3.5 **SOILS AND RECLAMATION COVER MATERIALS**

### 3.5.1 Introduction and Scope of Analysis

Soils provide support for complex food webs and habitat components, and maintenance of soil quality is important for soil-hydrologic functions such as water quality, surface water retention, and groundwater recharge (U.S. Forest Service [Forest Service] 2003). In addition, soils salvaged prior to construction and mining activities can provide important materials that may be used to reclaim disturbed areas. This section presents a description of the existing soils in the Stibnite Gold Project (SGP) area, including areas previously disturbed and reclaimed by historical mining and related activities. The focus of information in this section is the presentation of soil landscapes, soil types, suitable and unsuitable soils for use/re-use, and general characterizations of six broad areas of potential disturbance at the proposed mine site.

The analysis of existing soils in this affected environment section focuses on the proposed mine site and Burntlog Route locations, where field survey/soil investigation was conducted (Midas Gold Idaho, Inc. [Midas Gold] 2017a,b; Tetra Tech 2017, 2019). However, part of the analysis of environmental consequences associated with soils (Section 4.5, Soils and Reclamation Cover Materials) includes two specific terms from the Payette National Forest Land and Resource Management Plan (Payette Forest Plan) (Forest Service 2003) and Boise National Forest Land and Resource Management Plan (Boise Forest Plan) (Forest Service 2010a) that further define the analysis area for soils: Total Soil Resource Commitment (TSRC) and detrimental soil disturbance (DD):

- **Total Soil Resource Commitment (TSRC)**, as defined in the Payette Forest Plan and Boise Forest Plan, is the conversion of a productive site to an essentially non-productive site for a period of more than 50 years. Mining excavations and dumps, roads, dedicated trails, parking lots, and other dedicated facilities (e.g., landfills, borrow sites, surface water management features, etc.) are examples of TSRC. Productivity on these areas range from 0 to 40 percent of natural background.

- **Detrimental soil disturbance (DD)**, as defined in the Payette Forest Plan and Boise Forest Plan, is the alteration of natural soil characteristics that results in immediate or prolonged loss of soil productivity and soil-hydrologic conditions. DD can occur from soil that has been displaced, compacted, puddled (e.g., ruts with berms in mineral soil), or severely burned. Mining excavations and dumps, roads, parking lots, and other dedicated facilities are excluded from this requirement, which are assessed for TSRC. DD does apply to vegetation clearing activities (such as for new and upgraded utility corridors) in areas that are available for multiple uses on National Forest System (NFS) lands.

These two terms, which are discussed and defined in greater detail in Chapter 4, Environmental Consequences, Section 4.5, Soils and Reclamation Cover Materials, result in two defined analysis areas for soil resources. The Payette Forest Plan requires TSRC to be measured
across an all-inclusive activity area, and not just within a proposed disturbance footprint. The subwatersheds within which disturbance from the SGP components would occur were chosen as the smallest logical land area (where the effect being analyzed could be expected to occur) for the TSRC analysis area. Hydrologic units of the U.S. are defined by the U.S. Geological Survey using Hydrologic Unit Codes, and the sixth level of classification of these units, subwatersheds, are the smallest unit of analysis. This analysis area was selected as it is a reasonable extent to which some of the potential indirect effects of the SGP might extend, such as soil erosion and sedimentation. The TSRC analysis area only includes NFS lands (management of TSRC by the Forest Service does not apply to private lands) within the subwatersheds in which SGP components would occur. Excluded from the TSRC analysis area are Inventoried Roadless Areas, Research Natural Areas, Wilderness, and private land ownership (including private patented mining claims owned or controlled by Midas Gold) (Figure 3.5-1).

For the DD analysis area, DD is measured within the specific area where proposed actions may have detrimental soil impacts but excludes dedicated uses such as roads and mining facilities, which are covered under the TSRC analysis area. Thus, the DD analysis area excludes all the proposed mine site, access roads, and offsite facilities, and focuses only on the transmission line right-of-way (ROW) on NFS lands where vegetation clearing could occur (Figure 3.5-1). It also should be noted that some of the transmission line ROW would be considered in the TSRC analysis (e.g., access roads, construction laydown, and structure work areas serving the proposed mine site), and thus is encompassed by the TSRC analysis area. The entire transmission line ROW that is within NFS lands is depicted as the DD analysis area in Figure 3.5-1.

3.5.2 Relevant Laws, Regulations, Policies, and Plans

3.5.2.1 36 Code of Federal Regulations 228.8

Mining operations on NFS lands are required by these regulations to reclaim disturbed surfaces in a timely manner, where practicable, by taking measures to prevent or control on-site and off-site damage to the environment (Requirements for environmental protection: Reclamation, 36 Code of Federal Regulations 228.8[g]).

3.5.2.2 Forest Service Manual 2840

Forest Service Manual (FSM) 2840 – Reclamation, directs that lands disturbed by mining must be returned to a use consistent with long-term forest land and resource management plans. Plans of operations must include specific proposals to reclaim all lands disturbed by mining and address topsoil management (FSM 2840, Section 2841). Measurable performance standards are to be included for all reclamation requirements. A bond or other financial guarantee is normally required to cover the full cost of reclamation. Reclaimed areas may not always achieve the range of desired conditions described in Forest Service management direction.
3.5.2.3 Forest Service Manual 2550

The FSM guidelines on soil management (FSM 2550) require that NFS land be managed to maintain or improve soil quality (Forest Service 2010b). Soil quality is related to the functions that soils perform, including biodiversity, water storage, nutrient cycling, carbon storage, physical stability and support, and filtering and buffering. TSRC and DD generally result in physical, chemical and/or biological changes to soils which impair one or more of these functions. In the context of reclamation, improvement of soil quality and related soil functions should be a primary objective. Practical methods to ensure that reclamation cover materials are suitable are summarized in the guidelines.

3.5.2.4 National Forest Land and Resource Management Plans

Physical, social, and biological resources on National Forest System lands are managed to achieve a desired condition that supports a broad range of biodiversity and social and economic opportunity. National Forest Land and Resource Management Plans embody the provisions of the National Forest Management Act and guide natural resource management activities on National Forest System land.

In the SGP area, the Payette National Forest Land and Resource Management Plan (Payette Forest Plan; Forest Service 2003), and the Boise National Forest Land and Resource Management Plan (Boise Forest Plan; Forest Service 2010) provide management prescriptions designed to realize goals for achieving desired condition for soils and include various objectives, guidelines, and standards for this purpose."

3.5.2.5 Idaho Administrative Procedure Act 20.03.02

The Idaho Department of Lands regulates surface mining in Idaho on private and patented land. The Surface Mining Act of 1971 and implementing regulations require that land used for surface mining is reclaimed when mining is completed, meaning the mining operation must return the land to a “productive condition” (Idaho Administrative Procedure Act regulations, Section 20.03.02).

The Idaho Department of Lands has published a manual of Best Management Practices for Mining in Idaho (1992), which provides techniques and approaches for maintaining water quality and completing reclamation projects. This manual also is referenced in the Payette Forest Plan management direction (Mineral and Geology Resources) as a guide for evaluating the completeness of reclamation plans with respect to mitigating water quality effects.
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3 AFFECTED ENVIRONMENT
3.5 SOILS AND RECLAMATION COVER MATERIALS

Figure 3.5-1  Total Soil Resource Commitment and Detrimental Soil Disturbance Analysis Areas

Figure Source: AECOM 2020
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3.5.3 **Existing Conditions**

### 3.5.3.1 Soil Landscapes

The mine site is in the Salmon River Mountains, a high-relief mountainous physiographic province in central Idaho. It is located approximately 14 road miles east/southeast of the village of Yellow Pine, Idaho, in a drainage that is part of the East Fork South Fork Salmon River (EFSFSR). The terrain around the mine site consists of narrow valleys surrounded by steep mountains. The proposed mine site rests at an elevation of approximately 6,500 feet above mean sea level. Elevations along valley floors range from 6,000 to 6,600 feet above mean sea level. The surrounding mountains reach elevations of 7,800 to 8,900 feet above mean sea level.

Soil at the proposed mine site is generally characterized as weakly developed and coarse textured with a high prevalence of coarse fragments. It has formed in semi-humid, sub-alpine environments. The dominant parent materials are residual and colluvial material sourced from two main bedrock types: Paleozoic metamorphic rock and younger igneous intrusive rock of the Cretaceous Idaho Batholith. Igneous intrusive rock is much more prevalent in the SGP area. Metasediments (generally quartzite or marble) are only mapped in the vicinity of the proposed West End pit. Bedrock depths are typically deep in alluvial valley bottoms and on side slopes that have a mantle of glacial till, outwash, or colluvium. Very steep, glaciated valley walls typically have bedrock at the surface or at shallow depths. Surface cobbles, stones, and boulders also are locally prevalent, along with bedrock outcrops. While most common on very steep slopes, very stony surfaces also cover approximately 81 acres (5 percent) of the mine site with slopes less than 45 percent (Tetra Tech 2017).

There are many different types of soils, and each one has unique characteristics, like color, texture, structure, and mineral content. Residual soils form slowly as rock (the parent material) weathers in place. Organic matter decays and mixes with inorganic material (rock particles, minerals, and water) to form soil. Soil is made up of distinct horizontal layers, referred to as “horizons.” The A horizon is typically called topsoil. Seeds germinate and plants root mostly in this horizon. The B horizon is often called the subsoil. It contains clay and mineral deposits (like iron, aluminum oxides, and calcium carbonate) that leach out of the layers above and accumulate in the B horizon. The C horizon is called the substratum. It typically consists of slightly broken-up bedrock. There are few plant roots, and very little organic material is found in this layer. Below this layer is the R horizon, which is the unweathered rock (bedrock) layer that is beneath all the other layers.

In the SGP area, thin, poorly developed surface and subsurface layers (A, A/C and C horizons) have formed on steep slopes (30 to 80 percent gradient) where surface creep is evidenced by J-shaped trees. This soil has been interpreted to be generally stable unless it is disturbed or has its vegetative cover removed (Forest Service 1981, 1994). Approximately 677 acres, or 39 percent, of the mine site is considered to have very steep slopes (greater than 45 percent) (Tetra Tech 2017).
Soil development and thickness of A and B horizons is strongly correlated with slope position in the SGP area. In general, upper side slopes and ridge tops (runoff or convex positions) experience more erosion and have weaker soil development and shallower soils. Lower side slopes, foot slopes, and toe slopes (concave positions) experience more deposition and have deeper soil development. Mid slopes or backslopes (transitional areas) experience both erosion and deposition and have intermediate soil development.

The mine site is in the Stibnite Mining District, with prospecting dating back to the late 1800s. Mining began in the 1920s and continued intermittently through 1997. This historical use of the area has resulted in a wide variety of soils modified by human activity throughout the mine site and vicinity, with approximately 244 acres at the proposed mine site considered highly disturbed (Tetra Tech 2017).

### 3.5.3.2 Soil Types

Soils in the SGP area are generally young, poorly developed, and often occur on steep slopes. This means their physical and chemical characteristics are often closely associated with the underlying parent materials.

Three basic types of parent materials are present:

- Residuum and colluvium developed in bedrock. Intrusive igneous bedrock of the Idaho Batholith is dominant in the SGP area. The granitic bedrock varies in composition, hardness, and degree of weathering. Weathering products are generally coarse-grained and have a high percentage of coarse fragments.

  Metasedimentary rocks (primarily quartzite and marble) are exposed in and southeast of the West End and Yellow Pine pit areas. The weathering products of quartzite can be similar to granitic rocks, while those of marble tend to be finer grained with chemistry strongly influenced by calcite.

  Alpine glacial erosion has added to the complexity of the landscape. Colluvial materials or slope wash of varying depths are often present even on many of the steep slopes. Soils developed in place from granitic bedrock can have land use and management constraints when located on very steep slopes. These soils also typically have low productivity due to low water-holding capacity, slight to high acidity, and low fertility.

- Alpine glacial till on lateral and ground moraines and glacial outwash in valley bottoms and lower side slopes of glacial troughs. Isolated pockets of glacial till also may be present in depressions on some upper slopes. The depth of the till and outwash varies across the landscape. The till and outwash are generally derived from igneous intrusive rocks that weather to coarse-grained soils. Some areas of till also have a very stony surface and can occur on steep slopes.

- Alluvium on floodplains and terraces adjacent to streams. These are generally deep, well-sorted, loamy or sandy soils. Some areas may be poorly drained.
The geomorphic setting of the SGP area has resulted in a very complex pattern of soils across the landscape, depending on the presence/absence and depth of the glacial till, colluvium, alluvium, and the composition of the bedrock. The disturbance history also has added another layer of complexity. Pronounced changes in soil properties may occur across short distances. This variability is documented in the Soil Hydrologic Reconnaissance Reports (each land type unit includes two to four unique soil types) (Forest Service 1974, 1972, 1969) and the surface soil texture maps developed for the Soil Resources Baseline Study (Midas Gold 2017a). The Soil Resources Baseline Study used field transects based on a 100-meter systematic grid. Soil texture often varied considerably over short distances.

A map of dominant soil types at the mine site is provided on Figures 3.5-2 and 3.5-3. Figures 3.5-4 and 3.5-5 provide a map of dominant soil types along the proposed Burntlog Route. A summary description of mapped soil types and the extent mapped at the mine site and along the Burntlog Route is provided in Table 3.5-1, and detailed descriptions are provided later in this section. While the soil mapping is based on the Reclamation and Closure Plan (Tetra Tech 2019), the map unit descriptions incorporate information from the Soil Salvage Report (Tetra Tech 2017), the Soil Resources Baseline Study (Midas Gold 2017a), and the Forest Service mapping (Forest Service 1974). The Soil Resources Baseline Study provides extensive field descriptions of the upper 12 inches of soil in the mine site and vicinity, primarily for soil texture and evidence of disturbance such as compaction, burning, or erosion.

Baseline soil and surface characterization are presented below for the six broad areas of potential disturbance from the Soil Resources Baseline Study that generally correspond to the various proposed mine site areas (i.e., Meadow Creek, Fiddle Creek, Hangar Flats, Yellow Pine, West End, and Infrastructure Areas). Soil map units and layers are rated as either suitable or unsuitable for reclamation based on the suitability criteria in Table 3-1 of the Soil Salvage Report (Tetra Tech 2017). Suitable soils are further rated as either good, fair, or poor for reclamation in Table 3.5-2. Suitable soils rated as good generally have loamy soil textures, few coarse fragments, slightly acidic to slightly alkaline pH, and occur on level to gently sloping ground. Unsuitable soils have either very high coarse fragment content; are extremely acidic or very strongly alkaline; or occur on very steep slopes. Soils with a high proportion of surface stones, and soils disturbed by legacy mining activities also are considered unsuitable for reclamation.

### 3.5.3.2.1 **Suitable Soils**

Soil map unit number fOD is coarse-silty, mixed, frigid oxyaquic dystrochrepts formed in alluvium in drainage bottoms near stream channels. These soils are very deep (>60 inches). This soil has varying mean seasonal temperatures, is saturated but may not be hydric, and typically supports evergreen tree growth in alpine and subalpine communities. Depth to water is between 12 and 24 inches and fluctuates seasonally as indicated by redoximorphic soil features observed in the soil profile. Texture of these soils is silt, loam, silt loam, sandy loam, and loamy sand. Generally, these soils have high organic matter content in the upper soil layers and are suitable as sources for salvage assuming groundwater elevations are reduced. An average depth of 30 inches is available for soil borrow in this map unit.
### Table 3.5-1 Dominant Soil Types in the Proposed Mine Site and Burntlog Route

<table>
<thead>
<tr>
<th>Map Unit</th>
<th>Soil Description</th>
<th>Dominant Soil Suborder</th>
<th>Particle Size Class</th>
<th>Solum Depth (inches)</th>
<th>Depth to Extremely Cobbly or Gravelly Material (inches)</th>
<th>Extent Mapped (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mTC</td>
<td>A Orthents</td>
<td></td>
<td>Sandy/Loamy-Skeletal</td>
<td>8</td>
<td>15</td>
<td>749</td>
</tr>
<tr>
<td>sTC</td>
<td>A Orthents (stony)</td>
<td></td>
<td>Sandy/Loamy-Skeletal</td>
<td>8</td>
<td>15</td>
<td>112</td>
</tr>
<tr>
<td>S45+</td>
<td>A Orthents (very steep)</td>
<td></td>
<td>Sandy/Loamy-Skeletal</td>
<td>8</td>
<td>15</td>
<td>611</td>
</tr>
<tr>
<td>fOD</td>
<td>B Cryepts</td>
<td></td>
<td>Coarse-Silty</td>
<td>15</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>fTH</td>
<td>C Saprists</td>
<td></td>
<td>Decomposed organic material</td>
<td>&gt;30</td>
<td>&gt;30</td>
<td>89</td>
</tr>
<tr>
<td>AoD</td>
<td>D N/A</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>442</td>
</tr>
<tr>
<td>Other</td>
<td>Unsalvageable</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>172</td>
</tr>
</tbody>
</table>

Table Source: AECOM 2020; Midas Gold 2017a; Tetra Tech 2017, 2019

Table Notes:
1. mTC = mixed typic cryorthents
   sTC = stoney typic cryorthents
   S45+ = sandy-skeletal/loamy-skeletal, mixed typic cryorthents
   fOD = frigid oyaquic dystrocryepts
   fTH = frigid typic haplosaprists
   AoD = areas of previous disturbance
2. A Somewhat excessively and excessively drained soils developed in residuum and colluvium derived from igneous intrusive rock (granite, granodiorite, quartz diorite, quartz monzonite, and others). Map unit S45+ includes some areas of previous disturbance (AoD) on slopes greater than 45%.
   B Very deep to bedrock, somewhat poorly drained soils developed in recent silty alluvium near stream channels.
   C Very deep to bedrock, poorly and very poorly drained soils developed in organic materials in foot slope and toe slope positions subject to groundwater seepage.
   D Areas of Previous Disturbance – No Salvageable Soil.
   N/A = not available
3. From Soil Taxonomy (U.S. Department of Agriculture, Natural Resources Conservation Service 1999). Orthents (Entisols) have less soil development compared to Cryepts (Inceptisols). Orthents typically have a surface A horizon over a C horizon composed of weathered granitic material. Cryepts also have a subsurface B horizon with evidence of soil development. Saprists (Histosols) typically have highly decomposed organic materials deeper than 16 inches.
4. Skeletal classes have >35 percent (%) coarse fragments. Sandy = loamy sand or sand textures. Loamy = generally loam, sandy loam, and silt loam textures with <35% clay. Coarse-Silty has <35% coarse fragments, <15% fine sand or coarser, and <18% clay.
5. The solum includes all soil layers that have undergone soil forming processes, including the O, A, AC, and B horizons. It excludes the C horizon.
6. Estimated at >60% coarse fragments by volume.
Figure 3.5-2  Soil Map of the Mine Site – Page 1 of 2
Figure 3.5-3  Soil Map of the Mine Site – Page 2 of 2
Figure 3.5-4  Soil Map of Burntlog Route – Page 1 of 2
Figure 3.5-5  Soil Map of Burntlog Route – Page 2 of 2

Figure Source: AECOM 2020
3.5 SOILS AND RECLAMATION COVER MATERIALS

Soils from map unit fTH are euic, frigid typic haplosapristes meaning these soils lack definitive horizons, have elevated pH, and have varying mean seasonal temperatures. These soil types were observed on side slopes adjacent to the fOD soils. These soils develop by the accumulation and subsequent decomposition of organic matter in forested settings and lack the mineral soil layers and sandy textures found in the fOD soils. These soils are high in organic matter, occur on shallow to moderate slopes resulting from seeps, and are suitable as salvage material. An average depth of 36 inches is available for soil borrow in this map unit.

Soil pedons described in the sandy-skeletal/loamy-skeletal, mixed typic cryorthents (mTC) are classified as either sandy-skeletal or loamy-skeletal and are derived from slope colluvium or residuum. These soils have a fine loamy texture, typically have above freezing temperatures, and occur on steep slopes. Soils in this map unit were typically dug to 20 inches or less because of the high percentages of coarse fragments increasing with depth. Geotechnical investigations indicate these soils are very deep with surficial material varying in thickness from a few to over 40 feet (SRK Consulting 2012). Thin A horizons transitioning to C horizons are common in this map unit. No evidence of subsurface soil horizon development as required to identify a B horizon was observed. An average depth of 18 inches is available for soil borrow in this map unit.

### 3.5.3.2.2 UNSUITABLE SOILS

Sandy-skeletal/loamy-skeletal, mixed typic cryorthents (S45+) soil consists of sandy loam soil with a seasonal mean temperature regime and slopes greater than 45 percent, which are unsuitable for salvage. Characteristics of this soil are a thin A horizon underlain with C horizon material with high coarse fragment content increasing with depth and often over 60 percent (Midas Gold 2017a; Tetra Tech 2019). There are bedrock outcrops. Vegetation is sparse. Soils are similar to soil map unit mTC, but steep slopes make this map unit unsuitable for salvage.

The stoney typic cryorthents (sTC) soil unit is composed of high surface coarse fragment content—stones, cobbles, boulders, and bedrock outcrops occurring on slopes between 10 and 35 percent. Suitable soil for salvage in this map unit may be 2 to 6 inches in depth. However, the high percentages of large boulders and scree material impede salvage operations.

Areas of previous disturbance (AoD) occur on previous mining activities and include spent heap leach ore storage areas, deposited tailings, development rock dumps, and open pits. These materials are deemed unsuitable for salvage.

The suitability criteria in **Table 3.5-2** are applied to the mine site map units in **Table 3.5-1**.
### Table 3.5-2 Reclamation Cover Materials Suitability Ratings for Mine Site Soils

<table>
<thead>
<tr>
<th>Soil Map Unit (Depth in inches)</th>
<th>Suitability Rating</th>
<th>Limiting Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>fOD (0-12)</td>
<td>Fair</td>
<td>pH 5 to 6</td>
</tr>
<tr>
<td>fOD (12-30)</td>
<td>Fair</td>
<td>Coarse fragments 15-30%</td>
</tr>
<tr>
<td>fTH (0-12)</td>
<td>Good</td>
<td>None - organic soils</td>
</tr>
<tr>
<td>fTH (12-36)</td>
<td>Good</td>
<td>None - organic soils</td>
</tr>
<tr>
<td>mTC (0-6)</td>
<td>Fair on slopes &lt;25%&lt;br&gt;Poor on slopes 25-45%</td>
<td>Coarse fragments 15-30%; pH 5-6</td>
</tr>
<tr>
<td>mTC (6-18)</td>
<td>Poor</td>
<td>Coarse fragments near 60%</td>
</tr>
<tr>
<td>S45+ (all)</td>
<td>Unsuitable</td>
<td>Slope &gt;45%</td>
</tr>
<tr>
<td>sTC (all)</td>
<td>Unsuitable</td>
<td>Surface stones, boulders, and rock outcrop</td>
</tr>
<tr>
<td>AoD (all)</td>
<td>Unsuitable</td>
<td>Non-soil material related to legacy mining</td>
</tr>
</tbody>
</table>

Table Source: AECOM 2020; Midas Gold 2017a; Tetra Tech 2017, 2019

### 3.5.3.3 Mine Site

Baseline soil and surface characterization is provided below for the six broad areas of potential disturbance from the Soil Resources Baseline Study (Midas Gold 2017a) that generally correspond to the various proposed mine site areas (i.e., Meadow Creek, Fiddle Creek, Hangar Flats, Yellow Pine, West End, and Infrastructure Areas).

#### 3.5.3.3.1 MEADOW CREEK

This area includes the Meadow Creek valley floor, lower side slopes, and the surrounding valley walls.

The Meadow Creek valley floor has deep to very deep, loamy-skeletal, sandy-skeletal, coarse-loamy, and coarse-silty soils developed in alluvium, slope wash, and glacial outwash deposits (map units fOD, mTC). Approximately 54 acres of soils are slightly to strongly acid and have a moderate to high amount of organic matter and generally low levels of essential plant nutrients. Deep alluvial soils cover approximately 32 acres. A seasonal high water table and soil saturation is present in much of this area (Midas Gold 2017a). Organic soils (fTH) occur on poorly drained footslope and toeslope positions near seeps and streams above the active floodplain. The glaciated valley walls have weakly developed, loamy-skeletal and sandy-skeletal soils developed in residuum and colluvium derived from weathered granitic bedrock (map units mTc, S45+). Approximately 12 percent of these soils have a high percentage of surface coarse fragments and rock outcrops (sTC) (Midas Gold 2017a; Tetra Tech 2017).

Areas of legacy mining disturbance in the lower Meadow Creek area include Spent Ore Disposal Area, stream diversions, roads, and vehicle trails. Fifty-six acres, or 10 percent of the area, was mapped as disturbed (AoD) (Tetra Tech 2017). High soil compaction was identified in these areas. Natural disturbance in the Meadow Creek area includes historical wildfires and
past landslides and avalanches. Soil disturbance classes identified in burned areas were generally class 0 (none) or 1 (low), and legacy mining disturbance zones were class 2 (moderate) or 3 (severe) (Midas Gold 2017a). Soil disturbance classes are defined in the Forest Soil Disturbance Monitoring Protocol (Forest Service 2009). Although wildfires are not considered part of the Forest Soil Disturbance Monitoring Protocol, impacts on the soil are recorded.

### 3.5.3.3.2 FIDDLE CREEK

The main Fiddle Creek drainage encompasses the lower part of a glacially scoured (cirque) basin and glacial trough walls. The narrow valley floor has coarse-loamy and coarse-silty soils (fOD) developed in alluvium along the stream channel covering approximately 10 acres. The cirque basin and glaciated valley walls have predominantly sandy-skeletal and loamy-skeletal soils (mTC, S45+) developed in colluvium and residuum from granitic bedrock. Rock outcrop and areas of high surface stoniness occur over approximately 5 percent of the area with slopes less than 45 percent. Approximately 4 acres of organic soils (fTH) occur in seepage zones above Fiddle Creek (Midas Gold 2017a).

Two sample locations were investigated in the upper Fiddle Creek area, both receiving laboratory analysis (Tetra Tech 2017). Mineral soil textures were found to be predominantly sandy loam and very gravelly loamy sand. The soils are slightly to strongly acid, have a high content of organic matter in the surface (greater than 4 percent), and generally have low to very low levels of essential plant nutrients. Soil saturation was identified in only a few areas in the valley bottom.

Mapped legacy mining disturbance is minimal. One acre was mapped as disturbed (AoD). Former drill roads and drill pads are largely reclaimed. Areas of natural disturbance include both historical wildfires and former landslides and avalanches. Disturbance classes identified in burned areas were class 0 (none) or 1 (low) (Midas Gold 2017a).

### 3.5.3.3 HANGAR FLATS

This area contains predominantly steep, glaciated side slopes and a portion of the Meadow Creek valley floor.

Ninety-six samples were collected in Hangar Flats area, with seven samples receiving laboratory analysis (Midas Gold 2017a; Tetra Tech 2017). The soils are slightly to strongly acidic, have a moderate to high amount of organic matter in the surface, and generally have low to very low levels of essential plant nutrients. The steep glacial trough walls have weakly developed, sandy-skeletal and loamy-skeletal soils (mTC, S45+) developed in residuum and colluvium from granitic bedrock. The valley floor contains large areas of previous disturbance (AoD) from drilling and mining activities. Native soils are deep to very deep, coarse-loamy, coarse-silty, and loamy-skeletal soils developed in alluvium, glacial outwash, and slope wash. Deep alluvial soils (fOD) cover approximately 13 acres. There is a high percentage of histosols (fTH) in seepage zones totaling approximately 23 acres. A seasonal high water table is present over much of the valley floor and toe-slopes (Midas Gold 2017a).
Areas of legacy mining disturbance include a Spent Ore Disposal Area, Bradley tailings, smelter, mill site, historical creek diversions, private access roads on the hillside, and partially reclaimed zones on the valley floor from past drilling and mining and associated activities. Eighty-two acres, or 35 percent of the area, was mapped as disturbed (AoD) (Tetra Tech 2017). High soil compaction was identified in these areas by the Soil Resources Baseline Study. Natural disturbance in the Hangar Flats area includes historical wildfires and past landslides and avalanches. Soil disturbance classes identified in burned areas were generally class 0 (none) or 1 (low), whereas legacy mining disturbance zones were class 2 (moderate) or 3 (severe) (Midas Gold 2017a).

### 3.5.3.3.4 YELLOW PINE

Yellow Pine area contains predominantly steep, dissected mountain slopes on the east side, glaciated valley wall on the west side, and the EFSFSR valley floor in between.

Soil conditions were investigated at 73 locations in this area, with five samples receiving laboratory analysis (Midas Gold, 2017a; Tetra Tech 2017). The soils are slightly to moderately acidic, have a moderate amount of organic matter, and generally have low to very low levels of essential plant nutrients. The steep east- and west-facing slopes have weakly developed, loamy-skeletal and sandy-skeletal soils (mTC, S45+) developed in residuum and colluvium from granitic bedrock. The valley floor is mostly disturbed (AoD) by previous mining activities. Undisturbed soils are deep to very deep, loamy-skeletal, sandy-skeletal, and coarse-loamy soils (fOD, mTC) developed in alluvium and slope wash. Deep alluvial soils cover approximately 10 acres. Histosols (fTH) cover approximately 8 acres. A seasonal high water table is present adjacent to stream courses.

Past mining activity in this area is extensive and includes the historic Yellow Pine pit/lake and associated mine benches, waste rock dump, old drill and mine access roads, building sites, and underground portals. Recontouring has occurred in the reclaimed Homestake area (i.e., the northeast portions of the Yellow Pine area). These areas were identified using Light Detection and Ranging and aerial photographs, with little to no soil cover present. Forty acres, or 20 percent of the area, was mapped as disturbed (AoD) (Tetra Tech 2017). Thirty-six percent of the Yellow Pine area has slopes greater than 45 percent (S45+), a large portion of which also are disturbed. Evidence of wildfire was only present in the southwest portion of this area. Disturbance classes identified in burned areas were generally low (Midas Gold 2017a).

### 3.5.3.3.5 WEST END

This area is characterized by steep, dissected mountain slopes. Midnight Creek and West End Creek flow through the area and have created sharply incised channels. Much of this area has been disturbed by previous mining operations (AoD).

Undisturbed soils are predominantly sandy-skeletal and loamy-skeletal (S45+) developed in colluvium and residuum from metasedimentary rocks (predominantly quartzite). Deep alluvial soils (fOD) cover approximately 10 acres. Sixty sample locations were recorded in this area, with five samples receiving laboratory analysis (Midas Gold 2017a; Tetra Tech 2017). Surface
soil textures in undisturbed areas were predominantly very gravelly loamy sand, loamy sand, sandy loam, and loam. The soils are slightly to strongly acidic, have a moderate to high amount of organic matter, and generally have low to very low levels of essential plant nutrients.

Past mining activity in this area is extensive and includes multiple mining pits, haul roads, access roads, waste rock dumps, and areas of deep backfill. Surface materials are bare rock or backfill. These areas were identified using Light Detection and Ranging and aerial photography, with little to no natural soil cover present. Twenty-three acres, or 8 percent of the area, was mapped as disturbed (AoD) (Tetra Tech 2017). Eighty-four percent of the West End area has slopes greater than 45 percent (S45+), a large proportion of which also are disturbed. There was no evidence of wildfire in this area.

3.5.3.3.6 INFRASTRUCTURE AREAS

These areas are where most proposed mine site support infrastructure and facilities would be located, including the plant processing area, crusher, ore stockpile, truck shop, water treatment plant, underground and explosives area, worker housing facility, growth media stockpiles, and haul roads. These areas are predominantly within the EFSFSR valley floor and adjacent fan terraces and lower side slopes. Most of these areas have been previously disturbed (AoD) by mining activities.

One hundred and fourteen (114) sample locations were established in undisturbed soil areas, with 6 samples receiving laboratory analysis (Midas Gold 2017a). Surface soil textures were predominantly loamy-skeletal, sandy-skeletal, and coarse-loamy soils (mTC, fOD) developed in alluvium, glacial outwash, slope wash, and colluvium. Deep alluvial soils cover approximately 6 acres, primarily along haul road routes. Organic soils (fTH) cover approximately 5 acres and were observed in poorly drained areas near seeps and streams with saturation identified in a few (Midas Gold 2017a). The soils are slightly to strongly acidic, have a low to moderate amount of organic matter, and generally have low to very low levels of essential plant nutrients (Midas Gold 2017a).

Areas of existing disturbance include historic town sites, reclaimed haul roads, and mine access and infrastructure areas that show high soil compaction, as well as current roads, parking lots, laydown areas, and camp buildings. Thirty-two acres, or 12 percent of the areas, were mapped as disturbed (AoD) (Tetra Tech 2017). Areas of natural disturbance also exist, caused by both historical wildfires and former landslides and avalanches. Disturbance classes identified in burned areas were generally class 1 (low) to class 0 (none), whereas areas disturbed by past mining were class 3 (severe) or class 2 (moderate) (Midas Gold 2017a).

3.5.3.4 Access Roads

Geology and geomorphic features of the proposed Burntlog Route were investigated, and the bedrock geology and geomorphology were found to be very similar to those described for the mine site. Granitic bedrock underlies most of the route, with a few inclusions of volcanic and metasedimentary rock (Midas Gold 2017b). The area has been glaciated, creating narrow u-shaped valleys with steep sides and flat valley bottoms.
The route is characterized by weakly developed, loamy-skeletal and sandy-skeletal soils (mTC, S45+) developed in residuum and colluvium from granitic bedrock. Deep alluvial soils (fOD) and histosols (fTH) make up approximately 8 percent of the route, occurring in drainageways and slope seepage zones. It is assumed that 40 percent of the mTC soil map unit would be practically salvageable using heavy equipment (Tetra Tech 2019).

### 3.5.3.5 Utilities

No soils field investigations occurred for the existing or proposed transmission line ROW. The corridor crosses through 35 different land types on NFS lands. Mapping is available in the Soil Hydrologic Reconnaissance Reports (Forest Service 1969, 1972, 1974).

### 3.5.3.6 Off-site Facilities

Locations of off-site facilities include either the Landmark or Burntlog Maintenance Facility (depending on which alternative is selected) and the Stibnite Gold Logistics Facility. The Landmark Maintenance Facility would be constructed on a previously disturbed borrow site. The soils are mapped as mTC (Table 3.5-1) (Tetra Tech 2017). The Burntlog Maintenance Facility would be located in one of the access roads borrow source locations (4.4 miles east of the junction of Johnson Creek Road and Warm Lake Road along the proposed Burntlog Route), The Stibnite Gold Logistics Facility would be constructed on an alluvial fan terrace above Big Creek. Soils are mapped as Donnel sandy loam, 2 to 4 percent slopes (U.S. Department of Agriculture, Natural Resources Conservation Service 2017). These are well drained soils formed in alluvium weathered from granite. They have sandy loam textures in the solum, over stratified loamy sand and sandy loam starting below 20 inches. A seasonal high-water table is greater than 80 inches below the ground surface. Minor inclusions in the map unit include poorly drained soils in the floodplain. The Stibnite Gold Logistics Facility would be located on private land.

### 3.5.3.7 Existing Total Soil Resource Commitment

As defined in Section 3.5.1, Introduction and Scope of Analysis, TSRC is the conversion of a productive site to an essentially non-productive site for a period of more than 50 years. Mining excavations and dumps, roads, dedicated trails, parking lots, and other dedicated facilities (e.g., landfills, borrow sites, surface water management features, etc.) are examples of TSRC. As shown previously in Figure 3.5-1, the activity area for TSRC has been defined as NFS lands within the subwatersheds within which the SGP takes place.

Existing TSRC within the 16 subwatersheds encompassing where disturbance associated with the SGP would occur (Table 3.5-3) was mapped with the use of a geographic information system (ArcGIS) with relevant digital spatial layers including Lidar-generated terrain maps, aerial photographs, road and trail layers, and previous mapping of disturbed areas. Additional mapping details and methodology of existing TSRC is provided in Appendix G-1 (TSRC Methodology) and figures depicting existing TSRC are provided in Appendix G-2 (TSRC Analysis Figures) and in Chapter 4, Environmental Consequences, Section 4.5, Soils and Reclamation Cover Materials.
3.5.3.8 Existing Detrimental Soil Disturbance

As defined in Section 3.5.1, Introduction and Scope of Analysis, DD is the alteration of natural soil characteristics that results in immediate or prolonged loss of soil productivity and soil-hydrologic conditions. Areas considered for TSRC are excluded from this requirement, but DD applies to vegetation clearing for new and upgraded utility corridors in areas that are available for multiple uses on Forest Service lands. The activity area for DD has been defined as the new and upgraded transmission line corridor where it occurs on NFS lands. Existing DD within the transmission line ROW is estimated at 8 percent. This is a very rough estimate based on average extent of DD from ground-based forest harvesting operations in the Forest Service Northern Region (Reeves et al. 2012).
3.5.3.9 Soil Contamination/Chemistry

The proposed mine site occurs in an area containing numerous highly mineralized zones, and natural background concentrations of some metals are known to be relatively high in some soils and regolith (i.e., the unconsolidated material below the soil profile and on top of bedrock). In addition, elevated levels of arsenic, antimony, and mercury have been observed in soils contaminated by legacy mining operations (URS Corporation 2000). Some known locations of contamination were previously remediated, but it is possible that additional areas of contamination would be exposed and observed during SGP-related construction, operations, and closure and reclamation. Midas Gold evaluated 4,828 exploration soil samples collected from undisturbed areas adjacent to the mine site. The mean concentrations of antimony (11.63 parts per million [ppm]) and mercury (0.94 ppm) from the samples are high but are still within the highest screening-level phytotoxicity criteria concentrations from various literature references and federal agencies in U.S. and Canada cited in the Reclamation and Closure Plan (Tetra Tech 2019). The mean concentration of arsenic (94.40 ppm) from the samples is five times higher than the U.S. Environmental Protection Agency’s ecological soil screening level for arsenic and nearly twice as high as the highest screening-level phytotoxicity criteria concentration from other various sources (Tetra Tech 2019). A principal concern regarding the re-use of soil and rock at the mine site is the high metals concentrations that may remain and complicate revegetation plans for reclaimed areas. Total arsenic was identified as having the greatest potential for phytotoxicity in plants growing on reclaimed (and historical) mine lands at the mine site.

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1 It should be noted the samples were not analyzed using EPA-approved methodologies for environmental analysis. Samples were analyzed using exploration lab methodologies that have more aggressive extraction methods (resulting in potentially higher concentration outputs), which are not typically compared to these environmental screening levels.