MONTANA BUREAU OF MINES AND GEOLOGY A Department of Montana Tech History and Hydrogeology of the Berkeley Pit, MBMG Open-File Report 705, Plate 2 History and Hydrogeology of the Berkeley Pit, Butte, Montana, 1955–2017 **Butte, Montana, 1955–2017** Terence E. Duaime and Susan M. Smith 2018 Timeline for Butte Operations, beginning 1955 **→** MR deactivates leach pads (1998) MR begins pumping Pit water for Cu (copper)-recovery process (Aug 1998) **Selective vein mining ceases (1975)** Workings below Kelley 3900 flooded (1977) Landslide on SE corner of Pit wall (9/29/98), 1.3 M cubic yards of material; Water levels in Pit and mines rise 2.5 feet **Continental Pit started (1/1/80)** — Continental Pit suspended (6/30/83) - Leach pad ponds, Continental Pit, and Clear Water Ditch water diverted into Pit (Summer 1983) Intake line for Cu-recovery plant lowered in Pit to improve recovery efficiency (Dec 1999) **→ MR** resumes limited leaching operation (2004) **→** Washington purchases Butte Operation; Montana Resources (MR) formed (12/85) + MR resumes Berkeley Pit Cu-recovery process (Jan 2004) — Continental Pit mining resumes (7/86) Landslide on SE corner of Pit wall (2/8/13); Water levels rise 0.6 feet; MR suspends Cu-recovery operations; Berkeley Pit sampling activities suspended Anaconda Copper Mining Co. (ACM) begins operation of Berkeley Pit (7/1/55) TMR begins leaching operations 2015 1955 1975 1985 2005 2023 – Projected date Critical Water Level is reached in Pilot Kelley dewatering pump shut down, underground mine flooding begins (4/22/82) **Butte Mine and additional** Kelley Mine pump station constructed (1966–1967), pump station relocated from High Ore Mine pumping and treating of Pit water is required MR resumes mining operations (Nov 2003); Mining ceases in Berkeley Pit (May 1982) HSB water treatment plant Resumed Berkeley Pit water sampling and profiling using remotely operated boat (drone boat) (2017) Weed Concentrator online (May 1963); Yankee Doodle Tailings Pond operational Horseshoe Bend water diverted to Pit (Summer 1982) HSB drainage water diverted away from Pit HSB water diverted to pit (May 2015); Concentrator maintenance, 45.8 MG HSB water diverted to pit (Nov-Dec 2015); Water treatment plant and monitoring site maintenance, 88.2 million gallons **GENERALIZED CROSS SECTION LOOKING WEST Pilot Butte** 6057' Horseshoe Bend water pumped into Yankee Doodle Tailings Dam (Apr 1996), diverting it away from Berkeley Pit **Critical Water Level** The 2002 Consent Decree specified compliance points that MR begins pumping HSB water to leach pads; Q = 1200–2500 gpm (Aug 2012) - - Alluvial water level elevations groundwater levels could not exceed. In the East Camp bedrock system, the critical water level cannot exceed an Bedrock water level elevations elevation of 5,410 ft (mean sea level, msl, USGS NAVD29 Landslide on SE corner of Pit wall (8/22/12); datum) at any of the 14 compliance points. Water levels not impacted - - - Anticipated water level at **Berkeley Pit and Granite Mountain Point of Compliance** Reference: EPA Consent Decree, 2002, Butte Mine Landslide on SE corner of Pit wall (11/3/12); when water level reaches 5410 ft elevation at Pilot Butte Mine **⊥** Water levels not impacted; Flooding Operable Unit Consent Decree-02-35-BU-SEH. Minor damage to pontoon boat CROSS SECTION LOOKING WEST OF THE BERKELEY PIT **AND YEARLY WATER LEVEL ELEVATIONS*** AMC-5 **Elevation** Elevations based on 1990 ARCO survey data, USGS datum. 5509' **AMW-20** 6000' — 1828.8 South Kelley El. 5878' **Weed Concentrator** Belmont El. 5604' Critical water level - 5410' Rim El. 5509' (Low) (at well AMC-5) Date of **Water Level** 5410' Approximate bedrock-alluvial contact 5259'-5309' See Inset See Inset 5390' 12-28-88 4884' 5360' 12-30-87 12-23-86 12-11-85 4704' 5337' 12-20-84 Alluvium Bedrock not to scale 12-29-83 4320' **INSET Elevation Elevation** feet meters 5337' 12/16 5300' — 1615 5331' 12/15 12/14 3442' 12-23-82 12/13 12/12 5306' 12/11 5299' 5292' 12/10 12/09 12/08 12/07 5200' — 1585 3000' 12/06 12/05 12/04 12/03 12/02 12/01 5264' 5257' 5249' 5241' 5100' — 1554 5195' 01/01 12/99 12/98 12/97 12/96 12/95 5166' 5149' 5136' Flood start 4-23-82 2000' — 600 01/95 5000' — 1524 5084' 01/94 01/93 Belmont bottom El. 1820' 12/91 12/90 12/89 12/88 Cross section modified 1/18 by MBMG. Base from 1982 AMC 4900' _____ 1494 (ARCO) figure. *Water level elevations from 1982-1994 are based upon Kelley Mine observations. Water level elevations since 1995 are based upon Berkeley Pit measurements, NGVD29. Kelley bottom El. 1054' Mines 1000 feet or more in depth -East Gray Rock Copper recovery Horseshoe Bend **Continental Pit** operations & Horseshoe Bend BERKELEY discharge area Orphan Girl
WORLD MUSEUM Berkeley Pit **Background: Aerial photo of** Berkeley Pit in 1979, looking north-northwest Map showing general outline of the Berkeley Pit and location of Upper Silver Bow Creek drainage.

Historic mine shafts are shown for reference.

Photograph credits: All photos except those labeled are from the

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Maps may be obtained from:

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Phone: (406) 496-4174 http://mbmg.mtech.edu

May 2017, looking southeast

Photo provided by Daryl Reed, MDEQ