Finally, copper is not only used as an industrial commodity. Currently, refined copper ingots are widely used in China as collateral for business loans. There is significant concern that the stock of copper used as collateral is oversubscribed.[18] These collateral and other speculative holdings of copper make understanding demand and supply somewhat more complex than for other commodities.

The Long–Term Liability of Copper Mining

▲ Holden Mine Site: View of Mill Building
Image credit: USFS

Clearly, copper mining is important to human development, yet it does not come without costs. Terrestrial copper mining involves significant and often permanent ecological impact. Invariably, the local biodiversity, surface water and groundwater are impacted. Land covers from forests to wetlands and from deserts to coral reefs are often severely and perhaps irreversibly degraded. Mines move earth on a large scale. Tailings from underground or surface mines are typically measured in the hundreds of millions of metric tons. Terrestrial mining also involves impacts to indigenous peoples, communities, farms, towns, cities and coastal areas.

Active mining operations are not the only threat to local environments and communities. Closed or completed mines can also pose environmental risks and impacts in the form of ongoing rehabilitation requirements. The Holden Mine in Washington State, USA, is one such example. Now owned by Rio Tinto, the mine closed in 1957. In 2012, U.S. Federal Agencies ruled that, even in spite of its lack of on-site production activities, Rio Tinto was responsible for remediation of the mine site. The corporation subsequently embarked on a $200 million remediation project that is slated for completion in 2015.[19] Holden was an underground mine; however, over 100 million metric tons of tailings and acid leach heaps are currently eroding and leaching arsenic and other heavy metals into Lake Chelan and the Columbia River. However, even with a $200 million remediation expense, the wall to hold back erosion and the wastewater treatment system that will remove arsenic and other contaminants are not necessarily a permanent solution. In future decades, the more than 100 million metric tons of waste will likely continue to erode. Fifty-year flood events could wash enormous amounts of waste beyond the retention wall. There is often no permanent or cost-effective solution to the problem of hundreds of millions of metric tons of hazardous mining waste located in an upper watershed.[20]

Terrestrial copper mining involves significant and often permanent ecological impact.

Liability from historic terrestrial mining goes largely unmeasured worldwide, but estimates are substantial by any industry expert's

▲ Bio Bio river dam
Image credit: Roberto Araya Barckhahn

speculation. Aside from liability, other requirements of mining also come with high costs. In recent history, falling in-situ copper ore grades have required increased earth moving and processing that in turn require greater energy inputs for every metric ton of copper produced. Moving hundreds of millions of tons of rock demands energy. In Chile, for example, over 20%, or approximately 3,400 megawatts (MW), of national electrical production is consumed by the copper industry alone. Power and water constraints now limit the expansion of copper mines in Chile. Planned mines such as Intag in Ecuador require the construction of new hydroelectric dams to provide sufficient power for the mine operations.

The social and environmental impacts of open-pit copper mines can be tremendous. Terrestrial mines often have large geographic footprints that expand even after the mine closes as gravity carries mine tailings away from the mine site and eventually to the sea. The Ok Tedi Mine in PNG, for example, has deposited mine material and impacted 620 miles (1000 km) of the Fly River (the longest River in PNG). Hundreds of millions of metric tons of waste rock and mine waste material dumped into the Fly River have increased sediment load to the river by 5-10 times the natural background rate, and increased copper levels in the river system have reached 15 times the natural background rate.[21]

Mining disasters too, are not uncommon. The Marcopper mine in Marinduque, the Philippines, is a prime example of the catastrophic effects that mining disasters can create. In 1996, a retention dam at the mine failed, causing 84 million metric tons of mine tailings, of which 4 million metric tons were rich in sulphuric acid from copper leaching, to be released into the Makulapnit-Boac river system. The spill inundated over two-dozen communities and impacted 12 fishing villages by smothering a stretch of the river, the area's nearby towns, and the coral reef at the river's outlet with mine tailings.[22]

Additional examples of the impacts of copper mines are provided in Appendix E.

The history of terrestrial copper mining, and its large-scale impacts warrants a consideration of alternative options for future copper mining.

One alternative is the careful and responsible mining of copper resources on the seabed.

The history of terrestrial copper mining, including its large-scale impacts, challenges to rehabilitation, and history of significant incidents, warrants a consideration of alternative options for future copper mining. One such alternative is the careful and responsible mining of copper resources on the seabed. Seabed mining, however, should also be assessed for environmental and social impacts. One way to determine whether this alternative should be considered viable in the future is to complete a natural capital assessment of a potential seabed mine and to compare it with the natural capital assessment of a number of existing or proposed terrestrial mines. This report provides that analysis, recognizing that better natural capital accounting in the