4. PHYSIOGRAPHY

4.1 Introduction

This chapter discusses the physiographic characteristics of the Bristol Bay drainages study areas, including topography, landforms, and stream drainage patterns. Permafrost conditions also are discussed.

The Bristol Bay drainages study areas (mine study area and transportation-corridor study area) run generally eastward from the North Fork Koktuli River area to the Bristol Bay/Cook Inlet drainages boundary (Figure 1-4 in Chapter 1). The physiography discussion of the mine study area is based on a review of published information, information gathered from field reconnaissance studies during 2004 to 2008, and topographical information obtained from Eagle Mapping Ltd. The physiography discussion of the transportation-corridor study area is based on information obtained from Resource Data Inc.

4.2 Results and Discussion

The physiography of the Bristol Bay drainages has been strongly influenced by bedrock geology and by the erosion, transport, and deposition of surficial materials by Pleistocene glaciers and glacial meltwater. The Bristol Bay study areas are divided into three physiographic divisions within the U.S. Geological Survey Iliamna Quadrangle: Nushagak-Big River Hills, Nushagak-Bristol Bay Lowlands, and the southern part of the Alaska Range division (Detterman and Reed, 1973). The portions of these physiographic divisions contained within the Bristol Bay study areas are described below:

- The Nushagak-Big River Hills division encompasses the mine study area and the transportation-corridor study area west of Roadhouse Mountain.
- The Alaska Range division encompasses the transportation-corridor study area east of Roadhouse Mountain and along the north shore of Iliamna Lake to the boundary between the Bristol Bay drainages study areas and the Cook Inlet drainages study area. This division includes a strip of relatively flat terrain along the shore of Iliamna Lake, as well as the rugged mountains to the north and east of the lake.
- The Nushagak-Bristol Bay Lowlands division encompasses the lowland areas at the western end of Iliamna Lake and south of the Nushagak-Big River Hills division, including the village of Iliamna. Technically, this division does not encompass any of the mine study area or the transportation-corridor study area; however, the eastward extension of the same terrain type along the north shore of Iliamna Lake forms part of the transportation-corridor study area in the Alaska Range division.

4.2.1 Mine Study Area

As noted above, the mine study area is located in the Nushagak-Big River Hills division, which consists of low, rolling hills separated by wide, shallow valleys with sinuous drainage channels. The elevation in the vicinity of the mine study area varies from approximately 580 feet at the confluence of the south and north forks of the Koktuli River to 3,074 feet on Groundhog Mountain. The deposit area is in the pass between the South Fork Koktuli River and Upper Talarik Creek and lies at approximately 1,000 feet in elevation.

Glacial and fluvial sediments of varying thickness cover most of the mine study area at elevations below approximately 1,400 feet, whereas the ridges and hills above 1,400 feet generally exhibit exposed bedrock or have thin veneers of surficial material (Hamilton and Klieforth, 2010). The hills tend to be moderately sloped with rounded tops. The valley bottoms are generally flat, with some topographic anomalies that are explained by the glacial history of the surficial materials, as follows:

- The main stream channels are sinuous and their floodplains contain wetlands and oxbow lakes.
- Glaciofluvial terraces of outwash sediments occupy parts of the main valleys and take the form of flat to gently sloping benches or terraces situated above the adjacent floodplains.
- Glaciolacustrine deposits occupy the upper parts of the three main valleys and are represented by flat, poorly drained terrain. Frying Pan Lake is a shallow residual waterbody with a maximum depth of approximately 3 feet, located in the glaciolacustrine basin in the upper part of the South Fork Koktuli River valley.
- Extensive areas of glacial drift deposits occur along lower hillslopes and near the headwaters of the main stream valleys and are characterized by undulating terrain and numerous kettle lakes.

Photos 4-1 and 4-2 (following Section 4.3) illustrate some of the key physiographic features described above.

South of the mine study area, the Nushagak-Bristol Bay Lowlands comprises relatively flat-lying topography with abundant wetlands and ponds along the north shore of Iliamna Lake. The village of Iliamna lies in this division.

4.2.2 Transportation-corridor Study Area

The transportation-corridor study area is located within the Nushagak-Big River Hills, Nushagak-Bristol Bay Lowlands, and the southern part of the Alaska Range division, as described above.

The transportation-corridor study area traverses the following sequence of terrain types, some of which are illustrated in Photos 4-3 and 4-4:

- Flat to moderately undulating terrain in the Nushagak-Big River Hills division from the deposit area to Roadhouse Mountain.
- Flat to gently sloping terrain along the north shore of Iliamna Lake from Roadhouse Mountain to Canyon Creek.
- Mountain slopes and colluvial terrain along the north shore of Iliamna Lake from Canyon Creek to Pile River.
- Narrow valley-bottom and mountain-slope terrain in Chinkelyes Creek valley.

Major stream crossings in the transportation-corridor study area are the Newhalen River, which flows in a relatively stable, entrenched channel; Chekok Creek, which is relatively small and stable; Canyon Creek, Knutson Creek, the Pile River, and the Iliamna River, which have braided or meandering channels within actively eroding floodplains; and Chinkelyes Creek, which has a relatively stable lake-outlet channel.

4.2.3 Permafrost Conditions

The mine and transportation-corridor study areas lie in a zone of sporadic permafrost (Ferrians, 1965). The distribution of permafrost in the sporadic zone is patchy and complex, and permafrost-free terrain is common in this zone. Any permafrost in the study areas is most likely relict permafrost from previous periods of glaciation, because current climatic conditions do not support the aggradation of permafrost. Permafrost has not been encountered in previous site investigation and exploration programs in the mine study area.

4.3 References

Detterman, R.L., and B.L. Reed. 1973. Surficial Geology of the Iliamna Quadrangle, Alaska. U.S. Department of the Interior. Geological Survey Bulletin # 1368-A.

Ferrians, O.J. 1965. Permafrost Map of Alaska. U.S. Geological Survey.

Hamilton, T.D., and R.F. Klieforth. 2010. Surficial geologic map of parts of the Iliamna D-6 and D-7 quadrangles, Pebble Project area, southwestern Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2009-4, scale 1:50,000.

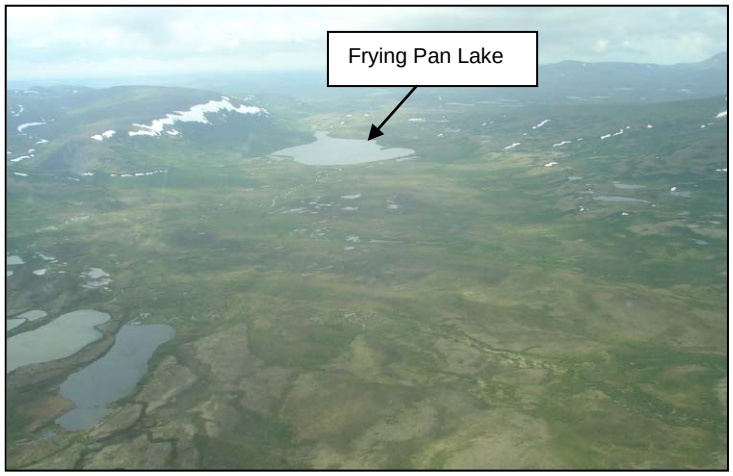

PHOTO 4-1. Mine study area, view to the south toward Frying Pan Lake, July 2004.

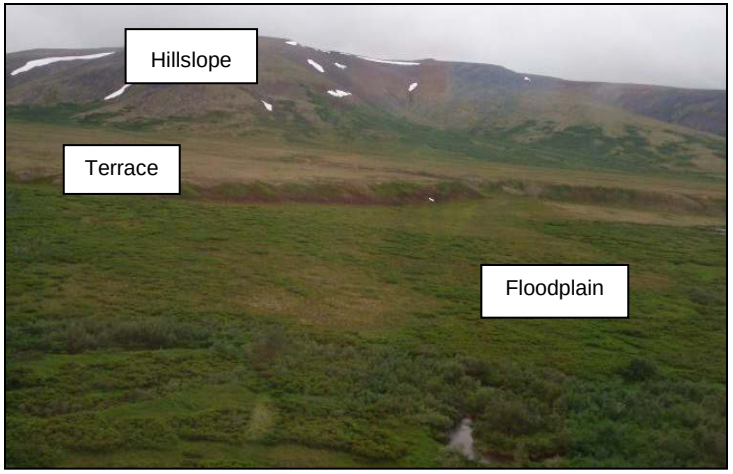

PHOTO 4-2. Mine study area, typical view across the South Fork Koktuli River valley showing floodplain, glaciofluvial terrace, and hillslope terrain, July 2008.

PHOTO 4-3. Transportation-corridor study area, typical mountain slope along the north shore of Iliamna Lake between Knutson Creek and Pile River, July 2008.

PHOTO 4-4, Transportation-corridor study area, typical braided channel pattern in the Pile River near the mouth, July 2008.