HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD—REVIEW COVER SHEET

Name of Site: AFTERTHOUGHT MINE

Contact Person: Leslie Ramirez, EPA Region 9 (415) 972-3978

Site Investigation: Leslie Ramirez, EPA Region 9 (415) 972-3978

Documentation Record: Christina Marquis, Weston Solutions, Inc. christina.marquis@westonsolutions.com

Pathways, Components, or Threats Not Scored

The ground water, soil exposure and subsurface intrusion, and air pathways were not scored. There are no known active drinking water wells within the Target Distance Limit (TDL) (Ref. 4, p. 17). There are no residents on or near the site sources (Ref. 3; Ref. 4, p. 19). Therefore, the listing decision is not significantly affected by those pathways. The site score is sufficient to qualify the site for the NPL on the surface water pathway score.

Table of Contents

HAZARD RANKING SYSTEM SUMMARY SCORESHEETS.2HRS TABLE 4-13REFERENCES5ACRONYM LIST8NOTES TO THE READER9SITE DESCRIPTION16SITE SOURCES192.2 SOURCE 1 SOURCE CHARACTERIZATION202.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4 L AZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY242.2 SOURCE I SOURCE CHARACTERIZATION262.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4 LAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4 LAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4 LAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.2 SOURCE I SOURCE CHARACTERIZATION312.2 SOURCE I SOURCE CHARACTERIZATION312.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4 LAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.5 OURCE CHARACTERIZATION362.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4 LAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4 LAZA
HRS TABLE 4-13REFERENCES5ACRONYM LIST8NOTES TO THE READER9SITE DESCRIPTION16SITE SOURCES192.2 SOURCE 1 SOURCE CHARACTERIZATION202.1 SOURCE IDENTIFICATION202.2 1 SOURCE IDENTIFICATION202.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.4 AZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.5 AHZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4 .2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4 .2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY262.1 SOURCE 1 SOURCE CHARACTERIZATION262.2 1 ASURCE IDENTIFICATION262.2 1 ASURCE IDENTIFICATION262.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4 .2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4 .2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY312.1 SOURCE 1 SOURCE CHARACTERIZATION312.2 SOURCE 3 SOURCE CHARACTERIZATION312.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY333.4 L HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY333.4 2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4 SOURCE IDENTIFICATION362.2 I SOURCE IDENTIFICATION362.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY383.4 2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY383.4 2 HAZARDO
REFERENCES5ACRONYM LIST8NOTES TO THE READER9SITE DESCRIPTION16SITE SOURCES192.2 SOURCE I SOURCE CHARACTERIZATION202.2.1 SOURCE IDENTIFICATION202.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2 HAZARDOUS WASTE QUANTITY242.2 SOURCE 2 SOURCE CHARACTERIZATION262.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.5 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH
ACRONYM LIST8NOTES TO THE READER9SITE DESCRIPTION16SITE SOURCES192.2 SOURCE 1 SOURCE CHARACTERIZATION202.1 SOURCE IDENTIFICATION202.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.4.1 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY242.5 SOURCE 2 SOURCE CHARACTERIZATION262.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE332.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.1 SOURCE IDENTIFICATION362.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE36<
NOTES TO THE READER9SITE DESCRIPTION16SITE SOURCES192.2 SOURCE 1 SOURCE CHARACTERIZATION202.1 SOURCE IDENTIFICATION202.2.1 SOURCE IDENTIFICATION202.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2 HAZARDOUS WASTE QUANTITY242.2 SOURCE 2 SOURCE CHARACTERIZATION262.2.1 SOURCE IDENTIFICATION262.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY312.1 SOURCE IDENTIFICATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.3 SOURCE 4 SOURCE CHARACTERIZATION362.1 SOURCE IDENTIFICATION362.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY3
SITE DESCRIPTION
SITE SOURCES192.2 SOURCE 1 SOURCE CHARACTERIZATION202.2.1 SOURCE IDENTIFICATION202.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2. HAZARDOUS WASTE QUANTITY242.5 SOURCE 2 SOURCE CHARACTERIZATION262.1 SOURCE IDENTIFICATION262.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.1 SOURCE IDENTIFICATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.2. SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.3.1 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.3.1 AAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY34<
2.2 SOURCE 1 SOURCE CHARACTERIZATION202.2.1 SOURCE IDENTIFICATION202.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2. HAZARDOUS CE CHARACTERIZATION262.1. SOURCE 2 SOURCE CHARACTERIZATION262.2.1 NOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.3.1 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY
2.2.1 SOURCE IDENTIFICATION202.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.3.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2. HAZARDOUS WASTE QUANTITY242.2 SOURCE 2 SOURCE CHARACTERIZATION262.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY292.2 SOURCE 1 DENTIFICATION312.1 SOURCE IDENTIFICATION312.2.1 SOURCE CHARACTERIZATION312.2.2 HAZARDOUS WASTE QUANTITY292.3 SOURCE 3 SOURCE CHARACTERIZATION312.1 SOURCE IDENTIFICATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.4.4.4.4.4.
2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE202.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2. HAZARDOUS WASTE QUANTITY242.2 SOURCE 2 SOURCE CHARACTERIZATION262.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY.292.2 SOURCE 3 SOURCE CHARACTERIZATION312.1 SOURCE IDENTIFICATION312.2.1 SOURCE IDENTIFICATION312.2.1 SOURCE JENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.3.1 SOURCE IDENTIFICATION312.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.3.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.4 AZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE41<
2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY232.4.2. HAZARDOUS WASTE QUANTITY.242.2 SOURCE 2 SOURCE CHARACTERIZATION262.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.1 SOURCE IDENTIFICATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.4 AZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWA
2.4.2. HAZARDOUS WASTE QUANTITY.242.2 SOURCE 2 SOURCE CHARACTERIZATION262.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY.292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.5 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.6 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY362.2.1 SOURCE IDENTIFICATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.5 OURCE 5 SOURCE CHARACTERIZATION412.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.3.1 AAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.3.1 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURC
2.2 SOURCE 2 SOURCE CHARACTERIZATION262.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY362.2.1 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE 1DENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.2. HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.3.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.4.4.4.2.4.2.4.2.4.2.4.4.4.4.4.4.4.4
2.2.1 SOURCE IDENTIFICATION262.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE 4 SOURCE CHARACTERIZATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.3.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.1 SOURCE IDENTIFICATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.3.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.3.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4
2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE262.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.1.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY342.4.2. HAZARDOUS WASTE QUANTITY342.2.3 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE 4 SOURCE CHARACTERIZATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.5 OURCE 5 SOURCE CHARACTERIZATION382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE 5 SOURCE CHARACTERIZATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.3.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.3.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.4 HAZARDOUS SUBSTANCES AVAILABLE
2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY282.4.2. HAZARDOUS WASTE QUANTITY292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.3.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.4.2. HAZARDOUS WASTE QUANTITY392.4.2. HAZARDOUS WASTE QUANTITY342.3. HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.1 SOURCE 5 SOURCE CHARACTERIZATION412.2.2.1 AZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.2.1 AZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3.1 AZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.2.1 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.3.1 AZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.2.1 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.3.1 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHW
2.4.2. HAZARDOUS WASTE QUANTITY.292.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY.342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY342.4.3. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY412.2.3. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY412.2.3. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4
2.2 SOURCE 3 SOURCE CHARACTERIZATION312.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY412.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY44
2.2.1 SOURCE IDENTIFICATION312.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.4.2. HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4.2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY44
2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE312.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.5 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.6 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.7 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY45
2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY332.4.2. HAZARDOUS WASTE QUANTITY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.5 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.6 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.7 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.8 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4 2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442 4 2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY45
2.4.2. HAZARDOUS WASTE QUANTITY342.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4 2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4 2 HAZARDOUIS WASTE OLIANTITY45
2.2 SOURCE 4 SOURCE CHARACTERIZATION362.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4 2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4 2 HAZARDOUS WASTE OLIANTITY45
2.2.1 SOURCE IDENTIFICATION362.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE362.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY382.4.2. HAZARDOUS WASTE QUANTITY392.2 SOURCE 5 SOURCE CHARACTERIZATION412.2.1 SOURCE IDENTIFICATION412.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE412.4 2 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY442.4 2 HAZARDOUS WASTE OLIANTITY45
2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 36 2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY 38 2.4.2. HAZARDOUS WASTE QUANTITY 39 2.2 SOURCE 5 SOURCE CHARACTERIZATION 41 2.2.1 SOURCE IDENTIFICATION 41 2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 41 2.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 41 2.2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 41 2.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 41 2.4 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 44 2.4 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY 45
2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY 38 2.4.2. HAZARDOUS WASTE QUANTITY 39 2.2 SOURCE 5 SOURCE CHARACTERIZATION 41 2.2.1 SOURCE IDENTIFICATION 41 2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 41 2.2.3 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 41 2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY 44 2.4 2 HAZARDOUS WASTE OLIANTITY 45
2.4.2. HAZARDOUS WASTE QUANTITY
2.2 SOURCE S SOURCE CHARACTERIZATION 41 2.2.1 SOURCE IDENTIFICATION 41 2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 41 2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY 44 2.4 2 HAZARDOUS WASTE OLIANTITY 45
2.2.1 SOURCE IDENTIFICATION
2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY
2.2.5 HAZARDOUS SUBSTANCES AVAILABLE TO ATATIWAT
2 2 SOURCE 6 SOURCE CHARACTERIZATION 47
2.2 SOURCE DESCRETE CHARGE CLEAR AND CONTRACT OF A CONTRAC
2 2 2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE 47
2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY
2.4.2. HAZARDOUS WASTE QUANTITY
4.0 SURFACE WATER MIGRATION PATHWAY
4.1 OVERLAND/FLOOD MIGRATION COMPONENT (Figures A-4 and A-5)
4.1.1 GENERAL CONSIDERATIONS
4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/flood Component55
4.1.1.2 Target Distance Limit
4.1.2.1 Likelihood of Release
4.1.2.1.1 Observed Release
4.1.2.1.2 Potential to Release

Figures

Figure A-1: Site Location Map

Figure A-2: Site Vicinity Map

Figure A-3: Afterthought Mine Source Sampling Map

Figure A-4: Afterthought Mine Probable Point of Entry Map

Figure A-5: 15-Mile Surface Water Target Distance Limit

Figure A-6: Afterthought Mine Stream Sample Location Map

HRS DOCUMENTATION RECORD

Name of Site:	AFTERTHOUGHT MINE
EPA ID#:	CAN000908808
EPA Region:	9
Date Prepared:	March 2024
Street Address of Site:	25 miles northeast of Redding on Highway 299
City, County and State:	Bella Vista, Shasta County, California 96008
Topographic Map:	Oak Run, CA USGS 7.5-Minute Quadrangle (Ref. 3)
Latitude: 40° 44' 4.3692" No	rth Longitude: 122° 4' 20.6256" West (Ref. 3; Ref. 4, p. 44)

Latitude/Longitude Reference Point: The latitude and longitude correspond to Portal 1 (Source 1) sampling location AC-03 (Ref. 4, p. 44).

SCORES			
Air Pathway	Ш	Not scored	
Ground Water ¹ Pathway	II	Not scored	
Soil Exposure and Subsurface Intrusion Pathway	=	Not scored	
Surface Water Pathway	=	100.00	
HRS SITE SCORE	=	50.00	

*The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area where the site is located. They represent one or more locations the United States Environmental Protection Agency (EPA) considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation & Liability Act (CERCLA). Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

¹ "Ground water" and "groundwater" are synonymous; the spelling is different due to "ground water" being codified as part of the HRS, while "groundwater" is the modern spelling.

HAZARD RANKING SYSTEM SUMMARY SCORESHEETS

SITE NAME: AFTERTHOUGHT MINE

CITY/COUNTY/STATE: Bella Vista, Shasta County, California

EPA ID #: <u>CAN000908808</u>

EVALUATOR: Christina Marquis DATE: March 2024

LATITUDE: <u>40° 44' 4.3692" N</u> LONGITUDE: <u>122° 4' 20.6256" W</u>

	S	S^2
Ground Water Migration Pathway Score (Sgw)	Not scored	Not scored
Surface Water Migration Pathway Score (Ssw)	100	10,000
Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi})	Not scored	Not scored
Air Migration Pathway Score (S _a)	Not scored	Not scored
$S_{gw}^{2} + S_{sw}^{2} + S_{sessi}^{2} + S_{a}^{2}$	XXXXXXX	10,000
$(S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2) / 4$	XXXXXXX	2,500
SQRT $((S_{gw}^2 + S_{sw}^2 + S_{sessi}^2 + S_a^2) / 4)$	XXXXXXX	50.00

Drinking Water ThreatImage: Constraint of the second s	Factor Categories and Factors	Maximum Value	Value Assigned	
Likelihood of Release:5505501. Observed Release5505502. Potential to Release by Overland Flow:10102b. Runoff25252c. Distance to Surface Water25262d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])500103. Potential to Release by Flood:3a. Containment (Flood)103b. Flood Frequency5050503c. Potential to Release by Flood (lines 3a x 3b)500103b. Flood Frequency505505503c. Potential to Release (lines 2d + 3c, subject to a maximum of 500)500Not scored5. Likelihood of Release (higher of lines 1 and 4)550550Waste Characteristics:1010107. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored9. Nearest Intake50Not scored100. Population:10Not scored101. Level I Concentrations(b)Not scored102. Population (lines 10a + 10b + 10c)(b)Not scored104. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scored13. Drinking Water Threat Score:100Not scored14. Likelihood of Release (same value as line 5)550550Waste Characteristics:100Not scored13. Drinking Water Threat Score:10010014.	Drinking Water Threat			
1. Observed Release 550 550 2. Potential to Release by Overland Flow: 10 2a. Containment 10 2b. Runoff 25 2c. Distance to Surface Water 25 2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c]) 500 3. Potential to Release by Flood: 10 3a. Containment (Flood) 10 3b. Flood Frequency 50 3c. Potential to Release by Flood (lines 3a x 3b) 500 4. Potential to Release (lines 2d + 3c, subject to a maximum of 500) 500 5. Likelihood of Release (lines 1 and 4) 550 50 550 Waste Characteristics:	Likelihood of Release:			
2. Potential to Release by Overland Flow: 10 2a. Containment 10 2b. Runoff 25 2c. Distance to Surface Water 25 2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c]) 500 3. Potential to Release by Flood: 10 3a. Containment (Flood) 10 3b. Flood Frequency 50 3c. Potential to Release by Flood (lines 3a x 3b) 500 4. Potential to Release (lines 2d + 3c, subject to a maximum of 500) 500 5. Likelihood of Release (higher of lines 1 and 4) 550 550 Waste Characteristics: (a) Not scored 6. Toxicity/Persistence (a) Not scored 7. Hazardous Waste Quantity (a) Not scored 8. Waste Characteristics 100 Not scored 10. Population:	1. Observed Release	550	550	
2a. Containment102b. Runoff252c. Distance to Surface Water252d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])5003. Potential to Release by Flood:103a. Containment (Flood)103b. Flood Frequency503c. Potential to Release by Flood (lines 3a x 3b)5004. Potential to Release (lines 2d + 3c, subject to a maximum of 500)5005. Likelihood of Release (higher of lines 1 and 4)5505. Likelihood of Release (higher of lines 1 and 4)5506. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored9. Nearest Intake500Not scored10. Population:100Not scored10. Population:100Not scored104. Level I Concentrations(b)Not scored105. Potential Contamination(b)Not scored106. Population (lines 10a + 10b + 10c)(b)Not scored117. Resources50Stored12. Targets (lines 9 + 10d + 11)(b)Not scored13. Drinking Water Threat Score100Not scored118. Resources:100Not scored14. Likelihood of Release (same value as line 5)550550Waste Characteristics:100Not scored14. Likelihood of Release (same value as line 5)550550Waste Characteristics:1001000015. Toxicity/Persistence/Bioaccumulation	2. Potential to Release by Overland Flow:			
2b. Runoff252c. Distance to Surface Water252d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])5003. Potential to Release by Flood:103a. Containment (Flood)103b. Flood Frequency503c. Potential to Release by Flood (lines 3a x 3b)5004. Potential to Release (lines 2d + 3c, subject to a maximum of 500)5005. Likelihood of Release (lines 2d + 3c, subject to a maximum of 500)5005. Likelihood of Release (lines 1 and 4)5505. Likelihood stelease (lines 2d + 3c, subject to a maximum of 500)5006. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored9. Nearest Intake50Not scored10. Population:	2a. Containment	10		
2c. Distance to Surface Water252d. Potential to Release by Overland Flow (lines $2a \times [2b + 2c]$)5003a. Containment (Flood)103b. Flood Frequency503c. Containtial to Release by Flood (lines $3a \times 3b$)5004. Potential to Release (lines $2d + 3c$, subject to a maximum of 500)5005. Likelihood of Release (lines $2d + 3c$, subject to a maximum of 500)5005. Likelihood of Release (lines $1 and 4$)550550Waste Characteristics:6. Toxicity/Persistence(a)7. Hazardous Waste Quantity(a)8. Waste Characteristics1009. Nearest Intake50102. Level I Concentrations(b)103. Level I Concentrations(b)104. Level II Concentrations(b)105. Lost cored(b)106. Population(b)107. Potential Contamination(b)108. Resources511. Resources512. Targets (lines $9 + 10d + 10c$)(b)13. Drinking Water Threat Score10014. Likelihood of Release:10014. Likelihood of Release (same value as line 5)550550550Waste Characteristics:10014. Likelihood of Release:10015. Toxicity/Persistence/Bioaccumulation(a)16. Hazardous Waste Quantity(a)17. Waste Characteristics:10014. Likelihood of Release (same value as line 5)55055055015. Toxicity/Persistence/Bioaccumulation(a)<	2b. Runoff	25		
2d. Potential to Release by Overland Flow (lines $2a \times [2b + 2c]$)5003. Potential to Release by Flood:103a. Containment (Flood)103b. Flood Frequency503c. Potential to Release by Flood (lines $3a \times 3b$)5004. Potential to Release (lines $2d + 3c$, subject to a maximum of 500)5005. Likelihood of Release (higher of lines 1 and 4)550550Waste Characteristics:(a)6. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored9. Nearest Intake50Not scored10. Population:50Not scored10a. Level I Concentrations(b)Not scored10b. Level I Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines $10a + 10b + 10c$)(b)Not scored11. Resources5Not scored12. Targets (lines $9 + 10d + 11$)(b)Not scored13. Drinking Water Threat Score: ([lines $5 \times 8 \times 12/82, 500$, subject to a maximum of 100)100Not scored14. Likelihood of Release: 14. Likelihood of Release (same value as line 5)550550Waste Characteristics:1001000000000000000000000000000000000000	2c. Distance to Surface Water	25		
3.Potential to Release by Flood:103a.Containment (Flood)103b.Flood Frequency503c.Potential to Release by Flood (lines $3a \times 3b$)5004.Potential to Release (lines $2d + 3c$, subject to a maximum of 500)5005.Likelihood of Release (higher of lines 1 and 4)550550 Waste Characteristics: (a)Not scored6.Toxicity/Persistence(a)Not scored7.Hazardous Waste Quantity(a)Not scored8.Waste Characteristics100Not scored7.Hazardous Waste Quantity(a)Not scored8.Waste Characteristics100Not scored9.Nearest Intake50Not scored10a.Level I Concentrations(b)Not scored10b.Level I Concentrations(b)Not scored10c.Population(b)Not scored10d.Population (lines $10a + 10b + 10c$)(b)Not scored10d.Population (lines $10a + 10b + 10c$)(b)Not scored11.Resources5Not scored12.Targets (lines $9 + 10d + 11$)(b)Not scored11.Resources100Not scored12.Targets (lines $5 \times 8 \times 12/82, 500$, subject to a maximum of 100)100Not scored11.Human Food Chain Threat10010014.Likelihood of Release (same value as line 5)550550Waste Characteristic	2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500		
3a. Containment (Flood) 10 3b. Flood Frequency 50 3c. Potential to Release by Flood (lines 3a x 3b) 500 4. Potential to Release (lines 2d + 3c, subject to a maximum of 500) 500 Not scored 5. Likelihood of Release (lines 2d + 3c, subject to a maximum of 500) 500 Not scored 5. Likelihood of Release (lines 1 and 4) 550 550 Waste Characteristics: (a) Not scored 6. Toxicity/Persistence (a) Not scored 7. Hazardous Waste Quantity (a) Not scored 8. Waste Characteristics 100 Not scored 9. Nearest Intake 50 Not scored 10. Population:	3. Potential to Release by Flood:			
3b. Flood Frequency503c. Potential to Release by Flood (lines $3a x 3b$)5004. Potential to Release (lines $2d + 3c$, subject to a maximum of 500)500Not scored5. Likelihood of Release (higher of lines 1 and 4)550550Waste Characteristics:(a)Not scored6. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored9. Nearest Intake50Not scored10. Population:	3a. Containment (Flood)	10		
3c. Potential to Release by Flood (lines 3a x 3b)5004. Potential to Release (lines 2d + 3c, subject to a maximum of 500)500Not scored5. Likelihood of Release (higher of lines 1 and 4)550550Waste Characteristics:(a)Not scored6. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scoredTargets:(a)Not scored9. Nearest Intake50Not scored10. Population:(b)Not scored10a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scored13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scored14. Likelihood of Release:	3b. Flood Frequency	50		
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)500Not scored5. Likelihood of Release (higher of lines 1 and 4)550550Waste Characteristics:(a)Not scored6. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored9. Nearest Intake50Not scored10. Population:	3c. Potential to Release by Flood (lines 3a x 3b)	500		
5. Likelihood of Release (higher of lines 1 and 4) 550 550 Waste Characteristics:(a)Not scored6. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored Targets: 100Not scored9. Nearest Intake50Not scored10. Population:100Not scored10a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines $10a + 10b + 10c$)(b)Not scored11. Resources5Not scored12. Targets (lines $9 + 10d + 11$)(b)Not scored13. Drinking Water Threat Score ([lines $5 \times 8 \times 12]/82,500$, subject to a maximum of 100)100Not scored14. Likelihood of Release:100S5055014. Likelihood of Release (same value as line 5)550550Waste Characteristics:11(a)500,000,00016. Hazardous Waste Quantity(a)10,00010,00017. Waste Characteristics10001,000100	4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	Not scored	
Waste Characteristics:(a)Not scored6. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scoredTargets:100Not scored9. Nearest Intake50Not scored10. Population:100Not scored10a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scoredItinking Water Threat Score: ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)10014. Likelihood of Release:1015. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics:10001000	5. Likelihood of Release (higher of lines 1 and 4)	550	550	
6. Toxicity/Persistence(a)Not scored7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scored Targets: 100Not scored9. Nearest Intake50Not scored10. Population:10110210a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scored Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)11. Likelihood of Release:100Not scored14. Likelihood of Release:10010015. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics:10001000	Waste Characteristics:			
7. Hazardous Waste Quantity(a)Not scored8. Waste Characteristics100Not scoredTargets:50Not scored9. Nearest Intake50Not scored10. Population:10a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scored13. Drinking Water Threat Score100Not scored13. Drinking Water Threat Score100Not scored14. Likelihood of Release:100Not scored15. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics:1001000	6. Toxicity/Persistence	(a)	Not scored	
8. Waste Characteristics100Not scoredTargets:9.Nearest Intake50Not scored10. Population:50Not scored10a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scored13. Drinking Water Threat Score:100Not scored14. Likelihood of Release:100Not scored15. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics:10001000	7. Hazardous Waste Quantity	(a)	Not scored	
Targets:Image: state st	8. Waste Characteristics	100	Not scored	
9. Nearest Intake50Not scored10. Population:	Targets:			
10. Population:10.10a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scored13. Drinking Water Threat Score:100Not scored13. Drinking Water Threat Score100Not scored14. Likelihood of Release:100Not scored15. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)1000100017. Waste Characteristics10001000	9. Nearest Intake	50	Not scored	
10a. Level I Concentrations(b)Not scored10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scoredDrinking Water Threat Score:13. Drinking Water Threat Score100Not scored([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat14. Likelihood of Release (same value as line 5)550550Waste Characteristics:(a)500,000,00016. Hazardous Waste Quantity(a)100017. Waste Characteristics10001,000	10. Population:			
10b. Level II Concentrations(b)Not scored10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scoredDrinking Water Threat Score:13. Drinking Water Threat Score100Not scored([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat14. Likelihood of Release (same value as line 5)550550Waste Characteristics:1(a)500,000,00016. Hazardous Waste Quantity(a)10001000	10a. Level I Concentrations	(b)	Not scored	
10c. Potential Contamination(b)Not scored10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scoredDrinking Water Threat Score:13. Drinking Water Threat Score100Not scored([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat14. Likelihood of Release:55055015. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics10001,000	10b. Level II Concentrations	(b)	Not scored	
10d. Population (lines 10a + 10b + 10c)(b)Not scored11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scoredDrinking Water Threat Score:13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat14. Likelihood of Release:55055015. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics:1001,000	10c. Potential Contamination	(b)	Not scored	
11. Resources5Not scored12. Targets (lines 9 + 10d + 11)(b)Not scoredDrinking Water Threat Score:100Not scored13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat100Not scoredLikelihood of Release:10010014. Likelihood of Release (same value as line 5)550550Waste Characteristics:100100016. Hazardous Waste Quantity(a)1000017. Waste Characteristics10001000	10d. Population (lines $10a + 10b + 10c$)	(b)	Not scored	
12. Targets (lines 9 + 10d + 11)(b)Not scoredDrinking Water Threat Score:100Not scored13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat100Not scoredLikelihood of Release:10055014. Likelihood of Release (same value as line 5)550550Waste Characteristics:10010,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics10001000	11. Resources	5	Not scored	
Drinking Water Threat Score:100Not scored13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat100100Likelihood of Release:10010014. Likelihood of Release (same value as line 5)550550Waste Characteristics:100100015. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics10001000	12. Targets (lines 9 + 10d + 11)	(b)	Not scored	
13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)100Not scoredHuman Food Chain Threat100Not scoredLikelihood of Release:10010014. Likelihood of Release (same value as line 5)550550Waste Characteristics:100100000016. Hazardous Waste Quantity(a)1000017. Waste Characteristics10001000	Drinking Water Threat Score:			
Human Food Chain ThreatImage: Characteristics:14. Likelihood of Release (same value as line 5)550Waste Characteristics:55015. Toxicity/Persistence/Bioaccumulation(a)16. Hazardous Waste Quantity(a)17. Waste Characteristics1000	13. Drinking Water Threat Score	100	Not scored	
Likelihood of Release:Image: Characteristics:14. Likelihood of Release (same value as line 5)550Waste Characteristics:55015. Toxicity/Persistence/Bioaccumulation(a)16. Hazardous Waste Quantity(a)17. Waste Characteristics1000	(Innes 5 x 8 x 12)/82,500, subject to a maximum of 100) Human Food Chain Threat			
14. Likelihood of Release (same value as line 5)550Waste Characteristics:55015. Toxicity/Persistence/Bioaccumulation(a)16. Hazardous Waste Quantity(a)17. Waste Characteristics1000	Likelihood of Release:			
Waste Characteristics:(a)15. Toxicity/Persistence/Bioaccumulation(a)16. Hazardous Waste Quantity(a)17. Waste Characteristics1000	14 Likelihood of Release (same value as line 5)	550	550	
15. Toxicity/Persistence/Bioaccumulation(a)500,000,00016. Hazardous Waste Quantity(a)10,00017. Waste Characteristics1,0001,000	Waste Characteristics:			
16. Hazardous Waste Quantity(a)10,00017. Waste Characteristics1,0001,000	15 Toxicity/Persistence/Bioaccumulation	(a)	500 000 000	
17 Waste Characteristics 1 000 1 000	16. Hazardous Waste Quantity	(a)	10,000	
	17. Waste Characteristics	1.000	1.000	

HRS TABLE 4-1 Surface Water Overland/Flood Migration Component Scoresheet

Factor Categories and Factors	Maximum Value	Value Assigned
Targets:		
18. Food Chain Individual	50	20
19. Population:		
19a. Level I Concentrations	(b)	0
19b. Level II Concentrations	(b)	0
19c. Potential Human Food Chain Contamination	(b)	0.00003
19d. Population (lines 19a + 19b + 19c)	(b)	0.00003
20. Targets (lines 18 + 19d)	(b)	20.00003
Human Food Chain Threat Score:		
21. Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	100.00
Environmental Threat		
Likelihood of Release:		
22. Likelihood of Release (same value as line 5)	550	550
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	500,000,000
24. Hazardous Waste Quantity	(a)	10,000
25. Waste Characteristics	1,000	1,000
Targets:		
26. Sensitive Environments:		
26a. Level I Concentrations	(b)	0
26b. Level II Concentrations	(b)	25
26c. Potential Contamination	(b)	0.175
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	25.175
27. Targets (value from 26d)	(b)	25.175
Environmental Threat Score:		
28. Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60	60
Surface Water Overland/Flood Migration Component Score for a Watershed		
29. Watershed Score ^c (lines 13 + 21 + 28, subject to a maximum of 100)	100	100.00
Surface Water Overland/Flood Migration Component Score		
30. Component Score (S_{of}), (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100) (c)	100	100.00

HRS Table 4-1 – Surface Water Overland/Flood Migration Component Scoresheet (cont'd)

(a) Maximum value applies to waste characteristics category.(b) Maximum value not applicable.

(c) Do not round to nearest integer.

Reference Number	Description of the Reference
1	U.S. Environmental Protection Agency (EPA). Hazard Ranking System (HRS), Title 40 Code of Federal Regulations (CFR) Part 300, Appendix A (55 Federal Register [FR] 51583, December 14, 1990, as amended at 82 FR 2779, Jan. 9, 2017; 83 FR 38037, Aug. 3, 2018), as published in the CFR on July 1, 2019, with two attachments—Attachment A: FR Vol. 55, No. 241. December 14, 1990. HRS Preamble. Attachment B: FR Vol. 82, No. 5, January 9, 2017. Addition of a Subsurface Intrusion Component to the Hazard Ranking System Preamble. 197 Pages. Available on-line at: <u>https://semspub.epa.gov/work/HQ/174028.pdf</u> and <u>https://www.regulations.gov/document?D=EPA-HQ-SFUND-2010-1086- 0104</u> .
2	EPA, Superfund Chemical Data Matrix (SCDM) Query, Accessed January 24, 2024, 18 pages. Available online at: http://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm.
3	U.S. Geological Survey, 7.5 Minute Topographic Map of Oak Run, California, 2018, 1 sheet.
4	Weston Solutions, Inc., Site Inspection Report Afterthought Mine, prepared for EPA, May 2023, 62 pages.
5	Weston Solutions, Inc., Site Inspection Report Afterthought Smelter, prepared for EPA, May 2023, 52 pages.
6	Ned Black, EPA, contact report with Leslie Ramirez, re: Fishing in Little Cow Creek, with attached California Department of Fish and Wildlife Fishing Guide and Article of 34 Best Fishing Spots Near Redding and Shasta County April 21, 2023, 25 pages
7	Weston Solutions, Inc., Site Inspection Sampling and Analysis Plan, Afterthought Mine, prepared for EPA, March 2020, 164 pages.
8	Fishbrain.com. Fishing spots, fishing reports and regulations in Little Cow Creek, data extracted January 28, 2024. 22 pages.
9	Eurofins Burlington, Analytical Report, Job Number: 200-64005-1, SDG Number: MY0AA0, July 28, 2022, 546 pages.
10	Eurofins Burlington, Analytical Report, Job Number: 200-64005-2, SDG Number: MY0AC1, July 28, 2022, 876 pages.
11	Eurofins Burlington, Analytical Report, Job Number: 200-64005-3, SDG Number: MY0AF9, July 29, 2022, 483 pages.
12	Eurofins Burlington, Analytical Report, Job Number: 200-63979-1, SDG Number: MY0AJ5, July 26, 2022, 2,420 pages.
13	U.S. Fish and Wildlife Service, National Wetlands Inventory, <u>https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/</u> , data extracted January 25, 2024, 5 pages.
14	Tuggle, J.M., Exploring Shasta County History, Furnaceville & Ingot: The Home of the Afterthought Mine. June 23, 2021, 22 pages.
15	EPA, Afterthought Mine Validation Report, October 5, 2022, 399 pages.
16	EPA, Afterthought Mine Validation Report, October 5, 2022, 180 pages.

REFERENCES

AFTERTHOUGHT MINE

Reference Number	Description of the Reference
17	Brown, G.C., California State Mining Bureau, Mines and Mineral Resources of Shasta County, Siskiyou County, Trinity County. 1915. 210 pages.
18	U.S. Fish and Wildlife Service, National Wetlands Inventory,
	https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/, data
	extracted October 3, 2023, 1 page.
19	EPA, Afterthought Smelter Validation Report, October 5, 2022, 220 pages.
20	U.S. Department of Commerce, National Oceanic and Atmospheric
	Administration, National Marine Fisheries Service, 50 CFR Part 226,
	Endangered and Threatened Species; Designation of Critical Habitat for
	Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in
	California, (70 FR 52488) September 2, 2005, 140 pages.
21	Albers, J., State of California Division of Mines, Special Report 29, Geology
	and Ore Deposits of the Afterthought Mine, Shasta County, California,
	February 1953, 30 pages.
22	State of California Department of Natural Resources, California Journal of
	Mines and Geology, Volume 50, Number 1, January 1954, 282 pages.
23	State of California Department of Natural Resources, California Journal of
24	Mines and Geology, Volume 53, Nos. 3 & 4, July-October 1957, 395 pages.
24	Cantornia State Mining Bureau, Mining in Cantornia, January 1925, 50
25	California Stata Mining Puroau Mining in California, April 1026, 112 pagas
25	State of California The Resources Agency, Department of Water Resources
20	The Greenhorn and Afterthought Mines – a Plan for the Control and
	Abatement of Acid and Heavy Metal Pollution. Shasta County, California
	July 1985, 97 pages.
27	Ecology & Environment, Inc., Preliminary Assessment, Afterthought Mine,
	August 24, 1987, 118 pages.
28	Hook & Bullet, Little Cow Creek Fishing near Palo Cedro, California,
	hookandbullet.com, July 24, 2019, 5 pages.
29	Heiman, Dennis, Associate Land and Water Use Analyst, Memorandum to
	File, Survey of Afterthought Mine and Little Cow Creek, May 11, 1982, 3
	pages.
30	Mining and Scientific Press, Shasta County as a Smelting Centre, October
	24, 1908, 2 pages.
31	Lewis, Robert H., Office Memorandum, Afterthought Mine, 205(j) Project,
	Second Quarterly Sampling Results, September 5, 1984, 4 pages.
32	California Regional Water Quality Control Board, Central Valley Region,
	Order No. 97-097, NPDES No. CA0084166, Waste Discharge Requirements
	Mine Sheste County, June 20, 1007, 7 pages
22	California Dagional Water Quality Control Deard Control Valley Degion
	Order No. Administrative Civil Liability in the Matter of Agricultural
	Management and Production Company Inc. Afterthought Mine Shasta
	County September 17 1999 8 pages
	- councy, september 17, 1777, 0 puges.

Reference Number	Description of the Reference
34	Rossi, Jeri, ICF, ESAT Region 9, Memorandum, Review of Analytical Data, Tier 3, Afterthought Mine SDG No. MY0AF9, September 30, 2022, 34 pages.
35	Andrews, John, SHN Consulting Engineers & Geologists, Letter with Attachments, Base Maps, Cease and Desist Order 97-098, Afterthought Mine, Shasta County, California, October 24, 1997, 7 pages.
36	SHN Consulting Engineers & Geologists, Remedial Action Plan, Afterthought Mine, Shasta County, California, August 31, 1998, 58 pages.
37	SHN Consulting Engineers & Geologists, Cow Creek Watershed Assessment, November 2001, 370 pages.
38	California State Water Resources Control Board, Final California 2012 Integrated Report (303(d) List/305(b) Report), Little Cow Creek (downstream from Afterthought Mine), https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2012. shtml?wbid=CAR5073301019990126112551, data extracted July 22, 2019, 7 pages.
39	U.S. Geological Survey, Geological Survey Professional Paper 338, Geology and Ore Deposits of East Shasta Copper-Zinc District, Shasta County, California, 1961, 125 pages.
40	U.S. Geological Survey, National Water Information System, USGS 11373300 Little Cow C NR Ingot CA, https://waterdata.usgs.gov/nwis, data extracted June 5, 2019, 2 pages.
41	Weston Solutions, Inc., Preliminary Assessment Report, Afterthought Mine, September 2019, 1,982 pages.
42	Weston Solutions, Inc., Preliminary Assessment Report, Afterthought Smelter, September 2019, 1,842 pages,
43	Rossi, Jeri, ICF, Environmental Services Assistance Team (ESAT) Region 9, Memorandum, Review of Analytical Data, Tier 3, Afterthought Mine SDG No. MY0AA0, September 30, 2022, 49 pages.
44	Rossi, Jeri, ICF, ESAT Region 9, Memorandum, Review of Analytical Data, Tier 3, Afterthought Mine SDG No. MY0AC1, September 30, 2022, 68 pages.
45	EPA, Afterthought Smelter Validation Report, October 5, 2022, 240 pages.
46	Rossi, Jeri, ICF, ESAT Region 9, Memorandum, Review of Analytical Data, Tier 3, Afterthought Mine SDG No. MY0AJ5, October 4, 2022, 53 pages.
47	Weston Solutions, Inc., Attachment 4 Field Logbook. June 2022, 3 pages.
48	EPA. Office of Superfund Remediation and Technology Innovation. Using Qualified Data to Document an Observed Release and Observed Contamination. Directive 9285.7-89FS. November 2022. 20 pages.

ACRONYM LIST

μg/l	micrograms per liter
AMD	acid mine drainage
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limit
EPA	United States Environmental Protection Agency
gpm	gallons per minute
HRS	Hazard Ranking System
ISM	Inorganic Superfund Method
mg/kg	milligrams per kilogram
ND	not detected at or above the method detection limit
NPL	National Priorities List
NS	Not Scored
PPE	Probable Point of Entry
PRP	Potentially Responsible Party
SAP	Sampling and Analysis Plan
SCDM	Superfund Chemical Data Matrix
SI	Site Inspection
SQL	Sample Quantitation Limit
TDL	Target Distance Limit
USGS	United States Geological Survey
WESTON	Weston Solutions, Inc.

NOTES TO THE READER

Page numbers have been added to the references in the lower right corner. For reference citations, please refer to the page numbers in this location.











15-mile TDL Hold Creek	Freik End Point		Clover rest
The source of this image is ESRI, used by the EPA with ESRI's permission	0 Scale in Miles 2 1:54,000	Prepared For: EPA Region 9 Site Assessment Program Prepared By: Weston Solutions, Inc. Concord, CA 94520 February 2024	FIGURE A-5 15-MILE SURFACE WATER TARGET DISTANCE LIMIT Afterthought Mine HRS Documentation Record Bella Vista, Shasta County, California



SITE DESCRIPTION

The Afterthought Mine site is located approximately 25 miles northeast of Redding on Highway 299 East, Bella Vista, Shasta County, California (Figure A-1 of this HRS documentation record; Ref. 4, p. 8). For Hazard Ranking System scoring purposes, the site consists of the release of hazardous substances from former operations associated with mining and ore processing. The sources of hazardous substances includes waste rock, tailings, and acid mine drainage (AMD) (Sources 1-6) (Figure A-2 and Figure A-3 of this HRS documentation record; see section 2.2 and subsections of this HRS documentation record).

Hazardous substances associated with the site sources include arsenic, cadmium, copper, lead, mercury, and zinc (see Section 2.2, Source Characterization of this HRS documentation record). An observed release of cadmium, copper, lead, and zinc is documented to Little Cow Creek (see Section 4.1.2.1.1, Observed Release of this HRS documentation record). Targets affected by the observed release include the Little Cow Creek fishery (see Section 4.1.3.3 Human Food Chain Threat Targets of this HRS documentation record). Additional targets include potential contamination of Critical Habitat for the Federal-listed threatened Steelhead (*Oncorhynchus mykiss*), and Level II actual contamination of wetlands (see Section 4.1.4.3 Environmental Threat Targets of this HRS documentation record).

The Afterthought Mine site is located in a canyon formed by Little Cow Creek, a perennial stream that flows southwest to Cow Creek. Afterthought Mine is located approximately 3/4 mile upstream from the town of Ingot. The former Afterthought Smelter is located approximately 1 mile downstream of Afterthought Mine. A former rail bed that appears to have been constructed from tailings and/or waste rock connects Afterthought Mine and Afterthought Smelter along the eastern bank of Little Cow Creek (Figure A-2 of this HRS documentation record; Ref. 4, p. 8; Ref. 14, pp. 9, 22; Ref. 17, pp. 28-29).

The Afterthought Mine dates to 1862, when seven claims of the Copper Hill group were staked. During the first few years after the mine's discovery, the oxidized ore near the surface was mined on a small scale for gold and silver. In 1873, M.H. Peck purchased the property, named it the Peck Mine, and mined copper ore that was shipped to Swansea, Wales, for processing. In 1875, Peck built a small reverberatory furnace to reduce the sulfide ore, which failed, as did a water-jacketed furnace built soon afterward. Subsequently, the mine was acquired by Joseph Conland and Associates, who built a 25-ton water-jacketed blast furnace. Two attempts to treat the ore in this furnace were made but both were unsuccessful. In 1896, 200 tons of ore were smelted. This yielded 32 tons of copper matte containing 37 percent copper, 45 ounces of silver, and \$7 in gold per ton (Ref. 17, pp. 28-29; Ref. 21, p. 5; Ref. 24, p. 26; Ref. 25, p. 35; Ref. 26, p. 54; Ref. 36, p. 7; Ref. 39, pp. 79, 95-96).

In 1903, the mine was purchased by the Great Western Gold Company. In 1905, the company constructed a 250-ton water-jacketed blast furnace 1 mile downstream of the site at Afterthought Smelter. Operation of this furnace continued successfully until 1908. During this period, the average yearly output was reported to have been \$350,000. The copper matte produced in the blast furnace was shipped to a smelter in Salt Lake City where it was converted into blister copper. However, the high zinc content of the ore made it extremely refractory, necessitating a large coke charge and causing the furnace to frequently freeze (Ref. 17, pp. 28-29; Ref. 21, p. 5; Ref. 24, p. 26; Ref. 25, p. 35; Ref. 26, p. 54; Ref. 30; Ref. 36, p. 7; Ref. 39, p. 96).

In 1909, the Afterthought Copper Company acquired Afterthought Mine. A 300-ton oil-flotation mill and a 300-ton reverberatory furnace were completed in 1919 at Afterthought Smelter, with the objective of treating the sulfide ore by the Harwood process. In this process, the ore was first pre-roasted in the reverberatory furnace and then treated by flotation. Operation began in July 1919 and lasted only 8 months, because the zinc and copper sulfides could not be cleanly separated. Late in 1923, the company lost the mine through foreclosure. In February 1925, the Glidden Paint Company, under the name California Zinc Company, began mining zinc ore under lease. The ore was moved by an 8.5-mile aerial tram to the Bully Hill Mill. This tramway was put in operation in November 1925 and delivered about 75 tons a day to the mill. A drop in the price of copper and zinc in 1927 closed the operation (Ref. 21, p. 5; Ref. 23, pp. 14, 340; Ref. 24, pp. 16, 26-27; Ref. 25, pp. 35-36, 108-110; Ref. 26, p. 54; Ref. 36, p. 7; Ref. 39, p. 96).

The Coronado Copper & Zinc Co. purchased the mine in 1946, and after new ore bodies had been located by exploratory drilling, the company constructed a 100-ton selective flotation plant. Mining started in October 1948 and continued until July 1949, when the operation ceased due to a drop in the price of metals. In July 1950, the mine reopened and operated continuously until August 1952. During this time, the crude oxide ore was ground to 94% minus 200 mesh, and the concentrates were made by selective flotation. A copper-lead concentrate was shipped to a smelter in Tooele, Utah, and a zinc concentrate was shipped to a smelter in Great Falls, Montana (Ref. 21, p. 5, Ref. 23, p. 340; Ref. 26, p. 56; Ref. 36, p. 7; Ref. 39, pp. 79, 96).

In 1951, Afterthought Mine was reported to be the highest producer of copper, the second highest producer of zinc, and the third highest producer of lead and silver in California (Ref. 22, pp. 129, 134, 138, 141). From 1900 to 1952, 166,424 tons of ore were mined from Afterthought Mine. Production included 10,730,580 pounds of copper, 23,635,840 pounds of zinc, 1,738,300 pounds of lead, 923,653 ounces of silver, and 4,992 ounces of gold (Ref. 39, pp. 80, 96). Afterthought Mine ceased operations in August 1952 (Ref. 23, p. 340; Ref. 26, p. 56; Ref. 36, pp. 7-8; Ref. 39, p. 79).

During operations, the mine workings totaled about 19,400 linear feet, including 17,200 feet of drifts, crosscuts, and stopes and 2,200 feet of raises and shafts, developed to a depth of 729 feet with 10 levels (Ref. 21, pp. 4, 23; Ref. 24, p. 27; Ref. 26, p. 56; Ref. 39, pp. 95, 97). Remnants of the mine are still present on the mine property, including waste rock piles, adits/portals, and the ruins of the mine plant. AMD discharges from mine portals and mine waste rock piles to Afterthought Creek, which flows into Little Cow Creek adjacent to the mine property (Ref. 4, p. 8).

From the late 1970s to the present, multiple sampling investigations were conducted at the mine property and in downstream surface water by the EPA, California Regional Water Quality Control Board, and California Department of Fish and Wildlife (Ref. 4, pp. 11-12; Ref. 26, p. 60; Ref. 27, pp. 1, 2; Ref. 29; Ref. 31; Ref. 32, p. 1; Ref. 33, p. 4; Ref. 36, p. 7; Ref. 37, pp. 200, 203; Ref. 41, p. 5; Ref. 42, p. 5). A 1.1-mile portion of Little Cow Creek downstream of Afterthought Mine is listed as impaired under Section 303 of the Clean Water Act (Ref. 38, p. 1).

In 2022, EPA conducted a Site Inspection (SI) at Afterthought Mine to determine whether the site was eligible for placement on the National Priorities List (NPL). Based on the June 2022 SI sampling event, on-site hazardous substance sources have been documented at Afterthought Mine, including waste rock, tailings, and AMD (Ref. 4, pp. 5-6; Ref. 5, p. 5). Elevated concentrations of metals, including maximum concentrations of 1,300 milligrams per kilogram (mg/kg) arsenic, 97

mg/kg cadmium, 9,600 mg/kg copper, 11,000 mg/kg lead, 27 mg/kg mercury, and 18,000 mg/kg zinc, were detected in soil and waste rock samples (Ref. 4, p. 5).

SITE SOURCES

A total of six sources were evaluated for scoring the Afterthought Mine site (see Figure A-3 of this HRS documentation record). The sources originated as part of the Afterthought Mine operations. Detailed information about each source, with reference citations, is available in the following sections.

Hazardous substances associated with these sources include arsenic, cadmium, copper, lead, mercury, and zinc.

Afterthought Mine Sources					
Source Number	Source Name	Source Type			
1	Portal 1	Other			
2	North Fork Waste Rock	Pile			
3	Central Waste Rock	Pile			
4	South Fork Waste Rock	Pile			
5	Mill Area Waste Rock	Pile			
6	Tailings Pile	Pile			

2.2 SOURCE 1 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Portal 1 Number of Source: 1

Source Type: Other

Description and Location of Source (see Figure A-3 of this HRS documentation record):

Source 1 consists of AMD discharge from Portal 1, located in the lower portion of the mine property adjacent to Afterthought Creek (Ref. 4, p. 36). Portal 1 is also referred to as the main portal in some historical documentation (Ref. 21, p. 4; Ref. 26, p. 16; Ref. 31, pp. 1-2; Ref. 35, p. 7). During mining operations, Portal 1 was the only known portal for the lower levels of the mine and accessed over 3,000 feet of tunnels. Portal 1 has since collapsed (Ref. 26, p. 56).

AMD from Portal 1 flows into Afterthought Creek from the south, depositing a bright orange and green slime on waste rock between the portal and the creek (Ref. 4, pp. 8, 50, 55; Ref. 41, pp. 33, 38-39). Flow from the portal was estimated at 10-20 gallons per minute (gpm) on April 23, 1982 (Ref. 29, p. 2). In 1984, average flow for Portal 1 was estimated at 20 acre-feet per year (Ref. 26, p. 60). When Afterthought Creek is flowing, discharge from Portal 1 has been observed flowing to Afterthought Creek and into Little Cow Creek causing a plume of mine drainage downstream on the south bank (Ref. 26, pp. 60, 62; Ref. 29, p. 2; Ref. 41, pp. 33, 39). Surveys conducted in 1984 estimated that over 90% of the Afterthought Mine-related AMD emanated from Portal 1 (Ref. 26, pp. 60-61; Ref. 31, p. 1).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

2022 EPA SI Sampling

From June 21, 2022 through June 24, 2022, Weston Solutions, Inc. collected soil, sediment, and surface water samples as part of the SI for Afterthought Mine (Ref. 4, pp. 50-51). Samples were collected in accordance with Sampling and Analysis Plan (SAP) approved by EPA on May 29, 2020 (Ref. 4, p. 13; Ref. 7, p. 2). Sediment samples were submitted to Eurofins Burlington under the EPA Contract Laboratory Program (CLP) for metals analysis by Inorganic Superfund Method (ISM) 02.4 ICP-AES. Surface water samples were submitted for metals analysis by ISM 0.24 ICP-AES and ICP-MS (Ref. 4, p. 14; Ref. 5, p. 11). Validation of analytical data was contracted by EPA in accordance with ISM 02.4 (Ref. 4, p. 13; Ref. 7, pp. 44-45; Ref. 34, pp. 1-3; Ref. 46, pp. 1, 2, 4).

Water and sediment samples were collected as it flows from the Portal 1 opening (AC-03). The surface water had a pH of 2.77 and conductivity of 2,898 μ S/cm (Ref. 4, pp. 50, 55). Sediment samples were collected using a sample-dedicated plastic disposable scoop and transferred to a 4-oz. wide-mouth glass jar. Water was removed from sediment samples by allowing the solids to settle in the sample container and decanting the water after the water clarified sufficiently (Ref. 4, pp. 13, 14; Ref. 7, p. 36). Surface water was collected by submerging the sample container in a location where the bottle could be submerged beneath the surface such that it could be filled and capped without entraining surface scum or bottom sediment. Two sets of surface water samples were collected. The first set was unfiltered and preserved with nitric acid to a pH of less than 2; the second set was filtered with a 0.45-micrometer, disposable filter and preserved with nitric acid

to a pH of less than 2. A peristaltic pump with disposable plastic tubing was used to draw the water through the disposable filter. (Ref. 4, p. 13; Ref. 7, pp. 36-37). Portal sediment samples are compared to a background sample to show the relative increase in hazardous substances over background levels. One background sediment sample was collected from South Fork Afterthought Creek upstream of areas impacted by mining activities. Background surface water samples were not collected as there was no surface water in Afterthought Creek upstream of mine property sources (Ref. 4, pp. 14, 15, 51). Background samples were collected using the same methods as the Source samples (Ref. 4, p. 14). Sampling locations are presented in Figure A-3 of this HRS documentation record.

	Table 1: 2022 SI, Source 1 Portal 1 Discharge Concentrations							
Station Location	CLP Sample ID	Filtered/ Unfiltered	Sampling Date	Hazardous Substance	Concentration (µg/L)	Sample Adjusted CRQL* (µg/L)	References	
ICP-MS R	ICP-MS Results							
				Arsenic	11	1.0	Ref 1 pp 31 11 50	
1.0.02				Cadmium	490	1.0	55; Ref. 12, pp. 3, 676;	
AC-03- W-T	MY0AJ8	Unfiltered	6/23/2022	Copper	16,000	10	Ref. 15, pp. 64-66, 73,	
**-1				Lead	81	1.0	85-87, 94; Ref. 46, p.	
				Zinc	120,000	150	20; Ref. 47, p. 2	
				Arsenic	3.6	1.0	Ref 1 pp 31 11 50	
1.0.02	MY0AJ7	OAJ7 Filtered	Filtered 6/23/2022	Cadmium	470	1.0	Kei, 4, pp. 31, 44, 50, 55; Ref. 12, pp. 3, 675; Ref. 15, pp. 43-45, 52, 64-66, 73; Ref. 46, p.	
AC-03- W-F				Copper	16,000	10		
				Lead	78	1.0		
				Zinc	110,000	150	17; Kel. 47, p. 2	
ICP-AES Results								
				Arsenic	15	10	P_{of} 4 pp 44 50 55.	
				Cadmium	460	5.0	Ref. 12, pp. 3, 18; Ref.	
АС-03- W-Т	MY0AJ8	Unfiltered	6/23/2022	Copper	15,000	50	15, pp. 64-66, 73, 85-	
				Lead	83	10	87, 94; Ref. 46, p. 19;	
				Zinc	110,000	600	Ref. 47, p. 2	
				Cadmium	460	5.0	Ref. 4, pp. 44, 50, 55;	
AC-03-	MNOA 17	E:14 and	(122/2022	Copper	15000	50	Ref. 12, pp. 3, 17; Ref.	
W-F	WIYUAJ/	Filtered	0/23/2022	Lead	80	10	15, pp. 43-45, 52, 64- 66, 73; Ref. 46, p. 16	
				Zinc	110,000	600	Ref. 47, p. 2	

CLP: Contract Laboratory Program

μg/L: micrograms analyte per liter adit discharge

ng/L nanograms mercury per liter adit discharge

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

Table 2: 2022 SI, Source 1 Portal 1 Sediment Concentrations							
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References	
Background S	ediment Sample						
			Arsenic	26	0.98		
			Cadmium	1.9	0.49	Ref. 4, pp. 31, 44,	
AC-BG-02-S	MY0AJ0	6/24/2022	Copper	53	2.5	51; Ref. 11, pp. 4, 27, 413, 435; Ref. 16, pp. 101-103, 110, 121-123, 130; Ref. 34, pp. 33-34; Ref. 47, p. 3; Ref. 48, pp. 8, 20	
			Lead	32 J (46.08)	0.98		
			Mercury	0.11 J- (0.2013)	0.097		
			Zinc	370	5.9		
Source 1 Porta	Source 1 Portal 1 Sample						
			Arsenic	800	4.8	Ref. 4, pp. 31, 44,	
			Cadmium	17	2.4	50, 55; Ref. 11, pp.	
AC-03-S	MY0AH2	6/23/2022	Copper	370	2.4	3, 21, 413, 429; Ref. 16, pp. 61-63, 70; Ref. 34, pp. 21-22; Ref. 47, p. 2; Ref. 48, pp. 8, 20	

CLP: Contract Laboratory Program

mg/kg: milligrams analyte per kilogram sediment

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J-: The sample concentration is an estimated quantity, but the result may be biased low (Ref. 34, pp. 4, 8).

J: The result is an estimated quantity because the laboratory duplicate results were outside the method limit (Ref. 34, pp. 5, 8).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

All hazardous substances associated with Source 1 are available to the surface water pathway based on a containment factor value of greater than zero (Ref 1, Section 2.2.3).

Containment Description	Containment Factor Value	References
Release to surface water: When Afterthought Creek is flowing, discharge from Portal 1 has been observed flowing into Afterthought Creek and into Little Cow Creek causing a plume of mine drainage downstream on the south bank. A containment factor of 10 is assigned.	10	Ref. 26, pp. 60, 62; Ref. 29, p. 2; Ref. 41, pp. 33, 39

2.4.2. HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, potentially responsible party [PRP] records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total Hazardous Wastestream Quantity for Source 1 could not be adequately determined according to the HRS requirements; that is, the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for Source 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Value: NS

2.4.2.1.3 Volume (Tier C)

The exact volume for Source 1 could not be adequately determined with reasonable confidence. Flow from the portal was estimated at 10-20 gpm on April 23, 1982 (Ref. 29, p. 2). In 1984, average flow for Portal 1 was estimated at 20 acre-feet per year (Ref. 26, p. 60). However, as these were not continuous observations and estimates, there is insufficient information to calculate the volume for Source 1 with reasonable confidence. Therefore, based on the presence of hazardous substances in the Portal 1 discharge, the volume of the source is greater than 0 but the total volume is unknown (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: >0

2.4.2.1.4 Area (Tier D)

Area is not evaluated for source type "other" (Ref. 1, Section 2.4.2.1.4).

Area Assigned Value: 0

Source Hazardous Waste Quantity Value

According to the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) is assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 1 Values
А	NS
В	NS
С	>0
D	0

Source 1 Hazardous Waste Quantity Value: >0

2.2 SOURCE 2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: North Fork Waste Rock Number of Source: 2

Source Type: Pile

Description and Location of Source (see Figure A-3 of this HRS documentation record):

Source 2 consists of the waste rock pile along North Fork Afterthought Creek (Ref. 4, p. 35; Ref. 21, p. 21; Ref. 36, pp. 16-18). This waste rock pile is located in the upper portion of the mine property and consists of waste rock from the No. 1 Shaft and Adit 4. Intermittent surface water in the North Fork Afterthought Creek flows through the waste rock pile (Ref. 4, p. 8; Ref. 36, pp. 16-18; Ref. 41, pp. 33, 36-37). A mine dump was mapped at this location in 1921 (Ref. 21, p. 21). The area of the Source 2 waste rock pile is approximately 42,672.58 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this HRS documentation record and on field observations during the 2019 PA and the 2022 SI correlating the unvegetated area with the boundaries of the waste rock pile (Ref. 4, pp. 35, 51, 53-54; Ref. 41, pp. 33, 36-37).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

2022 EPA SI Sampling

From June 21, 2022 through June 24, 2022, Weston Solutions, Inc. collected soil, sediment, and surface water samples as part of the SI for Afterthought Mine (Ref. 4, pp. 50-51). Samples were collected in accordance with the SAP approved by EPA on May 29, 2020 (Ref. 4, p. 13; Ref. 7, p. 2). Soil samples were submitted to Eurofins Burlington under the EPA CLP for metals analysis by ISM 02.4 ICP-AES (Ref. 4, p. 14). Validation of analytical data was contracted by EPA in accordance with ISM 02.4 (Ref. 7, pp. 44-45; Ref. 43, pp. 1, 2, 4; Ref. 44, pp. 1, 2, 4).

Waste rock samples were collected from one location within Source 2 (AM-25) (Ref. 4, p. 36). Waste rock samples were collected using a sample-dedicated plastic disposable scoop and transferred to a 4-oz. wide-mouth glass jar (Ref. 4, p. 13; Ref. 7, p. 36). Pile source samples were compared to a background sample to show the relative increase in hazardous substances over background soil levels. A background soil sample was collected from native soils north of the mine property in an area that was not observed to be impacted by mining activities (Ref. 4, pp. 13-14, 50). Background samples were collected using the same methods as the Source samples (Ref. 4, pp. 13, 14). Source sampling locations are presented in Figure A-3 of this HRS documentation record.

Table 3: 2022 SI, Source 2 North Fork Waste Rock						
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References
Background	Soil Samples					
			Arsenic	23	1.0	
			Cadmium	1.7	0.51	Ref. 4, pp. 29, 50;
		6/22/2022	Copper	77	2.5	Ref. 9, pp. 2-3, 12, 14, 470; Ref. 19, pp. 1-3, 10; Ref. 43, pp. 10-11; Ref. 47, p. 2; Ref. 48, pp. 8, 20
AM-BG-1	MY0AA0		Lead	100	1.0	
			Mercury	0.20 J-	0.10	
				(0.366)		
			Zinc	310	6.1	
Source 2 North Fork Waste Rock Sample						
			Arsenic	290	1.7	D 6 4 20 51
AM-25		6/24/2022	Cadmium	9.5	0.86	Ref. 4, pp. 29, 51; Ref. 10, pp. 3, 13, 18, 764, 786; Ref. 44, pp. 18-19; Ref. 45, pp. 41-43, 50; Ref. 47, p.
			Copper	780	2.2	
	MYUAC6		Lead	1,800	1.7	
			Mercury	2.9 J-	0.20	
		Zinc	1,400	10	3; Ref. 48, pp. 8, 20	

CLP: Contract Laboratory Program

mg/kg: milligrams analyte per kilogram tailings

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J-: The result is an estimated quantity, but the result may be biased low (Ref. 43, pp. 5, 9; Ref. 44, pp. 5, 10).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

All hazardous substances associated with Source 2 are available to the surface water pathway based on a containment factor value of greater than zero (Ref 1, Section 2.2.3).

Containment Description	Containment Factor Value	References
Release to surface water: There is no known maintained engineered cover or functioning and maintained run-on control system and runoff management system. Surface water in the intermittent North Fork Afterthought Creek flows	10	Ref. 4, p. 8; Ref. 41, pp. 33, 36- 37
through the waste rock pile.		

2.4.2. HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 2 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Value: Not Scored (NS)

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total Hazardous Wastestream Quantity for Source 2 could not be adequately determined according to the HRS requirements; that is, the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for Source 2 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Value: NS

2.4.2.1.3 Volume (Tier C)

The volume for Source 2 could not be adequately determined with reasonable confidence The depth of Source 2 is unknown. Scoring proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: 0

2.4.2.1.4 Area (Tier D)

The area of the Source 2 waste rock pile is approximately 42,672.58 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this documentation record and on field observations during the 2019 PA and the 2022 SI correlating the unvegetated area with the boundaries of the waste rock pile (Figure A-3 of this documentation record; Ref. 4, pp. 51, 53-54; Ref. 41, pp. 33, 36-37). In accordance with Ref. 1, Table 2-5, the equation for assigning a value for a pile is the area in square feet divided by 13:

Area Assigned Value: 3,282.51

Source Hazardous Waste Quantity Value

According to the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) is assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 2 Values
A	NS
В	NS
С	0
D	3,282.51

Source Hazardous Waste Quantity Value: 3,282.51

2.2 SOURCE 3 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Central Waste Rock Pile Number of Source: 3

Source Type: Pile

Description and Location of Source (see Figure A-3 of this HRS documentation record):

Source 3 consists of the waste rock pile between North Fork and South Fork Afterthought Creek in the upper portion of the mine property (Figure A-3 of this HRS documentation record; Ref. 4, pp. 35, 51, 53; Ref. 36, pp. 17-18). A mine dump was mapped at this location in 1921 (Ref. 21, p. 21). The area of the Source 3 waste rock pile is approximately 14,809.81 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this documentation record and on field observations during the 2022 SI correlating the unvegetated area with the boundaries of the waste rock pile (Figure A-3 of this documentation record; Ref. 4, pp. 35, 51, 53).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

2022 EPA SI Sampling

From June 21, 2022 through June 24, 2022, Weston Solutions, Inc. collected soil, sediment, and surface water samples as part of the SI for Afterthought Mine (Ref. 4, pp. 50-51). Samples were collected in accordance with the SAP approved by EPA on May 29, 2020 (Ref. 4, p. 13; Ref. 7, p. 2). Soil samples were submitted to Eurofins Burlington under the EPA CLP for metals analysis by ISM 02.4 ICP-AES (Ref. 4, p. 14). Validation of analytical data was contracted by EPA in accordance with ISM 02.4 (Ref. 7, pp. 44-45; Ref. 43, pp. 1, 2, 4; Ref. 44, p. 1, 2, 4).

Waste rock samples were collected from three locations within Source 3 (AM-35 through AM-37) (Ref. 4, pp. 36, 51, 53). Waste rock samples were collected using a sample-dedicated plastic disposable scoop and transferred to a 4-oz. wide-mouth glass jar (Ref. 4, p. 13; Ref. 7, p. 36). Pile source samples were compared to a background soil sample to show the relative increase in hazardous substances over background soil levels. A background soil sample was collected from native soils north of the mine property in an area that was not observed to be impacted by mining activities (Ref. 4, pp. 13-14, 50). Background samples were collected using the same methods as the Source samples (Ref. 4, pp. 13, 14). Source sampling locations are presented in Figure A-3 of this HRS documentation record.

Table 4: 2022 SI, Source 3 Central Waste Rock Pile						
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References
Background	Soil Samples	5				
			Arsenic	23	1.0	
			Cadmium	1.7	0.51	Ref. 4, pp. 29, 50;
			Copper	77	2.5	Ref. 9, pp. 2-3, 12,
AM-BG-1	MY0AA0	6/22/2022	Lead	100	1.0	14, 470; Ref. 19, pp. 1-3 10: Ref 43 pp
			Mercury	0.20 J- (0.366)	0.10	10-11; Ref. 47, p. 2; Ref. 48, pp. 8, 20
			Zinc	310	6.1	
Source 3 Cer	ntral Waste F	Rock Pile San	nples			
	MY0AD8	D8 6/24/2022	Arsenic	440	2.4	Ref. 4, pp. 29, 51, 53; Ref. 10, pp. 3, 13, 21, 764, 789; Ref. 44, pp. 30-31; Ref. 45, pp. 61-63, 70; Ref. 47, p. 3; Ref. 48, pp. 8, 20 Ref. 4, pp. 29, 51, 53; Ref. 10, pp. 3, 13, 22, 764, 790; Ref. 44, pp. 32-33; Ref. 45, pp. 61-63, 70, 81-83, 90;
			Cadmium	21	1.6	
AM 25			Copper	2,400	6.1	
Alvi-55			Lead	8,700	12	
			Mercury	16 J-	0.87	
			Zinc	3,200	19	
			Arsenic	470	3.7	
			Cadmium	34	1.9	
AM 36	ΜΥΛΛΟΩ	MY0AD9 6/24/2022	Copper	3,000	9.4	
AM-30 MIC	WITOAD?		Lead	8,500	9.4	
			Mercury	12 J-	0.95	Ref. 47, p. 3; Ref. 48,
			Zinc	4,200	22	pp. 8, 20
			Arsenic	300	2.0	Ref. 4, pp. 29, 51, 53; Ref. 10, pp. 3, 13, 23, 764, 791; Ref. 44, pp. 34-35; Ref. 45, pp. 81-83, 90; Ref. 47, p.
			Cadmium	6.5	0.98	
AM-37	MY0AE0	6/24/2022	Copper	1,200	2.5	
			Lead	3,100	3.9	
			Mercury	5.0 J-	0.37	3; Ref. 48, pp. 8, 20

CLP: Contract Laboratory Program

mg/kg: milligrams analyte per kilogram tailings

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J-: The result is an estimated quantity, but the result may be biased low (Ref. 43, pp. 5, 9; Ref. 44, pp. 5, 10).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

All hazardous substances associated with Source 3 are available to the surface water pathway based on a containment factor value of greater than zero (Ref 1, Section 2.2.3).

Containment Description	Containment Factor Value	References
Release to surface water: There is no evidence of a maintained engineered cover or functioning and maintained run-on control system and runoff management system.	10	Ref. 4, pp. 35, 51, 53; Ref. 21, p. 21
2.4.2. HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source 3 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 3 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total Hazardous Wastestream Quantity for Source 3 could not be adequately determined according to the HRS requirements; that is, the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for Source 3 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Value: NS

2.4.2.1.3 Volume (Tier C)

The volume for Source 3 could not be adequately determined in accordance with HRS requirements. The depth of Source 3 is unknown. Scoring proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: 0

2.4.2.1.4 Area (Tier D)

The area of the Source 3 waste rock pile is approximately 14,809.81 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this documentation record and on field observations during the 2022 SI correlating the unvegetated area with the boundaries of the waste rock pile (Figure A-3 of this documentation record; Ref. 4, pp. 35, 51, 53). In accordance with Ref. 1, Table 2-5, the equation for assigning a value for a pile is the area in square feet divided by 13:

14,809.81 / 13 = 1,139.22

Area Assigned Value: 1,139.22

Source Hazardous Waste Quantity Value

According to the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) is assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 3 Values
А	NS
В	NS
С	0
D	1,139.22

Source Hazardous Waste Quantity Value: 1,139.22

2.2 SOURCE 4 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: South Fork Waste Rock Number of Source: 4

Source Type: Pile

Description and Location of Source (see Figure A-3 of this HRS documentation record):

Source 4 consists of the waste rock pile along South Fork Afterthought Creek (Figure A-3 of this HRS documentation record; Ref. 4, p. 35; Ref. 21, p. 21; Ref. 36, pp. 16-18). This waste rock pile is located in the upper portion of the mine property and is associated with Adit 3, also known as Portal 3 (Ref. 4, pp. 8, 35, Ref. 36, pp. 16-18; Ref. 41, pp. 22, 33) A mine dump was mapped at this location in 1921 (Ref. 21, p. 21). Water in the South Fork Afterthought Creek flows through the waste rock pile (Figure A-3 of this HRS documentation record; Ref. 4, p. 8; Ref. 36, p. 17; Ref. 41, pp. 33, 36-37). The area of the Source 4 waste rock pile is approximately 10,136 square feet, based on the historical boundaries of the mine dump (Figure A-3 of this HRS documentation record; Ref. 4, p. 35; Ref. 21, p. 21; Ref. 36, pp. 17-18; Ref. 41, p. 22).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

2022 EPA SI Sampling

From June 21, 2022 through June 24, 2022, Weston Solutions, Inc. collected soil, sediment, and surface water samples as part of the SI for Afterthought Mine (Ref. 4, pp. 50-51). Samples were collected in accordance with the SAP approved by EPA on May 29, 2020 (Ref. 4, p. 13; Ref. 7, p. 2). Soil samples were submitted to Eurofins Burlington under the EPA CLP for metals analysis by ISM 02.4 ICP-AES (Ref. 4, p. 14). Validation of analytical data was contracted by EPA in accordance with ISM 02.4 (Ref. 7, pp. 44-45; Ref. 43, pp. 1, 2, 4; Ref. 44, pp. 1, 2, 4).

Waste rock samples were collected from two locations within Source 4 (AM-32 and AM-33) (Ref. 4, pp. 36, 51). Waste rock samples were collected using a sample-dedicated plastic disposable scoop and transferred to a 4-oz. wide-mouth glass jar (Ref. 4, p. 13; Ref. 7, p. 36). Pile source samples were compared to a background soil sample to show the relative increase in hazardous substances over background soil levels. A background soil sample was collected from native soils north of the mine property in an area that was not observed to be impacted by mining activities (Ref. 4, pp. 13-14, 50). Background samples were collected using the same methods as the Source samples (Ref. 4, pp. 13, 14). Source sampling locations are presented in Figure A-3 of this HRS documentation record.

Table 5: 2022 SI, Source 4 South Fork Waste Rock								
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References		
Background	Background Soil Samples							
			Arsenic	23	1.0			
			Cadmium	1.7	0.51	Ref. 4, pp. 29, 50;		
			Copper	77	2.5	Ref. 9, pp. 2-3, 12,		
AM-BG-1	MY0AA0	6/22/2022	Lead	100	1.0	14, 470; Ref. 19, pp.		
			Mana	0.20 J-	0.10	10-11; Ref. 47, p. 2;		
			Mercury	(0.366)		Ref. 48, pp. 8, 20		
		Zinc	310	6.1				
Source 4 Sou	th Fork Was	ste Rock Pile	Samples					
			Arsenic	560	4.0	Ref. 4, pp. 29, 51; Ref. 10, pp. 3, 13, 19, 764, 787; Ref. 44, pp.		
			Cadmium	13 J+	2.0			
ANK 22	MUOADS	C/24/2022		(9.219)				
AM-32	MY0AD5	6/24/2022	Copper	790	2.5	20-21; Ref. 45, pp.		
			Lead	1,300	2.0	41-43, 50; Ref. 47, p.		
			Mercury	4.2 J-	0.41	5; Kel. 48, pp. 8, 20		
AM-33	MY0AD6	6/24/2022	Copper	260	2.2	Ref. 4, pp. 29, 51; Ref. 10, pp. 3, 13, 20, 764, 788; Ref. 44, pp. 28-29; Ref. 45, pp. 41-43, 50, 61-63, 70; Ref. 47, p. 3; Ref. 48, pp. 8, 20		

mg/kg: milligrams analyte per kilogram tailings

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J-: The result is an estimated quantity, but the result may be biased low (Ref. 43, pp. 5, 9; Ref. 44, pp. 5, 10).

J+: The result is an estimated quantity, but the result may be biased high (Ref. 44, pp. 6, 10)

J: Result is considered qualitatively uncertain because serial dilution analysis does not meet analysis criteria (Ref. 44, pp. 6-7).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

All hazardous substances associated with Source 4 are available to the surface water pathway based on a containment factor value of greater than zero (Ref 1, Section 2.2.3).

Containment Description	Containment Factor Value	References
Release to surface water: There is no evidence of a maintained engineered cover or functioning and maintained run-on control system and runoff management system. Surface water in the South Fork Afterthought Creek flows intermittently through the waste rock pile	10	Ref. 4, pp. 8, 35, Ref. 21, p. 21; Ref. 41, pp. 22, 33, 36-37

2.4.2. HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source 4 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 4 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total Hazardous Wastestream Quantity for Source 4 could not be adequately determined according to the HRS requirements; that is, the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for Source 4 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Value: NS

2.4.2.1.3 Volume (Tier C)

The volume for Source 4 could not be adequately determined with reasonable confidence. The depth of Source 3 is unknown. Scoring proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: NS

2.4.2.1.4 Area (Tier D)

The area of the Source 4 waste rock pile is approximately 10,136 square feet, based on the historical boundaries of the mine dump (Figure A-3 of this HRS documentation record; Ref. 4, p. 35; Ref. 21, p. 21; Ref. 36, pp. 17-18; Ref. 41, p. 22). In accordance with Ref. 1, Table 2-5, the equation for assigning a value for a pile is the area in square feet divided by 13:

Area Assigned Value: 779.69

Source Hazardous Waste Quantity Value

According to the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) is assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 4 Values
А	NS
В	NS
С	0
D	779.69

Source Hazardous Waste Quantity Value: 779.69

2.2 SOURCE 5 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Mill Area Waste Rock Number of Source: 5

Source Type: Pile

Description and Location of Source (see Figure A-3 of this HRS documentation record):

Source 5 consists of the waste rock pile along Afterthought Creek and Little Cow Creek in the lower portion of the mine in the vicinity of the former mill (Figure A-3 of this HRS documentation record; Ref. 4, pp. 35, 51; Ref. 21, p. 21; Ref. 36, pp. 18-19; Ref. 41, pp. 33, 40). Afterthought Creek flows through this waste rock pile to Little Cow Creek (Ref. 4, p. 52; Ref. 36, pp. 17-18; Ref. 41, p. 40). A mine dump was mapped at this location in 1921, forming the flat surface beneath the former mill building (Ref. 21, p. 21).

Source 5 is located along the eastern bank of Little Cow Creek and has been observed to be in contact with Little Cow Creek surface water (Figure A-3 of this HRS documentation record; Ref. 4, pp. 8, 50-52, 58; Ref. 41, pp. 7, 33, 39-40). The area of the Source 5 waste rock pile is approximately 32,726 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this documentation record and on field observations during the 2019 PA and the 2022 SI correlating the unvegetated area with the boundaries of the waste rock pile (Figure A-3 of this HRS documentation record; Ref. 4, pp. 51-52, 58; Ref. 41, pp. 33, 40).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

2022 EPA SI Sampling

From June 21, 2022 through June 24, 2022, Weston Solutions, Inc. collected soil, sediment, and surface water samples as part of the SI for Afterthought Mine (Ref. 4, pp. 50-51). Samples were collected in accordance with the SAP approved by EPA on May 29, 2020 (Ref. 4, p. 13; Ref. 7, p. 2). Soil samples were submitted to Eurofins Burlington under the EPA CLP for metals analysis by ISM 02.4 ICP-AES (Ref. 4, p. 14). Validation of analytical data was contracted by EPA in accordance with ISM 02.4 (Ref. 7, pp. 44-45; Ref. 43, pp. 1, 2, 4).

Waste rock samples were collected from seven locations within Source 5 (AM-05 through AM-09 and AM-11 through AM-12) (Figure A-3 of this documentation record; Ref. 4, pp. 36, 51, 58). Waste rock samples were collected using a sample-dedicated plastic disposable scoop and transferred to a 4-oz. wide-mouth glass jar (Ref. 4, p. 13; Ref. 7, p. 36). Pile source samples were compared to a background soil sample to show the relative increase in hazardous substances over background soil levels. A background soil sample was collected from native soils north of the mine property in an area that was not observed to be impacted by mining activities (Ref. 4, pp. 13-14, 50). Background samples were collected using the same methods as the Source samples (Ref. 4, p. 14). Source sampling locations are presented in Figure A-3 of this HRS documentation record.

Table 6: 2022 SI, Source 5 Mill Area Waste Rock						
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References
Background	Soil Samples	; ;				
0			Arsenic	23	1.0	
			Cadmium	1.7	0.51	Ref. 4, pp. 29, 50;
			Copper	77	2.5	Ref. 9, pp. 2-3, 12,
AM-BG-1	MY0AA0	6/22/2022	Lead	100	1.0	14, 470; Ref. 19, pp.
			Mercury	0.20 J- (0.366)	0.10	- 1-3, 10; Ref. 43, pp. 10-11; Ref. 47, p. 2; Ref. 48, pp. 8, 20
			Zinc	310	6.1	, , , , , , , , , , , , , , , , ,
Source 5 Mil	l Area Waste	e Rock Samp	les	010	011	
		F	Arsenic	240	1.7	Ref $1 nn 29 51$:
			Cadmium	39	0.84	Ref 9, pp. 2-3, 5, 12,
			Copper	1.300	4.2	19, 460, 475; Ref. 19,
AM-05	MY0AA6	6/23/2022	Lead	2,500	2.5	pp. 41-43, 50, 61-63,
			Mercury	1.7 I-	0.10	- 70; Ref. 43, pp. 20- 21: Ref. 47, p. 2: Ref
			Zinc	8 700	50	48, pp. 8, 20
			Arsenic	500	3.8	Ref. 4, pp. 29, 51; Ref 9, pp. 2-3, 5, 12, 20, 460, 476; Ref. 19,
			Cadmium	20	19	
	MY0AA7	6/23/2022	Copper	640	1.9	
AM-06			Lead	2,100	2.3	pp. 61-63, 70; Ref.
			Mercury	2,9 J-	0.20	43, pp. 22-23; Ref. 47, p. 2; Ref. 48, pp. 8, 20
			Zinc	3.100	23	
			Arsenic	720	3.9	Ref. 4, pp. 29, 51; Ref 9, pp. 2-3, 5, 12, 21, 460, 477; Ref. 19,
			Cadmium	16	3.9	
			Copper	1.400	3.9	
AM-07	MY0AA8	6/23/2022	Lead	5,700	7.9	pp. 61-63, 70; Ref.
			Mercury	6.5 J-	0.58	43, pp. 24-25; Ref. 47 p 2: Ref 48 pp
			Zinc	1.500	9.4	8, 20
			Arsenic	620	4.1	Ref 4 nn 29 51.
			Cadmium	28	2.0	Ref 9, pp. 2-3, 5, 12,
			Copper	790	2.0	22, 460, 478; Ref. 19,
AM-08	MY0AA9	6/23/2022	Lead	1,900	1.6	pp. 61-63, 70, 81-83,
			Mercury	5.2 J-	0.48	27: Ref. 47. p. 3: Ref.
			Zinc	4,200	24	48, pp. 8, 20
			Arsenic	630	4.0	Ref 4 nn 29 51.
			Cadmium	19	2.0	Ref 9, pp. 2-3, 5, 12,
			Copper	600	2.0	23, 460, 479; Ref. 19,
AM-09	MY0AB0	6/23/2022	Lead	1,700	1.6	pp. 81-83, 90; Ref.
			Mercury	3.3 J-	0.21	45, pp. 28-29; KeI. 47, p. 3: Ref. 48, nn
			Zinc	2.200	14	8, 20
			Arsenic	810	5.4	Pof 4 nn 20 51.
AM-11	MY0AB2	6/23/2022	Cadmium	63	2.7	Ref 9, pp. 29, 51;
	1.110/102	0,20,2022	Copper	2,100	5.4	25, 460, 481; Ref. 19,

	Table 6: 2022 SI, Source 5 Mill Area Waste Rock					
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References
			Lead	4,800	5.4	pp. 121-123, 130;
			Mercury	11 J-	1.0	Ref. 43, pp. 32-33;
			Zinc	11,000	64	pp. 8, 20
			Arsenic	120	0.87	Ref. 4, pp. 29, 51;
			Cadmium	26	0.44	Ref 9, pp. 2, 4, 5, 12,
AN 12		(122/2022	Copper	2,000	6.5	26, 460, 482; Ref. 19,
AM-12	MI UAB5	0/23/2022	Lead	2,300	2.6	Ref 43 pp 34-35
			Mercury	3.5 J-	0.19	Ref. 47, p. 3; Ref. 48,
			Zinc	7,700	78	pp. 8, 20

mg/kg: milligrams analyte per kilogram tailings

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J-: The result is an estimated quantity, but the result may be biased low (Ref. 43, pp. 5, 9).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

All hazardous substances associated with Source 5 are available to the surface water pathway based on a containment factor value of greater than zero (Ref 1, Section 2.2.3).

Containment Description	Containment Factor Value	References
Release to surface water: There is no known maintained engineered cover or functioning and maintained run-on control system and runoff management system. Afterthought Creek runs through this waste rock pile to Little Cow Creek. Source 5 is located along the eastern bank of Little Cow Creek and has been observed to be in contact with Little Cow Creek surface water.	10	Figure A-3 of this HRS documentation record; Ref. 4, pp. 35, 50-52, 58; Ref. 21, p. 21; Ref. 41, pp. 7, 33, 39-40

2.4.2. HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source 5 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 5 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total Hazardous Wastestream Quantity for Source 5 could not be adequately determined according to the HRS requirements; that is, the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for Source 4 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Value: NS

2.4.2.1.3 Volume (Tier C)

The volume for Source 5 could not be adequately determined with reasonable confidence. The depth of Source 5 is unknown. Scoring proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: 0

2.4.2.1.4 Area (Tier D)

The area of the Source 5 waste rock pile is approximately 32,726 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this documentation record and on field observations during the 2019 PA and the 2022 SI correlating the unvegetated area with the boundaries of the waste rock pile (Figure A-3 of this HRS documentation record; Ref. 4, pp. 51-52, 58; Ref. 41, pp. 33, 40). In accordance with Ref. 1, Table 2-5, the equation for assigning a value for a pile is the area in square feet divided by 13:

32,726 / 13 = 2,517.38

Area Assigned Value: 2,517.38

Source Hazardous Waste Quantity Value

According to the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) is assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 5 Values
А	NS
В	NS
С	0
D	2,517.38

Source Hazardous Waste Quantity Value: 2,517.38

2.2 SOURCE 6 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of Source: Tailings Pile Number of Source: 6

Source Type: Pile

Description and Location of Source (see Figure A-2 and A-3):

Source 6 consists of the tailings pile along Little Cow Creek in the lower portion of the mine property (Figure A-3 of this HRS documentation record; Ref. 4, pp. 35, 51; Ref. 21, p. 21; Ref. 36, pp. 17-18; Ref. 41, pp. 33, 40). A mine dump was mapped at this location in 1921, forming the flat surface and road base along the eastern bank of Little Cow Creek (Ref. 21, p. 21). Tailings and waste rock appear to have been used to construct a rail bed between Afterthought Mine and Afterthought Smelter located approximately 1 mile downstream of the mine. The tailings pile was observed to be in direct contact with surface water in Little Cow Creek (Ref. 4, pp. 50-52, 59-60; Ref. 14, pp. 9, 22; Ref. 17, pp. 28-29; Ref. 41, pp. 33, 41). During the SI sampling event, acidic water was observed emerging from the tailings on Little Cow Creek bank and flowing into Little Cow Creek (Ref. 4, pp. 57-58).

The area of the Source 6 tailings pile is approximately 63,883 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this documentation record and on field observations during the 2019 PA and the 2022 SI correlating the unvegetated area with the boundaries of the tailings pile (Figure A-3 of this HRS documentation record; Ref. 4, pp. 35, 50-52, 59; Ref. 41, p. 33).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

2022 EPA SI Sampling

From June 21, 2022 through June 24, 2022, Weston Solutions, Inc. collected soil, sediment, and surface water samples as part of the SI for Afterthought Mine (Ref. 4, pp. 50-51). Samples were collected in accordance with the SAP approved by EPA on May 29, 2020 (Ref. 4, p. 13; Ref. 7, p. 2). Soil samples were submitted to Eurofins Burlington under the EPA CLP for metals analysis by ISM 02.4 ICP-AES (Ref. 4, p. 14). Validation of analytical data was contracted by EPA in accordance with ISM 02.4 (Ref. 7, pp. 44-45; Ref. 43, pp. 1, 2, 4; Ref. 44, pp. 1, 2, 4).

Tailings samples were collected from eight locations within Source 6 (AM-13 through AM-15 and AM-17 through AM-21) (Figure A-3 of this documentation record; Ref. 4, p. 36). Tailings samples were collected using a sample-dedicated plastic disposable scoop and transferred to a 4-oz. wide-mouth glass jar (Ref. 4, p. 13; Ref. 7, p. 36). Pile source samples were compared to a background soil sample to show the relative increase in hazardous substances over background soil levels. A background soil sample was collected from native soils north of the mine property in an area that was not observed to be impacted by mining activities (Ref. 4, pp. 13-14, 50). Background samples were collected using the same methods as the Source samples (Ref. 4, p. 14). Source sampling locations are presented in Figure A-3 of this HRS documentation record.

Table 7: 2022 SI, Source 6 Tailings Pile						
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References
Background	Soil Samples	5				
			Arsenic	23	1.0	
			Cadmium	1.7	0.51	Ref. 4, pp. 29, 50;
			Copper	77	2.5	Ref. 9, pp. 2-3, 12,
AM-BG-1	MY0AA0	6/22/2022	Lead	100	1.0	14, 470; Ref. 19, pp. 1-3, 10: Ref. 43, pp.
			Mercury	0.20 J- (0.366)	0.10	10-11; Ref. 47, p. 2; Ref. 48, pp. 8, 20
			Zinc	310	6.1	
Source 6 Tai	lings Pile Sar	nples				
			Arsenic	480	2.5	Ref. 4, pp. 29, 51;
			Cadmium	59	1.7	Ref. 9, pp. 2, 4, 12,
			Copper	2,100	6.2	27, 460, 483; Ref. 19, pp. 121, 123, 130
AM-13	MY0AB4	6/23/2022	Lead	3,000	2.5	141-143, 150; Ref.
			Mercury	8.6 J-	0.46	43, pp. 36-37; Ref.
			Zinc	13,000	75	47, p. 3; Ref. 48, pp. 8, 20
			Arsenic	1,300	9.6	Ref. 4, pp. 29, 51;
			Cadmium	38	4.8	Ref. 9, pp. 2, 4, 12,
AM 14	MV0AB5	6/23/2022	Copper	590	2.4	28, 460, 484; Ref. 19, pp. 141-143-150;
AWI-14	WITOAD5		Lead	2,200	2.9	Ref. 43, pp. 38-39;
			Mercury	6.9 J-	0.49	Ref. 47, p. 3; Ref. 48, pp. 8, 20
			Zinc	3,600	17	
			Arsenic	490	3.0	Ref. 4, pp. 29, 51;
			Cadmium	25	1.5	Ref. 9, pp. 2, 4, 12,
			Copper	480	2.5	29, 460, 485; Ref. 19 pp 141-143 150
AM-15	MY0AB6	6/23/2022	Lead	2,900	3.0	161-163, 170; Ref.
			Mercury	7.1 J-	0.46	43, pp. 40-41; Ref.
			Zinc	4,100	24	47, p. 3; Ref. 48, pp. 8, 20
			Arsenic	140	0.98	Ref. 4, pp. 29, 51;
			Cadmium	31	0.49	Ref. 9, pp. 2, 4, 12,
			Copper	2,400	4.9	pp. 161-163, 170,
AM-17/	MY0AB8	6/23/2022	Lead	2,000	2.0	181-183, 190; Ref.
			Mercury	3.5 J-	0.19	43, pp. 44-45; Ref.
			Zinc	7,500	59	47, p. 3; Ref. 48, pp. 8, 20
			Arsenic	250	1.6	Ref. 4, pp. 29, 51;
			Cadmium	24	0.79	Ref. 9, pp. 2, 4, 12,
AM-18	MY0AR9	6/23/2022	Copper	3,800	9.8	52, 401, 488; Kef. 19, pp 181-183 190.
1111-10	MI UAD)	0/23/2022	Lead	6,900	7.9	Ref. 43, pp. 46-47;
			Mercury	3.8 J-	0.20	Ref. 47, p. 3; Ref. 48,
			Zinc	4,300	24	pp. 8, 20
AM-19	MY0AC0	6/23/2022	Arsenic	520	3.1	

Table 7: 2022 SI, Source 6 Tailings Pile						
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References
			Cadmium	43	1.5	Ref. 4, pp. 29, 51;
			Copper	6,100	26	Ref. 9, pp. 2, 4, 12,
			Lead	6,200	10	pp. 181-183. 190.
			Mercury	18 J-	0.94	201-203, 210; Ref.
			Zinc	10,000	62	43, pp. 48-49; Ref. 47, p. 3; Ref. 48, pp. 8, 20
		IY0AC1 6/23/2022	Arsenic	1,000	9.7	Ref. 4, pp. 29, 51; Ref. 10, pp. 3, 13, 15, 764, 783; Ref. 44, pp. 12-13; Ref. 45, pp. 1- 3, 10, 21-23, 30; Ref. 47, p. 3; Ref. 48, pp.
			Cadmium	97	4.8	
AM-20 MY0AC1	MV0AC1		Copper	9,200	24	
	WITUACI		Lead	11,000	9.7	
			Mercury	27 J-	1.8	
			Zinc	18,000	87	8, 20
AM 21			Arsenic	230	1.4	Dof 4 nn 20 51.
		6/23/2022	Cadmium	34	0.72	Ref. 4, pp. 29, 51; Ref. 10, pp. 3, 13, 16, 764, 784; Ref. 44, pp. 14-15; Ref. 45, pp. 21-23, 30; Ref. 47, p. 3; Ref. 48, pp. 8, 20
	MY0AC2		Copper	4,200	9.0	
Alv1-21			Lead	4,300	3.6	
			Mercury	19 J-	0.99	
			Zinc	8,300	43	

mg/kg: milligrams analyte per kilogram tailings

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J-: The result is an estimated quantity, but the result may be biased low (Ref. 43, pp. 5, 9; Ref. 44, pp. 4-5, 10).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

All hazardous substances associated with Source 6 are available to the surface water pathway based on a containment factor value of greater than zero (Ref 1, Section 2.2.3).

Containment Description	Containment Factor Value	References
Release to surface water: There is no maintained engineered cover or functioning and maintained run-on control system and runoff management system. The tailings pile was observed to be in direct contact with surface water in Little Cow Creek. During the SI sampling event, acidic water was observed emerging from the tailings on Little Cow Creek bank and flowing into Little Cow Creek.	10	Figure A-3 of this HRS documentation record; Ref. 4, pp. 35, 50-52, 57-59; Ref. 14, pp. 9, 22; Ref. 17, pp. 28-29; Ref. 21, p. 21; Ref. 41, pp. 33, 40

2.4.2. HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The hazardous constituent quantity for Source 6 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). There are insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, etc.) available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous constituent quantity for Source 6 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total Hazardous Wastestream Quantity for Source 6 could not be adequately determined according to the HRS requirements; that is, the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass, or a partial estimate, of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate or extrapolate a total or partial Hazardous Wastestream Quantity for Source 6 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Value: NS

2.4.2.1.3 Volume (Tier C)

The volume for Source 6 could not be adequately determined with reasonable confidence. The depth of Source 6 is unknown. Scoring proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: NS

2.4.2.1.4 Area (Tier D)

The area of the Source 6 tailings pile is approximately 63,883 square feet. The area was measured based on the aerial photo presented in Figure A-3 of this documentation record and on field observations during the 2019 PA and the 2022 SI correlating the unvegetated area with the boundaries of the tailings pile (Figure A-3 of this HRS documentation record; Ref. 4, pp. 35, 50-52, 59-60; Ref. 41, pp. 33, 40). In accordance with Ref. 1, Table 2-5, the equation for assigning a value for a pile is the area in square feet divided by 13:

63,883 / 13 = 4,914.08

Area Assigned Value: 4,914.08

Source Hazardous Waste Quantity Value

According to the HRS, the highest of the values assigned to the source for hazardous constituent quantity (Tier A), hazardous wastestream quantity (Tier B), Volume (Tier C), and Area (Tier D) is assigned as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1.5).

Tier Evaluated	Source 6 Values
A	NS
В	NS
С	0
D	4,914.08

Source Hazardous Waste Quantity Value: 4,914.08

	Source Hazardous Waste	Containment						
Source No.	Quantity Value (see Section 2.4.2)	Ground Water	Surface Water	Gas	Air Particulate			
1	>0	NE	10	NE	NE			
2	3,282.51	NE	10	NE	NE			
3	1,139.22	NE	10	NE	NE			
4	779.69	NE	10	NE	NE			
5	2,517.38	NE	10	NE	NE			
6	4,914.08	NE	10	NE	NE			
TOTAL	>12,632.88							

SITE SUMMARY OF SOURCE DESCRIPTIONS

Notes:

NE = Not Evaluated.

Other Possible Sources Not Scored

Afterthought Smelter

Afterthought Smelter is located approximately 1 mile downstream of Afterthought Mine on the east bank of Little Cow Creek. In 1905, a 250-ton water-jacketed blast furnace was constructed at Afterthought Smelter to process ore from Afterthought Mine. Operation of this furnace continued successfully until 1908. A 300-ton oil-flotation mill and a 300-ton reverberatory furnace were completed in 1919 at Afterthought Smelter. Operation began in July 1919 and lasted only 8 months, because the zinc and copper sulfides could not be cleanly separated. (Ref. 21, p. 5; Ref. 23, p. 340; Ref. 24, pp. 16, 26-27; Ref. 25, pp. 35-36, 108-110; Ref. 26, p. 54; Ref. 36, p. 7; Ref. 39, p. 96).

Afterthought Smelter was terraced with waste rock and included tailings ponds and a tailings impoundment, which are still present on the smelter property (Ref. 5, p. 8). During the 2022 SI sampling event, the soil berm at the south end of the tailings ponds was observed to be breached, with a drainage channel to Little Cow Creek (Ref. 5, pp. 39-40, 47-50). A tailings impoundment located at the southern end of the smelter property in a ravine was observed to have failed, and tailings were deeply eroded from seasonal surface water drainage (Ref. 5, pp. 39, 46). Waste rock and tailings on the smelter property contained elevated concentrations of metals, including up to 2,600 mg/kg arsenic, 650 mg/kg cadmium, 54,000 mg/kg copper, 41,000 mg/kg lead, 73J mg/kg mercury, and 160,000 mg/kg zinc (Ref. 5, p. 5). Sources at Afterthought Smelter were not scored as part of this HRS documentation record due to the distance from the sources at Afterthought Mine.

Rail Bed

A rail bed that appears to have been constructed from tailings and/or waste rock connects Afterthought Mine and Afterthought Smelter along the eastern bank of Little Cow Creek (Figures A-2 and Figure A-4 of this HRS documentation record; Ref. 4, p. 8; Ref. 14, pp. 9, 22; Ref. 17, pp. 28-29). Based on the SI sampling results presented in Section 4.1.2.1.1 Observed Release, Attribution of this HRS documentation record, elevated concentrations of arsenic, cadmium,

copper, lead, mercury, and zinc are present in the rail bed materials. The rail bed was not scored as a source due to lack of information regarding the history and construction.

Other Areas of Concern

Afterthought Mine

Additional adits, portals, and waste rock piles are located on the mining property (Figure A-3 of this HRS documentation record; Ref. 21, pp. 21-23; Ref. 26, p. 56; Ref. 35, p. 5; Ref. 36, pp. 17-18). These possible sources are not scored as they were not sampled during the SI. Sampling was not conducted due to lack of field access, or lack of available surface water to sample (Ref. 4, p. 15).

4.0 SURFACE WATER MIGRATION PATHWAY

Little Cow Creek is a perennial stream that flows south adjacent to the Afterthought Mine site. The six site sources drain to Little Cow Creek. Little Cow Creek discharges into Cow Creek, which is a tributary to the Sacramento River. The Little Cow Creek confluence with Cow Creek is beyond the 15-mile target distance limit (TDL) from the site (Figure A-5 of this HRS documentation record; Ref. 3; Ref. 37, p. 149).

Little Cow Creek within the TDL is a fishery (Ref. 4, p. 18; Ref. 6, p. 1; Ref. 8, pp. 11-20; Ref. 28; Ref. 37, pp. 300, 305, 315-316, 320-321). Little Cow Creek within the TDL is designated critical habitat for steelhead trout (*Oncorhynchus mykiss*) (Ref. 20, pp. 117, 121). Approximately 2.31 miles of wetlands are located within the TDL (Figure A-6 of this HRS documentation record; Ref. 13, pp. 1-5; Ref. 18).

4.1 OVERLAND/FLOOD MIGRATION COMPONENT (Figures A-4 and A-5)

The overland/flood migration component evaluates surface water threats that result from overland migration of hazardous substances from a source at the site to surface water. Three types of threats are evaluated for this component: drinking water threat, human food chain threat, and environmental threat (Ref. 1, Section 4.1).

4.1.1 GENERAL CONSIDERATIONS

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/flood Component

The hazardous substance migration path includes both the overland segment and the in-water segment that hazardous substances would take as they migrate away from sources at the site. The overland segment begins at a source and proceeds downgradient to the probable point of entry (PPE) to the surface water. The in-water segment begins at this PPE. For rivers, the in-water segment continues in the direction of flow for the distance established by the TDL (Ref. 1, Section 4.1.1.1).

As shown in Figure A-4 of this HRS documentation record, most of Afterthought Mine, including Sources 1 through 5, is drained by the intermittent Afterthought Creek and its tributaries to Little Cow Creek. Sources 5 and 6 also drain directly into the perennial Little Cow Creek. Multiple mine adits/portals and waste rock piles are located throughout Afterthought Mine. In the upper portion of the mine, intermittent surface water in the North Fork Afterthought Creek flows through waste rock (Source 2) associated with the No. 1 Shaft and Adit 4. The overland drainage path from Source 2 waste rock to its PPE in Little Cow Creek is approximately 1,320 feet and consists of the North Fork Afterthought Creek and Afterthought Creek (Figure A-4 of this HRS documentation record). Intermittent surface water in the South Fork Afterthought Creek is fed in part by drainage emitting from Adit 3. The intermittent South Fork Afterthought Creek drains the South Fork Waste Rock pile (Source 4), and overland drainage flows from the Central Waste Rock pile (Source 3) to the South Fork Afterthought Creek before reaching the intermittent Afterthought Creek, which then drains into Little Cow Creek. The overland drainage paths from Sources 3 and 4 to their PPE in Little Cow Creek are approximately 1,690 feet and 1,162 feet, respectively (Figure A-4 of this HRS documentation record). The North Fork and South Fork Afterthought Creek join to flow downhill through the lower portion of the mine property. In the lower portion of the mine, near Little Cow Creek, AMD from Portal 1 (Source 1) flows into the intermittent Afterthought Creek

from the south, depositing a bright orange and green slime on waste rock between the portal and the creek. The overland drainage path from Source 1 to Little Cow Creek is approximately 528 feet (Figure A-4 of this HRS documentation record). In April 2019, Afterthought Creek was observed to flow into Little Cow Creek, causing the water in Little Cow Creek to be cloudy for some distance downstream. During the June 2022 SI sampling, surface water in Afterthought Creek infiltrated into the ground downstream of the confluence with the Portal 1 AMD before reaching Little Cow Creek. The point where Afterthought Creek flows into Little Cow Creek is designated as PPE 2 (Figure A-4 of this HRS documentation record; Ref. 4, pp. 8, 50-55; Ref. 36, pp. 17-18; Ref. 41, pp. 15, 33, 35-36, 39).

In addition to the flow from Afterthought Creek, Source 5 and Source 6 are located along the eastern bank of Little Cow Creek and have been observed to be in contact with Little Cow Creek surface water. PPE 1 is the length of approximately 250 feet where Source 5 is in contact with Little Cow Creek. PPE 3 is the length of approximately 500 feet where Source 6 in contact with Little Cow Creek (Figure A-4 of this HRS documentation record; Ref. 4, pp. 8, 50-55; Ref. 41, pp. 15, 33, 39).

Distance from Sources to Surface Water								
Source	Approximate Distance from Source to PPE	PPF						
Source	(Figure A-4 of this HRS documentation record)							
Source 1 – Portal 1	528 ft	2						
Source 2 – North Fork Waste Rock	1,320 ft	2						
Source 3 – Central Waste Rock Pile	1,690 ft	2						
Source 4 – South Fork Waste Rock	1,162 ft	2						
Source 5 – Mill Area Waste Rock	0 ft	1						
Source 6 – Tailings Pile	0 ft	3						

4.1.1.2 Target Distance Limit

The TDL defines the maximum distance over which targets are considered in evaluating the site. The TDL begins at the farthest upstream PPE (PPE 1). The TDL ending is measured from the furthest downstream PPE (PPE 3) and extends for 15 miles along the surface water from that point (Ref. 1, Section 4.1.1.2). The TDL is shown on Figure A-5 of this HRS documentation record.

Little Cow Creek is a perennial stream that flows south adjacent to the Afterthought Mine site. The six site sources drain to Little Cow Creek. Little Cow Creek discharges into Cow Creek, which is tributary to the Sacramento River. The Little Cow Creek confluence with Cow Creek is beyond the 15-mile TDL from the site (Figure A-1 and Figure A-5 of this HRS documentation record; Ref. 3; Ref. 37, p. 149).

The drainage basin of Little Cow Creek above Afterthought Mine comprises about 60 square miles. Mean flow in Little Cow Creek was measured at upstream USGS stream gage 11373300 from 1957-1965 at 51.1 to 252.0 cubic feet per second (cfs), or 62,657 gpm. Flows in Little Cow Creek were measured approximately 200 feet upstream from Afterthought Creek from August 1997 to May 1998 at an average flow rate of 211,509 gpm, or 565.9 cfs (Ref. 26, pp. 10, 61; Ref. 36, pp. 20, 22; Ref. 40).

4.1.2.1 Likelihood of Release

4.1.2.1.1 Observed Release

Observed Release by Direct Observation

An observed release to surface water may be established when a material that contains one or more hazardous substances has been seen entering surface water through migration or is known to have entered surface water through direct deposition (Ref. 1, Section 4.1.2.1.1).

Basis for Direct Observation:

Source 5 and Source 6 at the Afterthought Mine property are located along the bank of Little Cow Creek and have been observed to be in contact with surface water (PPE 1 and PPE 3) (Figure A-4 of this HRS documentation record; Ref. 3; Ref. 4, p. 8; Ref. 41, pp. 33, 41). Source 5 and Source 6 border Little Cow Creek for approximately 750 feet (Figure A-4 of this HRS documentation record).

Analytical data documenting the presence of hazardous substances in Source 5 and Source 6 is presented in Section 2.2.2 Hazardous Substances Associated with the Source of this HRS documentation record.

Hazardous Substances in Release:

Hazardous substances documented in Source 5 and Source 6 include arsenic, cadmium, copper, lead, mercury, and zinc (see Section 2.2.2, Hazardous Substances Associated with the Source of this HRS documentation record).

Observed Release by Chemical Analysis

The minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance significantly above the background level and some portion of the significant increase above the background level is attributable to the site. In accordance with HRS Table 2-3, if the background concentration is not detected, a significant increase is established when the sample measurement equals or exceeds the sample quantitation limit (SQL). If the background concentration equals or exceeds the detection limit, a significant increase is established when the sample measurement is three times or more above the background concentration. If the sample analysis was performed under the EPA CLP, the EPA Contract Required Quantitation Limit (CRQL) can be used in place of the SQL if the SQL is not available (Ref. 1, Section 2.3). Attribution will be discussed later in this Section.

2022 EPA SI Sampling

EPA tasked Weston Solutions, Inc. to conduct an SI at the Afterthought Mine site (Ref. 4, p. 13). From June 21, 2022 through June 24, 2022, Weston Solutions, Inc. collected soil, sediment, and surface water samples as part of the SI for Afterthought Mine (Ref. 4, pp. 50-51). Samples were collected in accordance with the SAP approved by EPA on May 29, 2020 (Ref. 4, p. 13; Ref. 7, p. 2). Sediment samples were submitted to Eurofins Burlington under the EPA CLP for metals analysis by ISM 02.4 ICP-AES. Surface water samples were submitted for metals analysis by ISM 0.24 ICP-AES and ICP-MS (Ref. 4, p. 14; Ref. 5, p. 11). Validation of analytical data was contracted by EPA in accordance with ISM 02.4 (Ref. 4, p. 13; Ref. 7, pp. 44-45; Ref. 46, p. 1).

To document an observed release, surface water and sediment samples were collected from Little Cow Creek upstream and downstream of site sources. Background sample LCC-AM-02 was collected upstream of all sources at Afterthought Mine (Ref. 4, pp. 44, 50, 57). Sample LCC-AM-04 was collected immediately downstream of the confluence with Afterthought Creek (PPE 2) (Ref. 4, pp. 44, 50, 56). Sample LCC-AM-05 was collected approximately 140 feet downstream of the confluence with Afterthought Creek (Ref. 4, pp. 44, 50-51, 57). Sample LCC-AM-10 was collected approximately 0.9 mile downstream of Afterthought Creek and upstream of Afterthought Smelter (Figure A-6 of this HRS documentation record; Ref. 5, pp. 33, 39, 49-50).

Each surface water sample included one filtered sample for dissolved metals and one unfiltered sample for total metals analyses. Sediment samples were analyzed for metals via EPA CLP ISM 02.4 ICP-AES. Filtered and unfiltered surface water samples were analyzed for metals via both EPA CLP ISM 02.4 ICP-AES and EPA CLP ISM 02.4 ICPMS. Water samples were also screened for pH in the field, using a YSI 650 Water Quality Meter (Ref. 4, p. 14; Ref. 5, p. 11). No other mining or smelting operations are known to be present downstream of Site sources and upstream of surface water and sediment samples documenting an observed release (Figure A-6 of this HRS documentation record; Ref. 3; Ref. 26, p. 11; Ref. 36, p. 6; Ref. 37, p. 198).

-Background Little Cow Creek

Background location LCC-AM-02 was sampled for surface water and sediments during the same sampling event using the same sampling methods and laboratories as the downstream contaminated Little Cow Creek surface water and sediment samples (Ref. 4, p. 14). An observed release is established based on Little Cow Creek surface water and sediment sampling.

	Table 8: 2022 SI, Little Cow Creek Background Surface Water Concentrations									
Station Location	CLP Sample ID	Filtered/ Unfiltered	Sampling Date	Hazardous Substance	Concentration (µg/L)	Sample Adjusted CRQL* (µg/L)	References			
ICP-MS R	esults									
				Cadmium	1.0U	1.0	Ref. 4, pp. 32, 50, 57;			
LCC-		I.I., C'14,	(122/22	Copper	2.0U	2.0	Ref. 12, pp. 4, 24, 682;			
AM-02- W-T	MY0AM6	Unfiltered	6/23/22	Lead	1.0U	1.0	199 211-213 220 Ref			
VV - 1				Zinc	5.0U	5.0	46, p. 38; Ref. 47, p. 2			
		5 Filtered	6/23/22	Cadmium	1.0U	1.0	Ref. 4, pp. 32, 50, 57; Ref. 12, pp. 4, 23, 681; Ref. 15, pp. 169-171, 178, 190-192, 199; Ref			
LCC-	MY0AM5			Copper	2.0U	2.0				
AM-02- W-F				Lead	1.0U	1.0				
				Zinc	5.0U	5.0	46, p. 35; Ref. 47, p. 2			
ICP-AES F	Results									
				Cadmium	5.0U	5.0	Ref. 4, pp. 32, 50, 57;			
LCC-		TT C'1, 1	C 122 122	Copper	25U	25	Ref. 12, pp. 4, 24; Ref.			
AM-02- W-T	MY0AM6	Unfiltered	6/23/22	Lead	10U	10	15, pp. 190-192, 199, 211-213, 220: Ref. 46			
				Zinc	60U	60	p. 37; Ref. 47, p. 2			
				Cadmium	5.0U	5.0	Ref. 4, pp. 32, 50, 57;			
LCC-		Tiltana 1	6/23/22	Copper	25U	25	Ref. 12, pp. 4, 23; Ref. 15, pp. 169-171, 178, 190-192, 199; Ref. 46, p. 34; Ref. 47, p. 2			
AM-02- W-F	MYUAM5	Y0AM5 Filtered		Lead	10U	10				
				Zinc	60U	60				

CLP: Contract Laboratory Program

 μ g/L: micrograms analyte per liter surface water

U: Not detected above the level of the reported CRQL (Ref. 46, p. 8)

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

Table 9: 2022 SI, Little Cow Creek Background Sediment Concentrations										
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References				
	MY0AF9	.F9 6/23/22	Cadmium	0.35 J	0.65	Ref. 4, pp. 32, 50, 57;				
LCC-AM-			Copper	21	3.3	Ref. 11, pp. 3, 13, 15; Ref. 16, pp. 1-3, 10, 21-23, 30; Ref. 34, p. 10; Ref. 47, p. 2; Ref. 48, pp. 8, 20				
LCC-AM- 02-S			Zinc	51	7.8					

mg/kg milligrams analyte per kilogram sediment

ND: Not Detected above the method detection limit

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J: Result is above the MDL but below the CRQL (Ref. 16, p. 1; Ref. 34, p. 4).

Table 10: Background Levels to Establish an Observed Release to Little Cow Creek									
Sample Type	Hazardous Substance	Maximum Background Concentration 2022 SI Sampling Results (µg/L)	HRS Table 2-3 Minimum Concentration to Document an Observed Release by Chemical Analysis (µg/L)						
Unfiltered Surface	Cadmium	ND	sample CRQL						
Water (μ g/L)	Copper	ND	sample CRQL						
ICP-MS and ICP-AES	Lead	ND	sample CRQL						
Results	Zinc	ND	sample CRQL						
Filtered Surface Water	Cadmium	ND	sample CRQL						
(µg/L)	Copper	ND	sample CRQL						
ICP-MS and ICP-AES	Lead	ND	sample CRQL						
Kesuits	Zinc	ND	sample CRQL						
Sodimont (mg/kg)	Cadmium	0.35 J, CRQL = 0.65*	1.95						
Sediment (mg/kg)	Copper	21	63						

 $\mu g/L$: micrograms analyte per liter surface water

ng/L: nanograms mercury per liter surface water

J: Result is above the MDL but below the CRQL (Ref. 11, p. 15; Ref. 16, p. 1).

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

ND: Not detected above the method detection limit

*: Detection below the CRQL is treated as non-quantifiable for HRS purposes, and adjustment factors are not applied. For a conservative background level, the sample adjusted CRQL of cadmium in sample LCC-AM-02-S is used here as a maximum background concentration (Ref. 12, p. 6; Ref. 16, p. 1; Ref. 34, p. 4).

- Little Cow Creek Samples Establishing an Observed Release

Surface water and sediment samples establishing an observed release are shown on Figure A-6 of this HRS documentation record. These samples contained cadmium, copper, lead, and/or zinc at concentrations exceeding the background levels specified above.

AFTERTHOUGHT MINE

Table 11: 2022 SI, Little Cow Creek Contaminated Surface Water Concentrations										
Station Location	CLP Sample ID	Filtered/ Unfiltered	Sampling Date	Hazardous Substance	Concentration (µg/L)	Sample Adjusted CRQL* (µg/L)	References			
ICP-MS R	esults									
				Cadmium	410	1.0	Ref. 4, p. 32; Ref. 12,			
LCC-				Copper	13,000	8.0	pp. 4, 684; Ref. 15, pp. 253-255, 262			
AM-05- W-T	MY0AN2	Unfiltered	6/23/22	Zinc	98,000	130	274-276, 283; Ref. 46, p. 44; Ref. 47, p. 2			
				Cadmium	410	1.0	Ref. 4, p. 32; Ref. 12,			
LCC- AM-05-	MY0AN1	Filtered	6/23/22	Copper	13,000	8.0	pp. 4, 683; Ref. 15,			
W-F	Thered	0/23/22	Zinc	98,000	130	Ref. 46, p. 41; Ref. 47, p. 2				
LCC- AM-10- W-T	MY0AP2	Unfiltered	6/23/22	Copper	15	2.0	Ref. 4, p. 32; Ref. 12, pp. 4, 686; Ref. 15, pp. 337-339, 346; Ref. 46, p. 50; Ref. 47, p. 3			
LCC- AM-10- W-F	MY0AP1	Filtered	6/23/22	Copper	12	2.0	Ref. 4, p. 32; Ref. 12, pp. 4, 685; Ref. 15, pp. 316-318, 325; Ref. 46, p. 47; Ref. 47, p. 3			
ICP-AES F	Results									
				Cadmium	380	5.0	Ref. 4, p. 32; Ref. 12,			
LCC- AM-05-	MY0AN2	Unfiltered	6/23/22	Copper	12,000	25	pp. 4, 26; Ref. 15, pp. 253-255, 262, 274-276, 283; Ref			
W-T				Lead	92	10	46, p. 43; Ref. 47, p. 2			
				Cadmium	380	5.0	Ref. 4, p. 32; Ref. 12,			
LCC-	MX/0 A NT 1	Eilter - J	6/22/22	Copper	12,000	25	pp. 4, 25; Ref. 15,			
W-F	IVI I UAN I	Filtered	0/23/22	Lead	92	10	Ref. 46. p. 40: Ref.			
				Zinc	89,000	600	47, p. 2			

CLP: Contract Laboratory Program

 μ g/L: micrograms analyte per liter surface water

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

Table 12: 2022 SI, Little Cow Creek Contaminated Sediment Concentrations										
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References				
LCC-AM- 04-S		6/23/22	Cadmium	4.6	0.47	Ref. 11, pp. 3, 13. 16;				
	MY0AG1		Copper	200	2.4	Ref. 16, pp. 21-23, 30; Ref. 34, p. 12; Ref. 47, p. 2				
LCC-AM- 05-S	MY0AG2	6/23/22	Cadmium	4.7	0.52	Ref. 11, pp. 3, 13, 17;				
			Copper	130	2.6	Ref. 16, pp. 21-23, 30; Ref. 34, p. 14; Ref. 47, p. 2				

mg/kg: milligrams analyte per kilogram sediment

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

Attribution

Operations at the Afterthought Mine began in 1862. The mine operated over a span of 90 years under various owners until activities ceased in August 1952 (Ref. 23, p. 340; Ref. 26, p. 56; Ref. 36, pp. 7-8; Ref. 39, p. 79). During operations, Afterthought Mine was mined for gold, silver, copper, and/or zinc (see the Site Description section of this HRS documentation record).

Remnants of the mine, including waste rock piles, adits/portals, and the ruins of the mine plant, are still present on the property. AMD still discharges from mine portals, including Portal 1 (Source 1), to the intermittent Afterthought Creek, and runoff from mine waste rock piles, including Sources 2 through 5, drains into the creek. Afterthought Creek then flows into Little Cow Creek adjacent to the mine property (Figure A-4 of this HRS documentation record; Ref. 4, p. 8).

Where AMD from Portal 1 (Source 1) flows into Afterthought Creek, it has deposited a bright orange and green slime on waste rock. In April 2019, Afterthought Creek was observed to flow into Little Cow Creek, causing the water in Little Cow Creek to be cloudy for some distance downstream (Ref. 4, pp. 8, 50-55; Ref. 41, pp. 15, 33, 35-36, 39). Water collected from Portal 1 had a pH of 2.77 during the 2022 SI (Ref. 4, pp. 50). The waste rock and tailings piles scored as sources in this HRS documentation record (Sources 2 through 6) and that drain to Little Cow Creek cover a combined area of about 164,227.39 square feet (Section 2.4.2 in this HRS documentation record for each source scored).

Little Cow Creek is a perennial stream that flows south adjacent to the Afterthought Mine site. The six site sources scored in this HRS documentation record all drain into Little Cow Creek at PPEs 1 through 3. Little Cow Creek discharges into Cow Creek beyond the site TDL (Figure A-5 of this HRS documentation record; Ref. 3; Ref. 37, p. 149).

Source 5 and Source 6 at the site are located along the bank of Little Cow Creek and have been observed to be in contact with surface water (PPE 1 and PPE 3) (Figure A-4 and Section 4.1.1.1 of this HRS documentation record; Ref. 3; Ref. 4, p. 8; Ref. 41, pp. 33, 41). Sources 1 through 4, as well as additional possible sources not scored at the mine property, drain to the intermittent

Afterthought Creek, which flows into Little Cow Creek (PPE 2) (Figure A-4 of this HRS documentation record; Ref. 4, pp. 8, 50-55; Ref. 41, pp. 15, 33, 35-36, 39).

Surface water and sediment samples were collected from the intermittent Afterthought Creek downstream of Sources 1 through 5 during the 2022 SI to show migration of hazardous substances from the sources to Little Cow Creek (Ref. 4, p. 13). A background sediment sample was collected from the intermittent South Fork Afterthought Creek upstream of site sources. Background surface water samples were not collected as surface water was not present in Afterthought Creek upstream of the site sources. (Ref. 4, pp. 14, 15, 50-51). Arsenic, cadmium, copper, lead, and zinc were present at detectable levels in surface water samples downstream of the Afterthought Mine sources. Arsenic, cadmium, copper, lead, mercury, and zinc were present at elevated concentrations in sediment samples (as compared to background levels) in Afterthought Creek downstream of Afterthought Mine sources, and they show the impact of the sources on Afterthought Creek sediments to its confluence with Little Cow Creek at PPE 2. Afterthought Creek water and sediment sample data are shown below in Table 13 and Table 14 of this HRS documentation record. Also shown below in Table 15 are the results of surface soil samples collected from the former rail bed during the SI, as it appeared to be constructed of waste rock from the Afterthought Mine operations (Ref. 4, pp. 29-30, 40, 50). This former rail bed runs south along Little Cow Creek through Source 6 and towards the Afterthought Smelter property (Figure A-2 and Figure A-4 of this HRS documentation record).

Surface water and sediment samples were collected from Little Cow Creek during the 2022 SI to determine if a release to the creek has occurred (Ref. 4, pp. 44, 50, 57). Cadmium, copper, lead, and zinc were detected at concentrations significantly above background levels in surface water samples collected from Little Cow Creek downstream of one or more PPEs from Sources 1 through 6. Cadmium and copper were detected at concentrations significantly above background levels in sediment samples collected from Little Cow Creek at or downstream of one or more PPEs from Sources 1 through 6 (Table 8 through Table 12 of this HRS documentation record).

As explained above, the hazardous substances in the observed release by chemical analysis to Little Cow Creek (cadmium, copper, lead, and zinc) at and downstream of the site PPEs were also detected in the reach of Afterthought Creek that drains Sources 1 through 4 and a portion of Source 5, in Sources 5 and 6 that border Little Cow Creek, and in each of the other four sources scored. No other non-site-related sources of the hazardous substances in the observed release have been identified in the immediate vicinity of the site or in between the site PPEs and the upgradient background samples. (See Figures A-1 and A-6 of this HRS documentation record).

Table 13: 2022 SI, Afterthought Creek Sediment Attribution Sampling									
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References			
Background Sedime	ent Sample								
			Arsenic	26	0.98	Ref. 4, pp. 31, 44, 51;			
AC-BG-02-S			Cadmium	1.9	0.49	Ref. 11, pp. 4, 13, 27,			
(South Fork	ΜΥΩΔΙΩ	6/24/2022	Copper	53	2.5	413, 435; Ref. 16, pp.			
Creek upstream of	MITORJO	0/24/2022	Lead	32 J ¹	0.98	121-123, 130; Ref.			
site sources)			Mercury	0.11 J-	0.097	34, pp. 33-34; Ref.			
			Zinc	370	5.9	47, p. 3			
Afterthought Creek	Attribution	Samples	Γ	Γ	1	Γ			
			Arsenic	920	5.3	Ref 4 nn 31 44 51.			
AC-07-S			Cadmium	21	2.6	Ref. 11, pp. 3, 13, 24,			
(South Fork	MY0AH6	6/24/2022	Copper	850	2.6	413, 432; Ref. 16, pp.			
Creek downstream	1011071110	0/24/2022	Lead	1,600J	2.1	81-83, 90, 101-103,			
of Adit 3)			Mercury	3.5 J-	0.18	110; Ref. 34, pp. 27- 28: Ref. 47, p. 3			
			Zinc	1,200	13	20, 101. 17, p. 5			
	MY0AH4	6/24/2022	Arsenic	140	0.98	Ref. 4, pp. 31, 44, 51; Ref. 11, pp. 3, 13, 23, 413, 431; Ref. 16, pp. 81-83, 90; Ref. 34, pp. 25-26; Ref. 47, p. 3			
AC-05-S			Cadmium	11	0.49				
(North Fork			Copper	1,200	2.5				
Creek downstream			Lead	1,200 J	0.98				
of Adit 4)			Mercury	2.1 J-	0.18				
			Zinc	2,000	12	5			
			Arsenic	260	1.9	Ref 1 nn 31 11 51.			
AC-04-S			Cadmium	11	0.96	Ref. 11, pp. 3, 13, 22,			
(Afterthought	MY0AH3	6/24/2022	Copper	950	2.4	413, 430; Ref. 16, pp.			
Creek downstream	10111071113	0/24/2022	Lead	1,800 J	1.9	61-63, 70, 81-83, 90;			
of East Portal)			Mercury	4.0 J-	0.40	Ref. 34, pp. 23-24; Ref. 47 p. 3			
			Zinc	1,500	12	Ref. 17, p. 5			
			Arsenic	490	3.5	Ref 4 nn 31 44 50			
AC-02-S			Cadmium	14	1.8	51; Ref. 11, pp. 3, 13,			
(Afterthought	MY0AH1	6/24/2022	Copper	480	2.9	20, 413, 428; Ref. 16,			
Creek downstream		0,21,2022	Lead	1,000 J	1.2	pp. 61-63, 70; Ref.			
of Portal 1)			Mercury	5.7 J-	0.46	47. n. 3			
			Zinc	1,200	7.0	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
AC-01-S			Arsenic	220	2.0	Ref 1 nn 31 11 50			
(Afterthought			Cadmium	9.2	1.0	51; Ref. 11, pp. 3, 13.			
Creek immediately	ΜΥΩΑΗΩ	6/24/2022	Copper	420	2.5	19, 413, 427; Ref. 16,			
upstream of		5/21/2022	Lead	670 J	1.0	pp. 41-43, 50; Ref.			
confluence with			Mercury	3.6 J	0.19	54, pp. 17-18; Kef. 47 p 3			
Little COW CIEEK)			Zinc	1,300 J ¹	12	···, P. 5			

- CLP: Contract Laboratory Program
- mg/kg: milligrams analyte per kilogram tailings
- CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit
- *: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).
- J-: The result is an estimated quantity, but the result may be biased low (Ref. 34, pp. 4, 8).
- J: Result is an estimated quantity because laboratory duplicate results are outside method limit (Ref. 34, pp. 5, 8)

Table 14: 2022 SI, Afterthought Creek Surface Water Attribution Sampling									
Station Location	CLP Sample ID	Filtered/ Unfiltered	Sampling Date	Hazardous Substance	Concentration (µg/L)	Sample Adjusted CRQL* (µg/L)	References		
ICP-MS Result	S								
				Arsenic	2.2	1.0	Ref. 4, pp. 31, 44, 50-		
AC-04-W-T				Cadmium	13	1.0	51, 55; Ref. 12, pp. 3,		
(downstream	MY0AK0	Unfiltered	6/24/2022	Copper	2,700	2.0	6/8; Ref. 15, pp. 106- 108 115 127-129		
of East Portal)				Lead	29	1.0	136; Ref. 46, p. 26;		
				Zinc	2,800	5.0	Ref. 47, p. 3		
	MY0AJ9	Filtered	6/24/2022	Cadmium	3.7	1.0	Ref. 4, pp. 31, 44, 50-		
AC-04-W-F				Copper	18	2.0	51, 55; Ref. 12, pp. 3,		
(downstream of East Portal)				Zinc	340	5.0	87, 94, 106-108, 115; Ref. 46, p. 23; Ref. 47, p. 3		
ICP-AES Resu	lts								
				Cadmium	13	5.0	Ref. 4, pp. 31, 44, 50-		
AC-04-W-T				Copper	2,400	25	51, 55; Ref. 12, pp. 3,		
(downstream	MY0AK0	Unfiltered	6/24/2022	Lead	29	10	20; Ref. 15, pp. 106-		
of East Portal)				Zinc	2,800	60	136; Ref. 46, p. 25; Ref. 47, p. 3		
				Cadmium	3.6 J	5.0	Ref. 4, pp. 31, 44, 50-		
AC-04-W-F		D'1 (1) 1	C/24/2022	Copper	19 J	25	51, 55; Ref. 12, pp. 3		
(downstream of East Portal)	MY0AJ9	Filtered	6/24/2022	Zinc	360	60	19, Kei. 15, pp. 85-87, 94, 106-108, 115; Ref. 46, p. 22; Ref. 47, p. 3		

µg/L: micrograms analyte per liter adit discharge

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J: Result is an estimated quantity. Result is above the MDL but below the CRQL (Ref. 15, p. 85; Ref. 46, pp. 5, 8).

Table 15: 2022 SI, Rail Bed Attribution Sampling									
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References			
			Arsenic	38	0.98				
			Cadmium	2.8	0.49	Ref. 4, pp. 29-30, 40,			
10.01		< 100 100000	Copper	410	2.5	26, 764, 794; Ref. 44,			
AR-01	MY0AE9	6/22/2022	Lead	190	2.0	pp. 40-41; Ref. 45, pp.			
			Mercury	0.40 J-	0.11	101-103, 110; Ref. 47,			
			Zinc	500	12	p. 2			
			Arsenic	14	0.96				
			Cadmium	2.1	0.48	Ref. 4, pp. 29-30, 40,			
AD 02	NOVOAEO	<i>c 1</i> 22 /2022	Copper	30	2.4	13, 27, 764, 795; Ref.			
AR-02	MYUAFU	6/22/2022	Lead	540	0.96	44, pp. 48-49; Ref. 45,			
			Mercury	4.0 J-	0.38	pp. 101-103, 110, 121-			
			Zinc	450	5.7	125, 150; Kel. 47, p. 2			
			Arsenic	210	1.8	D C 4 20 20 40			
			Cadmium	3.9	0.89	Ref. 4, pp. 29-30, 40,			
AD 02	MY0AF1	6/22/2022	Copper	620	2.2	28, 764, 796; Ref. 44, pp. 50-51; Ref. 45, pp.			
AK-05			Lead	250	1.8				
			Mercury	1.2 J-	0.096	121-123, 130; Ref. 47,			
			Zinc	170	11	p. 2			
	MY0AF2	c/22/2022	Arsenic	300	2.1	Ref. 4, pp. 29-30, 40, 50; Ref. 10, pp. 4, 13, 29, 764, 797; Ref. 44, pp. 52-53; Ref. 45, pp. 121-123, 130, 141- 143, 150; Ref. 47, p. 2			
			Cadmium	14	1.0				
AD 04			Copper	2,000	5.2				
AK-04		0/22/2022	Lead	2,100	2.1				
			Mercury	6.0 J-	0.48				
			Zinc	2,200	13				
			Arsenic	770	4.8	Def 4 mm 20 20 40			
			Cadmium	33	2.4	50: Ref 10 pp 4 13			
AD 05	MV0AE2	6/22/2022	Copper	780	2.4	30, 765, 798; Ref. 44,			
AK-03	WITOAF5	0/22/2022	Lead	320	0.96	pp. 54-55; Ref. 45, pp.			
			Mercury	2.3 J-	0.19	141-143, 150; Ref. 47,			
			Zinc	5,200	29	p. 2			
			Arsenic	370	2.9	Rof 4 pp 20 20 40			
			Cadmium	7.6	1.5	50: Ref. 10, pp. 4, 13.			
AP 06	MV0AE4	6/22/2022	Copper	370	2.4	31, 765, 799; Ref. 44,			
AR-00	WITOAP4	0/22/2022	Lead	570	0.98	pp. 56-57; Ref. 45, pp.			
			Mercury	10 J-	0.97	141-143, 150, 161- 163, 170: Ref. 47, p. 2			
			Zinc	340	5.9	105, 170, Kel. 47, p. 2			
			Arsenic	430	2.9	Ref. 4, pp. 29-30, 40,			
			Cadmium	18	1.5	50; Ref. 10, pp. 4, 13,			
AR-07	MY0AF5	6/22/2022	Copper	250	2.4	52, 705, 800; Kef. 44, pp. 58-59: Ref. 45, pp.			
			Lead	650	0.97	161-163, 170; Ref. 47,			
			Mercury	3.2 J-	0.19	p. 2			

Table 15: 2022 SI, Rail Bed Attribution Sampling										
Station Location	CLP Sample ID	Sampling Date	Hazardous Substance	Concentration (mg/kg)	Sample Adjusted CRQL* (mg/kg)	References				
			Zinc	2,200	12					
			Arsenic	220	1.7	D.C. 4				
		6/22/2022	Cadmium	34	0.87	Ker. 4, pp. 29-30, 40,				
	MY0AF6		Copper	2,400	6.5	13, 33, 765, 801; Ref. 44, pp. 60-61; Ref. 45, pp. 161-163, 170; Ref. 47, p. 2				
AK-08			Lead	2,500	2.6					
			Mercury	3.2 J-	0.17					
			Zinc	8,700	78					
			Arsenic	230	1.9	Def 4 mm 20 20 40				
			Cadmium	34	0.96	50. Ref 10 pp 4 13				
	MNOAE7	6/22/2022	Copper	2,300	4.8	34, 765, 802; Ref. 44,				
AR-08	MYUAF/	0/22/2022	Lead	2,100	1.9	pp. 62-63; Ref. 45, pp.				
			Mercury	4.9 J-	0.35	161-163, 170, 181-				
			Zinc	9,000	58	105, 190, Kei. 47, p. 2				

mg/kg: milligrams analyte per kilogram tailings

CRQL: EPA Contract Laboratory Program Contract Required Quantitation Limit

*: Since the samples were analyzed through the CLP, the CRQLs presented above are equivalent to the CRQL as defined by the HRS (Ref. 1, Sections 1.1 and 2.3).

J-: The result is an estimated quantity, but the result may be biased low (Ref. 44, pp. 4, 10).

Hazardous Substances Released

An observed release of cadmium, copper, lead, and zinc to surface water is documented by chemical analysis.

Surface Water Observed Release Factor Value: 550

4.1.2.1.2 **Potential to Release**

Potential to Release was not scored, because an Observed Release was established.

4.1.2 Drinking Water Threat

No drinking water intakes are located within 15 miles downstream of the PPEs. Therefore, the listing decision is not significantly affected by the drinking water threat to the surface water pathway.
4.1.3.2 **Human Food Chain Threat Waste Characteristics**

The human food chain threat waste characteristics factor category value is based on hazardous waste quantity, toxicity, surface water persistence, and bioaccumulation potential for the hazardous substances documented in the site source in the release to surface water.

4.1.3.2.1 **Toxicity/Persistence/Bioaccumulation**

HRS Toxicity, Persistence, and Bioaccumulation Potential Factor Values are presented below for the hazardous substances documented in Sources 1 through 6. Factor Values are provided in the Superfund Chemical Data Matrix (Ref. 2).

Table 16: Toxicity/Persistence/Bioaccumulation							
Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value*	Bioaccumulation Potential Factor Value**	Toxicity/ Persistence/ Bioaccumulation Factor Value (Ref. 1, Table 4- 16)	Reference	
Arsenic	1-6, OR	10,000	1	5	50,000	Ref. 2, p. 2	
Cadmium	1-6, OR	10,000	1	50,000	500,000,000	Ref. 2, p. 5	
Copper	1-6, OR	100	1	50,000	5,000,000	Ref. 2, p. 8	
Lead	1-6, OR	10,000	1	5,000	50,000,000	Ref. 2, p. 11	
Mercury	2-6, OR	10,000	1	50,000	500,000,000	Ref. 2, p. 14	
Zinc	1-3, 5, 6, OR	10	1	500	5,000	Ref. 2, p. 17	

Notes:

Persistence factor value for Rivers

** Bioaccumulation factor value for Freshwater

Observed Release OR =

Toxicity/Persistence/Bioaccumulation Factor Value: 500,000,000

(Ref. 1, Table 4-16)

4.1.3.2.2 Hazardous Waste Quantity

The calculations for hazardous waste quantities for Sources 1 through 6 are presented in Section 2.4.2.

Table 17: Hazardous Waste Quantity				
Source No.	Source Type	Source Hazardous Waste Quantity		
1	Other	>0		
2	Pile	3,282.51		
3	Pile	1,139.22		
4	Pile	779.69		
5	Pile	2,517.38		
6	Pile	4,914.08		
	sum:	>12,632.88		

Hazardous Waste Quantity Factor Value: 10,000

(Ref. 1, Table 2-6, Section 2.4.2.2)

4.1.3.2.3 Waste Characteristics Factor Category Value

Toxicity/Persistence/Bioaccumulation Factor Value: 500,000,000 Hazardous Waste Quantity Factor Value: 10,000

Toxicity/Persistence/Bioaccumulation Factor Value X Hazardous Waste Quantity Factor Value: 5,000,000,000

Waste Characteristics Factor Category Value: 1,000

(Ref. 1, Table 2-7)

4.1.3.3 Human Food Chain Threat Targets

Fall-run chinook salmon migrate upstream into Cow Creek, including Little Cow Creek, during the fall (late September through December) after the first autumn rains have increased stream flow. Little Cow Creek provides habitat for fish, including rainbow trout, steelhead trout, Sacramento sucker, and California roach. Fish reported caught in Little Cow Creek downstream of the site include largemouth bass, smallmouth bass, spotted bass, steelhead trout, carp, Chinook salmon, brown trout, bream/bluegill, brook trout, and rainbow trout (Ref. 4, p. 18; Ref. 8, pp. 11-22; Ref. 28; Ref. 37, pp. 300, 305, 315-316, 320-321).

Rainbow trout, Sacramento sucker, and California roach have been observed in Little Cow Creek downstream from the mine property, as well as upstream and in the vicinity of the smelter property (Ref. 26, pp. 62-63). Multiple documented fish catches on Little Cow Creek (Ref. 8, pp. 12-20). While most fish catches on Little Cow Creek did not log exact locations, at least one was logged within the TDL in 2019 (Ref. 8, p. 16).

The California Department of Fish and Wildlife refers to Little Cow Creek as North Cow Creek in some documents (Ref. 6, p. 1; Ref. 37, p. 154). North Cow Creek is identified as a fishery and has been stocked with trout in the past. Discarded fishing tackle has been observed all along Little Cow Creek, including within the zone of actual contamination and the TDL (Ref. 6, p. 1).

4.1.3.3.1 Food Chain Individual

Little Cow Creek within the TDL is a fishery and fish are caught for human consumption (see Section 4.1.3.3 of this HRS documentation record). An observed release of cadmium, copper, lead, and zinc from the site to surface water is documented by chemical analysis and by direct observation (see Section 4.1.2.1.1 of this HRS documentation record).

Food Chain Individual Factor Value: 20

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

Level I actual contamination is not documented.

Level I Concentrations Factor Value: 0

4.1.3.3.2.2 Level II Concentrations

Level II actual contamination is not documented

Level II Concentrations Factor Value: 0

4.1.3.3.2.3 Potential Human Food Chain Contamination

Potential Population Targets

Table 18: Potential Population Targets							
Identity of Fishery	Annual Production (pounds)	Type of Surface Water Body	Average Annual Flow (cfs)	Reference	Population Value (Pi) (Ref. 1, Table 4-18)	Dilution Weight (D _i) (Ref. 1, Table 4-13)	P _i x D _i
Little Cow Creek within the TDL	>0	moderate to large stream	51.1 to 252.1	Ref. 8, p. 16; Ref. 40, p.1	0.03	0.01	0.0003

Sum of P_i x D_i: 0.0003 (Sum of P_i x D_i)/10: 0.00003

Sum of $\Gamma_1 \times D_1 / 10$. 0.00005

Potential Human Food Chain Contamination Factor Value: 0.00003

4.1.4.2 Environmental Threat Waste Characteristics

The environmental threat waste characteristics factor category value is based on hazardous waste quantity, ecosystem toxicity, surface water persistence, and ecosystem bioaccumulation potential for the hazardous substances documented in the site source in the release to surface water.

4.1.4.2.1 **Ecosystem Toxicity/Persistence/Bioaccumulation**

HRS Ecosystem toxicity, Persistence, and Environmental Bioaccumulation Factor Values are presented below for the hazardous substances documented in Sources 1 through 6. Factor Values are provided in the Superfund Chemical Data Matrix (Ref. 2).

Table 19: Ecosystem Toxicity/Persistence/Environmental Bioaccumulation								
Hazardous Substance	Source No.	Ecosystem Toxicity Factor Value	Persistence Factor Value*	Environmental Bioaccumulation Factor Value**	Ecosystem Toxicity/ Persistence/ Environmental Bioaccumulation Factor Value (Ref. 1, Table 4-21)	Reference		
Arsenic	1-6, OR	10	1	50,000	500,000	Ref. 2, p. 2		
Cadmium	1-6, OR	10,000	1	50,000	500,000,000	Ref. 2, p. 5		
Copper	1-6, OR	1,000	1	50,000	50,000,000	Ref. 2, p. 8		
Lead	1-6, OR	1,000	1	50,000	50,000,000	Ref. 2, p. 11		
Mercury	2-6, OR	10,000	1	50,000	500,000,000	Ref. 2, p. 14		
Zinc	1-3, 5, 6, OR	10	1	50,000	500,000	Ref. 2, p. 17		

Notes:

Persistence factor value for Rivers

** Bioaccumulation factor value for Freshwater

OR = **Observed Release**

Toxicity/Persistence/Bioaccumulation Factor Value: 500,000,000

(Ref. 1, Table 4-21)

4.1.2.2.2 **Hazardous Waste Quantity**

The calculations for hazardous waste quantities for Sources 1 through 6 are presented in Section 2.4.2.

Table 20: Hazardous Waste Quantity				
Source No.	Source Type	Source Hazardous Waste Quantity		
1	Other	>0		
2	Pile	3,282.51		
3	Pile	1,139.22		
4	Pile	779.69		
5	Pile	2,517.38		
6	Pile	4,914.08		
	sum:	>12,632.88		

Hazardous Waste Quantity Factor Value: 10,000

(Ref. 1, Table 2-6, Section 2.4.2.2)

4.1.2.2.3 Waste Characteristics Factor Category Value

Toxicity/Persistence/Bioaccumulation Factor Value: 500,000,000 Hazardous Waste Quantity Factor Value: 10,000

Toxicity/Persistence/Bioaccumulation Factor Value X Hazardous Waste Quantity Factor Value: 50,000,000,000

Waste Characteristics Factor Category Value: 1,000

(Ref. 1, Table 2-7)

4.1.4.3 Environmental Threat Targets

Most Distant Level II Sample Sample ID: LCC-AM-10-W-F and LCC-AM-10-W-T Distance from the probable point of entry: Approximately 4,075 feet downstream of the downstream end of PPE 3 Reference: Figure A-6 of this HRS documentation record; Ref. 4, p. 32; Ref. 12, pp. 4, 27-28; Ref. 15, pp. 316-318, 325, 337-339, 346; Ref. 46, pp. 47, 50

4.1.4.3.1 Sensitive Environments

Little Cow Creek within the TDL provides Critical Habitat for the Federal-listed threatened Steelhead (*Oncorhynchus mykiss*) (Figure A-5 of this HRS documentation record; Ref. 20, pp. 117, 121).

Approximately 0.15 mile of wetlands frontage are located along Little Cow Creek between the most upstream point of PPE 1 and sample location LCC-AM-10. Approximately 2.15 miles of wetlands are located along Little Cow Creek downstream of sample location LCC-AM-10 within the TDL (Figure A-6 of this HRS documentation record; Ref. 13, pp. 1-5; Ref. 18).

4.1.4.3.1.1 Level I Concentrations

Level I actual contamination is not documented.

Level I Concentrations Factor Value: 0

4.1.4.3.1.2. Level II Concentrations

Level II Sensitive Environment Targets

Table 21: Level II Sensitive Environment Targets							
Total Length of Wetlands Frontage	Surface Water Body	Distance from PPE 1 to Nearest Sensitive Environment	References	Sensitive Environment Value (Ref. 1, Table 4-24)			
0.15 mile	Little Cow Creek	0 miles	Figure A-6 of this HRS documentation record; Ref. 13, p. 1	25			

Sum of Level II Sensitive Environments Value: 25

Level II Concentrations Factor Value: 25

4.1.4.3.1.3 Potential Contamination

Little Cow Creek within the TDL provides Critical Habitat for the Federal-listed threatened Steelhead (*Oncorhynchus mykiss*) (Figure A-5 of this HRS documentation record; Ref. 20, pp. 117, 121). Approximately 2.34 miles of wetlands are located along Little Cow Creek downstream of sample location LCC-AM-10 within the TDL (Figure A-6 of this HRS documentation record; Ref. 13, pp. 1-5; Ref. 18). Mean flow in Little Cow Creek was measured at upstream USGS stream gage 11373300 from 1957-1965 at 51.1 to 252.0 cubic feet per second (cfs). Flows in Little Cow Creek were measured approximately 200 feet upstream from Afterthought Creek from August 1997 to May 1998 at an average flow rate of 211,509 gpm (Ref. 26, pp. 10, 61; Ref. 36, pp. 18, 20, 22; Ref. 40). In accordance with Ref. 1, Table 4-13, Little Cow Creek within the TDL is described as a moderate to large stream.

Table 22: Potential Sensitive Environment Targets						
Type of Surface Water Body (Ref. 1, Table 4-13)	Sensitive Environment	References	Sensitive Environment Value (Ref. 1, Table 4-23)			
Moderate to large stream	Designated critical habitat for steelhead trout (<i>Oncorhynchus</i> <i>mykiss</i>)	Ref. 20, pp. 1, 117, 121	100			

Table 23: Potential Wetland Frontages					
Type of Surface Water Body (Ref. 1, Table 4-13)	Total Length of Wetlands	References	Sensitive Environment Value (Ref. 1, Table 4-23)		
Moderate to large stream	2.15 miles	Figure A-6 of this HRS documentation record; Ref. 13, pp. 2-5; Ref. 18	75		

Table 24: Potential Contamination						
Type of Surface Water Body	Sum of Sensitive Environments Values (S _j)	Wetland Frontage Value (Wj)	Dilution Weight (Dj) (Ref. 1, Table 4-13)	$D_{j}(W_{j}+S_{j}) \\$		
Moderate to large stream	100	75	0.01	1.75		

Sum of Dj(Wj + Sj): 1.75 (Sum of Dj(Wj + Sj))/10: 0.175

Potential Contamination Factor Value: 0.175