coarse sand) for pool sections as depicted in Sheet 18.

#### 6.3.1.12.2 Unmined Segment

Particle size and distribution data for the unmined study segment were similar to the results obtained for the mined segment. Specifically, 46 transects perpendicular to the channel (UPT1 through UPT46) were completed along the unmined segment that resulted in the collection and measurement of 460 particle samples. Seven transects were located within riffle sections, 25 transects were completed within runs/glides, and 14 transects were located along pool sections. Sheet 18 indicates that the  $D_{50}$  particle size for the entire unmined study segment is equivalent to 19.6 millimeters (medium gravel). The  $D_{50}$  particle sizes for individual bedform units is 56.9 millimeters (very coarse gravel) for riffle sections, 21.3 millimeters (medium gravel) for run/glide sections, and 5.7 millimeters (very fine gravel) for pool sections as depicted in Sheet 18.

#### 6.3.1.12.3 Particle Size in Relation to Stream Power

Stream power estimates were derived according to the procedures specified in the document “Stream Corridor Restoration” (Federal Interagency Stream Restoration Working Group, 2001). Stream power was calculated according to the following formula:

$$\phi = \gamma Q S$$

Where:

$\phi$  = Stream Power (foot-lbs/second-foot)

$\gamma$  = Specific Weight of Water (lbs/ft<sup>3</sup>)

Q = Discharge (ft<sup>3</sup>/second)

S = Slope (feet/feet)

As expected based on channel slope and surface water discharge data, stream power is greater within the mined study segment. At the time of the study, maximum stream power in this segment was approximately 3.18 foot-lbs/second-foot (Riffle MSR2) whereas an overall stream power estimate of 1.13 foot-lbs/second-foot was determined for the mined segment. Within the unmined segment, the maximum stream power was associated with Riffle R10 (approximately 1.28 foot-lbs/second-foot) with an overall stream power estimated at 0.49 foot-lbs/second-foot. These results indicate that the energy available for transporting sediment is greater in the mined segment and correlate with the finding that the  $D_{50}$  particle size for the mined segment (21.1 millimeters) was slightly larger than that within the unmined segment (19.6 millimeters).

### 6.3.2 Postmining Hydrology

This section contains detailed information regarding current hydrologic features within the mined study segment and within the unmined segment. Hydrologic data has been presented within the context of Rosgen's Level II stream classification.

#### 6.3.2.1 VLF Screening

The location and orientation of bedrock fracture zones is critical for modeling fluid flow in fractured rocks. In order to compare the degree of natural bedrock fractures versus fractures that may have been induced or enhanced by subsidence related to longwall mining, VLF screening was conducted along the mined and unmined study segments. Chapter 4.0 presents a detailed discussion of the results provided from this screening program.

#### 6.3.2.2 Quantification of Hydrologic Parameters

##### 6.3.2.2.1 Entrenchment Ratio

Entrenchment is qualitatively defined as the vertical containment of a stream and the degree to which it is incised in the valley floor (Kellerhalls et al. 1972). The term "entrenchment ratio" which refers to the vertical containment of a stream, was quantitatively defined by Rosgen (1994). In general, the entrenchment ratio is the ratio of the width of the flood-prone area to the surface width of the bankfull channel (Rosgen, 1996). Quantitative determination of entrenchment allows the delineation of flood-prone areas that are related to frequent flood events. As recommended by Rosgen, entrenchment ratios were calculated for riffle sections because this type of section is generally free to adjust its boundaries in response to frequent flows and does not have excessive deposition or constrictions. Entrenchment ratios were determined along two riffle section transects within the mined study segment (B-B' and F-F') and two riffle transects within the unmined study segment (I-I' and L-L'). The locations of entrenchment ratio transects are indicated in Sheets 10 and 11. Calculations for entrenchment ratio are contained in Appendix B.

Entrenchment ratios for the mined study segment ranged from 4.4 (B-B') to 7.8 (F-F'). Within the unmined segment, entrenchment ratios were comparable and ranged from 5.0 (I-I') to 11.1 (L-L'). These ratios reflect a slightly entrenched channel.

##### 6.3.2.2.2 Width/Depth Ratio

The width/depth ration is defined as the ratio of the bankfull surface width to the mean depth of the bankfull channel (Rosgen, 1996). The width/depth ratio is essential for discerning the distribution of

available energy within a channel and the capability of various discharges occurring within the channel to move sediment. This ratio is the most sensitive and positive indicator of trends in channel instability (Rosgen, 1996). For reasons previously discussed, width/depth ratios were determined from measurements obtained along riffle sections that included Transects B-B' and F-F' within the mined study segment and I-I' and L-L' along the unmined study segment. The locations of width/depth ratio transects are depicted in Sheets 10 and 11. Calculations for the width/depth ratios are provided in Appendix B.

Width/depth ratios for the mined study segment ranged from 7.9 (B-B') to 14.9 (F-F'). Within the unmined segment, width/depth ratios were ranged from 10.7 (I-I') to 7.4 (L-L').

As discussed by Rosgen (1996), the distribution of energy within channels having high width/depth ratios (i.e., shallow and wide channels) is such that stress is placed within the near bank region. As the width/depth ratio value increases (i.e., the channel grows wider and more shallow), the hydraulic stress against the banks also increases and bank erosion is accelerated. Increases in the sediment supply to the channel develop from bank erosion and, as a result of becoming an over widened channel, gradually loses its capability to transport sediment. Deposition then occurs, further accelerating bank erosion. Consequently, stream bank erosion and depositional processes appear to be the most dynamic within the mined study segment containing cross section F-F' (Sheets 10 and 17).

#### 6.3.2.2.3 Mean Surface Water Velocity and Discharge

Mean surface water velocity was measured at Transects A-A' through F-F' within the mined study segment, at Transects G-G' through L-L' within the unmined segment, and at Transect M-M' along the tributary to Robinson Fork within the unmined segment. Surface water velocity values reflect an average of velocity measurements across the wetted channel. Measurements were performed using a Global Flow Probe Model FP101 velocity meter. Water velocity values, in conjunction with the wetted-channel cross-sectional areas, were used to calculate surface water discharge values for each transect. Surface water velocity and discharge values are provided in Table 6-5. Calculations for surface water discharge are contained in Appendix B.

Surface water velocities typically vary depending on such variables as channel dimensions, channel slope, and position within the channel planform (i.e., meander bend or straight reach). Regarding bedform units, riffles and runs exhibit higher water velocities than pools. Water velocities within the mined study segment ranged from less than 0.1 foot per second within Run MSRR4 and Pools MSP1 and MSP3, to 1.05 feet per second for Riffle MSR2. Average surface water velocity within the mined segment was

approximately 0.4 foot per second. Within the unmined segment, surface water velocities ranged from 0.12 foot per second for Pool P1 to 1.68 feet per second within Run RR4. Surface water velocity for the tributary that enters the unmined segment was 0.11 foot per second. Average water velocity within the unmined segment was approximately 0.8 foot per second.

Surface water discharge volumes were variable and suggest losing segments within both the mined and unmined study segments. As indicated in Table 6-5, surface water discharge at the northern end of the mined study segment was 2.5 cubic feet per second (Riffle MSR7) and decreased downstream to 0.2 and less than 1.6 cubic feet per second within Run MSRR4 and Pool MSP3 respectively. Downstream discharge then increased to 3.0 cubic feet per second at Run MSRR2 and continued to increase through the end of the mined segment. Similarly, surface water discharge at the northern end of the unmined study segment increased downstream from Pool P1 through Run RR4 (2.0 and 2.5 cubic feet per second, respectively), but declined within Riffle R6 (1.7 cubic feet per second). Downstream discharge then increases to 3.7 cubic feet per second (Pool P4) before declining at Run RR12 and Riffle R10. The contribution from the tributary that enters the unmined segment upstream of Run RR12 and Riffle R10 was 0.02 cubic feet per second.

Based on the VLF survey and lineament study discussed in Chapter 4.0 as related to surface water discharge, several bedrock fractures were identified within the mined and unmined study segments. Bedrock fractures extending to the surface often function as a conduit that results in the loss of surface water. No sections of nonflowing (dry) channel were observed during the entire course of the field program. As previously discussed, the field program was conducted during the months of July and August, which were relatively dry, and precipitation for 2001 has been below normal.

Sheet 20 depicts the relationship between stream discharge, longwall mining panels, and bedrock fracture zones for the mined study segment and between stream discharge and bedrock fracture zones for the unmined segment. Within the mined segment, the loss of surface water discharge between Transects D-D' and F-F', including intervening Transect E-E', may be associated with the location of this segment above a longwall panel where an increase in bedrock subsidence fractures would be expected. Transect E-E' is situated above the approximate center of that panel in a probable area of maximum subsidence. Also, bedrock fracture lineaments (some which intersect) are present in this area as well as a VLF anomaly (suspected but unconfirmable bedrock fracture) near Transects D-D' and E-E'. The gain in surface water discharge between Transects B-B' and D-D' is likely due to the location of this segment above and slightly beyond the upstream and downstream sides of a deep mine gate. This is an area where

subsidence related bedrock fractures are least likely to develop. An intersection of bedrock fracture lineaments and a VLF anomaly, however, are located in proximity and north of the gate.

Within the unmined segment, the overall gain in surface water discharge between Transects G-G' and J-J' can probably be attributed to poor communication with the fracture lineament that underlies this segment. The loss in surface water discharge between Transects J-J' and K-K' may result from the proximity of VLF identified fractures and the intersection of fracture lineaments within this segment. Increased surface water discharge from Transects K-K' to L-L' suggests poor communication with the VLF recorded fracture and fracture lineaments identified within and near this segment.

#### 6.3.2.2.4 Channel Proportions

A total of 14 bedform units were identified and mapped within the mined study segment. Cumulatively, these units have an average length of 147.7 feet. The largest bedform unit is Pool MSP1 with a bankfull surface area of approximately 15,068 square feet. Based on a direct percentage of bedform unit types, the distribution of units within the mined segment is: riffles (35.7 percent); runs/glides (35.7 percent); pools (28.6 percent). However, according to bankfull surface area for the mined segment (approximately 72,067 square feet), pools constitute approximately 36.9 percent (26,626 square feet), riffles 34.3 percent (24,701 square feet), and runs/glides 28.8 percent (20,740 square feet). Pool to pool spacing within the mined segment ranged from approximately 300 to 400 feet.

Within the unmined study segment, 46 bedform units were identified and mapped. These units attain an average length of 65.5 feet. The largest bedform unit is Run RR15 with a bankfull surface area of approximately 4,538 square feet. The direct percentage of bedform unit types within the unmined segment is: runs/glides (41.3 percent); pools (34.8 percent); and riffles (23.9 percent). Based on bankfull surface area for the unmined segment (approximately 67,017 square feet), runs/glides comprise approximately 54.8 percent (36,695 square feet), pools 29.9 percent (20,053 square feet), and riffles 15.3 percent (10,269 square feet). Spacing between pools within the unmined segment ranged from approximately 20 to 680 feet.

The average bankfull channel width for pools within the mined study segment is 32.1 feet. Average bankfull channel widths for riffles and runs/glides within this segment are 35.7 feet and 36.0 feet, respectively. The average bankfull channel width for the entire mined segment 34.7 feet.

Within the unmined study segment, the average bankfull channel width for pools is 22.8 feet. The average bankfull channel width for riffles and runs/glides for this segment is 22.2 feet. Average bankfull channel width for the entire unmined segment 22.4 feet.

Bedform units are identified and depicted to scale in planimetric view in Sheets 10 and 11. A summary of bankfull channel widths is provided in Tables 6-1 and 6-2.

#### 6.4 Level II Stream Classification

According to an evaluation of specific stream parameters determined for the mined and unmined segments, a Level II Stream Classification Type was assigned to each segment based on the system developed by Rosgen (1996). In comparison to the broad Level I classification, the Level II classification provides a more detailed morphological description of stream types that is ascertained from field determined information. The Level II classification process uses more finely resolved criteria in order to address issues related to sediment supply, stream sensitivity to disturbance, potential for natural recovery, channel response to changes in flow regime, and fish habitat potential. Specific objectives for the stream classification systems introduced by Rosgen were previously described in Section 6.2.

The stream parameters upon which the Level II Classification is based are indicated in the following list:

- Bankfull width (riffle section)
- Mean depth (riffle section)
- Bankfull cross-sectional area (riffle section)
- Width/depth ratio (riffle section)
- Maximum depth (riffle section)
- Width of flood-prone area (riffle section)
- Entrenchment ratio (riffle section)
- Channel materials ( $D_{50}$  in millimeters)
- Water surface slope
- Channel sinuosity

Level II Classification Forms developed by Rosgen (1998) for the mined and unmined study segments are contained in Appendix C. The Forms provide values for the previously identified stream parameters and indicate the stream type classification.

As indicated by the Level II Classification Forms in Appendix C, the mined and unmined segments were classified as Stream Type C4. The C4 designation represents a best-fit classification based on an evaluation of the critical parameters. Specifically, a majority of parameter values coincide with the C4

stream type as defined by Rosgen, although some values are slightly beyond the expected ranges. The data characteristics, however, indicate that other stream types can be excluded.

In general, the “C” stream types are located in narrow to wide valleys formed from alluvial deposition. The C4 stream type has a gradient of less than 2 percent, displays a high width/depth ratio, and is slightly more sinuous than the C1, C2, and C3 stream types. Stream banks are generally composed of unconsolidated, heterogeneous, noncohesive, alluvial materials that are finer than the gravel dominated bed material. The C4 stream type is also characterized by point bars and other depositional features and is very susceptible to shifts in both lateral and vertical stability caused by direct channel disturbance. There is no evidence to support that the mined, or unmined, study segments are undergoing a change in stream type.

**Table 6-1**  
**Summary of Sedimentological and Stream Bank Data<sup>(1)</sup>**  
**Mined Segment**  
**Robinson Fork**  
**West Finley Township, Washington County, Pennsylvania**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
Transect A-A'	41	2.98	ND <sup>(4)</sup>	4.4	ND	ND	ND	Measured 7/23/01, Pool MSP1
Transect B-B'	35	0.50	ND	4.1	ND	ND	ND	Measured 7/23/01, Riffle MSR2
Transect C-C'	40	0.52	ND	3.9	ND	ND	ND	Measured 7/23/01, Run MSRR2
Transect D-D'	26	1.31	ND	2.6	ND	ND	ND	Measured 7/23/01, Pool MSP3
Transect E-E'	45	0.56	ND	4.3	ND	ND	ND	Measured 7/23/01, Run MSRR4
Transect F-F'	52	0.42	ND	4.2	ND	ND	ND	Measured 7/23/01, Riffle MSR7
LP0 <sup>(5)</sup>	ND	0.19	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR7
LP50'	39	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR7
LP100'	45	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR7
LP150'	30	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR7
LP194'	27	0.15	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR7
LP224'	36	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP5
LP274'	28	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP5
LP310'	43	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP5
LP328'	ND	0.34	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP5
LP378'	43	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR5
LP428'	45	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR5
LP478'	42	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR5
LP525'	50	0.80	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR5
LP575'	45	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR4
LP625'	33	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR4
LP675'	33	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR4
LP725'	35	0.19	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR4
LP775'	27	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP3
LP825'	26	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP3
LP870'	23	1.88	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP3
LP920'	20	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP3

See footnotes at end of table.

**Table 6-1  
(Continued)**

Location	Channel Width (Bankfull) (ft)	Maximum Water Depth (Thalweg) (ft)	Sediment Thickness (ft) <sup>(2)</sup>	Bank Height (Measured from Thalweg) (ft)	Bank Slope (Water Surface to Bankfull) (degrees from horizontal)	Channel Pavement Materials <sup>(3)</sup>	Bank Materials	Comments
LP970'	36	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR3
LP1020'	28	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR3
LP1070'	28	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Glide MSG1
LP1120'	29	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR2
LP1170'	30	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR2
LP1188'	28	0.4	ND	ND	ND	ND	ND	Measured 7/26/01, Run MSRR2
LP1238'	27	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR3
LP1288'	25	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR3
LP1338'	31	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR3
LP1388'	34	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR2
LP1438'	33	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR2
LP1488'	37	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR2
LP1508'	33	0.15	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR2
LP1658'	37	1.12	ND	ND	ND	ND	ND	Measured 7/26/01, Riffle MSR2
LP1708'	31	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP1
LP1758'	37	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP1
LP1808'	35	ND	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP1
LP1858'	44	1.40	ND	ND	ND	ND	ND	Measured 7/26/01, Pool MSP1
SB0 <sup>(6)</sup>	ND	ND	ND	ND	ND	ND	ND	Measured 8/1/01, Pool MSP1
SB33'	ND	2.23	0.27	4.1	EB <sup>(7)</sup> 52.5 WB <sup>(8)</sup> ND	Clay to pebble size	Clay and silty clay	Measured 8/1/01, Pool MSP1
SB66'	ND	2.50	0.48	5.1	EB 28 WB 90	Clay to pebble size; some cobbles	Clay and silty clay	Measured 8/1/01, Pool MSP1
SB100'	ND	1.92	0.91	4.2	EB 27 WB 51	Clay to pebble size	Clay and silty clay	Measured 8/1/01, Pool MSP1
SB133'	ND	1.70	1.07	4.6	EB 41 WB 45	Clay to pebble size	Clay and silty to sandy clay	Measured 8/1/01, Pool MSP1
SB166'	ND	1.89	1.03	3.7	EB 35.5 WB 44	Sand and pebbles with some silt and clay; cobbles rare	Clay and silty to sandy clay	Measured 8/1/01, Pool MSP1

See footnotes at end of table.

**Table 6-1  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB200'	ND	1.88	0.62	2.8	EB 32 WB 38	Sand and pebbles with some silt and clay; cobbles rare	Clay and silty to sandy clay	Measured 8/1/01, Pool MSP1
SB233'	ND	1.51	>2.96	4.1	EB 20.5 WB 35	Sand and pebbles with some silt and clay; cobbles rare	EB Silty clay with some pebbles WB Sandy clay	Measured 8/1/01, Pool MSP1
SB266'	ND	1.50	3.10	3.5	EB 41 WB 40	Sand and pebbles with some silt and clay; occasional cobbles	EB Silty clay WB Silty to sandy clay	Measured 8/1/01, Pool MSP1
SB300'	ND	1.28	0.26	3.9	EB 49 WB 45	Pebbles and cobbles with some silt and clay	EB Sand, pebbles, and cobbles WB Silty to sandy clay	Measured 8/1/01, Pool MSP1
SB333'	ND	1.48	0.1*	4.9	EB 36 WB 43	Pebbles and sand with some silt, clay, and cobbles; boulders rare	EB Silty to sandy clay WB silty clay	Measured 8/1/01, Pool MSP1
SB366'	ND	1.60	1.3*	3.3	EB 30 WB 18	Sand, pebbles, and cobbles; boulders rare	EB Sandy clay with pebbles WB Silty to sandy clay	Measured 8/1/01, Pool MSP1
SB400'	ND	2.76	1.14	5.2	EB 32 WB 28	Sand, pebbles, and cobbles; boulders rare	EB Silty clay with pebbles WB Silty to sandy clay with pebbles	Measured 8/1/01, Pool MSP1
SB433'	ND	1.41	0.07	3.2	EB 35.5 WB 16.5	Sand, pebbles, and cobbles; boulders rare	EB Clay with some silt and sand WB Silty to sandy clay	Measured 8/1/01, Riffle MSR2

See footnotes at end of table.

**Table 6-1  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB466'	ND	0.30	1.08	1.7	EB 33 WB 14	Cobbles and boulders with some pebbles and sand	EB Sandy clay with some pebbles WB Silty clay	Measured 8/1/01, Riffle MSR2
SB500'	ND	0.32	1.02	EB 3.3 WB 1.8	EB 28 WB 27	Cobbles and boulders with some pebbles and sand	EB Clay WB Clayey sand	Measured 8/1/01, Riffle MSR2
SB533'	ND	0.40	1.39	EB 2.5 WB 2.5	EB 36 WB 23	Cobbles and boulders with some pebbles and sand	EB Sandstone bedrock overlain by clay WB Sandy clay	Measured 8/1/01, Riffle MSR2
SB566'	ND	0.50	1.10	EB 1.8 WB 1.8	EB 38 WB 49.5	Cobbles and boulders with some pebbles and sand	EB Sandstone bedrock overlying silty clay WB Silty clay	Measured 8/1/01, Riffle MSR2
SB600'	ND	0.38	1.34	EB 2.8 WB 2.0	EB 37 WB 33.5	Cobbles and boulders with some pebbles and sand	EB Sandstone bedrock overlying silty clay WB Silty clay	Measured 8/1/01, Riffle MSR2
SB633'	ND	0.30	1.30	EB 3.2 WB 3.7	EB 60 WB 37	Cobbles and boulders with some pebbles and sand	EB ND WB ND	Measured 8/1/01, Riffle MSR2
SB650'	ND	1.40	1.23	EB 4.7 WB 5.4	EB 59.5 WB 68	Boulders and cobbles with some pebbles and sand	EB Sandstone bedrock underlying silty to sandy clay WB Silt, sand, pebbles, and cobbles	Measured 8/1/01, Riffle MSR2
SB700'	ND	1.08	0.36	EB 4.5 WB 5.2	EB 47 WB 70	Boulders and cobbles with some pebbles and sand	EB Sandstone bedrock WB Sand, gravel, pebbles, and cobbles overlain by sandy to silty clay	Measured 8/1/01, Riffle MSR2
SB750'	ND	0.45	1.00	EB 4.9 WB 5.3	EB 20 to 90 WB 62	Boulders and cobbles with some pebbles and sand	EB Sandstone bedrock WB Silty clay	Measured 8/1/01, Riffle MSR3

See footnotes at end of table.

**Table 6-1  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB800'	ND	0.50	0.60	EB 4.3 WB 4.7	EB 90 WB 49.5	Boulders, sandstone bedrock, and cobbles with some pebbles and sand	EB Sandstone bedrock WB Clayey sand	Measured 8/1/01, Riffle MSR3
SB850'	ND	0.30	<0.05	EB 4.5 WB 4.6	EB 34 WB 51	Sandstone bedrock with some boulders, pebbles, and sand	EB Sandstone bedrock WB Silty sand	Measured 8/1/01, Riffle MSR3
SB900'	ND	0.20	<0.05	EB 4.5 WB 4.0	EB 31.5 WB 30.5	Sandstone bedrock with some boulders, pebbles, and sand	EB Sandstone bedrock overlain by silty clay WB Pebbles overlain by sandy clay	Measured 8/1/01, Run MSRR2
SB950'	ND	0.50	0.40	EB 4.3 WB 4.3	EB 37 to near vertical WB 59	Sandstone bedrock with some boulders, pebbles, and sand	EB Sandstone bedrock overlain by clay WB Pebbles overlain by silty clay	Measured 8/1/01, Run MSRR2
SB1000'	ND	0.30	0.15*	EB 2.8 WB 4.7	EB 68 WB 57.5	Cobbles and pebbles with some sand, silt, and clay	EB Sandstone bedrock overlain by silty clay with some gravel WB Sandy clay	Measured 8/1/01, Glide MSG1
SB1050'	ND	1.10	2.94	EB 2.7 WB 5.6	EB 19 to near vertical WB 56	Boulders and cobbles with some pebbles and sand	EB Sandy clay with pebbles and cobbles WB Silty clay	Measured 8/2/01, Run MSRR 3
SB1100'	ND	0.94	1.11	EB 3.0 WB 2.9	EB 33.5 WB 90	Boulders, cobbles, pebbles, and sand	EB Sandy clay WB Clayey sand	Measured 8/2/01, Run MSRR 3
SB1150'	ND	1.67	1.07	EB 5.0 WB 3.3	EB 46 to near vertical WB 52	Sandstone bedrock, pebbles, and sand with some boulders and cobbles	EB Sandstone bedrock and sandy clay with pebbles WB Sandy clay	Measured 8/2/01, Pool MSP3

See footnotes at end of table.

**Table 6-1  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB1200'	ND	1.75	1.09	EB 5.4 WB 3.8	EB 44 WB 51	Pebbles and sand with some silt and clay	EB Sandstone bedrock and sandy clay with pebbles WB Silty clay	Measured 8/2/01, Pool MSP3
SB1250'	ND	1.40	3.70	EB 4.7 WB 2.9	EB 38.5 WB 56.5	Sand, silt, and clay with some pebbles	EB Clay with trace sand and silt WB Silty clay	Measured 8/2/01, Pool MSP3
SB1300'	ND	0.30	3.88	EB 2.4 WB 1.5	EB 27 WB 41	Pebbles and sand with some silt and clay	EB Silty clay WB Sandy clay	Measured 8/2/01, Pool MSP3
SB1350'	ND	0.20	1.35	EB 2.5 WB 2.3	EB 32 WB 43	Pebbles and sand with some silt and clay	EB Clay WB Silty clay	Measured 8/2/01, Run MSRR4
SB1400'	ND	0.20	0.60	EB 2.3 WB 3.7	EB 34 WB 25	Pebbles and sand with some silt and clay	EB Silty to sandy clay WB Sandy clay	Measured 8/2/01, Run MSRR4
SB1450'	ND	0.35	0.90	EB 3.2 WB 3.7	EB 34 WB 35 to near vertical	Cobbles and pebbles with some sand, silt, and clay	EB Clay WB Clay	Measured 8/2/01, Run MSRR4
SB1500'	ND	0.75	0.67	EB 3.4 WB 2.0	EB 37 WB 38.5	Pebbles with some sand, silt, and clay	EB Clay with trace sand and silt WB Silty clay	Measured 8/2/01, Run MSRR4
SB1550'	ND	0.45	0.65	EB 3.9 WB 2.7	EB 38 WB 45.5	Cobbles and pebbles with some sand, silt, and clay; boulders rare	EB Silty clay WB Silty clay with trace sand	Measured 8/2/01, Run MSRR5
SB1600'	ND	0.87	0.02*	EB 3.2 WB 3.7	EB 32 to 55 WB 49	Cobbles and pebbles with some boulders, sand, silt, and clay	EB Sandy clay WB Clay with trace sand	Measured 8/2/01, Run MSRR5

See footnotes at end of table.

**Table 6-1  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB1650'	ND	1.73	0.85	EB 4.3 WB 4.8	EB 29 to near vertical WB 44 to 90	Boulders, cobbles, and pebbles with some sand and little silt and clay	EB Silty clay WB Silty shale bedrock overlain by silty clay	Measured 8/2/01, Run MSRR5
SB1700'	ND	0.20	2.35	EB 1.8 WB 2.6	EB 90 WB 46	Boulders, cobbles, and pebbles with some sand and little silt and clay	EB Sandy clay WB Silty clay with fragments of silty shale	Measured 8/2/01, Riffle MSR6
SB1750'	ND	2.82	Refusal on boulders	EB 5.9 WB 5.1	EB 90 WB 63 to 90	Boulders and cobbles with some pebbles and little sand, silt, and clay	EB Sandy clay WB Sandy clay with some pebbles	Measured 8/2/01, Pool MSP5
SB1800'	ND	2.88	0.92	EB 5.5 WB 2.6	EB 53 to 90 WB 17	Cobbles and pebbles with some sand, silt, and clay; boulders rare	EB Silty to sandy clay WB Cobbles, pebbles, and sand	Measured 8/2/01, Pool MSP5
SB1850'	ND	0.1	0.75	EB 4.3 WB 2.2	EB 90 WB 17	Cobbles and pebbles with some boulders, sand, silt, and clay	EB Pebbles overlain by silty to sandy clay WB Sand with some pebbles	Measured 8/2/01, Riffle MSR7
SB1900'	ND	0.10	0.98	EB 5.4 WB 3.5	EB 90 WB 39	Boulders, cobbles, and pebbles with some sand, silt, and clay	EB Pebbles overlain by sandy clay WB Sandy to silty clay	Measured 8/2/01, Riffle MSR7
SB1950'	ND	0.33	0.93	EB 4.9 WB 3.9	EB 17 to 63 WB 22 to 90	Bedrock, boulders, cobbles, and pebbles with some sand, silt, and clay	EB Silty clay with some pebbles WB Weathered shale bedrock overlain by silty clay	Measured 8/2/01, Riffle MSR7

See footnotes at end of table.

**Table 6-1  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB2000'	ND	0.59	0.10	EB 4.8 WB 4.8	EB 90 WB 90	Bedrock, boulders, cobbles, and pebbles with some sand, silt, and clay	EB Pebbles overlain by silty clay with some pebbles WB Silty clay	Measured 8/2/01, Riffle MSR7

<sup>(1)</sup>Reference Sheet 16 which presents the locations of the transects from which the sedimentological and stream bank data were obtained.

<sup>(2)</sup>Measured using an incremented 1-inch diameter steel rod driven with a sledge hammer to refusal.

<sup>(3)</sup>Reference pebble count data for detailed particle-size range and distribution.

<sup>(4)</sup>ND denotes not determined.

<sup>(5)</sup>LP denotes longitudinal profile measurement station with LP0' representing the northern end of the mined study area.

<sup>(6)</sup>SB denotes sediment/bank assessment location with SBO' representing the southern end of the mined study segment.

<sup>(7)</sup>EB denotes east bank.

<sup>(8)</sup>WB denotes west bank.

\* denotes possible refusal on boulders and/or cobbles.

**Table 6-2**  
**Summary of Sedimentological and Stream Bank Data<sup>(1)</sup>**  
**Unmined Segment**  
**Robinson Fork**  
**West Finley Township, Washington County, Pennsylvania**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
Transect G-G'	21	1.69	ND <sup>(4)</sup>	2.8	ND	ND	ND	Measured 7/25/01, Pool P1
Transect H-H'	27	0.39	ND	3.1	ND	ND	ND	Measured 7/25/01, Run RR4
Transect I-I'	31	0.28	ND	3.7	ND	ND	ND	Measured 7/25/01, Riffle R6
Transect J-J'	17	1.01	ND	3.0	ND	ND	ND	Measured 7/25/01, Pool P4
Transect K-K'	19	0.72	ND	3.6	ND	ND	ND	Measured 7/25/01, Run RR12
Transect L-L'	21	0.30	ND	3.5	ND	ND	ND	Measured 7/25/01, Riffle R10
LP0 <sup>(5)</sup>	29	0.28	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR1
LP50'	25	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR1
LP95'	25	0.24	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR1
LP120'	19	ND	ND	ND	ND	ND	ND	Measured 7/30/01 Riffle R2
LP152'	11	0.59	ND	ND	ND	ND	ND	Measured 7/30/01, Riffle R2
LP202'	23	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P1
LP255'	22	0.61	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P2
LP305'	23	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR4
LP355'	19	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR4
LP405'	23	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR4
LP450'	24	0.15	ND	ND	ND	ND	ND	Measured 7/30/01, Riffle R3
LP474'	18	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P3
LP499'	35	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P3
LP529'	29	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P3
LP609'	28	0.12	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P3
LP659'	25	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR5
LP709'	23	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR5
LP759'	22	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Glide G1
LP818'	29	0.23	ND	ND	ND	ND	ND	Measured 7/30/01, Glide G1
LP868'	29	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Riffle R4
LP918'	24	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Glide G2

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
LP966'	23	0.66	ND	ND	ND	ND	ND	Measured 7/30/01, Glide G2
LP1021'	24	0.32	ND	ND	ND	ND	ND	Measured 7/30/01, Riffle R5
LP1071'	24	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Glide G3
LP1111'	26	0.20	ND	ND	ND	ND	ND	Measured 7/30/01, Glide G3
LP1161'	24	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Riffle R6
LP1185'	23	0.23	ND	ND	ND	ND	ND	Measured 7/30/01, Riffle R6
LP1295'	19	0.46	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR6
LP1320'	16	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P4
LP1361'	23	0.26	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P4
LP1411'	22	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P5
LP1458'	17	0.46	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR8
LP1508'	15	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR8
LP1530'	19	0.52	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR8
LP1557'	29	ND	ND	ND	ND	ND	ND	Measured 7/30/01, Pool P6
LP1617'	12	0.78	ND	ND	ND	ND	ND	Measured 7/30/01, Run RR9
LP1667'	18	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P7
LP1705'	20	0.68	ND	ND	ND	ND	ND	Measured 7/31/01, Riffle R7
LP1747'	24	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P8
LP1765'	24	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P8
LP1805'	19	0.37	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P8
LP1855'	19	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR10
LP1884'	19	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P9
LP1943'	19	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR11
LP1955'	34	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR11
LP1965'	39	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P10
LP1972'	39	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P10
LP2007'	26	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P11
LP2028'	16	0.33	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P11
LP2078'	20	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR12
LP2111'	16	0.12	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR12
LP2142'	19	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P12

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
LP2192'	24	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR13
LP2242'	23	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR13
LP2283'	21	0.31	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR13
LP2333'	18	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P13
LP2364'	24	0.33	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P13
LP2414'	22	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Riffle R10
LP2428'	20	0.31	ND	ND	ND	ND	ND	Measured 7/31/01, Riffle R10
LP2472'	17	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR14
LP2519'	15	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR14
LP2539'	19	1.37	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR14
LP2544'	20	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P14
LP2571'	18	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P14
LP2614'	18	0.90	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P14
LP2643'	20	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Riffle R11
LP2673'	20	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P15
LP2702'	18	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P15
LP2752'	16	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Glide G4
LP2814'	25	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P16
LP2846'	21	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Pool P16
LP2864'	19	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR15
LP2914'	37	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR15
LP2941'	32	ND	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR15
LP3011'	22	0.37	ND	ND	ND	ND	ND	Measured 7/31/01, Run RR15
SB0 <sup>(6)</sup>	ND	1.02	0.08	EB <sup>(7)</sup> 4.6 WB <sup>(8)</sup> 3.0	EB 18 to 56 WB 33 to near vertical	Boulders, cobbles, and pebbles with some sand, silt, and clay	EB Silty clay WB Sandy clay with pebbles overlain by sandstone bedrock	Measured 8/3/01, Riffle R1
SB50'	ND	0.89	0.01	EB 5.5 WB 2.9	EB 24 to 57 WB 36 to near vertical	Boulders, cobbles, and pebbles; some sand, silt, and clay	EB Silty clay WB Sandstone bedrock overlain by silty to sandy clay	Measured 8/3/01, Run RR1

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB100'	ND	0.15	0.54	EB 3.7 WB 3.5	EB 31 to 90 WB 33	Cobbles, pebbles, and sand with some silt and clay; boulders rare	EB Silty clay WB Silty clay	Measured 8/3/01, Riffle R2
SB150'	ND	0.33	0.06	EB 2.6 WB 2.9	EB 21.5 WB 48	Boulders, cobbles, and pebbles with some sand, silt, and clay	EB Silty to sandy clay WB Silty to sandy clay	Measured 8/3/01, Run RR2
SB200'	ND	1.27	1.47	EB 1.9 WB 4.8	EB 44.5 WB 50	Cobbles, pebbles, and sand with some silt and clay; boulders rare	EB Sandy clay WB Silty to sandy clay	Measured 8/3/01, Run RR3
SB250'	ND	1.24	2.06	EB 6.4 WB 3.6	EB 27.5 WB 50	Cobbles, pebbles, and sand with some boulders, silt, and clay	EB Silty clay WB Sandy clay	Measured 8/3/01, Run RR4
SB300'	ND	0.60	1.76	EB 3.8 WB 3.2	EB 43 to 90 WB 64 to 90	Boulders, cobbles, and pebbles with some sand, silt, and clay	EB Sandy clay WB Sandy clay	Measured 8/3/01, Run RR4
SB350'	ND	0.42	0.77	EB 3.7 WB 4.3	EB 19 to 90 WB 49	Boulders, cobbles, and pebbles with some sand, silt, and clay	EB Silty to sandy clay WB Sandstone bedrock overlain by sandy clay	Measured 8/3/01, Run RR4
SB400'	ND	0.43	0.55	EB 3.0 WB 3.8	EB 34.5 WB 32.5	Boulders, cobbles, and pebbles with some sand and little silt and clay	EB Silty to sandy clay WB Sandy clay	Measured 8/3/01, Run RR4

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB450'	ND	0.20	0.70	EB 3.2 WB 3.7	EB 26 WB 38.5 to 90	Boulders, cobbles, and pebbles with some gravel and little sand	EB Sandy clay WB Silty to sandy clay	Measured 8/3/01, Pool P3
SB500'	ND	1.94	2.02	EB 4.0 WB 3.7	EB 48 WB 85 to 90	Cobbles, pebbles, and sand with some silt and clay	EB Clayey sand WB Silty clay	Measured 8/3/01, Pool P3
SB550'	ND	1.32	1.83	EB 5.9 WB 3.3	EB 12 to 90 WB 32.5 to 90	Cobbles, pebbles, and sand with some silt and clay; boulders rare	EB Clayey to silty sand grading upward to silty clay WB Clayey to silty sand	Measured 8/3/01, Pool P3
SB600'	ND	0.54	2.06	EB 4.8 WB 2.8	EB 47 to 90 WB 47.5	Cobbles and pebbles with some sand, silt, and clay	EB Silty clay WB Silty to sandy clay	Measured 8/3/01, Run RR5
SB650'	ND	0.35	1.50	EB 4.3 WB 3.7	EB 10 to 40 WB 61 to 90	Cobbles, pebbles, and sand with some silt and clay; boulders rare	EB Silty to sandy clay overlain by sandy clay WB Silty clay	Measured 8/3/01, Run RR5
SB700'	ND	0.55	0.30	EB 4.0 WB 2.8	EB 41 to 90 WB 44	Boulders, cobbles, pebbles, and sand with some bedrock, silt, and clay	EB Sandy to silty clay WB Sandstone bedrock overlain by silty clay	Measured 8/3/01, Run RR5
SB750'	ND	0.40	0.30	EB 3.8 WB 3.2	EB 22 to 90 WB 56	Boulders, cobbles, and pebbles with some sand, silt, and clay	EB Silty clay with trace sand WB Silty clay with trace sand	Measured 8/3/01, Glide G1
SB800'	ND	0.30	0.30	EB 4.0 WB 2.7	EB 38 to 90 WB 23 to 90	Boulders, cobbles, and pebbles with some sand and trace silt and clay	EB Silty clay with trace sand WB Silty clay with trace sand	Measured 8/3/01, Riffle R4

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB850'	ND	0.32	0.95	EB 4.2 WB 3.3	EB 57 WB 19 to 54	Cobbles, pebbles, sand, and silt with some clay; boulders rare	EB Silty to sandy clay WB Silty to sandy clay	Measured 8/6/01, Glide G2
SB900'	ND	0.60	2.32	EB 4.4 WB 3.4	EB 19.5 to 37.5 WB 25 to 43.5	Pebbles, sand, and silt with some cobbles; boulders rare	EB Silty to sandy clay WB Silty clay overlain by sandstone bedrock	Measured 8/6/01, Glide G2
SB950'	ND	0.78	0.38	EB 4.4 WB 4.1	EB 44 WB 42	Pebbles, sand, and silt with some cobbles and boulders	EB Silty clay WB Sandy clay and slumped sandstone bedrock	Measured 8/6/01, Riffle R5
SB1000'	ND	0.43	0.42	EB 3.8 WB 3.5	EB 37 to 90 WB 48 to 90	Boulders, cobbles, pebbles, and sand with some silty and clay	EB Clay with trace silt WB Silty to sandy clay	Measured 8/6/01, Glide G3
SB1050'	ND	0.26	0.99	EB 3.7 WB 3.1	EB 21.5 to 78 WB 32.5 to 90	Pebbles and sand with some boulders and cobbles, trace silt, and clay	EB Silty clay WB Silty clay	Measured 8/6/01, Glide G3
SB1100'	ND	0.25	0.63	EB 3.8 WB 3.7	EB 17 to 46.5 WB 22.5 to 44	Cobbles, pebbles, and sand with some boulders, silt, and clay	EB Sandy clay WB Silty clay	Measured 8/6/01, Riffle R6
SB1150'	ND	0.27	0.56	EB 3.4 WB 4.1	EB 53 WB 33	Cobbles, pebbles, and sand with some boulders, silt, and clay	EB Silty clay WB Silty clay	Measured 8/6/01, Riffle R6

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB1200'	ND	0.13	1.45	EB 4.6 WB 3.4	EB 21 to 38 WB 55	Cobbles, pebbles, and sand	EB Silty clay WB Silty clay with trace sand	Measured 8/6/01, Run RR6
SB1250'	ND	0.24	1.21	EB 3.9 WB 2.4	EB 14.5 to 50.5 WB 42.5	Cobbles and pebbles with some boulders, sand, silt, and clay	EB Silty clay WB Sandy clay	Measured 8/6/01, Run RR6
SB1300'	ND	1.10	Refusal on boulders and cobbles	EB 3.6 WB 6.2	EB 27.5 to near vertical WB 44	Boulders, cobbles, sand, and silt with some clay	EB Sandy clay WB Sandy clay	Measured 8/6/01, Pool P4
SB1350'	ND	0.50	1.81	EB 3.8 WB 4.6	EB 34 WB 29.5 to 65	Pebbles and sand with some cobbles, silt, and clay	EB Sandy clay WB Sandy clay	Measured 8/6/01, Run RR7
SB1400'	ND	0.58	3.25	EB 4.9 WB 3.7	EB 41.5 to 45.5 WB 13.5 to 39	Boulders, cobbles, and pebbles with some sand and silt and trace clay	EB Clayey sand WB Clayey sand	Measured 8/6/01, Run RR8
SB1450'	ND	0.37	0.55	EB 4.1 WB 3.9	EB 19.5 to 90 WB 50	Cobbles, pebbles, and sand with some boulders, silt, and clay	EB Silty clay WB Sandy clay	Measured 8/6/01, Run RR8
SB1500'	ND	0.50	0.25	EB 4.3 WB 2.5	EB 23 to 90 WB 48.5	Boulders, cobbles, pebbles, and sand with trace silt and clay	EB Silty clay WB Clayey sand	Measured 8/6/01, Pool P6
SB1550'	ND	2.02	1.01	EB 4.4 WB 6.4	EB 30 to 90 WB 54	Sand and silt with some pebbles, and trace clay, boulders, and cobbles rare	EB Sandy clay WB Silty clay	Measured 8/6/01, Run RR9

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB1600'	ND	0.65	2.35	EB 5.2 WB 2.7	EB 49 WB 52.5	Boulders, cobbles, and pebbles with some sand, silt, and little clay	EB Silty clay with trace sand WB Silty to sandy clay	Measured 8/6/01, Pool P7
SB1650'	ND	1.36	2.69	EB 5.5 WB 4.9	EB 45 to 90 WB 59.5	Cobbles, pebbles, and sand with some silt and clay	EB Silty to sandy clay WB Silty to sandy clay	Measured 8/6/01, Riffle R7
SB1700'	ND	0.68	1.24	EB 5.1 WB 3.5	EB 53.5 to 90 WB 37.5 to 90	Cobbles, pebbles, and sand with some silt and clay	EB Silty to sandy clay WB Silty to sandy clay	Measured 8/6/01, Pool P8
SB1750'	ND	0.63	1.19	EB 3.5 WB 4.6	EB 26 to 70.5 WB 47 to 90	Boulders, cobbles, and pebbles with some sand and silt, trace clay	EB Sandy clay WB Sandy clay	Measured 8/6/01, Pool P8
SB1800'	ND	0.58	1.19	EB 3.6 WB 4.2	EB 29 to 90 WB 35.5	Boulders, cobbles, and pebbles with some sand and silt, trace clay	EB Silty clay WB Silty to sandy clay	Measured 8/6/01, Run RR10
SB1850'	ND	0.60	0.80	EB 3.0 WB 3.3	EB 45 WB 45 to 90	Boulders, cobbles, and pebbles with some sand and trace silt and clay	EB Sandy clay WB Sandy clay	Measured 8/6/01, Run RR11
SB1900'	ND	0.45	0.88	EB 4.0 WB 2.8	EB 61 WB 43.5	Boulders, cobbles, and pebbles with some sand and trace silt and clay	EB Silty to sandy clay WB Sandy clay	Measured 8/6/01, Pool P10
SB1950'	ND	3.33	0.75	EB 5.6 WB 6.5	EB 16 WB 21.5 to 57	Cobbles, pebbles, and sand with some silt and clay	EB Sand overlain by sandy clay WB Silty clay	Measured 8/6/01, Pool P11
SB2000'	ND	0.75	1.07	EB 5.2 WB 3.3	EB 63.5 to near vertical WB 15 to 40.5	Cobbles, pebbles, and sand with some silt and clay	EB Silty to sandy clay WB Clayey sand	Measured 8/6/01, Run RR12

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB2050'	ND	0.53	0.67	EB 4.9 WB 2.3	EB 53.5 WB 34	Boulders and cobbles with some pebbles and sand; trace silt and clay	EB Silty to sandy clay WB Clayey sand	Measured 8/6/01, Pool P12
SB2100'	ND	1.23	2.23	EB 3.7 WB 3.1	EB 34 to 90 WB 52	Boulders, cobbles, pebbles, and sand; trace silt and clay	EB Silty clay WB Sandy to silty clay	Measured 8/6/01, Run RR13
SB2150'	ND	0.75	0.50	EB 2.8 WB 3.5	EB 29 to 54 WB 6 to 47	Boulders and cobbles with some sand and pebbles; trace silt and clay	EB Sandy clay WB Sandy clay	Measured 8/6/01, Run RR13
SB2200'	ND	0.55	0.17	EB 4.0 WB 3.2	EB 62 WB 58	Cobbles and pebbles with some sand, silt, and clay; boulders rare	EB Silty clay WB Silty to sandy clay	Measured 8/6/01, Run RR13
SB2250'	ND	0.34	1.84	EB 2.8 WB 4.9	EB 20 to 36 WB 43 to 90	Cobbles, pebbles, and sand with some silt and clay	EB Silty to sandy clay WB Silty clay	Measured 8/6/01, Riffle R9
SB2300'	ND	0.25	0.10	EB 4.0 WB 4.7	EB 24 to 34.5 WB 36.5 to 90	Boulders and cobbles with some pebbles and sand, trace silt and clay	EB Sandy clay overlain by clay WB Sandy clay	Measured 8/6/01, Pool P13
SB2350'	ND	0.44	0.20	EB 4.4 WB 3.9	EB 21 to 57 WB 50	Boulders and cobbles with some pebbles and sand; trace silt and clay	EB Silty clay WB Silty to sandy clay	Measured 8/6/01, Run R10
SB2400'	ND	0.18	0.20	EB 4.4 WB 3.3	EB 48 WB 42.5	Boulders, cobbles, gravel, and sand; trace silt and clay	EB Sandy clay WB Silty to sandy clay	Measured 8/6/01, Run RR14
SB2450'	ND	0.34	2.80	EB 3.3 WB 5.0	EB 23.5 to 56 WB 41.5 to 90	Cobbles and pebbles with some sand; trace silt and clay; boulders rare	EB Sandy clay WB Silty to sandy clay	Measured 8/6/01, Run RR14

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB2500'	ND	1.40	2.57+	EB 3.2 WB 5.5	EB 23 WB 64 to 90	Pebbles and sand with some cobbles; trace silt and clay	EB Clayey sand WB Sandy clay	Measured 8/6/01, Pool P14
SB2550'	ND	1.62	0.58	EB 5.5 WB 4.5	EB 59.5 WB 32.5 to 47	Cobbles, pebbles, and sand with some silt and clay; boulders rare	EB Silty clay WB Clayey sand	Measured 8/6/01, Pool P14
SB2600'	ND	1.08	2.74+	EB 5.2 WB 3.5	EB 49.5 to 90 WB 28 to 53	Cobbles and pebbles with some sand, silt, and clay	EB Silty to sandy clay WB Sandy clay	Measured 8/6/01, Riffle R11
SB2650'	ND	ND	ND	EB 2.4* WB 4.7*	EB 48 to 53.5 WB 30 to 35	Cobbles, pebbles, and sand with some silt and clay	EB Sandy clay WB Silty to sandy clay	Measured 8/6/01, Pool P15
SB2700'	ND	ND	ND	EB 2.7* WB 4.0*	EB 63.5 WB 32 to 57	Cobbles, pebbles, and sand with some silt and clay; boulders rare	EB Silty to sandy clay WB Silty to sandy clay	Measured 8/6/01, Glide G4
SB2750'	ND	ND	ND	EB 2.5* WB 4.4*	EB 54.5 WB 20.5 to 40.5	Cobbles and pebbles with some sand, silt, and clay	EB Sandy clay WB Sandy clay	Measured 8/6/01, Pool P16
SB2800'	ND	ND	ND	EB 2.3* WB 3.9*	EB 56 WB 36 to near vertical	Silty shale bedrock, sand, and silt; trace cobbles and clay	EB Silty to sandy clay WB Silty to sandy clay	Measured 8/6/01, Pool P16
SB2850'	ND	ND	ND	EB 3.6* WB 1.8*	EB 24 to near vertical WB 41	Silty shale bedrock boulders, and cobbles with some pebbles and sand; trace silt and clay	EB Silty to sandy clay WB Sandy clay	Measured 8/6/01, Run RR15

See footnotes at end of table.

**Table 6-2  
(Continued)**

<b>Location</b>	<b>Channel Width (Bankfull) (ft)</b>	<b>Maximum Water Depth (Thalweg) (ft)</b>	<b>Sediment Thickness (ft)<sup>(2)</sup></b>	<b>Bank Height (Measured from Thalweg) (ft)</b>	<b>Bank Slope (Water Surface to Bankfull) (degrees from horizontal)</b>	<b>Channel Pavement Materials<sup>(3)</sup></b>	<b>Bank Materials</b>	<b>Comments</b>
SB2900'	ND	ND	ND	EB 3.7* WB 4.5*	EB 43 WB 0 to 53	Boulders and cobbles with some pebbles and sand; trace silt and clay	EB Silty to sandy clay WB Sandy clay overlain by sandy to silty clay	Measured 8/6/01, Run RR15
SB2950'	ND	ND	ND	EB 2.8* WB 5.4*	EB 30 WB 45 to 60	Boulders, cobbles, and pebbles with some sand; trace silt and clay	EB Silty to sandy clay WB Silty to sandy clay	Measured 8/6/01, Run RR15
SB3000'	ND	ND	ND	EB 2.4* WB 7.3*	EB 26 WB 62	Cobbles, gravel, and sand with trace silt and clay; boulders rare	EB Clayey sand WB Silty sand	Measured 8/6/01, Run RR15

<sup>(1)</sup>Reference Sheet 16 which presents the locations of the transects from which the sedimentological and stream bank data were obtained.

<sup>(2)</sup>Measured using an incremented 1-inch diameter steel rod driven with a sledge hammer to refusal.

<sup>(3)</sup>Reference pebble count data for detailed particle-size range and distribution.

<sup>(4)</sup>ND denotes not determined.

<sup>(5)</sup>LP denotes longitudinal profile measurement station with LP0' representing the northern end of the unmined study area.

<sup>(6)</sup>SB denotes sediment/bank assessment location with SB0' representing the northern end of the unmined study segment.

<sup>(7)</sup>EB denotes east bank.

<sup>(8)</sup>WB denotes west bank.

\* denotes water surface to top of bank.

Table 6-3

Summary of Pebble Count Data  
Robinson Fork, Mined Segment

West Finley Township, Washington County, Pennsylvania

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: MINED SEGMENT			Reach: MINED SEG.			Reach: MINED SEG.					
Party: ROB/KMB			Date: 8/7/01			Date: 8/7/01			Date: 8/7/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			PT1	1MSRT	PT2	2MSRT	PT3	3MSPS						
	Silt / Clay	< .062					11					2	100	20
	Very Fine	.062 - .125												
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0					1					1	50	10
.04 - .08	Very Coarse	1.0 - 2					1					1	50	10
.08 - .16	Very Fine	2 - 4	1		1		11		1	14.3	10	1	11.1	10
.16 - .22	Fine	4 - 5.7												
.22 - .31	Fine	5.7 - 8					1		1	14.3	10	1	11.1	10
.31 - .44	Medium	8 - 11.3	1				11		1	14.3	10	2	22.2	20
.44 - .63	Medium	11.3 - 16	1						1	14.3	10			
.63 - .89	Coarse	16 - 22.6	1				1		1	14.3	10	1	11.1	10
.89 - 1.26	Coarse	22.6 - 32	1				1		1	14.3	10	1	11.1	10
1.26 - 1.77	Very Coarse	32 - 45					1		1	14.3	10			
1.77 - 2.5	Very Coarse	45 - 64	11				11		2	28.6	20	2	22.2	20
2.5 - 3.5	Small	64 - 90	1				11		1	14.3	10			
3.5 - 5.0	Small	90 - 128					1					1	33.3	10
5.0 - 7.1	Large	128 - 180												
7.1 - 10.1	Large	180 - 256												
10.1 - 14.3	Small	256 - 362												
14.3 - 20	Small	362 - 512	1						1	50	10	1	100	10
20 - 40	Medium	512 - 1024	1						1	50	10			
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
<b>TOTALS →</b>						10		100	10		100	10		100

Table 6-3  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT							
Site: ROBINSON FORK				Reach: MINED SEGMENT			Reach: MINEY SEG.			Reach: MINEY SEG.						
Party: ROB/LMB				Date: 8/7/01			Date: 8/7/01			Date: 8/7/01						
Inches	PARTICLE	Millimeters		PT4 1MSRS	PT5 2MSRS	PT6 3MSRR4	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	
	Silt / Clay	< .062	S/C			1							1	100	10	
	Very Fine	.062 - .125	SAND													
	Fine	.125 - .25														
	Medium	.25 - .50														
	Coarse	.50 - 1.0														
.04 - .08	Very Coarse	1.0 - 2														
.08 - .16	Very Fine	2 - 4	GRAVEL		1	1				1	14.3	10	1	11.1	10	
.16 - .22	Fine	4 - 5.7		1			1	12.5	10							
.22 - .31	Fine	5.7 - 8														
.31 - .44	Medium	8 - 11.3		1		1	1	12.5	10				1	11.1	10	
.44 - .63	Medium	11.3 - 16		1			1	12.5	10							
.63 - .89	Coarse	16 - 22.6		111		111	1	3	37.5	30	3	42.9	30	1	11.1	10
.89 - 1.26	Coarse	22.6 - 32		1		111		1	12.5	10				3	33.3	30
1.26 - 1.77	Very Coarse	32 - 45				1	11				1	14.3	10	2	22.2	20
1.77 - 2.5	Very Coarse	45 - 64		1		11	1	1	12.5	10	2	28.6	20	1	11.1	10
2.5 - 3.5	Small	64 - 90		COBBLES			1	1	50	10	1	33.3	10			
3.5 - 5.0	Small	90 - 128				1					1	33.3	10			
5.0 - 7.1	Large	128 - 180														
7.1 - 10.1	Large	180 - 256	1			1	1	50	10		1	33.3	10			
10.1 - 14.3	Small	256 - 362	Boulders													
14.3 - 20	Small	362 - 512														
20 - 40	Medium	512 - 1024														
40 - 80	Large-Vry Large	1024 - 2048														
	Bedrock		BR													
TOTALS →							10		100	10		100	10		100	

Table 6-3  
(Continued)

PEBBLE COUNT										PEBBLE COUNT			PEBBLE COUNT			
Site: ROBINSON FORK				Reach: MINED SEGMENT						Reach: MINED SEG.			Reach: MINED SEG.			
Party: RPB/KMB				Date: 8/7/01						Date: 8/7/01			Date: 8/7/01			
Inches	PARTICLE	Millimeters		PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	
	Silt / Clay	< .062	SC	PT 7	1MSRR4	PT 8	2MSR3	PT 9	3MSR3	3	100	30	2	100	20	
	Very Fine	.062 - .125	SAND													
	Fine	.125 - .25														
	Medium	.25 - .50														
	Coarse	.50 - 1.0				1					1	50	10			
.04 - .08	Very Coarse	1.0 - 2		III	1		1			3	100	30	1	100	10	
.08 - .16	Very Fine	2 - 4	GRAVEL	II						2	28.6	20				
.16 - .22	Fine	4 - 5.7				1					1	20	10			
.22 - .31	Fine	5.7 - 8				1					1	20	10			
.31 - .44	Medium	8 - 11.3												2	33.3	20
.44 - .63	Medium	11.3 - 16			I	1					1	14.3	10			
.63 - .89	Coarse	16 - 22.6			II	1					2	28.6	20	1	20	10
.89 - 1.26	Coarse	22.6 - 32			II	1					2	28.6	20	1	20	10
1.26 - 1.77	Very Coarse	32 - 45												1	16.7	10
1.77 - 2.5	Very Coarse	45 - 64												1	16.7	10
2.5 - 3.5	Small	64 - 90		COBBLE										1	100	10
3.5 - 5.0	Small	90 - 128														
5.0 - 7.1	Large	128 - 180														
7.1 - 10.1	Large	180 - 256														
10.1 - 14.3	Small	256 - 362	BOULDER													
14.3 - 20	Small	362 - 512														
20 - 40	Medium	512 - 1024														
40 - 80	Large-Vry Large	1024 - 2048														
	Bedrock		NO BEDROCK													
<b>TOTALS →</b>							10		100	10		100	10		100	

Table 6-3  
(Continued)

PEBBLE COUNT				PEBBLE COUNT			PEBBLE COUNT								
Site: ROBINSON FORK				Reach: MINED SEGMENT			Reach: MINED SEG.								
Party: ROB/KMB				Date: 9/7/01			Date: 9/7/01								
Inches	PARTICLE	Millimeters	PT 10 7MSRR3	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM			
				PT 11 2MSRR3	PT 12 3MSRR2								TOT #	ITEM %	% CUM
	Silt / Clay	< .062	S/C												
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2								3	100	30			
.08 - .16	Very Fine	2 - 4							1	14.3	10	3	60	30	
.16 - .22	Fine	4 - 5.7													
.22 - .31	Fine	5.7 - 8							1	14.3	10	1	20	10	
.31 - .44	Medium	8 - 11.3													
.44 - .63	Medium	11.3 - 16					1	20	10	1	14.3	10			
.63 - .89	Coarse	16 - 22.6					1	20	10	1	14.3	10			
.89 - 1.26	Coarse	22.6 - 32													
1.26 - 1.77	Very Coarse	32 - 45					1	20	10	2	28.6	20			
1.77 - 2.5	Very Coarse	45 - 64					2	40	20	1	14.3	10	1	20	10
2.5 - 3.5	Small	64 - 90					2	50	20	1	33.3	10			
3.5 - 5.0	Small	90 - 128					1	25	10	1	33.3	10			
5.0 - 7.1	Large	128 - 180											1	100	10
7.1 - 10.1	Large	180 - 256					1	25	10	1	33.3	10			
10.1 - 14.3	Small	256 - 362					1	100	10				1	100	10
14.3 - 20	Small	362 - 512													
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock														
TOTALS →							10		100	10		100	10		100

Table 6-3  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: MINED SEGMENT			Reach: MINED SEG.			Reach: MINED SEG.					
Party: RDB/KMB			Date: 9/7/01			Date: 9/7/01			Date: 9/7/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			PT 13	1MSR3	PT 14	2MSR2	PT 15	3MSR2						
	Silt / Clay	< .062												
	Very Fine	.062 - .125	SAND											
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0												
.04 - .08	Very Coarse	1.0 - 2							1	100	10			
.08 - .16	Very Fine	2 - 4	GRAVEL											
.16 - .22	Fine	4 - 5.7		1		1			1	25	10	1	25	10
.22 - .31	Fine	5.7 - 8		1	11	1			1	25	10	2	50	20
.31 - .44	Medium	8 - 11.3												
.44 - .63	Medium	11.3 - 16		1		1			1	25	10	1	25	10
.63 - .89	Coarse	16 - 22.6												
.89 - 1.26	Coarse	22.6 - 32		1		1			1	25	10	1	25	10
1.26 - 1.77	Very Coarse	32 - 45			1	1			1	25	10	1	25	10
1.77 - 2.5	Very Coarse	45 - 64												
2.5 - 3.5	Small	64 - 90		COBBLE		11				2	50	20		
3.5 - 5.0	Small	90 - 128	1			11			1	25	10	2	33.3	20
5.0 - 7.1	Large	128 - 180				1						1	16.7	10
7.1 - 10.1	Large	180 - 256	11		1	111			2	100	20	3	50	30
10.1 - 14.3	Small	256 - 362	BOULDER		11				2	100	20			
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock			111				3	100	30				
TOTALS →						10		100	10		100	10		100

Table 6-3  
(Continued)

PEBBLE COUNT				PEBBLE COUNT			PEBBLE COUNT											
Site: ROBINSON FORK				Reach: MINED SEGMENT			Reach: MINED SEG.											
Party: RDB/KMB				Date: 8/7/01			Date: 8/7/01											
Inches	PARTICLE	Millimeters		PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM			
				PT16	1 MSPL	PT17	2 MSPL	PT18	3 MSPL									
	Silt / Clay	< .062	S/C		I		III			1	100	10	3	100	30			
	Very Fine	.062 - .125	SAND		I					1	100	10						
	Fine	.125 - .25																
	Medium	.25 - .50																
	Coarse	.50 - 1.0																
.04 - .08	Very Coarse	1.0 - 2					I						1	100	10			
.08 - .16	Very Fine	2 - 4	GRAVEL		II					2	33.3	20						
.16 - .22	Fine	4 - 5.7			I					1	16.7	10						
.22 - .31	Fine	5.7 - 8																
.31 - .44	Medium	8 - 11.3			I		I			1	16.7	10	1	20	10			
.44 - .63	Medium	11.3 - 16																
.63 - .89	Coarse	16 - 22.6					I						1	20	10			
.89 - 1.26	Coarse	22.6 - 32			I				I	1	50	10						
1.26 - 1.77	Very Coarse	32 - 45			I		I			1	50	10	1	20	10			
1.77 - 2.5	Very Coarse	45 - 64			II		II			2	33.3	20	2	40	20			
2.5 - 3.5	Small	64 - 90	COBBLE		II					2	100	20						
3.5 - 5.0	Small	90 - 128			I				I	1	20	10						
5.0 - 7.1	Large	128 - 180			II		I			2	40	20	1	100	10			
7.1 - 10.1	Large	180 - 256			II					2	40	20						
10.1 - 14.3	Small	256 - 362	BOULDER		I					1	33.3	10						
14.3 - 20	Small	362 - 512			I					1	33.3	10						
20 - 40	Medium	512 - 1024			I					1	33.3	10						
40 - 80	Large-Vry Large	1024 - 2048																
	Bedrock		NO MIN. SIZE															
TOTALS →										10		100	10		100	10		100

Table 6-3  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: MINED SEGMENT			Reach: MINED SEG.			Reach: MINED SEG.					
Party: ROB/KMB			Date: 8/7/01			Date: 3/7/01			Date: 8/7/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			PT19 1MSPI	PT202MSPI	3									
	Silt / Clay	< .062	III	III		5	100	50	3	100	30			
	Very Fine	.062 - .125		I					1	33.3	10			
	Fine	.125 - .25												
	Medium	.25 - .50	I			1	100	10						
	Coarse	.50 - 1.0		I					1	33.3	10			
.04 - .08	Very Coarse	1.0 - 2		I					1	33.3	10			
.08 - .16	Very Fine	2 - 4		II					2	66.7	20			
.16 - .22	Fine	4 - 5.7	I			1	33.3	10						
.22 - .31	Fine	5.7 - 8												
.31 - .44	Medium	8 - 11.3												
.44 - .63	Medium	11.3 - 16	I			1	33.3	10						
.63 - .89	Coarse	16 - 22.6												
.89 - 1.26	Coarse	22.6 - 32												
1.26 - 1.77	Very Coarse	32 - 45	I			1	33.3	10						
1.77 - 2.5	Very Coarse	45 - 64		I					1	33.3	10			
2.5 - 3.5	Small	64 - 90	I	I		1	100	10	1	100	10			
3.5 - 5.0	Small	90 - 128												
5.0 - 7.1	Large	128 - 180												
7.1 - 10.1	Large	180 - 256												
10.1 - 14.3	Small	256 - 362												
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100			

Table 6-4

Summary of Pebble Count Data  
Robinson Fork, Unmined Segment

West Finley Township, Washington County, Pennsylvania

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT		
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG			Reach: UNMINED SEG		
Party: ROB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01		
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPT1	TERR1	UPT2	2RR1	UPT3	3R2			
	Silt / Clay	< .062									
	Very Fine	.062 - .125									
	Fine	.125 - .25									
	Medium	.25 - .50									
	Coarse	.50 - 1.0									
.04 - .08	Very Coarse	1.0 - 2									
.08 - .16	Very Fine	2 - 4									
.16 - .22	Fine	4 - 5.7									
.22 - .31	Fine	5.7 - 8									
.31 - .44	Medium	8 - 11.3			I				1	10	10
.44 - .63	Medium	11.3 - 16	III			I			3	33.3	30
.63 - .89	Coarse	16 - 22.6	II		III				2	22.2	20
.89 - 1.26	Coarse	22.6 - 32	III		III		I		3	33.3	30
1.26 - 1.77	Very Coarse	32 - 45	I		I				1	11.1	10
1.77 - 2.5	Very Coarse	45 - 64									
2.5 - 3.5	Small	64 - 90									
3.5 - 5.0	Small	90 - 128					II				
5.0 - 7.1	Large	128 - 180					IIII				
7.1 - 10.1	Large	180 - 256									
10.1 - 14.3	Small	256 - 362	I				II		1	100	10
14.3 - 20	Small	362 - 512									
20 - 40	Medium	512 - 1024									
40 - 80	Large-Vry Large	1024 - 2048									
	Bedrock										
TOTALS →						10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPT4 TRR2	UPTS 2 PI	UPT6 3 RR3									
	Silt / Clay	< .062	11	11				2	100	20	2	100	20	
	Very Fine	.062 - .125												
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0	1	1				1	100	10	1	50	10	
.04 - .08	Very Coarse	1.0 - 2									1	50	10	
.08 - .16	Very Fine	2 - 4	1	1				1	25	10	1	33.3	10	
.16 - .22	Fine	4 - 5.7	1			1	12.5	10						
.22 - .31	Fine	5.7 - 8	1			1	12.5	10	1	25	10			
.31 - .44	Medium	8 - 11.3	11		1	2	25	20			1	33.3	10	
.44 - .63	Medium	11.3 - 16	1			1	12.5	10	1	25	10			
.63 - .89	Coarse	16 - 22.6	111			3	37.5	30						
.89 - 1.26	Coarse	22.6 - 32	1		1				1	25	10	1	33.3	10
1.26 - 1.77	Very Coarse	32 - 45												
1.77 - 2.5	Very Coarse	45 - 64												
2.5 - 3.5	Small	64 - 90	1	1		1	100	10	1	33.3	10			
3.5 - 5.0	Small	90 - 128		1	1				1	33.3	10	1	33.3	10
5.0 - 7.1	Large	128 - 180												
7.1 - 10.1	Large	180 - 256	1		11				1	33.3	10	2	66.7	20
10.1 - 14.3	Small	256 - 362												
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024	1			1	100	10						
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT				PEBBLE COUNT			PEBBLE COUNT							
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: ROB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPT 7 P2	UPT 8 2 RR4	UPT 9 3 RR4									
	Silt / Clay	< .062		I					1	100	10			
	Very Fine	.062 - .125		I					1	50	10			
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0	I			1	25	10						
.04 - .08	Very Coarse	1.0 - 2	III	I		3	75	30	1	50	10			
.08 - .16	Very Fine	2 - 4		II		2	40	20						
.16 - .22	Fine	4 - 5.7			I	1	20	10				1	16.7	10
.22 - .31	Fine	5.7 - 8			I	1	20	10						
.31 - .44	Medium	8 - 11.3												
.44 - .63	Medium	11.3 - 16			I							1	16.7	10
.63 - .89	Coarse	16 - 22.6			I	1	20	10						
.89 - 1.26	Coarse	22.6 - 32			I							1	16.7	10
1.26 - 1.77	Very Coarse	32 - 45			III							3	50	30
1.77 - 2.5	Very Coarse	45 - 64												
2.5 - 3.5	Small	64 - 90			III				3	60	30			
3.5 - 5.0	Small	90 - 128		I	II				1	20	10	2	50	20
5.0 - 7.1	Large	128 - 180	I	I	II	1	100	10	1	20	10	2	50	20
7.1 - 10.1	Large	180 - 256												
10.1 - 14.3	Small	256 - 362		I					1	50	10			
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024		I					1	50	10			
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: RDD/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPT10	TR3	UPT11	2RRS	UPT12	3RRS						
	Silt / Clay	< .062												
	Very Fine	.062 - .125												
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0												
.04 - .08	Very Coarse	1.0 - 2												
.08 - .16	Very Fine	2 - 4												
.16 - .22	Fine	4 - 5.7	I						1	20	10			
.22 - .31	Fine	5.7 - 8		II					2	28.6	20			
.31 - .44	Medium	8 - 11.3	I		I				1	20	10	1	14.3	10
.44 - .63	Medium	11.3 - 16		I					1	14.3	10			
.63 - .89	Coarse	16 - 22.6		I	I				1	14.3	10	1	14.3	10
.89 - 1.26	Coarse	22.6 - 32	I	I	II				1	20	10	1	14.3	10
1.26 - 1.77	Very Coarse	32 - 45	I		II				1	20	10	2	28.6	20
1.77 - 2.5	Very Coarse	45 - 64	I	II	I				1	20	10	2	28.6	20
2.5 - 3.5	Small	64 - 90	I		I				1	25	10			
3.5 - 5.0	Small	90 - 128		I					1	33.3	10			
5.0 - 7.1	Large	128 - 180	III	I	I				3	75	30	1	33.3	10
7.1 - 10.1	Large	180 - 256		I	I				1	33.3	10	1	33.3	10
10.1 - 14.3	Small	256 - 362	I						1	100	10			
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: RDB/KMB			Date: 8/8/01			Date: 3/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPT3 1 G1	UPT4 2 G2	UPT5 3 G2									
	Silt / Clay	< .062		1					1	100	10			
	Very Fine	.062 - .125												
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0	1		1	1	100	10				1	100	10
.04 - .08	Very Coarse	1.0 - 2												
.08 - .16	Very Fine	2 - 4												
.16 - .22	Fine	4 - 5.7	1		1	1	14.3	10				1	12.5	10
.22 - .31	Fine	5.7 - 8	1	1	1	1	14.3	10	1	11.1	10	1	12.5	10
.31 - .44	Medium	8 - 11.3	1	1	1111	1	14.3	10	1	11.1	10	4	50	40
.44 - .63	Medium	11.3 - 16	11	1	1	2	28.6	20	1	11.1	10	1	12.5	10
.63 - .89	Coarse	16 - 22.6		11					2	22.2	20			
.89 - 1.26	Coarse	22.6 - 32	11	11	1	2	28.6	20	2	22.2	20	1	12.5	10
1.26 - 1.77	Very Coarse	32 - 45		11					2	22.2	20			
1.77 - 2.5	Very Coarse	45 - 64												
2.5 - 3.5	Small	64 - 90			1							1	100	10
3.5 - 5.0	Small	90 - 128												
5.0 - 7.1	Large	128 - 180												
7.1 - 10.1	Large	180 - 256												
10.1 - 14.3	Small	256 - 362												
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048	11			2	100	20						
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT						
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.						
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01						
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	
			UPT16	1 R5	UPT17	2 G3	UPT18	3 RRB							
	Silt / Clay	< .062		1		1			1	100	10	1	100	10	
	Very Fine	.062 - .125	SAND												
	Fine	.125 - .25													
	Medium	.25 - .50													
	Coarse	.50 - 1.0													
.04 - .08	Very Coarse	1.0 - 2										1	100	10	
.08 - .16	Very Fine	2 - 4	GRAVEL	1		1			1	25	10	1	11.1	10	
.16 - .22	Fine	4 - 5.7											1	12.5	10
.22 - .31	Fine	5.7 - 8											1	12.5	10
.31 - .44	Medium	8 - 11.3			11		11			2	22.3	20	1	12.5	10
.44 - .63	Medium	11.3 - 16			1		1			1	11.1	10			
.63 - .89	Coarse	16 - 22.6			1		11			1	11.1	10	2	25	20
.89 - 1.26	Coarse	22.6 - 32			111		111			3	33.3	30	1	12.5	10
1.26 - 1.77	Very Coarse	32 - 45			1		1			1	11.1	10	1	12.5	10
1.77 - 2.5	Very Coarse	45 - 64			1		1			1	25	10	1	12.5	10
2.5 - 3.5	Small	64 - 90		COBBLE						1	25	10			
3.5 - 5.0	Small	90 - 128			11		11			2	50	20			
5.0 - 7.1	Large	128 - 180													
7.1 - 10.1	Large	180 - 256			1		1			1	25	10			
10.1 - 14.3	Small	256 - 362	BOULDER												
14.3 - 20	Small	362 - 512			11		11			2	100	20			
20 - 40	Medium	512 - 1024													
40 - 80	Large-Vry Large	1024 - 2048													
	Bedrock		BEDROCK												
TOTALS →						10		100	10		100	10		100	

Table 6-4  
(Continued)

PEBBLE COUNT					PEBBLE COUNT			PEBBLE COUNT									
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG			Reach: UNMINED SEG								
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01								
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM			
	Silt / Clay	< .062	UPT19 1 P4	UPT20 2 RR7	UPT21 3 RR8	4	100	40	1	100	10						
	Very Fine	.062 - .125	SAND														
	Fine	.125 - .25															
	Medium	.25 - .50					1				1	25	10				
	Coarse	.50 - 1.0				1	11		1	25	10	2	50	20			
.04 - .08	Very Coarse	1.0 - 2	111	1		3	75	30	1	25	10						
.08 - .16	Very Fine	2 - 4	1	1	1	1	50	10	1	20	10	1	14.3	10			
.16 - .22	Fine	4 - 5.7		1					1	20	10						
.22 - .31	Fine	5.7 - 8	GRAVEL									1	14.3	10			
.31 - .44	Medium	8 - 11.3				1			1	50	10						
.44 - .63	Medium	11.3 - 16					1	11				1	20	10	2	28.6	20
.63 - .89	Coarse	16 - 22.6					1	1				1	20	10	1	14.3	10
.89 - 1.26	Coarse	22.6 - 32			1							1	14.3	10			
1.26 - 1.77	Very Coarse	32 - 45		1					1	20	10						
1.77 - 2.5	Very Coarse	45 - 64			1							1	14.3	10			
2.5 - 3.5	Small	64 - 90	COBBLES														
3.5 - 5.0	Small	90 - 128						1						1	100	10	
5.0 - 7.1	Large	128 - 180															
7.1 - 10.1	Large	180 - 256															
10.1 - 14.3	Small	256 - 362	BOULDER									1	50	10			
14.3 - 20	Small	362 - 512						1						1	50	10	
20 - 40	Medium	512 - 1024															
40 - 80	Large-Vry Large	1024 - 2048															
	Bedrock		BEDROCK														
TOTALS →						10		100	10		100	10		100			

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: RDB/KMB			Date: 9/9/01			Date: 9/9/01			Date: 9/9/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPY22 1 P6	UPY23 2 R R 9	UPY24 3 P 7									
	Silt / Clay	< .062	1	1	III	1	100	10	1	100	10	3	100	30
	Very Fine	.062 - .125				3	75	30						
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0	1		III	1	25	10				3	75	30
.04 - .08	Very Coarse	1.0 - 2			I							1	25	10
.08 - .16	Very Fine	2 - 4	1			1	50	10						
.16 - .22	Fine	4 - 5.7												
.22 - .31	Fine	5.7 - 8	1			1	50	10						
.31 - .44	Medium	8 - 11.3		I					1	20	10			
.44 - .63	Medium	11.3 - 16		II					2	40	20			
.63 - .89	Coarse	16 - 22.6		I	I				1	20	10	1	100	10
.89 - 1.26	Coarse	22.6 - 32												
1.26 - 1.77	Very Coarse	32 - 45		I					1	20	10			
1.77 - 2.5	Very Coarse	45 - 64												
2.5 - 3.5	Small	64 - 90												
3.5 - 5.0	Small	90 - 128	1	I	I	1	100	10	1	25	10	1	50	10
5.0 - 7.1	Large	128 - 180		II					2	50	20			
7.1 - 10.1	Large	180 - 256		I	I				1	25	10	1	50	10
10.1 - 14.3	Small	256 - 362	1			1	50	10						
14.3 - 20	Small	362 - 512	1			1	50	10						
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: ROB/KMB			Date: 3/3/01			Date: 3/3/01			Date: 3/3/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPT25 1 P7	UPT26 2 P8	UPT27 3 R10									
	Silt / Clay	<.062	11	1	1	2	100	20	1	100	10	1	100	10
	Very Fine	.062 - .125												
	Fine	.125 - .25			1							1	100	10
	Medium	.25 - .50												
	Coarse	.50 - 1.0												
.04 - .08	Very Coarse	1.0 - 2		1					1	100	10			
.08 - .16	Very Fine	2 - 4		1	1				1	20	10	1	25	10
.16 - .22	Fine	4 - 5.7	1		1	1	20	10				1	25	10
.22 - .31	Fine	5.7 - 8		11					2	40	20			
.31 - .44	Medium	8 - 11.3												
.44 - .63	Medium	11.3 - 16	1	1		1	20	10	1	20	10			
.63 - .89	Coarse	16 - 22.6	1			1	20	10						
.89 - 1.26	Coarse	22.6 - 32	1		1	1	20	10				1	25	10
1.26 - 1.77	Very Coarse	32 - 45	1	1		1	20	10	1	20	10			
1.77 - 2.5	Very Coarse	45 - 64			1							1	25	10
2.5 - 3.5	Small	64 - 90	11	1	1	2	66.7	20	1	50	10	1	33.3	10
3.5 - 5.0	Small	90 - 128	1	1	1	1	33.3	10	1	50	10	1	33.3	10
5.0 - 7.1	Large	128 - 180			1							1	33.3	10
7.1 - 10.1	Large	180 - 256												
10.1 - 14.3	Small	256 - 362												
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024		1	1				1	100	10	1	100	10
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UPT 28 1 PY	UPT 29 2 RRII	UPT 30 3 P10									
	Silt / Clay	< .062				4	100	40	1	100	10			
	Very Fine	.062 - .125										1	20	10
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0										1	20	10
.04 - .08	Very Coarse	1.0 - 2							1	100	10	3	60	30
.08 - .16	Very Fine	2 - 4												
.16 - .22	Fine	4 - 5.7												
.22 - .31	Fine	5.7 - 8							1	25	10			
.31 - .44	Medium	8 - 11.3							1	25	10	1	33.3	10
.44 - .63	Medium	11.3 - 16										1	33.3	10
.63 - .89	Coarse	16 - 22.6				2	66.7	20				1	33.3	10
.89 - 1.26	Coarse	22.6 - 32												
1.26 - 1.77	Very Coarse	32 - 45				1	33.3	10	1	25	10			
1.77 - 2.5	Very Coarse	45 - 64							1	25	10			
2.5 - 3.5	Small	64 - 90							1	50	10			
3.5 - 5.0	Small	90 - 128				1	33.3	10				2	100	20
5.0 - 7.1	Large	128 - 180				1	33.3	10	1	50	10			
7.1 - 10.1	Large	180 - 256				1	33.3	10						
10.1 - 14.3	Small	256 - 362							1	50	10			
14.3 - 20	Small	362 - 512							1	50	10			
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG			Reach: UNMINED SEG					
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UP31 1 R3	UP32 2 P11	UP33 3 R12									
	Silt / Clay	< .062							2	100	20			
	Very Fine	.062 - .125							2	100	20	2	100	20
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0												
.04 - .08	Very Coarse	1.0 - 2												
.08 - .16	Very Fine	2 - 4												
.16 - .22	Fine	4 - 5.7												
.22 - .31	Fine	5.7 - 8												
.31 - .44	Medium	8 - 11.3	1	1		1	12.5	10	1	16.7	10			
.44 - .63	Medium	11.3 - 16		1					1	16.7	10			
.63 - .89	Coarse	16 - 22.6	1		1	1	12.5	10	2	33.3	20	1	16.7	10
.89 - 1.26	Coarse	22.6 - 32			1							1	16.7	10
1.26 - 1.77	Very Coarse	32 - 45			1	2	25	20	2	33.3	20	1	16.7	10
1.77 - 2.5	Very Coarse	45 - 64				4	50	40				3	50	30
2.5 - 3.5	Small	64 - 90				2	100	20						
3.5 - 5.0	Small	90 - 128												
5.0 - 7.1	Large	128 - 180										1	50	10
7.1 - 10.1	Large	180 - 256										1	50	10
10.1 - 14.3	Small	256 - 362												
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT				PEBBLE COUNT			PEBBLE COUNT									
Site: ROBINSON FORK		Reach: UNMINED SEGMENT		Reach: UNMINED SEG.			Reach: UNMINED SEG.									
Party: RDB/KMB		Date: 9/8/01		Date: 9/8/01			Date: 9/8/01									
Inches	PARTICLE	Millimeters		UP24 1 P12	UP35 2 RR13	UP36 3 RR13	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	
	Silt / Clay	< .062	SYC													
	Very Fine	.062 - .125	SAND				2	66.7	20							
	Fine	.125 - .25														
	Medium	.25 - .50														
	Coarse	.50 - 1.0					1	33.3	10							
.04 - .08	Very Coarse	1.0 - 2														
.08 - .16	Very Fine	2 - 4	GRAVEL													
.16 - .22	Fine	4 - 5.7														
.22 - .31	Fine	5.7 - 8					1	33.3	10							
.31 - .44	Medium	8 - 11.3					2	66.7	20	1	11.1	10				
.44 - .63	Medium	11.3 - 16											1	14.3	10	
.63 - .89	Coarse	16 - 22.6								1	11.1	10	3	42.9	30	
.89 - 1.26	Coarse	22.6 - 32								3	33.3	30				
1.26 - 1.77	Very Coarse	32 - 45								1	11.1	10	1	14.3	10	
1.77 - 2.5	Very Coarse	45 - 64								3	33.3	30	2	28.6	20	
2.5 - 3.5	Small	64 - 90		COBBLE						1		10	2	66.7	20	
3.5 - 5.0	Small	90 - 128											1	33.3	10	
5.0 - 7.1	Large	128 - 180														
7.1 - 10.1	Large	180 - 256														
10.1 - 14.3	Small	256 - 362	BOULDER													
14.3 - 20	Small	362 - 512														
20 - 40	Medium	512 - 1024														
40 - 80	Large-Vry Large	1024 - 2048														
	Bedrock						4	100	40							
TOTALS →							10		100	10		100	10		100	

Table 6-4  
(Continued)

PEBBLE COUNT				PEBBLE COUNT			PEBBLE COUNT									
Site: ROBINSON FORK		Reach: UNMINED SEGMENT		Reach: UNMINED SEG			Reach: UNMINED SEG									
Party: ROB/KMB		Date: 9/8/01		Date: 9/8/01			Date: 9/3/01									
Inches	PARTICLE	Millimeters		UPT371 P13	UPT382 R10	UPT393 R14	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	
	Silt / Clay	< .062	SAC	1		1	1	100	10				1	100	10	
	Very Fine	.062 - .125	SAND													
	Fine	.125 - .25												1	25	10
	Medium	.25 - .50				1			25					3	75	30
	Coarse	.50 - 1.0				III			75							
.04 - .08	Very Coarse	1.0 - 2														
.08 - .16	Very Fine	2 - 4	GRAVEL	1			1	14.3	10							
.16 - .22	Fine	4 - 5.7														
.22 - .31	Fine	5.7 - 8					2	28.6	20							
.31 - .44	Medium	8 - 11.3				1				1	14.3	10		1	25	10
.44 - .63	Medium	11.3 - 16				1								1	25	10
.63 - .89	Coarse	16 - 22.6								2	28.6	20				
.89 - 1.26	Coarse	22.6 - 32					1	14.3	10	1	14.3	10				
1.26 - 1.77	Very Coarse	32 - 45					2	28.6	20	2	28.6	20		2	50	20
1.77 - 2.5	Very Coarse	45 - 64					1	14.3	10	1	14.3	10				
2.5 - 3.5	Small	64 - 90		COBBLE							1	50	10			
3.5 - 5.0	Small	90 - 128									1	50	10			
5.0 - 7.1	Large	128 - 180														
7.1 - 10.1	Large	180 - 256														
10.1 - 14.3	Small	256 - 362	BOULDER							1	100	10				
14.3 - 20	Small	362 - 512														
20 - 40	Medium	512 - 1024				1								1	100	10
40 - 80	Large-Vry Large	1024 - 2048					2	100	20							
	Bedrock															
TOTALS →							10		100	10		100	10		100	

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG			Reach: UNMINED SEG					
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
			UP407 P14	UP412 R11	UP423 P15									
	Silt / Clay	< .062	III		II	3	100	30				2	100	20
	Very Fine	.062 - .125			III							3	100	30
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0	I			1	100	10						
.04 - .08	Very Coarse	1.0 - 2												
.08 - .16	Very Fine	2 - 4	I			1	25	10						
.16 - .22	Fine	4 - 5.7	I			1	25	10						
.22 - .31	Fine	5.7 - 8			I							1	25	10
.31 - .44	Medium	8 - 11.3		I					1	20	10			
.44 - .63	Medium	11.3 - 16	I	I		1	25	10	1	20	10			
.63 - .89	Coarse	16 - 22.6			II							2	50	20
.89 - 1.26	Coarse	22.6 - 32	I			1	25	10						
1.26 - 1.77	Very Coarse	32 - 45		I	I				1	20	10	1	25	10
1.77 - 2.5	Very Coarse	45 - 64		II					2	40	20			
2.5 - 3.5	Small	64 - 90		I					1	25	10			
3.5 - 5.0	Small	90 - 128		II	I				2	50	20	1	100	10
5.0 - 7.1	Large	128 - 180		I					1	25	10			
7.1 - 10.1	Large	180 - 256	I			1	100	10						
10.1 - 14.3	Small	256 - 362	I	I		1	100	10	1	100	10			
14.3 - 20	Small	362 - 512												
20 - 40	Medium	512 - 1024												
40 - 80	Large-Vry Large	1024 - 2048												
	Bedrock													
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT						PEBBLE COUNT			PEBBLE COUNT					
Site: ROBINSON FORK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG.			Reach: UNMINED SEG.					
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01					
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM
	Silt / Clay	< .062	UPT43 1 G4	UPT44 2 P16	UPT45 3 RR15	4	100	40	4	100	40			
	Very Fine	.062 - .125	SAND						1	100	10			
	Fine	.125 - .25												
	Medium	.25 - .50												
	Coarse	.50 - 1.0												
.04 - .08	Very Coarse	1.0 - 2												
.08 - .16	Very Fine	2 - 4	GRAVEL						1	50	10			
.16 - .22	Fine	4 - 5.7				1	20	10						
.22 - .31	Fine	5.7 - 8				1	20	10	1	50	10			
.31 - .44	Medium	8 - 11.3				1	20	10						
.44 - .63	Medium	11.3 - 16				1	20	10						
.63 - .89	Coarse	16 - 22.6				1	20	10						
.89 - 1.26	Coarse	22.6 - 32												
1.26 - 1.77	Very Coarse	32 - 45										1	100	10
1.77 - 2.5	Very Coarse	45 - 64												
2.5 - 3.5	Small	64 - 90	COBBLE									1	25	10
3.5 - 5.0	Small	90 - 128										1	25	10
5.0 - 7.1	Large	128 - 180										1	25	10
7.1 - 10.1	Large	180 - 256				1	100	10				1	25	10
10.1 - 14.3	Small	256 - 362	BOULDER									1	20	10
14.3 - 20	Small	362 - 512										3	60	30
20 - 40	Medium	512 - 1024										1	20	10
40 - 80	Large-Vry Large	1024 - 2048							3	100	30			
	Bedrock		BEDROCK											
TOTALS →						10		100	10		100	10		100

Table 6-4  
(Continued)

PEBBLE COUNT					PEBBLE COUNT			PEBBLE COUNT								
Site: ROBINSON FARK			Reach: UNMINED SEGMENT			Reach: UNMINED SEG			Reach: UNMINED SEG							
Party: RDB/KMB			Date: 8/8/01			Date: 8/8/01			Date: 8/8/01							
Inches	PARTICLE	Millimeters	PARTICLE COUNT			TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM	TOT #	ITEM %	% CUM		
	Silt / Clay	< .062	UPT	46	RRIS											
	Very Fine	.062 - .125	SAND													
	Fine	.125 - .25														
	Medium	.25 - .50														
	Coarse	.50 - 1.0														
.04 - .08	Very Coarse	1.0 - 2	GRAVEL													
.08 - .16	Very Fine	2 - 4														
.16 - .22	Fine	4 - 5.7														
.22 - .31	Fine	5.7 - 8														
.31 - .44	Medium	8 - 11.3														
.44 - .63	Medium	11.3 - 16				I			1	11.1	10					
.63 - .89	Coarse	16 - 22.6				I			1	11.1	10					
.89 - 1.26	Coarse	22.6 - 32				IIII			4	44.4	40					
1.26 - 1.77	Very Coarse	32 - 45	III			3	33.3	30								
1.77 - 2.5	Very Coarse	45 - 64	GOBBLE													
2.5 - 3.5	Small	64 - 90														
3.5 - 5.0	Small	90 - 128				I			1	100	10					
5.0 - 7.1	Large	128 - 180														
7.1 - 10.1	Large	180 - 256	BOULDER													
10.1 - 14.3	Small	256 - 362														
14.3 - 20	Small	362 - 512														
20 - 40	Medium	512 - 1024														
40 - 80	Large-Vry Large	1024 - 2048														
	Bedrock		BEDROCK													
TOTALS →						10		100								

**Table 6-5**  
**Summary of Surface Water Velocity and Discharge<sup>(1)</sup>**  
**Robinson Fork**  
**West Finley Township, Washington County, Pennsylvania**

Location	Transect	Average Velocity (ft/sec)	Discharge Volume (ft <sup>3</sup> /sec)
<b>Mined Segment</b>			
Pool MSP1	A-A'	<0.1	<7.2
Riffle MSR2	B-B'	1.05	5.8
Run MSRR2	C-C'	0.46	3.0
Pool MSP3	D-D'	<0.1	<1.6
Run MSRR4	E-E'	0.03 <sup>(2)</sup>	0.2
Riffle MSR7	F-F'	0.70	2.5
<b>Unmined Segment</b>			
Pool P1	G-G'	0.12 <sup>(2)</sup>	2.0
Run RR4	H-H'	1.68	2.5
Riffle R6	I-I'	1.13	1.7
Pool P4	J-J'	0.46	3.7
Run RR12	K-K'	0.21 <sup>(2)</sup>	0.5
Riffle R10	L-L'	1.42	2.1
Tributary to Robinson Fork	M-M'	0.11 <sup>(2)</sup>	0.02

<sup>(1)</sup>Surface water velocity, water depth, and width of wetted channel measurements performed on August 9, 2001.

<sup>(2)</sup>Velocity was below the sensitivity of the instrument. Therefore, velocity was estimated using a rule, a stopwatch, and a float.

\*Historically, Consol Pennsylvania Coal Company Surface Water Monitoring Point SW-8 was located near Transect F-F' (Riffle M SR7) and was likely 300 to 400 feet north of Transect F-F'. Surface water discharge measurements for Monitoring Point SW-8 during the month of August have been 1.14 ft<sup>3</sup>/s (8/93); 1.27 ft<sup>3</sup>/s (8/94); and 1.31 ft<sup>3</sup>/s (8/95).