

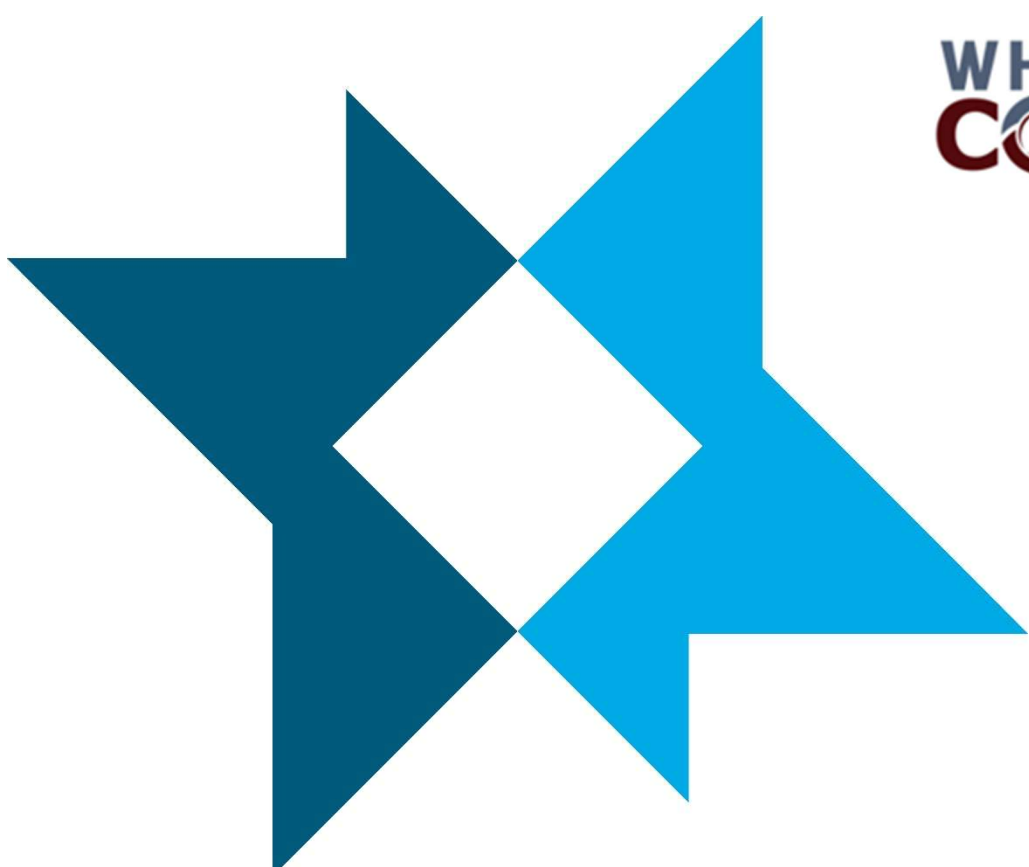


Permit Application

Environmental Impact Assessment

White Pine North Project Volume IIP

Appendices I through J



White Pine Copper LLC

White Pine, Michigan

September 2026

Project I.D.: 23W200

Solving our clients' toughest
science and engineering challenge.

Appendix I

Air Deposition Analysis on Water Quality and Soils

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September 14, 2026

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RE: White Pine North Project – Air Deposition and Water Quality and Soil Impact Analysis for the Mining Permit Application and Environmental Impact Assessment

Purpose

The purpose of this memorandum is to present the air deposition evaluations for water quality and soil provided for the White Pine North (WPN) Project (Project). This addresses R 425.202 (1)(b), which requires an analysis of potential cumulative impacts on each of the conditions or features listed in subrule (2). The deposition potential on water bodies and soil specific to the Project addresses the cross-media migration of emissions from the facility. Other potential cumulative impacts are addressed in the Environmental Impact Assessment (EIA) through engineering controls and monitoring requirements that prevent or contain impacts, in general and in particular media, as described.

The evaluation relies on air deposition modeling that considers facility air emissions. A Michigan Air Use Permit – Permit to Install Modification (Foth, 2026c) is being submitted to Michigan Department of Environment, Great Lakes, and Energy (EGLE). This deposition analysis is consistent with both documents.

Parameter Selection

Copper, silver, sulfur/sulfate, and mercury were selected for the deposition impact analysis.

Copper and silver were evaluated because they are target metals for recovery from the ore and are anticipated to be present at appreciable levels in the modeled facility emissions.

Sulfur is not expected to be present in the emissions in significant amounts. However, sulfur was retained because of its potential contribution to environmental acidification, and modeled sulfur deposition was converted stoichiometrically to sulfate to provide an environmentally relevant basis for evaluating deposition effects.

Geochemical characterization of the ore yielded mercury concentrations below EGLE's most stringent mercury water quality value (WQV) of 1.3 nanograms per liter (ng/L), indicating that ore and associated tailings are not significant sources of mercury at the site (SRK, 2026). In contrast, the estimated mercury concentration in precipitation is 14.9 ng/L, exceeding the WQV of 1.3 ng/L (SRK, 2026). Based on the geochemical characterization and estimated precipitation water quality, mercury detected at the site is expected to be attributable to captured precipitation rather than to mineralized rock or tailings. However, mercury was selected for the deposition impact analysis because it is a Lake Superior Basin Bioaccumulative Substance of Immediate Concern.

Deposition Modeling

Deposition modeling was conducted in the following manner:

Modeling air deposition rates for selected constituents is based on facility emissions estimates. Hourly emission rates for each metal and sulfur were first estimated from air emission calculations that were completed for the air permit application (Foth, 2026c). Constituent emissions were estimated from total particulate matter emissions in conjunction with the weight percent of each constituent in materials being emitted. Each constituent is bound to each process material as part of its lithology, and the constituent's weight percent was used in each calculation. To be conservative, the estimates were based on total particulate emissions rather than on size-fractionated emissions, such as particulate matter less than 10 microns (PM₁₀). Additionally, the facility's Maximum Controlled Emissions (MCE) serve as the basis. This represents an upper bound of permitted emissions. Routinely, the facility will operate below the MCE, with only occasional durations at the MCE. Emission sources included a mix of both point sources (stacks) and fugitive air emissions. Fugitive air emissions included sources such as material transfer and handling activities, and wind erosion from material storage areas. Given that metal concentrations in surficial soils associated with on-site haul roads were minimal and most haul roads are paved, they were not included in the analysis.

To obtain an accurate assessment of the metals and sulfur in ore and other materials on site, a detailed statistical review was performed on samples obtained at the proposed mine site. Documented in Foth (2026a), these materials include ore, concentrate, native soil, and tailings. Hourly emission rates and other input parameters for each constituent used in the air deposition model are provided in Attachment 1.

Constituent-specific emission rates were entered into AERMOD, United States Environmental Protection Agency's (USEPA) preferred near-field regulatory dispersion model, which can simulate both ambient air concentrations and deposition loading rates across the surrounding area. AERMOD is also the preferred model for conducting air quality analyses by state regulatory agencies, including EGLE. During preparation of the air permit application, dispersion modeling was conducted to predict airborne contaminant concentrations at receptors established on a receptor grid across the site. The purpose of the air dispersion modeling was to assess compliance with applicable ambient air quality standards.

AERMOD can also be used to estimate regional deposition of air contaminants. To evaluate deposition impacts, the model setup requires additional inputs, including particle density, particle size, and corresponding mass fractions for each emission source and process material. Particle density and size data used in the deposition modeling are provided in Attachment 1. As

a conservative approach, both wet and dry deposition were modeled for all parameters evaluated.

Execution of modeling runs used EGLE-sanctioned meteorological data from the weather station at the Houghton County Memorial Airport near Houghton, Michigan. EGLE provides processed datasets for several National Weather Service stations in the state, which are available on the EGLE website for use in AERMOD. These meteorological datasets included information on wind speed and wind direction, as well as rainfall data, the latter of which is a required element in deposition modeling.

While the air dispersion model used a 50-meter receptor grid extending approximately 1,000 meters from the site in all cardinal directions, the deposition model used a 200-meter receptor grid that extended approximately 14,000 meters west, 9,000 meters north, 12,000 meters east, and 12,500 meters south of the ore processing area. The larger deposition modeling domain was selected to cover the watersheds evaluated in the analysis. Figure 1 shows receptors covering each water body and watershed area.

The most recent year of meteorological data (2024) was used in this analysis. Using AERMOD over the 1-year period, annual deposition rates of the constituents of interest were predicted across all receptor points in the modeling domain. All deposition results are inclusive of wet and dry deposition rates. Deposition rates were expressed in grams per square meter per year ($\text{g}/\text{m}^2/\text{year}$). Figure 2 depicts the copper deposition modeling results over the receptor grid. Modeled deposition rates generally diminish with distance from WPN.

Deposition Post-Processing and Watershed Load Calculation

Air deposition modeling results generated using AERMOD were post-processed in Python to quantify annual deposition to selected HUC12 subwatersheds surrounding WPN. AERMOD was run using a uniform Cartesian receptor grid with 200-meter (m) spacing. Model output was provided separately for copper, silver, sulfur, and mercury. Because receptor locations were common among the individual model runs, analyte-specific results were combined by receptor coordinate to create a single master deposition grid.

Sulfur deposition was converted to an equivalent sulfate deposition rate using the stoichiometric relationship between sulfur and sulfate. The molecular weight of elemental sulfur is approximately 32 grams per mole (g/mol), whereas the molecular weight of sulfate ($\text{SO}_4^{(2-)}$) is approximately 96 g/mol . Accordingly, the equivalent sulfate mass is approximately three times the sulfur mass.

Each AERMOD receptor was treated as representing a 200 m $\times$ 200 m grid cell, corresponding to 40,000 square meters (m^2). Square polygons centered on the receptor coordinates were generated to represent the spatial area associated with each modeled deposition value. HUC12 subwatershed boundaries were projected into the same coordinate system as the AERMOD receptor grid.

Two HUC12 subwatersheds were selected for detailed evaluation because they encompass the principal surface-water drainage areas surrounding WPN: Anderson Creek-Big Iron River (HUC12 040201010403) to the west and Duck Creek-Frontal Lake Superior (HUC12 040201010109) to the east. The AERMOD receptor domain provides complete spatial coverage of both selected HUC12s (Figure 1).

Rather than assigning an entire receptor cell to a watershed based solely on its center point, each 200 m × 200 m cell was intersected with the HUC12 boundaries. Cells entirely within a watershed contributed their full 40,000 m² area, whereas cells crossing a watershed boundary contributed only the actual portion of the cell within that watershed.

For each analyte, the annual deposited mass was calculated as:

$$\text{Annual Cell Load} \left(\frac{\text{mg}}{\text{yr}} \right) = \text{Deposition Rate} \left(\frac{\text{mg}}{\text{m}^2 \text{ yr}} \right) \times \text{CellArea within HUC12 (m}^2\text{)}$$

Cell loads were summed to obtain the total modeled annual deposition load to each HUC12. Area-weighted average deposition rates were calculated by dividing the total annual load by the modeled watershed area. This method accounts explicitly for partial cells along watershed boundaries and avoids bias that could result from a simple arithmetic average of receptor values.

Table 1 summarizes the modeled annual deposition to the two HUC12 subwatersheds. The area-weighted deposition values provide a measure of the average deposition intensity within each watershed, whereas annual loads represent the total modeled mass deposited across the entire HUC12.

For the surface-water evaluation, the HUC12 deposition results were further refined to the contributing drainage area for each receiving water evaluated. This step preserves the spatial distribution of modeled AERMOD deposition while limiting the annual mass assigned to each receiving water to deposition occurring within the land area that actually drains to that water body. The drainage-area refinement is described below.

Potential Impacts on Water Quality

Potential surface-water effects were evaluated by converting modeled annual deposition within the contributing drainage area of each evaluated receiving water to theoretical incremental receiving-water concentrations. The calculation conservatively assumes that 100% of the modeled mass deposited within the contributing drainage area is ultimately available to the receiving water and does not account for retention, sorption, burial, biological uptake, chemical transformation, or other attenuation processes within the watershed.

Contributing drainage areas were delineated using the U.S. Geological Survey (USGS) NHDPlus High Resolution (NHDPlus HR) hydrographic network and associated catchments. For each receiving water, the upstream drainage network was traced to the selected evaluation point, and the associated NHDPlus catchments were combined to define the contributing drainage area. The resulting drainage polygons were intersected with the same 200-m × 200-m AERMOD receptor grid used for the HUC12 deposition analysis. For cells intersecting a drainage-area boundary, modeled deposition was multiplied by the actual area of overlap. Cell-specific loads were then summed to calculate the modeled annual deposition load for each contributing drainage area.

This procedure was applied consistently to both receiving waters evaluated. Argentine Creek at ARC-03 has a contributing drainage area of approximately 7.884 square kilometers (km²), representing 9.03% of the 87.303 km² Duck Creek-Frontal Lake Superior HUC12. The Big Iron River contributing drainage area within the Anderson Creek-Big Iron River HUC12 is

approximately 74.856 km², representing 99.91% of the 74.920-km² HUC12. Thus, the drainage-area refinement materially affects the mass assigned to Argentine Creek but has a negligible effect on the mass assigned to the Big Iron River.

For a specified streamflow, the theoretical concentration increment was calculated by dividing the annual deposited mass within the contributing drainage area by the corresponding annual water volume. The resulting incremental concentrations were compared with applicable Michigan Rule 57 water quality values (EGLE, 2026a, b). Copper was evaluated using the hardness-dependent final chronic value (FCV), silver against its FCV of 0.06 microgram per liter (µg/L), and mercury against the more restrictive Wildlife Value of 0.0013 µg/L because of its bioaccumulative significance.

Argentine Creek

Continuous streamflow data are not available for Argentine Creek. Nine manual flow measurements were collected at monitoring location ARC-03 between August 2024 and April 2026 under varying seasonal conditions. Three measurements indicated dry or negligible flow. The remaining six measurements ranged from approximately 0.54 to 14.18 cubic feet per second (cfs), with a mean of approximately 4.39 cfs. For screening purposes, two flow conditions were evaluated: 4.39 cfs, representing the mean of the non-negligible measured flows; and 0.541 cfs, representing the minimum non-negligible measured flow. Dry or effectively stagnant observations were not used as denominators because dividing an annual deposited mass by an instantaneous flow of essentially zero would not yield a physically meaningful annualized concentration estimate.

The contributing drainage area to Argentine Creek at ARC-03 was delineated using NHDPlus HR. ARC-03 was associated with the nearest Argentine Creek NHDPlus flowline, located approximately 12.4 m from the monitoring location. The NHDPlus total drainage-area attribute for the selected reach indicates a contributing drainage area of approximately 7.884 km². As an independent spatial quality-control check, upstream NHDPlus reaches and their associated catchments were traced and combined; the resulting drainage polygon had an area of 7.884 km², differing by approximately 0.01% from the NHDPlus-reported drainage area.

The Argentine Creek drainage area represents approximately 9.03% of the 87.303-km² Duck Creek-Frontal Lake Superior HUC12. Intersecting this drainage polygon with the AERMOD receptor grid and explicitly accounting for partial receptor cells yielded a modeled copper deposition load of approximately 4.190 kilograms per year (kg/yr) within the contributing drainage area, compared with 44.656 kg/yr deposited across the entire HUC12. The stream-specific copper load, therefore, represents approximately 9.38% of the HUC12 load. The close correspondence between the drainage-area fraction and deposition-load fraction provides an additional reasonableness check on the spatial calculation.

Because Michigan's Rule 57 copper FCV is hardness-dependent, hardness measurements collected at ARC-03 were used to bracket the evaluation. Nine measurements ranged from 32 to 88 mg/L as CaCO₃, with a median of 50 mg/L, corresponding to copper FCVs of approximately 3.38, 4.95, and 8.03 µg/L at hardness values of 32, 50, and 88 mg/L as CaCO₃, respectively.

The drainage-adjusted atmospheric deposition loads for Argentine Creek are summarized in Table 2. The contributing drainage area to ARC-03 receives approximately 4.190 kg/yr of copper

and 2.346 kg/yr of sulfate-equivalent deposition. Modeled silver and mercury deposition within the contributing drainage area are negligible at the precision of the AERMOD output.

Assuming complete delivery of deposited mass to Argentine Creek, the theoretical copper increment is approximately 1.07 µg/L under the representative flow condition of 4.39 cfs. This value is below the full hardness-dependent Rule 57 copper FCV range of approximately 3.38 to 8.03 µg/L. Under the conservative flow condition of 0.541 cfs, the theoretical copper increment is approximately 8.67 µg/L, slightly above the upper end of the calculated FCV range. The conservative-flow result therefore remains above the FCV under the evaluated hardness conditions; however, it combines the lowest observed non-negligible streamflow with the conservative assumption that 100% of copper deposited throughout the contributing drainage area is delivered to the stream without retention or attenuation in soils, vegetation, wetlands, sediments, groundwater, or other watershed features.

The theoretical sulfate increment is approximately 0.000599 mg/L under the representative-flow condition and 0.00486 mg/L under the conservative-flow condition. No Rule 57 FCV is established for sulfate. Modeled silver and mercury increments are negligible relative to their respective Rule 57 comparison values.

Big Iron River

Contemporary baseline flow and water-quality measurements are not available for the Big Iron River. Historical discharge data are available from USGS station 04032500 at Iron River near White Pine, Michigan, with a drainage area of 98.1 square miles. Daily discharge records are available from May 1952 through September 1957, and the published 5-year average discharge is 144 cfs (USGS, n.d.). Because the historical record is relatively short and the reported minimum discharge of 2.7 cfs represents an extreme short-duration condition, the mean flow of 144 cfs was used as the representative condition. A flow of 14.4 cfs, equal to 10% of the historical mean, was evaluated as a conservative sensitivity case. The 14.4-cfs value is not intended to represent a statistically derived low-flow metric.

Consistent with the Argentine Creek analysis, the contributing drainage area to the Big Iron River was delineated using the NHDPlus HR hydrographic network and associated catchments. The downstream-most Big Iron River reach within the Anderson Creek-Big Iron River HUC12 was identified using NHDPlus network topology, and all upstream reaches and associated catchments contributing to that reach were delineated. The resulting drainage area was intersected with the HUC12 boundary and the AERMOD receptor grid.

The Anderson Creek-Big Iron River HUC12 encompasses approximately 74.920 km², of which approximately 74.856 km², or 99.91%, drains to the Big Iron River. Thus, essentially the entire HUC12 contributes drainage to the receiving water under evaluation. Therefore, the application of the stream-specific drainage-area method produces deposition loads essentially equivalent to the whole-HUC12 loads reported in Table 1 while maintaining methodological consistency with the Argentine Creek evaluation.

Because contemporary Big Iron River hardness data are unavailable, the broader WPN stream baseline dataset was used to evaluate the hardness-dependent copper FCV. Baseline stream hardness ranged from approximately 15 to 360 milligrams per liter (mg/L) as calcium carbonate (CaCO₃). Even at the lowest observed baseline hardness of 15 mg/L, the calculated copper FCV is approximately 1.77 µg/L. The theoretical copper deposition increment remains below the

applicable FCV under both the representative and conservative-flow cases (Table 3). Accordingly, the Big Iron River screening conclusion is insensitive to the hardness selected within the observed regional range.

The drainage-adjusted atmospheric deposition loads for the Big Iron River are summarized in Table 3. Because approximately 99.91% of the Anderson Creek-Big Iron River HUC12 drains to the Big Iron River, the drainage-adjusted loads are nearly identical to the whole-HUC12 loads reported in Table 1. The contributing drainage area receives approximately 10.909 kg/yr of copper, 0.324 grams per year of silver, and 6.045 kg/yr of sulfate-equivalent deposition. Modeled mercury deposition is negligible at the precision of the AERMOD output.

Assuming complete delivery of deposited mass to the Big Iron River, the theoretical copper increment is approximately 0.0848 µg/L at the representative historical mean flow of 144 cfs and 0.848 µg/L under the conservative 14.4-cfs sensitivity condition. Both values remain below the copper FCV of approximately 1.77 µg/L calculated at the lowest observed WPN baseline stream hardness of 15 mg/L as CaCO₃. The screening conclusion is therefore insensitive to the particular hardness selected within the observed regional range.

Silver increments are approximately 0.000003 and 0.000025 µg/L under the representative and conservative-flow conditions, respectively, substantially below the Rule 57 FCV of 0.06 µg/L. Sulfate increments are approximately 0.000047 and 0.000470 mg/L, respectively. Modeled mercury increments are negligible relative to the Rule 57 Wildlife Value of 0.0013 µg/L.

Potential Impacts to Soils

Potential effects of atmospheric deposition on soils were evaluated using modeled annual deposition rates at 13 candidate soil monitoring locations established along the WPN perimeter and near principal emission sources. Candidate soil monitoring locations were established independently of the AERMOD receptor grid. For each monitoring location, the corresponding 200 m × 200 m AERMOD receptor cell was identified, and the modeled deposition value at that receptor was assigned to the monitoring location. No spatial interpolation of modeled deposition values was performed.

A soil mixing depth of 2 centimeters (cm) and an assumed soil bulk density of 1.33 grams per cubic centimeter were used. These assumptions correspond to a soil mass of 26.6 kilograms per square meter.

Potential changes in soil concentration were evaluated after 1 and 7 years of continuous modeled deposition. The calculation conservatively assumes that the entire modeled annual deposition mass remains within the upper 2 cm of soil and is uniformly mixed throughout. No reductions were applied for erosion, runoff, leaching, plant uptake, or other mechanisms that could remove deposited material from the surface-soil layer.

Baseline soil concentrations were obtained from the March 2026 WPN Soil Sampling Report (Foth, 2026b). The soil investigation was specifically conducted to establish baseline metal concentrations in areas of existing and future mining activities prior to surface disturbance. Median baseline concentrations were 120 milligrams per kilogram (mg/kg) for copper, 0.8 mg/kg for silver, and 0.018 mg/kg for mercury. Sulfate was not included in the WPN baseline metals sampling program; therefore, sulfate was evaluated as the incremental

concentration attributable to modeled deposition rather than as a predicted total soil concentration.

Comparison values were selected using an approach consistent with that applied to existing soil data in the WPN Soil Sampling Report (Foth, 2026b). Where an applicable screening level is lower than an established statewide or site-specific background concentration, the applicable background concentration was used as the comparison value. Accordingly, comparison values of 151 mg/kg for copper, 1.0 mg/kg for silver, and 0.13 mg/kg for mercury were used. A sulfate comparison value of 5,000 mg/kg was retained from the residential drinking-water protection criterion.

Table 4 summarizes the maximum calculated soil concentrations across the 13 candidate soil monitoring locations. The maximum modeled deposition rate for each evaluated analyte occurred at SL-13, the targeted monitoring location near Mine Return Air Raise No. 3. After 7 years of continuous modeled deposition, the calculated copper concentration increases from the baseline median of 120 mg/kg to approximately 124.4 mg/kg, remaining below the 151 mg/kg comparison value. Silver increases from 0.8 to approximately 0.811 mg/kg, remaining below the statewide background comparison value of 1.0 mg/kg. Mercury increases from 0.018 to approximately 0.0206 mg/kg, remaining well below the statewide background comparison value of 0.13 mg/kg.

For sulfate, the maximum calculated increase attributable to 7 years of continuous modeled deposition is approximately 2.48 mg/kg. Because sulfate was not analyzed as part of the WPN baseline soil sampling program, a post-deposition total soil concentration was not calculated. The modeled 7-year incremental concentration represents approximately 0.05% of the 5,000 mg/kg comparison value.

These calculations represent conservative screening estimates because they assume continuous deposition at the modeled annual rate throughout the evaluation period and complete retention of the deposited mass within the upper 2 cm of soil. Based on this evaluation, modeled atmospheric deposition is not expected to result in appreciable changes to existing soil concentrations or cause the evaluated soil concentrations to exceed the selected comparison values.

Sulfate Deposition Rate Comparison

Sulfur was retained for evaluation because atmospheric deposition of sulfur may contribute to acid-generating conditions. Modeled sulfur deposition was conservatively converted to an equivalent sulfate deposition rate, assuming complete conversion of sulfur to sulfate. Based on the respective molecular weights of sulfur and sulfate, the theoretical sulfate mass is approximately three times the modeled sulfur mass.

Michigan does not maintain a sulfate deposition standard applicable to this evaluation. Therefore, the theoretical sulfate deposition rate was compared to the former Minnesota Rule 7021.0030 Acid Deposition Standard of 11 kilograms of wet sulfate deposition per hectare per year (kg/ha/yr). Although this Minnesota standard was repealed in 2013 and is not an applicable Michigan regulatory criterion, it provides an environmentally protective screening benchmark for evaluating the magnitude of modeled sulfate deposition.

The maximum modeled sulfur deposition rate within the WPN AERMOD receptor grid was 12.92 milligrams per square meter per year (mg/m²/yr). Assuming complete conversion to sulfate results in a maximum theoretical sulfate deposition rate of 38.76 mg/m²/yr, equivalent to 0.388 kg/ha/yr. The maximum modeled WPN contribution, therefore, represents approximately 3.5% of the former Minnesota sulfate deposition benchmark.

Background wet sulfate deposition was estimated using the 2024 National Atmospheric Deposition Program (NADP) National Trends Network (NTN) sulfate wet-deposition grid (NADP, n.d.). The gridded NADP value at the WPN Project area was 2.017 kg/ha/yr. Adding the maximum modeled WPN sulfate-equivalent contribution of 0.388 kg/ha/yr results in a combined background-plus-WPN deposition rate of approximately 2.405 kg/ha/yr (Table 5). This combined rate represents approximately 21.9% of the former Minnesota benchmark of 11 kg/ha/yr.

This comparison is conservative because it combines the regional NADP background wet-deposition rate with the maximum modeled WPN sulfate-equivalent deposition rate at any individual AERMOD receptor, rather than an average modeled WPN deposition rate. In addition, the calculation assumes complete conversion of modeled sulfur deposition to sulfate. The combined background-plus-WPN sulfate deposition rate remains substantially below the screening benchmark, indicating that atmospheric sulfur deposition associated with WPN is unlikely to result in a significant increase in sulfate deposition relative to regional background conditions.

Results and Conclusions

Atmospheric deposition associated with WPN was evaluated for copper, silver, sulfur, and mercury based on annual deposition rates predicted by AERMOD. The evaluation considered potential effects on surface water and soil and included a separate screening evaluation of sulfate deposition. The analyses incorporated several conservative assumptions, including complete delivery of modeled watershed deposition to receiving surface waters, use of conservative streamflow conditions, complete conversion of deposited sulfur to sulfate, and complete retention and accumulation of deposited constituents within the upper 2 cm of soil without losses from erosion, runoff, leaching, plant uptake, or other processes.

For surface water, modeled deposition within the contributing drainage area of each evaluated receiving water was converted to theoretical incremental concentrations using annualized streamflow. NHDPlus HR drainage delineation indicated that approximately 9.03% of the Duck Creek-Frontal Lake Superior HUC12 drains to Argentine Creek at ARC-03, whereas approximately 99.91% of the Anderson Creek-Big Iron River HUC12 drains to the Big Iron River. The same drainage area and AERMOD spatial integration methodology were applied to both receiving waters.

For Argentine Creek, the drainage-adjusted copper load corresponds to a theoretical increment of approximately 1.07 µg/L under the representative flow condition, below the applicable hardness-dependent Rule 57 FCV range. Under the conservative flow condition, the theoretical copper increment is approximately 8.67 µg/L and remains above the evaluated FCV range. Silver and mercury increments are negligible relative to their applicable Rule 57 comparison values, and calculated sulfate increments are small. For the Big Iron River, copper, silver, and mercury increments remain below their applicable Rule 57 comparison values under both the representative and conservative-flow conditions, and sulfate increments are small.

Potential effects on soil were evaluated by converting modeled deposition at the proposed soil monitoring locations to incremental soil concentrations, assuming complete retention within the upper 2 cm of soil. Even under this conservative accumulation assumption, the modeled 1-year and 7-year increments were small relative to existing soil concentrations and the selected comparison values. Predicted total soil concentrations for copper, silver, and mercury remained below their respective comparison values after 7 years of modeled deposition. Baseline sulfate concentrations were not available; however, the calculated sulfate increment after 7 years was small relative to the selected sulfate comparison value. These results indicate that modeled atmospheric deposition from WPN is unlikely to materially alter soil concentrations of the evaluated constituents.

Sulfur deposition was also evaluated independently using a sulfate-deposition screening approach. The maximum modeled sulfur deposition rate anywhere within the AERMOD receptor grid was 12.92 mg/m²/yr, corresponding to a theoretical sulfate-equivalent deposition rate of 0.388 kg/ha/yr assuming complete conversion of sulfur to sulfate. The 2024 NADP background wet sulfate deposition rate at the WPN Project area was 2.017 kg/ha/yr. Combining the regional background rate with the maximum modeled WPN contribution results in a total screening deposition rate of 2.405 kg/ha/yr, or approximately 21.9% of the former Minnesota sulfate deposition benchmark of 11 kg/ha/yr. The WPN contribution alone represents approximately 3.5% of that benchmark. This comparison is conservative because it combines regional background deposition with the highest modeled WPN sulfate-equivalent deposition at any individual AERMOD receptor rather than an average WPN deposition rate.

Overall, the deposition evaluation indicates that modeled WPN emissions are unlikely to result in significant adverse effects to soil or surface-water quality. The principal screening exception is the theoretical copper increment calculated for Argentine Creek under the conservative-flow condition. That result combines the lowest observed non-negligible streamflow with the assumption that 100% of modeled copper deposited throughout the contributing drainage area is delivered to the stream without watershed retention or attenuation. Under representative Argentine Creek flow, the theoretical copper increment is below the applicable hardness-dependent FCV range. The Big Iron River evaluation, soil evaluation, sulfate-deposition comparison, and remaining surface-water screening results provide substantial margins below their respective comparison values. Taken together, the results support the conclusion that atmospheric deposition associated with WPN is unlikely to cause significant degradation of soil or surface-water quality within the evaluated area.

References

- Foth Infrastructure & Environment, LLC, 2026a. Mining Permit Application. September 2026.
- Foth Infrastructure & Environment, LLC, 2026b. Soil Sampling Report. March 2026.
- Foth Infrastructure & Environment, LLC, 2026c. Michigan Air Use Permit – Permit to Install. September 2026.
- Foth Infrastructure & Environment, LLC, 2026d. Groundwater and Surface Water Hydrology Baseline Report. August 2026.

Michigan Department of Environment, Great Lakes, and Energy, 2026a. Rule 57 Water Quality Values. Water Resources Division. Rule 57 Water Quality Values. Accessed September 2026.

Michigan Department of Environment, Great Lakes, and Energy, 2026b. Rule 57 Water Quality Values Spreadsheet. Water Resources Division. <https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/WRD/GLWARM/Toxics/rule-57-values.xlsx?rev=c72ed39ebfce447e930f84c1d25b0d85&hash=A5521BBBD45240E23E24E81E6108F8AB> . Accessed September 2026.

National Atmospheric Deposition Program, (n.d.). Annual NTN maps by year. Retrieved September 11, 2026, from <https://nadp.slh.wisc.edu/maps-data/ntn-gradient-maps/>

National Atmospheric Deposition Program, (n.d.). SO4_dep_2024 [Data set]. Retrieved September 11, 2026, from https://nadp.slh.wisc.edu/filelib/maps/NTN/grids/2024/SO4_dep_2024.zip

SRK Consulting, 2026. Baseline Geochemical Characterization Interim Report. August 2026.

U.S. Geological Survey, (n.d.). USGS 04032500 Iron River Near White Pine, MI. Water Data for the Nation. Accessed September 11, 2026, from <https://waterdata.usgs.gov/monitoring-location/USGS-04032500/#dataTypeId=daily-00060-0&period=periodOfRecord&showFieldMeasurements=true>.

Attachments:

Tables

Figures

Attachment 1 Air Deposition Model Inputs

Tables

Table 1
Modeled Annual Deposition to Selected HUC12 Subwatersheds
White Pine Copper LLC

HUC12	Analyte	Area-Weighted Deposition	Units	Annual Load	Units
Anderson Creek-Big Iron River (040201010403)	Copper	0.146	mg/m ² /yr	10.94	kg/yr
	Silver	0.004	µg/m ² /yr	0.33	g/yr
	Sulfur	0.027	mg/m ² /yr	2.02	kg/yr
	Sulfate	0.081	mg/m ² /yr	6.06	kg/yr
	Mercury	0.000	µg/m ² /yr	0.00	g/yr
Duck Creek-Frontal Lake Superior (040201010109)	Copper	0.512	mg/m ² /yr	44.66	kg/yr
	Silver	0.266	µg/m ² /yr	23.24	g/yr
	Sulfur	0.095	mg/m ² /yr	8.32	kg/yr
	Sulfate	0.286	mg/m ² /yr	24.96	kg/yr
	Mercury	0.003	µg/m ² /yr	0.28	g/yr

Notes:

mg = milligrams

µg = micrograms

m² = square meters

yr = year

g = grams

kg = kilograms

HUC12 = 12-digit Hydrologic Unit Code

Prepared by: NAA2

Checked by: CER2

Table 2
Argentine Creek Deposition Screening
White Pine Copper LLC

Analyte	Comparison Value	Drainage-Adjusted Annual Load	Representative Flow Increment (4.39 cfs)	Conservative Flow Increment (0.541 cfs)
Copper	3.38–8.03 µg/L FCV	4.190 kg/yr	1.07 µg/L	8.67 µg/L
Silver	0.06 µg/L FCV	0.000 g/yr*	0.000 µg/L*	0.000 µg/L*
Sulfate	No Rule 57 FCV	2.346 kg/yr	0.000599 mg/L	0.00486 mg/L
Mercury	0.0013 µg/L Wildlife Value	0.000 g/yr*	0.000 µg/L*	0.000 µg/L*

Notes:

CaCO₃ = calcium carbonate

cfs = cubic feet per second

FCV = final chronic value

km² = square kilometers

kg = kilograms

L = liter

g = grams

mg = milligrams

µg = micrograms

yr = year

* Reported as zero at the precision of the AERMOD deposition output.

The contributing drainage area to Argentine Creek at ARC-03 is 7.884 km², representing 9.03% of the Duck Creek-Frontal Lake Superior HUC12. Annual loads were calculated by spatially intersecting the contributing drainage area with the 200-m AERMOD receptor grid.

Theoretical concentration increments conservatively assume complete delivery of modeled deposition within the contributing drainage area to Argentine Creek without watershed retention or attenuation. Copper FCVs correspond to measured ARC-03 hardness values of 32 to 88 mg/L as CaCO₃.

Prepared by: NAA2

Checked by: CER2

Table 3
Big Iron River Deposition Screening
White Pine Copper LLC

Analyte	Comparison Value	Drainage-Adjusted Annual Load	Representative Flow Increment (144 cfs)	Conservative Flow Increment (14.4 cfs)
Copper	1.77 µg/L FCV at hardness = 15 mg/L	10.909 kg/yr	0.0848 µg/L	0.848 µg/L
Silver	0.06 µg/L FCV	0.324 g/yr	0.000003 µg/L	0.000025 µg/L
Sulfate	No Rule 57 FCV	6.045 kg/yr	0.000047 mg/L	0.000470 mg/L
Mercury	0.0013 µg/L Wildlife Value	0.000 g/yr*	0.000 µg/L*	0.000 µg/L*

Notes:

CaCO₃ = calcium carbonate

cfs = cubic feet per second

FCV = final chronic value

g = grams

kg = kilograms

km² = square kilometers

L = liter

mg = milligrams

µg = microgram

yr = year

* Reported as zero at the precision of the AERMOD deposition output.

The contributing drainage area to the Big Iron River within the Anderson Creek-Big Iron River HUC12 is 74.856 km², representing 99.91% of the HUC12. Annual loads were calculated using the same spatial intersection method applied to Argentine Creek. Theoretical concentration increments conservatively assume complete delivery of modeled deposition within the contributing drainage area to the Big Iron River without watershed retention or attenuation. The copper comparison value shown is the FCV calculated at the lowest observed WPN baseline stream hardness of 15 mg/L as CaCO₃.

Prepared by: NAA2

Checked by: CER2

Table 4
Potential Soil Impacts from Modeled Atmospheric Deposition
White Pine Copper LLC

Analyte	Baseline Soil Concentration (mg/kg)	Comparison Value (mg/kg)	Maximum Modeled Deposition (mg/m ² /yr)	1-Year Deposition Increment (mg/kg)	Predicted Soil Concentration After 1 Year (mg/kg)	7-Year Deposition Increment (mg/kg)	Predicted Soil Concentration After 7 Years (mg/kg)	Maximum Location
Copper	120	151	16.66	0.626	120.63	4.38	124.38	SL-13
Silver	0.8	1	0.04	0.00150	0.802	0.0105	0.811	SL-13
Sulfate (1)	—	5000	9.42	0.354	0.354	2.48	2.48	SL-13
Mercury	0.018	0.13	0.01	0.000376	0.0184	0.00263	0.0206	SL-13

Notes:
mg = milligrams
µg = micrograms
m² = square meters
yr = year
g = grams
kg = kilograms

1. Sulfate values represent the modeled incremental soil concentration attributable to atmospheric deposition because sulfate was not analyzed as part of the WPN baseline soil sampling program.
2. Calculations assume a 2-cm soil mixing depth, a bulk density of 1.33 g/cm³, and a corresponding soil mass of 26.6 kg/m².
3. One- and seven-year concentrations assume continuous deposition at the modeled annual rate and complete retention of deposited mass within the upper 2 cm of soil.
4. The maximum modeled deposition rate for each analyte occurred at SL-13.
5. Comparison values were selected consistent with the screening approach used in the WPN Soil Sampling Report, whereby statewide or site-specific background is used when it exceeds an otherwise applicable screening level. Copper (151 mg/kg) represents the WPN site-specific background concentration; silver (1.0 mg/kg) and mercury (0.13 mg/kg) represent EGLE statewide background concentrations; and sulfate (5,000 mg/kg) represents the

Prepared by: NAA2
Checked by: CER2

Table 5
Sulfate Deposition Rate Comparison
White Pine Copper LLC

Sulfate Deposition Component	Rate (kg/ha/yr)	Percent of Benchmark
2024 NADP background wet sulfate deposition	2.017	18%
Maximum modeled WPN sulfate-equivalent contribution	0.388	4%
Background + maximum modeled WPN contribution	2.405	22%
Former Minnesota sulfate deposition benchmark	11	100%

Notes:

kg/ha/yr = kilogram per hectare per year

NADP = National Atmospheric Deposition Program

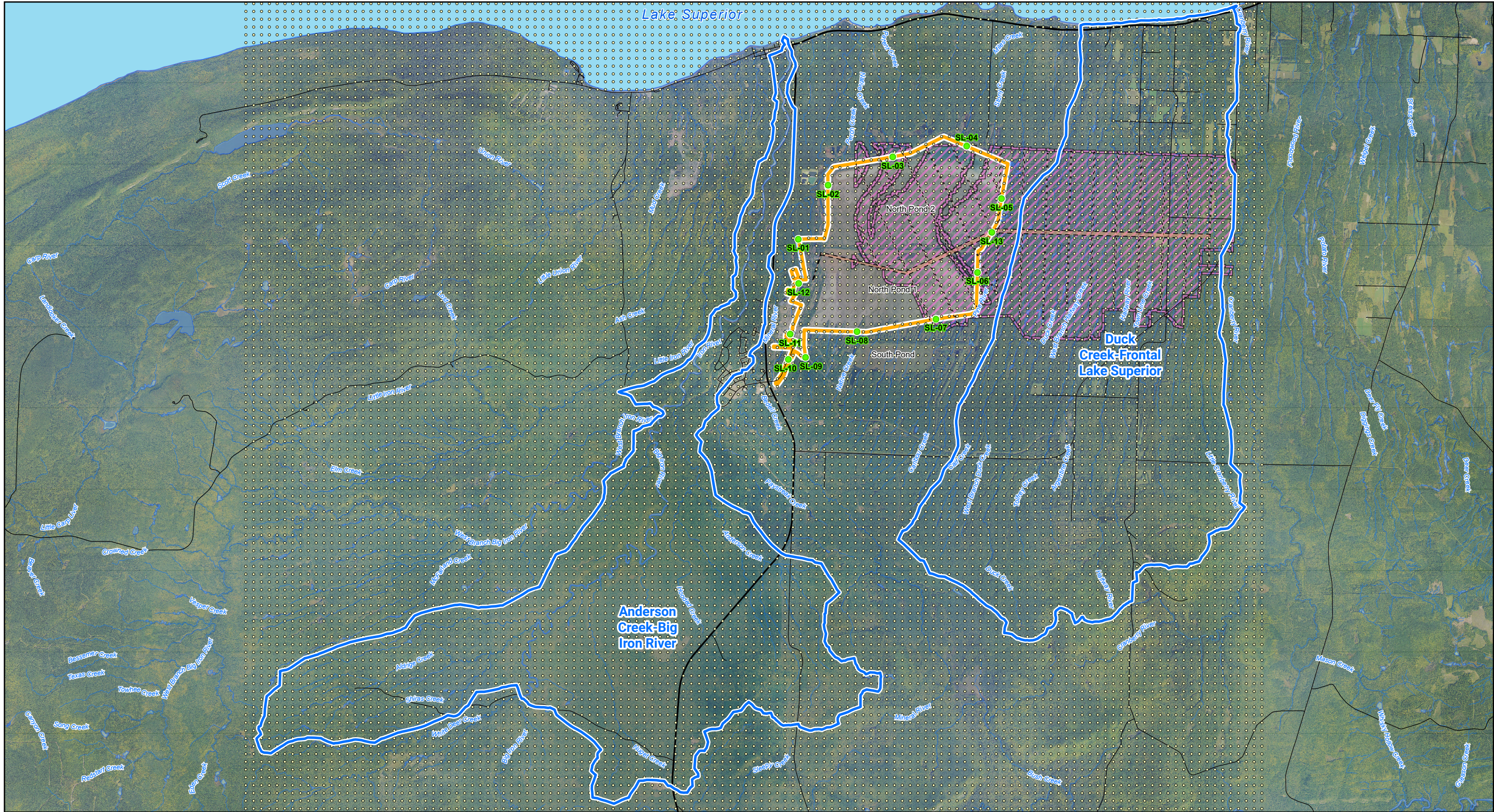
WPN = White Pine North

Modeled sulfur deposition was conservatively converted to sulfate assuming complete conversion and a sulfate-to-sulfur mass ratio of approximately 3:1. Background wet sulfate deposition was obtained from the 2024 NADP NTN sulfate wet-deposition grid. The former Minnesota Rule 7021.0030 value of 11 kg/ha/yr was repealed in 2013 and is not an applicable Michigan regulatory criterion; it is presented as an environmentally protective screening benchmark.

Prepared by: NAA2

Checked by: CER2

Figures



NOTES:

1. 2024 - 18in resolution air photo from the USDA NAIP.
2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
3. Road, boundary and hydrographic data from Michigan GIS Open Data.

LEGEND

- Major Road
- Minor Road
- River/Stream
- Lake/Pond

- Soil Monitoring Location
- AERMOD Receptor
- Watershed Boundary
- Proposed Project Surface Extent
- Proposed White Pine North Underground Mine Area



Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
PREPARED BY:			DATE:
REVIEWED BY:			DATE:
APPROVED BY:			DATE:

WHITE PINE COPPER LLC

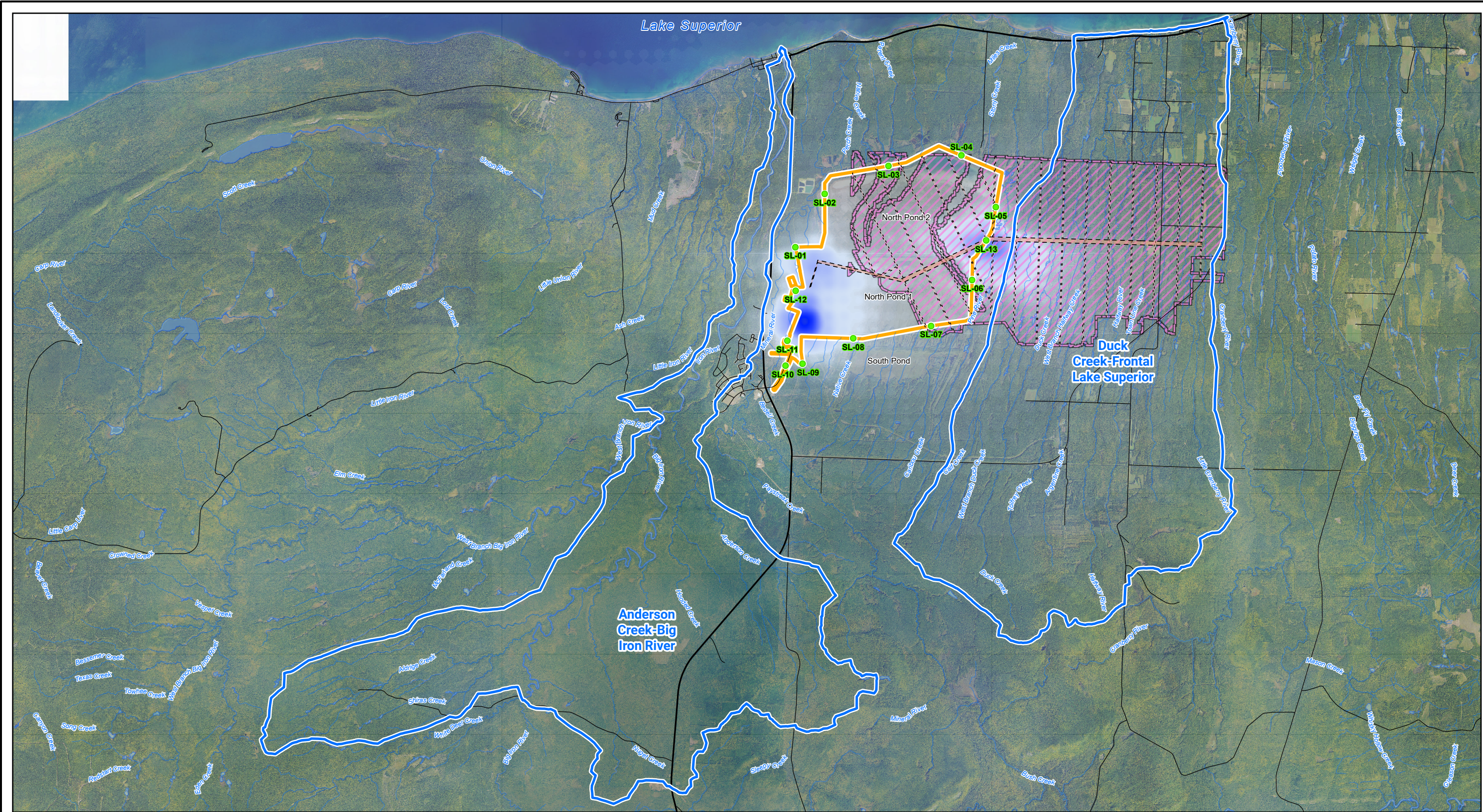
FIGURE 1
AERMOD RECEPTOR GRID
AIR DISPERSION MEMORANDUM
WHITE PINE NORTH, ONTONAGON COUNTY, MI

Scale: 0 4,000 8,000 Feet

Date: SEPTEMBER 2026

Drafted By: BJW1

Project: 25W006

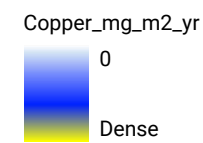


NOTES:

1. 2024 - 18in resolution air photo from the USDA NAIP.
2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
3. Road, boundary and hydrographic data from Michigan GIS Open Data.

LEGEND

- Major Road
- Minor Road
- River/Stream
- Lake/Pond
- Soil Monitoring Location
- Watershed Boundary
- Proposed Project Surface Extent
- Proposed White Pine North Underground Mine Area



Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
PREPARED BY:		DATE:	
REVIEWED BY:		DATE:	
APPROVED BY:		DATE:	

WHITE PINE COPPER LLC	
FIGURE 2 AERMOD DEPOSITION RESULTS – COPPER AIR DISPERSION MEMORANDUM WHITE PINE NORTH, ONTONAGON COUNTY, MI	
Scale: 0 4,000 8,000 Feet	Date: SEPTEMBER 2026
Drafted By: BJW1	Project: 25W006

Attachment 1

Air Deposition Model Inputs



Client: White Pine Copper

Project: Deposition Modeling

Prepared by: MMD

Checked by: BWB

Project ID.: 23W200

Date: 09/01/26

Date: 09/11/26

White Pine Copper Air Deposition Model Input Data - Emission Rates of Selected Air Contaminants for Deposition Modeling

	% Copper	% Mercury	% Silver	% Sulfur
Ore	1.36E+00	8.60E-04	3.57E-03	2.57E-01
Concentrate	2.66E+01	2.91E-04	4.89E-04	6.17E+00
Native Soils	2.83E-01	1.00E-05	4.00E-04	0.00E+00
Tailings	1.31E-01	3.00E-06	4.30E-05	5.00E-06

Point Sources

Model Source ID	Emission Source		Copper	Mercury	Silver	Sulfur	Units
SV-001	Raise 2 Mine Vent		9.70E-03	6.15E-06	2.55E-05	1.84E-03	g/sec
SV-002	Raise 3 Mine Vent		1.26E-02	7.99E-06	3.32E-05	2.39E-03	g/sec
SV-008	Primary Jaw Crusher Duct Collector Stack Exhaust		8.69E-05	5.51E-08	2.29E-07	1.65E-05	g/sec
SV-009	Reclaim System Dust Collector Exhaust		4.31E-07	2.73E-10	1.13E-09	8.17E-08	g/sec
SV-012	Concentrate Handling		1.30E-06	1.42E-11	2.39E-11	3.01E-07	g/sec
SV-0017	Rock Breaker and Vibrating Grizzly		2.61E-06	1.66E-09	6.88E-09	4.96E-07	g/sec

Volume Sources

Model Source ID	Emission Source	Number of Volume Source Segments	Copper ¹	Mercury ¹	Silver ¹	Sulfur ¹	Units
F001A	Ore Transfer from portal to conveyor	1	2.15E-04	1.37E-07	5.67E-07	4.09E-05	g/sec
F001B	Ore Transfer from portal conveyor to crusher	1	2.15E-04	1.37E-07	5.67E-07	4.09E-05	g/sec
F002	Ore Transfer to Temporary Stockpile	1	9.11E-05	5.78E-08	2.40E-07	1.73E-05	g/sec
F003	Ore Transfer from Temporary Stockpile to Jaw Crusher	1	4.31E-04	2.73E-07	1.13E-06	8.17E-05	g/sec
F008	Ore Stockpile Material Handling	1	2.41E-04	5.54E-09	7.94E-08	9.24E-09	g/sec
HR-01	Vehicle Traveling on Ore Stockpile	58	2.43E-05	1.54E-08	6.38E-08	4.60E-06	g/sec
HR-09A	Vehicle Travel on Tailings Disposal Facility	89	2.12E-07	4.87E-12	6.98E-11	8.11E-12	g/sec
HR-09B	Vehicle Travel on Tailings Disposal Facility	80	2.36E-07	5.42E-12	7.76E-11	9.03E-12	g/sec

Area Sources

Model Source ID	Emission Source	Area	Copper	Mercury	Silver	Sulfur	Units
F005	F005- Wind Erosion Temporary Ore Stockpile	67,000	1.70E-09	1.08E-12	4.46E-12	3.22E-10	g/m2-sec
F006	F006- Wind Erosion at TDF NP1	95,101	2.54E-09	5.84E-14	8.37E-13	9.73E-14	g/m2-sec
F006	F006- Wind Erosion at TDF NP2	95,101	2.54E-09	5.84E-14	8.37E-13	9.73E-14	g/m2-sec

Notes:

1. Emission rates are for each volume source segment.

	Client: White Pine Copper	Project ID.: 23W200
	Project: Deposition Modeling	
	Prepared by: MMD	Date: 09/01/26
	Checked by: BWB	Date: 09/11/26

Particle Density, Particle Size Diameters, and Associated Mass Fractions

Ore Density ¹ = 1.95 g/cm³

Tailings Dry Density ² = 1.46 g/cm³

Concentrate Density ³ = 2.75 g/cm³

Low Cut (µm)	Mean Particle Size Range Calculations ⁴		
	High Cut (µm)	Mean Size (µm)	
	0	1	0.63
	1	2	1.55
	2	2.5	2.26
	2.5	3	2.76
	3	4	3.52
	4	5	4.52
	5	6	5.52
	6	10	8.16
	10	15	12.66

Point Sources ⁵

Source ID	Source Description
SV-001	Raise 2 Mine Vent
SV-002	Raise 3 Mine Vent
SV-008 *	Primary Jaw Crusher Duct Collector Stack Exhaust
SV-009 *	Reclaim System Dust Collector Exhaust
SV-017 *	Rock Breaker and Vibrating Grizzly

*SV008, SV009, and SV017 emissions are controlled with baghouse

Ore Material Density = 1.95 g/cm³

Particle Size Range (µm)	Cum Size (%)	Cum Wt. (g/cm ³)	Mass (g/cm ³)	Uncontrolled Mass Fraction	Control (%)	Controlled Mass (g/cm ³)	Controlled Mass Fraction
1	4	0.08	0.08	0.04	99.5	0.0004	0.04
2	11	0.21	0.14	0.07	99.5	0.0007	0.07
2.5	15	0.29	0.08	0.04	99.5	0.0004	0.04
3	18	0.35	0.06	0.03	99.5	0.0003	0.03
4	25	0.49	0.14	0.07	99.5	0.0007	0.07
5	30	0.59	0.10	0.05	99.5	0.0005	0.05
6	34	0.66	0.08	0.04	99.5	0.0004	0.04
10	51	0.99	0.33	0.17	99.5	0.0017	0.17
15	100	1.95	0.96	0.49	99.5	0.0048	0.49
Totals			1.95	1.0		0.010	1.0

Source ID	Source Description
SV-012 *	Concentrate Handling

*SV012 emissions are controlled with a baghouse

Concentrate Material Density = 2.75 g/cm³

Particle Size Range (µm)	Cum Size (%)	Cum Wt. (g/cm ³)	Mass (g/cm ³)	Uncontrolled Mass Fraction	Control (%)	Controlled Mass (g/cm ³)	Controlled Mass Fraction
1	4	0.11	0.11	0.04	99.5	0.0006	0.04
2	11	0.30	0.19	0.07	99.5	0.0010	0.07
2.5	15	0.41	0.11	0.04	99.5	0.0006	0.04
3	18	0.50	0.08	0.03	99.5	0.0004	0.03
4	25	0.69	0.19	0.07	99.5	0.0010	0.07
5	30	0.83	0.14	0.05	99.5	0.0007	0.05
6	34	0.94	0.11	0.04	99.5	0.0006	0.04
10	51	1.40	0.47	0.17	99.5	0.0023	0.17
15	100	2.75	1.35	0.49	99.5	0.0067	0.49
Totals			2.75	1.0		0.014	1.0

	Client: White Pine Copper	Project ID.: 23W200
	Project: Deposition Modeling	
	Prepared by: MMD	Date: 09/01/26
	Checked by: BWB	Date: 09/11/26

Volume Sources ⁵

Source ID	Source Description
F001A	Ore Transfer from portal to conveyor
F001B	Ore Transfer from portal conveyor to crusher
F002	Ore Transfer to Temporary Stockpile
F003	Ore Transfer from Temporary Stockpile to Jaw Crusher
F008	Ore Stockpile Material Handling
HR-01	Vehicle Traveling on Ore Stockpile

No Control Devices Added to Mechanically Change Particle Size

Ore Material Density =		1.95 g/cm ³			
Particle Size Range (µm)	Cum Size (%)	Cum Wt. (g/cm ³)	Mass (g/cm ³)	Mass Fraction	
1	4	0.08	0.08	0.04	
2	11	0.21	0.14	0.07	
2.5	15	0.29	0.08	0.04	
3	18	0.35	0.06	0.03	
4	25	0.49	0.14	0.07	
5	30	0.59	0.10	0.05	
6	34	0.66	0.08	0.04	
10	51	0.99	0.33	0.17	
15	100	1.95	0.96	0.49	
Totals			1.95	1.0	

Source ID	Source Description
HR-09A	Vehicle Travel on Tailings Disposal Facility
HR-09B	Vehicle Travel on Tailings Disposal Facility

No Control Devices Added to Mechanically Change Particle Size

Tailings Material Density =		1.46 g/cm ³			
Particle Size Range (µm)	Cum Size (%)	Cum Wt. (g/cm ³)	Mass (g/cm ³)	Mass Fraction	
1	4	0.06	0.06	0.04	
2	11	0.16	0.10	0.07	
2.5	15	0.22	0.06	0.04	
3	18	0.26	0.04	0.03	
4	25	0.37	0.10	0.07	
5	30	0.44	0.07	0.05	
6	34	0.50	0.06	0.04	
10	51	0.74	0.25	0.17	
15	100	1.46	0.72	0.49	
Totals			1.46	1.0	

	Client: White Pine Copper	Project ID.: 23W200
	Project: Deposition Modeling	
	Prepared by: MMD	Date: 09/01/26
	Checked by: BWB	Date: 09/11/26

Area Sources ⁵

Source ID	Source Description
F005	F005- Wind Erosion Temporary Ore Stockpile
F006	F006- Wind Erosion at TDF NP1
F006	F006- Wind Erosion at TDF NP2

No Control Devices Added to Mechanically Change Particle Size

Tailings Density = 1.46 g/cm³

Particle Size Range (µm)	Cum Size (%)	Cum Wt. (g/cm ³)	Mass (g/cm ³)	Mass Fraction
1	4	0.06	0.06	0.04
2	11	0.16	0.10	0.07
2.5	15	0.22	0.06	0.04
3	18	0.26	0.04	0.03
4	25	0.37	0.10	0.07
5	30	0.44	0.07	0.05
6	34	0.50	0.06	0.04
10	51	0.74	0.25	0.17
15	100	1.46	0.72	0.49
Totals			1.46	1.0

Notes:

- Ore density was obtained from the *Material Handling Equipment Production Design Criteria for the White Pine Prefeasibility Study, Upper Peninsula, USA* completed by Stantec dated October 02, 2025.
- Tailings density information was derived from the value provided for Final Consolidated Dry Density as stated in Table 4-10 in the *Mining Permit Application* as prepared by Foth Infrastructure & Environment, LLC dated September 2026.
- Concentrate density was obtained from the Draft *White Pine North Prefeasibility Study, Section 17 Recovery Methods, Upper Peninsula, USA* completed by Ausenco dated May, 2026.
- The methodology for determining the mean particle size range is taken from the *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Chapter 3, Equation 3-1, Air Dispersion and Deposition Modeling, September 2005.
- Certain assumptions were made regarding particle size and density for input files to the air deposition model. Particle diameters were taken from Appendix B.2, Table B.2.2 to AP-42, Generalized Particle Size Distributions. Table B.2.2 is for use with aggregate and unprocessed ores that are mechanically generated. This broad category includes emissions from milling, grinding and crushing of these types of materials.

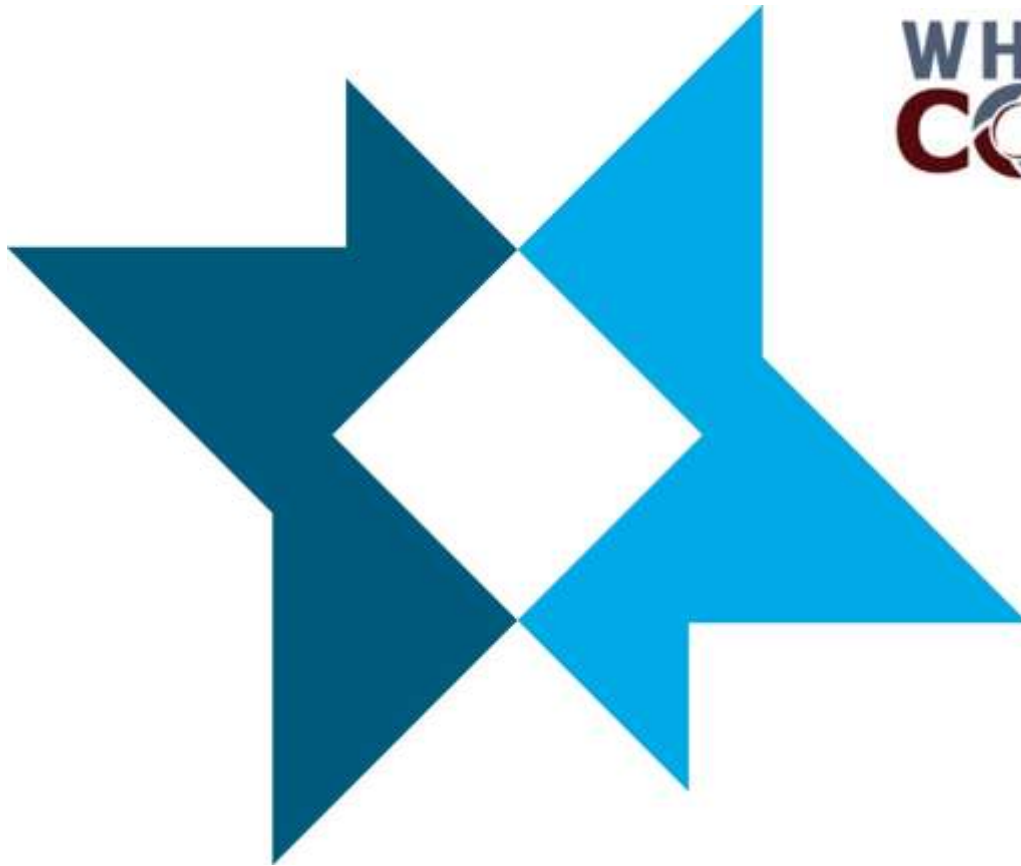
Appendix J

Alternatives Analysis



Report

Alternatives Analysis White Pine North Project



White Pine Copper LLC

White Pine, Michigan

August 2026

Solving our clients' toughest
science and engineering challenges.

Alternatives Analysis White Pine North Project

Project ID: 25W006

Prepared for
White Pine Copper LLC
White Pine, Michigan

Prepared by
Foth Infrastructure & Environment, LLC

August 2026

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Alternatives Analysis White Pine North Project

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Appendices

Appendix A	White Pine North Project: Economic Impact Report & Socioeconomic Study
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List of Abbreviations, Acronyms, and Symbols

CN	Canadian National
DPA	Defense Production Act
DSF	Drift, Slash, and Fill
EIA	Environmental Impact Assessment
EGLE	Michigan Department of Environment, Great Lakes, and Energy
Foth	Foth Infrastructure & Environment, LLC
LOM	Life of Mine
MCL	Michigan Compiled Law
NP1	North Pond 1
NP2	North Pond 2
NPDES	National Pollutant Discharge Elimination System
NREPA	Natural Resources and Environmental Protection Act
PEA	Preliminary Economic Assessment
Project	White Pine North Project
SX-EW	solvent extraction and electrowinning
TDF	Tailings Disposal Facility
WPC	White Pine Copper LLC
WPN	White Pine North

1. Introduction

White Pine Copper LLC (WPC) is wholly owned by Kinterra Copper USA, LLC. WPC is seeking to develop the brownfield site of the previous White Pine Mine located approximately three miles south of Lake Superior, east of M-64, in Carp Lake Township, Ontonagon County, Michigan as seen on Figure 1-1. White Pine Mine was part of the Upper Peninsula of Michigan's historical copper mining district. Underground mining on site began in the late 1800s. In 1952, the Copper Range Company began construction of a fully functioning underground mine and surface processing facilities, including a concentrator, smelter, and refinery. Tailings were placed in three tailings areas: North Dam 1, North Dam 2, and South Dam. Conventional mining and milling operations ceased in 1995, and flooding and reclamation activities began in 1997 under the State of Michigan regulatory framework.

WPC is seeking to develop the White Pine North (WPN) Project (Project) and planning to mine underground east of, and separate from, the historic underground mine workings of White Pine Mine. Copper ore will be extracted using conventional drill and blast room and pillar mining methods. A processing plant will be constructed on site to produce a copper concentrate, and processing will include crushing, grinding, flotation, concentrate thickening, and filtration. Tailings will be managed through re-use of one or more of the existing tailings dams.

This Alternatives Analysis has been prepared to support regulatory review under two distinct but interrelated Michigan statutes: Part 303, Wetlands Protection; and Part 632, Nonferrous Metallic Mineral Mining, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended. The proposed mining Project involves activities that may affect regulated wetlands and requires a mining permit for the extraction and processing of nonferrous metallic minerals.

Because these programs have different statutory purposes and evaluation criteria, this document is structured to meet the needs of both regulatory frameworks while maintaining a consistent technical basis.

Part 303 requires that a permit may only be issued if the Project is in the public's interest, does not cause unacceptable disruption to aquatic resources, and either shows the proposed activity is wetland-dependent or has no feasible and prudent alternative that would avoid or minimize wetland impacts. The analysis must demonstrate that the applicant has followed the avoid, minimize, and compensate sequence for wetland impacts.

Part 632 requires that a mining permit application includes an Environmental Impact Assessment (EIA) that evaluates feasible and prudent alternatives and demonstrates that the proposed mining operation will not pollute, impair, or destroy air, water, or other natural resources and that adverse environmental impacts are reasonably minimized.

Although these requirements differ in emphasis, Part 303 focuses on wetland protection and public interest, while Part 632 emphasizes overall environmental protection and operational feasibility, they intersect in the evaluation of alternatives. This report therefore uses a unified alternatives framework to ensure that both programs can rely on the same technical record, reducing the potential for conflicting conclusions.

The following sections describe the Project purpose and need, the components evaluated, the criteria used to assess alternatives, and the comparative evaluation of those alternatives with respect to both Part 303 and Part 632 standards.

The summary below is a regulatory crosswalk showing how this Alternatives Analysis addresses the requirements of Part 303, Wetlands Protection, and Part 632, Nonferrous Metallic Mineral Mining.

Section		Part 303 - Wetlands	Part 632 - Nonferrous Mining
1.	Introduction	Context for Project and regulatory framework	
2.	Project Purpose and Need	Defines basic Project purpose; explains why wetland alteration may be necessary	Establishes Project objectives and operational need for mineral development
2.4	Project Purpose Requirements	Supports determination of feasible and prudent alternatives	Supports EIA Alternatives Analysis
2.5	Need to Potentially Alter Wetland Resources	Identifies wetland impacts and triggers for Part 303 review	Provides linkage to mine design and environmental controls
3.	Project Components Evaluated	Identifies components that affect wetlands (surface facilities, water management, access corridors)	Identifies components relevant to mining and processing methods, material handling, utilities
4.	Criteria for Evaluation of Alternatives	Includes avoid → minimize → compensate sequence; cost reasonableness for alternatives	Includes technical feasibility, environmental risk, cumulative impacts
5.	Proposed Project and Alternatives Considered	Presents No Action and other alternatives; notes wetland impact potential	Presents mining, processing, and tailings alternatives per Rule 425.202 (EIA)
6.	Evaluation of Alternatives	Determines if feasible and prudent alternatives exist; evaluates wetland impacts and mitigation	Evaluates alternatives for compliance with no pollute/impair/destroy standard and reasonable minimization
6.3	Summary of Alternatives Evaluated	Summarizes wetland impact trade-offs and mitigation needs	Summarizes environmental performance and risk
7.	Public Interest Evaluation	Addresses public interest test (benefits vs. impacts)	Supports socioeconomic and environmental justification for mining

2. Project Purpose and Need

The purpose of the WPN Project is to responsibly develop a known mineral resource while minimizing environmental impacts, including potential alterations to wetland resources. The Project seeks to extract copper and associated metals from a known deposit, leveraging retained mineral rights to support Michigan's transition to a cleaner energy future by meeting growing demand for strategic materials essential to energy infrastructure and electrification.

2.1 Rights to Develop the Resource – Mineral Leases and Mineral Rights

WPC holds the legal and contractual rights to explore and develop the mineral deposit located in the Upper Peninsula of Michigan. These rights are established through a combination of:

- ◆ Private surface ownership
- ◆ Owned and leased mineral rights
- ◆ Compliance with applicable local zoning ordinances and land use regulations

The mineral resource, primarily consisting of copper and silver, has been confirmed through extensive geological exploration, including geophysical surveys, core drilling, and resource modeling. The deposit is considered economically viable and technically feasible for extraction using modern mining methods. Part 303's specific reference to the need for extraction of non-fuel minerals in areas that may result in wetland impacts, as well as Part 632's recognition of the importance of responsible mineral development to Michigan's economy both underscore the public interest served by moving viable projects like this forward. Figures 2-1 and 2-2 depict Surface Ownership and Mineral Rights.

2.2 Retained Metals

The proposed Project is designed to extract and process a mineral deposit primarily composed of copper, with silver present as a secondary but economically recoverable metal. These retained metals are critical to the Project's economic viability and contribute to broader industrial and strategic needs.

The Project is expected to produce substantial quantities of copper concentrate over its operating life, based on the current mine plan and associated reserve and production assumptions. Figure 2-3 presents the mine's production plan over the anticipated 26 years of mine life, while Table 2-1 details the Life of Mine (LOM) development and production at the Project. The extracted copper ore will be processed into a concentrate, which will be sold to third-party facilities for further refining into market-grade raw materials.

The deposit contains copper mineralization in two forms, dominantly very fine-grained chalcocite and lesser native copper, hosted within interbedded sandstone, siltstone, and shale typical of reduced-facies stratiform sediment-hosted copper systems. Geochemical characterization indicates that the acid-generating potential of Project ore and associated mine materials is low, and mine materials will be managed using the water management, treatment, and containment controls described in the permit application.

2.3 Overview of Mineral Resource and Market Demand

2.3.1 Strategic Importance of Copper and Its Role in Critical Infrastructure

Copper is a foundational material for modern infrastructure and is classified as a critical mineral due to its essential role in the energy transition, electrification, and national security. The proposed Project targets a geologically fixed deposit of copper with associated silver, which is both economically viable and strategically valuable.

Copper is indispensable to the development and maintenance of critical infrastructure, including:

- ◆ Transportation and industrial machinery
- ◆ Energy grids and renewable energy systems
- ◆ Telecommunications
- ◆ Water purification and distribution systems

Its high conductivity, durability, and recyclability make copper essential for technologies such as electric vehicles, solar panels, battery storage, and smart grid systems. A single electric vehicle can require up to 200 pounds of copper, and wind turbines may use 3 tons of copper per megawatt of capacity each. These applications are central to both Michigan's clean energy goals and broader national decarbonization efforts.

Global copper demand is projected to grow by over 40% by 2040, driven by the rapid expansion of clean energy and digital infrastructure. However, supply is constrained by declining ore grades, long permitting timelines, and geopolitical instability. Industry forecasts estimate that meeting global demand will require 80 new copper mines and \$250 billion in investment by 2030 (UN Trade and Development, 2025).

Recognizing copper's strategic importance, the U.S. federal government has taken actions to support domestic production:

- ◆ In July 2025, the Defense Production Act (DPA) was invoked to:
 - Require a portion of domestically produced copper to be retained for U.S. use
 - Support domestic refining and processing capacity
 - Impose tariffs on copper-intensive imports to protect national supply chains
- ◆ The proposed Unearth America's Future Act aims to streamline permitting for critical mineral projects, incentivize domestic exploration, and fund infrastructure to support responsible resource development.

These initiatives reflect copper's elevated status as a strategic resource necessary for economic competitiveness, energy independence, and national resilience. The proposed Project contributes directly to these goals by responsibly developing a domestic source of copper and silver, aligned with both state and federal priorities.

Beyond its role in strengthening domestic critical mineral supply chains, the Project supports broader economic priorities by generating significant regional and statewide economic activity. The Upper Peninsula stands to benefit directly through high-quality, long-term jobs created during construction, operations, and reclamation, along with indirect employment across supporting industries such as equipment supply, transportation, engineering, and local services.

In addition, Michigan's severance tax structure ensures that new mineral production yields substantial public revenue: 65% of severance tax proceeds are directed to local governments, providing stable funding for schools, road improvements, emergency services, and community development, while the remaining 35% supports the Rural Development Fund, which invests in infrastructure, economic diversification, and workforce development across rural Michigan. As a result, the Project not only advances national strategic objectives but also delivers transformative local economic benefits that strengthen the resiliency and long-term prosperity of Upper Peninsula communities.

2.3.2 Michigan's Energy Future

Michigan is advancing a comprehensive clean energy strategy aimed at transforming its energy production, infrastructure, and workforce. The foundation of this effort is the MI Healthy Climate Plan, which sets a statewide goal of achieving carbon neutrality by 2050, with interim targets including 100% clean electricity by 2040 and 50% renewable energy by 2030 (EGLE, 2022).

These goals have been codified through landmark legislation, including the Clean Energy & Jobs Act and the Clean Energy Future Package, signed into law in 2023. Together, these policies position Michigan as a national leader in climate action and energy innovation.

Key components of Michigan's energy transition include:

- ◆ Accelerated deployment of renewable energy sources such as wind, solar, and battery storage.
- ◆ Electrification of transportation and buildings, supported by incentives and infrastructure investment.
- ◆ Grid modernization, including upgrades to transmission and distribution systems.
- ◆ Energy efficiency programs targeting residential, commercial, and industrial sectors.
- ◆ Workforce development initiatives to train and employ Michigan residents in clean energy careers.

The state has also committed to expanding access to clean energy in underserved communities and ensuring that the transition supports economic growth across rural and urban areas. These efforts are supported by partnerships with federal agencies, utilities, and private industry.

Michigan's energy future depends on reliable access to the materials and technologies needed to implement these policies. The development of in-state mineral resources, such as copper, supports the infrastructure required for electrification and renewable energy deployment, aligning with both environmental goals and economic priorities.

2.4 Project Purpose Requirements

The purpose of the Project is to exercise WPC's mineral rights to extract copper with associated silver mineralization and to produce saleable concentrates at the WPN Project, in a manner that is environmentally responsible during operations and that facilitates effective reclamation and an environmentally sustainable closure. This purpose is consistent with the policy goals of Part 632 of NREPA, which provides a regulatory framework for fulfilling this purpose.

For purposes of the Part 303 analysis, the basic Project purpose is to develop a geologically fixed copper-silver mineral resource and the supporting mine, processing, tailings, water management, and utility infrastructure necessary to extract, process, and manage that resource in a manner that is environmentally responsible and capable of meeting applicable mining and water protection requirements. Because the orebody is fixed in place, the Alternatives Analysis focuses on whether feasible and prudent changes in configuration, method, layout, and supporting infrastructure can further avoid or minimize wetland impacts while still accomplishing that basic purpose.

To fulfill the purpose of the Project, the following infrastructure components are required:

- ◆ Mine access to the orebody via underground mining methods
- ◆ Surface infrastructure, including:
 - Portal/decline
 - Explosives storage
 - Ventilation raise/exhaust
 - Temporary handling and segregation of limited development rock for beneficial reuse as approved Project construction material, including use in tailings-area earthworks where suitable
 - Overburden stockpile area
 - Temporary ore and crushed ore storage areas with appropriate contact-water controls and lined containment features, as applicable to final design
 - Crusher
 - Mill facilities for ore processing
 - Load-out facilities for concentrate products
 - A tailings disposal facility
 - Lined water retention basins for mine-affected water
 - A wastewater treatment plant for discharge compliance
 - Administrative, showers/change rooms, and maintenance buildings
 - Wheel wash
 - Site access road
 - Electric utility corridor including electric substation and natural gas generator
 - Truck shop, Warehouse, Laboratory

The location of the mine is dictated by the fixed position of the mineralized resource, which cannot be altered. As such, alternatives related to mine design are limited to evaluating feasible mining methods (e.g., open pit vs. underground, or among various underground mining approaches), rather than relocating the Project footprint. Importantly, the selection of the underground mining method dictates the available tailings management options, such as whether backfilling with cemented or uncemented tailings is technically feasible, rather than tailings considerations determining the mining method. The necessary facility components and their spatial requirements are:

- ◆ The mine must be located at the orebody.
- ◆ Certain surface facilities must be located near the mine for operational efficiency and safety.

- ◆ Other surface facilities may be located further from the mine, subject to logistical and environmental constraints.

Given the fixed location of the mineral resource and the operational requirements of the Project, impacts to regulated wetlands may be unavoidable. The following section outlines the need to potentially alter wetland resources to access the mineral deposit and construct essential infrastructure.

2.5 Need to Potentially Alter Wetland Resources

Within the proposed Project Surface Extent, approximately 16.64 acres of regulated wetlands have been identified. These regulated wetlands occur in natural landscape positions across the Project area, such as portions of the main Project site, areas adjacent to existing tailings disposal facilities, and within the vicinity of the proposed underground mine footprint. Importantly, this total does not include any wetlands that have formed within the existing tailings disposal facility footprint, whether they developed through prior reclamation activities or through naturally occurring ponded-water conditions. Only wetlands located outside the historic tailings footprint are considered regulated resources that may require alteration to construct essential Project infrastructure. Delineated wetlands within the Project area can be reviewed on Figure 2-4.

While avoidance of all wetland impacts was considered, no feasible and prudent alternative exists that would allow full access to the mineral resource without some wetland alteration. The location of the mineral deposit is geologically fixed, meaning the orebody cannot be relocated or accessed from an alternative site. WPC has used all practical means to minimize impacts to wetlands across all alternatives evaluated in this report.

In considering the need to alter wetland resources, two key regulatory provisions apply:

- ◆ Under Section 324.30302(1)(d) of NREPA, the extraction of minerals may necessitate the use of a wetland if the activity is dependent on being in a wetland.
- ◆ Under Section 324.30311(4), a permit shall not be issued unless it is shown that an unacceptable disruption will not result to the aquatic resources. In determining whether a disruption to the aquatic resources is unacceptable, the criteria set forth in section 30302 and subsection (2) shall be considered. A permit shall not be issued unless the applicant also shows either of the following: (a) The proposed activity is primarily dependent upon being located in the wetland; or (b) A feasible and prudent alternative does not exist.

Only the surface facilities are expected to result in direct wetland impacts. Surface structures such as processing facilities and stockpiles have been intentionally designed in upland areas where it is feasible to reduce disturbance to wetland features. However, due to site constraints, complete avoidance is not possible.

In addition to direct impacts, temporary indirect effects may occur near the boundaries of the tailings disposal facility and within the proposed underground mine footprint. Predictive modeling simulations of the groundwater flow model have shown that underground mining is not expected to measurably affect stream hydrology or the hydrology of wetlands adjacent to these streams. Any changes would be localized changes to hydrology or ecological function

during construction and operation. Such impacts are expected to be limited in duration and addressed through reclamation and restoration efforts.

Wetland resources may be impacted by the Project through two mechanisms:

- ◆ Direct impacts: These include the placement of fill, excavation, or construction within a wetland. Such impacts are considered permanent wetland takes.
- ◆ Indirect impacts: These include changes to hydrology, such as mine dewatering, which may reduce groundwater discharge to adjacent wetlands. In the context of this Project, indirect impacts are expected to be temporary, occurring only during the operational life of the mine. Because indirect impacts are anticipated to be similar across all alternatives, this evaluation focuses primarily on direct impacts.

This section concludes that some wetland impacts are necessary and unavoidable to access the mineral resource and fulfill the Project's purpose. The Alternatives Analysis that follows is intended to demonstrate that the proposed Project configuration reflects avoidance and minimization of wetland impacts to the extent practicable and that no feasible and prudent alternative has been identified that would achieve the Project purpose with less adverse impact to regulated aquatic resources.

3. Project Components Evaluated

This section describes the major components of the proposed Project that influence the development and evaluation of alternatives under Part 303 (Wetlands Protection) and Part 632 (Nonferrous Metallic Mineral Mining). To clearly address the requirements of both statutes, the components are organized into three categories:

- ◆ Components Relevant to Part 303 – Elements that primarily affect wetlands and aquatic resources, such as surface facility locations, water management strategies, and transportation corridors.
- ◆ Components Relevant to Part 632 – Elements that primarily relate to mining operations and overall environmental performance, including mining method, material handling, and energy and utility infrastructure.
- ◆ Components Critical to Both Part 303 and Part 632 – Elements that have significant implications for both wetland protection and mining feasibility. The most critical of these is tailings management, including associated construction-material reuse of limited development rock, because it strongly influences wetland impacts, site layout, water management, and long-term environmental risk.

The components described in this section, and depicted on Figure 3-1 and Figure 3-2, form the basis for the alternatives presented in Section 5 and evaluated in detail in Section 6.

3.1 Components Relevant to Part 303 – Wetlands Protection

Part 303 review focuses on Project elements that influence direct and indirect impacts to regulated wetlands and other aquatic resources, and on whether feasible and prudent changes in location, configuration, size, or method can further avoid or minimize those impacts. This subsection highlights components where location and design decisions directly affect regulated wetlands, including surface facility locations, water management strategies, and transportation corridors.

3.1.1 Surface Facility Locations

The placement of surface facilities, such as processing plants, maintenance areas, and administrative buildings, is a critical consideration in the Alternatives Analysis because it directly influences both operational efficiency and environmental impact. From a regulatory perspective, this component represents a key intersection between Part 632 and Part 303 requirements. Part 632 emphasizes the need for a layout that supports safe, efficient mining operations and facilitates long-term reclamation, while Part 303 requires that wetland impacts be avoided and minimized to the greatest extent practicable.

Surface facilities typically require substantial land disturbance for grading, foundations, and supporting infrastructure. In many cases, the most operationally efficient locations may overlap with wetland areas or their buffers, requiring a balance between engineering feasibility and wetland protection. Conversely, relocating facilities to avoid wetlands can increase costs, extend utility corridors, and introduce additional environmental or social considerations.

The Alternatives Analysis will therefore evaluate different siting strategies to address these competing objectives. Key factors include minimizing wetland disturbance, reducing the overall

Project footprint, and ensuring compliance with both operational and environmental performance standards. This evaluation will also consider how facility placement influences reclamation planning and long-term land use compatibility.

3.1.2 Water Management Strategies

Effective water management is essential for mine operations but can significantly influence wetland hydrology. Water collection systems, sedimentation basins, and stormwater controls may be located in or near wetlands, resulting in direct impacts or hydrologic changes. Additionally, mine dewatering activities can lower groundwater levels, reducing the hydroperiod of wetlands and affecting their ecological function. Discharge of treated water, while regulated, may also alter wetland water quality or flow regimes.

3.1.3 Transportation and Access Corridors

Access roads, haul roads, and utility corridors are necessary to support mining operations but may intersect wetland areas. Road construction may require wetland crossings, culverts, or fill, which can fragment wetland habitats and disrupt natural hydrology. Similarly, linear infrastructure such as power lines and pipelines may require clearing through wetlands, resulting in temporary or permanent disturbance.

3.2 Components Relevant to Part 632 – Nonferrous Metallic Mineral Mining

Part 632 compliance depends on components that determine the technical feasibility, safety, and environmental performance of the mining operation. This subsection addresses elements such as the mining method, ore processing and material handling systems, and energy and utility infrastructure, all of which shape operational viability and long-term environmental outcomes.

3.2.1 Mining Method

The selected mining method determines the overall configuration of the mine site and influences nearly every aspect of Project design. For this Project, the choice between open-pit and underground mining affects the size and location of surface disturbance, the volume of waste rock generated, and the extent of water management required. The mining method also dictates the approach to ground stability, worker safety, and long-term reclamation. These considerations are central to Part 632 compliance, which requires that mining operations minimize environmental impacts while ensuring operational safety and economic viability.

Open pit mining is generally used when the mineralized resource is located near the surface. This approach involves removing overlying material to expose the orebody, creating a large excavation that expands laterally as mining progresses. While open pit mining allows for efficient ore recovery, it typically requires a larger surface footprint and generates substantial volumes of waste rock, which must be managed in engineered storage facilities. Open pit mining can also result in large-scale hydrogeological impacts in the glacial system and pose additional reclamation challenges.

Underground mining is employed when the orebody lies at greater depths or when minimizing surface disturbance is a priority. Access to the ore is achieved through ramps, declines, or shafts, and ore is extracted through a network of underground workings. This method generally results in a smaller surface footprint compared to open pit mining but requires complex ventilation systems, ground support, and water management. Waste rock generation is also

substantially reduced relative to open pit mining, and the limited development rock generated by the proposed underground method will be reused in Project construction or retained underground as described in Section 3.3.

In-situ recovery, a method that involves leaching minerals directly from the orebody without physical excavation. This method requires specific physical characteristics of both the host rock and the mineralogy of the ore to be effective.

3.2.2 Material Handling and Ore Processing

Ore processing and material handling are essential components of any nonferrous metallic mining project and represent a significant factor in the Alternatives Analysis under Part 632. These systems are designed to extract valuable metals from mined material and prepare them for shipment, while also managing the large volumes of residual material generated during processing. The design and location of processing facilities, along with associated handling systems, influence the overall Project footprint, energy and water requirements, and environmental controls.

At a conceptual level, mineral processing typically involves crushing and grinding the ore to liberate valuable minerals, followed by separation processes that concentrate those minerals for further refining. The remaining material, known as tailings, must be managed in a manner that ensures long-term stability and environmental protection. Material handling systems also include the movement of ore from the mine to the processing plant and the transport of tailings to storage facilities. These activities must be planned to meet the performance standards of Part 632 while minimizing environmental impacts and ensuring operational efficiency.

Moving raw material from the mine to the processing facility is a critical operational component that influences site layout, energy use, and environmental considerations. Two primary approaches are commonly used in mining operations: conveyor systems and haul trucks. Conveyor systems provide continuous, automated transport and can reduce fuel consumption, noise, and dust emissions, but they require significant infrastructure and are best suited for direct routes. Haul trucks, on the other hand, offer greater flexibility for varying terrain and operational changes but typically result in higher emissions, noise, and dust generation, and require well-maintained haul roads. The choice between these methods affects not only operational efficiency but also the overall environmental footprint of the Project.

Another key consideration is where the extracted ore will be processed. On-site processing allows for direct control over ore handling and can reduce transportation needs, while also enabling integrated tailings management at the mine site. Off-site processing, by contrast, involves transporting ore to an external facility, which may reduce the environmental footprint at the mine site and leverage existing infrastructure. However, this approach introduces logistical complexity, additional fuel use, and potential permitting challenges related to ore transport. Each approach carries implications for site design, environmental management, and long-term operational flexibility.

Once the ore has been processed into a concentrate, it must be transported to a smelter for further refinement. Common transportation modes include rail, truck, or a combination of both. Rail transport is generally more efficient for long-distance bulk shipments and can reduce emissions compared to trucking, provided that rail infrastructure is accessible. Truck transport offers flexibility where rail access is limited but results in higher operating costs, increased

traffic, and greater emissions. The selection of transportation mode influences cost, reliability, and environmental impacts, as well as integration with regional logistics networks.

3.2.3 Energy and Utility Infrastructure

Reliable energy and utility systems are critical to sustaining mining and processing operations. This includes the provision of electrical power, which may require new transmission lines or substations, as well as water supply systems for processing and dust control. Additional utilities, such as fuel storage and distribution, compressed air, and backup power systems, are also necessary. The design and placement of these facilities must consider environmental protection measures, including spill prevention and secondary containment, to comply with Part 632 requirements for minimizing risks to natural resources.

A reliable water supply is essential for mining operations, supporting activities such as mineral processing, dust control, and site utilities. From a regulatory perspective, water sourcing presents a key intersection between Part 632 and Part 303 requirements. Part 632 requires that water supply systems be designed to ensure operational reliability and environmental protection, while Part 303 emphasizes the preservation of wetland resources and the maintenance of natural hydrology.

Two primary approaches are typically considered for supplying water to a mining operation: withdrawal from groundwater sources or connection to an existing municipal system. Groundwater withdrawals can reduce aquifer levels and potentially influence wetland hydrology, raising concerns under Part 303. Conversely, utilizing a municipal water supply may reduce direct wetland impacts but introduces considerations related to infrastructure capacity, service agreements, and long-term reliability under Part 632. The Alternatives Analysis must weigh these competing factors to identify a water supply strategy that meets operational needs while minimizing environmental impacts.

Mining operations require a substantial and reliable power source to support energy-intensive activities such as ore processing, material handling, ventilation, and site infrastructure. Identifying an appropriate energy supply strategy is a critical consideration under Part 632, which requires operational reliability and environmental protection, and it also intersects with broader environmental and land-use considerations.

Two primary approaches are typically evaluated for large-scale mining projects: connection to the regional electrical grid through high-voltage transmission infrastructure or the development of on-site power generation systems. Each option presents distinct technical, economic, and environmental implications. Grid connection can provide a stable and scalable power source but may require significant new infrastructure, including transmission corridors, which could introduce additional permitting and land-use challenges. On-site generation offers operational independence and flexibility but involves fuel supply logistics and potential air emissions considerations.

Renewable energy sources, such as wind and solar, are also increasingly considered as supplemental or hybrid solutions to reduce greenhouse gas emissions and align with state energy transition goals. However, their intermittent nature typically necessitates integration with conventional power systems or energy storage solutions to ensure reliability for continuous mining operations.

3.3 Components Critical to Both Part 303 and Part 632 – Wetland Protection and Nonferrous Mining

The Project is not expected to require a separate or long-term waste rock storage facility. Waste rock generated during development is expected to be limited in volume and will be managed as part of the overall mine and tailings-area construction sequence. Development rock generated from the decline and the two western ventilation raises will be used, where geotechnically and geochemically suitable, as construction material for the barrier wall required by the tailings deposition plan. Waste rock generated from the eastern ventilation raise will remain underground and be placed in a mined-out area of the mine. Accordingly, waste rock management is not evaluated as a separate standalone surface facility alternative in this Alternatives Analysis; rather, it is addressed as an ancillary material-handling and reuse component of the selected underground mining and tailings management design.

3.3.1 Tailings Management

Tailings management is one of the most significant components of any mining project and represents a key intersection between the requirements of Part 632 and Part 303. Under Part 632, tailings must be managed in a manner that ensures structural stability, environmental protection, and long-term containment. Achieving these objectives typically requires large, engineered facilities designed to meet stringent geotechnical and hydrological standards, which often necessitate substantial land areas and robust water management systems.

Conversely, Part 303 emphasizes the avoidance and minimization of wetland impacts. In landscapes where mineral deposits and wetlands frequently coexist, the need for large, stable storage areas often conflicts with the goal of preserving wetland resources. This creates a fundamental challenge: how to design and locate tailings facilities that satisfy the technical and safety requirements of Part 632 while reducing or mitigating wetland impacts to the greatest extent practicable.

Tailings management decisions also influence broader environmental and operational outcomes, including water conservation, geotechnical stability, and long-term reclamation. Different strategies for tailings handling, ranging from conventional slurry to more advanced thickened or paste systems, vary in their land requirements, water recovery potential, and closure performance. These differences underscore the importance of evaluating alternatives that balance operational feasibility with environmental stewardship and regulatory compliance.

4. Criteria for Evaluation of Alternatives

The evaluation of alternatives is guided by a set of criteria that reflect regulatory requirements, environmental stewardship, and public interest considerations described in Michigan Compiled Law (MCL) 324.30311.

4.1 Technical and Practical Feasibility

Each alternative is assessed for its technical viability and operational practicality. The alternative must also be compatible with the proposed mining methods, infrastructure, and meet applicable safety and regulatory standards. The technical and practical feasibility are understood as follows:

- ◆ Technical feasibility: The alternative has no glaring technical flaws such as unrealistic technology needs, physical limitations, infeasible logistics, etc.
- ◆ Practical feasibility: The alternative does not have a prevalence of unknown technical, environmental, commercial, and cost related risks and uncertainties that do not substantiate practicality. Further evaluation is not pursued.

4.2 Project Economics

Economic considerations are central to determining whether an alternative is practicable. This includes evaluating capital and operating costs, ore recovery efficiency, and transportation logistics. Alternatives that result in unreasonable costs, as defined under R 281.922a(11) of the Michigan Administrative Code, may be excluded if the cost is substantially greater than what is typical for similar projects and disproportionate to the overall scope of the proposed activity.

At this stage of Project development, economic reasonableness is evaluated comparatively using available capital, operating, infrastructure, and logistics information rather than a single deterministic threshold. For purposes of the Alternatives Analysis, an alternative may be screened out where available information indicates that it would impose substantially greater and disproportionate cost, schedule, or operational burdens relative to the proposed Project while not providing materially lower aquatic-resource impact or materially better environmental performance.

For regulatory context:

- ◆ Under Part 303, economics is evaluated for reasonableness, whether the additional cost of an alternative is substantially greater and disproportionate to the overall Project scope.
- ◆ Under Part 632, economics is evaluated for feasibility, whether the alternative can realistically be implemented while maintaining operational viability and meeting environmental performance standards.

4.3 Wetland Impact Avoidance and Minimization

In accordance with MCL Section 30311, alternatives must be evaluated based on their ability to avoid and minimize direct and indirect impacts to wetlands. A permit cannot be issued unless it is demonstrated that the proposed activity will not result in unacceptable disruption to aquatic resources. The analysis must show that the activity is either primarily dependent on being

located in a wetland, or that no feasible and prudent alternatives exist. Importantly, whether an alternative is “feasible and prudent” cannot depend on the ease, availability, or anticipated success of mitigation or compensatory actions; mitigation may only be considered after avoidance and minimization have been fully evaluated.

- ◆ Direct impacts, for purposes of this evaluation, include wetland dredging (excavation) and filling (placement of soil, rock, or other non-native material). These impacts are long-term and permanent.
- ◆ Indirect impacts refer to potential changes to wetland or stream functions and values that occur without direct disturbance, such as alterations to hydrology, water quality, or ecological connectivity. Indirect impacts may negatively affect the ecological function of these resources but are expected to be similar across the evaluated alternatives and therefore are not specified further in this analysis.

The region in which the Project is located contains scattered wetlands that are closely integrated with the landscape’s natural hydrology. This pattern makes complete avoidance of regulated resources challenging and may limit opportunities for minimization depending on the location of essential mine infrastructure.

4.3.1 Wetland Restoration in Reclamation Planning

Wetland restoration in reclamation planning is relevant to the overall environmental performance of the Project, but it should not be conflated with compensatory mitigation required under Part 303. Under Part 303, the threshold permitting question is whether a feasible and prudent alternative exists that would have less adverse impact on aquatic resources while still being available and capable of being done after taking into consideration cost, existing technology, and logistics. If wetland impacts are ultimately determined to be permissible, compensatory mitigation may then be required as a condition of authorization. That mitigation may include off-site restoration, enhancement, preservation, or other measures authorized under the wetland permitting framework.

By contrast, Part 632 reclamation addresses the restoration and long-term stabilization of lands and features disturbed by mining within the Project footprint. Reclamation may include restoration of wetland areas that are temporarily affected during construction, operations, or closure, but it does not function as a substitute for Part 303 mitigation and should not be treated as satisfying the separate avoidance, minimization, and compensatory requirements of the wetland permit program. Concepts such as wetland banking or off-site wetland creation are therefore not part of the Part 632 reclamation standard itself and should be evaluated separately under the applicable wetland permitting framework.

That distinction is important for this Alternatives Analysis. Under Part 303, reclamation is not part of the determination of whether a less damaging feasible and prudent alternative exists, except to the extent that an alternative’s design materially affects the permanence, extent, or duration of impacts to aquatic resources. Under Part 632, however, the ability of an alternative to support long-term site stabilization and restoration within the mine footprint is a relevant aspect of environmental performance and closure planning.

When considered together, the two programs can provide complementary environmental outcomes. Part 303 may require compensatory mitigation for permitted wetland impacts, while Part 632 requires reclamation of temporarily disturbed mining areas, including restoration of

site conditions where practicable. As a result, the overall regulatory framework may produce regional wetland and aquatic-resource benefits that extend beyond simple no-net-loss concepts, but those outcomes arise from the combined operation of two distinct legal programs with different purposes and standards.

4.4 Cultural Resources

Cultural resource protection is an important aspect of overall Project planning and permitting, but it is not part of the determination of whether a feasible and prudent alternative exists under Part 303. For wetland permitting purposes, the Alternatives Analysis under Part 303 is limited to whether an alternative would have less adverse impact on regulated aquatic resources while still being available and capable of being done after taking into consideration cost, existing technology, and logistics. Cultural, historical, and Tribal resource considerations are therefore not part of the Part 303 alternatives test and are not used in this document to determine whether an alternative avoids or minimizes impacts to wetlands or other aquatic resources.

Cultural, archaeological, historical, and Tribal considerations are instead addressed as part of the broader Project review under Part 632 and other applicable cultural-resource protection requirements. Within that broader framework, it is appropriate to consider whether an alternative is located within previously surveyed areas, whether it extends into undisturbed ground, and whether it may increase the likelihood of affecting known or potential cultural resources, areas of Tribal significance, or locations of cultural patrimony. Site characteristics such as landform, hydrology, soil conditions, and past land use may also inform whether additional investigation is warranted before development proceeds.

Accordingly, cultural-resource considerations are included in this Alternatives Analysis only to inform the broader comparison of Project options and permitting implications under Part 632 and related review processes. They are not part of the legal standard applied to the Part 303 feasible-and-prudent alternatives determination, which remains focused on potential impacts to aquatic resources.

4.5 Recreational Resources and Scenic Resources

As with cultural resources, recreational-resource and scenic-resource considerations are not part of the feasible-and-prudent alternatives determination under Part 303. For wetland permitting purposes, Part 303 Alternatives Analysis is limited to whether an alternative would have less adverse impact on regulated aquatic resources while still being available and capable of being done after taking into consideration cost, existing technology, and logistics. Recreational and scenic considerations are therefore not used in this document to determine whether an alternative is preferable under the Part 303 wetlands test.

Recreational and scenic considerations are, however, relevant to the broader comparison of Project alternatives under Part 632 and other applicable planning and permitting frameworks. Within that broader context, the evaluation may consider how an alternative relates to surrounding land uses, whether it would place new industrial features in previously undisturbed settings, and whether it could affect public viewpoints, recreational access, or the character of nearby natural areas. Alternatives concentrated within or adjacent to previously disturbed industrial areas may have lower incremental scenic and recreational effects than alternatives requiring new disturbance in greenfield settings.

Recreational-resource considerations may include the proximity of alternatives to public lands, trail corridors, water-access areas, or other outdoor-use locations, as well as the potential for temporary access restrictions, noise, dust, lighting, or visual change during construction and operations. Scenic-resource considerations may include visibility from public roads or public use areas and the degree to which an alternative introduces new industrial infrastructure into otherwise undeveloped viewsheds. These considerations are appropriately part of the broader Project comparison, but they do not influence whether an alternative is feasible and prudent under Part 303, which remains focused exclusively on aquatic-resource impacts.

4.6 Ecological, Fish, and Wildlife Resources

The ecological impacts of each alternative are evaluated with attention to habitat integrity, aquatic resource function, and wildlife connectivity. This includes potential effects on fish and wildlife populations, habitat fragmentation, and disruption of aquatic ecosystems and movement corridors. These factors are closely interrelated and are assessed together to provide a comprehensive understanding of each alternative's environmental footprint.

A key consideration in this evaluation is the surface footprint of each alternative. Larger footprints result in greater habitat disturbance and fragmentation, which can affect species movement and ecological function. Additionally, a larger disturbed area tends to capture more precipitation, increasing the volume of water that must be managed on site. This can lead to a higher quantity of discharged water requiring treatment and may influence water quality and aquatic habitat conditions.

Wetland impacts are used as a proxy for evaluating aquatic resource effects, given the critical role wetlands play in supporting biodiversity, regulating hydrology, and maintaining water quality. Alternatives that result in greater wetland disturbance may have a proportionally higher impact on aquatic ecosystems.

The analysis also considers the difference between brownfield and greenfield development scenarios. Brownfield sites, which have been previously disturbed, may offer opportunities to reduce new ecological impacts by concentrating development in areas with existing infrastructure. In contrast, greenfield alternatives typically involve new land disturbance, which may affect intact habitats and require more extensive mitigation.

All alternatives are subject to environmental review and permit conditions that are designed to avoid, minimize, and mitigate ecological impacts. Therefore, this criterion is evaluated using a qualitative, comparative approach, recognizing that protective measures will be applied to all permitted activities.

4.7 Public Health

Public health and safety are key considerations in evaluating alternatives for the proposed mining Project. In accordance with Part 632 of NREPA, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) requires that mining operations be designed and operated in a manner that protects public health, minimizes environmental risks, and ensures long-term site stability.

The Upper Peninsula has a legacy of historic mining activity, and previously developed sites may still contain residual materials or infrastructure associated with past operations. While these brownfield sites can offer advantages in terms of reduced new land disturbance, they may also require additional evaluation to confirm that any remaining materials or conditions do not pose risks to human health or the surrounding environment.

5. Proposed Project and Alternatives Considered

This section describes specified components of the proposed mining project in detail and outlines the alternatives that were considered during Project planning, including the No Action Alternative. The purpose of this section is to present the design and operational concepts for each option without evaluating their relative merits. Evaluation of these alternatives against the regulatory and environmental criteria outlined in Section 4 is provided in Section 6.

5.1 Alternatives Considered but not Carried Forward

5.1.1 Open Pit and In-Situ Mining Methods

While Michigan Part 632 does not explicitly require an Alternatives Analysis in the same way that Part 303 mandates an evaluation of feasible-and-prudent alternatives for wetland impacts, it does require justification of the selected mining method. This includes a technical basis for the method and an explanation of how it supports environmental protection goals. As part of the Project's planning and permitting process, multiple mining methods were evaluated to ensure the chosen approach aligns with both operational and environmental objectives.

Two alternatives, open pit mining and in-situ recovery, were considered but ultimately not carried forward due to significant limitations. Open pit mining, although technically feasible, was deemed impractical due to the depth of the orebody and resulting poor economic viability and extensive environmental impacts. The scale of surface disturbance required for an open pit would result in substantial wetland (including cultural and ecological) destruction, triggering complex mitigation requirements and undermining the Project's environmental goals. Additionally, the cost of overburden and waste rock removal and surface infrastructure would render the Project economically unviable compared to underground mining.

In-situ mining was also evaluated but found to be neither practical nor technically feasible. Although mineralization is chemically amenable to solution-based extraction, the low permeability of the host rock prevents effective fluid movement through the orebody. This means that leaching solutions cannot adequately contact and mobilize the target minerals, making recovery inefficient or impractical. Although solution mining was historically considered and tested in the old underground mine to extract copper from rubbleized pillars, in-situ mining of the full orebody has not been tested in this geologic setting and would require extensive site-specific hydrogeological and metallurgical testing, adding uncertainty and cost to the Project.

As a result, conventional mining and processing methods (underground mining with flotation) are typically favored in such cases because they allow for controlled mechanical liberation and recovery of the minerals.

5.1.2 Off-site Mineral Processing

In the alternative for mineral processing, off-site options were not considered viable due to several key limitations. The local mills, such as Humboldt Mill and the proposed Copperwood facility, have significantly lower throughput capacities than what is required by the WPN Project, making them unsuitable for handling the volume of ore anticipated. Additionally, the existing flow sheets at these facilities differ substantially from the Project's processing requirements, which would necessitate major modifications or compromise metallurgical performance. Furthermore, these off-site options lack capacity for tailings disposal, meaning tailings would need to be transported back to the Project site, introducing substantial cost, logistical,

environmental, and regulatory challenges. As a result, on-site processing remains the only practical and efficient alternative.

5.1.3 Advanced Water Treatment Methods

Several advanced water management strategies were reviewed during the preliminary design phase to determine whether they could provide environmental or operational benefits beyond the proposed approach. These alternatives were ultimately not carried forward for detailed evaluation due to technical, economic, or site-specific constraints, as summarized below.

5.1.3.1 Closed-Loop Water Management System

A closed-loop system would capture, treat, and recycle all contact and process water within the mine circuit, minimizing or potentially eliminating the need for surface water discharge. While this approach provides strong environmental performance and aligns with the avoidance and minimization objectives of Part 303, it would require the construction of substantial additional water storage infrastructure to safely contain process water during periods of high inflow, treatment system downtime, or seasonal variability. The land area needed for these large storage facilities could extend into regulated wetland areas, resulting in new or expanded wetland impacts that may exceed those associated with the proposed action. In addition to the spatial footprint required, a closed-loop system demands advanced water treatment, extensive monitoring, and significantly higher capital and operating costs. For these reasons, this alternative was not carried forward for detailed analysis.

5.1.3.2 Bioremediation

This alternative considered incorporating biological treatment processes, such as constructed wetlands or sulfate-reducing bioreactors, into the water management system to reduce sulfate and metal concentrations. While bioremediation offers sustainability benefits and potential cost savings over time, its performance is highly sensitive to temperature, flow variability, and influent chemistry. These uncertainties, combined with the need for consistent treatment performance to meet Michigan water quality standards, led to this option being screened out at this stage.

5.1.4 Tailings Management

Several tailings disposal strategies were reviewed during the preliminary design phase to determine whether they could provide environmental or operational benefits beyond the proposed approach. These alternatives were ultimately not carried forward for detailed evaluation due to technical, economic, or site-specific constraints, as summarized below.

5.1.4.1 Dry Stack Filtered Tailings

This alternative involves dewatering tailings to a solids content of 80% or greater using filtration technologies such as pressure or vacuum filters, producing a material suitable for placement as a dry stack rather than in a conventional impoundment. Dry stacking is widely regarded as one of the most robust strategies for long-term stability because it eliminates the need for large water-retaining embankments and significantly reduces the risk of catastrophic failure.

From a geotechnical perspective, filtered tailings exhibit high shear strength and low liquefaction potential, allowing for progressive stacking and concurrent reclamation. Closure is simplified by enabling early-stage cover placement and reducing post-closure monitoring

requirements, aligning well with Part 632's objective of achieving a self-sustaining condition without perpetual care.

Water management benefits are substantial. Filtration recovers most process water for reuse, minimizing freshwater demand and reducing the potential for discharge. However, these advantages come at a cost: filtration systems require significant infrastructure, high energy input, and specialized equipment, making this one of the most capital-intensive tailings management options. The upfront investment for filter plants, conveyors, and stacking pads is considerably higher than for thickened or paste tailings systems, and operating costs remain elevated due to maintenance and energy requirements.

From a Part 303 perspective, dry stacking offers a smaller footprint than conventional slurry deposition and can often be sited on upland areas, reducing wetland impacts. At this site, however, implementing a dry stack would require constructing a new storage pad outside the existing tailings facility footprint, likely intersecting regulated wetlands. This introduces additional permitting challenges and mitigation obligations under Part 303.

In summary, while dry stack tailings provide strong environmental and closure performance advantages, the high capital intensity, operational complexity, and need for new land disturbance make this alternative less practicable for the proposed Project. For these reasons, it was considered but not carried forward.

5.1.4.2 Underground Tailings Backfill

This alternative considered returning a substantial portion of tailings underground as paste or thickened backfill to reduce surface storage requirements. Underground backfill can improve ground stability and reduce the size of surface tailings facilities, offering potential environmental benefits. However, this approach is highly dependent on the selected mining method.

The proposed Project is based on a room-and-pillar mining method, which does not create large voids suitable for extensive backfilling. While limited backfill may be used for ground control, the geometry and extraction sequence of room-and-pillar mining do not support the high-volume placement required to materially reduce surface tailings storage. Implementing a full-scale backfill program would require a different mining method, such as longhole stoping or block caving, which is incompatible with the orebody characteristics and current mine design.

From a Part 632 perspective, underground backfill can contribute to stability and reduce surface disturbance, but it does not eliminate the need for a tailings facility. Additional infrastructure, such as a paste plant, distribution pipelines, and underground pumping systems, would represent a major capital investment. These systems are highly specialized and energy intensive, adding significant cost and complexity without achieving meaningful environmental benefit under the chosen mining method.

Part 303 considerations are similar: while reducing surface footprint could lower wetland impacts, the residual need for a tailings facility means that avoidance and minimization objectives would not be fully met. Given the incompatibility with the selected mining method and the high capital intensity of the required infrastructure, this alternative was considered but not carried forward.

5.2 No Action Alternative

The No Action Alternative considers the scenario in which the proposed mining Project is not developed. Under this alternative, no mining permit would be issued under Part 632, and no wetlands permit would be issued under Part 303. Consequently, no new mine or supporting infrastructure would be constructed or operated, and no additional minerals would be extracted. The Project proponent would receive no return on their investment to date, and no new environmental impacts, such as additional surface disturbance, groundwater drawdown, or new wetland alteration would occur.

However, the No Action Alternative does not eliminate all ongoing environmental conditions at the site. The historic tailings basin, constructed and operated as part of past mining activities, would remain in place. This legacy facility continues to contain process-affected waters, including elevated chloride concentrations, and requires ongoing managed discharge under the existing regulatory framework for the foreseeable future. These discharges will remain part of the site's baseline environmental condition regardless of whether the proposed Project moves forward. Thus, while the No Action Alternative avoids new impacts, it does not return the site to an undeveloped or impact-free state; instead, it maintains the existing managed system and its associated long-term obligations.

From a Part 303 perspective, the No Action Alternative inherently avoids any new direct or indirect impacts to regulated wetlands. No additional areas of wetland would be filled or altered, and no new mitigation, monitoring, or compensatory restoration would be required. This outcome aligns with Part 303's preference for avoiding wetland impacts when feasible and prudent alternatives exist, while recognizing that existing hydrologic and water-quality conditions remain unchanged.

Under Part 632, the No Action Alternative has broader implications. Michigan's regulatory framework recognizes the importance of nonferrous metallic minerals, such as copper and silver, not only for economic development but also for environmental sustainability and national security. These minerals are essential for manufacturing clean energy technologies, electric vehicles, and emission control systems. The failure to develop domestic sources perpetuates reliance on foreign supply chains, many of which are geopolitically unstable or environmentally unregulated.

The No Action Alternative also conflicts with federal priorities under the DPA, which has been invoked to accelerate domestic production of critical minerals for national defense and energy security. By not developing the Project, Michigan forfeits an opportunity to contribute to this strategic effort and to strengthen its role in securing the U.S. mineral supply chain.

At the state level, the MI Healthy Climate Plan outlines a pathway to carbon neutrality by 2050, with interim goals for 2030 that depend on the widespread deployment of electric vehicles and modernization of the energy grid. Critical minerals are foundational to achieving these goals. The No Action Alternative reduces Michigan's ability to source these materials locally, potentially delaying or increasing the cost of implementing clean energy infrastructure and electrification initiatives.

In summary, while the No Action Alternative avoids new environmental impacts, it also results in:

- ◆ No contribution to Michigan's clean energy transition.

- ◆ No support for federal critical mineral supply chain resilience.
- ◆ No economic return for the Project proponent.
- ◆ Continued reliance on foreign sources for strategic materials.
- ◆ Continued long-term discharge and water-quality management obligations associated with the existing legacy tailings basin.
- ◆ Loss of regional economic benefits, including the absence of high-paying jobs and forfeiture of state and local tax revenues such as severance taxes that would otherwise support county governments and the Rural Development Fund.

Therefore, although environmentally protective in terms of new impacts, the No Action Alternative does not align with broader public interest considerations under Part 632, nor with Michigan's long-term climate and energy objectives, and it maintains existing environmental conditions rather than eliminating them.

5.3 The Proposed Project (Current Design)

5.3.1 Surface Facility Locations

The proposed surface facility layout reflects the Project team's current preferred configuration following iterative engineering tradeoff evaluation of multiple site layouts. The selected configuration concentrates facilities within and adjacent to previously disturbed industrial areas to the extent practicable, avoids the Village of Ontonagon potable water treatment plant and the Mineral River and its tributaries, and reduces direct wetland impacts relative to other layout configurations evaluated during planning.

The original tradeoff study compared four layout scenarios using a common screening-level basis focused on key cost drivers and operational considerations. Factors such as portal construction, conveyor systems, and major process building requirements were treated as generally comparable across options, while differences in property acquisition, earthworks, utility extensions, demolition requirements, and wetland impacts were used to distinguish the alternatives. Because the current preferred layout has since been refined through subsequent engineering, whereas the other layouts were not advanced to the same level of detail, the comparison is most appropriately understood as a relative planning evaluation rather than a final like-for-like cost estimate.

Several site constraints influenced the development of the preferred layout. The configuration was selected to avoid or reduce conflicts with the Village of Ontonagon potable water treatment plant, the Mineral River and its tributaries, multiple wetland areas, parcels associated with former industrial and portal features, and other site-specific constraints within the historic White Pine Mine industrial setting. The available area for surface facilities is further constrained by the existing tailings disposal facilities to the east and the Mineral River corridor to the west, which limits the range of practical configurations.

At the tradeoff study level, the preferred layout was identified as the most favorable overall because it:

- ◆ Resulted in the lowest direct wetland impact among the surface layout options evaluated;

- ◆ minimized earthworks relative to the other layouts considered;
- ◆ limited the extent of new utility extensions and associated construction disturbance;
- ◆ concentrated development within a compact footprint that makes greater use of previously disturbed industrial areas; and
- ◆ allowed Project earthworks to be integrated with approved construction areas associated with the tailings disposal system and other Project infrastructure.

The preferred layout also includes tradeoffs. In particular, it requires demolition and site preparation within portions of the historic industrial area and required acquisition of additional parcels relative to some other options. Even with those tradeoffs, the layout remained preferred because it provided the best overall balance of operational practicality, compact development, brownfield reuse, and wetland-impact reduction at the planning level on which the alternatives were screened.

Accordingly, Alternative 4 was recommended not because its early-stage screening values should be treated as fixed final design quantities, but because the tradeoff evaluation indicated that it offered the strongest overall combination of reduced wetland impact, efficient use of previously disturbed land, and practical support for mine, processing, and water management infrastructure. As final engineering proceeds, updated permit quantities may differ from the original tradeoff study values; however, the basis for selecting this layout remains its relative performance against the other alternatives considered during siting.

5.3.2 Water Management Strategies

Effective water management is a critical component of the proposed Project and has been developed to support mining and processing operations while minimizing impacts to surface water, groundwater, and wetlands. Consistent with the current Project water management design, the site-wide water management system is organized around separation of contact water and non-contact water, use of controlled collection and routing systems, and integration of reuse, reclaim, and treatment so that mine-affected water is managed within a defined operational framework rather than being allowed to migrate uncontrolled across the site. Detailed design responsibility for underground mine dewatering, internal process plant water management, and systems transporting water to and from the tailings basins lies with the respective mine, mill, and tailings design teams; this section describes the overall Project water management philosophy and the principal interfaces among those systems.

Under the current design basis, contact water generated from process areas, stockpiles, haul roads, and other designated contact surfaces is routed through a system of sumps, storm sewer connections, gravity piping, pressure pipelines, and lined conveyance features to a centralized Contact Water Pond. The Contact Water Pond functions as the primary collection, equalization, and routing facility for Project contact water generated at the surface. Specific flow paths identified in the current design include routing contact water from the Process Plant Area Contact Water Sump to the Contact Water Pond, as well as routing contact stormwater from the southeast watershed, stockpiles, and other contact areas into the same controlled system. Non-contact runoff from designated non-contact watersheds is instead routed through separate non-contact drainage paths and existing or improved non-contact ponds and channels. This separation of contact and non-contact systems is fundamental to the current Project

design and is carried through the Alternatives Analysis as a key environmental protection feature.

The Project water management philosophy also distinguishes, to the extent practicable, between legacy water associated with the historic White Pine Mine and Project-generated contact water associated with new operations. The current design basis treats North Pond 1 (NP1) as a contact-water basin during future operations, while non-contact water associated with legacy conditions is directed to and managed through designated non-contact pathways and, later in mine life, through the stormwater component of North Pond 2 (NP2). Once tailings deposition progresses into NP2, that facility is intended to be operated with separate contact (reclaim) and non-contact (stormwater) compartments established through berms, trenches, and related internal control features to prevent commingling to the extent practicable. The result is a water management approach in which legacy/non-contact water and Project-generated contact water remain operationally distinct within the overall site system, even though final discharges are expected to be addressed within a single renewed and modified National Pollutant Discharge Elimination System (NPDES) permit framework.

Water treatment is integrated with this site-wide framework rather than being applied as a direct point treatment step to each individual source stream. The current water balance and design memoranda indicate that Project-generated contact water, including contact stormwater, mine-related contact water, and water associated with new tailings deposition, is first routed through the contact water and reclaim system. During operations, surface contact water collected in the Contact Water Pond is routed to the appropriate tailings disposal compartment in accordance with the LOM sequence, with initial routing to NP1 and later routing to NP2. Excess reclaim water from the tailings disposal system is then directed to the industrial water treatment plant, where water requiring discharge is treated prior to discharge in accordance with the applicable renewed and modified NPDES permit. This integrated reclaim-and-treatment approach is more consistent with the current design basis than describing each source water stream as independently treated and discharged.

The proposed water management design also incorporates operational storage and hydraulic control measures intended to improve resilience during seasonal runoff and low-probability storm events. The current management philosophy assumes that available storage within NP1 and the reclaim and stormwater compartments of NP2 will be used to buffer inflows from typical operating conditions and design storm events, while pumping and controlled spillway arrangements provide redundancy and protection against overtopping. In that sense, the Project water management approach is not based solely on routine pumping and treatment; it also relies on preserving storage capacity, maintaining operational water levels, and providing controlled overflow and spillway pathways where necessary to safely manage larger storm events. These features are important to both Project operations and long-term environmental performance.

Sanitary wastewater is managed separately from the Project's contact water and non-contact water systems and is not part of the mine water management framework described here. Similarly, non-contact stormwater continues to be managed through separate drainage and sediment control measures outside the contact water system, including the use of non-contact ponds, bypass channels, and construction and operational best management practices appropriate to the watershed setting.

For purposes of this Alternatives Analysis, the principal environmental advantages of the proposed water management strategy are that it concentrates major water management infrastructure within previously disturbed or industrially influenced areas to the extent practicable, minimizes the need for construction of new greenfield contact-water impoundments, supports controlled routing and reuse of contact water within the Project, and reduces the likelihood that stormwater and process-related water management would require broader reconfiguration of surrounding surface water features. In combination with the reuse of the existing tailings disposal footprint, these measures support the Project's broader strategy of minimizing new wetland disturbance and maintaining controlled, monitorable water management over the LOM and through closure.

In summary, the proposed water management strategy supports compliance with both Part 303 and Part 632. From a wetlands perspective, the design emphasizes avoidance and minimization by reusing previously disturbed areas, segregating contact and non-contact water, and limiting the need for new water management footprints. From a mining-permit perspective, the strategy supports controlled operations, reclaim reuse, storm-event resilience, and integration with treatment and discharge systems in a manner intended to protect surface water and groundwater throughout operations, closure, and post-closure.

5.3.3 Transportation and Access Corridors

The Project site is accessible via Michigan State Highway 64, which runs north-south approximately 0.5 kilometers west of the Project footprint, providing the primary road connection to regional transportation networks. In addition, the site is served by an existing rail spur formerly owned by Canadian National (CN) and now operated by Watco, which connects to the Morengo Junction in Ashland County, Wisconsin. Another nearby rail spur, owned by the Escanaba and Lake Superior Railroad, connects southwest to Escanaba and the CN rail grid. Both rail spurs would require refurbishment to support commercial use for mining operations.

For off-site transport of concentrate, the current Project concept is a truck-and-rail logistics strategy in which concentrate would be hauled from the mine site to an off-site transload location with access to the regional rail network, then loaded to rail for shipment to downstream smelter or port destinations. The final transload location and operating arrangement are still under evaluation. For Alternatives Analysis purposes, the key distinguishing characteristic of the proposed transportation strategy is that it reduces long distance trucking relative to a truck-only alternative while avoiding the need to fully rehabilitate rail access directly at the mine site.

This transportation strategy minimizes long distance trucking, leverages existing rail infrastructure, and provides flexibility for future logistics needs.

5.3.4 Mining Method

The proposed Project will employ a modified room-and-pillar underground mining method selected for its suitability to the geometry and geotechnical conditions of the deposit, its operational simplicity, and its ability to limit surface disturbance relative to surface mining alternatives. The selected method uses conventional drill-and-blast mining with permanent support pillars and staged panel development and does not rely on large-scale backfill as part of the base mine plan.

Room-and-pillar mining offers several advantages for this Project. It eliminates the need for paste or cemented backfill, reducing cycle time and simplifying logistics. The method is

straightforward to schedule and execute, as production rates depend primarily on the advance rate of headings and the number of active headings. Detailed production rates, extraction ratios, and panel sequencing assumptions continue to be refined through mine design and scheduling. For purposes of this Alternatives Analysis, the selected underground method is considered technically feasible, operationally practical, and compatible with the required production profile and geotechnical design criteria for the Project.

While ventilation is a key constraint for underground operations, the proposed design incorporates a ventilation system capable of supporting progressive development and expansion into the ore zone. Once established, the room-and-pillar method provides a stable, predictable production profile and supports compliance with Part 632 requirements for safety and long-term stability.

5.3.5 Material Handling

Material handling is a critical component of the proposed Project, designed to ensure operational efficiency, worker safety, and environmental compliance under Part 632. The selected approach integrates underground production haulage with a conveyor-based main haulage system to surface.

Within the underground mine, broken rock from active production headings will be mucked using low profile load-haul-dump units and transferred to underground haul trucks operating within the production areas. Ore will then be delivered to centralized loading stations equipped with grizzlies, ore passes, feeders, and associated handling equipment that discharge to the main conveyor system. The main underground haulage system consists of fixed belt conveyors installed in the primary access declines to transport ore to the portal and onward to the surface material handling system.

This approach reflects a material handling design basis which combines the operational flexibility of truck haulage in the production panels with the lower ventilation demand and lower LOM operating cost of conveyor haulage in the main declines. Temporary material handling arrangements may be required during early development or while permanent infrastructure is being established, but the long-term production basis is truck haulage within production areas feeding a fixed main conveyor system to surface.

5.3.6 Ore Processing

The surface processing plant is based on a conventional beneficiation flowsheet including crushing, grinding, gravity recovery, flotation, concentrate thickening and filtration, and tailings thickening prior to tailings conveyance. This process route is consistent with the current Project infrastructure and metallurgical design basis and is intended to produce a saleable copper concentrate while supporting efficient water recovery and integrated tailings management. Major process operations will be housed within enclosed or covered facilities where practicable to reduce dust, noise, and weather-related operational constraints.

All processing operations, apart from the crushed ore stockpile area, which is planned to be enclosed under a geodesic dome, will be housed within enclosed buildings to minimize dust emissions and noise. The design also incorporates water recycling systems to reduce freshwater demand and align with the Project's overall water management strategy.

5.3.7 Energy Infrastructure

The proposed Project will utilize a hybrid power supply strategy combining utility-imported high-voltage power with on-site natural gas-fired generation operating in parallel. This approach provides two independent sources of power, supports the Project's continuous operating requirements, and reduces reliance on a single external power source.

The current design basis contemplates an on-site turbine generation facility integrated with a high-voltage substation and utility interconnection. Utility power would supply a portion of the Project load, while on-site natural gas generation would provide the balance and enhance overall reliability and flexibility. A natural gas supply connection would support the on-site generation facility, with routing preferentially aligned with existing utility or disturbed corridors where practicable.

For Alternatives Analysis purposes, the key attributes of the proposed power strategy are that it is technically proven, compatible with the Project site layout, and capable of meeting overall Project demand without requiring a fully grid-dependent design. It also reduces the need for separate large standby diesel generation because utility power and on-site generation are intended to operate in parallel. Final generation sizing, equipment selection, and utility interconnection designs will continue to be refined through detailed engineering.

5.3.8 Water Supply

The proposed Project water-supply strategy relies on existing regional water-supply infrastructure associated with Lake Superior and local municipal service. Raw or industrial water for Project needs is available through existing intake and conveyance infrastructure in the White Pine area, while potable water is expected to be supplied through existing local service infrastructure. By relying on existing regional systems rather than developing a new stand-alone raw water source, this approach limits the need for new intake structures and reduces the potential for additional wetland or aquatic-resource disturbance.

5.3.9 Tailings Management

5.3.9.1 Tailings Management Considerations Under Part 303

Tailings management is the primary driver of potential wetland effects because these facilities typically require the largest surface footprint, involve embankment construction and related earthworks, and strongly influence mine site water routing. To conform with Part 303's avoidance and minimization requirements and to reduce new wetland disturbance, the proposed Project prioritizes reuse of the existing, historically disturbed tailings disposal footprint to the maximum practicable extent. This approach is consistent with the preference for utilizing previously altered or industrial sites in lieu of creating new disturbance in currently functioning wetlands.

At the same time, the Project is designed to maintain clear physical and operational separation, to the extent practicable, between legacy water management features associated with the historic operation and the new tailings and contact-water systems required for the WPN Project. Under the Project-specific water management framework, legacy water and Project-generated contact water will be collected, routed, stored, treated, monitored, and discharged as distinct operational systems within a single renewed and modified NPDES permit structure. This means that although one permit will govern the overall tailings-related discharge framework, the permit

will continue to distinguish between legacy discharges and Project-generated discharges through separate management, monitoring, and compliance conditions, as applicable.

To avoid commingling of waters to the extent practicable, legacy water associated with the historic White Pine Mine and those portions of the existing tailings disposal system not used by the Project will continue to be managed through the existing legacy water pathways. Project-generated contact water, including water associated with new tailings placement, new underground mine inflow, process water, and contact stormwater, will be collected and managed within the Project's contact water management and treatment system. This functional separation is important for regulatory clarity because it allows the wetland and aquatic-resource effects of the proposed Project to be evaluated based on Project-specific water balance, treatment, monitoring, and discharge controls, while recognizing that the permit framework for the site is being renewed and modified rather than replaced.

From a wetland perspective, reuse of the existing tailings disposal footprint is intended to avoid and minimize new wetland fill, wetland crossings, and hydrologic alteration relative to alternatives requiring a new greenfield facility. Any modifications required to stabilize, retrofit, or support continued use of the existing embankments and tailings areas are intended, where practicable, to remain within previously disturbed or upland areas and to avoid creating new or expanded wetland impacts. For linear features needed to connect the new processing area to the reused tailings footprint, such as tailings pipelines, reclaim lines, power, and access, the Project will prioritize upland routing, shortest practicable crossings, and construction methods that reduce temporary disturbance. Where wetland impacts are unavoidable, the Project will apply minimization measures such as reduced work width, temporary matting, sequencing, and timing restrictions, and provide compensatory mitigation consistent with Part 303 requirements.

In sum, the tailings management strategy under Part 303 is to: 1) reuse the previously disturbed tailings disposal footprint to reduce new wetland disturbance; 2) maintain practical hydraulic and operational separation between legacy water and Project-generated contact water; and 3) manage all tailings-related water under a renewed and modified NPDES permit framework that distinguishes legacy and Project discharges through Project-specific routing, treatment, monitoring, and compliance conditions. This approach allows wetland impacts from the proposed Project to be evaluated on their own merits while remaining consistent with Part 303's hierarchy of avoidance, minimization, and mitigation.

5.3.9.2 Tailings Management Considerations Under Part 632

Under Part 632, tailings facilities must be designed, operated, and closed in a manner that achieves long-term environmental protection and does not rely on perpetual active care to meet post-closure performance objectives. Consistent with that standard, the proposed tailings management system is intended to achieve chemical and physical stability at closure through a combination of design and operational measures that may include selective handling of reactive materials, controlled water management, seepage collection and control, drainage management, progressive stabilization, and closure measures that limit long-term constituent migration. Closure performance will be supported by site-specific geochemical characterization, water balance modeling, and stability analyses intended to demonstrate that the Project can meet post-closure criteria without reliance on indefinite active treatment as a permanent condition of closure.

To avoid conflating historic and new obligations, the proposed Project is not designed to commingle Project-generated contact water with legacy water to the extent practicable. Instead, the historic tailings-related water systems and the new Project-generated tailings/contact water systems will remain operationally distinct within a single renewed and modified NPDES permit structure. Legacy discharges associated with the existing White Pine Mine and portions of the tailings disposal system not used by the Project will continue to be managed under the legacy component of the permit framework, while Project-generated contact water will be managed, monitored, treated, and discharged, if required, in accordance with Project-specific conditions established under that same renewed and modified permit. This is important because it allows the Project's tailings and water management design to be evaluated against Part 632's long-term performance and closure standards based on Project-specific water quality, treatment, and monitoring commitments, without obscuring those evaluations with unrelated legacy site conditions.

Design and siting decisions for tailings handling also reflect Part 632's environmental protection and reclamation requirements while coordinating with Part 303's wetland avoidance goals. Where feasible, new tailings placement and required modifications to support continued use of the existing tailings disposal system are confined to the previously disturbed footprint to the extent practicable, while ancillary facilities such as pumps, pipelines, access features, and electrical supply are preferentially sited in uplands or disturbed areas to reduce both operational risk and environmental impact. The overall closure concept emphasizes passive or low maintenance long-term stability through reclamation grading, drainage control, revegetation, and management of seepage and contact water so that the Project can transition from operations to closure in a manner consistent with Part 632's long-term performance objectives.

Consistent with the materials management approach described in Section 3.3, the Project is not expected to require a separate long-term waste rock storage facility. Limited development rock will be beneficially reused in required Project earthworks or retained underground, as appropriate.

The result is a tailings management approach that is compatible with both the technical requirements of Part 632 and the wetland-avoidance objectives of Part 303: reuse of the historic tailings footprint where practicable, functional separation of legacy and Project water systems under one renewed and modified permit, and a closure strategy intended to achieve long-term stability without creating new long-term dependence on active care as a permanent feature of closure.

5.3.9.3 Paste-thickened Tailings within the Existing Tailings Disposal Facility

The proposed Project will utilize paste-thickened tailings deposition within the existing legacy tailings disposal facilities, with tailings targeted to a solids concentration of approximately 60% by weight prior to conveyance. Tailings will be deposited first in NP1 and subsequently in NP2 in accordance with the LOM tailings management and water management sequence. This approach supports improved water recovery, controlled deposition, and efficient reuse of the existing historically disturbed footprint while reducing the need for a new greenfield tailings facility. The proposed approach also avoids a separate surface waste rock storage footprint because limited development rock will either be reused as suitable construction material for required tailings-area earthworks or retained underground, rather than placed in a standalone waste rock storage facility.

The paste deposition plan uses the existing NP1 and NP2 within the Tailings Disposal Facility (TDF). Due to the steeper assumed beach slopes of approximately 2%, the deposition system is designed to achieve the required tonnage while maintaining operational safety and stability. The current tailings management design assumes approximately 133.6 million dry tonnes of tailings over the operating life.

Paste-thickened tailings deposition offers significant water management advantages. The high solids content reduces water discharge to the TDF significantly, improving water recovery and reducing reliance on freshwater makeup. This supports a more sustainable site-wide water balance and aligns with Part 632 objectives for water conservation. The design includes maintaining reclaim water ponds within NP1 and NP2, supported by a conveyance channel and berm system in NP2 to separate contact and non-contact water. Existing overflow pipes in NP1 will be abandoned to prevent uncontrolled water transfer between ponds, and spillway modifications will increase reclaim and stormwater storage capacity.

From a closure perspective, paste tailings consolidate rapidly and exhibit low residual pore pressures, enabling earlier implementation of engineered cover systems and progressive reclamation. These characteristics reduce long-term monitoring and maintenance requirements, supporting compliance with Part 632 reclamation standards. The reduced footprint and improved containment integrity also lower the risk of dam breach and downstream impacts, which is consistent with Part 303 objectives to minimize environmental harm.

By utilizing the existing TDF footprint, this strategy minimizes the need for new land disturbance and avoids the creation of an additional tailings facility, thereby reducing potential wetland impacts under Part 303. While some modifications to existing infrastructure are required, the overall environmental risk profile is significantly improved compared to conventional slurry disposal.

5.4 Alternatives Considered

5.4.1 Surface Facility Locations

A screening-level tradeoff study of alternative surface facility locations was completed in 2025 during Project planning and forms the basis for the preferred option carried forward in this analysis.

5.4.1.1 Alternative 1: Preliminary Economic Assessment Baseline Layout – Fully within WPC Property

This alternative reflects the original Preliminary Economic Assessment (PEA) baseline layout, in which the major surface facilities are located entirely within lands already controlled by WPC. The layout was initially attractive because it avoided the need for additional property acquisition and made use of a relatively level area within the historic White Pine industrial setting. The area was also considered favorable from a constructability standpoint because it reduced immediate land control complexity during early Project planning.

At the tradeoff study level, however, this configuration was found to have the greatest direct wetland impact of the surface layout options evaluated. Although it reduced land acquisition requirements, that benefit was offset by higher levels of site preparation, more extensive interaction with wetland areas, and a less favorable overall fit with the evolving surface

infrastructure arrangement. In the context of the broader alternatives evaluation, this option was therefore not preferred because it was less effective at avoiding and minimizing wetland impacts than the alternatives that shifted portions of the facility layout closer to previously disturbed industrial ground.

This alternative remains important to the record because it demonstrates that an “all facilities on existing property” approach was considered early in Project planning and was not selected where it resulted in greater direct wetland impact and a less efficient overall surface arrangement.

5.4.1.2 Alternative 2: Process Plant Closer to Old Industrial Area

This alternative shifted the process plant closer to the historic industrial area while maintaining the portal and related surface facilities in a configuration intended to reduce interaction with surrounding wetlands and site constraints. Relative to the PEA baseline layout, this option reduced direct wetland disturbance by pulling more of the facility arrangement toward previously disturbed ground and away from some of the more constrained areas near the western portion of the site.

At the planning level, this option presented a more favorable wetland impact profile than Alternative 1, but it also introduced tradeoffs related to land control, earthworks, and facility arrangement. In particular, it required acquisition of additional property and a more complex relationship between the portal, process plant, and connecting infrastructure. Although this configuration improved wetland avoidance relative to the original baseline layout, it did not provide the same overall balance of compactness, constructability, and use of previously disturbed industrial land that was ultimately achieved by the preferred layout.

Accordingly, Alternative 2 was considered an improvement over the original baseline layout from a wetland-impact perspective, but it was not selected as the preferred option because the final tradeoff favored a more integrated configuration that better balanced wetland avoidance, site preparation requirements, and infrastructure efficiency.

5.4.1.3 Alternative 3: Former Process Plant Location

This alternative relocated the process plant farther southeast into the area of the former process plant and associated historic industrial disturbance. The principal advantage of this configuration was that it made greater use of previously developed ground and reduced reliance on certain parcels associated with other layout concepts. From a surface siting perspective, it was an intuitively attractive brownfield-oriented alternative because it concentrated development within an area already altered by historic industrial activity.

However, although this option reduced some land control and siting conflicts, it also required additional site preparation associated with the former process plant area, including demolition and redevelopment of legacy features. At the tradeoff study level, it performed better than the original PEA baseline in terms of wetland impact, but not as well as the preferred layout. It also introduced more complexity in facility redevelopment and did not provide the same overall balance of compact development, efficient infrastructure layout, and minimization of new disturbance that was ultimately achieved by the selected configuration.

As a result, Alternative 3 was retained through the comparative siting analysis as a viable brownfield-oriented option, but it was not selected because the preferred layout provided a

stronger overall combination of wetland impact reduction, site efficiency, and practical integration of new facilities with existing site constraints.

5.4.2 Transportation and Access Corridors

Transportation of concentrate from the mine site to a smelting facility is a critical component of the Project's overall design. The selected method influences operational efficiency, cost, safety, and environmental performance. This section describes two transportation alternatives, Truck-Only and Rail-Only, that were considered.

5.4.2.1 Alternative 1: Rail-Only

Under this alternative, all concentrate would be transported exclusively by rail using the existing rail spur located near the proposed site facilities. To implement this option, the rail spur would need to be rehabilitated and upgraded to meet operational and safety standards. A rail loading facility would also be constructed at the mine site, incorporating conveyors or loading bins to handle material efficiently. In addition, coordination with regional rail operators would be required to secure scheduling and capacity for outbound shipments.

This approach offers several operational advantages, including a significant reduction in long-distance truck traffic and associated emissions. However, it would require substantial upfront investment in rail infrastructure and loading systems. Another important consideration is the potential for temporary or permanent disturbance to wetlands during rail spur rehabilitation and grading activities.

From a regulatory perspective, this alternative has implications for both Part 632 and Part 303. While it supports operational efficiency and reduces highway impacts, the necessary rail upgrades could affect regulated wetlands, triggering Part 303 review. The extent of wetland impacts would depend on the scope of grading, drainage improvements, and any new culverts or crossings required.

5.4.2.2 Alternative 2: Truck-Only

This alternative would rely exclusively on highway trucks to transport concentrate from the mine site to the final processing facility, such as smelters in Quebec or Ontario. Similar to the preferred alternative, implementing this option would require construction or improvement of on-site haul roads and a dedicated truck loading area, but the increased truck traffic on regional highways would be extended to accommodate the full transport distance. Additional fuel storage and maintenance facilities at the mine site would likely be necessary to support continuous trucking operations.

The truck-only approach offers logistical simplicity by eliminating the need for rail coordination and provides flexibility in scheduling and routing. However, it would significantly increase reliance on road infrastructure, potentially requiring upgrades to nearby public highways to handle heavy truck loads. This alternative would also result in higher fuel consumption and associated emissions compared to rail-based options.

From a regulatory standpoint, this alternative primarily relates to Part 632, as it affects operational feasibility, safety, and environmental performance factors such as air emissions, noise, and spill risk. It has minimal direct implications for Part 303, since no new infrastructure or wetland crossings would be required.

5.4.3 Mining Methods

For the purposes of this Alternatives Analysis, the criteria of Wetland Impact Avoidance and Mitigation, Cultural Resources, Scenic and Recreational Resources, Ecological, Fish and Wildlife Resources, and Public Health are considered functionally equivalent across all underground mining methods evaluated, Room and Pillar, L-Block Retreat, and Drift and Slash. This is because each method requires similar surface infrastructure, including portals, ventilation shafts, access roads, and support facilities, which are the primary drivers of surface-level environmental and cultural impacts.

Underground mining methods do not differ significantly in their influence on surface hydrology, proximity to wetlands, or groundwater drawdown. All methods are subject to the same mitigation and monitoring protocols under Part 303. Likewise, potential impacts to cultural resources, scenic viewsheds, recreational access, and ecological habitats are tied to surface disturbance and facility placement, not the subsurface extraction technique. Public health considerations, such as air and water quality protections, noise management, and emergency response planning, are also consistent across methods due to shared operational controls and regulatory requirements under Part 632.

A screening-level tradeoff study of alternative underground mining methods was completed in 2024 during Project planning and forms the basis for the preferred method carried forward in this analysis.

5.4.3.1 Alternative 1: Room and Pillar with Partial Pillar Recovery

This method builds upon the standard Room and Pillar approach by incorporating a secondary recovery phase to increase overall ore extraction. Initially, a grid of drifts and crosscuts is developed, creating rooms separated by support pillars, similar to conventional room-and-pillar mining. Once the primary ore extraction is complete in a defined area, paste backfill walls are constructed within the drifts and crosscuts to provide temporary ground support. After backfilling, the pillars are partially mined on retreat, allowing for a higher extraction ratio than standard room and pillar.

While this method improves ore recovery, it introduces additional complexity to the mining cycle. The requirement for backfilling slows production compared to conventional room and pillar, as mining cannot advance until paste walls are placed and cured. Implementing this method would also require the construction of a surface paste backfill plant, increasing both capital and operating costs. The backfill plant and associated infrastructure would expand the surface footprint, potentially resulting in additional wetland impacts under Part 303.

From a geotechnical perspective, this method demands careful design and monitoring to ensure stability during pillar recovery. This alternative was not selected due to geotechnical concerns and the increased operational risk associated with partial pillar extraction. Although the method offers higher ore recovery, these benefits are offset by slower production rates, higher costs, and a larger environmental footprint.

5.4.3.2 Alternative 2: L-Block Retreat

The L-Block Retreat method is a variation of drift-and-slash mining that incorporates backfilling for ground support. This approach begins with the development of a single access drift of planned length, from which L-shaped drifts are driven perpendicular to the main drift. At the end

of the panel access drift, a perpendicular drift is created to provide a free face for blasting, allowing the rock to expand into the void during slashing. This configuration enables the excavation of longer blocks with fewer overall blasts, improving efficiency in material breakage and handling.

Once a slash cell is excavated, a paste backfill wall is constructed, and the area is backfilled to provide temporary ground support. The process is repeated in sequence, retreating toward the main haulage drive. While this method can improve ore recovery and maintain ground stability, it requires a surface paste backfill plant and associated infrastructure, which increases capital and operating costs and expands the surface footprint, potentially resulting in additional wetland impacts under Part 303.

Following a preliminary geotechnical assessment, this method was not fully developed as a viable option for the Project. Concerns included the complexity of sequencing, slower production rates due to backfilling requirements, and increased operational risk associated with ground stability during retreat.

5.4.3.3 Alternative 3: Drift, Slash, and Fill

The Drift, Slash, and Fill (DSF) method is a selective underground mining approach suited for deposits with complex geometry or variable grade distribution. This technique divides the orebody into parallel panels, each developed with a production drift followed by slashing on retreat. Mining advances in a chevron pattern, with slashes typically 4 meters wide on either side of a 6-meter drift, leaving 4-meter pillars between panels. After each slash cycle, a fill cycle occurs, involving fence construction, paste pouring, and curing to maintain ground stability.

Operationally, DSF offers flexibility and improved ore recovery by reducing dilution, which can enhance the value of extracted material. However, these benefits come with trade-offs. Frequent backfill placement, complex sequencing, and slower cycle times result in higher labor and equipment demands. Capital costs are elevated due to the need for paste backfill systems, slurry pipelines, and mixing facilities. Production rates are constrained by geotechnical considerations and paste curing cycles, with an estimated extraction ratio of about 61% and aggregate output of 125 to 163 tonnes per day.

While DSF can optimize recovery in challenging zones, its overall economic efficiency is generally lower than simpler methods such as Room and Pillar, particularly where those methods can achieve similar results with fewer infrastructure requirements.

5.4.4 Material Handling

Efficient movement of ore from underground workings to the surface and through the processing circuit is fundamental to the success of the proposed mining operation. Material handling methods influence not only production rates and operating costs but also ventilation requirements, energy consumption, and overall environmental performance.

5.4.4.1 Alternative 1: Underground Material Movement by Haul Trucks

This alternative would rely exclusively on underground haul trucks to transport ore and waste from production headings to the surface for processing. Under this approach, material would be loaded into diesel-powered trucks at the active heading and hauled through the ramp system to surface facilities, eliminating the need for conveyor infrastructure.

Operationally, a truck-only system offers flexibility in routing and sequencing, allowing equipment to move between headings without fixed infrastructure constraints. It can be advantageous during early development phases or in areas where ore geometry limits conveyor installation. However, this method introduces several trade-offs. Continuous truck haulage increases ventilation requirements due to diesel emissions, elevates fuel consumption, and generates higher heat and particulate loads underground. It also results in greater wear on ramp systems and higher maintenance costs for mobile equipment.

From an economic perspective, truck-only haulage typically involves lower initial capital investment compared to conveyor systems, as it avoids the need for belt installation and drive stations. However, operating costs are significantly higher over the LOM due to fuel, labor, and maintenance demands. Production rates may also be constrained by ramp congestion and cycle times, particularly in deeper sections of the mine.

While this alternative provides operational flexibility, its overall efficiency and environmental performance are generally inferior to conveyor-based systems, especially for long-haul distances where conveyors offer lower cost per ton and reduced energy intensity.

5.4.5 Ore Processing

Ore processing methods determine how copper is recovered from the mined material and have significant implications for operational efficiency, environmental performance, and regulatory compliance under Part 632. While the proposed Project will use conventional grinding and flotation to produce a concentrate for off-site smelting, alternative approaches were considered to evaluate potential differences in water use, chemical handling, and infrastructure requirements.

5.4.5.1 Alternative 2: Gravity Separation

Gravity separation is a physical beneficiation method that uses differences in mineral density to separate copper-bearing particles from gangue. In this approach, crushed ore is processed through equipment such as jigs, spirals, or shaking tables, where heavier particles are concentrated and lighter material is rejected. While this method can reduce reagent consumption relative to flotation, it is generally most effective for comparatively coarse, well-liberated particles and is less effective for fine-grained sulfide mineralization.

For a deposit dominated by chalcocite, gravity separation presents challenges because the mineral commonly occurs in fine-grained form and would likely require additional grinding to achieve sufficient liberation for effective separation. That additional comminution would increase energy demand relative to a flotation-based process and could also increase indirect air emissions associated with power generation for grinding and materials handling. Even with additional grinding, gravity methods typically recover fine sulfide minerals less efficiently than flotation, so this alternative would likely result in lower overall recovery and reduced process efficiency at the scale contemplated for the Project.

5.4.5.2 Alternative 3: Hydrometallurgy

Hydrometallurgy involves dissolving copper from ore using chemical leaching, followed by solvent extraction and electrowinning (SX-EW) to produce refined copper cathodes. For chalcocite ore, acidic leaching solutions are commonly used to break down sulfide minerals, after which copper is recovered through SX-EW circuits.

This method eliminates the need for off-site smelting and can produce market ready cathodes on site. However, it requires extensive solution handling, large leach pads or tanks, and robust water treatment systems to manage acidic effluents. Hydrometallurgy also introduces additional chemical storage and handling requirements, increasing operational complexity and environmental safeguards. While technically viable for chalcocite, this approach would significantly expand the surface footprint and water management infrastructure compared to conventional flotation.

5.4.6 Energy Infrastructure

A screening-level tradeoff study of alternative power supplies was completed in 2025 during Project planning and forms the basis for the preferred layout carried forward in this analysis.

5.4.6.1 Alternative 1: High Voltage Transmission

This alternative considered supplying Project power primarily through an upgraded high-voltage transmission connection rather than through the currently preferred hybrid power configuration. Under this concept, the Project would rely on regional utility infrastructure as the primary source of electrical power and would construct the site electrical infrastructure necessary to receive, transform, and distribute imported power to the mine and process facilities.

At the screening level, this alternative was viewed as technically feasible because regional transmission providers indicated that service could potentially be provided with upstream transmission upgrades and a dedicated high-voltage substation at the mine site. To maintain operational reliability, the alternative also assumed that on-site backup or standby generation would be required to reduce the risk of complete power loss affecting mining, processing, and environmental control systems.

The principal advantage of this alternative is that it would reduce or eliminate the need for permanent on-site gas-fired generation infrastructure. However, it also depends more heavily on external transmission capacity, utility-system upgrades, and the long-term reliability of imported power. As a result, the alternative was considered less favorable from an overall operational resilience standpoint than the currently preferred configuration, which incorporates multiple independent power sources.

5.4.6.2 Alternative 2: Renewable Energy Sources – Wind and Solar

While renewable energy sources like wind and solar align with the MI Healthy Climate Plan and offer long-term sustainability benefits, they were not considered feasible alternatives for powering the proposed WPN Project due to several critical limitations. The mine's large and consistent power demands exceed what current regional wind and solar infrastructure can reliably provide, especially without extensive energy storage systems. Additionally, utility-scale wind and solar installations require substantial land footprints, which in this case would result in significantly greater impacts to regulated wetlands. As a result, renewable energy was not a practical feasible alternative for this Project's operational needs.

5.4.7 Water Supply

5.4.7.1 Alternative 1: Water Supply – Groundwater Wells

The use of groundwater wells as a raw water source was considered but ultimately not carried forward due to a combination of hydrogeological limitations and regulatory considerations.

Under Part 632, any water supply infrastructure must be evaluated in terms of its long-term environmental impact and integration into the overall reclamation plan. In this case, the regional geology presents significant constraints: unconsolidated sediments in the Project area are low yielding, and the underlying Precambrian bedrock has inherently low permeability. Groundwater in the upper bedrock is derived primarily from secondary fracture systems formed by glacial processes, but these fractures diminish rapidly with depth, making deeper zones unsuitable for sustained water extraction.

Groundwater wells would require new infrastructure, including well fields, pumps, and pipelines. The Project area already benefits from existing raw water infrastructure originally developed for mining and now managed by the Village of Ontonagon. This system provides access to high-quality water from Lake Superior, which is abundant and expected to require minimal treatment for use in mineral processing. In contrast, groundwater may require additional treatment to meet process water standards, further reducing its viability.

Although Part 303 wetland regulations do not directly apply to groundwater extraction, they may become relevant if groundwater withdrawal affects surface water features or wetland hydrology. Given the low productivity of the aquifers and the potential for indirect impacts to wetlands, groundwater wells were deemed environmentally and operationally inefficient. As such, this alternative was eliminated from further consideration due to its inability to meet the Project's water supply needs and its inconsistency with the environmental planning and reclamation requirements of Part 632.

5.4.8 Tailings Management

A screening-level tradeoff study of alternative tailings disposal designs was completed in 2025 during Project planning and forms the basis for the preferred option carried forward in this analysis.

5.4.8.1 Alternative 1: Unthickened Tailings within the Existing Tailings Disposal Facility

This alternative involves the deposition of conventional slurry tailings, typically containing 30 to 40% solids, within the existing TDF. Tailings would be hydraulically transported to the facility using standard pipeline systems. While this method is widely used in the mining industry due to its operational simplicity, it introduces several technical and environmental challenges that influence both regulatory compliance and long-term performance.

From a geotechnical perspective, the low solids content of unthickened tailings increases the risk of liquefaction and requires robust embankment design, continuous monitoring, and careful management of differential settlement and segregation. The fluid nature of the slurry also results in flatter beach slopes, which can reduce storage efficiency and necessitate larger containment structures. These factors collectively expand the facility's footprint and complicate stability analyses under Part 632 requirements.

Water management is another critical consideration. Conventional slurry deposition generates significant volumes of decant water, leading to higher evaporation and seepage losses and increasing reliance on freshwater makeup. Extensive reclaim systems would be required to maintain water balance, and the potential for uncontrolled water movement between legacy and new areas would need to be addressed through engineered isolation measures. These characteristics make it more challenging to achieve a near-closed-loop water system, which is a

key objective for minimizing discharge and meeting Part 632's environmental protection standards.

Closure and reclamation under this alternative are typically prolonged. Persistent saturation delays consolidation, complicates cover system design, and often necessitates engineered covers to control infiltration and erosion. Extended post-closure monitoring is generally required to confirm stability and water quality performance, raising concerns about long-term care obligations. While these measures can be implemented to meet Part 632's "no perpetual care" criterion, they require more aggressive engineering and financial assurance compared to thickened or filtered tailings strategies.

From a Part 303 perspective, reusing the existing TDF footprint would reduce new wetland disturbance relative to a greenfield facility; however, the larger operational footprint and need for embankment expansions would result in incremental wetland impacts. Routing of pipelines and ancillary infrastructure would require careful planning to minimize crossings and temporary disturbance. Where impacts are unavoidable, mitigation would be required consistent with Part 303 standards.

In summary, while unthickened tailings deposition within the existing TDF offers operational simplicity it results in higher initial and sustaining capital costs due to the required embankment raises. This method also presents greater challenges for water management, geotechnical stability, and closure performance. These factors increase the complexity of demonstrating compliance with Part 632's long-term stability requirements and Part 303's avoidance and minimization hierarchy.

5.4.8.2 Alternative 2: Thickened Tailings within the Existing Tailings Disposal Facility

This alternative involves increasing tailings solids content prior to deposition in the existing TDF, but to a lower degree than the selected paste-thickened tailings approach. Thickened tailings represent an intermediate option between conventional slurry and paste deposition, offering improved water efficiency and geotechnical performance relative to conventional slurry while retaining greater operational flexibility than a fully paste-based system.

Relative to conventional slurry deposition, thickened tailings would reduce the amount of free water reporting to the TDF, improve beach slope development, and enhance geotechnical stability by lowering the potential for segregation and reducing the volume of mobile water stored within the deposited tailings mass. These characteristics would improve reclaim efficiency and reduce some closure risks relative to a conventional slurry alternative.

However, this alternative was not selected because it does not achieve the same degree of water management and closure benefit as the selected paste-thickened tailings approach. Compared to paste, thickened tailings retain more water within the tailings stream, generate more bleed water after deposition, and require greater reclaim handling and water management within the TDF. As a result, this alternative would be expected to increase the volume of contact water requiring active management, pumping, and potential treatment relative to the selected alternative. It would also result in slower consolidation of deposited tailings and a longer period before closure surfaces could be stabilized and reclaimed. These differences are important in the context of the Project's water management framework, which is designed around

maximizing reuse, minimizing excess reclaim water, and reducing long-term closure and treatment demands.

This alternative also does not provide a material siting advantage over the selected approach and may be less favorable than originally understood during the tradeoff study. The tradeoff study was completed when the Project assumed a shorter mine life and lower total tailings volume. Under the current LOM tailings basis, thickened tailings are not expected to fit entirely within the existing TDF footprint without expansion, which could require additional containment, embankment modifications, ancillary infrastructure, and potentially greater wetland disturbance. While thickened tailings improve upon conventional slurry deposition, they retain more water and provide less storage efficiency than the selected paste-thickened alternative. As a result, this alternative would likely involve greater water management demands and increased expansion risk, without materially improving isolation of new tailings from the historic tailings footprint.

From a Part 303 perspective, this alternative would continue to benefit from reuse of the existing TDF footprint and would avoid the need for a new greenfield tailings facility. However, because it retains more water than the selected paste-thickened alternative, it would require somewhat greater reliance on reclaim pumping, contact water routing, and associated ancillary systems over the LOM. From a Part 632 perspective, it represents an improvement over conventional slurry deposition, but it is less favorable than paste-thickened tailings in supporting reduced contact-water volumes, faster stabilization, and a more efficient path toward long-term closure performance.

In summary, thickened tailings deposition within the existing TDF was considered a technically feasible intermediate alternative, but it was not selected because it does not provide the full water recovery, reduced bleed water, faster consolidation, and closure-related advantages of the selected paste-thickened tailings approach, while still relying on essentially the same legacy TDF footprint and associated ancillary infrastructure.

5.4.8.3 Alternative 3: Tailing Disposal Facilities in Greenfields Locations

This alternative considered constructing a new TDF in an undeveloped, greenfield location rather than reusing the existing footprint. While technically feasible, this approach introduces significant environmental, logistical, and regulatory challenges under both Part 632 and Part 303.

Under Part 632, any tailings facility must be supported by a comprehensive reclamation plan that ensures long-term stability, ecological recovery, and minimal environmental impact. Greenfield sites are typically ecologically intact and hydrologically connected to wetlands and streams. Developing such areas would require extensive clearing, embankment construction, and water management infrastructure, creating permanent alteration of natural landscapes and increasing the complexity of achieving post-closure performance objectives without perpetual care.

Part 303 considerations are even more prohibitive. Most greenfield locations evaluated intersected large expanses of regulated wetlands, triggering stringent requirements for avoidance, minimization, and mitigation. The scale of wetland disturbance associated with these alternatives far exceeded that of the proposed Project or other reuse options. Impacts would include the destruction of high-functioning wetland systems that provide flood storage,

wildlife habitat, and water quality benefits. Demonstrating compliance would require compensatory mitigation, conservation easements, and substantial financial assurance to guarantee long-term wetland function. In practice, the extent and severity of these impacts made mitigation infeasible. Suitable mitigation sites were limited, and replicating the ecological complexity of affected wetlands posed significant challenges.

Beyond environmental concerns, any greenfield alternative would require identifying and acquiring a tract of land large enough to accommodate the tailings facility and close enough to the mine site to be operationally viable. This introduces additional costs, schedule risk, and potential land use conflicts, further reducing the practicability of this option.

From a public interest perspective, the environmental trade-offs of greenfield development were unacceptable. These alternatives would result in far greater wetland loss than any other option considered, conflicting directly with Part 303's hierarchy of avoidance and minimization. For these reasons, and due to the difficulty of meeting Part 632's reclamation standards in an undisturbed landscape, greenfield tailings facilities were eliminated from further consideration.

6. Evaluation of Alternatives

The evaluation of alternatives is guided by the criteria outlined in Section 4 and reflects the regulatory framework established under Michigan's Natural Resources and Environmental Protection Act. This analysis considers both environmental and operational factors to determine whether each alternative represents a feasible and prudent option for the proposed mining Project. Because the Project must comply with two distinct regulatory programs, Part 303 (Wetlands Protection) and Part 632 (Nonferrous Metallic Mineral Mining), the evaluation is divided into three parts:

- ◆ Section 6.1 focuses on alternatives pertinent to Part 303, emphasizing wetland avoidance, minimization, and mitigation.
- ◆ Section 6.2 addresses alternatives pertinent to Part 632, evaluating technical feasibility, closure performance, and compliance with the requirement to avoid perpetual care.
- ◆ Section 6.3 summarizes the evaluation of alternatives.

Each alternative is assessed against the criteria in Section 4, including technical and practical feasibility, Project economics, wetland impacts, cultural and ecological resources, scenic and recreational values, and public health. The goal is to identify the least environmentally damaging practicable alternative that meets the Project's purpose and need while satisfying both regulatory programs.

6.1 Evaluation of Alternatives Pertinent to Part 303 – Wetlands Protection

For purposes of Part 303, the alternatives evaluation focuses on whether a feasible and prudent alternative exists that would have less adverse impact on regulated aquatic resources while still being available and capable of being done after taking into consideration cost, existing technology, and logistics. This section therefore emphasizes wetland and aquatic-resource impacts, the practicality of implementing each alternative, and the extent to which impacts can be avoided or minimized through configuration, method, and siting decisions. Broader public interest considerations such as cultural resources, scenic resources, recreational resources, and public health are addressed separately in Section 7.

6.1.1 Surface Facility Locations

6.1.1.1 Proposed: Project Locations (Current Design)

The proposed surface layout is the preferred configuration from a wetland-permitting perspective because it concentrates facilities within and adjacent to previously disturbed industrial areas to the extent practicable and results in the smallest direct wetland impact among the surface layout options evaluated. The layout is technically and practically feasible because it is compatible with the selected underground mining method, processing arrangement, and supporting infrastructure, and because no significant engineering or logistical barriers were identified that would prevent implementation. In addition, the layout avoids or reduces conflicts with the Village of Ontonagon potable water treatment plant, the Mineral River corridor, and other constrained areas that limit available siting options.

From a wetland-impact standpoint, the proposed layout is preferred because it minimizes new disturbance relative to the other surface siting alternatives evaluated and makes the greatest practical use of previously altered ground. Although wetland impacts remain unavoidable, the

current configuration reflects avoidance and minimization through compact siting, reconfiguration and redesign of facilities, brownfield reuse, reduced earthworks in undisturbed areas, and limitation of new utility and access extensions where practicable. Any remaining unavoidable impacts would be addressed through the applicable Part 303 mitigation process only after avoidance and minimization have been evaluated and ability to permit has been established. On that basis, the proposed layout is the preferred surface siting alternative under the Part 303 alternatives framework.

6.1.1.2 Alternative 1: PEA Baseline Layout – Fully within WPC Property

The original PEA baseline layout is technically feasible and has the practical advantage of avoiding additional property acquisition because it is located entirely within land already controlled by White Pine Copper. However, the advantages of land control and early planning simplicity are outweighed, for Part 303 purposes, by the substantially greater direct wetland impact associated with this configuration. Compared with the proposed layout and other alternatives considered, this option would disturb the largest amount of regulated wetland area and would require a broader zone of site preparation and supporting infrastructure.

Because Part 303 requires serious consideration of whether a feasible and prudent alternative exists that would reduce aquatic-resource impacts, this alternative is less favorable than the current proposed layout. Even if it remains technically available, it is not preferred because it is less effective at avoiding and minimizing wetland impacts than other practical configurations. For that reason, the PEA baseline layout does not represent the least damaging practicable surface siting option among the alternatives reviewed.

6.1.1.3 Alternative 2: Process Plant Closer to Industrial Area

This alternative is also technically and practically feasible and improves upon the PEA baseline by shifting a greater portion of the facility arrangement toward previously disturbed industrial ground. Relative to Alternative 1, it reduces direct wetland disturbance and therefore performs better under the Part 303 avoidance and minimization framework. However, the alternative still introduces a more complex arrangement between the portal, process plant, and connecting infrastructure and requires a larger amount of site preparation and supporting earthworks than the preferred layout.

From a wetlands perspective, this option represents a meaningful improvement over the original baseline layout, but it is still less favorable than the current proposed configuration because it does not achieve the same overall combination of compactness, brownfield reuse, and reduced wetland effect. Accordingly, while this alternative is feasible and prudent in a general sense, it is not preferred because another available configuration, the current proposed layout, accomplishes the Project purpose with less adverse impact to aquatic resources.

6.1.1.4 Alternative 3: Former Process Plant Location

This alternative would place the process plant within the former process plant area and thus makes substantial use of previously developed ground. From an aquatic-resource perspective, that is a meaningful advantage because it avoids some of the new disturbance that would otherwise occur in less disturbed portions of the site. The alternative is technically feasible, but it also requires more redevelopment of legacy industrial features and a more complex site-preparation effort than the preferred layout.

Although this alternative performs better than the PEA baseline in terms of wetland impact, it still does not perform as well as the preferred layout. Its greater redevelopment complexity and less favorable overall integration of facilities mean that it does not offer the same balance of practicality and wetland minimization achieved by the selected configuration. Under the Part 303 alternatives test, it therefore remains inferior to the proposed layout because a less damaging feasible and prudent configuration has already been identified.

6.1.2 Transportation and Access Corridors

6.1.2.1 Proposed: Transload Facility

The proposed truck-and-rail transload strategy is intended to reduce long-distance trucking while avoiding the need to fully rehabilitate rail access directly at the mine site. At the current stage of planning, the strategy is technically and practically feasible because it relies on conventional concentrate handling, truck transport, and rail transload operations, all of which are well-established methods.

From the mine site perspective, the principal wetland-related advantage of the proposed transportation strategy is that it avoids more extensive on-site rail rehabilitation and associated corridor disturbance while still reducing long-haul truck dependence. The proposed strategy remains the preferred transportation concept because it appears capable of reducing overall infrastructure burden at the mine site without introducing the larger on-site wetland effects associated with a rail-only option.

6.1.2.2 Alternative 1: Rail-Only

The rail-only alternative is technically feasible, but it would require rehabilitation and upgrading of the existing rail spur and associated loading infrastructure near the mine. From a wetland permitting standpoint, the key concern is that rail rehabilitation could require grading, culvert work, drainage improvements, and corridor construction activity in areas that may intersect wetlands or affect aquatic-resource functions. That makes this alternative less favorable than the proposed transportation concept if equivalent Project benefits can be achieved with less corridor disturbance.

Although rail-only transport offers operational efficiency and reduces long-distance highway trucking, it is not preferred under Part 303 because it likely requires greater on-site linear infrastructure disturbance and associated wetland impact potential than the proposed truck-and-rail transload strategy. In that sense, the proposed transportation concept appears to provide a less damaging feasible and prudent means of achieving the Project purpose.

6.1.2.3 Alternative 2: Truck-only

The truck-only alternative is technically straightforward and would make use of existing road infrastructure and conventional concentrate hauling methods. From a strictly mine-site wetland perspective, this alternative may have fewer direct wetland impacts than a rail-only approach because it avoids rehabilitation of the rail spur and associated corridor disturbance. However, it would also require greater ongoing dependence on highway trucking and does not provide the same overall logistics balance as the proposed transload concept.

For Part 303 purposes, the truck-only alternative appears capable of limiting direct mine-site wetland impacts, but the record currently supports the proposed transload strategy as a more

balanced approach that reduces the need for extensive on-site rail work while also reducing long-distance trucking relative to a truck-only system. Final preference between these two approaches should remain tied to the final logistics study and any resulting wetland-impact comparison for the selected transload location and mine-site infrastructure.

6.1.3 Tailings Management

6.1.3.1 Proposed: Paste-thickened Tailings within the Existing Tailings Disposal Facility

The proposed tailings management approach reuses the existing historic TDF footprint and places paste-thickened tailings within NP1 and NP2. From a Part 303 perspective, this is the preferred tailings alternative because it avoids the need for a new greenfield tailings facility and minimizes new wetland disturbance by making use of an already altered industrial footprint. Under this alternative, the LOM tailings volume fits within the existing footprint of the TDF without the need for any dam expansions. The approach is technically feasible and compatible with the selected mining and processing design, and it provides the strongest overall wetland-performance profile among the tailings options evaluated.

The aquatic-resource advantage of the proposed approach is not limited to footprint reuse. Paste-thickened tailings also reduce the amount of free water reporting to the TDF relative to lower-solids alternatives, which supports reduced reclaim handling, reduced contact-water volumes, and a more controlled water management framework. Ancillary infrastructure such as pipelines and reclaim systems would still need to be routed and constructed carefully, but the selected approach minimizes both the need for new disposal footprint and the long-term burden on-site water management relative to the alternatives considered. For those reasons, it represents the preferred tailings alternative under the Part 303 alternatives framework.

6.1.3.2 Alternative 1: Unthickened Tailings within the Existing Tailings Disposal Facility

This alternative would also reuse the existing TDF footprint, which is a significant advantage relative to any greenfield tailings facility. However, because conventional slurry tailings retain substantially more water and require more extensive management of reclaim, decant water, and embankment performance, the alternative would likely increase the operational area and water management burden within the TDF relative to the proposed paste-thickened approach. It is technically feasible, but it is less favorable from a wetland and aquatic-resource perspective because it would create a larger water management footprint and require additional embankment-related disturbance over time.

Accordingly, although this alternative is feasible, it is not preferred under Part 303 because another available option, the proposed paste-thickened approach, achieves the same basic purpose with less adverse impact to aquatic resources and less long-term reliance on expanded water management and containment measures.

6.1.3.3 Alternative 2: Thickened Tailings within the Existing Tailings Disposal Facility

This alternative represents an intermediate option between conventional slurry and the selected paste-thickened approach. Like the proposed Project, it would initially reuse the existing TDF footprint and therefore avoid the large new wetland impacts associated with development of a

greenfield tailings facility. It is also technically feasible and provides an improvement over conventional slurry deposition in terms of reduced free water, improved reclaim efficiency, and improved geotechnical behavior.

However, compared with the selected paste-thickened approach, this alternative would still retain more water in the deposited tailings, generate more bleed water, and require greater reclaim handling and water management within the TDF. In addition, the original tradeoff evaluation was completed when the Project assumed a shorter mine life and lower total tailings volume. Under the current LOM tailings basis, thickened tailings may not be fully accommodated within the existing TDF footprint without additional storage capacity. As a result, this alternative could require embankment expansion, additional containment or drainage infrastructure, and associated ancillary construction, which could lead to additional wetland impacts.

Therefore, this alternative does not provide the same degree of wetland and aquatic-resource minimization as the selected paste-thickened approach, even though it improves on the conventional slurry alternative. It was therefore not preferred because the selected paste-thickened alternative provides a better general benefit of reusing the existing TDF footprint while better reducing contact water volumes, improving storage efficiency, reducing operational water-management burden, and lowering the risk that additional TDF expansion would be required to accommodate the full LOM tailings volume.

6.1.3.4 Alternative 3: Tailings Disposal Facility in Greenfields Locations

Greenfield tailings disposal locations are technically feasible in the abstract, but they are the least favorable alternatives under Part 303 because they would require construction of a new large footprint facility in undeveloped areas, with extensive direct wetland disturbance, hydrologic alteration, and associated ancillary infrastructure. Relative to all reuse alternatives, greenfield disposal introduces substantially greater aquatic-resource impacts and would require far more extensive avoidance, minimization, and compensatory mitigation.

Because the Project can achieve its purpose by reusing the existing disturbed tailings footprint, a greenfield tailings facility is not the preferred alternative under Part 303. The ability to use the existing TDF means that a less damaging feasible and prudent alternative to greenfield disposal has already been identified. On that basis, greenfield tailings sites were appropriately eliminated from further consideration in favor of the reuse-based alternatives.

6.2 Evaluation of Alternatives Pertinent to Part 632- Nonferrous Metallic Mining

6.2.1 Mining Method

6.2.1.1 Proposed: Room and Pillar

The proposed mining method for the Project is modified room-and-pillar mining. This method is well suited to the geometry and geotechnical conditions of the orebody, provides predictable ground control, and limits the overall surface disturbance relative to more expansive mining alternatives. From a Part 632 perspective, this method is preferred because it is technically proven, operationally straightforward, and compatible with the Project's production profile, ventilation design, and closure planning objectives. It does not require large-scale backfill as

part of the base mine plan, which simplifies underground logistics and reduces the infrastructure and materials handling burden associated with more complex mining systems.

Room-and-pillar mining also performs favorably from an economic and environmental standpoint. It offers a relatively low unit mining cost compared with more complex alternatives, supports predictable production scheduling, and minimizes technical risk. Because the method results in a comparatively limited surface footprint for active mine infrastructure, it also reduces the scale of surface disturbance, habitat fragmentation, and potential indirect effects on water and ecological resources relative to more disruptive mining approaches. From a health and safety standpoint, the method benefits from mature industry practices, well-understood ventilation requirements, and a relatively simple production sequence. Taken together, these factors make room-and-pillar mining the preferred alternative under Part 632.

6.2.1.2 Alternative 1: Room and Pillar with Partial Recovery

This alternative would increase ore recovery by removing selected pillars after initial extraction. Although the method offers the potential to improve resource recovery, it also introduces materially greater geotechnical complexity and operational risk than the proposed room-and-pillar approach. Partial pillar recovery requires enhanced ground control, additional monitoring, and more complex sequencing to manage the change in support conditions during retreat. These additional requirements increase technical uncertainty and reduce the simplicity and predictability that make the selected room-and-pillar method attractive.

From an economic standpoint, increased ore recovery could improve revenue, but that benefit is offset by higher costs for support, sequencing, and geotechnical risk management. Surface disturbance would not differ substantially from the proposed method, but the potential for localized instability or subsidence introduces additional closure and long-term performance considerations under Part 632. For those reasons, room-and-pillar with partial recovery was not preferred. It remains technically possible, but it is less favorable than the selected method because it adds risk and complexity without a commensurate overall advantage in environmental or operational performance.

6.2.1.3 Alternative 2: L-Block Retreat

L-Block Retreat was evaluated as an underground mining alternative that could potentially improve ore recovery through retreat sequencing, but it is more complex than the selected room-and-pillar method. This alternative would require more demanding mine planning, more robust ground support, and greater operational control to maintain stability during retreat. While technically viable, the added complexity makes it less attractive from a Part 632 standpoint, where predictability, mine stability, and practical implementation are central considerations.

Economically, the method could provide somewhat greater recovery, but that benefit is offset by a more complex sequencing regime, increased support requirements, and a higher overall implementation burden. Surface impacts would be broadly similar to the selected underground method because the core mine access and support infrastructure would still be required, but the greater geotechnical complexity and potential for surface deformation if not carefully managed reduce its attractiveness from a mine-permit perspective. L-Block Retreat was therefore considered a technically possible, but less favorable alternative, appropriate only if maximizing recovery were prioritized over simplicity, stability, and reduced operational risk.

6.2.1.4 Alternative 3: Drift, Slash, and Fill

DSF is a more selective underground mining method that uses backfill to maintain stability and can reduce the amount of tailings requiring surface storage. However, the method is substantially more labor intensive and operationally complex than room-and-pillar mining. It requires continuous backfill preparation and placement, more complicated production sequencing, and a more intensive underground materials logistics program. Although technically feasible, it is less efficient for a large, laterally extensive orebody of the type proposed for the Project.

Economically, DSF is disadvantaged by slower production rates, higher labor intensity, and the requirement for binder and backfill infrastructure. While reduced surface tailings demand could provide some environmental benefit, those gains are offset by the need for additional surface facilities and by more complex underground operations. From a Part 632 perspective, it does not provide the same balance of practicality, cost effectiveness, and operational reliability as the selected room-and-pillar method. Accordingly, DSF was not carried forward as the preferred primary mining approach, though some of its features could remain relevant at a limited, supplemental scale if needed.

6.2.2 Material Handling

6.2.2.1 Proposed: Underground Material Movement by Conveyor

The proposed underground material handling system combines production area load-haul-dump units and trucks with a conveyor-based main haulage system to surface. This approach is preferred because it combines the flexibility needed in production headings with the lower LOM operating cost and lower ventilation demand associated with conveyor haulage in the main declines. For the Project's tonnage and mine geometry, this is a technically proven and operationally practical arrangement. It supports stable throughput, reduces dependence on diesel haulage for long underground travel distances, and fits well with the selected mining method.

Although the conveyor system requires higher initial capital investment than a truck-only alternative, it provides lower operating cost over time through reduced fuel use, lower equipment maintenance, and more predictable material movement. It also performs better environmentally and from a worker health standpoint because it reduces underground diesel emissions, lowers heat load, and reduces ventilation demand. Surface disturbance associated with the conveyors and associated support facilities is limited and can be concentrated within previously disturbed areas, which helps support the Project's broader environmental performance objectives. For these reasons, the conveyor-based system is the preferred material handling alternative under Part 632.

6.2.2.2 Alternative 1: Underground Material Movement by Haul Trucks

Truck-only underground haulage is a well-established mining method and offers flexibility, particularly in early development or in areas where fixed infrastructure is not yet installed. However, for the sustained mining profile anticipated for the Project, truck-only haulage is less favorable than the proposed conveyor-based approach. Continuous underground truck operation would increase diesel emissions, heat load, and ventilation demand, while also increasing maintenance requirements and ramp congestion.

Economically, the truck-only option has lower initial capital cost because it avoids conveyor installation, but it is less favorable over the LOM due to substantially higher fuel, labor, and equipment maintenance costs. Operationally, production efficiency may also be reduced because haul cycles become more sensitive to depth, congestion, and ramp conditions. From a Part 632 perspective, truck-only haulage was not preferred because its long-term operational and environmental performance is inferior to the selected conveyor-assisted system, particularly with respect to ventilation burden, worker exposure to diesel particulate matter, and sustained mine efficiency.

6.2.3 Ore Processing

6.2.3.1 Proposed: Ore Processing by Traditional Grinding and Flotation

The proposed ore processing method is conventional grinding and flotation, consistent with the current metallurgical and infrastructure design basis for the Project. This is the preferred processing approach because it is a mature and well-understood method for copper sulfide ores and is capable of achieving reliable recovery with conventional, commercially proven equipment. The process route supports production of a marketable concentrate while integrating well with the Project's water management and tailings handling framework.

From an economic perspective, conventional flotation offers predictable recovery and stable operating cost relative to more speculative or specialized alternatives. While capital investment is significant, the technology is well established, minimizing technical risk and supporting long-term operational reliability. The processing plant is also planned within a previously disturbed industrial setting, reducing the need for new site disturbance. Enclosed operations, water recycling, and standard reagent handling practices support environmental control and worker protection. Taken together, conventional grinding and flotation provide the strongest balance of technical reliability, economic viability, and environmental compatibility, making this the preferred ore processing alternative under Part 632.

6.2.3.2 Alternative 2: Ore Processing by Gravity Separation

Gravity separation offers the theoretical advantage of lower reagent use and potentially lower water demand than flotation, but it is not well suited to the fine-grained chalcocite-dominant mineralization present at White Pine. To achieve sufficient liberation for gravity recovery, the ore would require additional grinding, which increases energy demand and associated indirect emissions. Even with finer grinding, recovery of fine sulfide minerals would be expected to remain lower than with flotation.

While gravity separation equipment may have lower capital cost than a full flotation circuit, the reduction in recovery would materially reduce economic performance. Additional comminution also increases operating cost and can offset some of the apparent simplicity of the method. From a Part 632 perspective, gravity separation was not preferred because it does not provide a technically or economically robust processing solution at the scale and ore characteristics contemplated for the Project. Its lower recovery and greater grinding burden make it inferior to conventional flotation despite some potential reduction in reagent use.

6.2.3.3 Alternative 3: Ore Processing by Hydrometallurgy

Hydrometallurgy was also considered as an alternative processing route. This method could theoretically produce refined copper cathodes on site through leaching, solvent extraction, and electrowinning, thereby reducing dependence on off-site smelting. However, the approach is

operationally much more complex than flotation and would require extensive chemical handling, large solution-management infrastructure, and significantly expanded water treatment needs.

Although hydrometallurgy is proven for certain copper ores, it is less commonly applied to large-scale sulfide operations of this type and would require substantially more testing and engineering confirmation to reduce technical uncertainty. Capital cost for leach pads, solution ponds, SX-EW facilities, and associated water treatment systems would be high, and operating costs would also increase because of reagent use and effluent management. The method would also likely expand the Project's surface footprint relative to conventional flotation. Under Part 632, hydrometallurgy was not preferred because of its technical complexity, larger infrastructure demand, and less favorable economic profile outweigh the potential advantage of producing refined copper on site.

6.2.4 Energy Infrastructure

6.2.4.1 Proposed: Power Supply – Gas Turbine and High-Voltage Transmission

The proposed power supply strategy is a hybrid configuration combining utility imported high-voltage power with on-site natural gas-fired generation operating in parallel. This is the preferred alternative because it provides two independent power sources, supports the Project's continuous operating needs, and reduces reliance on a single external utility connection. It is a technically proven arrangement for industrial operations and is compatible with the Project site layout and infrastructure plan.

From an economic perspective, the hybrid system requires significant capital investment, but it provides better long-term cost stability and operational resilience than a fully grid-dependent alternative. On site gas-fired generation reduces vulnerability to external grid constraints, while the utility interconnection provides redundancy without the same dependence on large back-up diesel systems. Environmentally, the system can be integrated within the existing industrial footprint and routed along disturbed or utility corridors where practicable, limiting incremental disturbance. For these reasons, the hybrid power strategy is the preferred energy alternative under Part 632.

6.2.4.2 Alternative 1: High-Voltage Transmission

This alternative would supply Project power primarily through an upgraded high-voltage transmission connection, supplemented by back-up diesel generation. It is technically feasible, but its practicality depends on upstream transmission upgrades and continued regional grid reliability. While a grid-dominant power strategy reduces or eliminates the need for permanent on-site gas generation infrastructure, it also introduces greater dependence on external utility capacity and backup generation.

Economically, this alternative may appear less capital intensive at a screening level than a hybrid on-site generation system, but it carries additional long-term uncertainty associated with grid pricing, upstream system upgrades, and standby diesel operation and maintenance. From an operational and environmental standpoint, the alternative is less favorable because it provides less resilience and requires greater reliance on diesel backup to protect critical mine and environmental control systems during outages. Under Part 632, the grid-only alternative was therefore not preferred because it is less robust from an operational continuity and long-term risk standpoint than the selected hybrid configuration.

6.2.4.3 Alternative 2: Renewable Energy Sources – Wind and Solar

Renewable energy sources such as wind and solar were considered as a supplemental or conceptual alternative because they align with broader sustainability goals. However, they are not practical as the primary power source for the Project because the mine's load is large, continuous, and highly reliability sensitive. Without very large-scale energy storage systems, wind and solar cannot provide the consistent power needed to operate mining, ventilation, and processing systems.

Economically, this alternative is disadvantaged by the very high capital cost associated with utility-scale renewable generation and storage, as well as the land area required for implementation. Operationally, the variability of renewable generation creates a significant challenge for an underground mine and processing plant requiring stable, uninterrupted power. For these reasons, renewable energy as a primary stand-alone Project power source was not considered a feasible and prudent alternative under Part 632, even though it may remain relevant as a supplemental sustainability measure in the future.

6.2.5 Water Supply

6.2.5.1 Proposed: Water Supply – Municipal

The proposed water supply strategy relies on the existing municipal system associated with the Village of Ontonagon and regional infrastructure drawing from Lake Superior. This is the preferred alternative because it makes use of existing, historically mining-related infrastructure, minimizes the need for new water-supply construction, and provides a stable and sustainable water source for both process and potable needs. From a Part 632 standpoint, the strategy is technically straightforward, economically favorable, and environmentally responsible.

Using existing water-supply infrastructure significantly reduces capital costs relative to development of new raw-water sources and reduces the overall Project footprint by avoiding new intake construction and extensive new pipelines or well fields. The system is also well suited to the Project's long-term needs because it relies on a large and dependable regional source rather than low-yield local groundwater. Its use supports overall Project sustainability in combination with the site water recycling and reclaim strategies. For those reasons, the municipal/regional water-supply approach is the preferred alternative under Part 632.

6.2.5.2 Alternative 1: Water Supply - Groundwater Wells

Groundwater wells were considered as an alternative water source but were not preferred because the regional hydrogeologic conditions are not favorable for reliable, sustained water supply at the scale required by the Project. Available information indicates that unconsolidated materials in the Project area are low yielding and that bedrock permeability diminishes significantly with depth, making groundwater supply less dependable than use of existing regional infrastructure connected to Lake Superior.

Development of well fields would also require new pumps, pipelines, and associated support infrastructure, increasing both environmental complexity and capital cost. Additional treatment might be needed to meet process-water standards, further reducing the attractiveness of this alternative. Under Part 632, groundwater wells were therefore not preferred because they are less reliable, less efficient, and less sustainable than leveraging the existing regional raw-water and potable-water system already available to the Project.

6.3 Summary of Alternatives Evaluated

The Alternatives Analysis indicates that the proposed WPN Project configuration represents the preferred overall combination of technical feasibility, operational practicality, and environmental performance among the alternatives evaluated. Across the major Project components, surface facility siting, transportation, mining method, material handling, ore processing, energy infrastructure, water supply, and tailings management, the selected alternatives consistently make use of previously disturbed or industrially influenced areas where practicable, rely on established and commercially proven technologies, and reduce the need for more expansive or higher-risk infrastructure. Alternatives that were not selected generally involved either greater wetland and aquatic-resource impact, greater technical or operational complexity, higher long-term environmental risk, or a less favorable balance of constructability and closure performance.

From the perspective of Part 303, the preferred Project configuration is supported by the finding that no other feasible and prudent alternative evaluated would achieve the Project purpose with less adverse impact on regulated aquatic resources while still being available and capable of being done after taking into consideration cost, existing technology, and logistics. The analysis shows that reuse of previously disturbed industrial areas for surface facilities, reuse of the existing tailings disposal footprint, and selection of a water management approach centered on controlled contact-water routing and treatment collectively reduce direct wetland impacts and limit the need for new greenfield disturbance. Alternatives that would have required larger wetland footprints, more extensive corridor construction, or construction of a new tailings facility on undisturbed land were not preferred because they would have increased adverse effects on aquatic resources relative to the selected configuration.

From the perspective of Part 632, the preferred alternatives are those that best support safe and efficient mine operation, environmental protection during operations, and long-term closure performance. The selected underground mining and material handling approach provides the most practical combination of stable production, manageable ventilation demand, and reduced operational risk. The selected processing, power, water supply, and tailings management approaches are preferred because they are technically proven, compatible with the Project's infrastructure and ore characteristics, and more supportive of long-term reclamation and closure objectives than the alternatives considered. Taken together, the preferred configuration provides the strongest overall alignment with the EIA requirement to evaluate feasible and prudent alternatives and explain why the chosen alternatives are preferred.

The alternatives evaluation indicates that the proposed Project configuration provides the strongest overall balance of technical feasibility, environmental performance, and operational practicality under Part 632, while also minimizing wetland and aquatic-resource impacts to the extent practicable under Part 303. A qualitative summary of the preferred alternatives and the principal reasons for their selection is provided in Table 6-1.

7. Public Interest Evaluation

This section evaluates the proposed WPN Project in relation to the public interest considerations applicable to permitting under Part 303 of the NREPA. Under MCL 324.30311, a permit may not be approved unless EGLE determines that issuance of the permit is in the public interest, that the permit is necessary to realize the benefits derived from the activity, that the activity is otherwise lawful, and that unacceptable disruption to aquatic resources will not result. In making that determination, EGLE balances the reasonably expected benefits of the proposal against the reasonably foreseeable detriments, considering factors such as public and private need, feasible and prudent alternatives, permanence of effects, cumulative effects, ecological and recreational values, public health, wetland acreage, proximity to waterways, and economic value to the general area. EGLE's public guidance similarly states that a wetland permit may be issued only if the activity is in the public interest, is necessary to realize the benefits of the activity, will not cause unacceptable disruption to aquatic resources, and is wetland dependent or has no feasible and prudent alternative.

The public interest evaluation presented here is based on the Project purpose and need, the alternatives evaluated in this document, the site's brownfield context, and currently available policy and planning information relevant to copper supply, energy transition, and regional economic conditions. The intent of this section is not to advocate for the Project in the abstract, but to identify the Project-specific facts that are relevant to the statutory balancing required under Part 303.

Unlike the feasible-and-prudent alternatives evaluation under Part 303, which is focused on whether a less damaging alternative to aquatic resources exists, the public interest evaluation appropriately considers the broader effects of the proposal on recognized historic, cultural, scenic, recreational, ecological, and public health values as identified in MCL 324.30311(2). Part 303 specifically identifies "extraction and processing of nonfuel minerals" as potentially unavoidable in the context of wetland-dependent projects, indicating mining's heightened relationship to the broader public interest more generally (MCL 324.30302(d)).

7.1 Public Need and Project Benefit

The WPN Project is intended to develop a geologically fixed copper-and-silver deposit at a previously disturbed mining site in Ontonagon County. As described in Section 2, the Project purpose is to exercise WPC's mineral rights to extract copper with associated silver mineralization and produce saleable concentrates in a manner that is environmentally responsible during operations and that supports effective reclamation and closure. Because the mineral resource is fixed in place, the Project cannot be relocated to avoid all site-specific constraints; consequently, the Alternatives Analysis focuses on feasible mining, processing, infrastructure, and tailings-management configurations that can achieve the Project purpose while reducing impacts to the greatest extent practicable.

Copper is a foundational industrial material used in electrical transmission and distribution systems, electrified transportation, renewable energy equipment, telecommunications, and water infrastructure. This document also identifies copper as strategically important because of its role in electrification, grid modernization, and broader industrial systems. That context is relevant to the public interest analysis because MCL 324.30311 directs EGLE to consider both the relative extent of public and private need and the economic value of the proposed land change to the general area.

Michigan's broader climate and energy policy framework provides additional context for public need. The MI Healthy Climate Plan identifies a path toward economy-wide carbon neutrality by 2050 and emphasizes expanded electrification, grid modernization, renewable energy deployment, and associated infrastructure development. EGLE's summaries of the 2023 clean energy legislation likewise describe those laws as implementing key elements of the MI Healthy Climate Plan and accelerating the state's transition in the electricity, transportation, and building sectors. Although those state policies do not determine the outcome of a wetland permit decision, they do provide evidence that the end uses of copper are tied to current state planning and infrastructure priorities rather than to speculative future demand alone.

7.2 Brownfield Setting and Existing Site Conditions

The proposed Project is located within and adjacent to a historically disturbed mining setting rather than a previously undeveloped greenfield site. As described in this Alternatives Analysis, the WPN Project would redevelop portions of the former White Pine Mine site, including areas affected by prior mining, processing, and tailings management activities. Existing industrial disturbance, legacy tailings facilities, and preexisting water-management features are therefore part of the site context against which alternatives have been evaluated. This brownfield setting is relevant to the public interest determination because it bears on the relative environmental consequences of the proposal and on the availability of practical alternative locations and methods under MCL 324.30311(2).

The No Action Alternative would avoid new direct wetland impacts, but it would not eliminate all existing site conditions associated with the historic mine. As described in Section 5.2, the No Action Alternative would leave the existing historic tailings facilities and associated managed conditions in place while foregoing the benefits associated with redevelopment of the site and extraction of the resource. This does not diminish the environmental value of the No Action Alternative with respect to avoiding new impacts, but it is relevant to the public interest analysis that the baseline condition is an already altered brownfield landscape rather than an undisturbed natural setting.

7.3 Feasible and Prudent Alternatives

Part 303 requires consideration of the availability of feasible and prudent alternative locations and methods to accomplish the expected benefits of the activity. This Alternatives Analysis evaluates alternatives related to surface facility siting, transportation and access, mining method, material handling, ore processing, energy and utility infrastructure, and tailings management. For purposes of the wetland-focused Part 303 review, the analysis places particular emphasis on reuse of previously disturbed areas, use of existing industrial footprints where practicable, and reuse of the legacy tailings footprint to reduce new wetland disturbance.

The alternatives comparisons in Sections 5 and 6 indicate that several alternatives would result in greater direct wetland disturbance, greater land conversion, or both. In particular, the analysis identifies reuse of the existing tailings footprint as less impactful than greenfield tailings disposal and indicates that some alternative site layouts would require larger wetland disturbance than the current proposed layout. Greenfield tailings alternatives are described as introducing larger wetland impacts, greater habitat fragmentation, and greater cumulative land disturbance than reuse of the existing disturbed footprint. These findings are directly relevant to the Part 303 balancing test because they bear on whether a practicable alternative exists that would achieve the Project purpose with less overall wetland impact.

The current analysis framework indicates that the Project has been designed to concentrate activity within previously disturbed areas to the extent practicable and to avoid greater environmental impacts associated with more expansive or greenfield alternatives.

7.4 Wetland Impact and Aquatic Resource Considerations

As described in Section 2.5, the Project is expected to affect regulated wetlands within the proposed surface extent. Based on the current design, direct wetland impacts are estimated at approximately 16.64 acres. Wetland and aquatic-resource evaluations being completed in support of the Part 303 wetland permit application and the NPDES permitting process distinguish between regulated wetlands outside the historic tailings footprint and wetland-like conditions that may exist within the legacy tailings footprint, which may not be treated identically for permitting purposes. These evaluations also consider both direct impacts, such as fill, excavation, or vegetation clearing, and potential indirect impacts, such as hydrologic change, water-quality effects, or changes in drainage patterns associated with mine development, dewatering, tailings management, and water management systems. Potential indirect effects are being addressed through Project design, water management controls, monitoring, reclamation planning, and permit-specific mitigation and compliance measures.

For public interest purposes, the relevant inquiry is not solely the acreage of direct impact, but also whether the proposed activity will cause unacceptable disruption to aquatic resources. This Alternatives Analysis evaluates the proposed design as relying extensively on previously disturbed areas, emphasizing upland siting where practicable, minimizing new crossings and fill, and using the existing tailings footprint to reduce the need for new large-footprint disposal facilities. To the extent that impacts remain unavoidable, the Project incorporates avoidance and minimization measures and anticipates compensatory mitigation consistent with Part 303 requirements, along with water management and discharge controls developed through the NPDES permitting process. These features are relevant to the public interest analysis because they reduce the magnitude, duration, and permanence of wetland and aquatic-resource effects relative to other alternatives evaluated.

7.5 State Energy and Industrial Context

Michigan's official climate and energy planning materials provide additional context for the public interest inquiry. The MI Healthy Climate Plan and EGLE implementation materials describe a state-wide objective of economy-wide carbon neutrality by 2050 and emphasize electrification, renewable energy deployment, grid improvements, and associated manufacturing and infrastructure investment. EGLE's summaries of 2023 clean-energy legislation state that those laws were intended to implement key recommendations of the MI Healthy Climate Plan and support clean-energy deployment, jobs, and related investment. Because copper is used extensively in electrical systems, motors, charging systems, renewable technologies, and associated infrastructure, a domestic copper project is reasonably connected to the material supply demands created by those transitions.

This policy context should be treated as relevant background rather than as a substitute for the statutory findings required under Part 303. Public interest review under Part 303 remains site specific and resource specific; state energy policy does not displace the requirement to avoid unacceptable disruption to aquatic resources or to evaluate feasible and prudent alternatives. It does, however, provide objective context for the public and economic need associated with a domestic copper project.

7.6 Cultural, Scenic, and Recreational Resource Considerations

Part 303 public interest review expressly includes consideration of the probable effects of the proposal on recognized historic, cultural, scenic, and recreational values. These considerations are distinct from the aquatic-resource focused feasible-and-prudent alternatives test discussed in Section 6.1, but they are properly considered here as part of the broader statutory balancing required under MCL 324.30311(2).

With respect to cultural and historic resources, the Project is located within and adjacent to a historically disturbed mining setting rather than within a wholly undeveloped landscape. The Alternatives Analysis identifies that many of the preferred Project features are concentrated within previously disturbed industrial areas, reducing the extent of new surface disturbance in undisturbed ground relative to some alternatives. The record also indicates that cultural resource considerations have been evaluated separately under the broader Project permitting framework and that known cultural and Tribal resource issues are not driving the selection of alternatives under the wetlands analysis. For public interest purposes, the relevance of this factor is that the preferred Project configuration seeks to limit unnecessary expansion into undisturbed areas where the likelihood of encountering unknown cultural resources could be greater.

Scenic and recreational considerations are also relevant to public interest determination. The preferred Project configuration is concentrated within an existing or historic industrial setting and makes substantial use of brownfield and previously altered land. As a result, the Project does not introduce the same degree of new visual or land use change that would be associated with a more expansive greenfield alternative, particularly a new greenfield tailings facility or more extensive new corridor development. To the extent practicable, major facilities are located within areas already characterized by industrial disturbance, which limits the incremental effect of the proposal on surrounding scenic character and recreational land use.

Recreational impacts are not anticipated because the Project will be developed entirely within a privately owned, legacy mining property that has not been open to public access for decades. The Project will not displace existing public recreational facilities, public access areas, trail systems, or other established recreational uses. Because the selected Project configuration is concentrated within previously disturbed mining and industrial areas, it avoids expansion into surrounding undeveloped lands where recreational use may occur. Temporary construction-related effects such as traffic, noise, or dust will be limited primarily to the existing industrial setting and are not expected to materially affect recreational opportunities in the surrounding area. For public interest purposes, the selected Project configuration is compatible with the existing character and historical industrial use of the site and avoids the larger landscape changes associated with more expansive greenfield alternatives.

7.7 Public Health Considerations

Public health is also a factor identified in MCL 324.30311(2) for purposes of determining whether a proposal is in the public interest. For the WPN Project, the most relevant public health considerations include the management of contact water and treated discharge, handling of mine-related materials, air emissions and dust control, traffic and transportation effects, and management of legacy brownfield conditions where Project facilities are proposed within historically disturbed areas. Air emissions and fugitive dust will be managed through applicable permit requirements, operational controls, and monitoring programs, and the Project will be required to demonstrate compliance with applicable air quality standards at the property

boundary. Accordingly, Project-related air emissions are not expected to result in adverse impacts to public health.

The Alternatives Analysis and related Project design documents indicate that the preferred Project configuration incorporates several features that support protection of public health. These include reuse of the existing disturbed tailings footprint rather than development of a new greenfield disposal area, separation to the extent practicable of legacy and Project generated contact water within the Project water management framework, treatment of Project generated water prior to discharge where required, and concentration of major surface facilities within previously disturbed industrial areas. These design choices reduce the need for broader new land disturbance and support positive hydraulic control, treatment, and monitoring of mine-affected water.

The proposed Project also relies on existing or established industrial systems for power, water treatment, materials handling, and tailings management rather than more speculative or higher-risk alternatives. From a public health perspective, that is relevant because the selected alternatives are generally associated with more predictable operating conditions, better understood control systems, and lower reliance on extensive new disturbance in undeveloped areas. To the extent that some Project features occur within a brownfield setting, those conditions also require appropriate investigation, demolition controls, and environmental management to ensure that historic site conditions are not exacerbated during redevelopment.

Overall, the current record supports the conclusion that public health risks associated with the preferred Project configuration can be managed through the design, operational controls, monitoring, treatment systems, and contingency measures described elsewhere in the permit application. This factor therefore weighs in favor of the proposal in the public interest analysis, provided the final permit record continues to demonstrate that aquatic resource disruption will be avoided to the extent practicable and that required treatment and control systems are implemented as proposed.

7.8 Regional Economic and Socioeconomic Considerations

Part 303 expressly directs EGLE to consider the economic value, both public and private, of the proposed land change to the general area, as well as the relative extent of public and private need. A Project-specific socioeconomic analysis has been prepared for the WPN Project to evaluate the regional and statewide economic significance of the Project and to provide quantitative support for these public interest considerations. The analysis was prepared by researchers at Michigan Technological University and uses IMPLAN, an input-output economic modeling platform, to estimate direct, indirect, and induced effects associated with Project construction and operations. The analysis evaluates employment, economic output, and tax revenue effects across Ontonagon County, the rest of the Upper Peninsula, the rest of Michigan, and Wisconsin.

The socioeconomic analysis evaluates six scenarios: three operations scenarios reflecting low, average, and peak operational employment levels, and three construction scenarios reflecting reduced, baseline, and increased in-state construction spending. The operations scenarios are interpreted as annual effects during the Project's 26-year operating life, while the construction scenarios are interpreted as total effects over the 3-year construction period. The analysis estimates employment effects, output effects, and tax effects, and separately reports Michigan

severance-tax estimates provided by White Pine Copper because those severance taxes are not included in the IMPLAN tax-impact results.

The socioeconomic analysis identifies several categories of anticipated economic benefit, including direct mine employment, indirect and induced employment across supporting industries, increased regional output, construction-period business activity, and public revenues associated with operations and construction. The analysis also evaluates the contribution of severance-tax revenues, which are allocated between the State of Michigan and local entities in Ontonagon County. These findings are relevant to the public interest factors identified in MCL 324.30311(2)(a) and (i), including the relative extent of public and private need and the economic value of the proposed land change to the general area.

The economic impact results are projections and are subject to uncertainty. The socioeconomic report expressly notes that projected impacts are not guaranteed outcomes and that actual impacts may differ from the estimates presented due to risk and uncertainty. Accordingly, the findings should be considered as quantitative support for the Part 303 public interest evaluation, rather than as guaranteed economic outcomes. Detailed results and supporting methodology are provided in the WPN Project: Economic Impact Report & Socioeconomic Study in Appendix A.

7.8.1 Summary of Socioeconomic Findings

The socioeconomic analysis indicates that operation of the WPN Project would generate substantial annual economic activity during the projected 26-year operating life. Across the three operations scenarios, the Project is estimated to support approximately 712 to 1,388 total jobs annually across all modeled regions, including direct, indirect, and induced employment. More than 90% of the operations-related employment effects are estimated to occur in Ontonagon County, where total employment effects are estimated at approximately 644 to 1,258 jobs, representing an estimated 27% to 54% increase relative to the County's 2024 baseline employment level.

Operations are also estimated to generate substantial economic output. Across the operations scenarios, total annual output effects are estimated at approximately \$467.7 million to \$914.1 million across all modeled regions. Most of this output is estimated to occur in Ontonagon County, where annual output effects are estimated at approximately \$448.9 million to \$877.5 million, representing an estimated 141% to 275% increase relative to the County's 2024 baseline output level. These findings indicate that the operational phase would represent a significant economic change for Ontonagon County relative to existing baseline conditions.

The operations phase is also projected to generate substantial tax revenue. IMPLAN-modeled tax revenue associated with operations is estimated at approximately \$47.1 million to \$92.0 million annually across all modeled regions, with more than 95% of the estimated tax impacts associated with Ontonagon County. These IMPLAN tax estimates do not include Michigan severance taxes, which were evaluated separately based on Project-specific estimates provided by WPC. Estimated severance taxes range from approximately \$7.45 million to \$16.45 million per year, with an average of approximately \$14.0 million per year over the 26-year operating life. Based on the severance-tax allocation described in the socioeconomic report, approximately 35% of severance-tax revenue would be allocated to the State of Michigan and approximately 65% would be allocated to local entities in Ontonagon County, corresponding

to average annual allocations of approximately \$4.9 million to the state and \$9.1 million to local entities.

Construction of the Project is also expected to generate significant, though temporary, economic activity. Across the three construction scenarios, the 3-year construction period is estimated to support approximately 2,796 to 3,379 total jobs, generate approximately \$566.1 million to \$682.4 million in total output, and produce approximately \$64.1 million to \$77.2 million in total tax revenue across all modeled regions. Unlike operations, construction-phase impacts are more broadly distributed across Michigan, with the largest absolute employment, output, and tax effects occurring in the rest of Michigan, followed by the rest of the Upper Peninsula and Ontonagon County.

For the State of Michigan as a whole, the socioeconomic analysis reports that the average operations scenario would support approximately 1,057 jobs, \$715.9 million in annual output, and \$71.9 million in annual tax revenue within Michigan. For the baseline construction scenario, the analysis reports approximately 3,015 jobs, \$603.7 million in output, and \$68.4 million in tax revenue within Michigan over the 3-year construction period. These statewide totals are aggregations of the modeled impacts for Ontonagon County, the rest of the Upper Peninsula, and the rest of Michigan, and are not additional impacts beyond the regional results.

The socioeconomic analysis also provides important local context for evaluating the Project's potential public interest benefits. In 2024, Ontonagon County had a population of 5,824 and employment of 2,328 jobs, following long-term population and employment declines since 2001. The report states that the County's population declined by approximately 25% from 2001 to 2024, while employment declined by approximately 31% over the same period. In that context, the Project's projected employment, output, and tax effects would represent a substantial potential economic contribution to a rural County with a relatively small existing employment and output base.

Taken together, the socioeconomic findings support the conclusion that the Project would provide meaningful economic value to the general area, particularly Ontonagon County, through mine employment, construction activity, business-to-business spending, household spending, and public revenue. These socioeconomic benefits do not replace the separate Part 303 requirements to avoid and minimize wetland impacts, evaluate feasible and prudent alternatives, and prevent unacceptable disruption to aquatic resources. However, the findings provide quantitative support for the public interest balancing required under MCL 324.30311.

7.9 Public Interest Evaluation Summary

Based on this Alternatives Analysis and the supporting technical evaluations, the WPN Project possesses several characteristics that support a finding that the proposal is consistent with the public interest criteria of Part 303. These include:

- ◆ Redevelopment of a previously disturbed brownfield mining setting rather than creation of a wholly new industrial footprint in an undisturbed landscape.
- ◆ Development of a geologically fixed copper-and-silver resource that cannot be relocated and contributes to domestic critical mineral supply.

- ◆ Evaluation of alternative methods and locations, including alternatives that would have resulted in greater wetland disturbance, greater land conversion, or greater environmental impact.
- ◆ Public and private benefits associated with mineral production, employment, economic activity, and regional development.
- ◆ Concentration of major Project components within a historically disturbed mining setting, reducing incremental scenic, recreational, and cultural-resource effects relative to more expansive greenfield alternatives.
- ◆ Use of established treatment, water management, and industrial infrastructure strategies intended to protect public health and environmental quality during construction, operations, closure, and post-closure.

This alternatives evaluation demonstrates that the Project has been designed to avoid and minimize wetland impacts to the extent practicable while fulfilling the Project purpose and need. The analysis further indicates that the preferred Project configuration makes substantial use of previously disturbed lands, reuses existing industrial and tailings management infrastructure where practicable, and avoids the greater environmental effects associated with several feasible alternatives that were considered. Collectively, these factors support the conclusion that the Project is capable of providing significant public and economic benefits while maintaining protection of aquatic resources, public health, and other environmental values through compliance with applicable regulatory requirements and permit conditions.

Accordingly, when considered in the context of the alternatives evaluated, the brownfield setting of the Project, the avoidance and minimization measures incorporated into the design, and the anticipated public and economic benefits associated with responsible development of a domestic copper resource, the proposed WPN Project is consistent with the public interest considerations identified in Part 303.

8. References

Michigan Department of Environment, Great Lakes, and Energy, 2022. MI Healthy Climate Plan. April 2022.

UN Trade and Development, 2025. Global Trade Update (May 2025): Focus on critical minerals – copper in the new green and digital economy.

Tables

Table 2-1
LOM Production Summary
White Pine Copper LLC - Alternatives Analysis

		Total	PY-02	PY-01	PY 01	PY 02	PY 03	PY 04	PY 05	PY 06	PY 07	PY 08	PY 09	PY 10	PY 11	PY 12	PY 13
DEVELOPMENT SUMMARY																	
Combined Lateral Tonnes & Grades																	
Ore (kt)	Development Ore	14,342		748	1,276	930	744	894	691	587	699	873	902	553	543	797	760
NSR (\$/t)	Mined NSR	42.9		43.3	44.0	46.6	46.1	46.1	44.9	42.3	39.8	42.4	42.4	41.6	41.8	41.0	40.4
Cu (%)	Mined Cu%	0.6		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.5
Ag (g/t)	Mined Ag g/t	7.8		6.5	6.8	9.3	10.3	10.3	10.1	8.2	7.5	8.5	8.4	7.4	7.6	7.3	7.4
S (%)	Mined S%	0.1		0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PRODUCTION SUMMARY																	
Total Ore (kt)	Production Ore	123,501			3,226	4,470	4,656	4,506	4,710	4,815	4,703	4,531	4,498	4,847	4,857	4,603	4,642
NSR (\$/t)	Mined NSR	80.9			87.1	85.3	85.2	88.0	85.7	93.3	85.6	86.4	82.4	89.8	83.7	83.0	86.1
Cu (%)	Mined Cu%	1.1			1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.2	1.1	1.1	1.1
Ag (g/t)	Mined Ag g/t	17.0			18.2	17.2	19.4	21.4	24.1	22.7	24.6	20.5	20.0	21.3	21.0	17.5	20.9
S (%)	Mined S%	0.2			0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
TOTAL ORE DELIVERED																	
Ore (kt)	Mined Ore Tonnes	137,843		748	4,502	5,400	5,400	5,400	5,401	5,401	5,402	5,404	5,400	5,400	5,400	5,400	5,402
NSR (\$/t)	Mined NSR	77.0		43.3	74.9	78.6	79.9	81.1	80.5	87.7	79.7	79.3	75.7	84.9	79.5	76.8	79.7
Cu (%)	Mined Cu%	1.0		0.6	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Ag (g/t)	Mined Ag g/t	16.0		6.5	14.9	15.8	18.1	19.6	22.3	21.1	22.4	18.5	18.0	19.9	19.6	16.0	19.0
S (%)	Mined S%	0.2		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

(Continued)					PY 14	PY 15	PY 16	PY 17	PY 18	PY 19	PY 20	PY 21	PY 22	PY 23	PY 24	PY 25	PY 26
DEVELOPMENT SUMMARY																	
Combined Lateral Tonnes & Grades																	
Ore (kt)	Development Ore				459	640	56	462	92	363	268	166	50	245	409	120	16
NSR (\$/t)	Mined NSR				40.8	40.7	41.5	41.3	43.8	42.0	38.7	40.4	42.1	44.1	43.5	47.5	48.1
Cu (%)	Mined Cu%				0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.7	0.7
Ag (g/t)	Mined Ag g/t				7.0	6.7	6.6	6.2	7.3	6.0	4.5	5.4	5.9	6.9	6.0	5.1	4.0
S (%)	Mined S%				0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1
PRODUCTION SUMMARY																	
Total Ore (kt)	Production Ore				4,941	4,760	5,346	4,938	5,308	5,037	5,134	5,234	5,350	5,155	4,778	5,277	3,180
NSR (\$/t)	Mined NSR				85.1	80.6	83.2	72.5	79.8	73.6	71.1	74.5	71.0	75.1	77.7	73.1	68.4
Cu (%)	Mined Cu%				1.1	1.1	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Ag (g/t)	Mined Ag g/t				18.6	17.0	16.3	15.1	16.3	15.1	11.6	10.7	9.4	11.8	13.9	11.4	7.8
S (%)	Mined S%				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
TOTAL ORE DELIVERED																	
Ore (kt)	Mined Ore Tonnes				5,400	5,400	5,402	5,400	5,400	5,400	5,402	5,400	5,400	5,400	5,187	5,397	3,197
NSR (\$/t)	Mined NSR				81.3	75.9	82.8	69.8	79.2	71.5	69.5	73.5	70.7	73.7	75.0	72.5	68.3
Cu (%)	Mined Cu%				1.1	1.0	1.1	0.9	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0
Ag (g/t)	Mined Ag g/t				17.7	15.8	16.2	14.3	16.1	14.4	11.2	10.5	9.3	11.5	13.3	11.3	7.8
S (%)	Mined S%				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Notes:
Sourced from the White Pine North Project Pre-Feasibility Study by Ausenco, 2026.

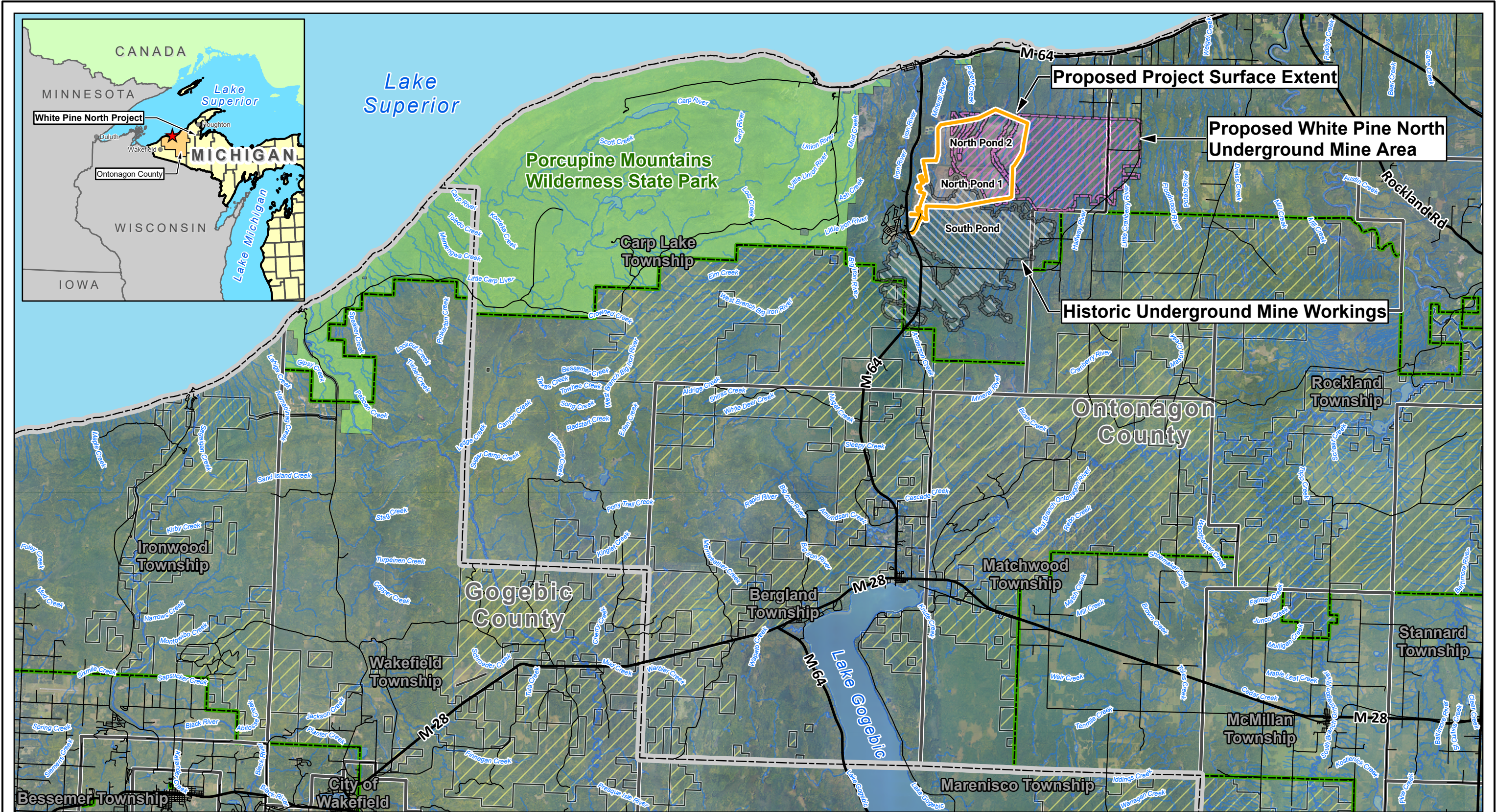
Prepared by: MJG4
Checked by: CER2

Table 6-1
Summary of Alternatives Evaluated
White Pine Copper LLC - Alternatives Analysis

Project Component	Preferred Alternative	Main Alternatives Evaluated	Why Preferred
Surface Facility Locations	Current preferred layout	PEA baseline layout; process plant closer to industrial area; former process plant location	Preferred because it provides the best overall balance of brownfield reuse, compact facility arrangement, and reduced direct wetland impact relative to the other layout options considered.
Transportation and Access Corridors	Truck-and-rail transload concept	Rail-only; truck-only	Preferred because it reduces the need for extensive on-site rail rehabilitation while also limiting long-distance trucking relative to a truck-only system. Final transload details remain subject to completion of the logistics study.
Mining Method	Modified room-and-pillar	Room and pillar with partial recovery; L-Block Retreat; drift, slash, and fill	Preferred because it is technically proven, operationally straightforward, compatible with the orebody geometry, and best supports mine stability, ventilation design, and closure performance with lower complexity than the other underground methods evaluated.
Material Handling	Conveyor-assisted underground haulage	Truck-only underground haulage	Preferred because it lowers life-of-mine operating burden, reduces underground diesel use and ventilation demand, and provides a more efficient long-term haulage system than truck-only movement.
Ore Processing	Conventional grinding and flotation	Gravity separation; hydrometallurgy	Preferred because it is the most technically proven and economically robust method for the Project ore type, with better expected recovery and lower technical risk than the alternatives.
Energy Infrastructure	Hybrid utility power plus on-site natural gas generation	Grid-dominant high-voltage transmission; renewable energy sources	Preferred because it provides the most reliable combination of operational resilience, practical implementation, and long-term energy supply stability for continuous mining and processing operations.
Water Supply	Existing municipal/regional water supply infrastructure	Groundwater wells	Preferred because it relies on existing infrastructure, provides a more reliable and sustainable source of supply, and avoids the hydrogeologic and operational limitations associated with groundwater development.
Tailings and Waste Rock Management	Paste-thickened tailings within the existing TDF	Unthickened tailings in existing TDF; thickened tailings in existing TDF; greenfield TDF	Preferred because it reuses the existing disturbed tailings footprint, reduces free water reporting to the TDF, improves water recovery and closure performance, and avoids the substantially greater environmental impact associated with greenfield disposal.

Prepared by: MJG4
Checked by: CER2

Figures



NOTES:

1. 2024 - 18in resolution air photo from the USDA NAIP.
2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
3. Road, boundary and hydrographic data from Michigan GIS Open Data.

LEGEND

Major Road	Proposed Project Surface Extent	Municipal Boundary
Minor Road	Proposed White Pine North Underground Mine Area	County Boundary
River/Stream	Historic Underground Mine Workings	Ottawa National Forest Boundary
Lake/Pond		Porcupine Mountains Wilderness State Park
		USDA Forest Service Owned Property

WHITE PINE COPPER

Foth

Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
PREPARED BY:		DATE:	
REVIEWED BY:		DATE:	
APPROVED BY:		DATE:	

WHITE PINE COPPER LLC

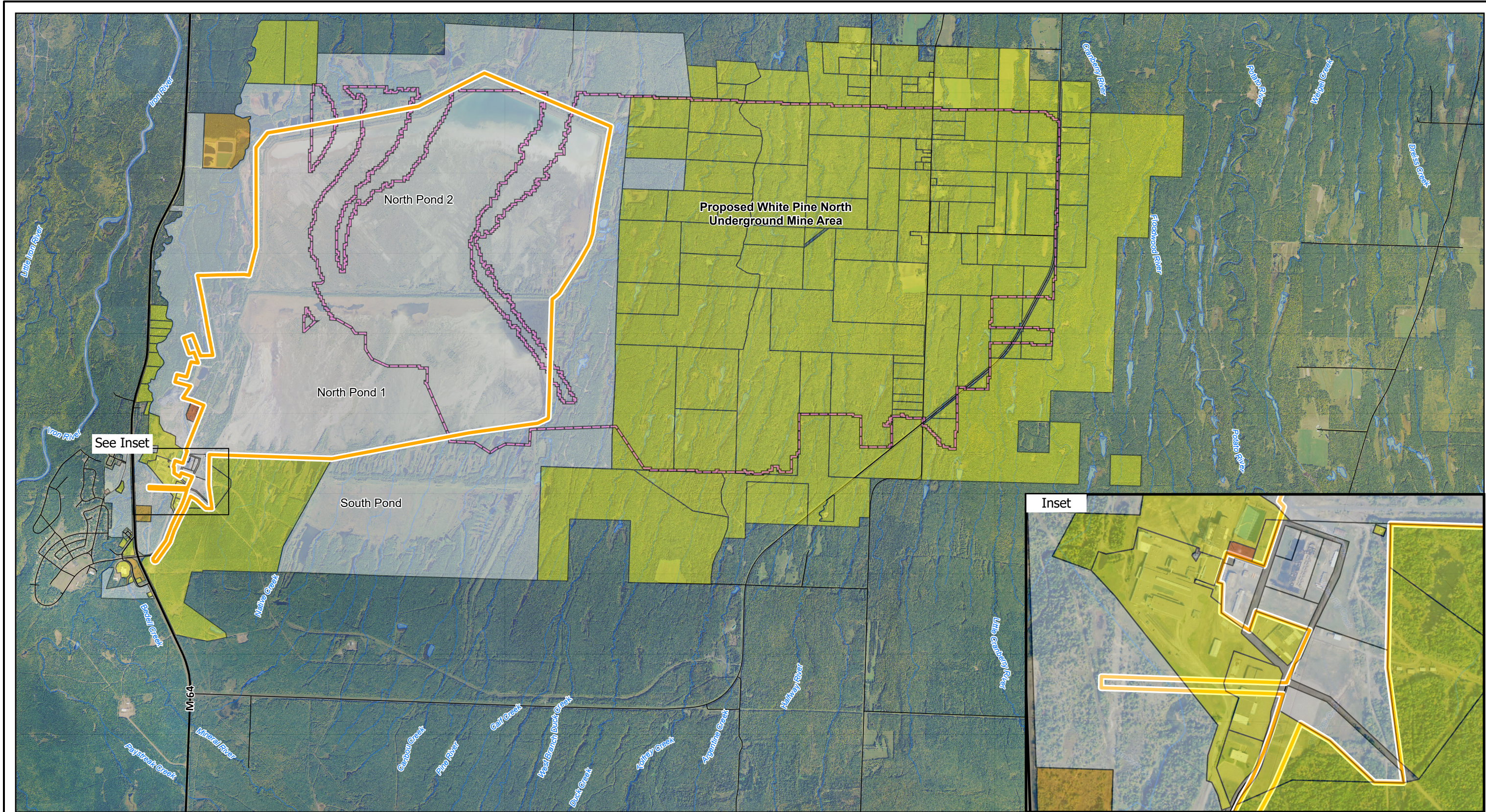
FIGURE 1-1
PROJECT LOCATION LAYOUT
ALTERNATIVES ANALYSIS
WHITE PINE NORTH, ONTONAGON COUNTY, MI

Scale: 0 1.5 3 Miles

Date: JULY 2026

Drafted By: NEE

Project: 25W006



- NOTES:**
1. 2024 - 18in resolution air photo from the USDA NAIP.
 2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
 3. Road, boundary and hydrographic data from Michigan GIS Open Data.
 4. Parcel information sourced from Ontonagon County.

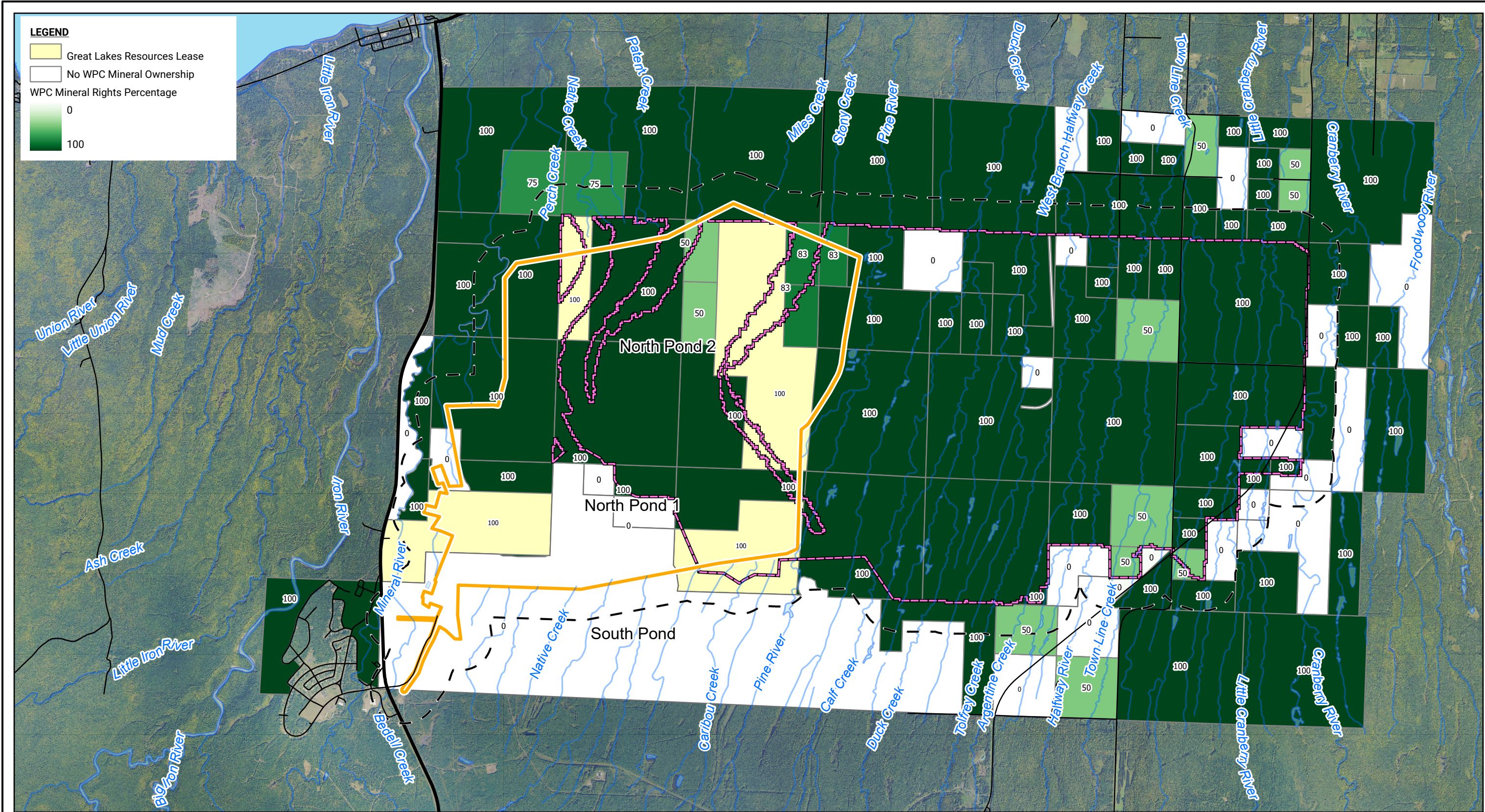
LEGEND

	Proposed Project Surface Extent		Lake/Pond
	Proposed White Pine North Underground Mine Area		Private
	Major Road		Township of Carp Lake
	Minor Road		Village of Ontonagon
	River/Stream		White Pine Copper LLC



Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
PREPARED BY:		DATE:	
REVIEWED BY:		DATE:	
APPROVED BY:		DATE:	

WHITE PINE COPPER LLC	
FIGURE 2-1 SURFACE OWNERSHIP ALTERNATIVES ANALYSIS WHITE PINE NORTH, ONTONAGON COUNTY, MI	
Scale:	Date: JULY 2026
Drafted By: NEE	Project: 25W006



NOTES:

1. 2024 - 18in resolution air photo from the USDA NAIP.
2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
3. Road, boundary and hydrographic data from Michigan GIS Open Data.

LEGEND

- Major Road
- Minor Road
- River/Stream
- Lake/Pond

LEGEND

- 1320 foot buffer
- Proposed Project Surface Extent
- Proposed White Pine North Underground Mine Area



Foth Infrastructure & Environment, LLC			
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PREPARED BY:		DATE:	
REVIEWED BY:		DATE:	
APPROVED BY:		DATE:	

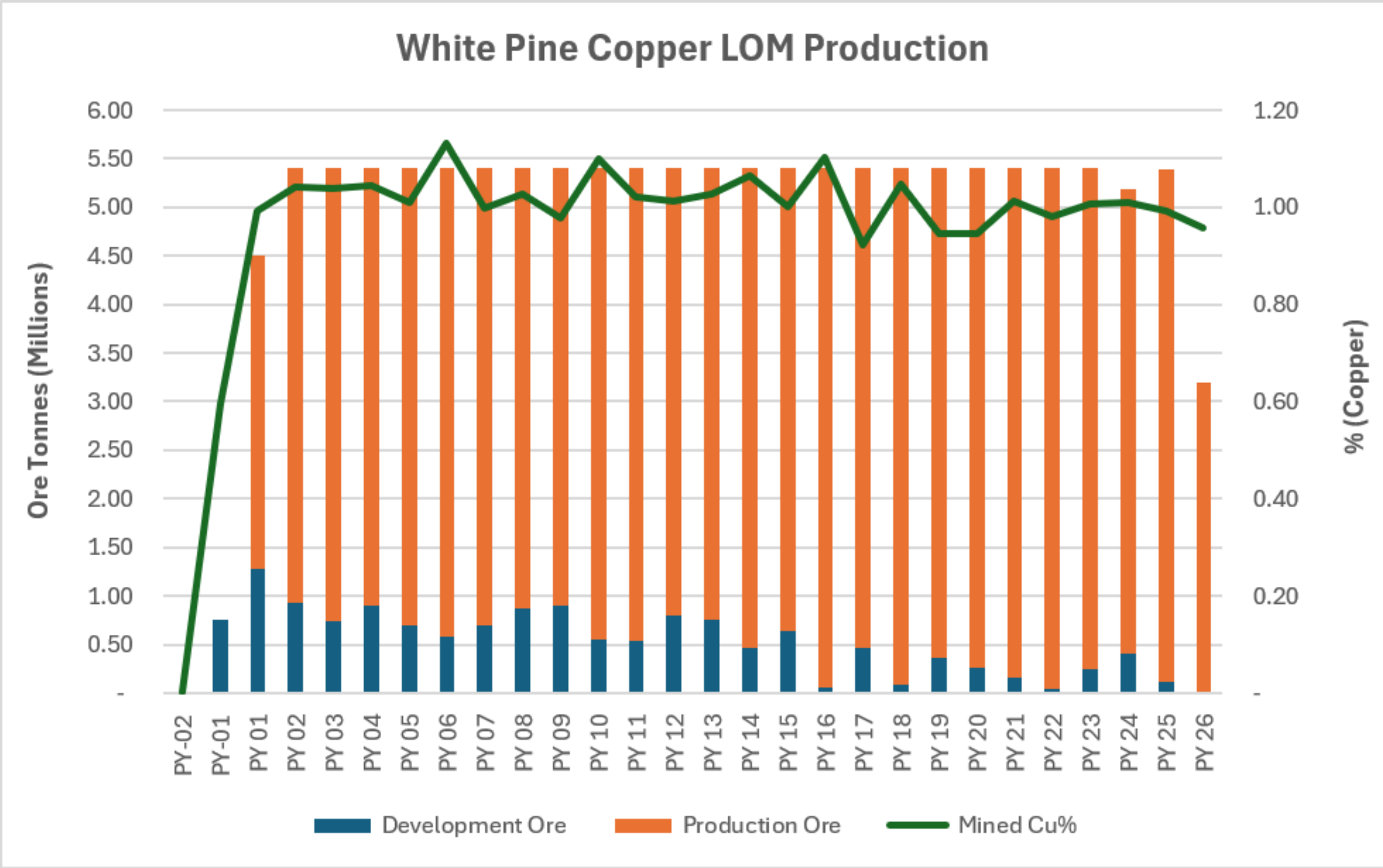
WHITE PINE COPPER LLC

FIGURE 2-2
MINERAL RIGHTS
ALTERNATIVES ANALYSIS
WHITE PINE NORTH, ONTONAGON COUNTY, MI

Scale: 0 2,000 4,000 Feet

Date: JULY 2026

Drafted By: NEE Project: 25W006



NOTES:

Sourced from the White Pine North Project Pre-Feasibility Study by Ausenco, 2026.

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data used for reference purposes only.



WHITE PINE COPPER LLC

FIGURE 2-3

WHITE PINE COPPER LOM PRODUCTION CHART
WHITE PINE NORTH
ALTERNATIVES ANALYSIS

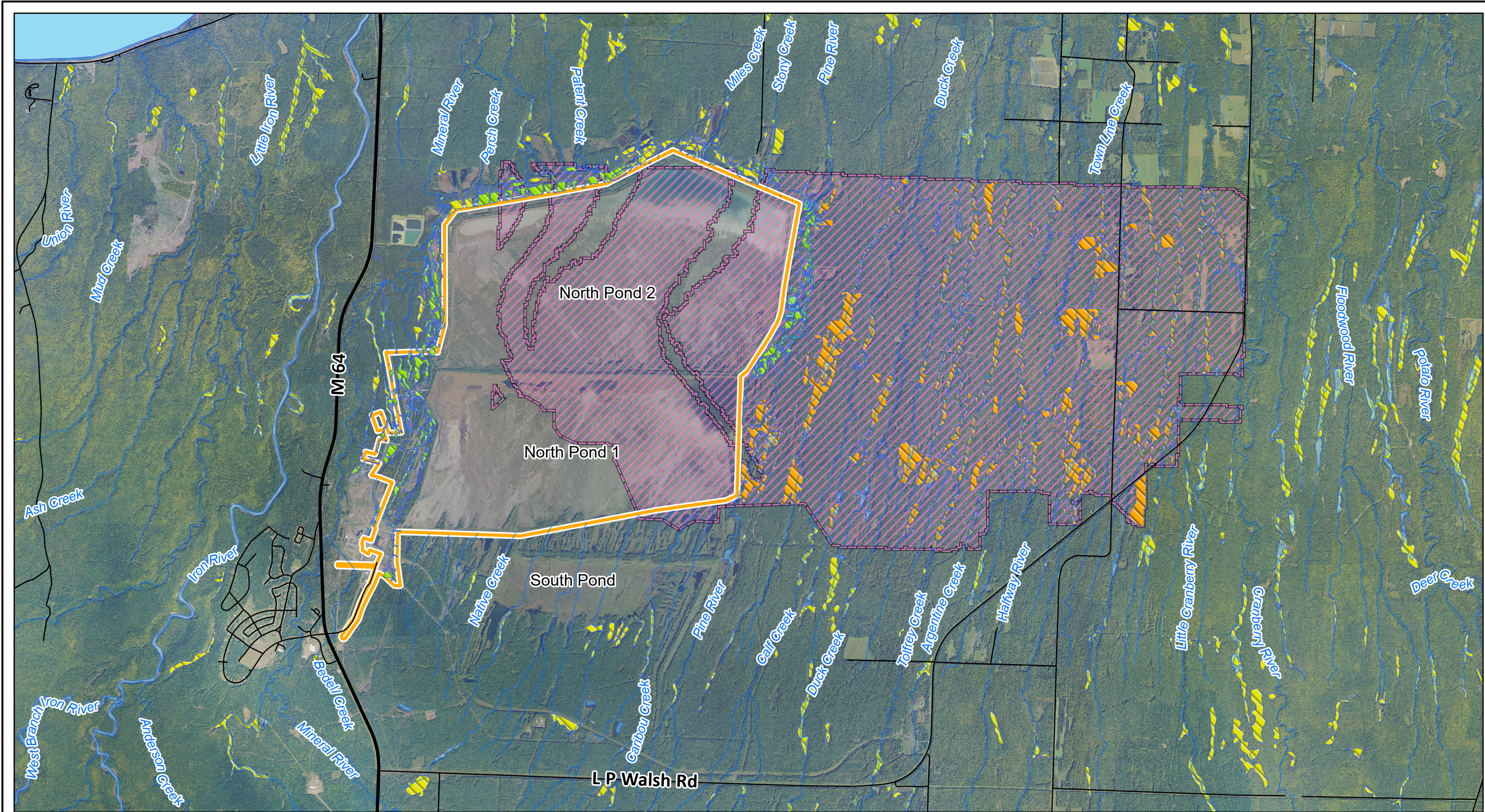
Date: JULY 2026

Revision Date:

DRAWN BY: MJG4

CHECKED BY:

PROJECT: 25W006



NOTES:

1. 2024 - 18in resolution air photo from the USDA NAIP.
2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
3. Road, boundary and hydrographic data from Michigan GIS Open Data.

LEGEND

- Major Road
- Minor Road
- Lake/Pond
- River/Stream
- Proposed Project Surface Extent
- Proposed White Pine North Underground Mine Area
- NWI Wetlands
- Delineated Wetlands (Barr, 2024-2025)
- UG Mine Area Delineated Wetlands 2025



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REVISED	DATE	BY	DESCRIPTION
PREPARED BY:			DATE:
REVIEWED BY:			DATE:
APPROVED BY:			DATE:

WHITE PINE COPPER LLC

FIGURE 2-4

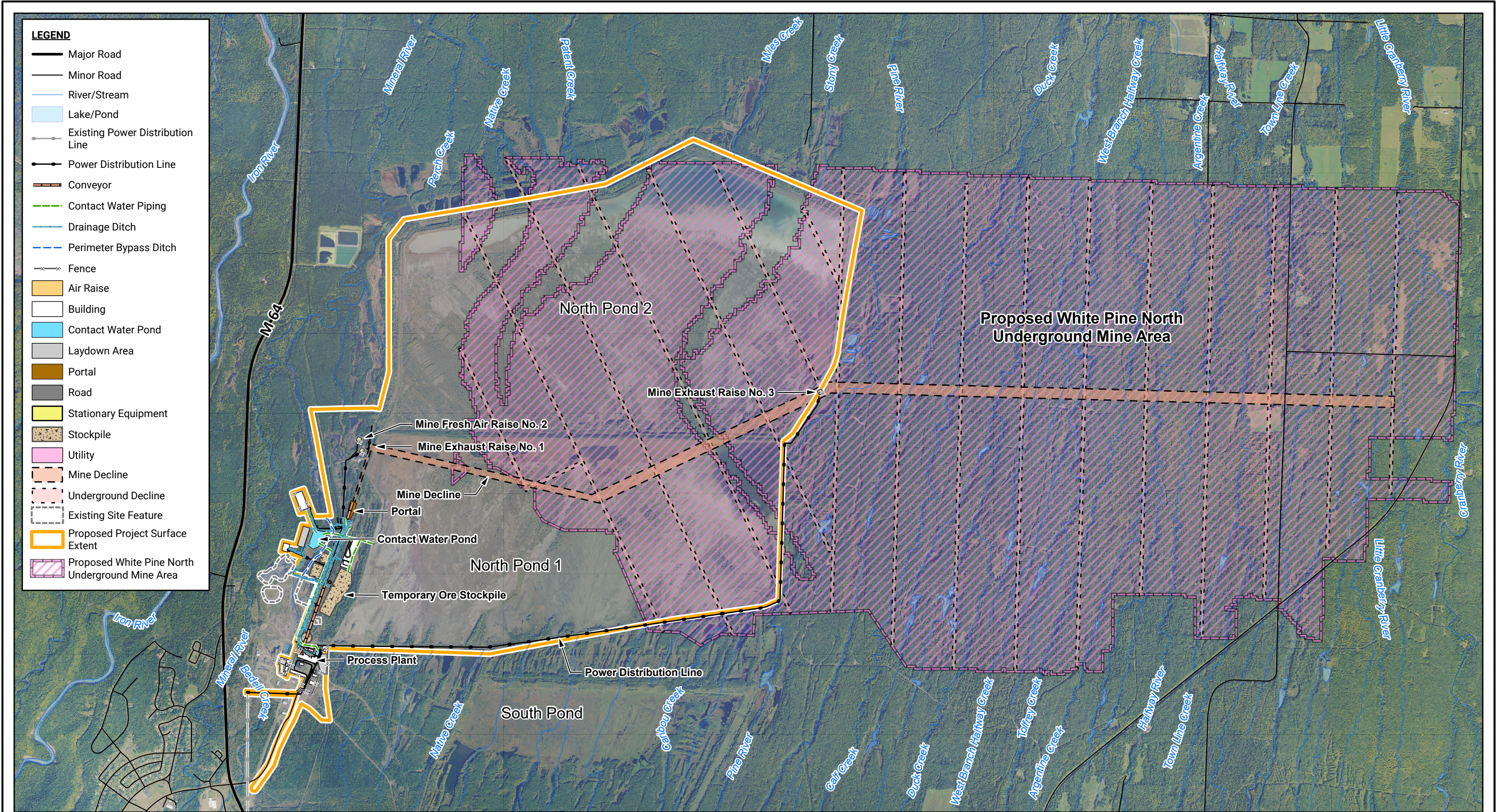
WETLANDS WITHIN THE PROJECT AREA
ALTERNATIVES ANALYSIS
WHITE PINE NORTH, ONTONAGON COUNTY, MI

Scale: 0 2,000 4,000 Feet

Date: JULY 2026

Drafted By: NEE

Project: 25W006

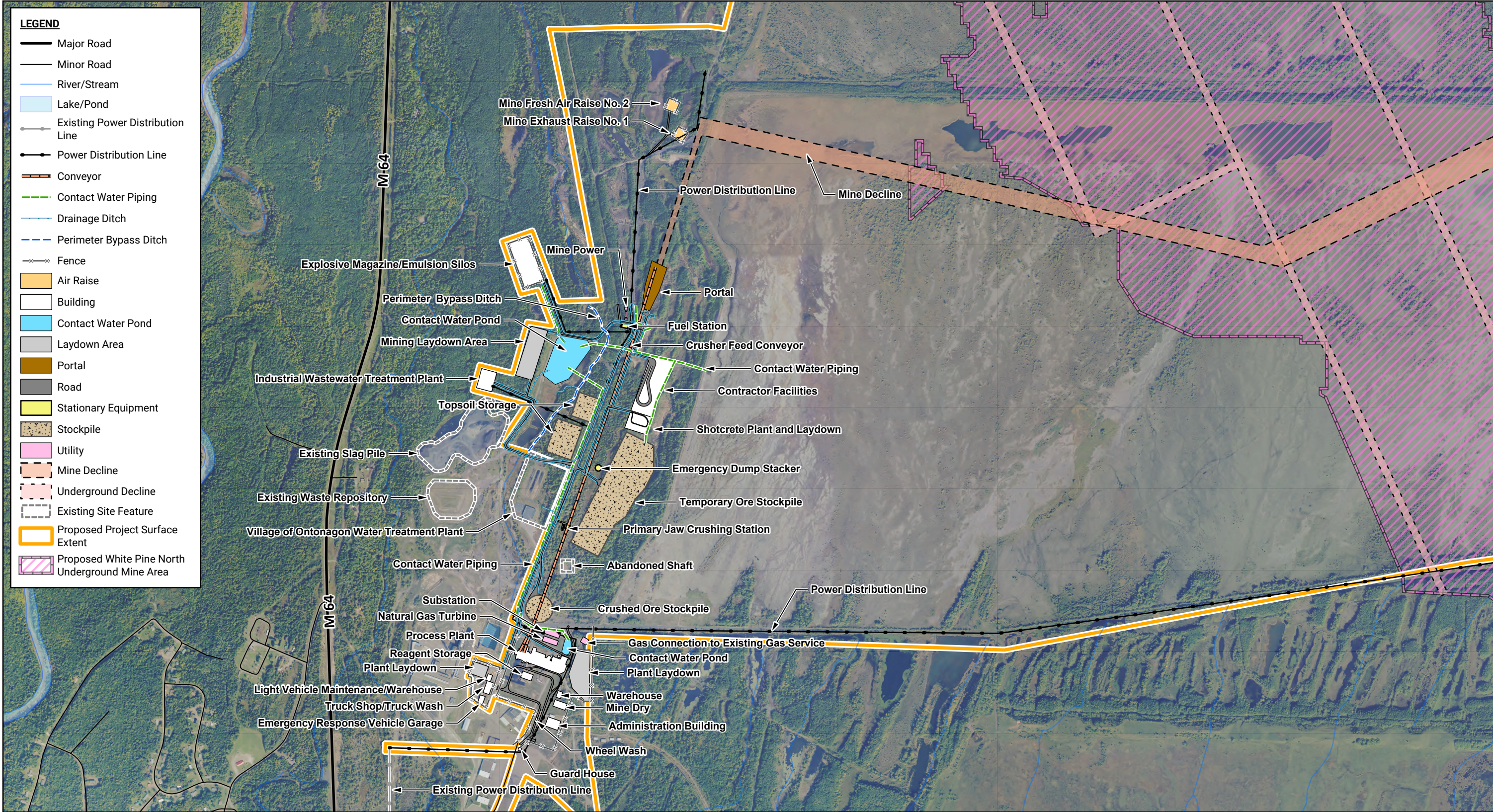


- NOTES:**
- 1. 2024 - 18in resolution air photo from the USDA NAIP.
 - 2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
 - 3. Road, boundary and hydrographic data from Michigan GIS Open Data.
 - 4. Site layout and infrastructure data from Ausenco, March 2026.



Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
PREPARED BY:		DATE:	
REVIEWED BY:		DATE:	
APPROVED BY:		DATE:	

WHITE PINE COPPER LLC	
FIGURE 3-1 PROPOSED OVERALL SITE LAYOUT ALTERNATIVES ANALYSIS WHITE PINE NORTH, ONTONAGON COUNTY, MI	
Scale: 0 1,500 3,000 Feet	Date: JULY 2026
Drafted By: DAT	Project: 25W006



- NOTES:**
1. 2024 - 18in resolution air photo from the USDA NAIP.
 2. Horizontal coordinate system is NAD1983 UTM Zone, 16N, units in meters.
 3. Road, boundary and hydrographic data from Michigan GIS Open Data.
 4. Site layout and infrastructure data from Ausenco, March 2026.



Foth Infrastructure & Environment, LLC			
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PREPARED BY:		DATE:	
REVIEWED BY:		DATE:	
APPROVED BY:		DATE:	

WHITE PINE COPPER LLC

FIGURE 3-2
MINE SITE LAYOUT
ALTERNATIVES ANALYSIS
WHITE PINE NORTH, ONTONAGON COUNTY, MI

Scale: 0 600 1,200 Feet

Date: JULY 2026

Drafted By: DAT

Project: 25W006

Appendix A

**White Pine North Project: Economic Impact Report &
Socioeconomic Study**

White Pine North Project: *Economic Impact Report & Socioeconomic Study*

Prepared for:
White Pine Copper LLC

July 2026

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I. EXECUTIVE SUMMARY

Purpose of Report

In February 2025, White Pine Copper LLC (WPC) sought proposals for a socioeconomic study to support development of permitting applications for the White Pine North Project. WPC is wholly owned by Kinterra Copper USA, LLC. WPC proposes to develop an underground copper and silver mine at the brownfield site of the former White Pine Mine, located approximately three miles south of Lake Superior, east of M-64, in Carp Lake Township, Ontonagon County, Michigan. WPC partnered with researchers at Michigan Technological University, a public research university located in Houghton, Michigan (also in Michigan's Upper Peninsula), to complete the study. This report outlines the local economic conditions, discusses the methodology used for the analysis, and presents the estimated economic impacts associated with the White Pine North Project.

Overview of Methodology

We use IMPLAN to estimate the projected economic impacts associated with the construction and operation of the White Pine North Project. IMPLAN is an input-output economic database and modeling software that accounts for linkages across industries and household spending patterns. We developed three scenarios to evaluate the potential impacts associated with the construction phase and three scenarios to evaluate the potential impacts associated with the mine's operations. The scenarios vary in the magnitude of direct economic shocks across industries and regions to represent a spectrum of possible outcomes over the life of the mine. We estimate the direct, indirect, and induced economic impacts for each scenario for four geographic regions: Ontonagon County, the Rest of Michigan's Upper Peninsula (excluding Ontonagon County), the Rest of Michigan (excluding the Rest of the Upper Peninsula and Ontonagon County), and Wisconsin.

Summary of Main Findings

The results highlight the potential economic gains associated with the White Pine North Project, with an estimated operational life of 26 years. Based on the outcomes of the three scenarios, during the operations phase the mine is estimated to create 712 to 1,388 jobs, generate \$467 million to \$914 million in economic output, and support additional tax revenue of \$47 million to \$92 million each year (total of direct, indirect, and induced effects across all regions). Over 90% of the estimated impacts from the mine's operations are in Ontonagon County, which represent a significant boost to the local economy. The county's employment increases by 27–54% and output increases by 141–275%, both relative to 2024 levels. In addition, the mine estimates they will pay an average of \$14 million in severance tax each year of operations, approximately 35% (\$4.9 million) to the state of Michigan's Rural Development fund and 65% (\$9.1 million) to school districts, the state, and local governmental units in Ontonagon County.

Further, the initial construction required to develop the mine will support 2,796 to 3,379 jobs, generate \$566 million to \$682 million in output, and lead to \$64 million to \$77 million in tax revenue in total for the 3-year period across all regions. The construction impacts are largest for the Rest of Michigan (46–53% of total impacts) and the Rest of the Upper Peninsula (27–29% of total impacts). The local relative gains in Ontonagon County from construction activities are also significant, accounting for 15–22% of total impacts and boosting the county’s employment and output by approximately 9–11% per year relative to 2024 levels. The construction analysis only reflects the impact of capital expenditures spent in Michigan (\$362.8 million in direct expenditures). The mine estimates an additional \$542.5 million in capital expenditures outside of Michigan, which are beyond the scope of the analysis but will also generate significant economic impacts in other regions. The results overall highlight the economic benefits associated with the White Pine North project throughout the state of Michigan.

Disclosure of Projected Impacts

This report relies on projected data to estimate potential future economic impacts. All estimated economic impacts are inherently subject to risk and uncertainty and are not guaranteed outcomes. This risk and uncertainty may lead the actual impacts from the White Pine North Project to differ from the estimated impacts in this report.

II. INTRODUCTION

Metal Mining in the Western Upper Peninsula

The state of Michigan has a long history of copper mining, dating back to the mid 1800s. Commercial copper deposits were initially discovered in a 100-mile geological belt spanning through Keweenaw, Houghton, and Ontonagon Counties in the Western Upper Peninsula (UP) in the Portage Lake Lava Series (Lankton, 2005). Unusually, the copper found was primarily in native form with the additional presence of copper minerals like chalcocite (copper sulfide) and copper arsenide. Silver in native form or alloyed with copper was also found. Douglass Houghton explored this copper belt in the 1840s, and the Western UP quickly became the major source of copper in the United States from 1845–1887, earning its nickname as the “Copper Country” (National Park Service, 2024; 2025). Although the region’s copper production was eventually surpassed by copper mining in the Western US, the Copper Country remained an important source of copper until the last mine, White Pine, closed in 1995 (Federal Reserve Bank of Minneapolis, 1995).

Historical White Pine Mine

The historical White Pine Mine is located at the south end of the Keweenaw copper belt near the community of White Pine in Carp Lake Township in Ontonagon County. In contrast with the northern copper mines in the UP, White Pine mainly mined chalcocite with small amounts of native copper. The ore is found in the Nonesuch shale, which overlays the same Portage Lake Lava Series used by northern mines (US Geological Survey, 1954). Milling, smelting, and refining were also conducted on site at the White Pine mine.

The White Pine mine began production in 1955 and was operated by the White Pine Copper Co., a subsidiary owned by Copper Range Company (Chamber of Commerce Ontonagon County, n.d.). At the time, the White Pine operation was known for its technological advances in mining. Louisiana Land and Exploration bought Copper Range Company in 1977 (NS Energy, 2024), and the White Pine mine continued to experience changes in ownership until the decision was made to close the mine in 1995 (Federal Reserve Bank of Minneapolis, 1995). Some above ground operations continued through the early 2000s. Over the life of the White Pine mine, over 4.5 billion pounds of copper were produced (Globe Newswire, 2021).

White Pine North

Despite White Pine mine ceasing underground operations in the mid 1990s, significant minerals remained, particularly to the north and east of the original mine site, which has continued interest in producing copper at the site since the closure. Initial attempts to make use of the closed mine and its facilities were not successful. Interest renewed in the 2010s when Highland Copper,

through its subsidiary Upper Peninsula Copper Holdings, began the process of buying the White Pine North project and its assets from Copper Range in 2014, which was finalized in 2021 (Marketwire, 2014). Highland Copper established White Pine Copper LLC (WPC) as a subsidiary to oversee the White Pine North project, and WPC signed a 20-year agreement to lease the White Pine mineral rights from Great Lakes Resources in April 2015 (NS Energy, 2024). More recently, Kinterra Copper USA LLC acquired 66% of the White Pine North project in a joint venture agreement with Highland Copper in 2023 and bought out Highland Copper’s remaining 34% stake in the White Pine North Project in early 2026 (Globe Newswire, 2026).

As part of WPC’s efforts to develop the White Pine North Project, this study evaluates the potential economic impacts of the project. The analysis utilizes data provided by WPC and estimates the economic benefits to the local and regional economies for both the initial construction to develop the mine site and the projected 26-year operational life of the mine.

III. LOCAL ECONOMIC CONTEXT

We first present an overview of local economic conditions in Ontonagon County and the Upper Peninsula to provide context behind the analysis. The White Pine North facilities will be in Ontonagon County in Michigan’s Upper Peninsula (UP). The UP is made up of 15 counties: Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft. Figure 1 provides a map of the Upper Peninsula, highlighting Ontonagon County and the remaining 14 counties that make up the rest of the Upper Peninsula. We present an overview of the local economies for Ontonagon County and the Upper Peninsula below.

Figure 1. Map of Michigan's Upper Peninsula



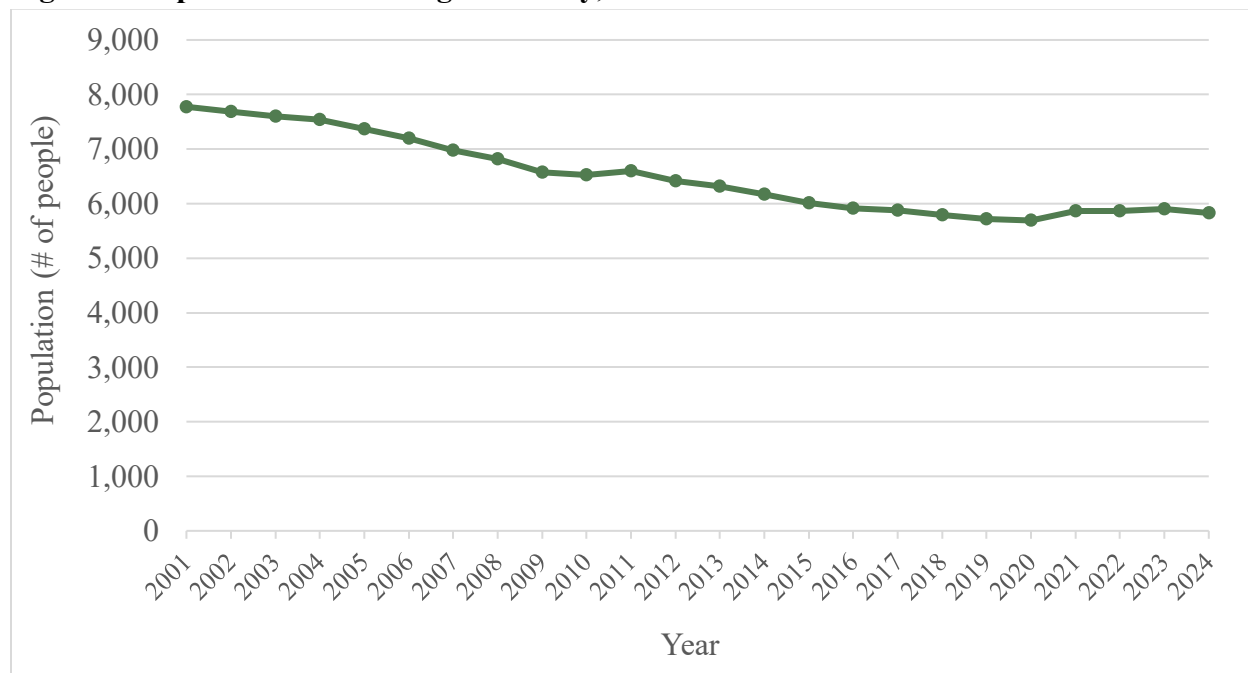
Sources: Bureau of Labor Statistics & U.S. Census

Ontonagon County

Ontonagon County is the third-largest county by land area in Michigan (1,312 square miles) and is in the Western UP with Lake Superior to the north, Gogebic County to the west, and Houghton County to the east (U.S. Census Bureau, 2024). Figure 2 illustrates the population of Ontonagon County from 2001 to 2024. In 2024, Ontonagon County had a population of 5,824 people, comprising less than 2% of the UP’s population and making it the second least populated county

in Michigan (IMPLAN, 2024). The county’s population has steadily declined over time, from a peak of 7,775 people in 2001 to 5,824 people in 2024, or a decline of 25% (IMPLAN, 2024).

Figure 2. Population in Ontonagon County, 2001–2024



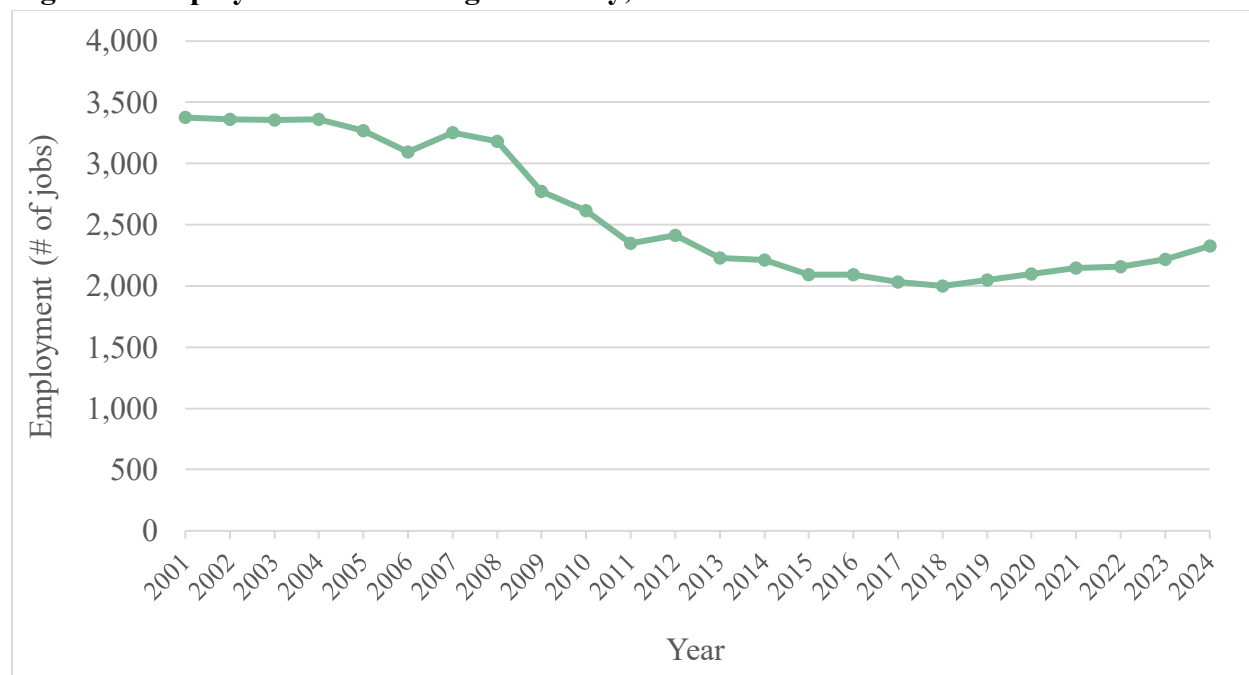
Notes: IMPLAN data for years 2001-2024

Ontonagon County’s demographic profile from 2024 shows that the median age was 60 years; 18.4% of the population aged 25 and older held a bachelor’s degree or higher; and the average employee compensation (per wage and salary employee) was \$43,651 (U.S. Census Bureau, 2024; IMPLAN, 2024). These compare to 48 years, 26.5%, and \$65,739, respectively, for the Upper Peninsula; and 40 years, 32.5%, and \$83,933, respectively, for the state of Michigan (IMPLAN, 2024). Thus, Ontonagon County’s population is relatively older, less educated, and of lower income compared to both the Upper Peninsula and the state of Michigan.

Figure 3 illustrates total employment (number of jobs), in Ontonagon County from 2001 to 2024. Employment steadily declined from 2001 to 2018, dropping from 3,376 to 2,000 jobs, a decrease of almost 41%. This highlights the county’s declining economic activity following the closure of the original White Pine mine in 1995, although the county’s employment has slowly increased since 2018. In 2024, the county’s 138 industries contained a total of 2,328 jobs, an increase of 16% relative to 2018 levels or a total decline of 31% since 2001. The largest share of jobs were in retail establishments (aggregated 21.6%), followed by local, state, and federal governments (aggregated 18%) and dining establishments (aggregated 9.8%) (IMPLAN, 2024). Additionally, the county generated approximately \$165.6 million in GDP in 2024, which represents a small portion of the Upper Peninsula’s (1.1%) and Michigan’s GDP (0.02%) (IMPLAN, 2024). The sectors that

contributed the most within the county were owner-occupied housing (19.0%);¹ local, state, and federal governments (aggregated 18.2%); retail establishments (aggregated 17.4%); and electric power transmission and distribution (6.3%) (IMPLAN, 2024).

Figure 3. Employment in Ontonagon County, 2001–2024



Notes: IMPLAN data for years 2001-2024

The Upper Peninsula

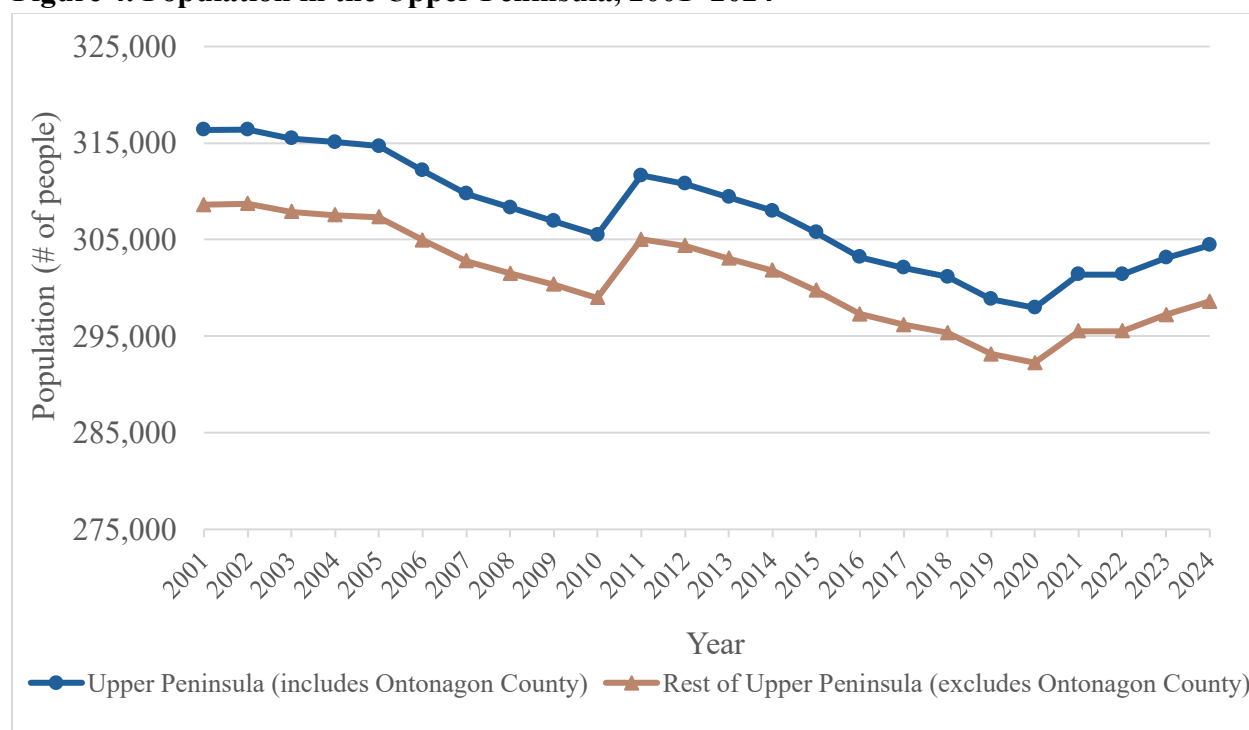
The Upper Peninsula covers a land area of 15,109 square miles, making up approximately one-third of the state of Michigan geographically, but only 3% of the state’s population (IMPLAN, 2024). The region has a rich history in mining and is well known for its natural resources and outdoor recreation, attracting tourists year-round. It is home to a total of 23 state and national parks, including Pictured Rocks National Lakeshore and Tahquamenon Falls State Park, and five federally recognized Native American communities, including the Keweenaw Bay Indian Community in Baraga County, which serves members in Ontonagon County (Upper Peninsula Travel and Recreation Association, 2026).

Figure 4 shows the population of the Upper Peninsula from 2001 to 2024, both for the UP as a whole and excluding Ontonagon County, noting the trends are nearly identical since Ontonagon County makes up a small share of the region’s population. The total population for the UP declined 5.8% from 2001 to 2020, dropping from 316,369 in 2001 to 297,948 in 2020. Further, the region’s

¹ The owner-occupied housing industry in IMPLAN aligns with a special sector developed by the Bureau of Economic Analysis (BEA) to represent the economic value of homeownership and to account for the flow of funds associated with home ownership. There is no employment or labor income associated with the industry, but it is a top industry for household demand in the model (Data Team, 2017; Lucas, 2020).

population has steadily increased since the pandemic with an aggregate population of 304,430 people in 2024 (IMPLAN, 2024), a modest increase of 2.2% since 2020 or a total decline of 3.8% since 2001. Although the overall decline is similar to the population trend in Ontonagon County, the relative magnitude is smaller for the UP, a drop of under 4% compared to 25% for Ontonagon County over the same period (2001 to 2024), and the UP's population has increased in recent years.

Figure 4. Population in the Upper Peninsula, 2001–2024

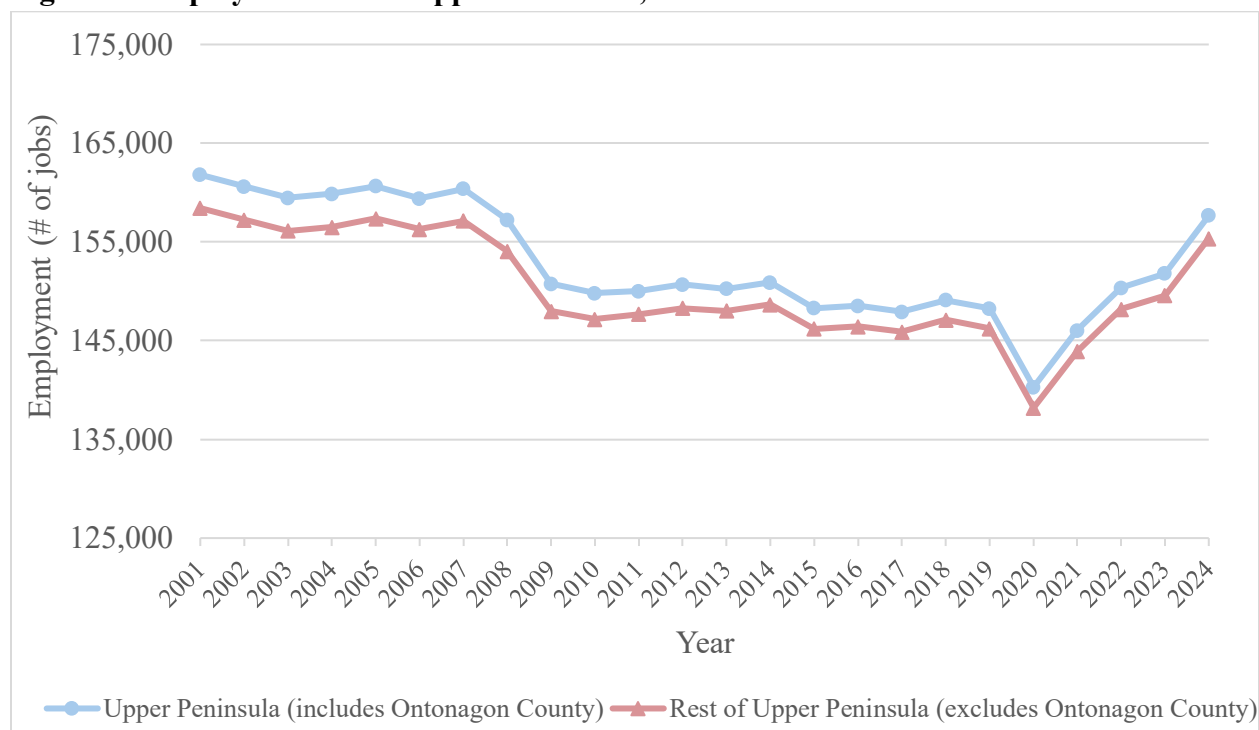


Notes: IMPLAN data for years 2001-2024

The demographics in 2024 for the Upper Peninsula show that the median age was 48 years; 26.7% of the population aged 25 and older held a bachelor's degree or higher; and the average employee compensation (per wage and salary employee) was \$66,018 (U.S. Census Bureau, 2024; IMPLAN, 2024). Thus, the UP has a younger median age, higher share of the population with a bachelor's degree, and higher average compensation compared to Ontonagon County. Although, the UP lags the overall state of Michigan.

Total employment for the Upper Peninsula (again, with and without Ontonagon County) from 2001 to 2024 is displayed in Figure 5 and follows a similar pattern to population in the region. Employment steadily declined by 13% from 2001 (161,801 jobs) to 2020 (140,305 jobs), with sharp drops around the 2008 recession and 2020 pandemic. Employment has since recovered to 157,662 jobs in 2024, an increase of 12% since 2020 or an overall decline of 2.6% since 2001. We continue to see lower relative declines in the Upper Peninsula (under 3%) compared to Ontonagon County where employment dropped over 30% from 2001 to 2024.

Figure 5. Employment in the Upper Peninsula, 2001–2024



Notes: IMPLAN data for years 2001-2024

Across the Upper Peninsula’s 334 detailed industries in 2024, the largest proportions of employment were in the following sectors: local, state, or federal governments (aggregated 20.9%), retail establishments (aggregated 10.5%), dining establishments (aggregated 7.8%), health and wellness establishments (aggregated 7.8%), manufacturing and mills (aggregated 6.9%), and construction (aggregated 6.2%) (IMPLAN, 2024). Additionally, the region generated \$14.9 billion in GDP in 2024, which represents 2.1% of Michigan’s total GDP. The predominant contributions in the UP came from local, state, and federal governments (aggregated 21.2%); owner-occupied housing (10.5%); manufacturing and mills (aggregated 9.6%); retail establishments (aggregated 8.0%); health and wellness establishments (aggregated 6.6%); and construction (aggregated 5.6%) (IMPLAN, 2024).

IV. ECONOMIC ANALYSIS: METHODOLOGY

For the economic analysis, we use IMPLAN, a regional input-output modeling software, to evaluate the anticipated economic impacts from the White Pine North Project. IMPLAN is widely used for economic impact studies and accounts for the interdependence across up to 528 industries and household spending (Clouse, 2020). We use IMPLAN’s multi-region input-output (MRIO) model and directly shock employment or output in specific industries to represent the mine’s activities. We separately analyze the construction and operations phases of the mine and consider direct shocks in three regions: Ontonagon County, Rest of the Upper Peninsula, and Rest of

Michigan.² Then, we analyze how these direct economic shocks create additional economic effects as they circulate through those same three regions and Wisconsin.

The model allows us to estimate direct, indirect, and induced economic impacts by region and industry, which can be aggregated to represent the total economic impacts.

- **Direct Effects:** represent the initial change in activity associated with an economic event and are the catalyst for generating indirect and induced effects. For example, the direct effects include White Pine Copper's investments into developing the mine site and purchasing equipment during construction (capital expenditures) and the jobs and output created during the mine's operational life.
- **Indirect Effects:** generated from changes in business-to-business purchases as money associated with the direct effects of the mine circulate through the supply chain. For example, businesses in other industries support the mine's activities by supplying materials or services during the mine's construction and operation phases.
- **Induced Effects:** capture changes in household spending in the local economy from direct and indirect jobs as employees spend their labor earnings. For example, workers employed directly at the mine and those indirectly employed in the supply chain will spend their money on housing, food, recreation, etc.

We focus on three primary economic outcomes for the analysis: employment, output, and taxes. Employment represents the total number of jobs, which accounts for full-time, part-time, and seasonal employment, rather than the number of employed persons. Output measures the total value of annual production and can be interpreted as annual sales or revenue. Taxes account for a variety of taxes paid by both businesses and households across different levels of government (federal, state, county, and sub-county), including sales tax; property tax; payroll taxes; and income taxes.

Prior to conducting any economic analyses, we gathered data from White Pine Copper on the mine's projected employment, revenue, taxes, capital expenditures, and timeline and met with White Pine Copper virtually to discuss the project and review the data. We also relied on context from the Preliminary Economic Assessment Report conducted by G Mining Services (2023) for the White Pine North project. The analysis also required that we create a proxy "copper, nickel, lead, and zinc mining" industry in Ontonagon County in IMPLAN since the industry did not exist in the county in 2024 (Lucas, 2019a).³ Standard practice is to either use national averages for the industry or to use averages for the industry in a specific region or county. Given the rural dynamics of the Upper Peninsula, we imported data for the "copper, nickel, lead, and zinc mining" industry

² All direct shocks are in Ontonagon County for the mine's operation phase since all activity and jobs are expected to be performed locally at the White Pine North site.

³ IMPLAN includes data from 2001 to 2024; the last positive economic activity for the copper, nickel, lead, and zinc mining industry in Ontonagon County was in 2002 (3 jobs and output of \$727,000). We believe this represents the last of the historical White Pine mine site cleanup.

in Marquette County in 2024, which represents the operations of Eagle Mine, a high-grade nickel and copper mine, and their Humboldt Mill.⁴ Data from another Upper Peninsula county with an active copper mine is more likely to accurately represent the economic activity and dynamics of White Pine North in Ontonagon County compared to national averages.

Scenarios

We developed six scenarios to evaluate the possible outcomes of White Pine North’s construction and mining activities. The scenarios are rooted in data provided by White Pine Copper and follow-up conversations with White Pine Copper leadership. The scenarios analyze both the ongoing operations phase of the mine (Scenario 1, 2, and 3) and the initial construction phase of the mine (Scenario 4, 5, and 6). For each scenario, we shock either the level of employment or the level of output in specific industries in specified regions. The scenarios vary in the magnitude of the employment or output shocks across industries and geographic locations.

Table 1. Scenario Assumptions for Operations, Scenarios 1–3

	Scenario 1: Low Employment (Year 26)	Scenario 2: Average Employment (Over 26 Years)	Scenario 3: Peak Employment (Year 10)
Underground Mine Emp.	272 employees	507 employees	671 employees
Other Staffing	146 employees	146 employees	146 employees
Total Direct Emp.	418 employees	653 employees	817 employees

Notes: All direct employment is in the copper, nickel, lead, and zinc mining industry in Ontonagon County.

The three scenarios for the mine’s ongoing operations (Scenarios 1, 2, and 3) are included in Table 1. Detailed employment data provided by White Pine Copper for the estimated 26-year life of the mine showed variation in underground mining employment and stable employment for other staffing (processing plant; general and administrative; water treatment plant; logistics). Therefore, each scenario assumes a consistent level of other staffing per year (146 workers) and a different level of underground mine employment per year: 272 workers (S1, lowest); 507 workers (S2, average); and 671 workers (S3, maximum). The three scenarios are intended to represent different levels of economic activity the mine may experience over its operational life and the results can be interpreted as average annual effects.

The construction analysis is based on capital expenditure (capex) data provided by White Pine Copper, which allocated expenses across nine groups and four regions: Ontonagon County, the Rest of the Upper Peninsula, the Rest of Michigan, and Out of State (Outside of Michigan). Each

⁴ Specifically, we used the per-worker values for employee compensation, proprietor income, other property income, and taxes on production and imports reported by IMPLAN for the “copper, nickel, lead, and zinc mining” industry in Marquette County for the year 2024.

capital expenditure group was further broken down into categories.⁵ The capital expenditure data required a few adjustments as we developed the scenarios for the analysis. We first describe the data adjustments, then we present the assumptions for the three construction scenarios associated with the mine's initial construction in Tables 2, 3, and 4 (Scenario 4, 5, and 6, respectively).

First, the capital expenditures represent a direct output shock in the analysis and must be allocated to specific industries in each region. Therefore, we mapped each capital expenditure category to an IMPLAN industry.⁶ Second, the capital expenditure data included a general group for provisions (contingency funds) to provide a buffer for unexpected expenses that were not allocated to a specific category or industry. Therefore, we distributed the contingency funds proportionally to each capex category, which we previously mapped to IMPLAN industries, within each region and then eliminated the separate contingency capex group.⁷ For example, the contingency rate for Ontonagon County was 19.28% so we increased the capital expenditures for each category in the county by 19.28% and eliminated the contingency capex group. The adjusted capital expenditure data mapped to specific industries is the starting point for the construction scenarios (Scenario 5, Baseline in Table 3, Panel A).

Then, we developed two additional scenarios (Scenarios 4 and 6) relative to the baseline data in Scenario 5. Scenario 4 (Reduced Local Spending, Table 2) represents the possibility that fewer capital expenditures are spent in Michigan (in state) relative to the baseline (-10%); Scenario 6 (Increased Local Spending, Table 4) represents more capital expenditures spent in Michigan (+10%). We followed the general process below to generate the two alternative scenarios:

1. We calculated the total capital expenditures in Michigan, the sum of capital expenditures allocated to Ontonagon County, the Rest of the Upper Peninsula, and the Rest of Michigan.
2. We calculated the share of in-state expenditures in each category for each region: Ontonagon County; the Rest of the Upper Peninsula; and the Rest of Michigan. These shares sum to 1 (or 100%) for each category. For example, the share of in-state expenditures for Ontonagon County is capital expenditures in the county divided by total in-state expenditures (for each specific category).
3. For Scenario 4 (6), we estimated a 10% decrease (increase) in total in-state capital expenditures and a parallel increase (decrease) of the same dollar amount in total capital expenditures outside of Michigan. This holds total capital expenditures constant for each category, but varies the portion spent in Michigan versus outside of Michigan.

⁵ The nine groups include: mining; process plant; tailing storage facility and site wide water management; on site infrastructure; off site infrastructure; project preliminaries; project delivery; owner's costs; and provisions.

⁶ The original capital expenditure data provided by White Pine Copper and our mapping of capital expenditure categories to IMPLAN industries are included in Tables A1 and A2 in the appendix.

⁷ The capital expenditure data with the provisions/contingency included in each specific category, rather than a separate line item, is included in Table A3 in the appendix. The contingency funds ranged from 19.28% to 19.45% in each region.

-
4. For Scenario 4 (6), we distributed the 10% decrease (increase) in capital expenditures in Michigan using the baseline share of in-state expenditures from Step 2. For example, if 22% of in-state capital expenditures in category A were allocated to Ontonagon County, then we allocated 22% of the decreased (increased) in-state spending to Ontonagon County for Category A.
 5. Last, for Scenario 6, there were four categories where the increased in-state spending was greater than the aggregate out-of-state capital expenditures, which creates a negative value for out-of-state capital expenditures. Therefore, we manually adjusted these four cases to 100% in-state spending and 0% out-of-state spending. No manual adjustments were required for Scenario 4.

Tables 2, 3, and 4 present assumptions for the three scenarios (Scenarios 4, 5, and 6, respectively) associated with the mine's initial construction. The adjusted capital expenditure data by region and industry is presented in Panel A. The construction scenarios also account for per-diem spending on lodging, meals, and incidental expenses by workers temporarily in Ontonagon County to complete their jobs during the construction phase (Panel B). We took an iterative approach to calculate per-diem spending. First, we began with three simulations using the capital expenditure data for each scenario (Panel A in Tables 2, 3, and 4) and a basic IMPLAN industry event analysis to estimate the number of direct jobs supported in Ontonagon County by the construction of the mine and its facilities. Then, we used the direct jobs estimate from those simulations to calculate aggregate per-diem spending for both lodging and meals/incidental expenses for each scenario. We rely on federal per-diem rates, \$110/day for lodging and \$68/day for meals and incidental expenses, and assume each worker is physically present in Ontonagon County for a 6-month period (US General Services Administration, 2026).⁸ Finally, we rely on IMPLAN's household demand data (2024), which reflects how households spend their money on goods and services in the economy, to allocate aggregate per-diem expenditures to specific industries.⁹

⁸ We assume each worker is in Ontonagon County for a 6-month period (0.5*365 days) during the 3-year construction phase since it is unlikely that each worker is in the local area full 3-year timeframe. This could represent either a consistent 6-month stay in the local area or an aggregate duration of 6-months over the 3-year period (on average).

⁹ Lodging is split across two industries: hotels and motels, including casino hotels (93%) and other accommodations (7%). Meals and incidental expenses are split across four industries: retail food and beverage stores (25%); full-service restaurants (27%); limited-service restaurants (38%); and all other food and drinking places (10%), where the proportions come from total household demand across all IMPLAN income brackets.

Table 2. Scenario 4 Assumptions, Construction Reduced Local (In State) Spending

IMPLAN Industry	Industry Description	Ontonagon County	Rest of Upper Peninsula	Rest of Michigan	Out of State	Industry Total
<i>Panel A. Capital Expenditures</i>						
22	Copper, nickel, lead, and zinc mining	\$6,588,095	\$13,181,789	\$13,185,410	\$3,661,699	\$36,616,993
46	Construction of new manufacturing structures	\$11,339,269	\$31,361,355	\$43,640,229	\$174,300,167	\$260,641,020
47	Construction of new power and communication structures	\$2,461,061	\$6,551,764	\$9,950,882	\$94,581,882	\$113,545,589
51	Construction of other new nonresidential structures	\$31,361,925	\$54,960,343	\$59,681,781	\$189,356,027	\$335,360,076
378	Wholesale - machinery, equipment, and supplies	\$0	\$931,332	\$0	\$70,472,411	\$71,403,743
439	Architectural, Engineering, and Related Services	\$6,493,646	\$6,496,405	\$28,305,717	\$46,384,339	\$87,680,107
Total Capital Expenditures		\$58,243,996	\$113,482,988	\$154,764,020	\$578,756,524	\$905,247,528
<i>Panel B. Per-diem spending for jobs in Ontonagon County supported by construction activities</i>						
489	Hotels and motels	\$7,415,700				
490	Other accommodations	\$585,793				
Total Lodging Expenditures		\$8,001,494				
389	Retail, food and beverage stores	\$1,240,092				
491	Full-service restaurants	\$1,345,053				
492	All other food and drinking places	\$1,887,381				
493	Limited-service restaurants	\$473,852				
Total Meal and Incidental Expenditures		\$4,946,378				

*Notes: Per-diem spending numbers based on initial estimated direct employment of 399 in Ontonagon County from capital expenditures in Panel A. Calculations use federal per-diem rates (\$110/day for lodging and \$68/day for meals and incidental expenses) and assume each worker is in the local area for 6 months (0.5*365 days).*

Table 3. Scenario 5 Assumptions, Construction Baseline Local (In State) Spending

IMPLAN Industry	Industry Description	Ontonagon County	Rest of Upper Peninsula	Rest of Michigan	Out of State	Industry Total
<i>Panel A. Capital Expenditures</i>						
22	Copper, nickel, lead, and zinc mining	\$7,320,106	\$14,646,432	\$14,650,456	\$0	\$36,616,993
46	Construction of new manufacturing structures	\$12,599,187	\$34,845,950	\$48,489,144	\$164,706,738	\$260,641,020
47	Construction of new power and communication structures	\$2,734,512	\$7,279,738	\$11,056,535	\$92,474,804	\$113,545,589
51	Construction of other new nonresidential structures	\$34,846,584	\$61,067,048	\$66,313,090	\$173,133,355	\$335,360,076
378	Wholesale - machinery, equipment, and supplies	\$0	\$1,034,813	\$0	\$70,368,930	\$71,403,743
439	Architectural, Engineering, and Related Services	\$7,215,162	\$7,218,228	\$31,450,797	\$41,795,920	\$87,680,107
Total Capital Expenditures		\$64,715,551	\$126,092,208	\$171,960,023	\$542,479,746	\$905,247,528
<i>Panel B. Per-diem spending for jobs in Ontonagon County supported by construction activities</i>						
489	Hotels and motels	\$8,239,729				
490	Other accommodations	\$650,886				
Total Lodging Expenditures		\$8,890,615				
389	Retail, food and beverage stores	\$1,377,890				
491	Full-service restaurants	\$1,494,515				
492	All other food and drinking places	\$2,097,106				
493	Limited-service restaurants	\$526,506				
Total Meal and Incidental Expenditures		\$5,496,017				

Notes: Per-diem spending numbers based on initial estimated direct employment of 443 in Ontonagon County from capital expenditures in Panel A. Calculations use federal per-diem rates (\$110/day for lodging and \$68/day for meals and incidental expenses) and assume each worker is in the local area for 6 months (0.5*365 days).

Table 4. Scenario 6 Assumptions, Construction Increased Local (In State) Spending

IMPLAN Industry	Industry Description	Ontonagon County	Rest of Upper Peninsula	Rest of Michigan	Out of State	Industry Total
<i>Panel A. Capital Expenditures</i>						
22	Copper, nickel, lead, and zinc mining	\$7,320,106	\$14,646,432	\$14,650,456	\$0	\$36,616,993
46	Construction of new manufacturing structures	\$13,859,106	\$38,330,545	\$53,338,058	\$155,113,310	\$260,641,020
47	Construction of new power and communication structures	\$2,817,112	\$7,625,848	\$11,780,221	\$91,322,408	\$113,545,589
51	Construction of other new nonresidential structures	\$37,442,609	\$66,272,778	\$72,899,104	\$158,745,585	\$335,360,076
378	Wholesale - machinery, equipment, and supplies	\$0	\$1,138,294	\$0	\$70,265,448	\$71,403,743
439	Architectural, Engineering, and Related Services	\$7,936,678	\$7,940,051	\$34,595,877	\$37,207,501	\$87,680,107
Total Capital Expenditures		\$69,375,612	\$135,953,948	\$187,263,715	\$512,654,253	\$905,247,528
<i>Panel B. Per-diem spending for jobs in Ontonagon County supported by construction activities</i>						
489	Hotels and motels	\$8,895,380				
490	Other accommodations	\$702,679				
Total Lodging Expenditures		\$9,598,058				
389	Retail, food and beverage stores	\$1,487,531				
491	Full-service restaurants	\$1,613,436				
492	All other food and drinking places	\$2,263,976.57				
493	Limited-service restaurants	\$568,401.16				
Total Meal and Incidental Expenditures		\$5,933,345				

Notes: Per-diem spending numbers based on initial estimated direct employment of 478 in Ontonagon County from capital expenditures in Panel A. Calculations use federal per-diem rates (\$110/day for lodging and \$68/day for meals and incidental expenses) and assume each worker is in the local area for 6 months (0.5*365 days).

V. ECONOMIC IMPACTS OF WHITE PINE NORTH: RESULTS

Baseline Economic Conditions

The economic impact results we present in this section represent changes relative to the baseline economic conditions in each region in 2024, which are presented in Table 5. The baseline economic conditions align with those presented previously in the local economic context section and can be interpreted as the economic activity in each region in the absence of any economic changes. For example, employment levels in 2024 are: 2,328 jobs in Ontonagon County; 155,335 jobs in the Rest of the Upper Peninsula (excluding Ontonagon County); 5,878,842 jobs in the Rest of Michigan (excluding the UP); and 3,834,299 jobs in Wisconsin.

Table 5. Baseline Economic Data by Region

	Ontonagon County	Rest of Upper Peninsula	Rest of Michigan	Wisconsin
Population (# of people)	5,824	298,606	9,836,029	5,960,975
Median Age (years)	59.8	47.5	38.4	40.2
Employment (# of jobs)	2,328	155,335	5,878,842	3,834,299
Output (millions USD)	\$318.33	\$29,422.74	\$1,382,925.71	\$896,894.67
GDP (millions USD)	\$165.65	\$14,934.49	\$705,369.05	\$458,002.08

Notes: Data from IMPLAN (2024) and U.S. Census Bureau (2024)

Forecasted Results for Operations: Scenarios 1–3

Next, we present the forecasted results for the operations phase of the mine (Scenarios 1–3). The impacts of Scenarios 1 through 3 are considered ongoing for the projected 26-year life of the mine and should be interpreted as the annual impact to the specified region for as long as the mine’s estimated employment level is valid. We focus on the employment, output, and tax implications in each region.

Employment

Scenarios 1 through 3 are based on modeling direct changes to employment in the “copper, nickel, lead, and zinc mining industry” in Ontonagon County (Table 1). Therefore, we present the employment results first. Table 6 shows the total change in employment across the regions for

each scenario, which includes direct employment (at the mine), indirect employment, and induced employment. Total employment across all regions is projected to increase by 712 (S1), 1,110 (S2), and 1,388 jobs (S3) across the three scenarios. The bulk of the employment changes (90-91% across the three scenarios) occur in Ontonagon County, while 4% and 5% of the employment increase comes from the Rest of the Upper Peninsula and Wisconsin, respectively. There is minimal employment change for the Rest of Michigan (<1%).

In all three scenarios, the mine's operations represent a significant increase in employment in Ontonagon County. Focusing on Scenario 1, which represents the mine's lowest projected employment, 644 of the estimated 712 total jobs are in Ontonagon County. This represents a 27% increase relative to the baseline employment in the county (2,328 in 2024; Table 5). For Scenario 3 (peak employment at the mine), 1,258 jobs are created in Ontonagon County (out of 1,388 total jobs), which is a 54% increase relative to the county's baseline employment.

Table 6. Change in Employment Across Regions, Scenarios 1–3 (Operations)

	Scenario 1	Scenario 2	Scenario 3
Ontonagon County	644	1,005	1,258
Rest of Upper Peninsula	30	46	57
Rest of Michigan	4	6	8
Wisconsin	34	53	65
Total Employment	712	1,110	1,388

Notes: Employment numbers represent the total annual change in the number of jobs for each region and scenario associated with the mine's operations. Total employment is the sum of the direct, indirect, and induced employment effects.

In addition to the total employment impacts in Table 6, we can also disaggregate these effects into the direct, indirect, and induced effects by region across the scenarios (Figure 6). The direct employment impacts represent the estimated employment at the White Pine North mine and align with the employment numbers presented in Table 1 (Operations Scenarios); the indirect employment impacts represent the additional jobs created in the supply chain from business-to-business purchases; and the induced employment impacts represent the additional jobs created throughout the economy as households spend their income. Since the mine operates in Ontonagon County, all direct employment impacts occur in the county, with a projected increase of 418–817 direct jobs in Ontonagon County across Scenarios 1–3. Ontonagon County also sees the largest impacts for indirect employment (102–199 jobs) and induced employment (124–242 jobs). In both Ontonagon County and the Rest of the Upper Peninsula, the induced employment impacts are larger than the indirect impacts, but the opposite is true in Wisconsin. This suggests that in the UP, household spending has a larger impact on employment than business-to-business purchases. We continue to see minimal employment impacts for the Rest of Michigan (2–5 indirect jobs; 2–3 induced jobs).

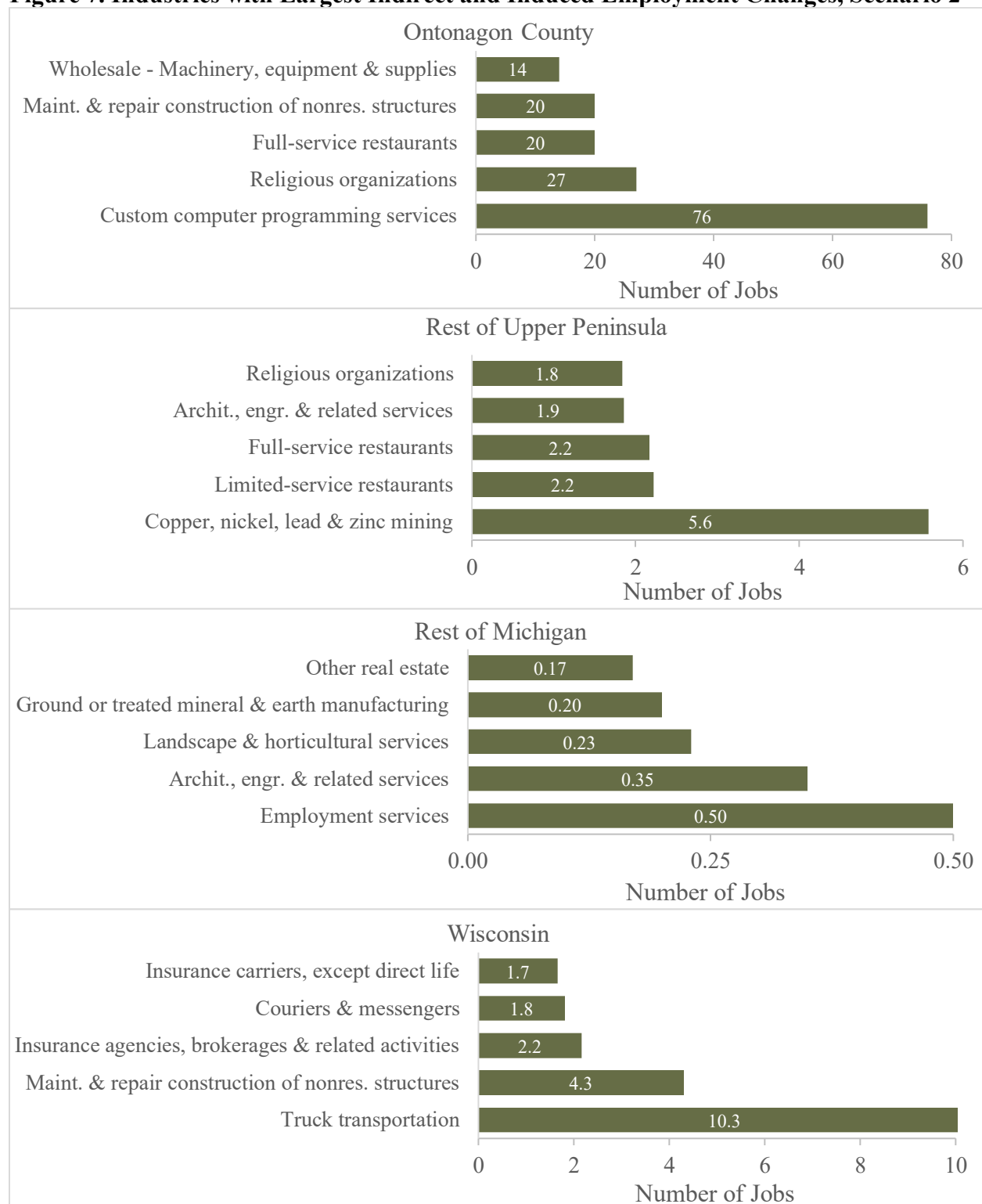
Figure 6. Direct, Indirect, and Induced Employment Changes, Scenarios 1–3 (Operations)



Notes: Employment numbers represent the total annual change in the number of direct, indirect, and induced jobs.

We can also identify the industries in each region that experience the largest employment gains. For this purpose, we focus on Scenario 2, the average employment at the mine, and indirect and induced employment gains. We do not include the direct employment gains in the copper, nickel, lead, and zinc mining industry in Ontonagon County since they are much larger in magnitude and represent the direct shock in the analysis (employment at the mine). In Ontonagon County, the five industries with the largest employment gains (beyond mining) are: custom computer programming services (76 jobs); religious organizations (27 jobs); full-service restaurants (20 jobs); maintenance and repair construction of nonresidential structures (20 jobs); and wholesale machinery equipment and supplies (14 jobs).

Figure 7. Industries with Largest Indirect and Induced Employment Changes, Scenario 2



Notes: Employment numbers represent the total annual change in indirect and induced jobs for Scenario 2.

These industries highlight those in the county most connected to the mine's operations via business-to-business transactions and consumer spending. For example, based on IMPLAN

spending patterns (2024), the highest share of business-to-business transactions for the copper, nickel, lead, and zinc mining industry is from the custom computer programming services industry. Additionally, the religious organizations industry is a prominent industry in Ontonagon County for employment and household industry demand (consumption), so the model estimates that economic growth in the county leads to growth in the industry even though it is seemingly unrelated to mining. Top industries for the other three regions vary and, similar to the main employment results, are much smaller in magnitude.

Output

Next, we present the parallel results for output, which highlight the changes to the total value of production, the sum of intermediate inputs and value added, throughout each region (Lucas, 2019b). Table 7 shows the estimated total output impacts for Scenarios 1 through 3 (the sum of the direct, indirect, and induced effects), which range from \$468 million (S1) to \$914 million (S3). We continue to see most of the impacts concentrated in Ontonagon County, approximately \$449 million (S1) to \$877 million (S3) in additional output across the three scenarios, which accounts for 96% of total output impacts. Wisconsin and the Rest of the Upper Peninsula see 2% and 1.7%, respectively, of the total output impact and the Rest of Michigan contributes less than 0.5% to the output impacts across the scenarios. The economic significance of the mine's operations in Ontonagon County is even larger in relative terms compared to the employment gains. The output impacts in Ontonagon County translate to a 141% (S1) to 275% (S3) increase relative to the baseline level in 2024 (\$318.3 million).

Table 7. Change in Output Across Regions, Scenarios 1–3 (Operations)

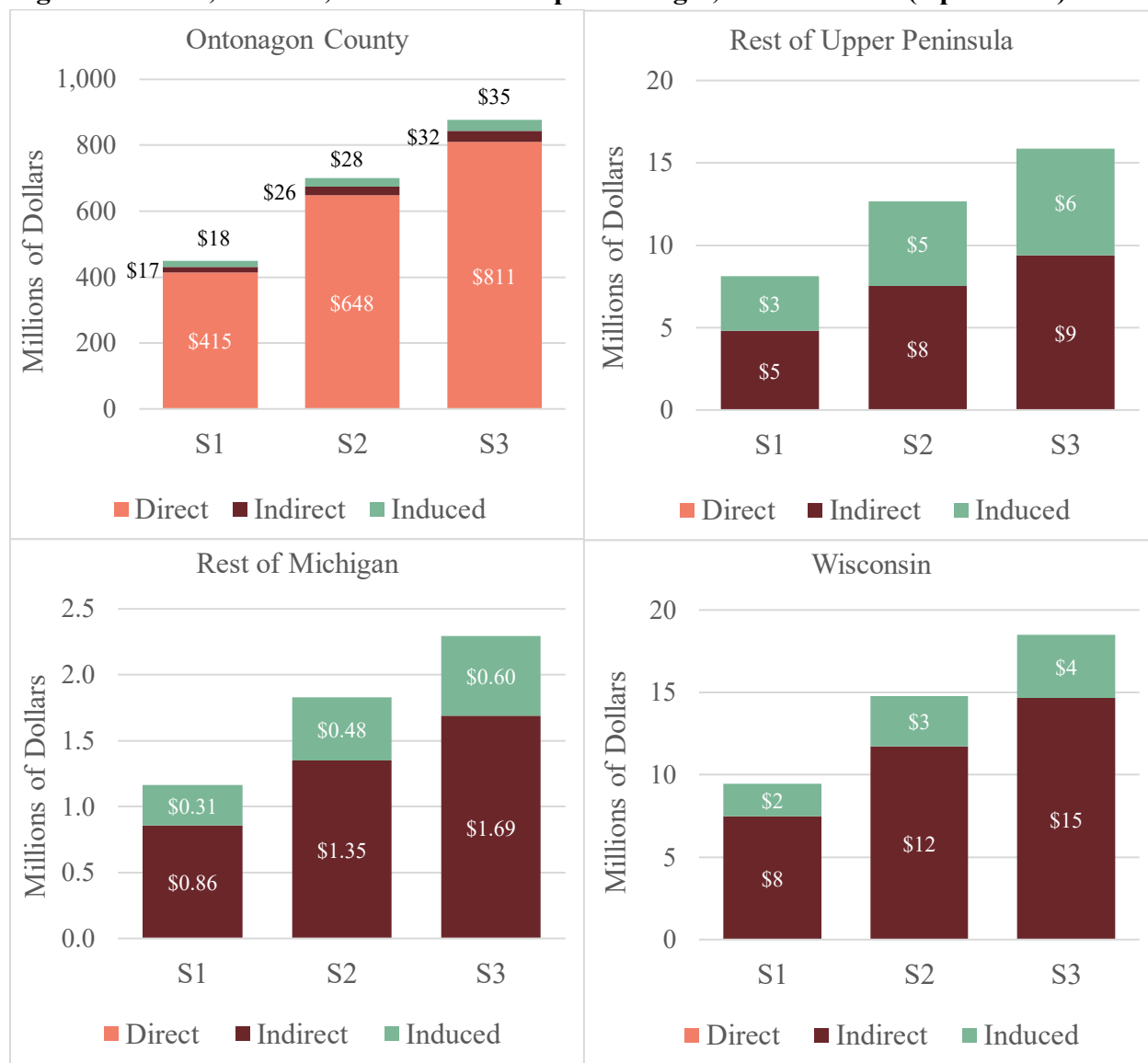
	Scenario 1	Scenario 2	Scenario 3
Ontonagon County	\$448,949,960	\$701,350,209	\$877,493,372
Rest of Upper Peninsula	\$8,108,861	\$12,671,053	\$15,854,860
Rest of Michigan	\$1,165,349	\$1,830,100	\$2,293,824
Wisconsin	\$9,460,355	\$14,785,617	\$18,502,879
Total Output	\$467,684,525	\$730,636,979	\$914,144,935

Notes: Output numbers represent the total annual change in output for each region and scenario during the mine's operations. Total output is the sum of the direct, indirect, and induced output effects.

Figure 8 disaggregates the output impacts by direct, indirect, and induced effects and illustrates a pattern similar to the disaggregated employment impacts. The direct output impacts all occur in Ontonagon County, ranging from \$415 million (S1) to \$811 million (S3) across scenarios, and represent the mine's economic output stemming from the direct employment levels in each scenario. Ontonagon County again sees the largest indirect (\$17–\$32 million) and induced (\$18–\$35 million) output impacts. Also consistent with employment, the induced output impacts are larger than the indirect output impacts in the county. One difference from the employment impacts is that the Rest of the Upper Peninsula sees larger indirect output impacts than induced impacts.

This suggests that consumer spending continues to drive the output impacts in Ontonagon County, and business-to-business purchases drive the output impacts in the Rest of the Upper Peninsula.

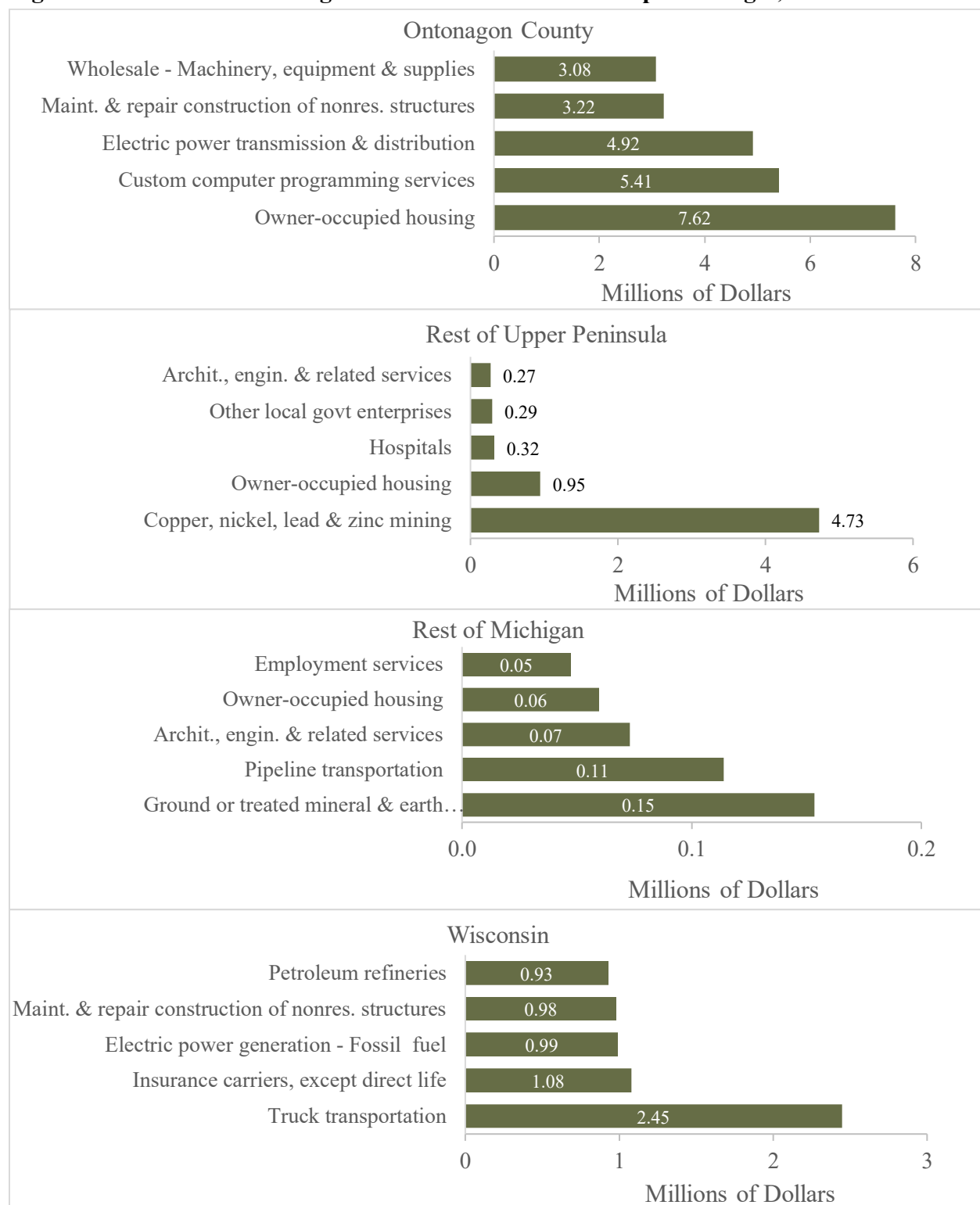
Figure 8. Direct, Indirect, and Induced Output Changes, Scenarios 1–3 (Operations)



Notes: Output numbers represent the total annual change in direct, indirect, and induced output.

Figure 9 presents the industries with the largest indirect and induced changes in output for Scenario 2 (average employment). We continue to exclude the direct gains in the copper, nickel, lead, and zinc mining industry in Ontonagon County since they represent the direct shock in the analysis and are concentrated in one industry. In Ontonagon County, three of the top five industries for output overlap with those for employment (wholesale machinery, equipment, and supplies; maintenance and repair construction of nonresidential structures; and custom computer programming services). Owner-occupied housing and electric power transmission and distribution, which are the two top industries for output in the county, also experience large output

Figure 9. Industries with Largest Indirect and Induced Output Changes, Scenario 2



Notes: Output numbers represent the total annual change in indirect and induced output for Scenario 2.

gains from the mine's operations.¹⁰ The top industries for output vary in the other regions, and the magnitudes are again smaller relative to output generated in the county.

Taxes

Last, we consider the estimated tax impacts from White Pine North's operations. The IMPLAN tax estimates we present below account for taxes on production and imports (sales and excise tax; property tax; customs duties; licensing fees); personal taxes (income tax; property tax; estate and gift taxes; and licensing fees), social insurance taxes (employer and employee payroll taxes); and corporate profit taxes. White Pine Copper also provided data on estimated federal income tax (corporate profit tax) and severance tax for each year of operations.

Table 8. Change in Tax Revenue Across Regions, Scenarios 1–3 (Operations)

	Scenario 1	Scenario 2	Scenario 3
Ontonagon County	\$44,899,966	\$70,142,784	\$87,759,052
Rest of Upper Peninsula	\$976,712	\$1,526,155	\$1,909,670
Rest of Michigan	\$134,123	\$210,483	\$263,740
Wisconsin	\$1,074,261	\$1,678,902	\$2,100,955
Total Tax Revenue	\$47,085,062	\$73,558,324	\$92,033,417

Notes: Tax numbers represent the total annual change in tax revenue for each region and scenario associated with the mine's operations. Total tax revenue is the sum of the direct, indirect, and induced tax effects. Tax impacts do not include severance taxes, which are reported separately based on WPC estimates.

Table 8 shows the total tax revenue impacts by region and scenario, which include taxes at the county, state, and federal level. Across the three scenarios, the mine's operations are associated with total tax revenue increases of \$47 million (S1) to \$92 million (S3). Over 95% of the additional tax revenue is generated in Ontonagon County, \$44.9 million (S1) to \$87.8 million (S3), which is consistent with the output and employment results. Approximately 2% of the tax impacts come from economic activity in the Rest of the Upper Peninsula and Wisconsin. Economic activity from the Rest of Michigan contributes 0.2%–0.3% to tax revenue generation.

Figure 10 presents the changes in tax revenue at the county, state, and federal level accrued to each region. County taxes include county, sub-county special districts (which can include entities like fire and school districts), and sub-county general (such as city and township jurisdictions) (Nealy, 2023). In Ontonagon County, we see a projected increase of approximately \$9 million (S1) to \$17.5 million (S3) in county tax revenue, \$11.3 million to \$22.1 million in state tax revenue, and

¹⁰ *The input-output model in IMPLAN does not estimate costs and benefits but rather changes in value. While some stakeholders (i.e. business owners, homeowners) may see the increased demand for their goods, services, and homes, and the likely associated increase in their prices, as a positive (benefits), other stakeholders may experience the increased demand as a burden (costs). It is beyond the scope of this study and modeling tool to estimate the change in prices and associated costs and benefits.*

\$24.6 million to \$48.1 million in federal tax revenue. The patterns are similar for the other three regions; federal tax revenue increases the most, followed by state taxes, and then county taxes. However, the magnitudes are much smaller compared to those for Ontonagon County.

Figure 10. Tax Revenue Impacts by Region, Scenarios 1–3 (Operations)



Notes: Tax numbers represent the total annual change in tax revenue at the county, state, and federal levels.

Importantly, the tax results presented in Table 8 and Figure 10 *exclude* severance tax estimates. While IMPLAN simulates severance taxes, the estimates are based on regional averages and are not industry specific. Relative to the mineral severance tax of 2.75% in Michigan, the simulated IMPLAN severance tax estimates underestimate the severance taxes White Pine Copper will pay during their operational life. Therefore, we *exclude* the IMPLAN severance tax estimates from the IMPLAN results and separately report the severance tax estimates provided by White Pine Copper.

Table 9. Federal Income Tax and Michigan Severance Tax Estimates, Operations

Year	Federal Income Tax (21%)	<u>Michigan Severance Tax (2.75%)</u>		
		<i>Total</i>	<i>Michigan (35%)</i>	<i>Ontonagon County (65%)</i>
1	\$3.59	\$12.59	\$4.41	\$8.18
2	\$7.49	\$14.82	\$5.19	\$9.63
3	\$6.73	\$14.88	\$5.21	\$9.67
4	\$8.08	\$15.14	\$5.30	\$9.84
5	\$25.85	\$15.15	\$5.30	\$9.85
6	\$42.84	\$16.45	\$5.76	\$10.69
7	\$38.57	\$15.04	\$5.26	\$9.77
8	\$36.57	\$14.85	\$5.20	\$9.65
9	\$30.61	\$14.19	\$4.97	\$9.22
10	\$35.04	\$15.85	\$5.55	\$10.30
11	\$32.32	\$14.87	\$5.21	\$9.67
12	\$32.10	\$14.22	\$4.98	\$9.24
13	\$34.88	\$14.83	\$5.19	\$9.64
14	\$37.13	\$15.11	\$5.29	\$9.82
15	\$32.37	\$13.98	\$4.89	\$9.09
16	\$35.78	\$15.26	\$5.34	\$9.92
17	\$25.83	\$12.91	\$4.52	\$8.39
18	\$34.29	\$14.56	\$5.10	\$9.47
19	\$23.54	\$13.18	\$4.61	\$8.56
20	\$26.54	\$12.70	\$4.45	\$8.26
21	\$25.54	\$13.35	\$4.67	\$8.68
22	\$26.64	\$12.88	\$4.51	\$8.37
23	\$26.85	\$13.47	\$4.72	\$8.76
24	\$21.23	\$13.24	\$4.63	\$8.61
25	\$27.89	\$13.22	\$4.63	\$8.59
26	\$0.00	\$7.45	\$2.61	\$4.84
Average	\$26.09	\$14.01	\$4.90	\$9.10

Notes: Federal income tax (21%) and Michigan severance tax (2.75%) estimates provided by White Pine Copper for each year of operations. Severance taxes are based on the value of minerals produced and represent a significant tax source not reflected in the IMPLAN results. The severance tax is split between the state of Michigan (35%) and local entities in Ontonagon County (65%).

Table 9 presents the severance tax and federal income tax estimates for each year of operations provided by White Pine Copper. White Pine Copper is estimated to pay \$7.45 million (year 26) to \$16.45 million (year 6) in severance taxes per year, with an average of \$14 million in annual severance tax across the 26 years of operations. In Michigan, 35% of severance taxes are allocated to the state's rural development fund, an average of \$4.9 million per year. The remaining 65% are designated as the local share, an average of \$9.1 million per year, and are distributed to school

districts, the state, and local governmental units in Ontonagon County. The severance tax estimates further illustrate the additional tax revenue generated from the mine's operations that will benefit the local area since the majority goes to school districts and local townships in Ontonagon County. The mine is projected to pay an average of \$26.1 million in federal income taxes per year (minimum of \$3.59 million and maximum of \$42.84 million). These federal income tax estimates provide an additional level of detail to the IMPLAN federal tax results presented thus far and can be thought of as a component of the direct tax revenue impacts in Ontonagon County.

Forecasted Results for Construction: Scenarios 4–6

We now turn to the anticipated economic impacts from the initial construction necessary for White Pine North's operations to begin (Scenarios 4, 5, and 6). We present analogous results for the construction scenarios as those presented for operations. However, the results for Scenarios 4–6 should be interpreted as the *total impact* of the construction phase rather than annual impacts. The construction impacts are a one-time occurrence and will not persist after construction is complete and operations begin. Further, the only direct shock in the operations scenarios was to the copper, nickel, lead, and zinc mining industry in Ontonagon County. In contrast, direct shocks for the construction scenarios occur in multiple industries and regions to represent where the capital expenditures and per-diem spending is expected to occur (Tables 2, 3, and 4).¹¹

Employment

Table 10. Change in Employment Across Regions, Scenarios 4–6 (Construction)

	Scenario 4	Scenario 5	Scenario 6
Ontonagon County	607	675	728
Rest of Upper Peninsula	798	887	962
Rest of Michigan	1,308	1,453	1,589
Wisconsin	83	92	100
Total Employment	2,796	3,107	3,379

Notes: Employment numbers represent the total change in the number of jobs for each region and scenario for the 3-year construction period (the total over all three years). Total employment is the sum of the direct, indirect, and induced employment effects.

Table 10 presents the employment results for Scenarios 4–6. Recall that we use capital expenditure data and per-diem spending to model the direct shocks in the construction scenarios as changes in industry output. Then, IMPLAN uses the direct output shocks to estimate the number of jobs supported, which are generated by the model and do not represent employment data provided by WPC. Across the three-year construction period, the construction activities are expected to support

¹¹ The construction scenarios assume that short-term lodging capacity in Ontonagon County is sufficient for temporary workers per-diem spending in the area during construction. If lodging capacity is limited, then local impacts from per-diem spending in Ontonagon County could be partially shifted to surrounding counties in the UP.

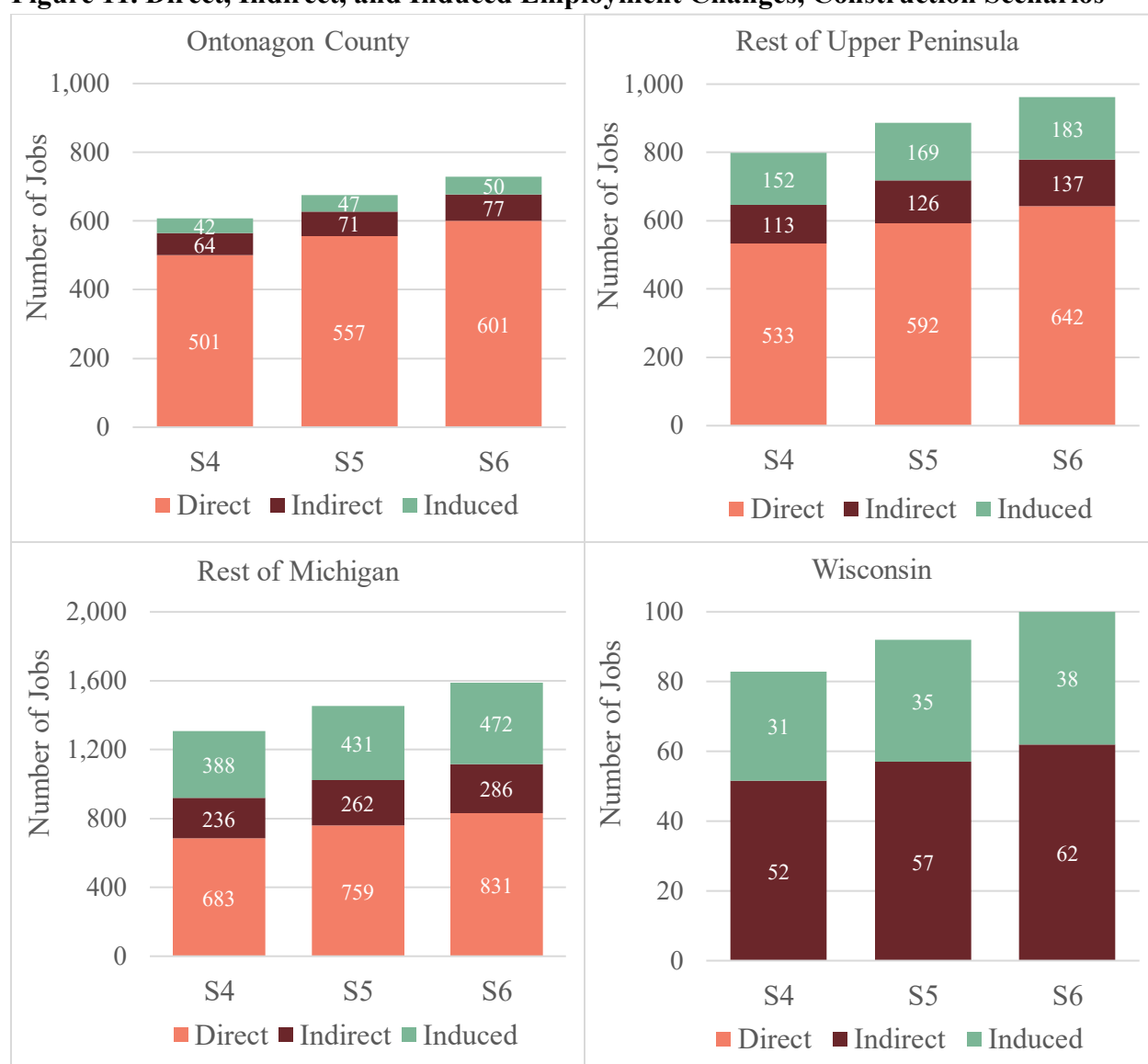
2,796 (S4) to 3,379 (S6) jobs in total across all regions. This translates to an annual average of 932 jobs for Scenario 4 and 1,126 jobs for Scenario 6 across the three-year period. In contrast to the operations results, we see the largest employment impacts in the Rest of Michigan (1,308–1,589; 47% of total jobs), followed by the Rest of the Upper Peninsula (798–962 jobs; 28% of total jobs). These additional jobs supported outside of Ontonagon County during the mine’s three-year construction period reflect the magnitude of expenditures occurring in other regions and the additional benefits as those dollars circulate throughout the economy. Although we observe limited job impacts in Wisconsin (3%), this is expected since there are no direct expenditure shocks in Wisconsin.

We continue to see significant employment impacts in Ontonagon County (607–728 jobs), which accounts for 22% of the total employment effects. The employment estimates for the construction scenarios reflect the aggregate number of jobs supported during the three-year period. These correspond with *annual* employment gains of 202–243 jobs in Ontonagon County, 436–530 jobs in the Rest of Michigan, and 266–321 jobs in the Rest of the UP. Relative to baseline 2024 employment levels, the annual gains are most significant in Ontonagon County, an 8.7–10.4% increase per year in the county’s employment.

Figure 11 disaggregates the employment results from the construction of the mine and its facilities into the direct, indirect, and induced effects for each region and scenario across the full three-year construction period. The majority of the employment supported in each region in Michigan stem from direct jobs, 501–601 direct jobs in Ontonagon County; 533–642 direct jobs in the Rest of the Upper Peninsula; and 683–831 direct jobs in the Rest of Michigan. Across all direct employment impacts, approximately 40% occur in the Rest of Michigan; 31% in the Rest of the Upper Peninsula; and 29% in Ontonagon County. This is consistent with the scenarios since the capital expenditure estimates, or the direct shocks, are largest in the Rest of Michigan. There are no direct construction expenditures allocated to Wisconsin in the analysis, so the region does not contribute to the direct employment estimates.

The indirect and induced impacts then represent additional employment supported via linkages across industries and household spending in each region. Again, the Rest of Michigan sees more indirect (236–286 jobs) and induced employment (388–472 jobs) than the other regions during construction. Ontonagon County and Wisconsin both experience larger indirect than induced job impacts, while the opposite is true in the Rest of the Upper Peninsula and the Rest of Michigan. This suggests that for the construction phase, business-to-business purchases have a larger impact in Ontonagon County and Wisconsin, while household spending has more impact in the Rest of the Upper Peninsula and Rest of Michigan.

Figure 11. Direct, Indirect, and Induced Employment Changes, Construction Scenarios

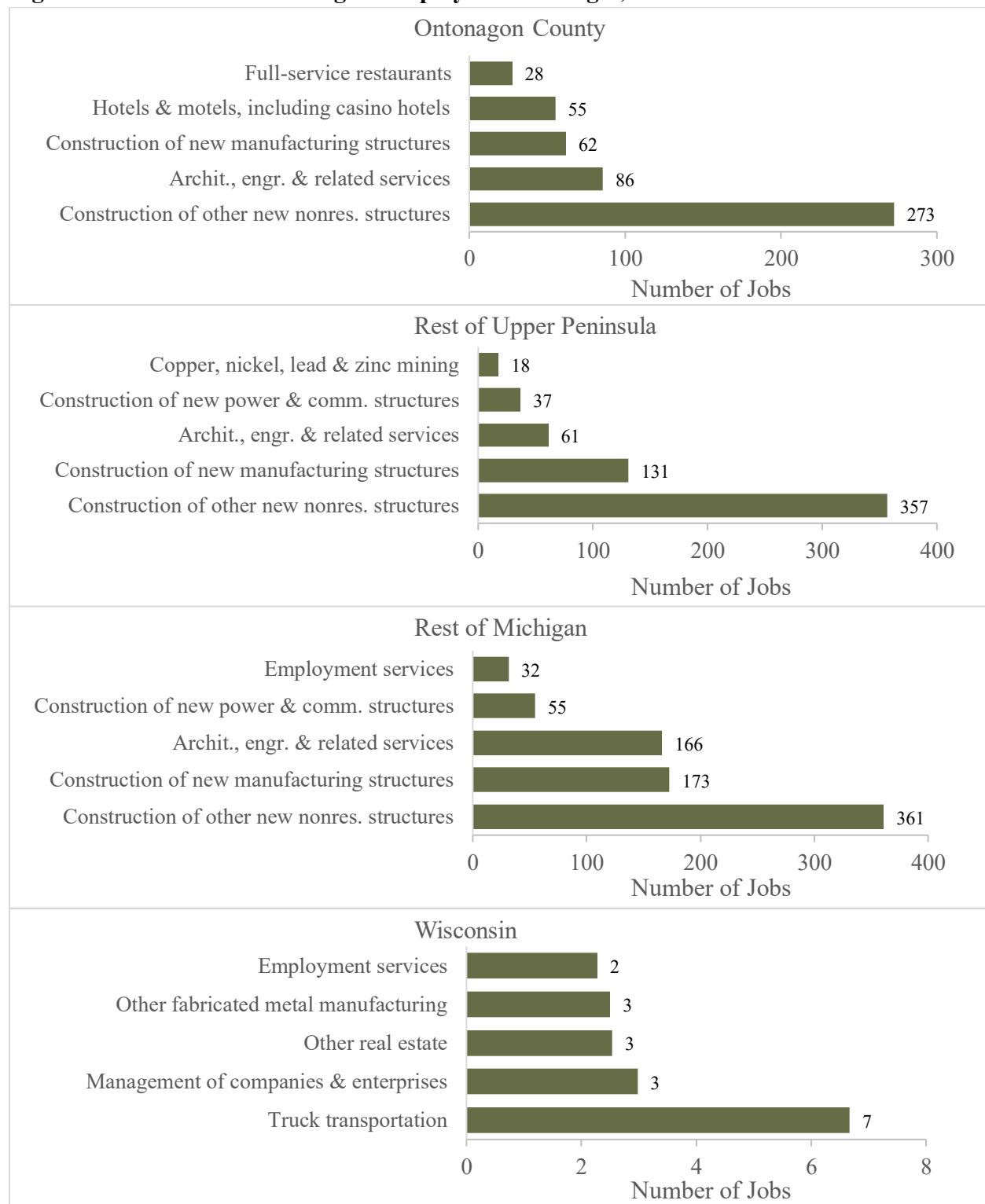


Notes: Employment numbers represent the total change in the number of direct, indirect, and induced jobs for the 3-year construction period (the total over all three years).

We can also identify the industries in each region that experience the largest employment impacts across the construction scenarios. For this purpose, we focus on Scenario 5, the baseline construction scenario. Figure 12 shows the industries with the largest total employment effects in each region and shows the sum of direct, indirect, and induced impacts for each industry across the three-year period.¹² The results show significant overlap in the top industries for employment

¹² In contrast to the operations scenarios, the top industry results for construction include the direct impacts since we modeled direct expenditures in multiple industries in three regions compared to direct employment in one industry and one region for operations.

Figure 12. Industries with Largest Employment Changes, Scenario 5



Notes: Employment numbers represent the total change in the number of jobs, the sum of the direct, indirect, and induced jobs, for Scenario 5 for the 3-year construction period (the total over all three years).

across Ontonagon County, the Rest of the Upper Peninsula, and the Rest of Michigan, three regions where direct expenditures occur. Top industries for employment in these three regions include: construction of other new non-residential structures; construction of new manufacturing structures; and architectural, engineering, and related services. Per-diem spending on food and lodging is only applicable to Ontonagon County, where we also see top employment impacts in full-service restaurants and hotels and motels. Except for employment services in the Rest of Michigan, the most impacted industries across the three Michigan regions are all driven by the direct capital expenditures modeled in those regions. In contrast, the top employment industries for Wisconsin are solely driven by indirect and induced employment impacts, which include truck transportation; management of companies and enterprises; other real estate; other fabricated metal manufacturing; and employment services.

Output

Next, we turn to the output results. Table 11 shows the estimated total output impacts for Scenarios 4 through 6 (the sum of the direct, indirect, and induced effects), which range from a total of \$566 million (S4) to \$682 million (S6) across the three-year construction period. As with the employment impacts in Scenarios 4–6, we continue to see that the Rest of Michigan contributes the most (52%) to the output impacts, specifically \$291 million (S4) to \$353 (S6) million across the scenarios for the three-year construction phase. Looking at the other regions, approximately 15% of the output impacts are in Ontonagon County, 29% in the Rest of the Upper Peninsula, and 4% in Wisconsin. Although the absolute output impacts are largest in the Rest of Michigan, the effect relative to each region’s baseline output level in 2024 is most significant in Ontonagon County; the county’s annual output increases by approximately 9–11% per year.¹³

Table 11. Change in Output Across Regions, Scenarios 4–6 (Construction)

	Scenario 4	Scenario 5	Scenario 6
Ontonagon County	\$86,988,011	\$96,654,010	\$103,834,813
Rest of Upper Peninsula	\$165,356,646	\$183,734,564	\$198,435,371
Rest of Michigan	\$290,927,513	\$323,267,045	\$352,585,736
Wisconsin	\$22,809,224	\$25,359,182	\$27,548,381
Total Output	\$566,081,394	\$629,014,801	\$682,404,300

Notes: Output numbers represent the total change in output for each region and scenario for the 3-year construction period (the total over all three years). Total output is the sum of the direct, indirect, and induced output effects.

Figure 13 disaggregates the output impacts by direct, indirect, and induced effects. Consistent with the employment results in the construction scenarios, the majority of the impacts continue to reflect

¹³ Ontonagon County has total output gains of \$87 to \$104 million over the 3-year period, or an average of \$29 to \$34.7 million per year. Relative to the county’s 2024 output of \$318.3 million, this translates to a 9–11% increase. For comparison, output gains for the other regions relative to their 2024 baseline are less than 0.2%.

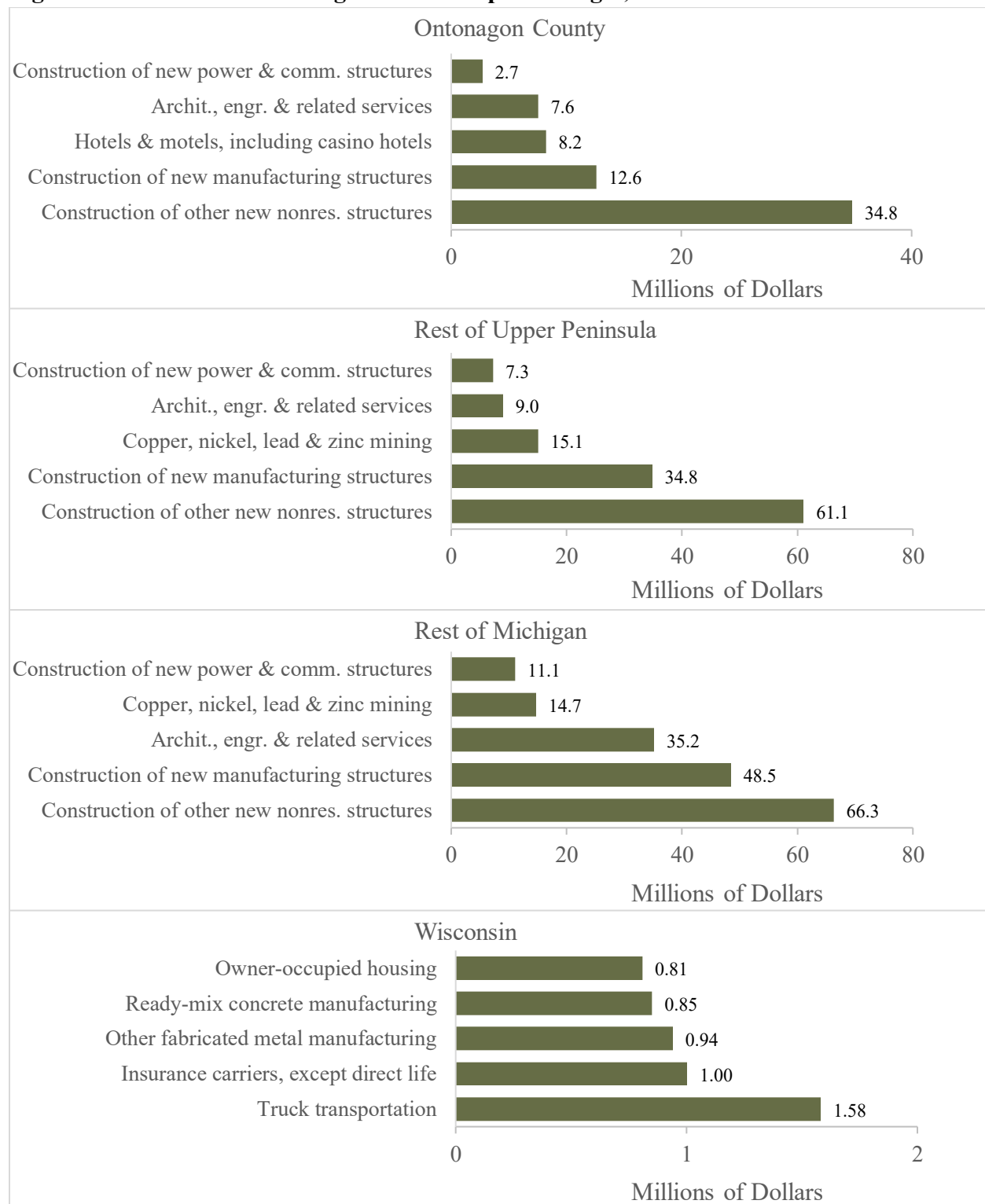
direct output in the three Michigan regions and the Rest of Michigan experiences the largest effects in each category (direct, indirect, and induced). The Rest of Michigan generates more induced (\$75–\$91 million) than indirect output effects (\$61–\$74 million). In contrast, the other three regions all experience greater indirect effects than induced effects for output. For the Rest of the Upper Peninsula, this differs from the employment results. This suggests that business-to-business purchases drive the additional output impacts in Ontonagon County, the Rest of the Upper Peninsula, and Wisconsin, while household spending drives the spillover output impacts in the Rest of Michigan.

Figure 13. Direct, Indirect, and Induced Output Changes, Construction Scenarios



Notes: Output numbers represent the total change in direct, indirect, and induced output for the 3-year construction period (the total over all three years).

Figure 14. Industries with Largest Total Output Changes, Scenario 5



Notes: Output numbers represent the change in total output, the sum of the direct, indirect, and induced effects, for Scenario 5 for the 3-year construction period (the total over all three years).

Next, we highlight the industries with the highest total output impacts during construction in each region for Scenario 5 (Baseline) in Figure 14. In the three regions where direct capital expenditures occur (Ontonagon County, Rest of the Upper Peninsula, and the Rest of Michigan) top industries for output across the three years include: construction of other new non-residential structures; construction of new manufacturing structures; architectural, engineering, and related services; and construction of new power and communication structures. These industries all had direct capital expenditures and mostly overlap with top industries for employment. In Ontonagon County, hotels and motels are also a top industry for output, which continues to reflect the impacts of local per-diem spending during construction. Together this suggests that the industries with the largest impacts in the Michigan-based regions are those with direct capital expenditures. In Wisconsin, where no direct capital expenditures occur, truck transportation; insurance carriers except direct life; other fabricated metal manufacturing; ready-mix concrete manufacturing; and owner-occupied housing are the industries with the largest output impacts, several of which are different from the top industries for employment.

Taxes

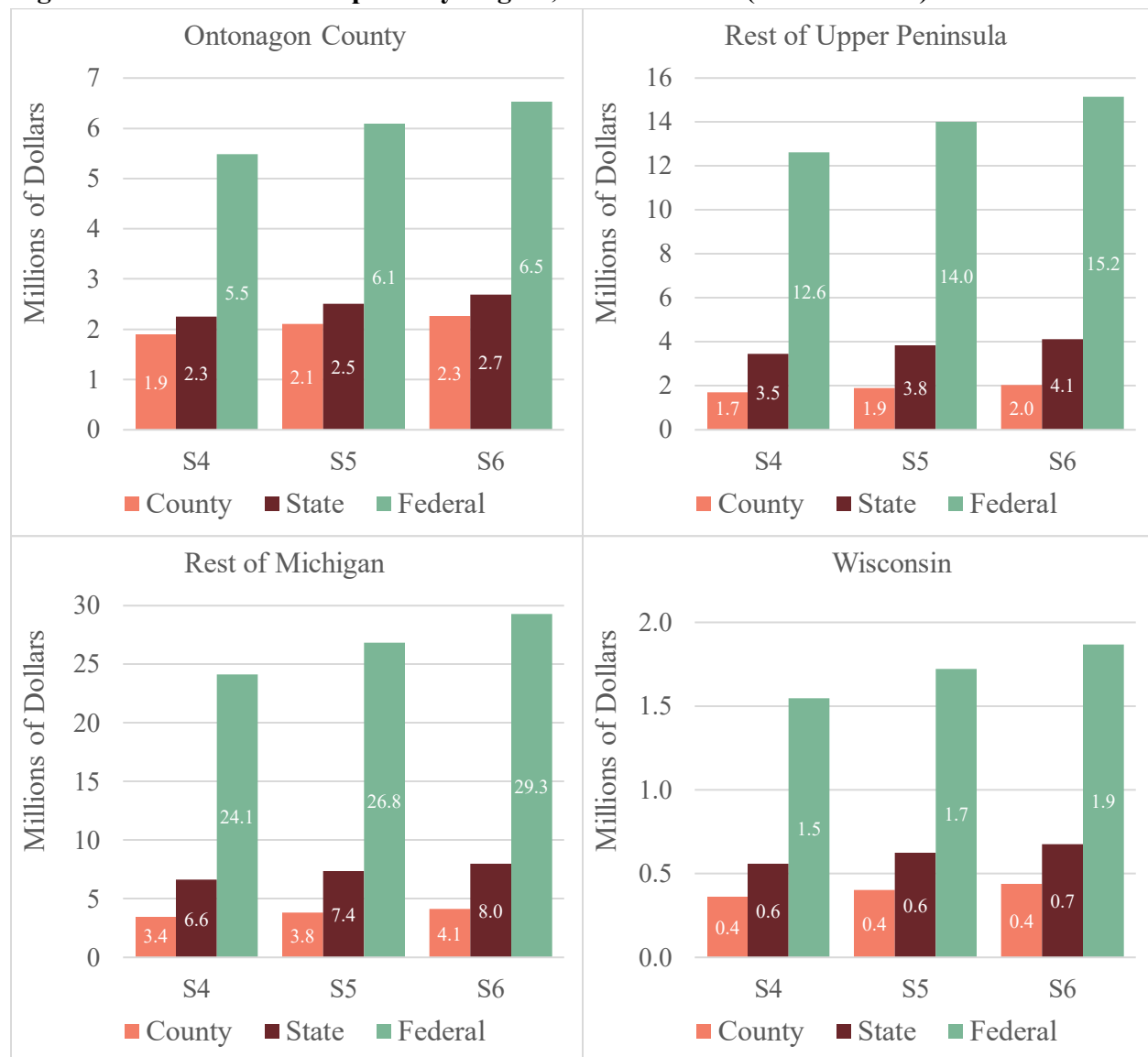
Finally, we turn to the estimated tax revenue impacts for the construction phase of the White Pine North Project. The IMPLAN tax estimates account for the same tax categories included for the operations scenarios (taxes on production and imports; personal taxes, social insurance taxes; and corporate profit taxes). Table 12 shows the total tax revenue impacts by region and scenario, which include taxes at the county, state, and federal level. Across the three scenarios, the mine's operations are associated with total tax revenue increases of \$64 million (S4) to \$77 million (S6). The Rest of Michigan contributes approximately 53% of the additional tax revenue, \$34 million (S4) to \$41 million (S6). Ontonagon County, the Rest of the Upper Peninsula, and Wisconsin contribute 15%, 28%, and 4% respectively to the additional tax revenue generated from construction. These results are similar to the employment and output results for construction, but they differ from the tax results for the operational scenarios (S1–S3). The tax impacts are heavily concentrated in Ontonagon County for operations, while the tax revenue gains are more dispersed across regions for construction with the largest gains in the Rest of Michigan.

Table 12. Change in Tax Revenue Across Regions, Scenarios 4–6 (Construction)

	Scenario 4	Scenario 5	Scenario 6
Ontonagon County	\$9,629,284	\$10,699,285	\$11,481,802
Rest of Upper Peninsula	\$17,776,079	\$19,751,715	\$21,322,738
Rest of Michigan	\$34,193,119	\$37,993,864	\$41,445,013
Wisconsin	\$2,471,648	\$2,747,868	\$2,984,081
Total Tax Revenue	\$64,070,130	\$71,192,732	\$77,233,634

Notes: Tax numbers represent the total change in tax revenue for each region and scenario for the 3-year construction period (the total over all three years). Total tax revenue is the sum of the direct, indirect, and induced tax effects. Tax impacts do not include severance taxes because the mineral severance tax is not applicable during the construction phase.

Figure 15. Tax Revenue Impacts by Region, Scenarios 4–6 (Construction)



Notes: Tax numbers represent the total change in county, state, and federal tax revenue for the 3-year construction period (the total over all three years).

Figure 15 presents the changes in tax revenue at the county, state, and federal level by region for the construction scenarios. Across all regions, we see that federal taxes are the largest followed by state taxes and then county taxes. We also continue to see the largest tax impacts for each category in the Rest of Michigan, followed by the Rest of the Upper Peninsula, Ontonagon County, and Wisconsin. For example, federal tax revenue ranges from \$24.1 million (S4) to \$29.3 million (S6) in the Rest of Michigan, \$12.6 to \$15.2 million in the Rest of the Upper Peninsula, \$5.5 to \$6.5 million in Ontonagon County, and \$1.5 to \$1.9 million in Wisconsin. Importantly, severance tax and federal corporate income tax estimates from White Pine Copper were only provided for the operations phase since they are not applicable during construction; the severance tax is based on the value of minerals produced and corporate income taxes require positive revenue. Overall, the

results for Scenarios 4–6 highlight the additional economic benefits from the mine’s initial construction, particularly within the state of Michigan. The aggregate gains are largest for the Rest of Michigan, but the relative gains are most significant for Ontonagon County.

Aggregate Impacts for the State of Michigan

The main results focus on the estimated impacts to four regions: Ontonagon County; the Rest of the Upper Peninsula (excluding Ontonagon County); the Rest of Michigan (excluding the Upper Peninsula); and Wisconsin. It is also of interest to consider the aggregate estimated impacts to the state of Michigan. Table 13 shows the aggregate impacts to Michigan, which correspond with the sum of the impacts across Ontonagon County, the Rest of the Upper Peninsula, and the Rest of Michigan. The results in Table 13 are not additional impacts to those previously reported, but rather an aggregation of prior results to reflect the Michigan total. Focusing on average employment during operations, Scenario 2, the estimated impact for the state of Michigan is 1,057 jobs, \$716 million in output, and \$72 million in tax revenue each year of operations. In the baseline construction phase (Scenario 5), the results indicate that construction will support 3,015 jobs, \$604 million in output, and \$68 million in tax revenue throughout the state of Michigan in total across the three-year period.

Table 13. Aggregate Economic Impacts, Michigan

	Employment	Output	Taxes
Scenario 1	678	\$458,224,170	\$46,010,801
Scenario 2	1,057	\$715,851,362	\$71,879,422
Scenario 3	1,323	\$895,642,056	\$89,932,462
Scenario 4	2,713	\$543,272,170	\$61,598,482
Scenario 5	3,015	\$603,655,619	\$68,444,864
Scenario 6	3,279	\$654,855,920	\$74,249,553

Notes: All values are the sum of the total values for Ontonagon County, the Rest of the Upper Peninsula, and the Rest of Michigan previously reported for each respective variable. These results are not additional impacts, but rather the total economic impact for the entire state of Michigan for each variable across scenarios. Results for Scenarios 1-3 represent annual changes for each year of operations, while those for Scenarios 4-6 represent cumulative changes across the three-year construction period.

Reflecting on the overall analysis, Michigan is projected to experience significant economic benefits via employment gains, output created, and additional tax revenue from White Pine North’s estimated three-year construction period and 26-year operational life. Further, White Pine North represents a substantial investment into Ontonagon County, an area that has experienced a declining or stagnant economy since the early 2000s. The mine represents an opportunity to significantly boost the county’s economic development.

VI. CONCLUSION

This report estimates the economic impacts of the construction and operation phases of the White Pine North project using IMPLAN, an input-output economic modeling software. We focus on the impacts in four regions: Ontonagon County, the Rest of the Upper Peninsula (excluding Ontonagon County), the Rest of Michigan (excluding the Upper Peninsula), and Wisconsin. We developed six scenarios, three focus on construction and three focus on operations to represent the potential impacts of the mine's activities on employment, output, and tax revenue. The construction scenarios vary the share of capital expenditures within Michigan to model a +/-10% deviation from the baseline in-state expenditure estimates; the operations scenarios vary the number of workers employed by the mine to capture the minimum, average, and maximum estimated employment levels. We highlight the total estimated impacts as well as the direct, indirect, and induced impacts in each region. Direct impacts capture the mine's economic activity; indirect and induced impacts reflect additional economic activity from business-to-business transactions throughout the supply chain and household spending as workers spend their earnings.

The results indicate that the mine's operations are estimated to create a total of approximately 700–1,400 jobs on average each year across all regions. Over 90% of the jobs (approximately 640–1,260 jobs) are in Ontonagon County, which corresponds with a 27% to 54% increase in the county's total employment relative to 2024 levels. The remaining job growth is split as follows: 4% in the Rest of the Upper Peninsula, 0.5% in the Rest of Michigan, and 5% in Wisconsin. Almost 65% of the jobs created in Ontonagon County are directly with the mine, while the remaining 35% represent indirect and induced employment as the mine's activity spills over to impact other industries in the region.

The estimated output impacts for the mine's operations in Ontonagon County are even larger compared to the employment estimates, increasing the county's baseline output relative to 2024 levels by 141% to 275%. This corresponds with average output gains of \$449 to \$877 million per year in the county, which accounts for approximately 96% of the total output gains (\$468 to \$914 million). In addition to employment and economic output, the mine's operations will also significantly increase tax revenue by \$47 to \$92 million across regions. The impacts continue to be concentrated in Ontonagon County, \$45 to \$88 million, representing 95% of the total tax impact. The tax revenue generated in Ontonagon County is split across levels as follows: \$9 to \$18 million in county taxes, \$11 to \$22 million in state taxes, and \$25 to \$48 million in federal taxes. The mine will also pay a 2.75% severance tax to the state of Michigan based on the value of minerals produced each year, which generates additional tax revenue of \$7.5 to \$16.5 million per year. Thirty-five percent (\$2.6 to \$5.8 million) of the severance tax remains with the state and 65% (\$4.8 to \$10.7 million) goes to local entities in Ontonagon County. Overall, the operation of White Pine North will generate significant economic benefits by creating jobs, generating economic output, and increasing tax revenue, particularly in Ontonagon County, an area that will greatly benefit from an economic recovery.

We also estimate the economic impacts from the construction required to develop the mine site over a three-year. The construction scenarios are based on estimated expenditures in Michigan (\$362 million); the additional \$562 million in estimated expenditures outside of Michigan are beyond the scope of the analysis and will generate additional economic impacts not reflected in this report. The results estimate that the construction phase will support 2,800–3,380 jobs, \$566 to \$682 million in economic output, and \$64 to \$77 million in tax revenue in total across all regions. These numbers reflect the total impact for the entire three-year construction period rather than annual impacts. The construction impacts are largest in the Rest of Michigan, accounting for approximately 47–53% of the total impacts and partially reflecting the magnitude of direct capital expenditures, \$172 million, expected to occur in the Rest of Michigan. The Rest of the Upper Peninsula accounts for 27–29% and Ontonagon County accounts for 15–22% of total construction impacts. The relative gains in Ontonagon County are also significant, as the jobs supported and output generated in the county during construction increases the county’s employment and output by 9–11% relative to the 2024 baseline levels.

The White Pine North project represents a significant investment in Ontonagon County’s economic development. Following the closure of the historical White Pine mine in the late 1990s, the county’s population and employment have declined by approximately 25% and 31%, respectively, from 2001 to 2024 (IMPLAN, 2024). White Pine Copper plans to invest over \$905 million in capital expenditures to develop the mine site over a planned three-year construction period. Over 40% of the expenditures, \$362.8 million, are expected to occur in Michigan. Further, WPC estimates average annual employment of over 650 workers directly at the mine and its facilities during its 26-year operational life. These new jobs in the mining industry are estimated to increase the county’s employment by 28% relative to 2024 employment levels and represent a strong shift in the county’s employment trend since 2001. In the state of Michigan, average employee compensation in the copper, nickel, lead, and zinc mining industry is approximately \$137,300, which is more than three times higher than Ontonagon County’s average employee compensation across all industries, \$43,651 (IMPLAN, 2024). Although compensation estimates for jobs at White Pine North are not yet available and may differ from the state’s industry average, new jobs at the mine will likely provide high-paying employment opportunities in the area, which will further boost the county’s economic activity via household spending. Overall, the analysis highlights the positive economic benefits associated with the White Pine North project, particularly for Ontonagon County during operations and the broader state of Michigan during construction.

VII. REFERENCES

Chamber of Commerce Ontonagon County (n.d.). Copper History.

<https://ontonagonmi.org/explore-ontonagon/copper-history/>

Clouse, C. (2020 March 13). IMPLAN Report Toolkit.

<https://support.implan.com/hc/en-us/articles/360044985833-About-IMPLAN>

Data Team (2017 June 27). Special Industry Definitions.

<https://support.implan.com/hc/en-us/articles/115009505667-Special-Industry-Definitions>

Federal Reserve Bank of Minneapolis (1995 October 1). Western U.P. mine closes, locals look to keep workers at home.

<https://www.minneapolisfed.org/article/1995/western-up-mine-closes-locals-look-to-keep-workers-at-home>

Globe Newswire (2021 July 27). Highland Copper Announces Completion of the White Pine North Project Acquisition.

<https://www.globenewswire.com/news-release/2021/07/27/2269643/0/en/Highland-Copper-Announces-Completion-of-the-White-Pine-North-Project-Acquisition.html>

Globe Newswire (2026 March 2). Highland Copper Closes Sale of 34% Interest in White Pine for US\$30 Million.

<https://www.globenewswire.com/news-release/2026/03/02/3247271/0/en/highland-copper-closes-sale-of-34-interest-in-white-pine-for-us-30-million.html>

G Mining Services (2023 September 7). Preliminary Economic Assessment, White Pine North Project.

IMPLAN (2024). IMPLAN system (2024 model) [Software and data].

<https://www.implan.com>

Lankton, Larry (2005). Keweenaw National Historic Park Historic Resource Study. Prepared for the National Park Service, United States Department of the Interior.

<https://npshistory.com/publications/kewe/hrs.pdf>

Lucas, M. (2019a July 3). Adding an Industry that Doesn't Exist Yet by Customizing a Region.

<https://support.implan.com/hc/en-us/articles/360025897334-Adding-an-Industry-that-Doesn-t-Exist-Yet-by-Customizing-a-Region>

Lucas, M. (2019b September 17). Understanding Output.

<https://support.implan.com/hc/en-us/articles/360035998833-Understanding-Output>

Lucas, M. (2020 March 20). Housing: Owning, Buying, Selling, and Renting.

<https://support.implan.com/hc/en-us/articles/360044820554-Housing-Owning-Buying-Selling-and-Renting>

Marketwire (2014 March 5). Highland Enters Into Definitive Agreement to Acquire the White Pine Copper Project in Michigan.

https://www.highlandcopper.com/wpcontent/uploads/2024/01/62921a_82d87602db894acb958820963e7ea298.pdf

National Park Service (2025 May 7). Timeline of Michigan Copper Mining Prehistory to 1850.

<https://www.nps.gov/kewe/learn/historyculture/copper-mining-timeline.htm>

National Park Service (2024 July 25). Timeline of Michigan Copper Mining 1851 to 1900.

<https://www.nps.gov/kewe/learn/historyculture/copper-mining-timeline-page-2.htm>

Nealy, M. (2023 September 8). Tax results.

<https://support.implan.com/hc/en-us/articles/18626179073179-Tax-Results>

NS Energy (2024 July 11). White Pine North Project, Michigan, US.

<https://www.nsenergybusiness.com/projects/white-pine-north-project-michigan-us>

US General Services Administration (2026 July 8). FY 2026 per diem rates for Ontonagon, Michigan.

https://www.gsa.gov/travel/plan-book/per-diem-rates/per-diem-rates-results?action=perdiems_report&fiscal_year=2026&state=MI&city=Ontonagon&zip=

US Geological Survey (1954 November 1). The White Pine Copper Deposit, Ontonagon County, Michigan.

<https://www.usgs.gov/publications/white-pine-copper-deposit-ontonagon-county-michigan>

VIII. APPENDIX

Table A1. Capital Expenditure Data Provided by WPC

Group	Group Description	Category	Category Description	Total	Ontonagon County	Rest of UP	Rest of Michigan	Out of State
1000	MINING	1200	Mine Infrastructure and Services	\$50,166,371	\$1,488,845	\$5,827,788	\$12,196,561	\$30,653,178
		1300	Underground Mining	\$78,411,488	\$4,577,997	\$8,904,599	\$15,682,298	\$49,246,595
		1400	Mine to Surface Conveyor	\$25,015,011	\$1,520,536	\$2,501,501	\$5,003,002	\$15,989,972
		1600	Mobile Equipment	\$46,241,424	-	-	-	\$46,241,424
		1700	Temporary Ore Stockpile	\$6,071,412	\$2,884,506	\$2,926,356	\$140,400	\$120,150
2000	PROCESS PLANT	2100	ROM Ore Stockpile and Reclaim	\$24,183,582	\$1,178,486	\$2,876,865	\$3,988,428	\$16,139,802
		2200	Crushing	\$16,175,241	\$1,722,116	\$4,661,724	\$3,214,544	\$6,576,857
		2300	Grinding	\$81,541,599	\$3,795,926	\$12,250,734	\$17,190,071	\$48,304,867
		2400	Flotation & Regrind	\$49,155,868	\$1,778,535	\$4,137,734	\$7,988,182	\$35,251,417
		2500	Concentrate Handling	\$10,257,032	\$540,807	\$1,371,003	\$1,914,534	\$6,430,688
		2600	Tailings Handling	\$26,061,052	\$899,281	\$2,520,354	\$3,832,451	\$18,808,965
		2700	Reagents	\$3,465,062	\$194,116	\$418,757	\$700,116	\$2,152,073
		2800	Process Plant Services and Common	\$7,439,319	\$453,285	\$963,587	\$1,794,210	\$4,228,237
3000	TAILINGS STORAGE FACILITY & SITE WIDE WATER MANAGEMENT	3100	Tailings Management Facility	\$23,193,272	\$7,815,221	\$8,360,522	\$3,486,190	\$3,531,339
		3200	Site Wide Water Management	\$12,555,684	\$1,446,540	\$3,007,272	\$4,124,218	\$3,977,653
4000	ON SITE INFRASTRUCTURE	4100	Bulk Earthworks	\$13,354,234	\$6,347,382	\$6,429,816	\$329,735	\$247,301
		4300	Power Generation	\$55,514,011	-	\$374,564	\$882,227	\$54,257,219
		4400	HV Power Switchyard and Power Distribution	\$31,561,791	\$692,483	\$2,525,826	\$5,180,558	\$23,162,924
		4600	Infrastructure Buildings	\$18,538,133	\$1,384,314	\$4,111,564	\$5,707,122	\$7,335,132
		4700	Industrial Water Treatment	\$36,475,843	\$697,474	\$4,036,036	\$4,659,198	\$27,083,135

		4800	Mobile Equipment	\$5,319,780	-	-	-	\$5,319,780
5000	OFF SITE INFRASTRUCTURE	5300	Power Transmission to Site	\$8,000,000	\$1,600,000	\$3,200,000	\$3,200,000	-
		5400	Effluent (sewage) Water Treatment	\$1,677,252	\$5,293	\$32,211	\$98,916	\$1,540,832
		5600	Rail / Logistics study	\$10,765,088	-	-	\$2,153,018	\$8,612,070
6000	PROJECT PRELIMINARIES	6100	Temporary Construction Facilities and Services	\$15,431,442	\$1,045,590	\$5,036,264	\$4,127,185	\$5,222,403
		6400	Commissioning Reps and Assistance	\$2,184,203	-	-	-	\$2,184,203
		6500	Spares	\$3,638,290	-	-	-	\$3,638,290
		6600	First Fills & Initial Charges	\$4,580,724	-	\$867,169	-	\$3,713,555
7000	PROJECT DELIVERY	7100	Engineering Services	\$55,106,336	\$5,510,634	\$5,510,634	\$22,042,534	\$22,042,534
		7200	Commissioning Services	\$5,382,110	\$538,211	\$538,211	\$2,152,844	\$2,152,844
8000	OWNER'S COSTS	8100	Owner's Costs	\$30,684,120	\$6,136,824	\$12,273,648	\$12,273,648	-
9000	PROVISIONS	9200	Contingency	\$147,100,753	\$10,461,149	\$20,427,469	\$27,897,830	\$88,314,305
			<i>Contingency Rate</i>	<i>19.40%</i>	<i>19.28%</i>	<i>19.33%</i>	<i>19.37%</i>	<i>19.45%</i>
TOTAL EXPENDITURES				\$905,247,526	\$64,715,551	\$126,092,208	\$171,960,020	\$542,479,744

Table A2. Capital Expenditure Categories Mapped to IMPLAN Industries

Group	Group Description	Category	Category Description	IMPLAN Industry	IMPLAN Industry Description
1000	MINING	1200	Mine Infrastructure and Services	51	Construction of other new nonresidential structures
		1300	Underground Mining	51	Construction of other new nonresidential structures
		1400	Mine to Surface Conveyor	51	Construction of other new nonresidential structures
		1600	Mobile Equipment	378	Wholesale - machinery, equipment, and supplies
		1700	Temporary Ore Stockpile	51	Construction of other new nonresidential structures
2000	PROCESS PLANT	2100	ROM Ore Stockpile and Reclaim	46	Construction of new manufacturing structures
		2200	Crushing	46	Construction of new manufacturing structures
		2300	Grinding	46	Construction of new manufacturing structures
		2400	Flotation & Regrind	46	Construction of new manufacturing structures
		2500	Concentrate Handling	46	Construction of new manufacturing structures
		2600	Tailings Handling	46	Construction of new manufacturing structures
		2700	Reagents	46	Construction of new manufacturing structures
		2800	Process Plant Services and Common	46	Construction of new manufacturing structures
3000	TAILINGS STORAGE FACILITY & SITE WIDE WATER MANAGEMENT	3100	Tailings Management Facility	51	Construction of other new nonresidential structures
		3200	Site Wide Water Management	51	Construction of other new nonresidential structures
4000	ON SITE INFRASTRUCTURE	4100	Bulk Earthworks	51	Construction of other new nonresidential structures
		4300	Power Generation	47	Construction of new power and communication structures
		4400	HV Power Switchyard and Power Distribution	47	Construction of new power and communication structures
		4600	Infrastructure Buildings	51	Construction of other new nonresidential structures
		4700	Industrial Water Treatment	51	Construction of other new nonresidential structures
		4800	Mobile Equipment	378	Wholesale - machinery, equipment, and supplies

5000	OFF SITE INFRASTRUCTURE	5300	Power Transmission to Site	47	Construction of new power and communication structures
		5400	Effluent (sewage) Water Treatment	51	Construction of other new nonresidential structures
		5600	Rail / Logistics study	439	Architectural, Engineering, and Related Services
6000	PROJECT PRELIMINARIES	6100	Temporary Construction Facilities and Services	51	Construction of other new nonresidential structures
		6400	Commissioning Reps and Assistance	439	Architectural, Engineering, and Related Services
		6500	Spares	378	Wholesale - machinery, equipment, and supplies
		6600	First Fills & Initial Charges	378	Wholesale - machinery, equipment, and supplies
7000	PROJECT DELIVERY	7100	Engineering Services	439	Architectural, Engineering, and Related Services
		7200	Commissioning Services	439	Architectural, Engineering, and Related Services
8000	OWNER'S COSTS	8100	Owner's Costs	22	Copper, nickel, lead, and zinc mining
9000	PROVISIONS	9200	Contingency	*Allocated proportionally to each capex category above	

Table A3. Capital Expenditure Data with Provisions Proportionally Redistributed to Other Categories

Group	Group Description	Category	Category Description	Ind.	Total	Ontonagon County	Rest of UP	Rest of Michigan	Out of State
1000	MINING	1200	Mine Infrastructure and Services	51	\$59,902,608	\$1,775,919	\$6,954,436	\$14,558,441	\$36,613,812
		1300	Underground Mining	51	\$93,628,767	\$5,460,711	\$10,626,067	\$18,719,195	\$58,822,794
		1400	Mine to Surface Conveyor	51	\$29,869,947	\$1,813,721	\$2,985,100	\$5,971,840	\$19,099,286
		1600	Mobile Equipment	378	\$55,233,256	-	-	-	\$55,233,256
		1700	Temporary Ore Stockpile	51	\$7,243,878	\$3,440,686	\$3,492,089	\$167,589	\$143,514
2000	PROCESS PLANT	2100	ROM Ore Stockpile and Reclaim	46	\$28,877,794	\$1,405,718	\$3,433,031	\$4,760,793	\$19,278,252
		2200	Crushing	46	\$19,309,911	\$2,054,169	\$5,562,944	\$3,837,045	\$7,855,753
		2300	Grinding	46	\$97,363,826	\$4,527,843	\$14,619,088	\$20,518,951	\$57,697,944
		2400	Flotation & Regrind	46	\$58,700,422	\$2,121,466	\$4,937,655	\$9,535,104	\$42,106,197
		2500	Concentrate Handling	46	\$12,247,581	\$645,084	\$1,636,050	\$2,285,286	\$7,681,161
		2600	Tailings Handling	46	\$31,121,330	\$1,072,677	\$3,007,598	\$4,574,610	\$22,466,445
		2700	Reagents	46	\$4,137,505	\$231,545	\$499,713	\$835,695	\$2,570,552
		2800	Process Plant Services and Common	46	\$8,882,652	\$540,686	\$1,149,871	\$2,141,661	\$5,050,434
3000	TAILINGS STORAGE FACILITY & SITE WIDE WATER MANAGEMENT	3100	Tailings Management Facility	51	\$27,678,249	\$9,322,125	\$9,976,806	\$4,161,295	\$4,218,023
		3200	Site Wide Water Management	51	\$14,988,107	\$1,725,457	\$3,588,648	\$4,922,878	\$4,751,124
4000	ON SITE INFRASTRUCTURE	4100	Bulk Earthworks	51	\$15,933,091	\$7,571,262	\$7,672,850	\$393,589	\$295,390
		4300	Power Generation	47	\$66,307,803	-	\$446,976	\$1,053,072	\$64,807,755
		4400	HV Power Switchyard and Power Distribution	47	\$37,690,961	\$826,005	\$3,014,127	\$6,183,780	\$27,667,049
		4600	Infrastructure Buildings	51	\$22,131,451	\$1,651,233	\$4,906,426	\$6,812,314	\$8,761,478

		4700	Industrial Water Treatment	51	\$43,559,272	\$831,959	\$4,816,296	\$5,561,457	\$32,349,560
		4800	Mobile Equipment	378	\$6,354,233	-	-	-	\$6,354,233
5000	OFF SITE INFRASTRUCTURE	5300	Power Transmission to Site	47	\$9,546,826	\$1,908,507	\$3,818,635	\$3,819,684	-
		5400	Effluent (sewage) Water Treatment	51	\$2,003,276	\$6,314	\$38,438	\$118,071	\$1,840,453
		5600	Rail / Logistics study	439	\$12,856,674	-	-	\$2,569,952	\$10,286,722
6000	PROJECT PRELIMINARIES	6100	Temporary Construction Facilities and Services	51	\$18,421,429	\$1,247,197	\$6,009,892	\$4,926,420	\$6,237,920
		6400	Commissioning Reps and Assistance	439	\$2,608,931	-	-	-	\$2,608,931
		6500	Spares	378	\$4,345,770	-	-	-	\$4,345,770
		6600	First Fills & Initial Charges	378	\$5,470,483	-	\$1,034,813	-	\$4,435,670
7000	PROJECT DELIVERY	7100	Engineering Services	439	\$65,789,037	\$6,573,175	\$6,575,968	\$26,311,100	\$26,328,794
		7200	Commissioning Services	439	\$6,425,465	\$641,987	\$642,260	\$2,569,745	\$2,571,473
8000	OWNER'S COSTS	8100	Owner's Costs	22	\$36,616,994	\$7,320,106	\$14,646,432	\$14,650,456	-

IX. ABOUT THE AUTHORS

Dr. Laura Connolly is an Associate Professor of Economics in the College of Business at Michigan Technological University. She is an applied microeconomist with expertise in labor and demographic economics. Her research explores labor market outcomes across populations and the impacts of public policies on workers and firms. She also has experience conducting economic impact studies that support local economic development, most of which focused on Michigan's Upper Peninsula.

Dr. Jenny Apriesnig is an Associate Professor of Economics in the College of Business at Michigan Technological University and Director of the MS in Applied Natural Resource Economics program. She is a natural resource economist with an emphasis on regional modeling. She has designed multiple regional economic models to evaluate natural resource related policies in the Great Lakes Region and has contributed to multiple Michigan-based economic impact studies.

Dr. Gary Campbell is a Professor Emeritus of Economics in the College of Business at Michigan Technological University. He served the university with distinction for over 40 years. He founded the Masters in Mineral Economics program, which is now the Applied Natural Resource Economics program, and has advised over 70 graduate students. He has consulted on many mining projects throughout his career and served as Editor-in-Chief of *Resources Policy* for 12 years.

Cody Owens is a graduate student enrolled in the MS Applied Natural Resource Economics program at Michigan Technological University's College of Business. She is a paralegal at a law firm based in Ann Arbor, Michigan and is furthering her education with the intent of changing careers.