Buckwheat Protection Plan: Applicant Proposed Conservation Measures for Tiehm's Buckwheat and its Critical Habitat

Rhyolite Ridge Lithium Boron Project
Esmeralda County, Nevada

Prepared for:

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Photo Credit: Kris Kuyper, WestLand Engineering and Environmental Services

This document is compiled for ease of attachment to the Biological Assessment prepared by the Bureau of Land Management for the Rhyolite Ridge Project. Attachment B is included by reference but not attached to this version and the history of USFWS and BLM comments and responses has been excluded from the front matter. The document is also not provided in a redline strike format showing the changes made since the December 22, 2023, Revisions. Attachment B, the history of comments and agency responses, and the redline changes made in response to ongoing informal consultation and agency comments is provided in the Record Document of the Buckwheat Protection Plan and Applicant Proposed Conservation Measures submitted under separate cover to the Bureau of Land Management.

Rev	Document No.	Date	Prepared by	Approved	Revision
0	RR30-0013-00-EN-REP-00010	06/16/2023	WestLand	Ioneer	For Review
1	RR30-0013-00-EN-REP-00010	09/26/2023	WestLand		For Final Review
2	RR30-0013-00-EN-REP-00010	09/27/23	WestLand	Ioneer	For Use
3	RR30-0013-00-EN-REP-00010	12/22/2023	WestLand	Ioneer	For Use
4	RR30-0013-00-EN-REP-00010	3/22/2024	WestLand	Ioneer	For Use

Revision History

Date	Summary
09/27/2023	Revisions following FWS and BLM review and comments on Draft BPP submitted June 16, 2023, to include additional detail in APCMs including reclamation, success criteria, monitoring approach, along with additional detail and refinement of other conservation measures and addition of a conservation measure regarding blasting
12/22/2023	Updated to reflect internal comments on BLM BA and BLM request for clarification and an additional conservation measure outlining monitoring of ERTI populations. Corrections of some scrivener's errors and updated project information regarding water use. Responses to BLM comments provided on the following pages.
3/22/2024	Revisions in response to ongoing informal consultation and request for clarification from BLM on USFWS comments on draft BA and BLM comments. Three conservation measures were added to the plan. Section 3.3 and Tables 4 and 5 were added at the request of the reviewing agencies. Table 4 captures in one place supplemental procedure and protocol documents that would be prepared, a general description of the content of each procedure and protocol documents, and the desired qualifications for the organizations/individuals responsible for preparing the documents. Table 5 was added to capture key Project milestones. Additional air quality effects review was included in Section 4 based on agency questions and comments. Section 4 also includes several new graphics prepared at the request of the reviewing agencies. One depicts the progression of Quarry and OSF development proximate to critical habitat and four provide cross sections at selected locations that show the progression of Quarry development.

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1. INTRODUCTION

1.1. PURPOSE

Ioneer's Rhyolite Ridge Lithium-Boron Project (Project) is located approximately 40 miles southwest of Tonopah, and 160 miles southeast of Reno, Nevada, in the Silver Peak Range (**Figure 1**). The nearest population centers are the small community of Dyer (approximately 13 air miles to the southwest), the communities of Silver Peak and Goldfield, located to the east across the Silver Peak Range (approximately 13 and 35 air miles, respectively), and Benton and Bishop, California (33 miles west and 43 miles southwest respectively) (the Rhyolite Ridge Project, Ioneer 2022).

The U.S. Fish and Wildlife Service (USFWS) listed Tiehm's buckwheat (*Eriogonum tiehmii*) as an endangered species and designated 910 acres of critical habitat, encompassing the existing Tiehm's buckwheat populations and a 500-meter buffer on December 16, 2022 (87 FR 6101). This document provides Ioneer's proposed conservation measures to avoid and minimize the impacts of the Rhyolite Ridge Project to Tiehm's buckwheat, including significant reconfiguration of Project features, and, based upon implementation of the applicant proposed conservation measures outlined in this document, provides an assessment of the effects of Project development to Tiehm's buckwheat and its designated critical habitat.

1.2. ENVIRONMENTAL SETTING

The Project Area lies within the west Central Silver Peak Range in the Intermountain Region, Great Basin floristic zone (Cronquist et. al. 1972). The terrain consists of steep slopes, ephemeral drainages, and alluvial fans. Elevations within the Project Area range from approximately 5,436 feet (ft) above mean sea level (amsl) to approximately 7,000 ft amsl. Soils within the Project Area are composed of 12 soil map units (NRCS 2019) which are generally comprised of shallow soils overlying bedrock, coarse excessively drained soils, or deep sandy soils formed in alluvium (NewFields 2019, 2020).

Climatic conditions at Rhyolite Ridge are typical of the southwestern part of the Great Basin, characterized by cold winters, warm summers, and low precipitation. Estimated site-specific temperatures in the vicinity of the Tiehm's buckwheat populations are extrapolated from the Dyer meteorological station (HydroGeoLogica 2018). Temperatures vary widely throughout the year, with the lowest and highest temperatures occurring in January and July, respectively. Summer high temperatures range from 79.5°F to 89.6°F. The average summer temperature and average maximum summer temperature is 68.1°F and 86.8°F, respectively.

Freezing temperatures typically begin in October and may last until April. Winter low temperatures average between 13.0°F to 19.3°F during December, January, and February. The average winter temperature at the Project Area is 30.1°F, with an average minimum winter temperature of 15.2°F.

The small amount of precipitation that falls comes mainly as snowfall. A comparison of precipitation from the three meteorological stations (Silver Peak, Dyer, and Tonopah) considered by HydroGeoLogica (2018) indicates that precipitation ranges between 5.5 and 8.1 inches per year. A characteristic of any arid environment is the inherent variability in annual precipitation year over year.

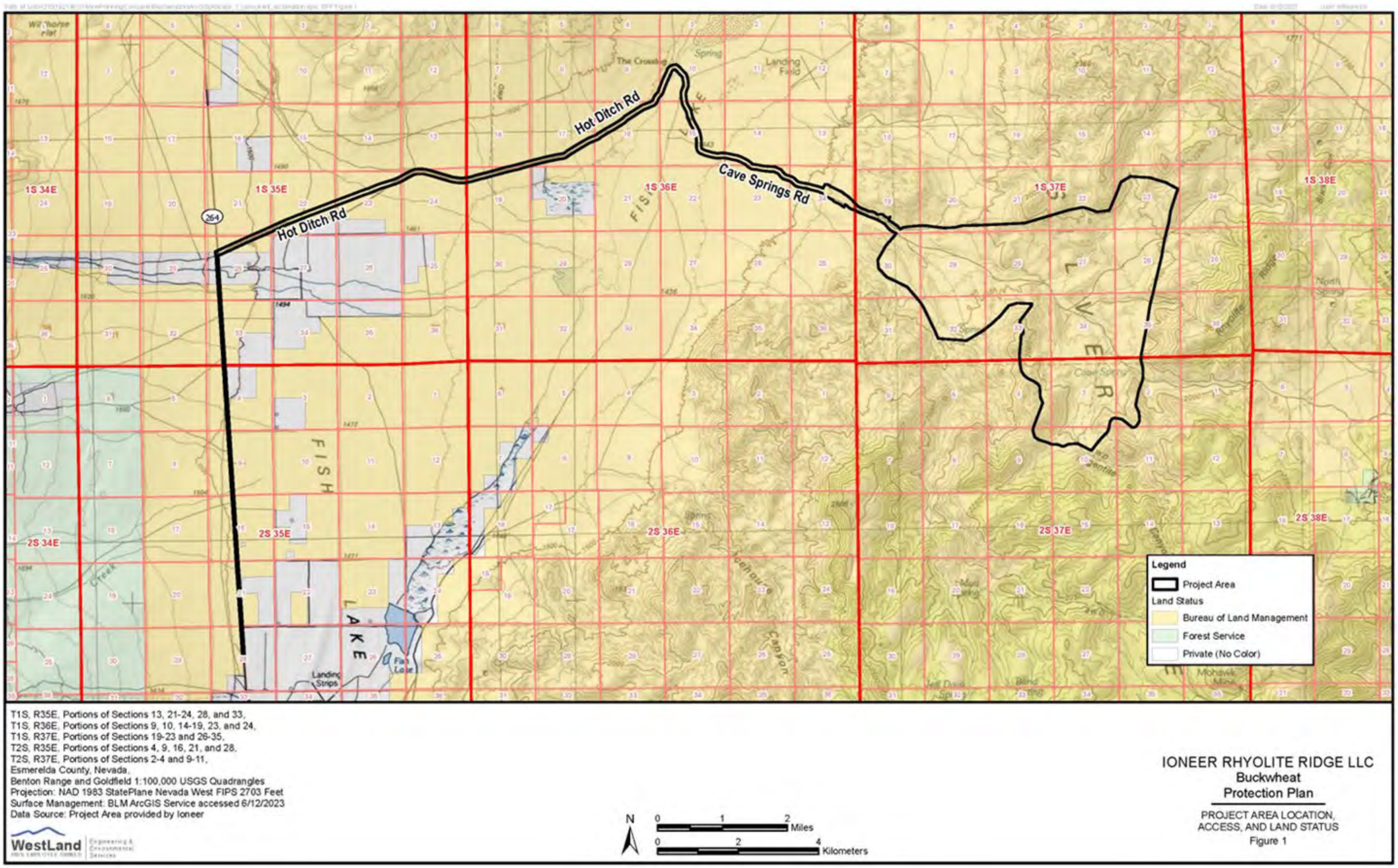

Figure 1. Project Area Location, Access, and Land Status

2. TIEHM'S BUCKWHEAT LISTING AND NATURAL HISTORY

On October 7, 2019, the USFWS received a petition to list Tiehm's buckwheat under the Endangered Species Act (ESA) as an endangered or threatened species, and to concurrently designate critical habitat. On June 4, 2021, the USFWS announced its 12-month finding on a petition to list Tiehm's buckwheat as an endangered or threatened species under the ESA, determining that the petitioned action to list Tiehm's buckwheat was warranted (USFWS 2021a [86 FR 29975]). On October 7, 2021, the USFWS published a proposed rule to list Tiehm's buckwheat as endangered (USFWS 2021b [86 FR 55775]) and on February 3, 2022, they published a proposed rule to designate approximately 910 acres of critical habitat for Tiehm's buckwheat (USFWS 2022a [87 FR 6101]). The USFWS listed Tiehm's buckwheat as an endangered species and designated 910 acres of critical habitat, encompassing the existing Tiehm's buckwheat populations and a 500-meter buffer on December 16, 2022 (USFWS 2022b [87 FR 77368]).

Tiehm's buckwheat is a low, spreading, perennial herb that forms a dense mat up to 12 inches across. It produces light yellow to cream colored clusters of flowers at the end of slender stalks held above the leaves (USFWS 2022c). The flowers turn reddish as they age. Individual plants change in size very little from year to year. New leaves are produced in late winter and early spring and inflorescences appear by April. Flowers are open from late April to mid-June, with seeds ripening in late-June to mid-July. Plants may look reddish in color and desiccated through the late fall and winter when they are dormant. Genetic analyses suggest that the closest known relative to Tiehm's buckwheat is a mat buckwheat, *Eriogonum shockleyi* that also occurs in the Silver Peak Range (USFWS 2022c and references therein). Like other cushion buckwheats, Tiehm's buckwheat is thought to be a long-lived species with high flower production, high seedling mortality, and high variability of growth between individuals and between years. The known elevational range of Tiehm's buckwheat is between 5,906 and 6,234 ft amsl, and it occurs on all aspects and on slopes from zero to 50 percent.

Tiehm's buckwheat was first collected by Arnold Tiehm in 1983 and later described and named as a new species by James Reveal (1985). It occurs as a single population within the Rhyolite Ridge area. The plants occur at nine discrete sites, identified as subpopulations 1-5, 6a, 6b, and 7-8 (**Figure 2**). However, several of these sites are separated by such small distances that it is currently unclear how distinct these subpopulations are. Subpopulation 8 is composed of four plants and may be regarded as an incidental occurrence and currently not of significance to the overall population. All nine sites are within a 1.5 square-mile area, and collectively cover approximately 10 acres. **Table 1** provides a summary of the 2023 Tiehm's buckwheat population by subpopulation (WestLand 2023a, provided as **Attachment A**).

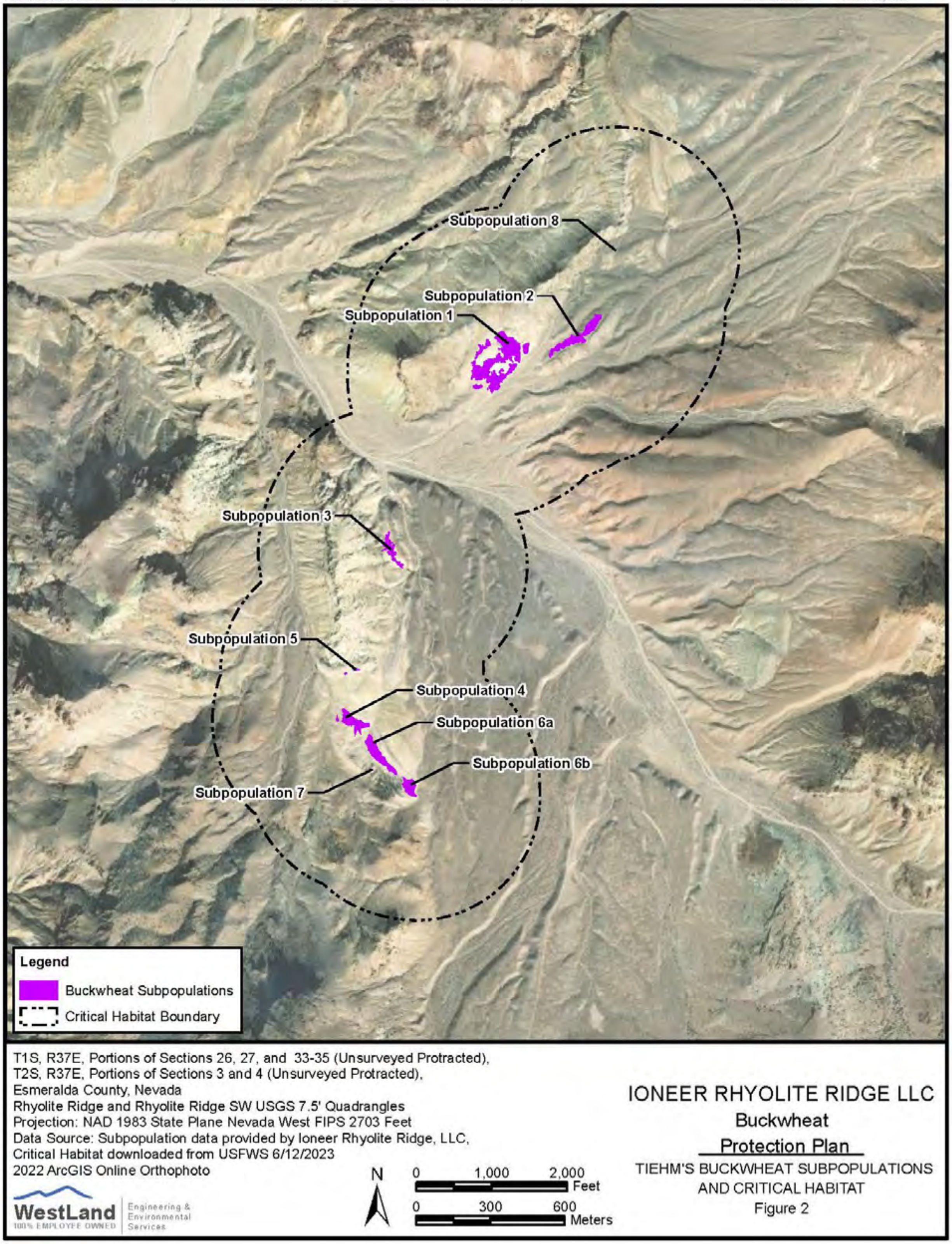

Figure 2. Tiehm's Buckwheat Subpopulations and Critical Habitat

Table 1. 2023 Tiehm's Buckwheat Population Count by Subpopulation

Based on a comprehensive count in known subpopulations conducted from May 25 to June 7, 2023 (WestLand 2023a).

Subpopulation	Number of Plants
1	5,600
2	4,190
3	1,943
4	1,888
5	31
6a (incl. 7)	7,784
6b	3,476
8	4
Total	**24,916**

Tiehm's buckwheat is seemingly restricted to dry, open, relatively barren, light-colored rocky clay soils derived from a formation of interbedded claystones, shales, tuffaceous sandstones, and limestones (Morefield 1995, NDNH 2001). The soils are poor, with little development, lack an A horizon, are clayey in nature, and are full of broken pieces of the parent bedrock. The distribution of the plant follows an outcrop of interbedded lacustrine sediments that are typically high in carbonate and clay.

As outlined in previous submittals to the USFWS (WestLand 2021, included here as **Attachment B**), we concluded that the soils on which Tiehm's buckwheat is present are better characterized as two distinct soil types – one boron-rich and the other boron-poor and that the chemical and physical properties of these soil types vary. Newfields (2021a, 2021b) point out that two of the largest plant populations (by number of plants and aerial extent) Subpopulation 1 and Subpopulation 6, occur on boron-rich and boron-poor sites, respectively. Occupied boron-rich sites have significantly lower chlorine, magnesium, sodium, sulfur sulfate, cation exchange capacity, and estimate plant-available water than non-occupied boron-rich sites. In contrast, occupied boron-poor sites exhibited significantly lower potassium and zinc concentrations, but higher magnesium concentrations than non-occupied boron-poor sites. Table 1 in **Attachment B** summarizes the sites (occupied and unoccupied) that were sampled by McClinton et al. (2020) as boron-rich sites or boron-poor sites. What is remarkable about the soil chemistry data is the range of soil chemistries occupied by Tiehm's buckwheat and the substantial overlap in soil chemistry between occupied and unoccupied sites (WestLand 2021).

GHD (2021) evaluated the statistical analysis completed by McClinton et al. that showed significant differences in boron, silt, bicarbonate, pH, potassium, zinc, sulfur, and magnesium. McClinton et al. (2020) analyses are based on group comparisons of averages (using t-tests and Wilcoxon rank-sum tests). Statistically significant differences in mean or median values for studied parameters (e.g., metals concentrations, percentage soil composition) are found, which are interpreted as meaning that Tiehm's buckwheat requires these differences to grow – i.e., it is a soil specialist needing a narrow range of soil composition. These apparent statistically significant differences ignore the variation of conditions found in both occupied and unoccupied site groups and appear to be simply coincidence rather than causative effects. The analysis demonstrates there is substantial overlap in soil chemistry between occupied and unoccupied sites and, therefore, occupied and unoccupied soils cannot be distinguished based on major ion chemistry.

Tiehm's buckwheat has been documented growing on previously disturbed sites and it is not restricted to undisturbed/unimpacted habitats. **Figure 3** depicts a typical view of the exploration trenches and associated disturbance in Tiehm's buckwheat subpopulations. Subpopulations 1, 2, 3, 4, and 6 all contain various levels of surface disturbance from previous mineral exploration activities. In all of these subpopulations, Tiehm's buckwheat occurs in disturbed areas. Using the 2023 population census data, subpopulations 1, 2, and 3 support greater densities of Tiehm's buckwheat than the adjacent undisturbed areas (WestLand 2023b provided in **Attachment C**). Subpopulation 6 supports similar densities of plants in disturbed and undisturbed areas. This data was updated from the initial findings provided in WestLand (2021, provided in **Attachment B.**) and reflects use of more complete census data rather than the sampling data collected via drone relied on previously.

Figure 3. Exploration Trench Disturbance in Subpopulation 6

Vegetation data was collected from a total of 45 3-m radius plots within the subpopulations of Tiehm's buckwheat in 2021 by Cedar Creek Associates, Inc. (Cedar Creek; Cedar Creek 2021). Tiehm's buckwheat occurs in areas with plants of low stature and sparse canopy cover that generally ranges from 7.1 to 15.5 percent cover (Cedar Creek 2021). Perennial grasses are the dominant lifeform and on average in all plots comprises approximately 3.89 percent of total plant canopy cover (Cedar Creek 2021). Of these, James' galleta (*Pleuraphis Jamesii*) is the most dominant species with 1.88 percent canopy cover. Other species that occur in the subpopulations include alkali dropseed (*Sporobolus airoides*), saltlover (*Halogeton glomeratus*), shadscale (*Atriplex confertifolia*), and black sagebrush (*Artemisia nova*) (Cedar Creek 2021). None of the subpopulations of Tiehm's buckwheat occur as a monoculture. Relative canopy cover for Tiehm's buckwheat averaged 7.5 percent across all sample plots and is commonly found with other species. When Tiehm's buckwheat occurred on a plot, perennial grasses were detected in the plot 69 percent of the time, saltlover was encountered 66 percent of the time, and shadescale was encountered 86 percent of the time. Tiehm's buckwheat was the only species encountered in a plot in only one of the sample plots. Notably, saltlover was not included on the list of associated species in Morefield (1995) and it is now co-dominant in all of the subpopulations. Cedar Creek (2021 revised) provided in **Attachment D** provides vegetation cover data for each of the subpopulations of Tiehm's buckwheat.

Relative canopy cover of Tiehm's buckwheat across all plots within occupied subpopulations sampled averaged 8.0%. This accounts for less than half the relative cover of all insect-pollinated species (17.5%, inclusive of Tiehm's buckwheat). Absolute cover displays a similar trend, with Tiehm's buckwheat amounting to only 0.7% and all insect-pollinated vegetation (inclusive of Tiehm's buckwheat) totaling 1.7%. Tiehm's buckwheat accounted for over half of the relative and absolute vegetative cover in only two of the six Tiehm's buckwheat sub-populations. These findings draw into question whether the high arthropod diversity associated with Tiehm's buckwheat populations can be fully attributed to presence of Tiehm's buckwheat, and no other insect-pollinated vegetative species.

In 2022, Cedar Creek continued its evaluation of vegetation in critical habitat sampling 96 plots co-located with pollinator evaluation sites, 6 within occupied habitat and 90 outside of occupied habitat. Eighty-three of these plots were located within unoccupied critical habitat and the results presented in Cedar Creek 2023, provided in **Attachment D**. They stratified their sampling based on landform as either valley bottom, lower slopes, steep slopes, upper slopes, or ridges. A brief description of vegetation in critical habitat, by landform for the portions of critical habitat that are not occupied by Tiehm's buckwheat is provided below.

- The valley bottoms within critical habitat exhibited a total vegetation canopy cover of 23.98 percent, where shrubs and sub-shrubs were the dominant lifeform with 16.56 percent canopy cover. The dominant vegetation community included the native shrub black sagebrush (6.52 percent; *Artemisia nova*), the native perennial grass galleta (3.46 percent; *Pleuraphis jamesii),* and the native shrubs Nevada jointfir (2.48 percent; *Ephedra nevadensis*), fourwing saltbush (1.25 percent;

Atriplex canescens), spiny hopsage (0.98 percent; *Grayia spinosa*), and Greene's rabbitbrush (0.79 percent; *Chrysothamnus greenei*);

- The lower slopes exhibited a total vegetation canopy cover of 20.70 percent, where shrubs and sub-shrubs were the dominant lifeform with 12.50 percent canopy cover. The dominant vegetation community included the native shrub black sagebrush (5.20 percent), the native perennial grass galleta (3.55 percent), and the native shrubs spiny hopsage (1.70 percent) and fourwing saltbush (1.15 percent);
- The steep slopes exhibited a total vegetation canopy cover of 20.83 percent, where shrubs and sub-shrubs were the dominant lifeform with 13.60 percent canopy cover. The dominant vegetation community included the native perennial grass galleta (5.25 percent) and the native shrubs black sagebrush (2.59 percent), spiny menodora (2.3 percent; *Menodora spinescens*) and Nevada jointfir (2.05 percent);
- The upper slopes exhibited a total vegetation canopy cover of 18.53 percent, where shrubs and sub-shrubs were the dominant lifeform with 11.63 percent canopy cover. The dominant vegetation community included the native perennial grass galleta (6.0 percent), the native shrubs Nevada jointfir (4.38 percent) and spiny hopsage (2.5 percent), and the nonnative forb saltlover (1.13 percent cover); and,
- The ridges exhibited a total vegetation canopy cover of 18.53 percent, where shrubs and sub-shrubs were the dominant lifeform with 12.93 percent cover. The dominant vegetation community included the native perennial grass galleta (3.73 percent), and the native shrubs black sagebrush (4.34 percent), and shadescale (2.17 percent *Atriplex confertifolia*), and Nevada jointfir (1.90 percent).

Valleys within designated critical habitat exhibit the greatest vegetation cover and species diversity. Black sagebrush was the dominant species. Total cover for black sagebrush averaged 4.23 percent in the unoccupied portions of critical habitat. Overall, the vegetation assemblage of the critical habitat area differs from occupied Tiehm's buckwheat habitat and exhibits significantly greater species cover, diversity, and lifeform composition.

Tiehm's buckwheat is thought to primarily reproduce sexually (USFWS 2022c), with no documented occurrence of apomixis or natural vegetative reproduction known to WestLand. To determine the importance of pollinators to seed production, McClinton et al. (2020) examined seed set in flowers where pollinators were or were not excluded. They determined that some seed was produced in absence of pollinators, however, seed production was an average of 7.3 times higher in flowers where pollinators were not excluded (McClinton et al. 2020). From this, USFWS concluded that Tiehm's buckwheat "benefits from pollinator services and needs pollination to increase seed production" (USFWS 2022c).

To identify potential pollinators for Tiehm's buckwheat, McClinton et al. (2020) used pitfall trapping and direct observation of species visiting flowers. Pitfall trapping by McClinton et al. (2020) identified an "especially high" abundance and diversity of arthropods in Tiehm's buckwheat subpopulations (USFWS 2022c). However, McClinton et al. (2020) concluded that abundance and diversity were similar between occupied and unoccupied sites. Moreover, the small sample size of the study and the high variability through time indicate that this conclusion should be interpreted with caution. McClinton et al. measured arthropod abundance at only two sites where Tiehm's buckwheat were present and two sites that were unoccupied and at only temporal periods in 2020. The results of these data collection efforts clearly indicate the high variability in arthropod abundance between and within sites. In fact, abundance and diversity of arthropods was highest at unoccupied sites during one of these time periods (McClinton et al. 2020). Clearly, these data are not consistent with a conclusion that abundance and diversity of arthropods within occupied areas was "especially high" when compared to unoccupied areas. Based on flower visitation rates and the assumption that flying insects are the most likely pollinators out of all flower visitors, McClinton et al. (2020) suggest that beetles, wasps, and flies are the most important pollinators for Tiehm's buckwheat. Further, there were no apparent specialist pollinators (McClinton et al. 2020). This suggests that Tiehm's buckwheat is primarily served by generalist pollinators, like most other members of the genus *Eriogonum* (Anderson 2004, 2006).

Because a variety of species may pollinate Tiehm's buckwheat, the composition of pollinators is expected to vary between subpopulations and within a flowering season. Such temporal and spatial variation in flower visitors was detected in Tiehm's buckwheat despite a single season of study (McClinton et al. 2020). This suggests that seed production in Tiehm's buckwheat is unlikely to be dependent on a single pollinator species and thereby unaffected by fluctuations in the populations of any single species. McClinton et al. (2020) concluded that occupied and unoccupied sites were similarly abundant and diverse; the presence of Tiehm's buckwheat had no bearing on the overall abundance and diversity of the arthropod community.

Further, McClinton et al. (2020) performed an experiment to test explicitly whether insect pollinators are necessary for seed production in Tiehm's buckwheat. By excluding insect pollinators, McClinton et al. (2020) showed that individual buckwheat can still produce seeds, albeit at a lower rate. "Our results indicate that, while *E. tiehmii* plants may be able to produce some seeds when pollinators are excluded (through wind pollination or selfing), open flowers that were visited by pollinators substantially increased seed production" (McClinton et al. 2020, pg. 24). It is unclear whether seed production in flowers where pollinators were excluded occurred as a result of self-pollination or another mechanism, or whether small insects could have penetrated the exclusion method for pollinators.

To further refine and understand the nature and distribution of potential pollinators for Tiehm's buckwheat WestLand (2023c, provided in **Attachment E**) sampled for day-flying potential pollinators at 50 sites across critical habitat and within Tiehm's buckwheat subpopulations to:

- Determine how potential pollinator communities varied;
- Illustrate the lack of similarity of potential pollinator communities; and
- Inform the patterns behind potential pollinator communities across critical habitat.

Two morphospecies of the soft-winged flower beetle (Melyridae) genus *Eudasytes* were the most commonly encountered species (56% of all specimens) and accounted for the vast majority of both soft-winged flower beetles and coleopterans encountered in the survey area. *Eudasytes* beetles were important contributors to differences in total abundance specimens collected between sites, with some sites recording hundreds of these beetles. Bee flies (Diptera: Bombyliidae) were the second most abundant family within the survey area and accounted for 11% of all specimens. Bees belonging to Apidae (Hymenoptera) accounted for 5% of all specimens. All remaining insect families were less abundant, with each accounting for less than 5% of total specimens captured in the survey area. (See WestLand 2023c.)

The numbers of coleopteran, dipteran, hymenopteran and lepidopteran specimens collected varied more than tenfold across sites from a low of 47 to a high of 620 individuals. Abundance was typically higher in the eastern portion of the survey area. Abundance had no association with northing, elevation or the cover of grasses, forbs or shrubs (all $p>0.05$); however, abundance was positively associated with easting and location relative to Tiehm's buckwheat (ln abundance = easting + location, $F2, 48 = 17.71$, $R2 = 0.42$, $p >0.001$). After controlling for the effects of easting, Tiehm's buckwheat survey locations had an estimated marginal mean of 93 specimens (95% CI: 64 to 134) whereas locations outside of the Tiehm's buckwheat subpopulations had an estimated marginal mean of 202 specimens (95% CI: 178 to 233). For most locations, beetles were more numerous than other groups, and at all locations, Lepidoptera were the least numerous. These trends are also evident when sites are grouped by location within or outside of Tiehm's buckwheat subpopulations, however, the relative abundance of the orders is dependent upon location ($X2=71.39$, $df = 3$, $p<0.001$), with samples from Tiehm's buckwheat populations having fewer beetles and more flies and hymenopteran than expected. (See WestLand 2023c.)

To determine how much the community of potential pollinators varied throughout critical habitat, WestLand calculated two indices of ecological dissimilarity examining species community composition. The Sørensen index takes into account species composition and Bray-Curtis takes into account species composition and abundance. Both indices are pairwise comparisons between sampling locations and vary between zero and one. A dissimilarity value of zero indicates that the community composition at the two sites is identical whereas a value of one indicates that there is no shared species between the sites. For example, a Sørensen dissimilarity value of 0.25 indicates that 25 percent of the species occur at only one of the two locations. Bray-Curtis dissimilarity is a quantitative extension of the Sørensen index and accounts for both species' community composition and abundance. Bray-Curtis dissimilarity increases when there are either fewer shared species between sites or lower abundance of the shared species, or both conditions co-occur. Further, differences in species communities are underlain by two distinct phenomena: species turnover, where one species is replaced by another and nestedness, where sites with fewer species contain a subset of species found at sites with a greater number of species. Overall, both dissimilarity indices show similar patterns; potential pollinator communities within Tiehm's buckwheat subpopulations are dissimilar across subpopulations and across critical habitat (**Figures 4 and 5**).

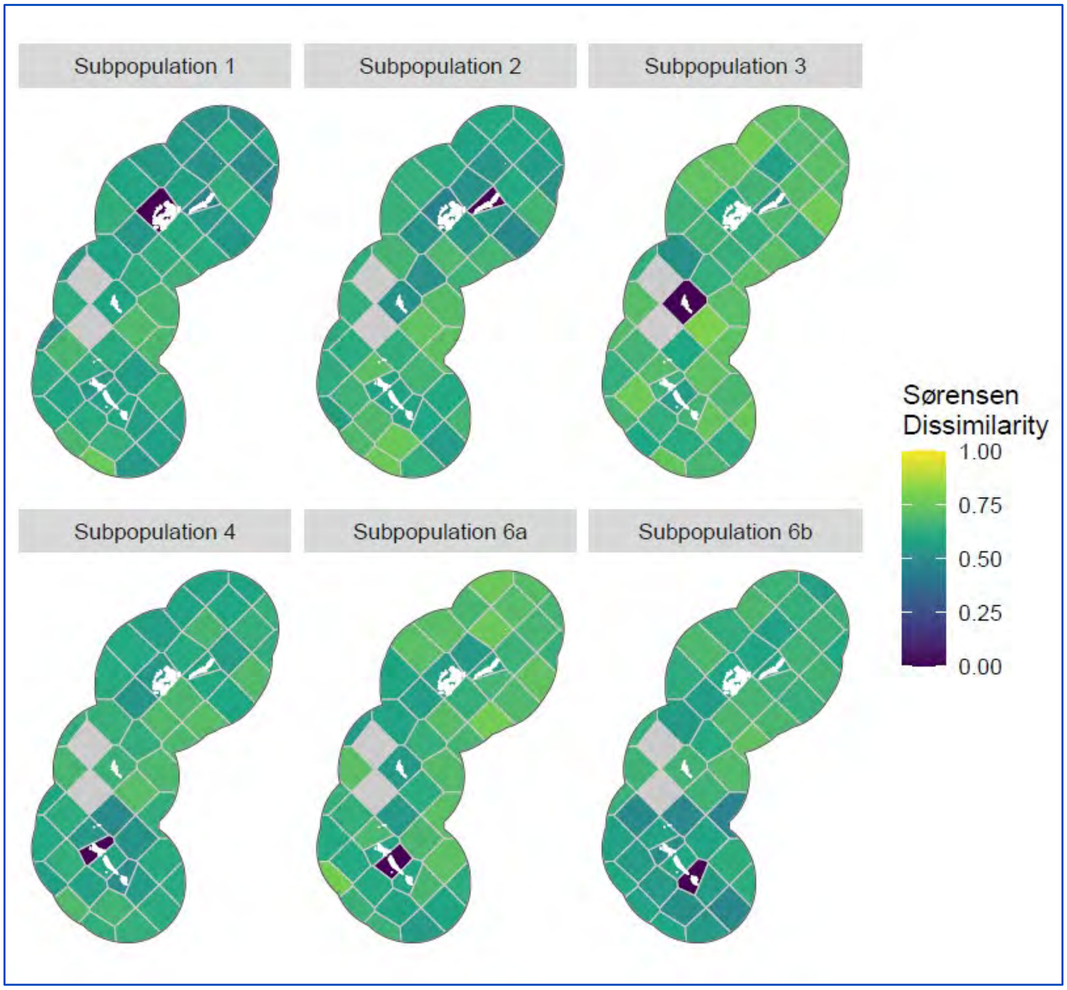

Figure 4. Pairwise Dissimilarity Comparison of Potential Pollinator Species Composition (Sorensen) Between Occupied Tiehm's Buckwheat Habitat and Unoccupied Critical Habitat for Tiehm's Buckwheat
(WestLand 2023c)

Results of the Sørensen indices indicate:

1) No strong spatial patterns, sites have substantially different species composition from even nearby locations;
2) Sørensen dissimilarity between a given Tiehm's buckwheat subpopulation and all other survey locations was equal or greater than 0.59 (i.e. a median of 59% or more species different between sites);
3) The minimum Sørensen dissimilarity in the species community composition between a Tiehm's buckwheat subpopulation and another survey location was 0.44 and a maximum of 0.80; and
4) Across critical habitat, differences between sites was driven almost entirely by species turnover (median percent of difference attributable to turnover 86 percent).

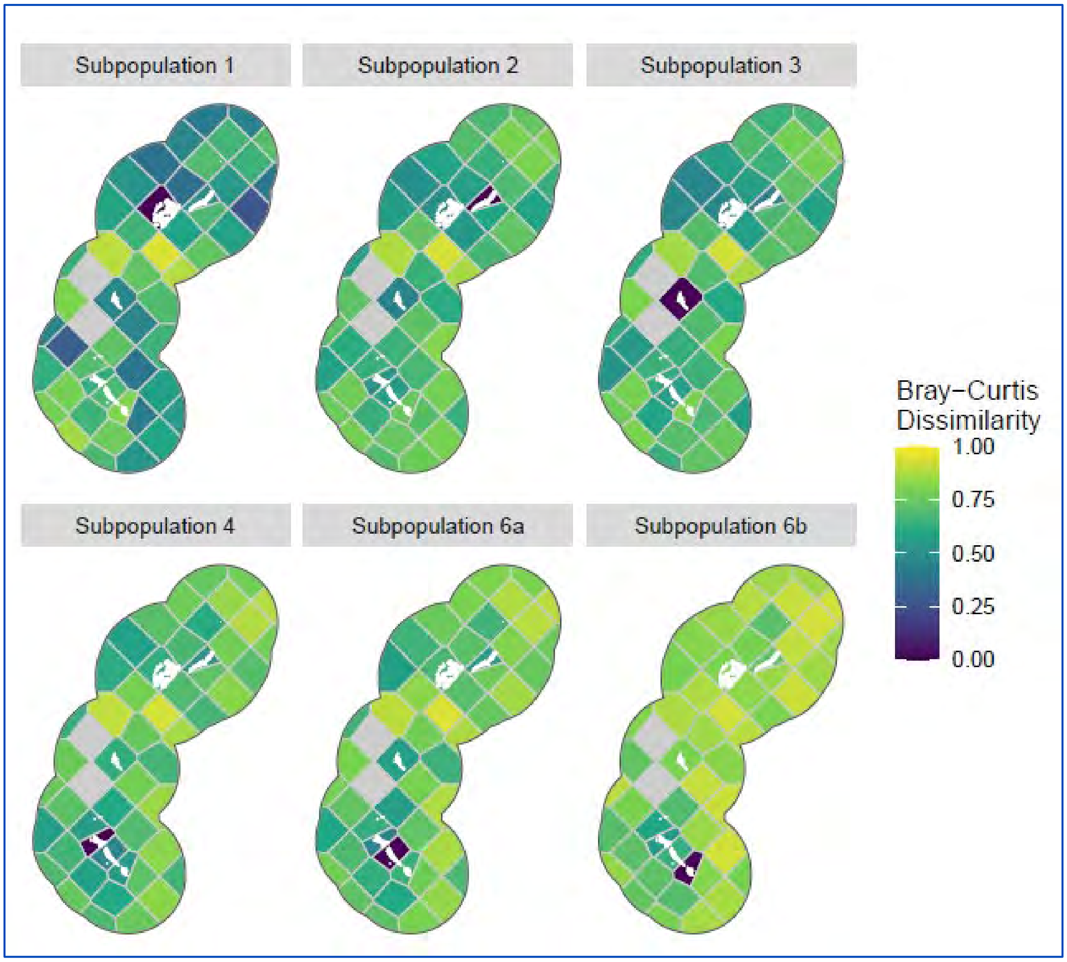

Figure 5. Pairwise Dissimilarity Comparison of Potential Pollinator Community Species Composition and Abundance (Bray-Curtis) between Occupied Tiehm's Buckwheat Habitat and Unoccupied Critical Habitat for Tiehm's Buckwheat
(WestLand 2023 In Prep.)

Results of the Bray-Curtis indices indicate:

1) No strong spatial patterns, sites have substantially different species composition from even nearby locations;
2) Bray-Curtis dissimilarity among the Tiehm's buckwheat subpopulation (i.e., pairwise between the six subpopulations) ranged from 0.44-0.81 (i.e., 44 to 81 percent difference in species composition and relative abundance); and
3) Dissimilarity considering species composition and abundance (Bray-Curtis) between Tiehm's buckwheat subpopulations and critical habitat ranged from 0.27-0.94 with a median of 0.62.

Across the survey area, the differences between sites were driven predominately by balanced variation in abundance (i.e., turnover) but unidirectional abundance gradients were also important contributors to dissimilarity (median percent of difference attributable to turnover (72%) whereas median percent of difference attributable to unidirectional abundance gradients (20%). The abundance gradients are primarily caused by variation in the abundance of the nearly ubiquitous Eudasytes beetles. These results indicate that the structure of potential pollinator communities within critical habitat are likely driven by local conditions. The conclusion that the differences in pollinator communities among sites is driven largely by species turnover provides further evidence of the broad diversity across critical habitat and the lack of similarity in potential pollinator communities between subpopulations, affirming the previous work that concluded that Tiehm's buckwheat is likely capable of being pollinated by a diverse guild of pollinators.

3. PROJECT DESCRIPTION AND APPLICANT PROPOSED CONSERVATION MEASURES

3.1. RHYOLITE RIDGE PROJECT SUMMARY [APPLICANT'S PREFERRED ALTERNATIVE]

Ioneer Rhyolite Ridge LLC (Ioneer) (the Applicant) submitted a Plan of Operations (Plan) (NVN-098058) and Nevada Reclamation Permit Application for the Project to the Tonopah Field Office of the Battle Mountain District Bureau of Land Management (BLM) and Nevada Division of Environmental Protection (NDEP), Bureau of Mining Regulation and Reclamation in May 2020. Responding to comments by the BLM, the proposal and eventual listing of Tiehm's buckwheat and designation of its critical habitat, and ongoing coordination with the USFWS, revised Plans were submitted in July 2020, August 2020, November 2021, January 2022, and July 2022 (Ioneer 2022). The Applicant's Preferred Alternative summarized here further revises the July 2022 Plan (Ioneer 2023).

The proposed Project will be developed by excavating overburden rock and ore from a surface quarry (Quarry), then transporting the ore to a facility within the Processing Plant Area and the overburden rock to three Overburden Storage Facilities (OSFs). The extracted ore will be crushed and placed into a vat leach system where sulfuric acid will be used to leach the lithium and boron. An evaporation/crystallization process will then be used to produce the lithium and boron products, which will be shipped off-site in solid form. Residue from the vat leach and evaporation/crystallization processes including the spent ore, sulfate salts, and filter cake, will be dewatered at the Processing Plant Area and then trucked to an on-site Spent Ore Storage Facility (SOSF). All of these activities will occur within the Operational Project Area and the proposed mine facilities are depicted on **Figure 6**.

The transportation route for import of equipment and supplies and export of processed materials will be from SR-264 along the existing road in the Access Road and Infrastructure Corridor portion of the Project Area to the Operational Area, which currently is an Esmeralda County-maintained Road on public lands (Hot Ditch Road and Cave Springs Road, aka Cave Springs Road-Coyote Summit) (**Figure 1**).

The dewatering water system will be used to provide water during the initial construction phase of the Project. During the operational phase of the Project, water from Quarry dewatering wells will be supplemented with water from existing wells or new wells located on private land in the Fish Lake Valley and will be pumped to the Operational Area via a pipeline adjacent SR-264, Hot Ditch Road, and the access road to the Processing Facility. A pump station will be located on private lands and within the access corridor to provide pressures needed to transport water to the Project. On an annual basis Project groundwater pumping in Fish Lake Valley would be equal to the agricultural pumping suspended during the term of the water lease less the NDWR adjustment for the change in use.

A steam turbine generator will be constructed as part of the proposed Sulfuric Acid Plant (SAP) within the processing area, which will serve as an internal source of power to the Project during the operational phase. As necessary, mobile generators will be used as the primary power source prior to power plant construction, as a backup power supply during interruptions to the primary power source during operations as needed, and during reclamation activities.

The total disturbance will occur in phases, including the Quarry, the Processing Facility, OSFs and SOSF, haul/service roads, publicly accessible roads, growth media stockpiles, Explosive Storage Area, communication towers (and ATV access), initial and long-term water supply system, monitoring wells (and access), sewage package plant or septic system and leach fields (if required), and other ancillary disturbance. More detailed descriptions of the Project can be found in the Applicant Preferred Alternative (Ioneer 2023).

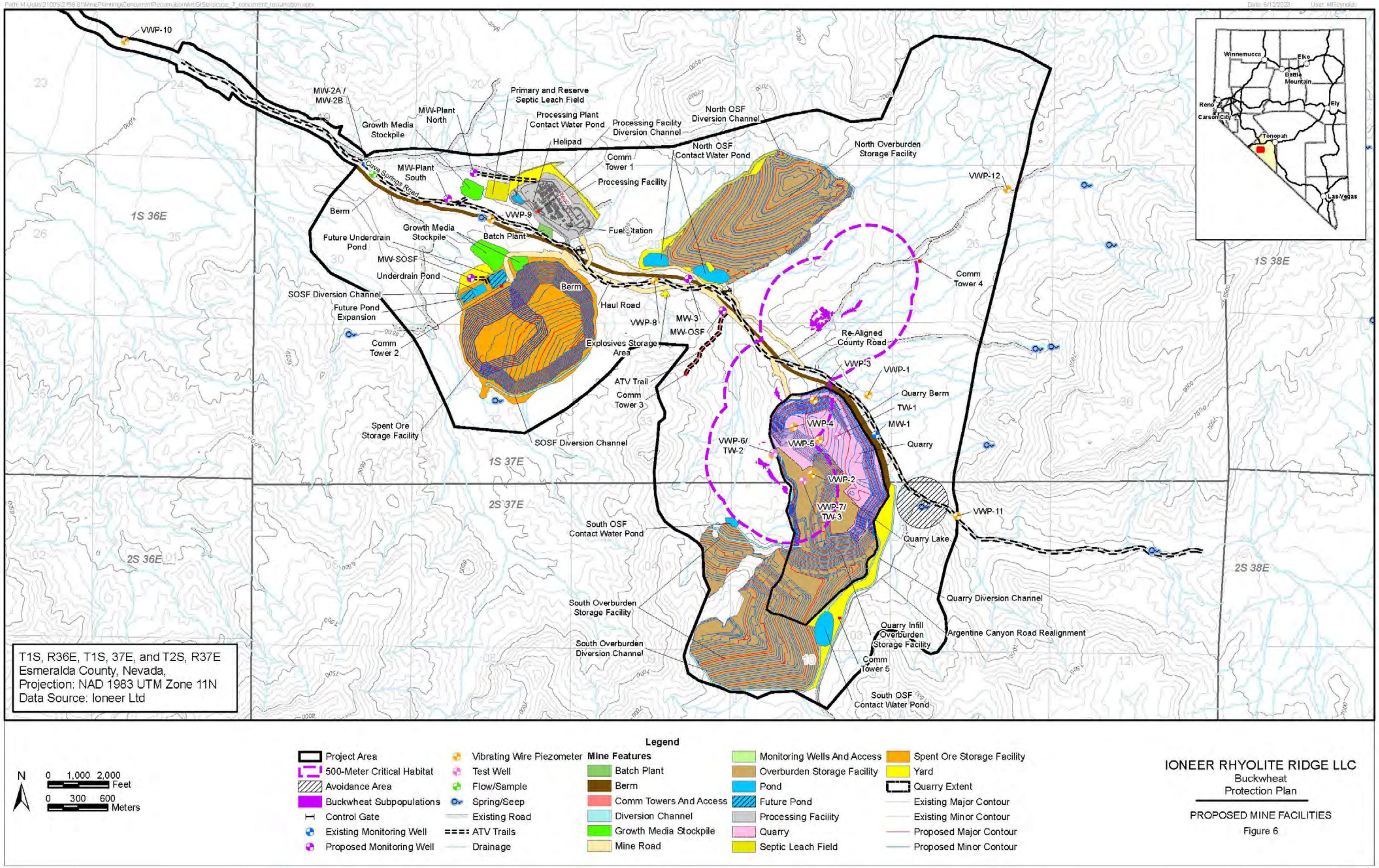

Figure 6. Proposed Mine Facilities

3.2. APPLICANT PROPOSED CONSERVATION MEASURES

In this section we describe the conservation measures Ioneer has proposed to avoid and minimize the impacts of the Rhyolite Ridge Project to Tiehm's buckwheat and its designated critical habitat. They have been developed with input from the USFWS and BLM and reflect substantial changes in proposed Quarry development, overburden storage facility design, and other infrastructure, as well as other specific conservation measures related to mine operations and reclamation to avoid and minimize impacts to Tiehm's buckwheat and its designated critical habitat.

APCM-1. Avoidance of Tiehm's Buckwheat and Designated Critical Habitat. Ioneer has redesigned significant parts of its Plan of Operations since their original plan was submitted in 2020 to avoid impacts to Tiehm's buckwheat subpopulations and avoid and minimize impacts to designated critical habitat. This has been an iterative process that has required extensive evaluation of slope stability, quarry sequencing, collection of additional geotechnical data, and iterative quarry wall stability assessment along with revision of appropriate mitigative measures to achieve stability requirements. **Figure 7** depicts the major iterations that were developed and direct surface disturbance to Tiehm's buckwheat subpopulations and critical habitat. In June of 2022 Ioneer submitted its Applicant Preferred Alternative (also referred to as the North and South OSF Alternative in the Draft EIS) to the BLM. To prepare this plan, Ioneer completed an extensive redesign of the proposed Quarry and the overburden storage facilities, (i.e., relocation and creation of an additional storage facility with substantially greater haul distance to minimize direct impacts to critical habitat). The Applicant Preferred Alternative has relocated all overburden storage, with the exception of Quarry backfill, from within the boundaries of Tiehm's Buckwheat critical habitat (**Figure 6**). The storage of explosive materials and communication towers that were located near Subpopulation 1 have been relocated outside the boundaries of critical habitat and away from all subpopulations. As illustrated in **Figure 7**, these conservation measures have significantly reduced the overall effect of the Project on Tiehm's buckwheat and its critical habitat, down from 357.2 acres of critical habitat disturbance under the 2022 Plan of Operations to 196.65 acres of critical habitat that would be affected by the Applicant Preferred Alternative. During the initial phases of project construction and development activities in critical habitat, including the surveying and construction of the conservation fencing (APCM-4), a Biological Monitor will be present. Once initial construction has reasonably established the limits of authorized activities within critical habitat have been constructed biological monitoring within critical habitat will occur quarterly (see APCM-15).

APCM-2. Geotechnical Design of the Quarry Walls to Provide Appropriate Margins of Safety. The design Factor of Safety (FOS) criteria for Quarry wall stability during operations is 1.20 or greater (Geo-Logic Associates 2023). Where initial analysis indicated that this design FOS would not be maintained in certain locations during operations while personnel and equipment were working in the Quarry, ground anchors have been incorporated into Quarry wall design where necessary to achieve the targeted FOS (Geo-Logic Associates 2023). Where ground anchors were required during operations to achieve desired FOS, buttresses ranging in width from 180 to 620 feet with a slope angle that ranges from roughly 27 to 33 degrees will be constructed as part of closure to provide long term stability of the Quarry walls to protect Tiehm's buckwheat. As knowledge is gained during the progression of Quarry development and the implementation of monitoring activities described in **APCM-3**, deeper understanding of site-specific rock mechanics will be derived during operations and will allow for continued refinement of the geotechnical stabilization methods deployed.

Note that the diversion ditch located at the western edge of the Quarry will no longer be constructed. The stormwater benefits were determined to be marginal and that the discharge stormwater runoff at a single point of discharge to the buttress structure had potential to create long term adverse effects on the buttress structure and pollinator habitat reclamation objectives. This area will now be part of the overall area reclaimed as part of the highwall bench reclamation (APCM-6). At closure and following construction of the buttresses, the modeled slope stability in the vicinity of the Tiehm's buckwheat populations in the closed Quarry would range from 1.81 to 2.71 (Geo-Logic Associates 2023 and included as Attachment F).

2020 Proposed Plan of Operations	**2022 Proposed Plan of Operations**	**2023 Applicant Preferred Alt.**
292.9 acres of disturbance within critical habitat before concurrent reclamation to establish functional pollinator habitat. 2.98 acres of direct impact to Tiehm's buckwheat subpopulations. Subpopulations 4, 5, 6a, 6b, and 7 affected.	357.2 acres of disturbance within critical habitat before concurrent reclamation to establish functional pollinator habitat. No direct impacts to Tiehm's buckwheat subpopulations.	196.65 acres of disturbance within critical habitat before concurrent reclamation to establish functional pollinator habitat. No direct impact to Tiehm's buckwheat subpopulations.

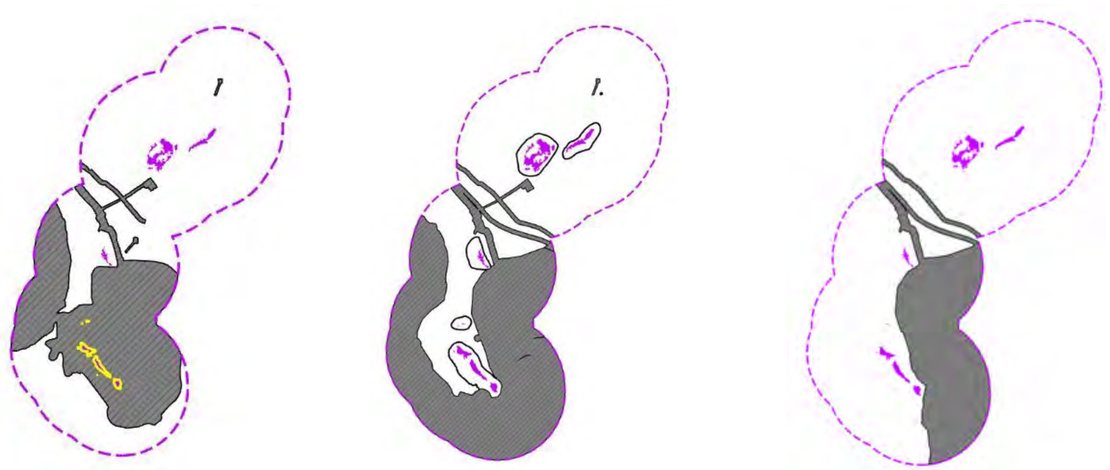

Figure 7. Comparison of the 2020 Proposed Plan of Operations, 2022 Proposed Plan of Operations, and the 2023 Applicant Preferred Alternative (referred to as the North-South Alternative in the DEIS)
Note that critical habitat was not designated until 2023, but for comparative purposes it has been used to evaluate all of the plans.

APCM-3. Geotechnical Monitoring. Ioneer will implement multiple slope monitoring systems to identify and track physical evidence of surface movement, such as tension cracks, rock fall, and surface movement as well as subsurface conditions. This will be accomplished by visual inspections of the Quarry wall twice daily and Ioneer will deploy an advanced stability radar system that will provide 24-hour real time monitoring of rock slope behavior. Additional survey monitoring could be conducted using one or more of the following remote monitoring systems:

- prism targets with survey instrumentation,
- radar,
- UAV/drone surveys, and/or
- Interferometric Synthetic Aperture Radar (InSAR) surveys.

Subsurface monitoring would include one or more of the following techniques:

- piezometers,
- inclinometers,
- time-domain reflectometers, and/or
- extensometers.

Should new technologies or processes that are superior in some fashion be identified, the new technology may be incorporated or used in lieu of the technologies identified here. Any change in monitoring technology will be vetted with BLM and USFWS. The combination of automated and human monitoring systems will provide continuous monitoring at the site during operations. A key benefit of Quarry design and sequencing that allows for progression of Quarry development from south to north will be the ongoing monitoring and observation of the geologic features in the west Quarry wall, such as the M5a unit, to inform refinement of the geotechnical design requirements to achieve the desired FOS, prior to mining operations near Tiehm's buckwheat populations. Should geotechnical monitoring activities indicate additional management action is required, those actions could include deployment of additional ground anchors, additional layback of the Quarry wall, or buttress construction in the Quarry prior to the currently planned deployment. Any management action that would change the current proposed limits of disturbance in critical habitat could trigger the requirement for re-initiation of consultation and evaluation of the adequacy of existing National Environmental Policy Act (NEPA) analysis and if necessary supplemental NEPA documentation.

APCM-4. Establish Fencing and Signage to Protect Tiehm's buckwheat and Critical Habitat Designated for Tiehm's buckwheat. Fencing and or signage as appropriate will be placed along the limits of proposed disturbance within critical habitat as depicted in **Figure 8**. Fencing would be four strand wildlife friendly fencing with the top and bottom strands barbless (**Figure 9**). Gates would be constructed at key areas to control access to critical habitat as depicted in **Figure 10** or of similar design/function. Approximately 19,342 linear feet of fence would be constructed at the limit of planned surface disturbances and approximately 22,400 linear feet of fence would be constructed in undisturbed areas except where site topography makes fence construction impracticable or unsafe (**Figure 8**). Specific treatment and design features for the fence proximate to quarry or other project features (i.e. drainage features and roads) will be developed at the time of construction to ensure compatibility. The fencing plan provided for up to 5 locked gates. Gates expecting higher levels of use would be built in a manner that generally follows the detail provided in **Figure 10**. Gates with less use and that do not require a lock would be built as a wire gate (**Figure 9**). Signage will be placed on the fence at 100-foot intervals and as otherwise appropriate. Monitoring of the fence will coincide with quarterly critical habitat monitoring (APCM-15).

The proposed fence will be constructed at the edge of the maximum extent of planned disturbance to avoid additional disturbance whenever possible. Fence construction will provide a clear demarcation between areas where disturbance has been authorized and areas where it is not authorized. Fencing will also help to control unauthorized access to mining areas for safety purposes and by extension to areas of critical habitat. Fence construction will be accomplished using standard methods and practices. Due to the nature of plant communities at the site, vegetation clearing will be limited where fence construction is not being accomplished at the limits of authorized disturbance. When fence construction is at the limits of the disturbance, the limits will be surveyed and any disturbance for fence construction would occur on the "mine" side of the fence. Where fence construction is proposed that are not at the limits of authorized disturbance, the fence will be constructed approximately 1-foot outside of critical habitat and all access for construction will be outside of critical habitat. The fence locations will be located and staked prior to construction by a land surveyor licensed in the state of Nevada. During survey and construction of all fencing a Biological Monitor will be present.

APCM-5. Restrict Public Access to the County Road. The Applicant, per MSHA obligations, will restrict public access to all roads in and through critical habitat within the Project. Where Cave Springs Road passes through mine operations and critical habitat, this restriction will be accomplished by managing the interactions between the public and mine traffic on the county road using pilot vehicles.

APCM-6. Development of a Pollinator Habitat Reclamation Program Within Critical Habitat. As part of the Applicant's proposed concurrent reclamation plan, the Applicant will enhance reclamation efforts inside of critical habitat to foster faster recovery of pollinator habitat. The three Project phases applicable to the pollinator habitat reclamation effort are:

1) Planning and design
2) Implementation
3) Performance Criteria, Monitoring, and Reporting

Each is discussed in more detail in the sections that follow.

1. Planning and Design

The planning and design of the pollinator habitat reclamation within the critical habitat relies on a science-based approach to achieve effective and resilient reclamation outcomes. The reclamation goals are informed by reference ecosystems but consider how ecological conditions are changed by Quarry development. The overall goal of the reclamation is to support the restoration of ecosystem processes and function. Specifically, reclamation efforts inside of critical habitat will be enhanced to accelerate the establishment of habitat suitable for the various life history stages of the diverse pollinator guild that supports Tiehm's buckwheat (Functional Habitat).

To inform the design and planning for the pollinator habitat reclamation area, vegetation (Cedar Creek 2021 and 2023) and pollinator studies (WestLand 2023c) were implemented throughout the reference ecosystems within the critical habitat. A desktop assessment of edaphic conditions was also implemented. These reference studies serve as the basis for establishing ecosystem processes. Ultimately, the goal of pollinator habitat reclamation approach is to develop ecosystem functions which will offer ecological services to the nearby Tiehm's Buckwheat populations while limiting risk from undesirable species which are common in young reclamation. We do not expect the reclaimed ecosystem developed in response to this effort to be completely similar to the undisturbed native ecosystems in critical habitat.

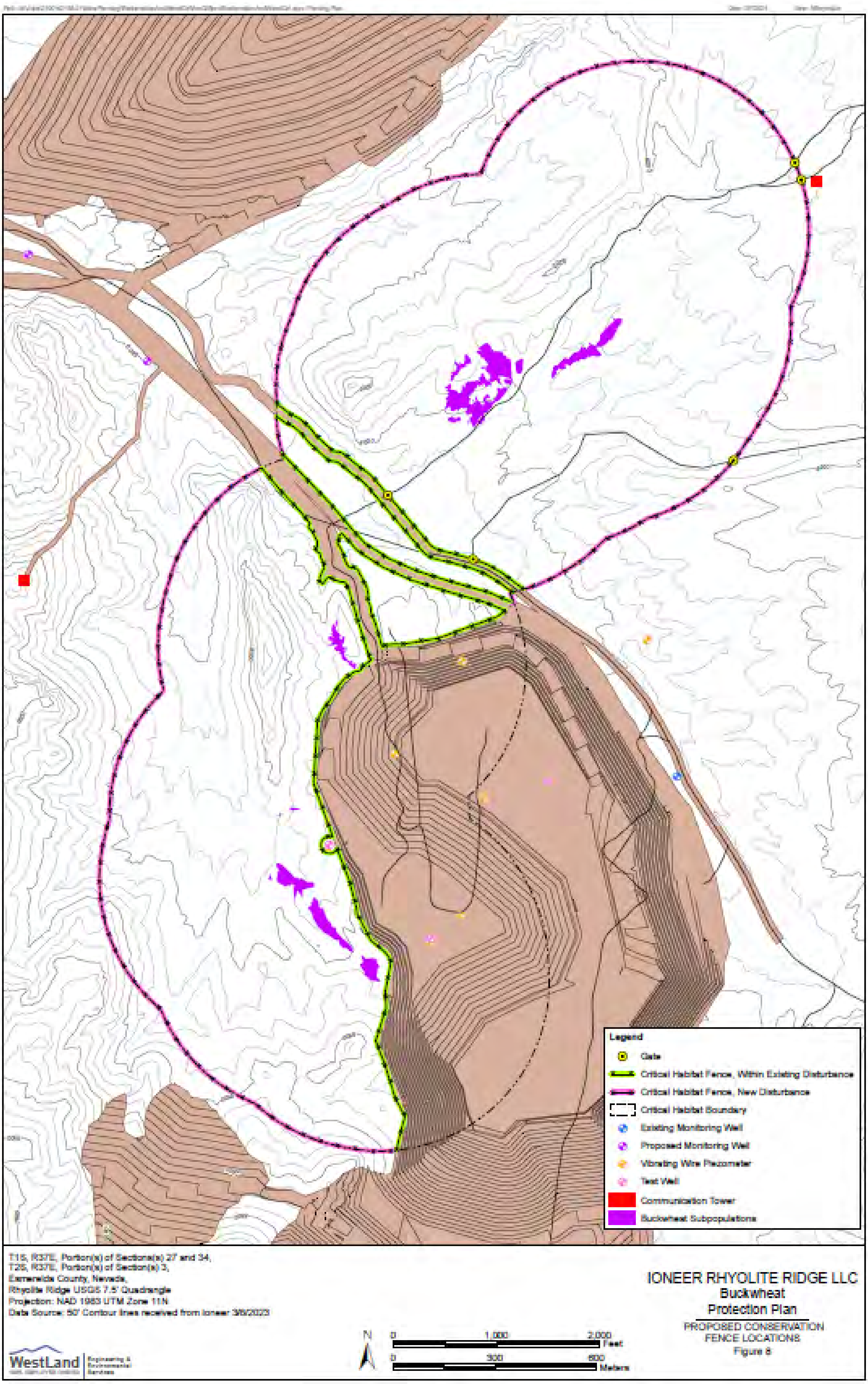

Figure 8. Proposed Conservation Fence Locations

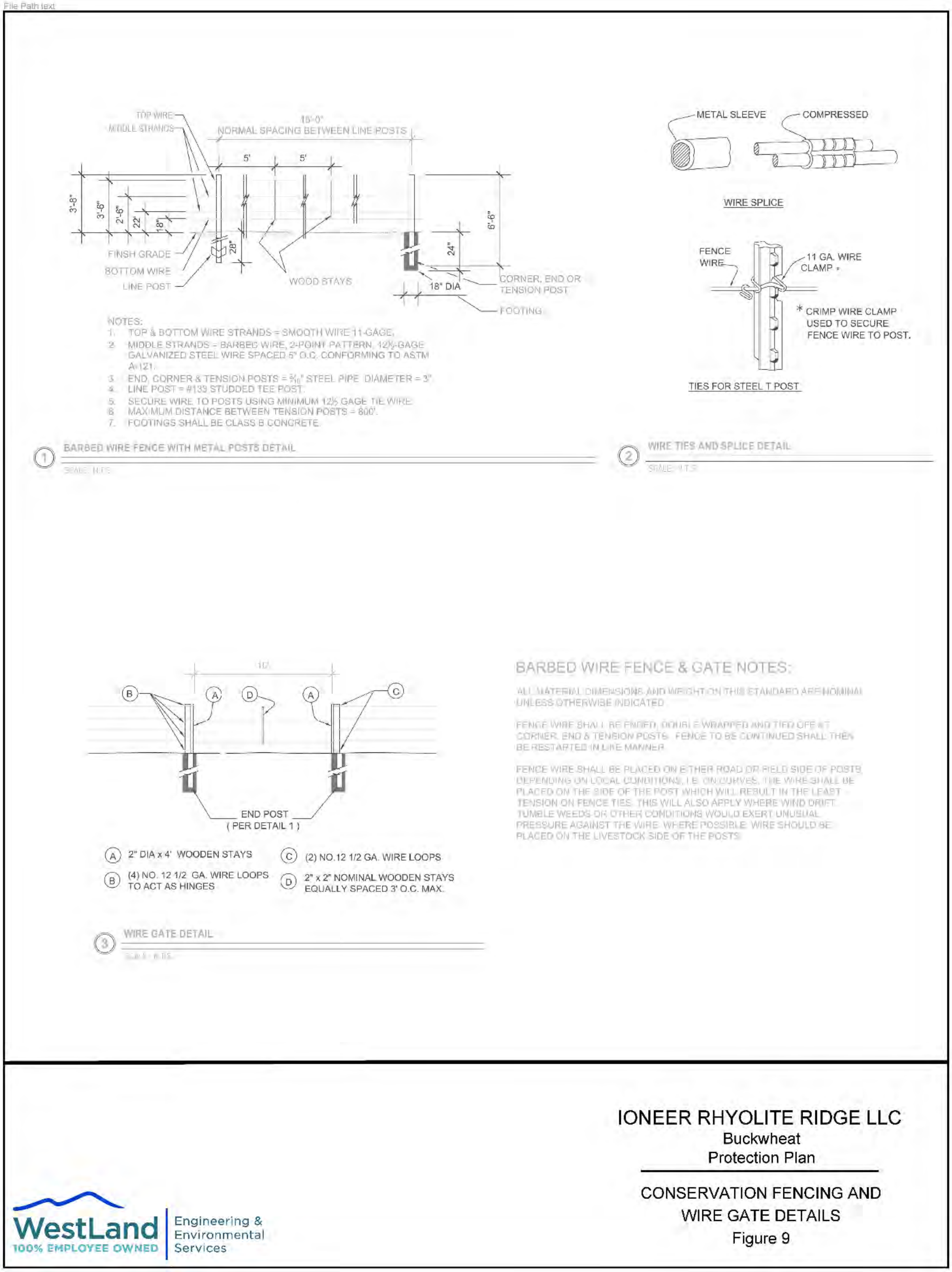

Figure 9. Conservation Fencing and Wire Gate Details

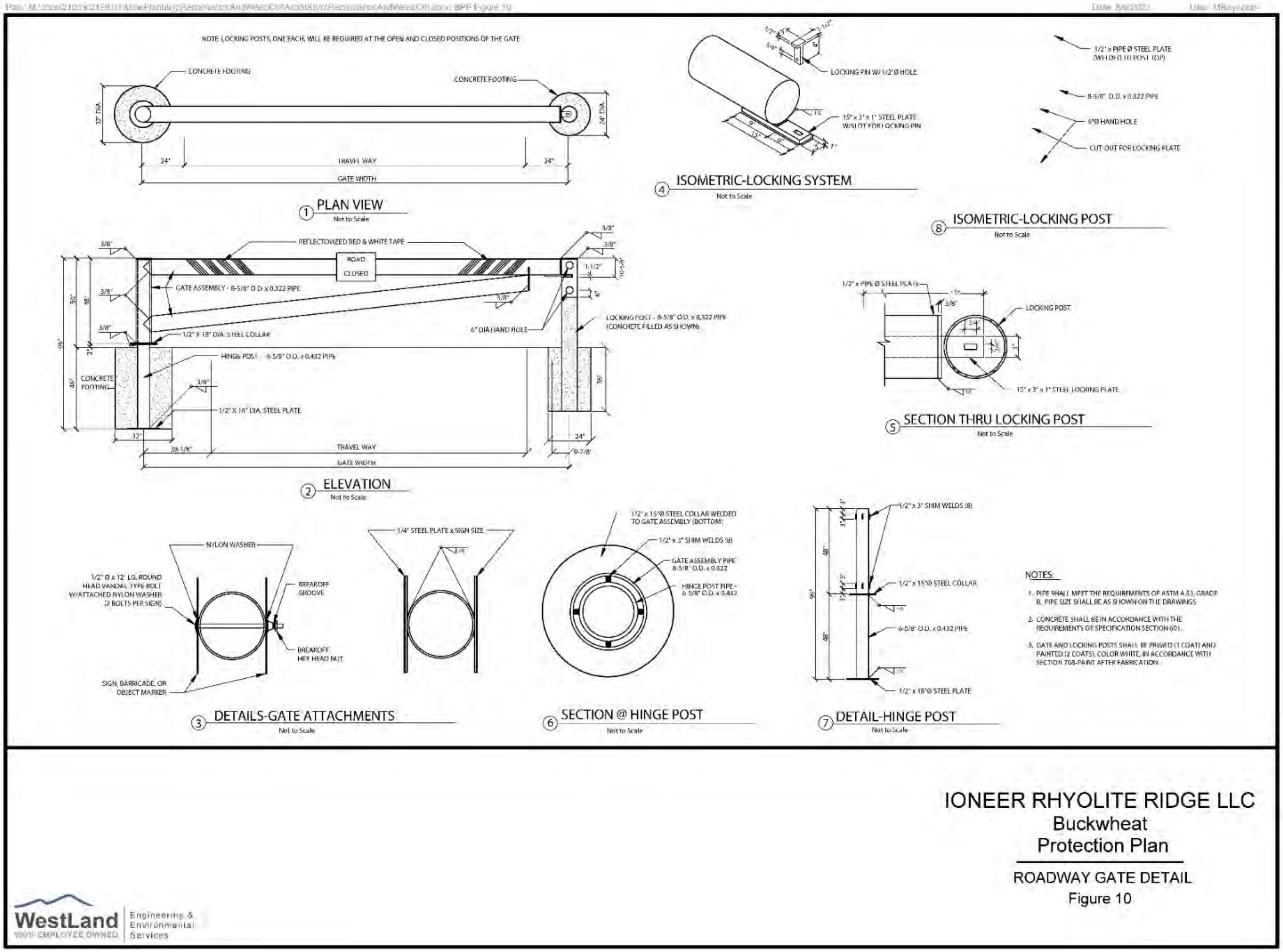

Figure 10. Roadway Gate Detail

A robust design and planning effort has been undertaken to establish a framework for the reclamation. As described below, several methods to enhance the establishment of vegetation within critical habitat will be evaluated during the early phases of concurrent reclamation. These methods will include, but may not be limited to, soil amendments to facilitate establishment of soil biome, establishment of biological soil crusts, enhanced (diversity and quantity) seed mixes, containerized plantings, supplemental irrigation approaches, and salvaged succulents. The validation and the effectiveness of these various methods will be refined and optimized during early phase reclamation efforts, mine years 3 to 18, and prior to bulk of reclamation efforts within critical habitat which will begin in Year 19 once buttresses have been constructed to provide for long term stability of the west Quarry wall. The protocols and procedures to evaluate enhanced reclamation methods to achieve the Pollinator Habitat Reclamation objectives outlined in this plan shall be developed in collaboration with the USFWS and the BLM prior to Year 2 of the Project life.

2. Implementation

Attachment G depicts the progression of Quarry development, development of the OSFs and implementation of concurrent reclamation through the life of the Quarry based on the Applicant's Preferred Alternative. All reclamation activities have been designed to achieve post-Project land uses consistent with the BLM's land use management plans for the area outlined in the Tonopah Resource Management Plan (BLM 1997). Post-Project land uses are anticipated to include wildlife habitat (including habitat for pollinators), hunting, and dispersed recreation. Post-Project land use is not expected to differ from pre-activity land use.

Except as noted here, reclamation of Project disturbance within critical habitat will occur as described in the Applicant's Preferred Alternative. Areas within critical habitat that will be reclaimed when no longer in use include overburden stockpiles, the Quarry buttress, and Haul Roads no longer needed. The Quarry wall and areas that will be inundated by the Quarry Lake may not be actively reclaimed. Depending upon the timing of Quarry Lake development, some of the areas that will ultimately be inundated by the lake may be reclaimed on an interim basis to stabilize the soil surface.

The initially designed approach for concurrent reclamation activities within critical habitat is described below followed by a description of the pollinator habitat reclamation approaches to be evaluated for their efficacy during the early stages of concurrent reclamation and then applied as appropriate within critical habitat. The following sections describe growth media characterization, site preparation, seeding, containerized plantings, and monitoring and success criteria.

Growth Media Characterization

- Growth media used for pollinator habitat reclamation within critical habitat will be comprised of two types of materials, which will be salvaged, stockpiled, and placed separately:

  - Topsoil – The topsoil will be salvaged from the top 6 inches of the native soil profiles, prior to Project facilities construction. The native A/B soil horizons contain a valuable soil biome to achieve goals in the pollinator habitat reclamation area.
  - Alternative Growth Media – The alternative growth media is comprised of alluvial geologic material which will be removed from within the Quarry footprint during operations. The alternative growth media exhibits physical and chemical characteristics to achieve pollinator habitat reclamation area goals.

- Growth media will be removed from within the Quarry footprint during operations, as needed to meet reclamation requirements. In most of these areas it is anticipated that because of the nature of the overburden (primarily alluvium) being removed from the Quarry, it will be much thicker. Within critical habitat, the 196.65 acres to be disturbed during Quarry development will have suitable topsoil salvaged and stockpiled during Project development. The top six inches of topsoil and associated vegetation over this area will be salvaged. Assuming a 25 percent swell factor, this would generate approximately 198,290 cubic yards of topsoil for use in subsequent reclamation within critical habitat.
- The stockpile will be managed in a manner to keep the soil biome in the best condition possible. Specifically, the stockpile design will have a very high surface area and a limited depth, this is to ensure the soil biome has access to oxygen and the opportunity to interact with plants. The topsoil salvaged from critical habitat will be stockpiled on the Quarry berm and the yard area to the south of the Quarry (**Figure 6**). The critical habitat topsoil will be placed in a two-foot lift to maintain biological viability while stockpiled. The surfaces of the stockpiles will be contoured with slopes of 3:1 (horizontal: vertical) to reduce erosion potential. The topsoil stockpiles will be seeded with seed approved for use in critical habitat to stabilize the material, support soil seed bank, support soil biological function, minimize establishment of undesirable weeds, and stabilize the topsoil stockpile. Seeding will follow the procedures and approaches outlined herein. The topsoil stockpile will be stabilized through seeding with the reclamation seed mix and temporary erosion protection measures. As required, topsoil stockpiles will be treated for invasive and noxious weeds to control the establishment of these species with the long-term goal of reducing the available seedbank for those species. This control will occur in conformance with the requirements of APCM-7. The goal of these best management practices for the topsoil stockpile is to hopefully achieve live-haul topsoil conditions. Maintaining a living soil biome during storage will accelerate revegetation performance by transplanting a healthy soil biome, seed bank, and established ecosystem processes and function.
- Surface water will be diverted around the topsoil stockpiles as needed to prevent erosion from stormwater runoff. BMPs such as silt fences or staked weed-free straw bales or wattles will be applied as necessary to limit wind and water erosion.

- Suitable alternative growth media will be used for reclamation purposes and placed prior to the placement of topsoil. This material will exhibit the physical and chemical characteristics which are likely to support the robust reclamation goals within the critical habitat. Prior to placement of growth media in the critical habitat, agronomic testing will be completed to demonstrate the suitability of alluvium. The initial suitability criteria are presented on **Table 2**. As reclamation is implemented and early monitoring results are evaluated, further refinement of suitability criteria should be conducted.

Table 2. Cover Material Assessment

Optimal Agronomic Ranges		
Parameter	**Optimal Suitability Ranges**	**Units**
pH(Paste)	6.5 – 8.5	N/A
Electrical Conductivity	< 8	mmhos/cm
Organic Matter	< 10	% of Total Soil
Texture	No Textural Extremes	% Size Fraction
Soil/Gravel Fraction	> 50	% of Total Soil
NO_3-N	> 0.1+	ppm
Phosphorus (P)	> 1+	ppm
Potassium (K)	> 20+	ppm
Zinc (Zn)	> 0.25+	ppm
Iron (Fe)	> 1.0+	ppm
Manganese (Mn)	> 0.1+	ppm
Copper (Cu)	> 0.1+	ppm
Calcium (Ca)	Addressed as EC	ppm
Magnesium (Mg)	Addressed as EC	ppm
Sodium (Na)	Addressed as SAR	ppm
Sodium Adsorption Ratio	< 15	N/A

+ Values can be increased through OM additions.

- The suitable alternative growth media shall exhibit diminished nitrogen levels to meet Project goals. It has been shown on numerous reclamation projects in northern and central Nevada that elevated soil nitrogen leads to an increase in annual weedy species, which are aggressive when surplus plant available water and soil fertility are present. In contrast, native species are well adapted to low fertility situations and while the reclamation typically takes longer to establish, the outcomes are much more favorable. Therefore, the application of soil amendments, particularly to address soil fertility, should be carefully planned based on analytical data.

Site Preparation

- During the first year that a disturbed land area is no longer needed, reclamation activities will commence at the earliest feasible time. The portions of the South and Quarry Infill Overburden Storage Areas and the quarry buttress within the critical habitat to be reclaimed will have a minimum of 2.5 feet of suitable growth media for reclamation. During this first year, any minor regrading and recontouring necessary to control runoff or run-on and prepare the growth media for seeding will be completed. Seedbed preparation will be conducted, as needed, following growth media placement. On slopes that are less than 33 percent, the seedbed will be prepared along the contour, utilizing a chisel-plow, disc, harrow or other appropriate equipment to break up the surface. If any slopes are present that are steeper than 33 percent (and not benched), too narrow to operate equipment, or where organic debris have been re-spread, the surface will be left in a roughened condition to help retain seed.

- Once the haul roads are no longer needed, they will be regraded and reshaped to approximate surrounding topography. Existing fill material pushed into berms or otherwise stockpiled in the disturbed areas will be redistributed within the disturbed areas to approximate natural contours of the landscape prior to the disturbance activities. The disturbed areas will be scarified and left in a rough state as necessary to relieve compaction, inhibit soil loss from runoff, and prepare the seed bed. Regrading and reshaping activities will maintain an access road to the Quarry for ongoing monitoring purposes following closure.
- To the extent possible, heterogeneity will be implemented into the reclamation units within critical habitat to support the reclamation goals. This may entail special handling of growth media materials to create heterogeneity in the engineered soil profile. The topsoiled stockpiles will be used to create "islands of fertility" where replaced depths will vary. Alternative strategies may include variable application of soil amendments or seed mixes, the use of rock piles or woody debris to create habitat islands, or strategic plantings.
- The benches of the Quarry highwall that will not be covered with buttress at final closure will be ripped to relieve compaction and have growth media applied to prepare them for seeding once they are in their final configuration and remain accessible to reclamation equipment.

Seed Mix and Plant Materials

- Appropriate (locally adapted and/or genetically appropriate) native plants will be used. Procedures and protocols for collecting seed for experimental plot seeding, use in this pollinator habitat reclamation plan, seed bulking, and plant propagation will be prepared to provide to our venders to ensure that they are conforming to the requirements of this plan. Ioneer will consider opportunities to partner with BLM's Seeds for Success Program or similar.[1] Based on planned rates of mining and scheduled stockpile development, Ioneer will work with qualified revegetation contractors and native seed suppliers to ensure that enough seed are secured and available to meet reclamation

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[1] "Seeds of Success (SOS) is the national native seed collection program, led by the Bureau of Land Management (BLM) in partnership with numerous federal agencies and non-federal organizations. As the first step of the Native Plant Materials Development Program (NPMDP), SOS's mission is to collect wildland native seed for research, development, germplasm conservation, and ecosystem restoration. The NPMDP's mission is to increase the quality and quantity of native plant materials available for restoring and supporting resilient ecosystems."
https://www.blm.gov/sites/blm.gov/files/program_nativeplants_collection_quick%20links_SOS%20Handout.pdf

schedules. Select targeted plant species to be used for reclamation will be based on vegetation studies of the designated critical habitat completed in 2022, the availability of suitable seed, and experience gained during concurrent reclamation efforts. Ioneer will work closely with the USFWS and BLM as concurrent reclamation progresses to optimize the seed mix based on consideration of seed availability and success of previous seeding efforts. Since initial reclamation efforts are not anticipated in critical habitat until 19 years into Project life, once the buttresses are fully constructed, the final seed mix used for critical habitat will benefit from the knowledge gained from those previous efforts. Species that will be considered in the seed mix may include the species listed in **Table 3** and will be developed in coordination with Great Basin Ecoregional Coordinator at BLM NVSO and USFWS.

- Beginning in year 3 (first year of concurrent reclamation outside of critical habitat), Ioneer will explore methods to establish containerized plantings as well as the efficacy of other reclamation techniques in this Pollinator Habitat Reclamation Plan to identify an effective method to accelerate the establishment of habitat suitable for the various life history stages of the diverse pollinator guild that supports Tiehm's buckwheat. The experimental plots will be focused on the South OSF but other OSFs may be used. Plot size is expected to vary from ½ to 1 acre in area. Over the 14 years of this experimental/evaluation period we anticipate that from 15 to 25 plots will be established and monitored. Methods to be evaluated will include tall pot plantings, use of Dri-water or its equivalent, time of year for plantings, and temporary irrigation system design options, etc. The outcomes of these various treatment options and methods will be shared with the BLM and USFWS. The plots would also be used to test soil and site preparation methods and various seed mixes derived from **Table 3** to test the efficacy of the variety of species that would potentially be used in the larger scale Pollinator Habitat Reclamation efforts that occur in Year 19. If methods for establishing containerized plantings are demonstrated to be practicable, they will be used within critical habitat as described in this plan to accelerate dryland reclamation activities to create functional pollinator habitat as quickly as practicable. Plant species expected to be used for containerized plant experiments could include black sagebrush, Greene's rabbitbrush, winterfat, and rubber rabbitbrush and subshrubs/forbs such as Panamint beardtongue, cushion buckwheat, desert globemallow, and any of the grass species listed in **Table 3**. The ongoing analysis and the results of these experimental plantings will be shared with the USFWS and the BLM and will inform final development of pollinator habitat reclamation efforts within critical habitat for Tiehm's buckwheat.

Seeding and Erosion Protection

- Broadcast seeding will be completed using conventional methods such as broadcast drop seeders, manually operated cyclone-type bucket spreaders, or a mechanical seed blower. Seed will be mixed frequently in the seed boxes to discourage settling. Where possible and practical, broadcast-seeded areas will be chained or harrowed to cover the seed. Where slope conditions allow, broadcast-seeded areas may be dozer-tracked perpendicular to the slope to cover the seed. On small or inaccessible sites, hand raking may be used to cover seed.

- As appropriate, straw wattles or equivalent will be installed to protect newly planted areas from erosion and associated soil loss and loss of seed (applied or within the seedbank of the topsoil redistributed across the site).
- When hydroseeding is used, seed, fertilizer (if the analytical data support its use) and mulch (about 250 pounds per acre) will be sprayed in one application. A second application will be required to spray the remainder of the cellulose fiber mulch (to achieve a total of about one ton per acre) and a tackifier (at the manufacturer's recommended application rates).
- Mulching with certified noxious weed-free straw or cellulose fiber mulches will be conducted on areas where growth media has been applied to provide erosion control, promote soil moisture retention, and provide supplemental organic material. Supplemental mulching may be required on a site-by-site basis if revegetation is not successful, or if erosion is evident. Where used, mulch will be re-spread over seeded areas at rates dependent on seeding method and slope. Straw mulch will be applied at a rate of up to two tons per acre on steeper slopes where conventional broadcast methods are used. Straw mulch will be anchored into the seedbed using a mulch crimper, disc, or by dozer tracking. Cellulose fiber mulch will be applied at a rate of about one ton per acre on hydroseeded areas. Other soil stabilizing products such as tackifiers, erosion control blankets, bonded fiber matrix, turf reinforcement mats, fiber logs, or channel liners may be specified on a site-by-site basis, as needed; they would be applied and/or installed per manufacturers' recommendations.
- Highwall benches will be seeded following preparation using the approved seed mix.
- Seeding will generally be planned for late fall to take advantage of winter stratification and precipitation. When deemed appropriate seeding may occur at other times of the year.

Table 3. Current Suite of Species to be Considered for Concurrent Reclamation within Critical Habitat

Species with an '**' were suggested by USFWS, others were selected from species detected in vegetation plots completed in critical habitat in 2022. Those that have been documented to occur within the critical habitat are identified in **bold** text. P= perennial. A=annual. W=wind pollinated. I=insect pollinated

Duration[1]	Species		Bloom Time[2] & Principal Pollinator[3]
	Shrubs		
P	*Artemisia arbuscula***	low sagebrush	March through August, W
P	***Artemisia nova****	**black sagebrush**	July through October, W
P	*Artemisia tridentata* spp. *Tridentata***	basin big sagebrush	July through October, W
P	***Atriplex canescens****	**fourwing saltbush**	March through November, W
P	*Atriplex confertifolia***	Shadscale	March through November, W
P	*Chrysothamnus viscidiflorus* ssp*. Puberulus***	yellow rabbitbrush	June through November, I
P	***Chrysothamnus greenei***	**Greene's rabbitbrush**	June through November, I
P	***Ephedra nevadensis****	**Nevada jointfir**	February through May, W
P	***Ericameria nauseosa****	**rubber rabbitbrush**	August through November, I
P	***Grayia spinosa****	**spiny hopsage**	March through August, W
P	*Hymenoclea Salsola***	Burrobush	March through June
P	*Krascheninnikovia lanata***	Winterfat	March through October, W
P	*Picrothamnus desertorum***	Budsage	April through June, W
P	***Purshia glandulosa****	**desert bitterbrush**	March through May, I
P	*Symphoricarpos longiflorus***	desert snowberry	April through August, I
P	***Tetradymia canescens****	**spineless horsebrush**	March through November, I
	Forbs		
A	*Astragalus* lentiginosus**	Freckled milkvetch	April through July, I
A[4]	***Eriogonum inflatum***	**desert trumpent**	January through December, I
P	***Eriogonum ovalifolium***	**cushion buckwheat**	May through August, I
A	*Mentzelia albicaulis***	whitestem blazingstar	March through June, I
P	*Penstemon floridus var. floridus***	Panamint beardtongue	May through July, I
P	*Penstemon laevis*	Southwestern beardtongue	May June, I
P	*Sphaeralcea ambigua*	desert globemallow	February through November, I
P	*Stanleya pinnata***	desert princes' plume	April through September
	Grasses		
P	***Achnatherum hymenoides****	**Indian ricegrass**	June through September, W
P	***Aristida purpurea***	**Purple threeawn**	Late spring to summer,
P	***Elymus elymoides****	**Squirreltail**	May through July, Self Fert.
P	***Pleuraphis jamesii****	**James' galleta**	April through November, W
P	***Poa secunda****	**Sandberg bluegrass**	April, May, W
P	***Sporobolus airoides***	**Alkali sacatan**	Beginning in June, W
P	***Sporobolus cryptandrus***	**Sand dropseed**	July, August, September, W

1 Duration taken from United States Department of Agriculture (USDA) plants database. Online at www.plants.usda.gov. Accessed April 3, 2023.

2 Lady Bird Johnson Wildflower Center Plant Database. Available online at https://www.wildflower.org/plants/. Accessed March 31, 2023.

3 Determined from various online sources, including those listed in notes 1 and 2.

4 Often considered annual but may last two to three years.

Containerized Planting & Other Enhancement Methods

- Due to the avoidance of impacts that resulted from the removal of overburden storage and other non-essential Project elements from within critical habitat, reclamation, other than incidental areas totaling less than 10 acres and some benches on the highwall, is not expected to commence inside of critical habitat until Year 19 of the Project life, after the buttress is fully constructed. Initial reclamation activities under the concurrent reclamation plan will occur outside of critical habitat and will provide opportunity to refine and validate the reclamation enhancement methods to be used inside of critical habitat.
- Ioneer will complete soil analyses and evaluate revegetation efforts conducted during operations within the early phase evaluation areas to inform and optimize future efforts and to specifically determine what, if any, organic matter and nutrients will need to be added to the prepared surfaces prior to or at the time of seeding and planting. This evaluation will consider means of inoculating sites ready for revegetation with mycorrhizae and other components of the soil biome. The results of these investigations and proposed changes to site preparation methods will be reported to the USFWS and the BLM as part of this management approach for their input and concurrence.
- During the initial stages of concurrent reclamation (year 3+ of Project development), cacti will be salvaged from areas that will be disturbed by planned mining activities and planted within the reclamation areas. Both bare root and cuttings will be used. These plants, assuming successful establishment at densities that would support harvesting, could be used to supplement reclamation activities within critical habitat.
- We currently anticipate that containerized plantings and succulents will be planted at a combined density of approximately 125 shrubs/sub-shrubs per acre. The plant species expected to be used for containerized plantings include black sagebrush, Greene’s rabbitbrush, winterfat, and rubber rabbitbrush and subshrubs/forbs such as Panamint beardtongue, cushion buckwheat, desert globemallow, and any of the grass species listed in **Table 3**. A conceptual layout depicting the density and clustering of plantings is provided in **Figure 11**. This density and the general pattern of plantings is based on the work of McCormick et al. 2019. As part of the experimental plots implemented early in concurrent reclamation efforts outside of critical habitat, Ioneer will evaluate the efficacy of alternative densities, configurations, and irrigation options. As illustrated, plantings would be clustered with wider spacings between clusters that would be interspersed with land being reclaimed with more conventional dry land reclamation techniques. Efforts will focus on relatively dense, diverse clusters of vegetation (pollinator garden). These “pollinator gardens” may provide opportunity for increased irrigation efficiency without adversely affecting the overall benefits reclamation provides to pollinators. See for example discussions by McCormick et al. (2019) regarding flowering patches vs uniformly distributed flowers across a landscape. Key findings from McCormick et al. (2019) indicate that the addition of flower patches (versus uniformly distributed flowers) within habitats provide support for resident pollinator communities. The study further

indicated that while isolated flower patches may produce fewer flowers and result in reduced pollinator visitation, increasing isolation does not appear to affect pollinator visitation.

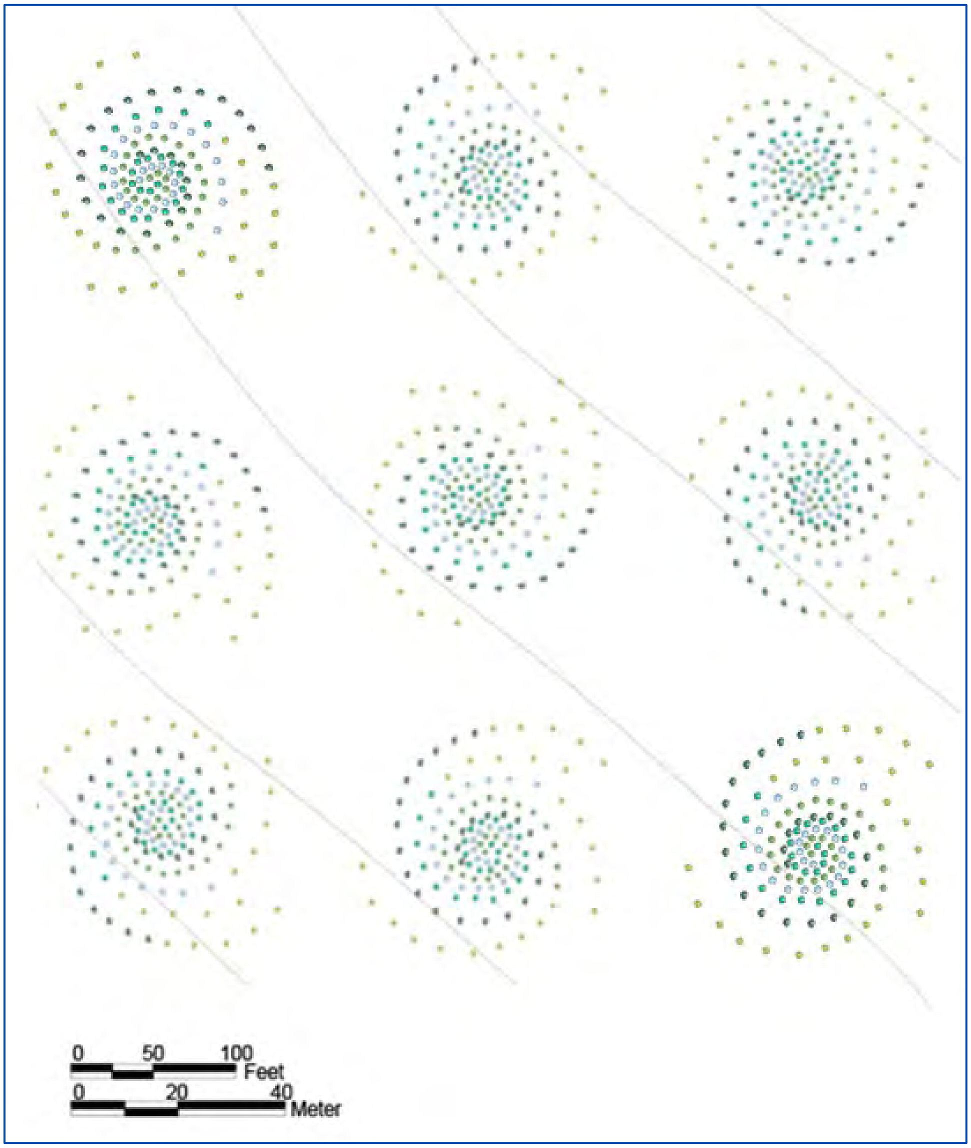

Figure 11. Schematic Depiction of Clustered Planting Approach Proposed for Enhanced and Accelerated Reclamation Efforts within Critical Habitat

Each "spiral of plantings" represents 125 containerized or plug plantings, they would be placed on approximately 200-foot centers creating a mosaic of shrubs and forbs within the overall reclamation area to support accelerated development of habitat and in turn accelerate development of pollinator populations. See McCormick et. al. 2019.

3. Performance Criteria and Reporting

In this section we describe success criteria for interim functional habitat objectives and final reclamation success criteria and the monitoring methods to achieve that success.

Performance Criteria

- The long-term goal of reclamation efforts on the pollinator habitat enhancement area is to establish self-sustaining biotic systems with appropriate ecological resistance and resilience. This does not necessarily mean that the reclaimed area will exactly replicate the surrounding vegetation communities, but that it will successfully support the designated post-mining land uses.
- The long-term goal of the reclamation program within critical habitat is based on reasonably achievable standards necessary for return of the reclaimed area to a self-sustaining ecosystem that meets post-mining land use and support of pollinators. Revegetation success within critical habitat is based on a two-step process to accelerate and focus the development of pollinator habitat. First by using pollinator habitat reclamation techniques as described above to achieve an interim Functional Habitat objective as quickly as possible. The interim functional objective is to establish a point on the continuum of ultimate reclamation success. It is established to help track and guide progress toward the ultimate success criteria. As an interim objective, it focuses reclamation efforts on those habitat elements that appear most important to supporting the diverse guild of pollinators and is it is NOT an endpoint in this process. Figure 13 illustrates the expected trend towards ultimate success objectives. The ultimate success objective coincides with bond release objectives. Both the Pollinator Habitat Reclamation objective and the final pollinator habitat reclamation objective for bond release are points on the continuum of reclaimed habitat establishment, not the forecasted climax state of the reclaimed plant communities. As plants continue to become established and grow after the success criteria are met, the sites will develop to their climax state and that could approach the range of vegetation cover observed in baseline studies of critical habitat. Both of these criteria are described below.

    1) Because of the expected depth of alluvial growth media and slopes in the reclamation area, site conditions will likely be similar to those found on lower slopes and valley bottoms. The available data from recent studies indicates that total canopy cover in these sites, excluding noxious and invasive weed species, is 17.4 and 21.8 percent for lower slopes and valley bottom habitats, respectively. Therefore, 75 percent of the average of these two communities would be 19.6 percent canopy cover.
    2) The Interim Functional Habitat objective is designed to as quickly as reasonably possible develop habitats within reclaimed areas that are capable of supporting pollinators from the diverse guild of pollinators that support Tiehm's buckwheat populations. Building on the pollinator habitat reclamation program outlined above, the Interim Functional Habitat objective will be deemed

successful when i) combined shrub/subshrub/forb densities exceed 250 individuals per acre and are not dependent upon any form of supplemental irrigation, ii) perennial species diversity (measured as species richness and including at least four insect pollinated species) is equal to or greater than 10, and iii) perennial plant cover, excluding noxious or invasive weeds, is 40 percent of the final success criteria or 7.8 percent canopy cover.

3) Final success would be achievement of vegetation cover within the pollinator habitat reclamation areas in critical habitat that is at least 75 percent of the average canopy cover of the average of the lower slope and valley bottom communities' canopy cover (14.7 percent canopy cover) and that supports perennial species diversity (measured as species richness) is equal to or greater than 10 and includes at least four insect pollinated species.

4) Should factors outside of Ioneer's control, such as climate change, result in circumstances that make achievement of the success criteria outlined above an unreasonable expectation, Ioneer will work with the USFWS and the BLM to collaboratively define reasonable new success standards.

Monitoring

- The sampling approach to demonstrate reclamation success presented below was derived from the Interagency Technical Reference 'Sampling Vegetation Attributes'. The intent of this interagency monitoring guide is to provide the basis for consistent, uniform, and standard vegetation attribute sampling that is economical, repeatable, statistically reliable, and technically adequate. The methodologies presented in this handbook provide scientifically sound monitoring data to determine and demonstrate revegetation success. (Source: https://www.blm.gov/noc/blm-library/technical-reference/sampling- vegetation-attribute)
- Following the first growing season after seeding, each reclaimed unit will be evaluated using semi-quantitative methods to document plant establishment as well as record other pertinent reclamation considerations. This evaluation will be conducted by a qualified ecologist traversing the reclamation areas and evaluating vegetation establishment and related physical and biotic conditions. During these traverses, the qualified ecologist shall note: 1) areas of poor seedling emergence, 2) the presence of distribution of pervasively weak or stressed seedlings, 3) indicators of soil fertility problems, 4) noxious weeds or invasive plant infestation, 5) evidence of unintended livestock grazing, 6) excessive erosion, and 7) any other similar revegetation / reclamation related issues.
- Reclaimed sites will be visited on at least a quarterly basis by a qualified ecologist to qualitatively evaluate the conditions of the sites and identify any areas that would require additional work such as supplemental seeding or other stabilization efforts.
- Quantitative sampling to characterize the status of reclamation efforts will be implemented within reclaimed sites on an annual basis beginning in the second year of the reclamation effort, the year

after growth media application and seeding/planting occurs. Quantitative assessments of reclaimed areas will be conducted to determine progress towards the Interim Functional Habitat and Final Success objectives and to inform management activities, as appropriate.

- Within 12 months of issuance of the Record of Decision (ROD) by BLM, Ioneer will develop and submit a detailed quantitative sampling protocol to the BLM and USFWS. Quantitative sampling will be conducted using standardized sampling techniques such as those found in Sampling Vegetation Attributes Interagency Technical Reference (1999). Data collection will use highly replicable techniques, such as the point intercept method, to determine canopy and ground cover and plot or plotless techniques for estimating shrub density. Specific data collected will include cover, density, frequency, species present by life form, etc.
- Reclaimed areas will be partitioned into appropriately sized, homogeneous units to reflect the age of the reclamation unit and to facilitate interpretation of data relative to individual site progression towards the success criteria. Within each reclaimed vegetation unit sampling protocols will be implemented to ensure unbiased sample site location using methods such as systematic (biased-free) method using a random start.[2]
- Sample size will be sufficient within each discrete sampling unit when the number of samples collected provides a level of precision that is within 20 percent of true mean with an 80 percent confidence. The minimum sample size (n_{min}) will be calculated as follows:

$$n_{min} = (t^2 * s^2)/(0.2u)^2$$

where:

n = the number of actual samples collected with a minimum of 10 in each unit;

t = the value from the *t* -distribution for 80% confidence with n-1 degrees of freedom;

***s* ²** =the variance of the estimate as calculated from the initial samples; and

u = the mean of the estimate as calculated from the initial samples.

- Qualitative and quantitative monitoring efforts will be reported to BLM and USFWS annually.

APCM-7. Control of Nonnative, Invasive, and Noxious Species. Ioneer will implement a non-native, noxious, and invasive weed species control program within the operations footprint with a particular focus on saltlover (collectively ‘weeds’) for the life of the Project. Areas of existing disturbance will be evaluated

[2] Systematic sampling (with random initiation) is superior to other sample distribution procedures because it forces representation from across the reclaimed unit. It accounts better for heterogeneous expressions of multiple seedings or revegetation conditions by "forcing" a patterned distribution of samples. This method thus minimizes the risk that significant pockets will be either entirely missed or overemphasized. However, in research applications statistical analysis methods may be limited.

on an annual basis to determine the relative level of infestation and required weed control efforts. Weed treatment will be achieved using herbicide treatments and where appropriate, mechanical removal techniques. Timing of weed control activities is important to the overall success of the effort. Application during this period takes advantage of post emergence when weeds are small and growing rapidly, but prior to the blooming period to prevent seed development. Considering the focus on saltlover, treatment is planned for late May into early June while this species is active but before seed development. A noxious weed monitoring and control plan will be developed prior to implementation of Project construction in coordination with the Weeds Coordinator at BLM NVSO and USFWS.

Ioneer selected herbicide without long-term residual toxicities and without toxic nitroguanidine neonicotinoids. Thus, DuPontTM Telar® XP herbicide or an equivalent approved substitute will be applied. Application Rate of Telar® will be applied at the rate of 1 ounce per acre utilizing Methylate Seed Oil as a surfactant at the rate of 2 quarts per acre. A blue marker dye will be added to easily identify areas that have been treated. Following regrading and reshaping efforts in reclamation areas, when appropriate, and in other large areas that would benefit and where it would be appropriate, a pre-emergent herbicide may be used to limit germination of non-native, invasive, and noxious weed species with specific focus on saltlover. A pre-emergent herbicide, Imazapic (tradename: Plateau; DiTomaso et al. 2013) or equivalent, will be applied before seedling emergence in areas that are regraded and in Project areas with extensive infestation of saltlover delineated during pre-reclamation monitoring. Imazapic can also be effective during early post emergence on seedlings 1 to 3 inches tall (DiTomaso et al. 2013). The application rate will be 4-6oz per acre and if applied during early post emergence a surfactant will be included at approximately 1.5 oz/acre (DiTomaso et al. 2013). Blue dye will be used as an aid to monitor coverage areas and optimize treatment. The average half-life of Imazapic is reported to be 120 days (Tu et. al 2001, Washington State Department of Transportation [WDOT] 2021) but has been reported to range from 31 to 410 days (WDOT 2021).

All herbicide applicators are required to be trained and certified for application of herbicide by the Nevada Department of Agriculture prior to deployment. Ioneer will require validation of plant identification skills for the Project Area to ensure that assigned staff have a working knowledge in the identification of nonnative, invasive, or noxious weed species as well as native plant species. All personnel will be provided with site specific training regarding the specific requirements of this work plan including the location and identification of Tiehm's buckwheat sub-populations' locations, the location and approximate boundaries of ecology, and staging areas and be qualified as a Biological Monitor. If a trained and certified herbicide applicator is not qualified as a Biological Monitor, then a Biological Monitor will be present for all weed control efforts within undisturbed portions of critical habitat.

Reduction of off-site movement and drift is a key element to the weed treatment activities' overall success. Precautions to avoid off-site movement and reduction of the risk of drift are as follows:

- Ioneer's contractor will use spray nozzles that are capable of operating at low pressure (15 to 30 pounds per square inch [psi]) and the spray nozzles will be calibrated to operate within this range to produce larger herbicide droplets. Larger droplets are heavier and less likely to be carried off-site by wind.
- Application during hotter and dryer times of the day will be done with lower pressures to increase droplet size and reduce effects of evaporation.
  - Spray nozzles will be held low and close to target plants so that herbicide application occurs just above plant height.
  - Spray application of herbicide will occur only on days/at times when windspeed is less than or equal to 10 miles per hour. If windspeeds in excess of 10 miles per hour are encountered the contractor can elect to transition to wicking application methods.
  - Drift potential may be higher during temperature inversions and spraying will be avoided during these times.
  - Herbicide application will not occur within 50 feet of delineated Tiehm's buckwheat subpopulations. When weed removal within subpopulations is required it will be accomplished mechanically and in a manner that minimizes disturbance to soils and desirable plants.
  - Wicking techniques will be employed when appropriate to avoid risk of overspray when proximate to Tiehm's buckwheat subpopulations or when windspeeds are in excess of 10 miles per hour.
  - Backpack sprayers will be the primary application method. Should larger areas such as SOSF or the OSFs require more efficient application methods, other application methods, such as application from ATV or other suitably equipped vehicle, may be considered and deployed, subject to BLM approval.

APCM-8. Light Management to Minimize Adverse Impacts to Pollinators. Dark sky lighting best management practices would be used throughout the operations area to minimize the effects of lighting on pollinators and other wildlife that may be present in the area. To minimize the effects from lighting, Ioneer would utilize hooded stationary lights and lighting plants. Lighting will be directed onto the pertinent site only and away from adjacent areas not in use, with safety and proper lighting of the active work areas being a priority. To help guide efforts to minimize the potential adverse effects of light from operations on adjacent ecosystems, a qualified light management consultant will be retained to assist Ioneer with implementation of this APCM. As a first principal, the implementation of this requirement must comply with safety requirements prescribed by the Mine Safety and Health Administration.

Key elements of light management to minimize impacts to pollinators and other wildlife would include use of state-of-the-art light sources (LED or OLED) that can be switched on and off easily and dim well. These state-of-the-art light sources can be aimed well and individually shielded to prevent/minimize up-lighting and “wasted” light. As appropriate and when color rendering is not critical or an important part of the job task, the use of sub-500 nanometer lighting spectra will be limited by using 500nm filtered LED fixtures or pure narrow-band amber LED lamps or their equivalent. Solid state lighting will also be used wherever practical for vehicular mounted task lighting to reduce stray light and direct more useful light to task areas.

APCM-9. Dust Control and Monitoring of fugitive dust emissions within Tiehm’s Buckwheat Subpopulations. The Air Quality Impact Analysis (AQIA) prepared for the Project has shown that primary and secondary air quality standards are met during the life of the mine project (Trinity Consultants 2024a). Contour maps of expected emissions show that within critical habitat, including the subpopulations dust emissions will be less than the primary standards (Trinity Consultants 2024b). Fugitive dust will be controlled on roadways and other areas of disturbance within the Project in accordance with the Project’s Air Quality Operating permit. Along the Haul Road, where it is proximate to subpopulations 3 and 6, control efforts will be implemented to achieve necessary efficiency using water applications and NDEP/BLM approved dust suppressants. We anticipate that NDEP/BLM approved dust suppressants would generally be needed from May through September when evaporation rates are highest and during years when haul truck activity is higher. Maximum Haul Road speed limits will be 35mph.

Data collection to establish baseline dust levels (PM 30) and the variability of these levels over time at Tiehm’s buckwheat subpopulations closest to the Quarry prior to Project development have been proposed but have not been authorized at the time this document is being drafted. For baseline dust collection, monitoring stations would be located outside of critical habitat. After approval of the ROD and prior to construction of Project facilities, dust monitors would be placed adjacent to the subpopulations, generally between the subpopulations and the closest source of fugitive dust emissions as depicted in **Figure 12**. The monitors will be designed, constructed, and located in general accordance with the ASTM Standard D1739-98 (2017) and the Air and Waste Management Association APM-1, Revision 1, which provides guidelines for proper exposure to measure dust fall rates proximate to the Tiehm’s buckwheat subpopulations. The sampling sites depicted in Figure 12 have been located with the following parameters in mind:

- Location in an open area, free of structures higher than 1 meter within a 20-meter radius of the container stand.
- The sites will be located adjacent to ERTI subpopulations and between the subpopulations and potential sources of dust.
- To the extent practical, the sites have been located to avoid proximity to ridgelines.

A t-post and wire fence will be placed around each of the dust monitoring stations to protect the monitor. The fence will be five strands and the strands barbed to discourage large wildlife from accessing the enclosure. Access to construct the fence and place the monitoring equipment will be accomplished on foot. The t-post will be placed to avoid any adverse impacts to vegetation. A biological monitor will be present during placement of the monitoring equipment and protective fencing and as appropriate assist with the installation of the monitoring equipment and fence. The construction of the fence and the placement of the monitoring equipment is not expected to result in any loss of pollinator habitat.

Dust monitoring procedures and protocols will be developed to implement the requirements of this APCM. The specific procedures and protocols will be developed in cooperation with the USFWS and the BLM and will outline dust monitoring protocols and procedures and data management and documentation requirements. During the installation of dust monitoring equipment and during collection of dust monitoring data a Biological Monitor will present.

The efficacy of dust control efforts will be evaluated monthly. As illustrated in the effects analysis below, data will be collected and reported to show an ongoing trailing 12-month average for dust deposition and reported as grams per meter squared per day.

Dust deposition from each of the monitoring sites will be collected and reported monthly along with a log of haul road traffic, watering frequency, and surfactant application frequency to monitor the efficiency of control efforts. Collection of the data from the dust monitors will entail collection of a filter and delivery of the filter with appropriate chain of custody to a laboratory for analysis. If the trailing 12-month average dust deposition level at any monitoring site is found to exceed 4g/m2/day[3] Action will be taken to minimize dust generation. Potential actions include increasing the frequency of water applications proximate to Tiehm's buckwheat subpopulations and increasing the frequency of approved dust suppressants. Should these initial management actions not result in a material reduction in dust deposition attributable to mining activities, Ioneer will evaluate specific placement of dust control fencing along the haul road proximate to subpopulations of Tiehm's buckwheat or establishment of speed limits along the haul road proximate to Tiehm's buckwheat subpopulations to reduce them further, as appropriate.

We are aware of no studies that look at the effects of dust on Tiehm's buckwheat. Ioneer proposes as part of this applicant proposed conservation measure to fund research using Tiehm's buckwheat plants it has growing in its greenhouse and if authorized in situ studies at the site. The study would further our understanding of the physiology and growth of Tiehm's buckwheat, and the data will be used to refine thresholds for implementation of management strategies outlined above. Once a potential researcher is identified for this effort, Ioneer would fund the preparation of a detailed study design that would be submitted to the USFWS and the BLM for review and approval within twelve months of approval of the ROD. We anticipate the lead scientist overseeing the study would be a researcher with appropriate expertise in the

[3] This value was selected after review of data presented in Wijayratne et al. 2009 (Figure 13). At this average daily loading there were no discernable impacts to shoot growth and number of leaves produced by Lane Milkvetch, an endangered perennial herb native to lower deserts in Nevada.

ecophysiology of plants and would have access to lab facilities and/or portable monitoring equipment capable of conducting in situ investigation.

APCM-10. Remove fencing and debris from the three UNR transplant experimental sites that are located within Tiehm's buckwheat critical habitat. Ioneer will conduct closure activities of areas involved in research activities related to Tiehm's buckwheat on lands administered by the BLM [N-99671 2920 (NVB0200)]. The sites are currently fenced, and other debris present from the experiments include partially buried clay pots, covers for the pots, hoses, wire baskets, etc. All debris will be collected and removed from the site and disposed of or recycled as appropriate and in conformance with applicable regulations. Limited regrading and reshaping of disturbed areas associated with the Project will be completed using hand tools. Where removal of debris, such as clay pots or posts leave a hole, soil from nearby disturbed areas will be used to fill the hole to the extent practical. If the hole cannot be fully filled, the slopes of the depression will be raked and contoured to leave gradual slope/transition to adjacent undisturbed areas. Seeding of disturbed areas would occur in the fall. All surfaces to be seeded will have been left in a textured or rough condition (i.e., small humps, pits, etc.) to enhance moisture retention and revegetation success while minimizing erosion potential and soil loss. All areas will be broadcast seeded with a cyclone-type bucket spreader. Broadcast seed will be covered by raking, as necessary, to provide seed cover and enhance germination. Seed used for reclamation will be selected from the approved seed list (Table 2) and approved by BLM and USFWS. A biological monitor will be present during these closure activities. Because of the nature of the sites and the limited disturbance to vegetation that occurred when the experimental plantings were installed, the sites will be considered reclaimed when initial site cleanup and seeding have been completed. Sites will be incidentally monitored by Ioneer staff on a regular basis for three years. Qualitative monitoring of the sites will be completed annually in the fall. This will include inventory and monitoring of noxious weeds, with a particular focus on saltlover in the closure areas. Concurrent with the qualitative sampling effort, established photograph points will be used to document site conditions. The timing of this monitoring effort will be such that if deemed appropriate by the BLM and Ioneer, supplemental seeding could occur in the fall or spring, as appropriate.

APCM-11. Utilize blasting mats when any blasting is to occur proximate to Tiehm's buckwheat subpopulations and trim blasting techniques and charge delays. To minimize energy transmission to the Quarry highwall Line, drilling and Pre-splitting will be incorporated into a Perimeter /Trim blast Protocol used for the Rhyolite Ridge Project. The trim blast will vary from 40-90 feet in width. This will represent final excavated material from the highwall. The proper use of Trim blasting techniques will be important to the maintenance of Quarry wall stability factors of safety and by extension will minimize vibration experienced by Thiem's buckwheat populations that are proximate to the west Quarry wall. In addition to the use of proper trim blasting techniques to minimize the amount of energy that is transmitted into the Quarry highwall, maximizing the efficiency of the use of energy to fragment rock for Quarry excavation can also minimize flyrock which is a critical safety concern in Project development and operation. To further protect

Tiehm's buckwheat from flyrock and minimize dust generated by blasting, blasting within 100 meters of any Tiehm's buckwheat subpopulation will incorporate additional measures to physically arrest flyrock by muffling/covering the blasting area by heavy rubber mats/wire rope mats and/or other suitable covering materials.

As soon as safely feasible, Biological Monitors will visit potentially effected Tiehm's buckwheat subpopulations within 24 hours of any blasting that occurs within 100 meters of any Tiehm's buckwheat subpopulation.

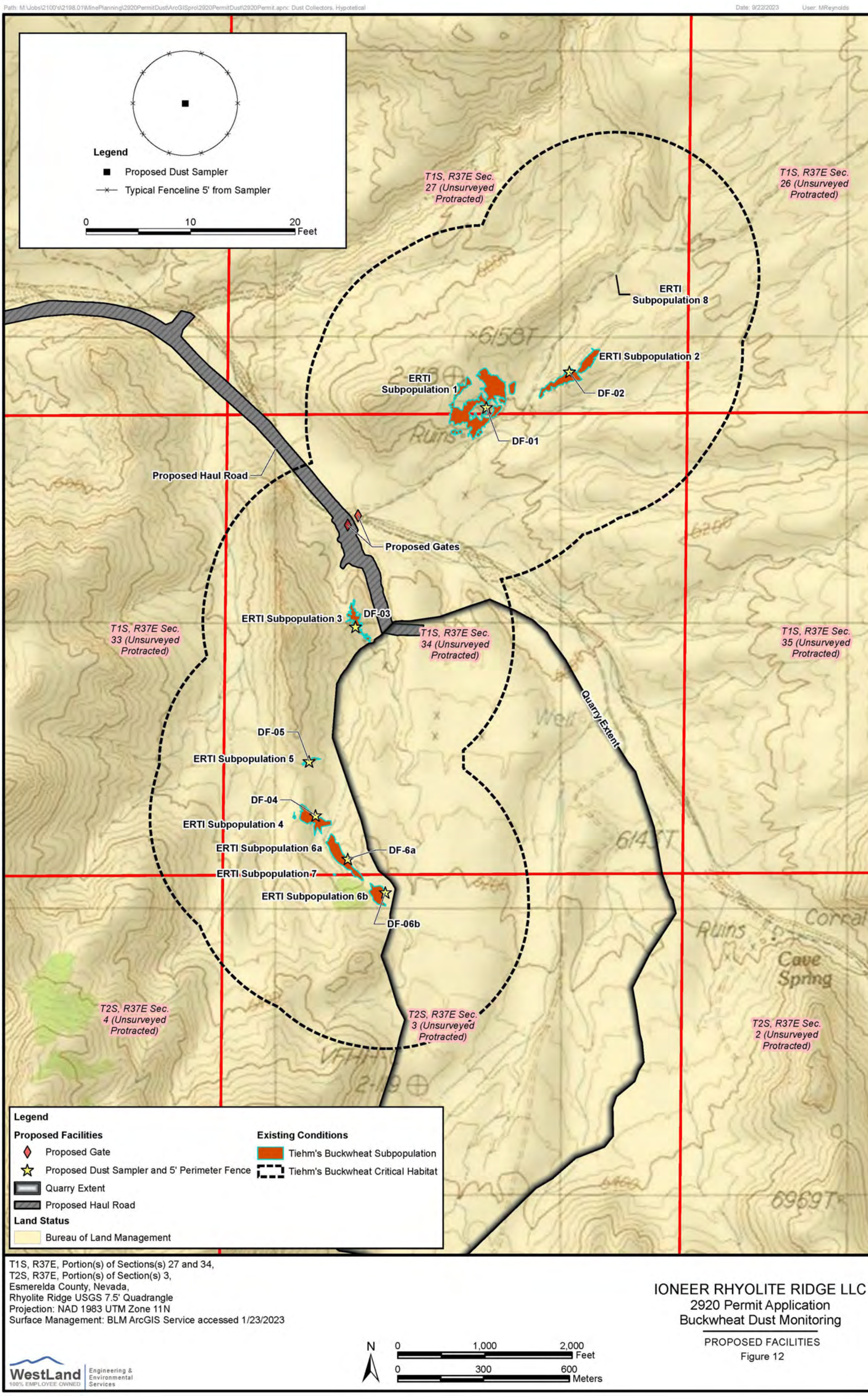

Figure 12. Proposed Facilities

APCM-12. Demographic and Recruitment Monitoring. Quantitative data will be collected along previously established transects on an annual basis to estimate the number of plants in each subpopulation and track changes in population density, flower production, and size structure. Every four years a full census of the subpopulations will be conducted. As part of currently authorized endangered species recovery permit (ESPER2424938) issued to WestLand Resources Inc., Tiehm's buckwheat seed collection efforts in accordance with the currently accepted standards determined by the Center for Plant Conservation will continue and inform long term monitoring of seed viability in support the demographic monitoring outlined in this APCM. Viability determinations shall be made by the Ray Selling Berry Seed Bank and Plant Conservation Program where the collected seeds are conserved. Specific procedures and protocols outlining the data collection, reduction, and long term data management and reporting for this APCM will be developed in cooperation with USFWS and the BLM. The quantitative annual monitoring report will be prepared and submitted by November 1st of each calendar year. After submittal of the annual monitoring report, Ioneer will meet with USFWS and the BLM to discuss key observations outcomes from the annual demographic and recruitment monitoring effort.

Quarterly site inspection reports will be submitted within 20 working days of each inspection. The reports will specifically note the amount and extent of habitat disturbance within critical habitat to document compliance with the authorized action or if there are effects of the action that may affect Tiehm's buckwheat in a way or to an extent that was not previously considered. Should, during quarterly site inspections or at any other time Ioneer become aware of any event that may adversely affect critical habitat or ERTI subpopulations or have the potential to do so in a way not contemplated herein, they shall, as soon as reasonably possible, notify the BLM and USFWS and schedule a meeting to discuss the issue and develop an appropriate course of action. The quantitative annual monitoring report will be prepared and submitted by November 1st each calendar year.

APCM-13. Develop an ERTI-Specific Environmental Awareness Program for Project Employees, Contractors, and Guests. The program will be integrated into the site-specific MSHA training programs required of all individuals entering the property, excluding those passing through on Cave Spring Road. The program will include a brief description of the natural history and status of Tiehm's buckwheat and its critical habitat, the conservation programs integrated into the Project, and specifically outline restrictions related to unauthorized access to critical habitat and the specific consequences for violation of those requirements. For operations staff with specific activities that may be related to the requirements of this plan, (e.g. general maintenance staff responsible for lighting systems, autonomous haul truck operators, water truck operators, OSF managers, supervisors, and foreman responsible for any field operations within or proximate to critical habitat) more specific task training focused on their job duties and the integration of those duties with this plan and conservation of Tiehm's buckwheat will be prepared.

APCM-14. Monitor Stormwater Control Measures for Project Activities Located in or with the Potential to Discharge to Critical Habitat. Ioneer has prepared a stormwater plan for the Project. The stormwater management Plan (Provided as Appendix C to the Plan of Operations) outlines the designs of structural controls and procedures to keep non-contact surface water runoff separate from contact water. Features have been designed to capture runoff from planned facilities outside of critical habitat and keep contact water from running on to undisturbed portions of critical habitat. Erosion and sediment control will be accomplished through application of BMPs to limit erosion and reduce sediment from precipitation or snowmelt runoff. Following construction, areas of cut and fill proximate to or within critical habitat will be seeded using a seed mix developed in conjunction with the BLM and USFWS using species listed in **Table 3** and BMPs, such as straw wattles or silt fence, will be used to control stormwater runoff from these areas pending establishment of native vegetation. As described in the plan, stormwater sediment basins and structural BMPs will be inspected and maintained monthly and following significant storm events of one inch of precipitation or more to mitigate erosion and maintain minimum freeboard requirements.

Ioneer will provide relevant portions the existing stormwater plan, provided as Appendix C to the Plan of Operations, that describes the design elements and best management practices that will be implemented within critical habitat and for flows that have the potential to discharge to critical habitat. These relevant portions will include the specific monitoring and reporting protocols that will be implemented through closure of Project facilities. By design, stormwater plans are a living document, and we anticipate that this plan will be updated regularly as part of ongoing stormwater inspections. Minor updates to the stormwater plan that result from regular inspections of stormwater features will be available for BLM and USFWS review but will not be dependent upon their review and approval for implementation, provided the revisions are minor and they do not change overall effects to Tiehm's buckwheat and critical habitat documented in the Section 7 consultation and the FEIS. Monitoring and maintenance activities will be included in the Quarterly critical habitat monitoring reports submitted in accordance with the requirements outlined in APCM-15.

APCM-15. Critical Habitat Subpopulation Monitoring. On a quarterly basis, qualified biological monitors will monitor the conservation fencing surrounding undisturbed critical habitat and document general condition of critical habitat, including the Tiehm's buckwheat subpopulations. These monitoring efforts will be conducted on foot. Monitoring efforts will focus on qualitative assessments of general habitat condition, whether or not the fencing is intact or in need of repair, and if there have been any unauthorized encroachments or disturbance. In addition, as part of this qualitative monitoring effort, the Biological Monitor will place twenty cameras within the subpopulations to document insect visitors and potential pollinators of Tiehm's buckwheat. Photos will be collected in May and June when Tiehm's buckwheat is normally flowering.

Minor fence repairs will be implemented during the monitoring effort and larger repair needs will be reported immediately and implemented with 48 hours of reporting. Permanent photo points will be established throughout critical habitat and used to document site conditions. Qualitative site descriptions and ground photos will be supplemented from time to time with aerial photography as new aerial photography becomes available.

Biological monitors conducting these monitoring efforts will be MSHA certified, have a demonstrated understanding of the ecology and natural history of ERTI and its identification at all times of year, have a thorough understanding of the requirements of the BPP/APCM and the USFWS's BO and any relevant requirements from the FEIS. Monitors conducting the quarterly fence monitoring efforts will have knowledge and the ability to implement minor fence repairs.

Quarterly site inspection reports will be submitted within 20 working days of each inspection. The reports will specifically note the amount and extent of habitat disturbance within critical habitat to document compliance with the authorized action or if there are effects of the action that may affect Tiehm's buckwheat in a way or to an extent that was not previously considered. Should, during quarterly site inspections or at any other time Ioneer become aware of any event that may adversely affect critical habitat or ERTI subpopulations or have the potential to do so in a way not contemplated herein, they shall, as soon as reasonably possible, notify the BLM and USFWS and schedule a meeting to discuss the issue and develop an appropriate course of action.

3.3. SUMMARY OF PROCEDURE AND PROTOCOL DOCUMENTATION AND IMPLEMENTATION SCHEDULE FOR APPLICANT PROPOSED CONSERVATION MEASURES

Table 4 lists the stand-alone documents that will be prepared for APCMs provided in this Plan. These documents will provide the protocols and procedures required to implement the conservation plans provided in this document as APCMs. These stand-alone documents are intended to facilitate implementation of the APCMs by outlining the specific protocols and procedures for each plan. As stand-alone procedures and protocols, the documents will assist Ioneer in its internal communications and communications with vendors and contractors retained to implement the plans outlined in this document. As outlined in Table 4, Ioneer will fund development of the required documents. They will select contractors or individuals meeting desired qualifications as described in that table and submit their selection to USFWS and BLM for review and confirmation that they meet the desired requirements outlined in **Table 4**. USFWS and BLM shall not unreasonably withhold their confirmation.

Table 5 lists key milestones of project implementation, including the schedule for draft submittals to the USFWS and the BLM. Ioneer anticipates that both agencies shall complete their reviews within 30 days or a mutually agreed upon time frame established when each document is submitted. It is anticipated that Ioneer and agency staff will be able to resolve all substantive matters in a single round of review. Should this not be the case and after the second review by the agencies, the matter will be elevated to the BLM Deputy State Director for Minerals, Region 8 USFWS Assistant Regional Director – Ecological Services, and Bernard Rowe, President for Ioneer Rhyolite Ridge, to be resolved.

Table 4. Monitoring and Implementation Protocol & Procedures Schedule and Requirements

Year 0 = start of construction, Year 1 = end of first year of Project activity, etc.

Protocol/Procedure & Due Date	Applicant Proposed Conservation Measure Summary	Protocol Description	Qualifications of Author
Geotechnical Slope Management and Monitoring Procedures and Protocols Documentation Draft Due Three Months Prior to start of Construction (Year 0)	APCM-2 Geotechnical Design of the Quarry Walls to Provide Appropriate Margins of Safety has resulted in factors of safety of 1.2 or greater during the operation phase of the Project and 1.81 or greater post closure. APCM-3 Geotechnical Monitoring describes the steps and procedures and responses Ioneer will accomplish to protect miners and Tiehm's buckwheat. As knowledge is gained during the progression of Quarry development the monitoring activities and understanding of the rock mechanics derived during operations will allow for continued refinement of the geotechnical stabilization methods deployed. The technical background and a more detailed description of these mitigation measures is provided in Geo-Logic 2022 and 2023.	In accordance with standard mining geotechnical protocol and MSHA requirements identifying the specific procedures that will be used to implement APCM-2 and -3 will be documented. Elements of the site-specific implementation procedures will include more specific description of the monitoring protocols described in APCM-3, and provided in Geo-Logic 2022 and 2023, as well as the timing of the inspections, internal and external reporting requirements.	Ioneer will be responsible for funding the ongoing professional services contract. It is anticipated that a professional geotechnical and engineering firm will be retained to prepare and implement the monitoring procedures and protocol document. The preparation of the document shall be overseen and approved by a Professional Geotechnical Engineer with 10 or more years of relevant experience.
Native Seed Collection and Propagation Protocols and Procedures (to support APCM-6) Draft Due Q3 2024	APCM-6, Development of a Pollinator Habitat Reclamation Program within Critical Habitat outlines the planning and design process, implementation, and performance criteria, monitoring and reporting requirements of this mitigation measure. It outlines the criteria for growth media, preparation of the growth media for reclamation activities, including harvesting the top layer of soil and stockpiling it in a manner that allows for the maintenance of the biotic components found in the top layer of soil. The mitigation approach outlined in APCM 6 outlines the species to be used for pollinator habitat mitigation seeding as well as the species planned for use in containerized plantings. APCM-6 provides a conceptual planting plan and outlines specific monitoring objectives and success criteria. APCM-6 also includes requirements for development of reclamation test plots that will be implemented in years four through 18 of the Project life to refine and inform implementation of the plan outlined in APCM-6. As appropriate and consistent with overall objectives of APCM-6, the seed collection protocol will identify and incorporate opportunities to partner with BLM's Seeds for Success Program.	This protocol will be developed in coordination with the Great Basin Ecoregional Coordinator at BLM NVSO and USFWS. It will provide guidance for venders and contractors that Ioneer would work with to accomplish the objectives of APCM-6. The protocol shall identify specific seed zones suitable for seed collection for the species in Table 3 of this document, their propagation and use for the Rhyolite Ridge Project, estimate anticipated quantities of seed and plants needed per year, and outline planned seed collection and propagation schedules to ensure that sufficient locally sourced plants are available for experimental studies and reclamation needs. These procedures would utilize, as appropriate, the standard techniques, such as those outlined in the BLMS's Seeds of Success Technical Protocol for collection from native plant species.	Ioneer will fund the development of the procedures and protocol document and implementation of this aspect of APCM-6. We anticipate that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that have training as a horticulturalist, reclamation/restoration ecologist, or biologist and would benefit from participation in the BLM Arid Lands Reclamation Course. Ioneer will select a qualified contractor or individual to prepare the procedures and protocol document and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.

Table 4. Monitoring and Implementation Protocol & Procedures Schedule and Requirements

Year 0 = start of construction, Year 1 = end of first year of Project activity, etc.

Protocol/Procedure & Due Date	Applicant Proposed Conservation Measure Summary	Protocol Description	Qualifications of Author
Pollinator Habitat Reclamation Experimentation and Optimization Study Procedures and Protocols (APCM-6) Draft Due Year 2	See the description of APCM-6 above and in Section 3.2 of this document.	APCM-6 requires implementation of study plots to evaluate reclamation methods outlined in the conservation measure. Several methods to optimize the procedures provided to establish pollinator habitat vegetation within disturbed portions of critical habitat will be evaluated during the early phases of concurrent reclamation, through year 18. These methods will include, but may not be limited to, soil amendments to facilitate establishment of soil biome, enhanced (diversity and quantity) seed mixes based on the species identified in APCM-6, containerized plantings, supplemental irrigation approaches to support containerized plants used in reclamation until establishment, and the use of salvaged succulents. The procedures and protocols for implementation of the study plots called for in APCM-6 will lay out an experimental design that includes the treatments above, the monitoring and analytical approach for evaluation of the treatments identified and reporting requirements to optimize the pollinator habitat reclamation program.	Ioneer will fund the development of the procedures and protocol document and implementation of APCM-6. We anticipate that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that have training in restoration/reclamation ecologist or biologist with at least 10 years of relevant experience and participation in Center for Plant Conservation Rare Plant Academy Courses. The development of the document would benefit from the participation of a pollinator ecologist familiar with the ecology and participation in BLM Arid Lands Reclamation Course by document preparers. Ioneer will select a qualified contractor or individual(s) to prepare the procedures and protocol document and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.

Table 4. Monitoring and Implementation Protocol & Procedures Schedule and Requirements

Year 0 = start of construction, Year 1 = end of first year of Project activity, etc.

Protocol/Procedure & Due Date	Applicant Proposed Conservation Measure Summary	Protocol Description	Qualifications of Author
Pollinator Habitat Reclamation Implementation and Monitoring Protocols and Procedures (APCM-6) Draft Due Three Months Prior to Start of Construction (Year 0)	See the description of APCM-6 above and Section 3.2 of this document for additional details.	Using the plan provided in APCM-6, a stand-alone Pollinator Habitat Reclamation Implementation and Monitoring Protocols and Procedures will be developed in coordination with the Great Basin Ecoregional Coordinator at BLM NVSO and USFWS in support of Ioneer's implementation of plan requirements in APCM-6 and their coordination and communication with venders and contractors that may be retained to execute the work described in APCM-6. Specific monitoring protocols for annual quantitative sampling, including sampling design, field methods, data reduction, and statistical analysis to document progress towards success criteria are outlined in APCM-6 and will be included in the stand-alone protocol and procedures document. The stand-alone protocol and procedures document will outline the requirements for planning, implementation, and agency coordination for specific reclamation campaigns that will be implemented for the life of the Project. As appropriate, new information learned during test plot experimentation, lessons learned during ongoing monitoring activities, and/or general advances in reclamation science will be incorporated into the stand-alone protocol and procedure document, as appropriate. For planned Pollinator Habitat Reclamation activities anticipated in Year 2, detailed implementation plans will be prepared as part of this effort.	Ioneer will fund the development of the procedure and protocol document and implementation of the pollinator habitat reclamation and implementation plan outlined in APCM-6. We anticipate that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that have training as a horticulturalist, reclamation/restoration ecologist or biologist with 10 years of relevant experience. The development of the document would benefit from the participation of a pollinator ecologist and participation in BLM Arid Lands Reclamation Course by document preparers. Ioneer will select a qualified contractor or individual(s) to prepare the procedures and protocol document and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.

Table 4. Monitoring and Implementation Protocol & Procedures Schedule and Requirements
Year 0 = start of construction, Year 1 = end of first year of Project activity, etc.

Protocol/Procedure & Due Date	Applicant Proposed Conservation Measure Summary	Protocol Description	Qualifications of Author
Nonnative, Invasive, and Noxious Species Management and Monitoring Protocols and Procedures (APCM-7) Draft Due Three Months Prior to Start of Construction (Year 0)	APCM-7, Control of Nonnative, Invasive and Noxious Species, describes the means and methods by means and methods by which Ioneer will control invasive and noxious plant species within the Project and specifically within critical habitat. The plan was based on the comments and recommendations provided by the USFWS and Appendix XX in the Plan of Operations. It identifies the standard for the herbicide to be used, procedures for application, equipment requirements, and adjustment of those procedures considering weather conditions and proximity to sensitive resources such as Tiehm's buckwheat. For example, when it may be appropriate to use mechanical control techniques over herbicide treatment. The plan in this BPP/APCM also describes the required skills and certifications for applicators, optimal timing for application,	A stand-alone noxious weed monitoring and control Procedures and Protocols Guide will be developed in coordination with the Weeds Coordinator at BLM NVSO and USFWS. The procedures and protocol guide will build on the plan outlined in APCM-7 to provide specific guidance to field personnel for implementation and monitoring activities, including the frequency of monitoring efforts, data collection to track distribution of invasive and noxious plant species, control efficacy, and reporting requirements.	Ioneer will fund the development of the detailed procedures and protocol documentation and implementation of APCM-7. We anticipate that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that include qualified biologist familiar with biology and identification of the targeted noxious and invasive plant species and Tiehm's buckwheat, who have completed the Nevada weed identification training or have completed comparable training protocols or have relevant experience/expertise, in conjunction with a certified weed applicator. Ioneer will select a qualified contractor or individual(s) to prepare the procedures and protocol document and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Dust Monitoring Protocols and Procedures (APCM-9) Draft Due Q3 2024	APCM-9 Dust Control and Monitoring of Fugitive Dust Emissions within Tiehm's Buckwheat Subpopulations provides for the placement of monitors proximate to the subpopulations and between the subpopulations and potential sources of dust. As outlined in the BPP/APCM, the monitors will be visited monthly and reported along with the log of haul road traffic and the frequency of application of water and surfactants on the haul road. A specific trigger to implement management actions and the specific management actions that would be implemented have been provided in the APCM.	Specific procedures and protocols will be developed to aid operations with the implementation of the plan outlined in APCM-9. The procedures and protocols will provide the design of the dust monitors to be deployed, detailed sampling and reporting protocols.	Ioneer will fund the development of the detailed procedures and protocols document to implement the plan outlined in APCM-9. Procedures and protocol document development will be led by an air quality specialist with 10 plus years of experience in the monitoring and modeling of air resources. Ioneer will select a qualified contractor or individual to prepare the procedures and protocol document and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Study Design to Refine Trigger Thresholds for Dust Deposition on Tiehm's Buckwheat Draft Due Year 1	The trigger for implementation of management actions outlined in APCM-6 if a rolling 12-month average for dust deposition exceeds 4g/m2/day is based on the best available science. Absent the availability of specific studies on buckwheats and Tiehm's buckwheat in particular, Ioneer proposes to conduct research to add to the base of	The study design will lay out the statistical design including the treatments proposed, means and methods to administer the treatments, sample size, specific physiological parameters to be measured, and schedule. The experimental design will include, to the extent authorized by	Ioneer will fund the development of the study and its implementation. The lead researcher overseeing the study would be a plant ecologist/biologist with appropriate expertise in the ecophysiology of plants and would have access to lab

Table 4. Monitoring and Implementation Protocol & Procedures Schedule and Requirements
Year 0 = start of construction, Year 1 = end of first year of Project activity, etc.

Protocol/Procedure & Due Date	Applicant Proposed Conservation Measure Summary	Protocol Description	Qualifications of Author
	knowledge in this area and if appropriate and informed by science modify the trigger identified in APCM-6. This work would use plants Ioneer has propagated in their greenhouse constructed for Tiehm's buckwheat and if authorized studies could be carried out *in situ*.	USFWS, *in situ* experiments on individual Tiehm's buckwheat within the sub-populations.	facilities and field equipment necessary to conduct the study. Ioneer will select a qualified contractor or individual to prepare the study plan and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Tiehm's Buckwheat Demographic and Recruitment Monitoring protocols and procedures (APCM-12) Draft Due Three Months Prior to Start of Construction (Year 0)	APCM-12 lays out specific requirements for demographic and recruitment monitoring. The effort builds upon the ongoing annual monitoring efforts Ioneer has funded and includes requirement for full census every four years. Data collected from this effort includes estimated numbers of plants in each subpopulation, flower production, and size class. These data will be supplemented with seed viability testing of seed collected in accordance with existing endangered species recovery permit or new permit issued for that purpose.	The protocol and procedures document will provide a stand along document to guide long term implementation of this APCM. It will provide an opportunity to refine and enhance the procedures currently being used. The annual quantitative monitoring component of the plan will document the specific sampling protocols and data analysis to track and monitor subpopulation demographics and recruitment.	Ioneer will be responsible for funding the preparation of the protocol and procedure document. We anticipate that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that have an advanced degree in plant ecology or allied ecological field, 10 years of relevant experience, and participation in available courses offered by the Center for Plant Conservation Rare Plant Academy. [We note that only one of the nine training modules are complete at this time (March 15, 2024).] Ioneer will select a qualified contractor or individual to prepare the protocol and procedure document and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.
ERTI-Specific Environmental Awareness Program (APCM-13) Draft Due Three Months Prior to Start of Construction (Year 0)	As outlined in APCM-13, this program will be integrated in site-specific MSHA training programs required for all individuals entering the property, excluding the public passing through the property on Cave Spring Road.	The training module will focus on general awareness (including identification and natural history) and restrictions put in place to protect Tiehm's buckwheat.	Ioneer will fund the development of the awareness program and its implementation. The program will be prepared by Ioneer personnel or contractors familiar with the requirements of the BPP/APCM and the final BO issued by the USFWS, and the ROD.
Operation Specific Training Modules (APCM-13) Draft Due Three Months Prior to Start of Construction (Year 0)	As outlined in APCM-13 the operation specific training program will focus on operations staff with specific activities/duties related to the requirements of this plan or who may work in proximity to critical habitat for Tiehm's. buckwheat.	These modules will be developed in addition to the ERTI-Specific Environmental Awareness Program and will be tied to specific operational disciplines (e.g. general maintenance staff responsible for lighting systems, autonomous haul truck operators, water truck operators, OSF managers, supervisors, and foreman responsible for any field operations within or proximate to critical habitat) at the mine	Ioneer will fund the development of the work plan and its implementation. The program will be prepared by Ioneer personnel or contractors familiar with the requirements of the BPP/APCM and the final BO issued by the USFWS. They will be supported by personnel with specific operations expertise.

Table 4. Monitoring and Implementation Protocol & Procedures Schedule and Requirements

Year 0 = start of construction, Year 1 = end of first year of Project activity, etc.

Protocol/Procedure & Due Date	Applicant Proposed Conservation Measure Summary	Protocol Description	Qualifications of Author
		that interface with the requirements of this BPP/APCM. These training modules will be updated as necessary.	
Stormwater Management Plan Monitoring and Reporting Procedures and Protocols for Project Activities Within or Having the Potential to Discharge to Critical Habitat (APCM-14) Draft Due Three Months Prior to Start of Construction (Year 0)	APCM-14 lays out requirements to provide quarterly monitoring reports of stormwater management activities in and proximate to critical habitat that will be implemented in accordance with the plan provided in Appendix C of the Plan of Operations.	To facilitate focused reporting on stormwater management activities in and proximate to critical habitat to the USFWS and the BLM, relevant portions of the stormwater plan will be provided. These relevant portions will include descriptions and mapping of the stormwater plan elements established within or proximate to critical habitat and a description of monitoring and reporting protocols based on the stormwater plan provided in Appendix C of the Plan of Operations.	Ioneer will fund the development and implementation of stormwater plan requirements. The relevant portions of the stormwater plan will be prepared by an individual familiar with the requirements of stormwater management in industrial operations and preparation will be at the direction of a registered professional engineer or surface water hydrologist. Ioneer will select a qualified contractor or individual to provide the relevant portions of the stormwater plan included in the Plan of Operations and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Critical Habitat Monitoring Protocol and Procedures (APCM-15) Draft Due Three Months Prior to Start of Construction, (Year 0)	As outlined in the monitoring plan provided as APCM-15, quarterly monitoring of critical habitat and Tiehm's buckwheat subpopulations will be implemented. Monitoring will include monitoring of fence condition, implementation of minor repairs, and documentation of conditions using permanent photo points. Minimum requirement for biological monitors will include MSHA certification, and a demonstrated understanding of the ecology and natural history of ERTI and its identification at all times of year, and the requirements of this plan and the USFWS's BO.	This monitoring protocol and procedures document will outline specific quarterly monitoring elements required by the APCM including the planned location of long-term monitoring photo points. The protocol and procedures document will also include required skill sets/training for biological monitors conducting quarterly monitoring activities and monitoring of project development activities within or adjacent to critical habitat.	Ioneer will be responsible for funding the preparation of the critical habitat monitoring procedures and protocol document. We anticipate that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that have an advanced degree in plant ecology or allied ecological field, 10 years of relevant experience, and participation in available courses offered by the Center for Plant Conservation Rare Plant Academy. Ioneer will select a qualified contractor or individual to prepare the monitoring procedures and protocol document and they shall provide their recommendation to BLM and USFWS for review and confirmation that they meet the requirements set forth in the BPP/APCM. Such confirmation shall not be unreasonably withheld.

Table 5 provides a summary of key milestones, including monitoring and implementation plan submittal through the life of the Project.

Table 5. Project Milestones

Year 0 = start of construction in the OPA, Year 1 = end of first year of Project activity, etc.

Schedule	Milestone/Activity
Q3 2024	• Draft Native Seed Collection and Propagation Protocols and Procedures (to support APCM-6) submitted to USFWS and BLM. • Draft Dust Monitoring Protocols and Procedures (APCM-9) submitted to USFWS and BLM
Three Months Prior to Construction (Year 0)	• Draft Tiehm's Buckwheat Demographic and Recruitment Monitoring Protocols and Procedures (APCM-12) submitted to USFWS and BLM • Draft Critical Habitat Monitoring Protocol and Procedures (APCM-15) submitted to USFWS and BLM. • Draft Nonnative, Invasive, and Noxious Species Management and Monitoring Plan (APCM-7) • Draft ERTI-Specific Environmental Awareness Program (APCM-13) • Draft Operation Specific Training Module • Draft Geotechnical Slope Management and Monitoring Procedures and Protocols Documentation • Draft Stormwater Management Plan Monitoring and Reporting Procedures and Protocols for Project Activities Within or Having the Potential to Discharge to Critical Habitat
Year 1	• Prior to initiation of any construction/Quarry development activities in critical habitat Ioneer will construct conservation fencing pursuant to APCM-4 at the limits of proposed and authorized encroachment into critical habitat and at the limit of undisturbed critical habitat. • Select researcher and draft Study Design to Refine Trigger Thresholds for Dust Deposition on Tiehm's buckwheat. Submit draft research plan to USFWS and BLM. • Approximately 41-acres of impact in critical habitat, includes haul road construction and some overburden stripping (overburden stripping within critical impacts total approximately 4.8 acres). No highwalls established within critical habitat at this time. Construction of haul road, Cave Springs Road Realignment within OPA, and portions of the Cave Springs Wash berm occur within Tiehm's buckwheat designated critical habitat.
Year 2	• Initial year ore transported to processing plant, haul truck round trips per day past subpopulation 3 averages two. • Reclamation of approximately 6 acres of land inside of critical habitat that was disturbed as part of the Cave Springs Wash berm in Year 1 of Project development. • Quarry impacts in critical habitat expands to approximately 5 acres. • Daft Pollinator Habitat Reclamation Experimentation and Optimization Study Procedures and Protocols (APCM-6)
Year 3	• Continued quarry development at the southern extent of designated critical habitat. Some quarry development, including highwall and highwall benching occurs within designated critical habitat. Total Quarry impacts (excluding Haul Road footprint) at the end of Year 3 totals approximately 5 acres. • Continued ore hauling to processing plant – two haul truck round trips per day average.
Year 4	• Continued Quarry Encroachment into critical habitat, total acres of CH disturbance from Quarry expansion totals approximately 50 acres (excluding the haul road footprint). • Average Round Trips per day past subpopulation 3 averages three. • Implement Pollinator Habitat Reclamation studies on South and Quarry Infill OSF (APCM-6).
Year 5	• Continued quarry development, including highwall and highwall benching, within designated critical habitat. This includes adjustments of haul road alignment within designated critical habitat to accommodate the expanded quarry. • Continued ore hauling along haul road to the processing plant outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 11. • Experimental pollinator habitat reclamation studies continue.

Table 5. Project Milestones

Year 0 = start of construction in the OPA, Year 1 = end of first year of Project activity, etc.

Schedule	Milestone/Activity
Year 6	• Continued Quarry development, including highwall and highwall benching, within designated critical habitat. Continued ore hauling along haul road to the processing plant outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 12. • Continued development of the South and Quarry Infill OSF outside of designated critical habitat. • Experimental pollinator habitat reclamation studies continue on completed portions of the South and Quarry Infill OSF.
Year 7	• Continued quarry development, including highwall and highwall benching, within designated critical habitat. Continued ore hauling along haul road to the processing plant outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 17. • Continued development of the South and Quarry Infill OSF outside of designated critical habitat. • Experimental pollinator habitat reclamation studies continue on completed portions of the South and Quarry Infill OSF.
Year 8	• Continued quarry development, including highwall and highwall benching, within designated critical habitat. Continued ore hauling along haul road to the processing plant outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 33. • Continued development of the South and Quarry Infill OSF outside of designated critical habitat. • Experimental pollinator habitat reclamation studies continue on completed portions of the South and Quarry Infill OSF.
Year 9	• Continued quarry development, including highwall and highwall benching, within designated critical habitat. Continued ore hauling along haul road to the processing plant outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 41. • Continued development of the South and Quarry Infill OSF outside of designated critical habitat. • Experimental pollinator habitat reclamation studies continue on completed portions of the South and Quarry Infill OSF.
Year 10	• Continued quarry development, including highwall and highwall benching, within designated critical habitat. Continued ore hauling along haul road to the processing plant outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 124. • Continued development of the South and Quarry Infill OSF outside of designated critical habitat. • Begin Construction of North OSF • Experimental pollinator habitat reclamation studies continue on completed portions of the South and Quarry Infill OSF.
Year 11	• Continued quarry development, including highwall and highwall benching, within designated critical habitat. Quarry moves further into designated critical habitat. Haul road alignment is adjusted away from undisturbed critical habitat and subpopulation 6 to accommodate expanded quarry operations. • Continued ore hauling along haul road to the processing plant outside of designated critical habitat. Peak haul truck traffic per day past subpopulation 3 averages 525 roundtrips per day. • Continued development of the North OSF outside of designated critical habitat begins. • Experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF. • Predicted dust deposition peak at 0.90 g/m2/day assuming a 75 percent control efficiency and 6.4 percent silt content, less than 25 percent of trigger threshold of 4 g/m^2/day (see APCM-9 and analysis in Section 4.)

Table 5. Project Milestones

Year 0 = start of construction in the OPA, Year 1 = end of first year of Project activity, etc.

Schedule	Milestone/Activity
Year 12	• Quarry operations move further into designated critical habitat and reach maximum extent of surface impacts (approximately 197 acres). Haul road alignment is adjusted to accommodate expanded quarry operations. • Portion of quarry berm is constructed in designated critical habitat. • Continued ore hauling along haul road to the processing plant and North OSF outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 275 per day. • Continued development of the North OSF outside of designated critical habitat. • Experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF.
Year 13	• Quarry operations continue. • Continued ore hauling along haul road to the processing plant and North OSF outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 383 per day. • Continued development of the North OSF outside of designated critical habitat. • Experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF. • Approximately 0.7 acres of Quarry Berm available for reclamation using pollinator habitat reclamation protocol.
Year 14	• Quarry operations continue. • Continued ore hauling along haul road to the processing plant and North OSF outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 434 per day. • Continued development of the North OSF outside of designated critical habitat. • Experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF. • Approximately 3 acres of highwall bench reclamation within critical habitat.
Year 15	• Quarry operations continue. • Continued ore hauling along haul road to the processing plant and North OSF outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 253 per day. • Experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF. • Approximately 7 acres of highwall bench reclamation within critical habitat.
Year 16	• Quarry operations continue. • Continued ore hauling along haul road to the processing plant and North OSF outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 136 per day. • Experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF.
Year 17	• Quarry operations within critical habitat ends. • Continued ore hauling along haul road to the processing plant and North OSF outside of designated critical habitat. Average haul truck round trips per day past subpopulation 3 averages 66 per day. • Experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF.
Year 18	• Construction of Quarry Buttress as part of Quarry closure. • Approximately 16 acres of highwall bench reclamation within critical habitat. • End experimental pollinator habitat reclamation plots continue on completed portions of the South and Quarry infill OSF. • Prepare final experimental pollinator habitat reclamation study report. • Develop implementation plan for pollinator habitat reclamation in Year 19.
Year 19	• Approximately 109 acres of pollinator habitat reclamation • approximately 10 acres of highwall bench reclamation. • Total cumulative reclamation implemented in critical habitat 152 acres.

Table 5. Project Milestones
Year 0 = start of construction in the OPA, Year 1 = end of first year of Project activity, etc.

Schedule	Milestone/Activity
Year 20 to 33(e)	• Ongoing pollinator habitat reclamation monitoring and reporting. • Implementation of management activities as needed.
Year 23(e)	• Achieve functional (interim) reclamation objective for pollinator habitat reclamation.
Year 31(e) to 33(e)	• Achieve long-term reclamation objective and release of reclamation bond for reclamation inside of critical habitat.

4. ANALYSIS OF EFFECTS AND EFFICAY OF PROPOSED CONSERVATIONS MEASURES

In this section, we summarize the likely effects of the proposed action and the efficacy of the Applicant's proposed conservation measures on Tiehm's buckwheat and its critical habitat. Effects of the action are defined in USFWS regulation as:

> *"..all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action." [50 CFR 402.02]*

Cumulative effects are:

> *"Those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation" [50 CFR 402.02].*

Cumulative effects are considered together with the effects of the federal action under consultation by the USFWS to determine whether the effects of the federal action are likely to jeopardize the continued existence of a listed species or adversely modify its critical habitat. Other future federal actions that may affect a listed species would be subject to consultation requirements established in Section 7 of the ESA and, therefore, are not considered cumulative to the proposed action for purposes of Section 7 consultation.

As outlined in greater detail below, the Project will not result in the direct loss of any Tiehm's buckwheat or habitats occupied by Tiehm's buckwheat and the effects of Project activities to Tiehm's buckwheat that could result from dust, noise, lights and impacts to the pollinator guilds associated with Tiehm's buckwheat are not expected to result in population level effects that would appreciably diminish both the survival and recovery of this species. The development of the Project will directly impact approximately 196.65 acres of critical habitat for the Tiehm's buckwheat. Temporal loss of this habitat, prior to reclamation of functional habitat within these areas, will affect the physical and biological features of the designated critical habitat identified by USFWS in their final rule, but not to an extent that would preclude the ability of designated critical habitat to provide services essential for the conservation of Tiehm's buckwheat.

4.1. ACTION AREA

The Action Area is defined as "all areas affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (USFWS 2023 [50 CFR 402.2]). Because Tiehm's buckwheat is the primary species of concern, potential impacts to Tiehm's buckwheat were used to define the Action Area for this analysis. The Action Area of the Project includes the Operations Area which includes the known population of Tiehm's buckwheat and its designated critical habitat.

4.2. EFFECTS TO TIEHM'S BUCKWHEAT CRITICAL HABITAT

Through extensive revision of the Project plan, direct loss of all or a portion of any of the delineated Tiehm's buckwheat subpopulations has been avoided. As illustrated in **Figures 7, 13,** and **14a through 14f,** the Applicant's Preferred Alternative will directly impact 196.65 acres of critical habitat and at completion of Quarry development this would result in approximately 21.6 percent of the designated critical habitat being directly altered by development of the Quarry and related Project facilities, such as the haul road and re-routing of the county road. Year over year sequencing of Project development is provided in **Attachment G.** The sequencing of Quarry development proceeds from south to north with total surface impacts to critical habitat reaching their maximum extent in Year 12 of Project operations (**Table 6**). Reclamation activities as outlined in APCM 6 will be implemented concurrently with Project operations and as soon as a portion of any area to be reclaimed is no longer subject to surface disturbance, reclamation will commence. **Table 6** depicts the timing of concurrent reclamation activities relative to Project development within critical habitat.

The essential physical and biological features identified by the USFWS in their final rule (USFWS 2022a) to designate critical habitat included:

"1. Plant community. A plant community that supports all life stages of Tiehm's buckwheat includes:

a. Open to sparsely vegetated areas with low native plant cover and stature.

b. An intact, native vegetation assemblage that can include, but is not limited to, shadscale saltbush, black sagebrush, Nevada mormon tea, James' galleta, and alkali sacaton to maintain plant–plant interactions and ecosystem resiliency and provide the habitats needed by Tiehm's buckwheat's insect visitors and pollinators.

c. A diversity of native plants whose blooming times overlap to provide insect visitors and pollinator species with flowers for foraging throughout the seasons and to provide nesting and egg laying sites; appropriate nest materials; and sheltered, undisturbed habitat for hibernation and overwintering of pollinator species and insect visitors.

2. Pollinators and insect visitors. Sufficient pollinators and insect visitors, particularly bees, wasps, beetles, and flies, are present for the species' successful reproduction and seed production.

3. Hydrology. Hydrology that is suitable for Tiehm's buckwheat consists of dry, open, relatively barren, upland sites subject to occasional precipitation from rain and/or snow for seed germination.

4. Suitable soils. Soils that are suitable for Tiehm's buckwheat consist of:

a. Soils with a high percentage (70–95 percent) of surface fragments that is classified as clayey, smectitic, calcareous, mesic Lithic Torriorthents; clayey-skeletal, smectitic, mesic Typic Calcicargids; and clayey, smectitic, mesic Lithic Haplargids.

b. Soils that have a thin ((0–5.5 in (0–14 cm)) A horizon, B horizons that are present as Bt (containing illuvial layer of lattice clays) or Bw (weathered), C horizons that are not always present, and soil depths to bedrock that range from 3.5 to 20 in (9 to 51 cm).

c. Soils characterized by a variety of textures, and include gravelly clay loam, sand, clay, very gravelly silty clay, and gravelly loam.

d. Soils with pH greater than 7.6 (i.e., alkaline) in all soil horizons.

e. Soils that commonly have on average boron and bicarbonates present at higher levels, and potassium, zinc, sulfur, and magnesium present at lower levels. (USFWS 2022d)"

Table 6. Project Development and Reclamation Activities for Quarry, Overburden Stockpiles, and Similar Features within Critical Habitat

Pollinator habitat reclamation represents the acres of reclamation to be accomplished using the methods outlined in this document for critical habitat. Highwall bench reclamation acres represent the acreage of highwall benches where the benches will be ripped and seeded. Cumulative acres reclaimed is the running total of reclamation through life of project within critical habitat. Reclaimed in current year represents the total acres reclaimed in any given year within critical habitat based on the current Project schedule.

Year of PoO Implementation	Cumulative Acres Disturbed	Reclamation acres by year and type of Reclamation			
		Pollinator Habitat	Highwall Bench	Cumulative Acres Reclaimed	Reclaimed in Current Year
1	41.03			0.00	0.00
2	41.35	6.19		6.19	6.19
3	41.35			6.19	0.00
4	83.09			6.19	0.00
5	104.08			6.19	0.00
6	104.08			6.19	0.00
7	104.77			6.19	0.00
8	105.43			6.19	0.00
9	105.43			6.19	0.00
10	105.43			6.19	0.00
11	144.25			6.19	0.00
12	196.65			6.86	0.00
13	196.65	0.67		6.86	0.67
14	196.65		2.64	9.50	2.64
15	196.65		7.09	16.59	7.09
16	196.65			16.59	0.00
17	196.65			16.59	0.00
18	196.65		16.49	33.08	16.49
19	196.65	109.04	9.61	151.73	118.65
TOTAL (rounded to nearest whole acre)	**197**	**116**	**36**	**152**	**na**

Figure 13 depicts the projected total impacts to critical habitat and forecasts the trajectory of pollinator habitat reclamation efforts against the ultimate reclamation objectives identified above. The functional objective is forecast to be achieved in the fourth year after reclamation activities occur. Achieving the long-term objective is forecast 12 to 14 years after buttress construction.

The effects of the Applicant's Preferred Alternative that relate to development of the Quarry and associated infrastructure within critical habitat to each of the four PBFs are described in greater detail below.

PBF 1a – Open to sparsely vegetated habitats suitable for Tiehm's buckwheat and PBF4 – Soils suitable for Tiehm's buckwheat. There will be no direct removal of habitat suitable for Tiehm's buckwheat. Within the designated critical habitat all occupied subpopulations will remain intact and will not be removed by development of the Quarry. After redesign of the Quarry (APCM 1) to avoid direct impacts, the Quarry is still proximate to the southern subpopulations, particularly subpopulations 6 and 3, with the limits of disturbance occurring 114 feet (34.7m) and 44 feet (13.3m) from the closest plants in these subpopulations, respectively. Because of the proximity of the Quarry to these two subpopulations and the nature of the underlying geology, structural controls (APCM 2 & 3) were required to ensure that the Quarry wall achieved the design FOS requirements. To accomplish this, ground anchors have been incorporated into Quarry wall design during Quarry operations wherever the design FOS was less than 1.2. To ensure long term stability of the Quarry wall proximate to Tiehm's buckwheat subpopulations, a buttress comprised of overburden will be constructed at Quarry closure resulting in a FOS after closure of 1.81 to 2.71 (Geo-Logic Associates 2023).

The design FOS is described more fully in Geo-Logic Associates (2022 and 2023). FOS is defined as the resisting forces (forces resisting slope failure) divided by the driving forces (forces causing slope failure). Failure will only occur if the driving forces are greater than the resisting forces. To address this, Geo-Logic Associates (2022 and 2023) discussed several of the factors, such as blasting and slope saturation, that could affect the FOS. Each is discussed below.

Once mining commences and a Quarry wall is developed, monitoring of Quarry wall stability will occur twice daily and Ioneer will deploy an advanced stability radar system that will provide 24-hour real time monitoring of rock slope behavior to protect the lives of the miners working in the Quarry and by extension protect Tiehm's buckwheat (Geo-Logic Associates 2023).

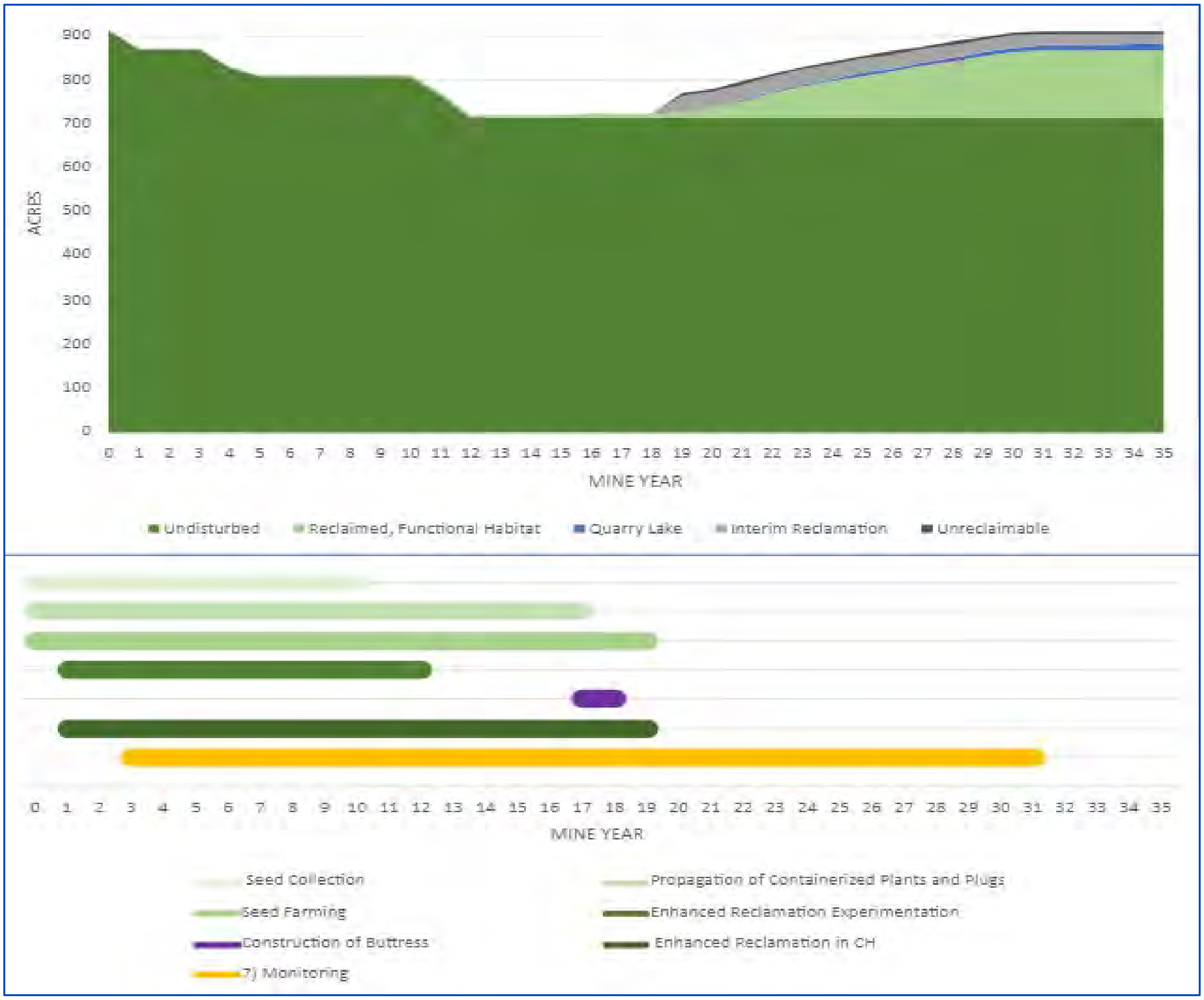

Figure 13. Timeline of Effects and Reclamation Efforts within Critical Habitat for Tiehm's Buckwheat

At year zero of the Project life the approximately 910 acres of critical habitat are shown as unimpacted by Project activities. The 10 acres of occupied habitat are part of the critical habitat area and will not be directly impacted by the Project. As the Project progresses the total acreage of unimpacted critical habitat decreases. As landforms created by mining activity stabilize and are no longer being used for mining purposes, enhanced reclamation activities will commence within critical habitat. For the bulk of impacted areas within critical habitat this happens once the buttress to provide long term stability to the Quarry wall is constructed. To measure reclamation progress towards the ultimate closure objective, the acres of pollinator habitat reclamation predicted to be achieved are calculated as a percentage of the targeted long-term reclamation goal. So, for example, if 25 acres were reclaimed using the enhanced reclamation methods proposed, the acres credit in the first year of reclamation is assumed to be zero. In the second year after pollinator habitat reclamation is initiated five percent of the 25 acres (5-acres) is counted as credit towards the long-term goal based on the assumption that we would be five percent of the way to the final success criteria objectives over the 25 acres. In year three of pollinator habitat reclamation, we have assumed that we will be at 17 percent of the final success criteria objectives, in year four 29 percent of the ultimate closure target, and in year five 41 percent. If density and species richness goals are achieved in year five as well, this would accomplish the interim Functional Reclamation objective. This can be achieved given the approach to pollinator habitat reclamation proposed that includes the judicious use of supplemental irrigation to support initial plant establishment and growth. Areas of interim reclamation effort that will ultimately be inundated by the Quarry Lake are not considered in the calculation of long-term success.

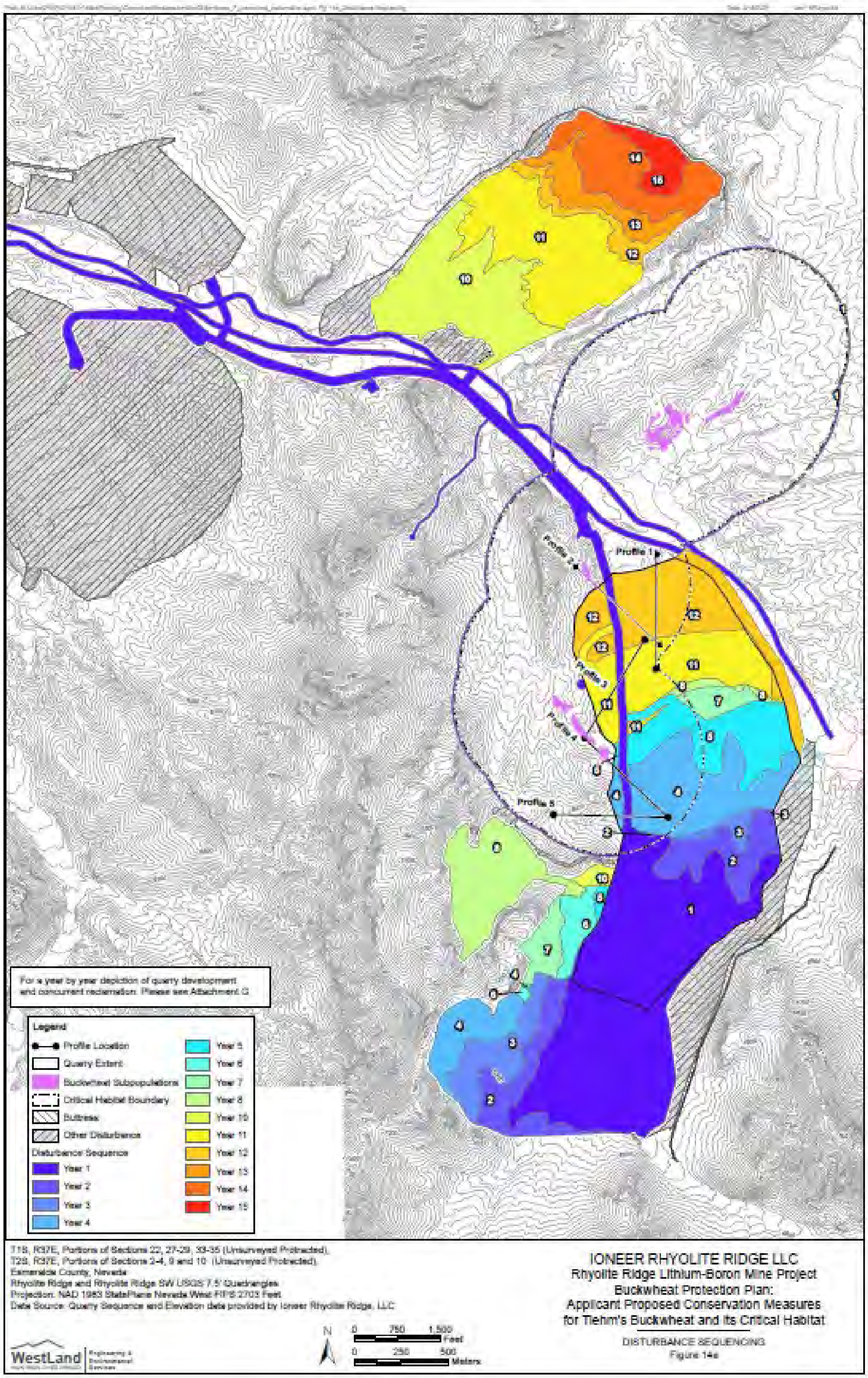

Figure 14a. Disturbance Sequencing

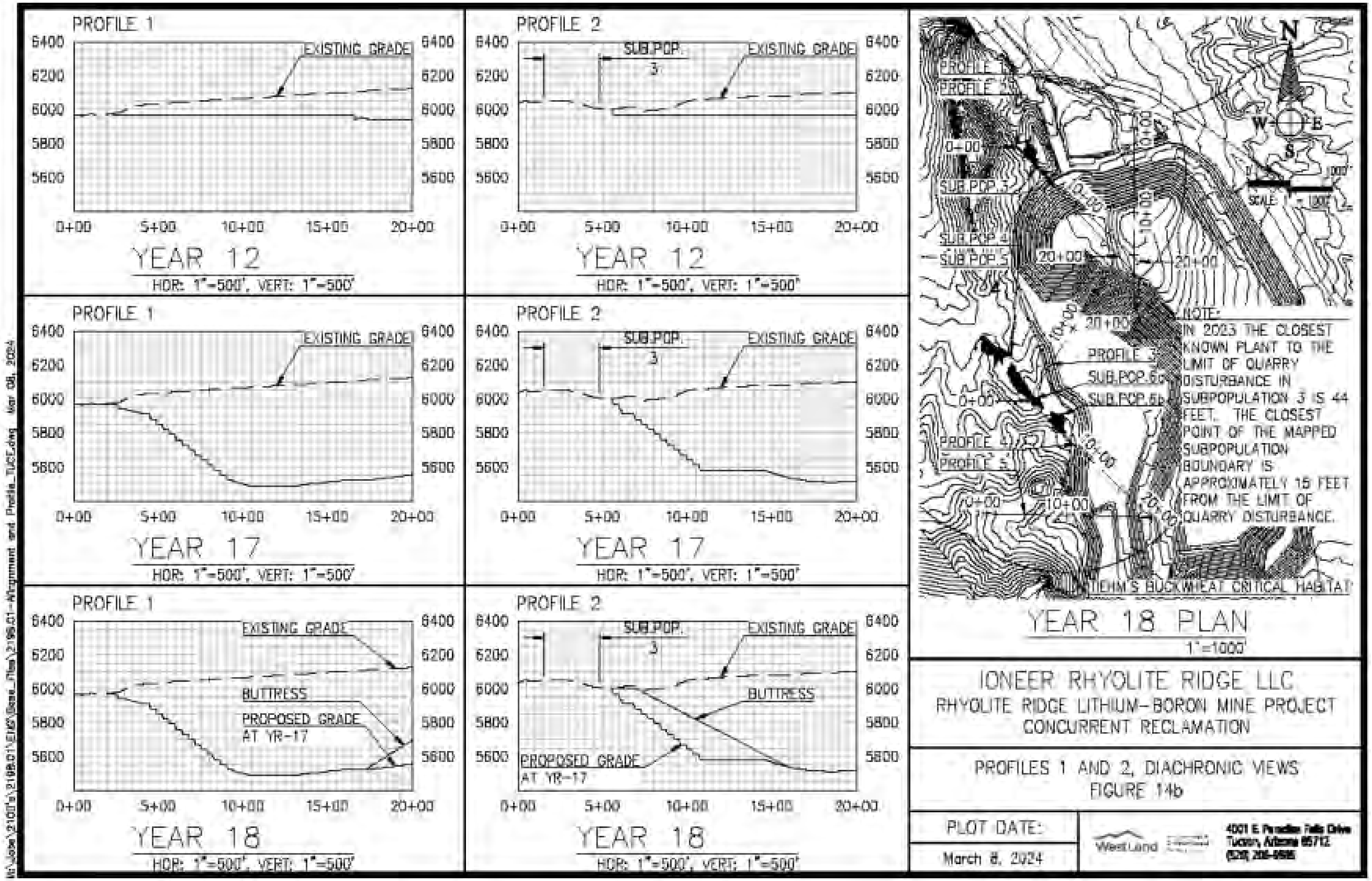

Figure 14b. Profiles 1 and 2, Diachronic Views

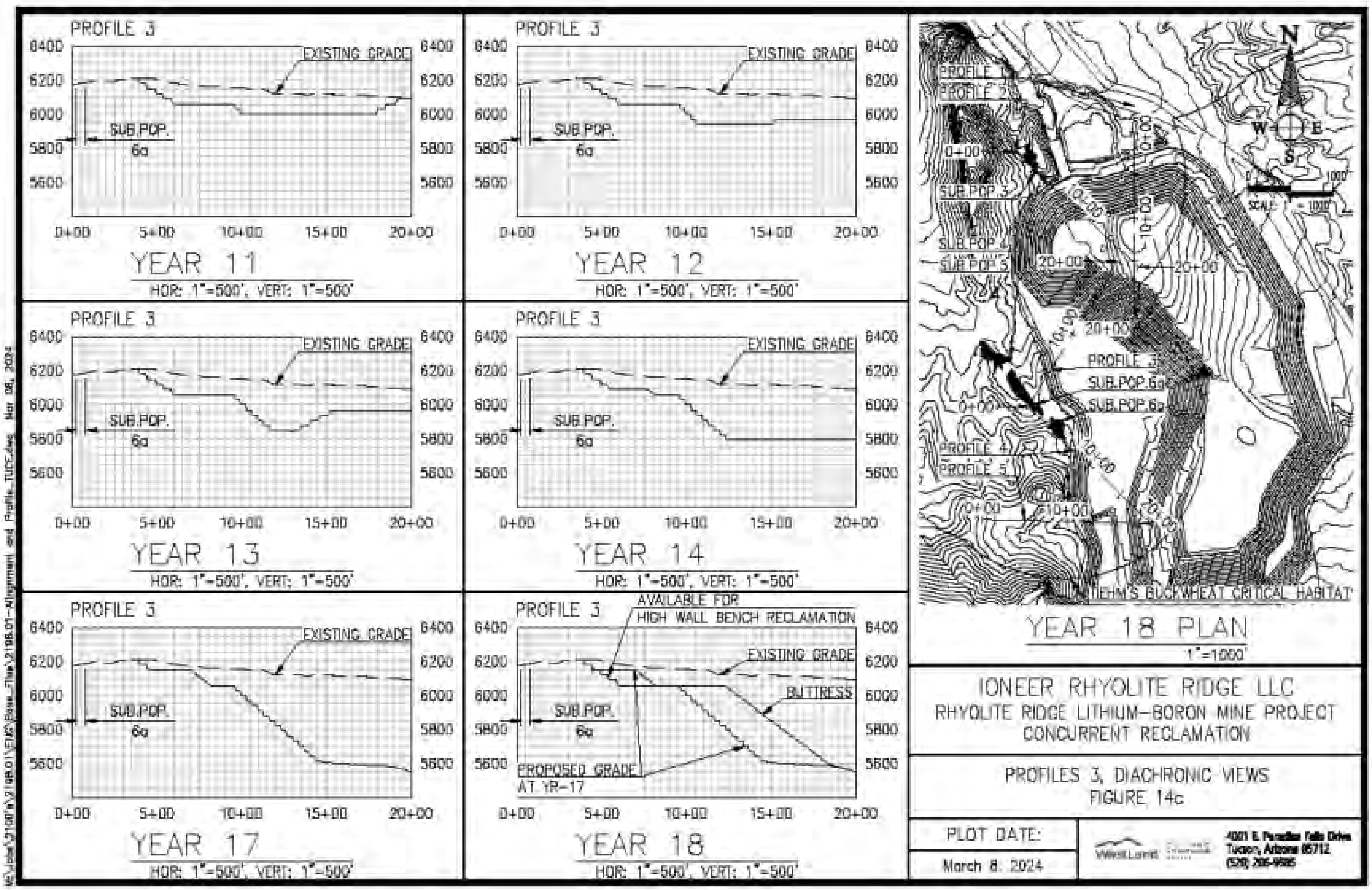

Figure 14c. Profiles 3, Diachronic Views

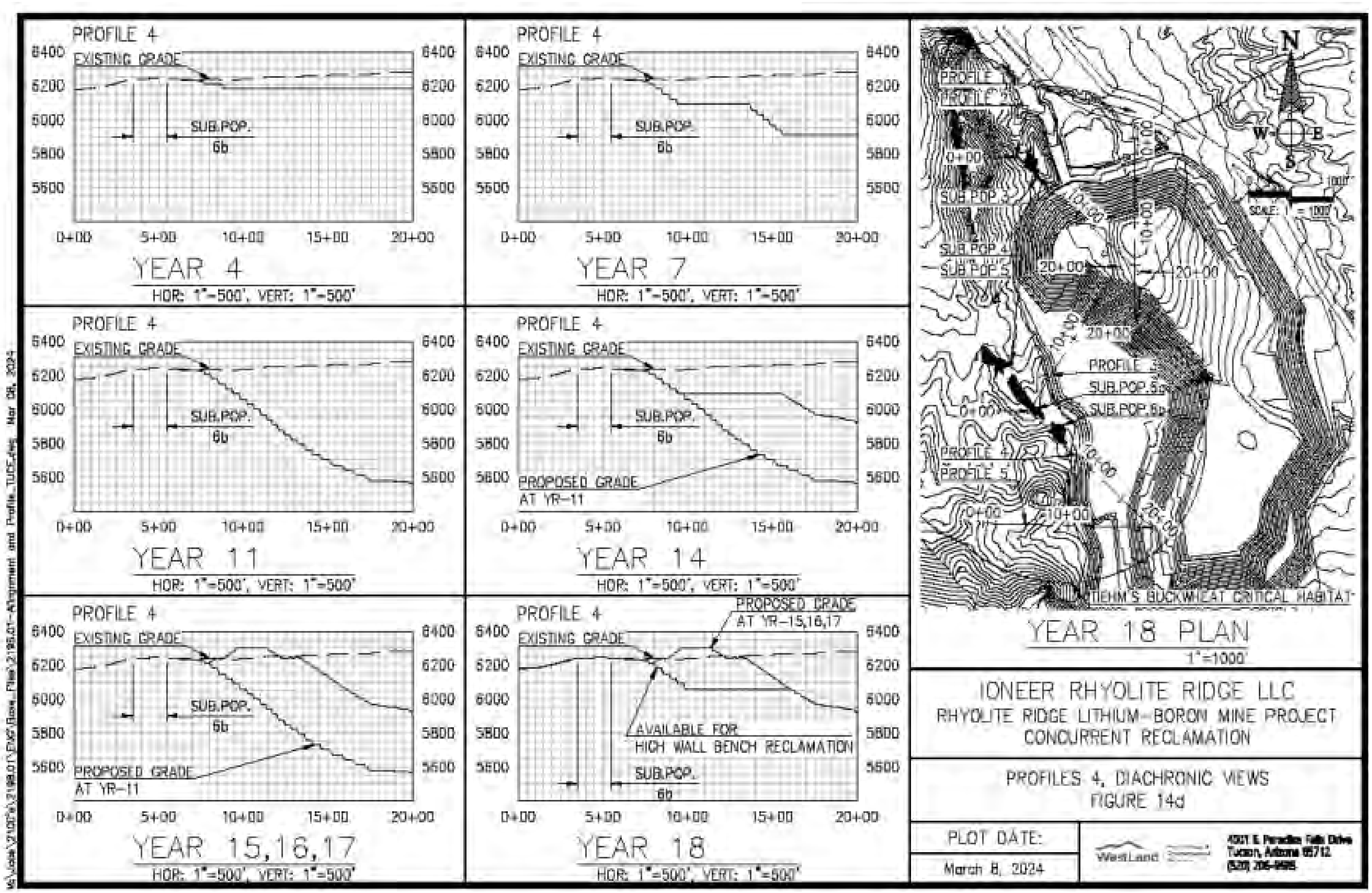

Figure 14d. Profiles 4, Diachronic View

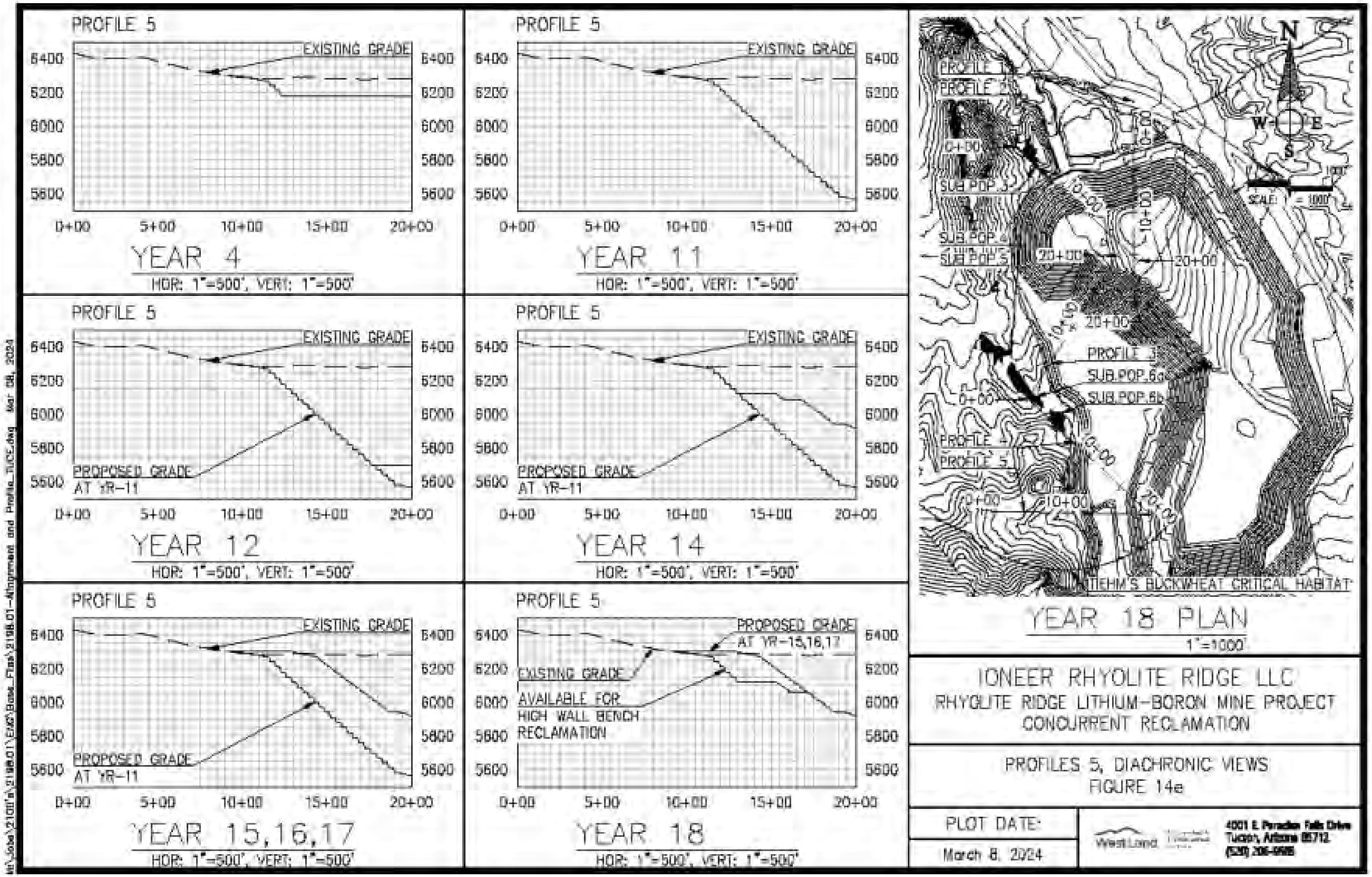

Figure 14e. **Profiles 5, Diachronic Views**

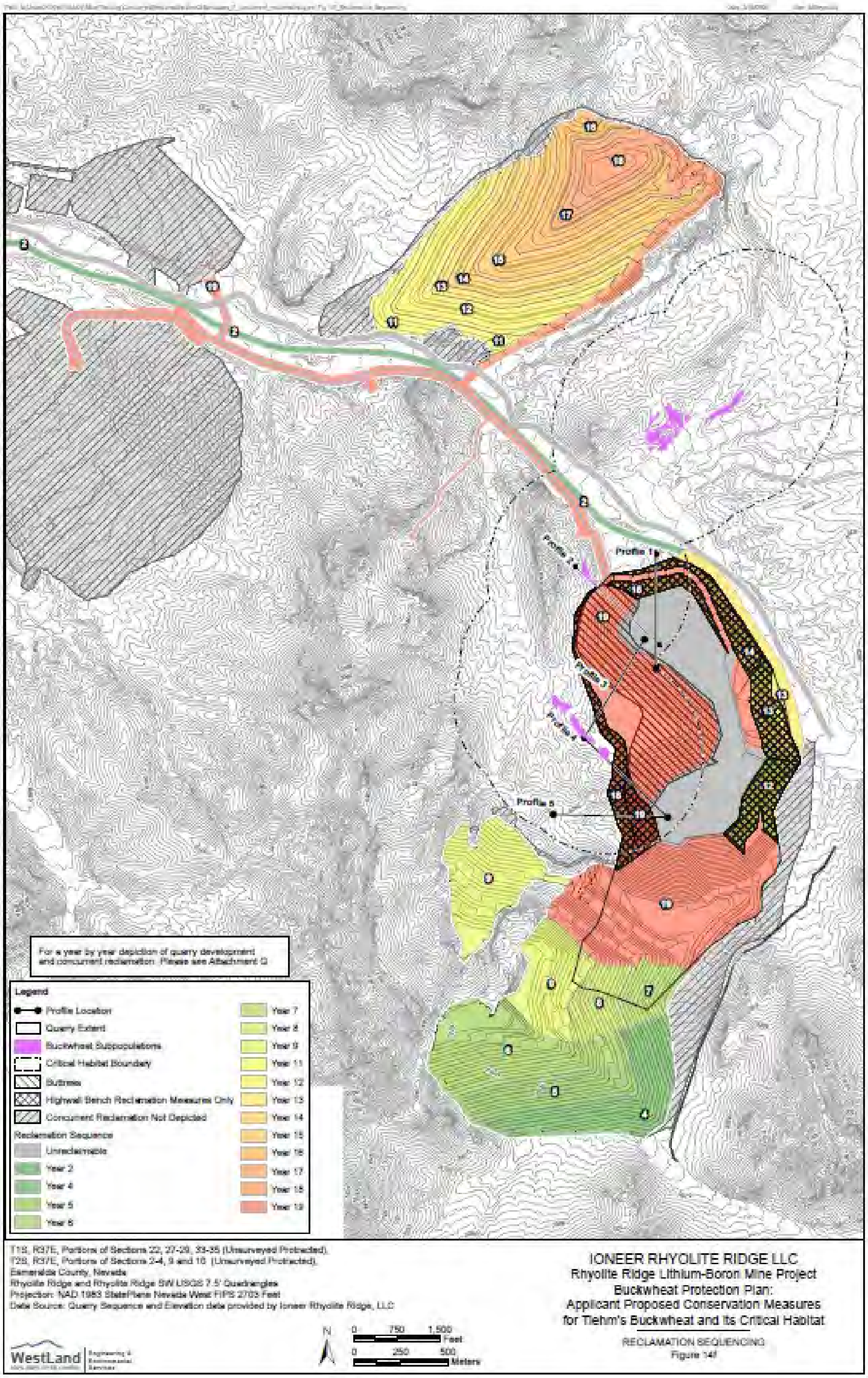

Figure 14f. Reclamation Sequencing

As mining progresses, information gathered from ongoing monitoring efforts will refine the current understanding of the design to maintain desired factors of safety. After mining starts and long before it reaches the proximity of Tiehm's buckwheat, Ioneer will develop a Geotechnical Slope Management Plan. (See Project Plan of Operations Section 2.1.1.) The Geotechnical Slope Management Plan will be developed by the Rhyolite Ridge Technical service group with the support of third-party geotechnical experts. This detailed plan will be based on the geotechnical observations made during the initial progression of the Quarry and outline the specific threshold conditions that will inform day to day operations and responses to specific monitoring observations.

Like the iterative process used to establish acceptable factors of safety during development of the Project Plan of Operations, appropriate actions to be taken in response to any observed instability will vary depending upon the nature of the instability observed, the extent of the instability, and the geologic unit in which it is observed. Initial actions in response to an observed instability would first focus on protecting miners and other resources potentially affected and could include suspending mining activity in portions of the Quarry or stopping mining activity altogether until the risk is abated. Longer-term responses could include, but are not limited to, placement of additional wall anchors, changing bench configuration, or more significant modifications of the Quarry.

Blasting will be required to fragment some of the materials to be quarried. Control of blasting proximate to the Quarry Walls, including the west wall, will be essential to maintenance of the FOS where deeply sloping M5a material is present and to maintain the rated loads of the ground anchors. Controlled blasting techniques recommended for consideration by Geo-Logic Associates include buffer blasting, trim blasting, pre-splitting, post-split blasting, and line drilling.

The combination of these methods will help to ensure that the final quarry slopes are properly established, remain stable and create a safe workplace. The application of various blasting techniques will vary horizontally and vertically based on the geology present in the final highwall. Line drilling and Pre-splitting will be incorporated into a Perimeter /Trim blast protocol used for the Rhyolite Ridge Project. The trim blast will vary 40-90 feet in width.

Line drilling is defined as a single row of closely spaced (5 feet), small diameter (4 inch) holes that are drilled along the excavation line. These holes would be drilled to a depth equal to a single bench height of 30 ft and most likely vertical. The holes remain unloaded in a trim or perimeter blast. The intention of this line drilling is to create a plane of weakness to which the trim or primary blast can break to. It will create relief of the shock wave limiting energy that could otherwise travel into the wall, creating back break damage. Line drilling is best suited for homogenous formations where bedding planes, joints and seams are at a minimum.

Pre-split Blasting is highly successful in a stronger rock and forms a discontinuous zone that minimizes or eliminates overbreak from the subsequent primary blast and produces a smooth rock wall. Pre-split involves a single row of holes drilled along the excavation line. These holes would be drilled to the full height of the excavated bench, this will vary from 30-60 feet. They are most successful when drilled at the angle of the face. These holes would be loaded with a light continuous or decked charge of explosives that would be initiated before primary or trim blasting to establish and propagate the defined excavated line. Success can often be identified when there are half barrels (longitudinal section of the initial drill holes) evident in the final quarry wall.

As the Quarry progresses from south to north and before Quarry development proximate to the subpopulations commences, ongoing monitoring (APCM 3) and management of Quarry development as outlined in Geo-Logic Associates (2023) will inform and provide the level of assurance needed to maintain the west Quarry wall at the desired FOS to protect miners and the occupied subpopulations of Tiehm's buckwheat from slope failure.

Most of the Quarry is comprised of rock containing fractures which have the potential to facilitate infiltration of water and to distribute that water to depth. The kinematic analysis conducted by Geo-Logic Associates considers this stability risk and assumes the fractures are saturated to the surface during either snow melt or precipitation events in their analysis of the west Quarry wall. A deep well system will be used to effectively dewater the Quarry during operations (Geo-Logic Associates 2023). Because of the presence of a significant thickness of low permeability clay materials, dewatering/depressurization may require additional measures such as bench scale horizontal drains. After pit dewatering necessary to allow mining the risk of re-saturation of the low permeability clays is not expected to be an issue that could affect west Quarry wall stability (see discussion in Geo-Logic Associates 2023).

The main objective of controlled blasting is to control the direction and magnitude of the energy and vibration. In the blasting process, the energy generated by the explosion in the blasting hole propagates through the rock mass medium in the form of seismic waves and then accumulates and dissipates, thereby weakening the rock structure and affecting its stability. In addition to interrupting the propagation of blast vibrations using the trim blasting techniques described above, the effect of blasting vibrations can be reduced by adopting an appropriate differential time delay in the blasting sequence. When the blasting vibration waves differ by half a period the amplitude of the wave is reduced. This common blasting control technique will be used in all trim blasting to control vibrations and protect pit wall integrity. The precision that is required to manage a millisecond of time requires the use and implementation of electronic detonators. Electronic detonators enable exact time delays between blasts to ensure the blast energy is used to break rock, reducing fugitive energy loss in the form of vibrations.

It is important to note that blasting is not very effective in soil and clay material. This is because of the low density of this material (1.20-1.5 g/cm3). Rather than creating confinement to allow for effective breakage mechanism, the energy is absorbed and dissipated by low density material. Energy will not travel far through the material or create any confinement to allow for disruption. Where vibrations generated by trim or production blasting encounter lower density materials, vibrations induced by blasting for quarry development will be quickly attenuated.

The final Quarry pit lake will not affect the stability of the west Quarry wall proximate to Tiehm's buckwheat subpopulations (Geo-Logic Associates 2023). The ultimate pit lake elevation is estimated to be 5,720 feet amsl and it will only intercept the critical slip surface at transect TRO2E-5, which does not contain any M5a material. As a result, the FOS for this location of the west Quarry wall which is not below any Tiehm's buckwheat subpopulations will be reduced from 1.91 to 1.72 (Geo-Logic Associates 2023). This is substantially above the design FOS of 1.2.

Pseudo-static analysis of Quarry wall stability has been completed for the probabilistic seismic hazard determined using the USGS Unified Hazard Tool (see Geo-Logic Associates 2022) and the results of that analysis are included in the geotechnical reports that have been prepared and submitted to the USFWS. In all cases, the results of the analysis for the design earthquake indicated that the FOS used for the seismic analysis (1.05) was met or, when not met, the calculated permanent seismic displacements are less than the Project criteria of 24 inches (which is just under 1 percent elongation of the longer ground anchors used in the analysis).

Based on this analysis, PBF1a will not be reduced by the development of the Applicant's Preferred Alternative.

PBF 1b, 1c and 2. Plant Communities that support potential pollinators of Tiehm's buckwheat; suitable habitat to support the generalist guild of pollinators that support Tiehm's buckwheat; and a sufficient population of pollinators to support Tiehm's buckwheat. Following full development of the Project and prior to creation of functional habitat to support potential pollinators of Tiehm's buckwheat as part of the pollinator habitat reclamation efforts proposed in the Applicant's proposed conservation measures, all physical and biological features that have been determined by the USFWS essential for sustaining life history processes for Tiehm's buckwheat will remain in undisturbed portions of critical habitat and on immediately adjacent public lands that are not disturbed by proposed Project activities. Within designated critical habitat, approximately 713.4 acres of intact plant communities (including the approximately 10 acres of habitat occupied by Tiehm's buckwheat) that support the diverse generalist pollinator guild that is relied upon by Tiehm's buckwheat will remain. Following reclamation activities, there will be approximately 865 acres of plant communities capable of providing physical/biological factors necessary to support Tiehm's buckwheat as defined in the final rule designating critical habitat, approximately 95 percent of the designated 910 acres of critical habitat. These undisturbed lands are well integrated into the significantly larger framework of public land that will be left undisturbed by proposed mining activities and capable of supporting the guild of pollinators that support Tiehm's buckwheat reproduction.

Critical habitat around the Tiehm's buckwheat subpopulations south of Cave Spring's Road will see the greatest loss of pollinator habitat. Because of the redesign of the Project (APCM 1), most of these effects have been limited to unoccupied habitat east of the subpopulations. This loss is temporary during Project operations and prior to construction of the buttress within the Quarry and concurrent reclamation programs within the Quarry are sufficiently progressed to support potential pollinator communities. As outlined below, this temporal loss is not expected to result in a reduction in the effectiveness of the pollinator communities to provide essential services to Tiehm's buckwheat subpopulations.

The designation of critical habitat for Tiehm's buckwheat was predicated on the assumption that protection of the pollinator communities that support Tiehm's buckwheat is essential for survival and recovery of the species. Absent clear information to the contrary, USFWS argued that the flight distance of potential large pollinators would be a suitable surrogate for determining the size of the area necessary to achieve the purpose for critical habitat designation. The pollinator study conducted by WestLand suggests that the abundance and distribution of potential pollinator morphospecies are heavily influenced by local conditions. These differences in potential pollinator communities within critical habitat support the conclusion that pollinators are not flying long distances to reach Tiehm's buckwheat populations and that the potential pollinators that are using the Tiehm's buckwheat as a resource are local to the subpopulation. This is consistent with the hypothesis that a generalist pollinator guild supports Tiehm's buckwheat (McClinton et. al. and WestLand in prep).

The dissimilarity analyses presented (**Figures 4 and 5**) also show that pollinator communities within the areas being impacted by Quarry development are not very similar in overall species composition and abundance to the pollinator communities found within the Tiehm's buckwheat subpopulations; having lower diversity of potential pollinators but greater abundance of a few species of softwing flower beetles (Eudacite morphospecies) which comprise the majority of the potential pollinator guild in the Quarry area (>50 percent). These beetles, however, are also well represented throughout other areas of critical habitat. The localized nature of the pollinator communities, the diverse guild of potential pollinators, and the common nature of the dominant potential pollinator in the Quarry area collectively result in a high degree of redundancy within the remaining undisturbed areas of critical habitat that would enable it to continue to support the Tiehm's buckwheat subpopulations during and after Project development.

It is also interesting to note that the preliminary genetics work that has been completed is also consistent with the idea that the potential pollinator guild that utilizes the resource provided by Tiehm's buckwheat is local and that gene flow between subpopulations may not be great.

The nature of the potential pollinator communities within critical habitat and the diverse guild of potential pollinators that utilize the resource provided by Tiehm's buckwheat provides redundancy essential to compensate for the effects of the Applicant's Preferred Alternative. This redundancy is illustrated by comprehensive pollinator sampling conducted within critical habitat (WestLand 2023c).

PBF3 – Hydrology that is capable of supporting Tiehm's buckwheat. Project development activities will not alter surface water drainage patterns within any of the subpopulations of Tiehm's buckwheat. The subpopulations are all located at elevations greater than planned facilities and surface water flow onto those subpopulations will not be altered by Project development activities. Tiehm's buckwheat is a xeric adapted species and is not dependent on a shallow groundwater table, localized pumping of groundwater for Project development and operations, pit dewatering, and the maintenance of a pit lake at closure are not expected to have any effects to Tiehm's buckwheat or the suitability of the occupied habitats located within critical habitat.

4.3. EFFECTS TO TIEHM'S BUCKWHEAT

4.3.1. Dust Impacts to Tiehm's Buckwheat

Photosynthesis and growth of plants can be negatively affected by increased rates of deposition, though not surprisingly the degree of effect and response to deposition is dependent on the amount of dust deposited, rainfall patterns (within and across years), soil types, etc. (Wijayratne et al 2009, Reheis 2013).

In a study of common Mohave desert shrubs (creosote, burrobrush, and saltbush) that was conducted on a military base on the upwind and downwind side of a dirt road used to transport tanks, Sharifi et al. (1997) demonstrated significant differences in net photosynthesis, leaf conductance, transpiration and water use efficiency between control and heavily dusted plants. Heavily dusted shrubs had smaller leaf areas and greater leaf-specific masses which were speculated to be a consequence of lower primary productivity (Sharifi et al. 1997). Rates ($g/m^2/d$) of dust deposition were not reported but soils in the region were characterized as alluvial in origin and ranged from sandy loam to fine loams lacking in surface gravels. In their study they reported that "a persistent and strong up-slope wind during the period of spring training maneuver's yield an extremely heavy dusting on shrubs along the downwind (upper) side of the tank trail and little or no detectable dusting along the upwind (lower) side of the same trail." The leaf surfaces of Larrea and saltbush had $16g/m^2$ and $40g/m^2$, respectively, and dust loading is presumed to be very high on the downwind side of the road.

Lewis et al. (2017) evaluated road dust impacts on reproduction of endangered shrub Uinta Basin waxfruit (*Hesperidanthus suffrutescens),* a monoecious perennial shrub. In this study they found a significant correlation (after controlling for plant size and distance from the road) between number of fruits matured and total dust deposition for the period of the study. While not statistically significant they also showed a similar negative relationship between total number of seeds per plant and total seed weight per plant. The effects of dust on the proportion of hand pollinated followers that set fruit was not significant. The mechanisms of reduced fruit production were not clear in their study though they speculate that based on increased stomatal conductance (presumably by dust influencing both opening and closing of stomata) dust could impact photosynthetic capacity of plants by decreasing carbon-dioxide uptake and increasing water loss. They noted that "if dust were preventing successful pollination through, for example, by stigma clogging, then the proportion of hand-pollinated flowers that set fruit would also be expected to decrease with increasing levels of dust deposition," but they found no evidence for this in their study. Their study also provided "no data that can address the possibility that dust interferes with pollinator abundance or behavior."

The study did not report the daily rates of deposition and relied upon total grams of dust collected in collection pans of the course of the study following the methods of Sharifi et al. (1997). To be able to compare their results to the modeled deposition rates (g/m^2/d) for the Rhyolite Ridge Project we estimated dust flux using the typical size of collection pan and the data presented in Figure 2 of Lewis et al. 2017. Daily dust deposition (flux) rates are provided in **Table 7** below. The range of values provided represents plus or minus one standard deviation for each distance category.

Table 7. Daily Dust Deposition Rates Interpolated from Lewis et al. 2017

Total dust deposition as grams deposited in the dust trap were converted to g/m^2/d assuming a 10-inch diameter collection surface for trap and 83-day study period (Lewis et al. 2017).

Distance Category from Road (m)	Dust Deposition (Flux) as g/m^2/d		
	-1 SD g/m^2/d	mean g/m^2/d	+1SD g/m^2/d
100	2.14	2.55	2.97
200	1.50	1.81	2.11
300	0.81	1.20	1.59
400	1.19	1.47	1.76
700	1.43	1.68	1.92

Lewis et al. reported that dust deposition mostly followed the expected pattern with most dust deposited near the road and trending downward as distance increased to the 201-300 m interval. Their data show dust deposition begins to increase at 400m and 700m and they ascribe the observed pattern to 400 and 700m sample sites being closer to a section of dirt road that was the proximate source of anthropogenic dust that turned back to the southwest and runs generally parallel with the transect line of their dust traps (see Lewis et al. Figure 1).

Wijayratne (2009) found that supplemental dust deposition to *Astragalus jaegerianus* (Lane milkvetch, a perennial herb) ranging from 0 (control) to 32 g/m^2 to simulate potential conditions that could result from future military activities resulted in declines in average shoot growth with increasing concentrations, but seasonal net photosynthesis increased as concentrations increased. These trends were replicated in their greenhouse studies, but the results were not statistically significant (Wijayratne 2009). The plants which showed some effects to the increased dust exposure fully recovered and showed no adverse effects the following year. In the field Wijayratne et al. had difficulty maintaining a constant dust application rate per their treatment plan; however, they were able to achieve a dust concentration gradient and were able to determine the average daily dust concentration (daily dust concentration as g/m^2 or deposition rate reported as $g/m^2/d$) that each individual plant experienced over the period of the growth and physiological measurements. Average daily dust concentration (flux) and plant response are shown in the following **Figures 15 and 16** excerpted from Wijayratne (2009).

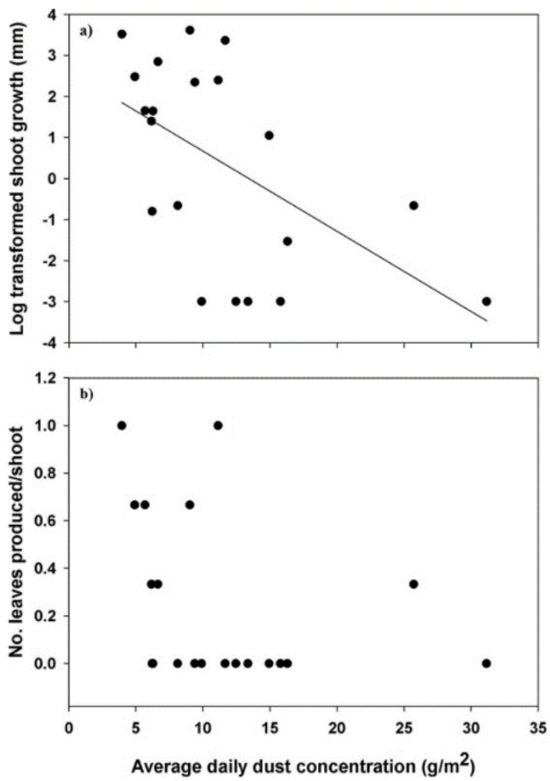

Figure 2 from Wijayratne et al. 2009. Seasonal shoot growth (a) (i.e. change in shoot length) declined with increasing leaf dust concentration (log[shoot growth] = 2.62-0.20*[dust concentration]). Leaf production (b) declined slightly as leaf dust concentration increased.

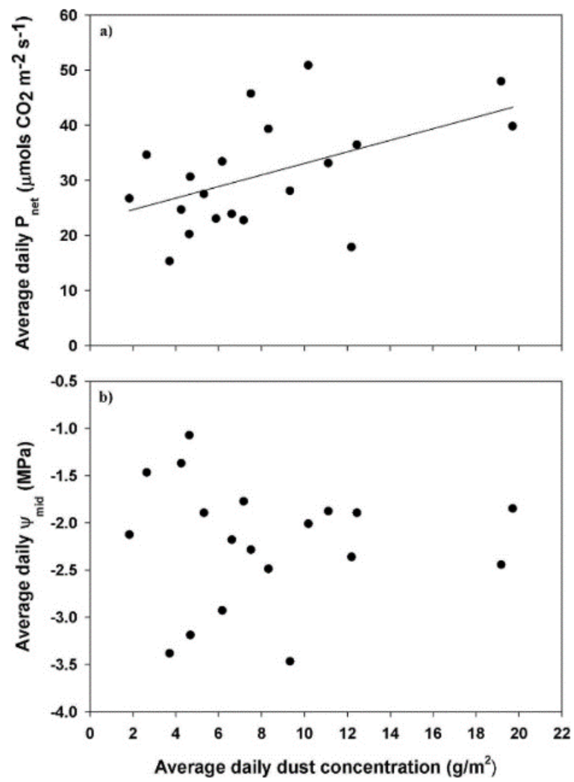

Figure 3 from Wijayratne et al. 2009. Average leaf-level net photosynthesis (a) increased with increasing leaf dust concentration. Average midday water potential (b) did not change significantly with increasing dust concentration.

Figure 15. Figures Excerpted from Wijayratne et al. 2009 Showing Effects of Increasing Dust Deposition on Growth and Physiological Processes of Lane Milkvetch

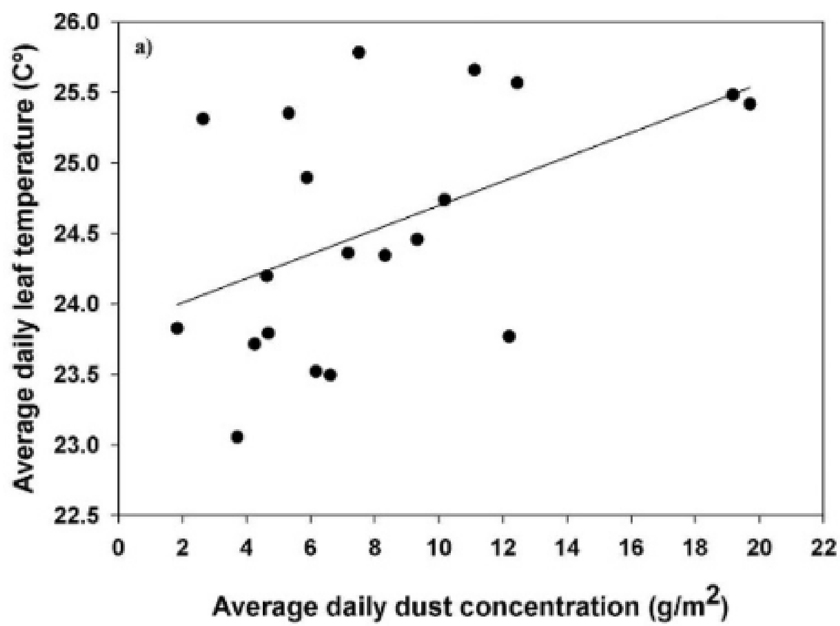

Figure 4(a) from Wihayratne et al. 2009. Relationships between dust concentration and leaf temperature (leaf temperature = 23.84 + 0,09*[dust concentration])

Figure 16. Relationship between Dust Concentration and Average Daily Leave Temperature for Lane Milkvetch

Matsuki et al. (2016) evaluated two independent monitoring studies in semi-arid Australia to evaluate the longer-term effects of dust on a threatened plant and on changes in plant health and floristic composition in a native plant community. Peak dust deposition rates for these studies were 20 and 77 g/m^2/month. In the first study reviewed, they found over a 10-year period that there were no significant effects to the threatened species Paynter's tetratheca (*Tetratheca paynterae paynterae)* when compared to less dusty sites over a 10-year period. In the second study reviewed of a plant community on Barrow Island, they found no significant effects between distance from the dust source and floristic composition over a five-year period. On the Barrow Island study, they were able to evaluate the data in two sets, one before road paving and the second after paving the road that was the principal source of fugitive dust. In their Paynter's tetratheca study they observed dust loads decreasing over time as the pit deepened. During initial pit development high dust loads were found on some plants up to 150m from the pit but the majority of the plants that were more than 20m from the pit had low dust loads. As the pit deepened, dust loads on the plants decreased. From 2007 to 2010 dust loads were less than 5 percent regardless of the distance from the pit. Between 2011 and 2014, using different monitoring techniques, dust deposition ranged from 0.6 to 20.1 g/m^2/month. In their study they found that the probability of plants transitioning to a lower health condition from one year to the next did not appear to be related to dust load and seemed to be driven more by the variability of cumulative rainfall in the preceding five months.

Common to many of the studies of the effects of dust deposition on plants in the arid west is the source of anthropogenic dust (i.e., unpaved roads without any dust control). Modern mining activities are highly regulated, and control of fugitive dust emissions are an important part of the Project's Environmental, Safety, and Health (ES&H) programs.

The Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to develop National Ambient Air Quality Standards (NAAQS) for pollutants known as "criteria pollutants," that are common in outdoor air, considered harmful to public health and the environment, and that are released from numerous and diverse sources. The statute established two types of NAAQS: primary standards and secondary standards. Pursuant to Title 40 of the Code of Federal Regulations (40 CFR), §50.2(b) primary standards define levels of air quality which the EPA judges are necessary, with an adequate margin of safety, to protect the public health and secondary standards define levels of air quality which the EPA judges necessary to protect the public "welfare" from any known or anticipated adverse effects of a pollutant. Pursuant to Title 42 of the United States Code (42 U.S. Code) §7602(h) all language referring to effects on "welfare" include, but is not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being, whether caused by transformation, conversion, or combination with other air pollutants. (As provided in Trinity 2024a).

The AQIA evaluation was completed for the Ioneer Rhyolite Ridge Project at locations that are considered "ambient air". Pursuant to 40 CFR §50.1(e) "ambient air" means that portion of the atmosphere, external to buildings, to which the general public has access. Based on this definition the AQIA evaluation for the Rhyolite Ridge Project was completed for receptors along the County Road that traverses the project area, including critical habitat for Tiehm's buckwheat, as well as receptors outside the project boundary for all criteria pollutant emissions. The following tiered Cartesian receptor array was used for the analysis:

- "Boundary" receptors spaced at approximately 50-meter intervals along the boundary of the Facility as well as along the county road that bisects the Facility;
- Cartesian grid receptors, spaced at 100-meter intervals, out to a distance of at least 1,500 meters from the boundary of the Facility;
- Cartesian grid receptors spaced at 250-meter intervals, between 1,500 and 5,000 meters from the boundary of the Facility; and
- Cartesian grid receptors spaced at 500-meter intervals between 5,000 meters and 15,000 meters from the boundary of the Facility. (Trinity 2024a)

The AQIA demonstrates that impacts from the proposed project are below the primary and secondary NAAQS standards for all receptors and emissions combinations. **Figure 17** (Trinity 2024b) was developed using peak (H1H) data for PM10 emission data generated by the AQIA. As illustrated in **Figure 17**, the impacts from the proposed project are not expected to cause or contribute to any adverse effects on human health or the environment. (Trinity 2024a).

The closest potential regular source of fugitive dust to Tiehm's buckwheat is the dust generated by haul trucks as they are traversing the haul road to transport material to the overburden stockpiles or the processing plant.

Dust from Cave Springs Road is expected to be reduced from the current levels because of the control of traffic through the Project and reduction in travel speeds within critical habitat and application of watering and other dust palliatives. Travel on the unpaved road that goes between Subpopulation 1 and 2 will be restricted by gate and will be reduced from current levels of recreational use. Ioneer will access the Com Tower 4 via this same road. For construction, the road will be used for approximately seven days. Vehicles using the road include one backhoe, two pickup trucks, one with a trailer, for a total of three round trips a day. Due to the existing condition of the road and limited use, water trucks will not be used and travel will be limited to 10 mph. Once in operation, Ioneer anticipates a single round trip per month for inspection and routine maintenance. On rare instances when the tower is in need of repair additional trips will be required for maintenance. All of these will be limited to 10mph. This level of use will be less than current recreational uses and at slower speeds. Dust from blasting and operations in the pit are also not expected to be a significant sources of fugitive dust emissions potentially impacting Tiehm's buckwheat populations and will be further mitigated within 100 meters of Tiehm's buckwheat subpopulations by the use of blasting mats.

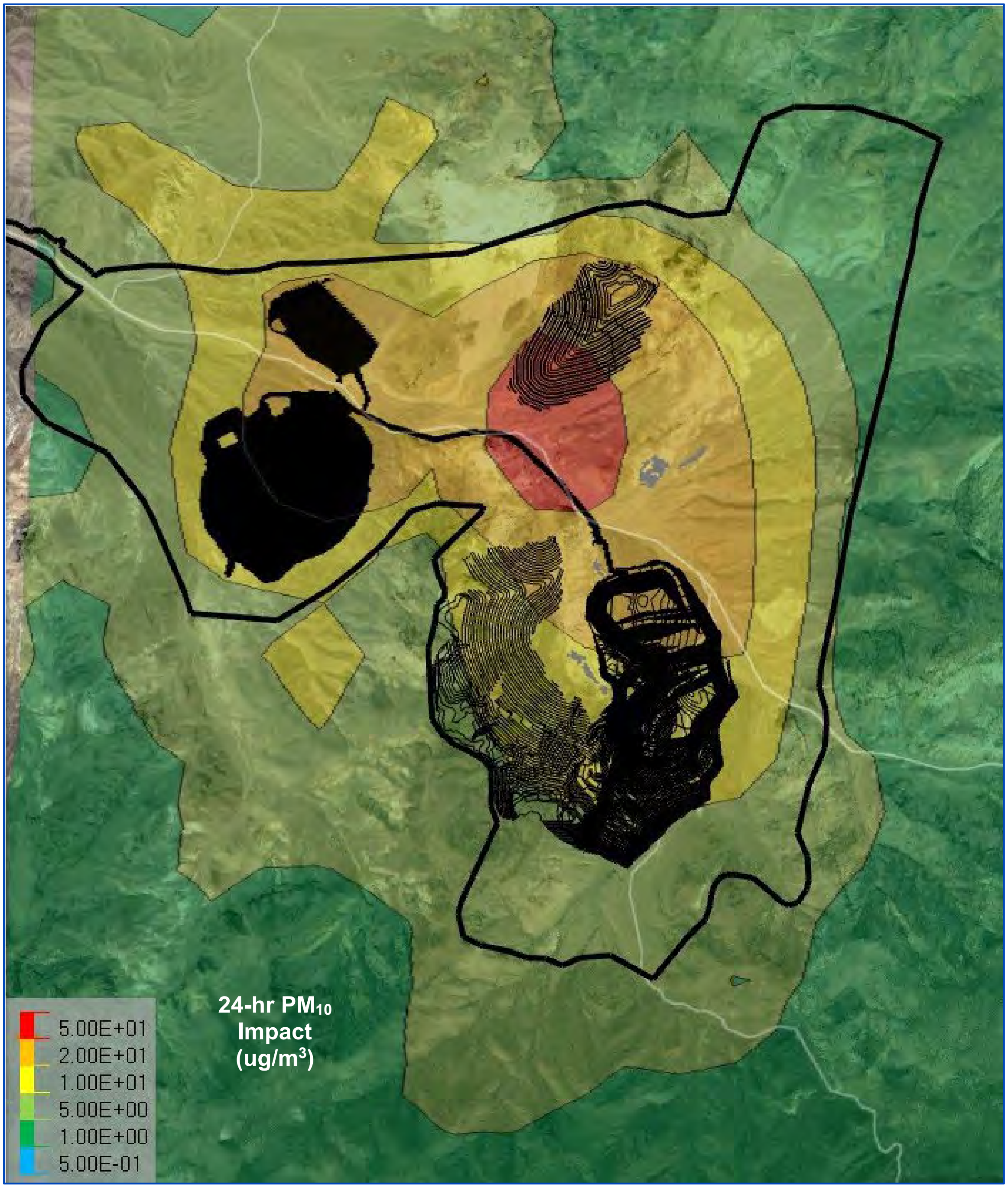

Figure 17. Contour Plot of Maximum 24-hour Average Particulate Matter with a Diameter of 10 Microns or Less (PM_{10}) Impacts

Contours are based on modeled impacts at receptors with public access located at 50-meter intervals around the project boundary and along the county road. The model results are based on the AQIA prepared in support of the Rhyolite Ridge Project. Contours generated using BREEZE 3D Analyst. Emission sources modeled include all mining and processing operations, and project roads, including fugitive dust, non-point, and point emission sources. Tiehm's buckwheat subpopulations are indicated in gray. Air impacts over the life of the Project do not exceed the primary and secondary federal and state ambient air quality standards established to protect public health and welfare which is defined by regulation to include natural plant and animal communities and agriculture. (Source: Trinity Consultants 20240320.)

As the pit progresses, emissions to the atmosphere from mining activities occurring inside the Quarry are further reduced due to the wall effects of the Quarry. The tendency of dust particles to remain in a mine pit, particularly as the pit deepens, is referred to as “pit retention” (Cole and Fabrick 1984). The early stages of Quarry development will generate dust and standard control measures used for construction will be implemented to limit fugitive dust during this phase of Project development. Early in quarry development the number of vehicles passing by Tiehm’s buckwheat subpopulations will be extremely low because of the relatively low volume of ore produced daily and because the overburden excavated in the early phases of Quarry development will be transported to the South OSF. Haul trucks will pass Tiehm’s Buckwheat Subpopulations 3 and 6 only four times a day in Year 3. Conversely, as Project operations peak and overburden is being moved to the North OSF, Haul Trucks will drive by Tiehm’s buckwheat Subpopulation 3 a maximum of 1,050 times per day (525 round trips) on average in Year 11.

To understand the potential effects of the haul road on Subpopulations 3 and 6, dust dispersion models to estimate dust deposition within these subpopulations were run (Trinity 2023a and 2023b, **Attachment H**) and background dust deposition data were collected from readily available sources (**Table 8**).

The background dust deposition information summarized in **Table 8** represent a variety of primary and secondary sources of dust (alluvium, playa, bedrock or dune) and a variety of primary and secondary lithologies (basaltic, limestone, calcareous fines, granitic, or mixed). There is a fair degree of overlap between the differently characterized sites and substantial variation dust deposition between years within a given site. We do not have any information regarding the nearest dirt roads to these sites, traffic levels, etc. nor do we have a good handle on the influence of Cave Springs Road or the road that goes between Tiehm’s buckwheat Subpopulations 1 and 2 on average daily dust flux at these sites. Therefore, for the purposes of this analysis we have used the maximum average daily dust flux reported for all sites provided in **Table 8** as the assumed background dust loading at Tiehm’s buckwheat subpopulations.

Table 8. Summarized Dust Flux (annual and daily) from 19 Sites in Nevada and California

Rhyolite Ridge Project Site Located on Figure 18. Data Source: https://pubs.usgs.gov/of/2003/ofr-03-138/. Daily dust flux ($g/m^2/day$) was estimated from the annual dust flux provided in the opensource data base.

Trap	Altitude (m)	Primary Source	Primary Lithology	Sec. Source	Sec. Lithology	Dust flux ($g/m^2/yr$) – includes carbonate and soluble salt			Dust flux ($g/m^2/day$) – includes carbonate and soluble salt		
						99-00	00-01	01-02	99-00	00-01	01-02
T1	1235	alluvium	rhyolitic	n/a	n/a	3.92	7.66	6.93	0.011	0.021	0.019
T2	1235	alluvium	rhyolitic	n/a	n/a	9.00	7.35	5.65	0.025	0.020	0.015
T3	1237	alluvium	rhyolitic	n/a	n/a	11.11	8.68	8.84	0.030	0.024	0.024
T4	1238	alluvium	rhyolitic	n/a	n/a	8.05	5.88	6.03	0.022	0.016	0.017
T5	1238	alluvium	rhyolitic	n/a	n/a	4.52	6.07	5.13	0.012	0.017	0.014
T9	952	alluvium	rhyolitic	n/a	n/a	7.58	10.48	9.73	0.021	0.029	0.027
T10	805	alluvium	limestone[3]	playa	Calc. fines	7.15	5.14	11.45	0.020	0.014	0.031
T11	903	bedrock	Meta-morphic	playa	Calc. fines	4.00	20.98	5.01	0.011	0.057	0.014
T12	1098	bedrock	Meta-morphic	playa	Calc. fines	4.94	6.21	4.07	0.014	0.017	0.011
T13	793	alluvium	mixed	playa	Calc. fines	8.30	12.88	14.96	0.023	0.035	0.041
T14	851	alluvium	mixed	n/a	n/a	18.04	14.25	18.96	0.049	0.039	0.052
T23	1327	alluvium	granitic	n/a	n/a	8.93	10.96	9.51	0.024	0.030	0.026
T28	921	dunes	granitic	alluvium	mixed	8.68	10.08	8.50	0.024	0.028	0.023
T29	1257	playa	Calc. fines	bedrock	basaltic	10.40	8.62	10.94	0.028	0.024	0.030
T30	290	playa	Calc. fines	alluvium	granitic	10.30	11.95	9.48	0.028	0.033	0.026
T31	366	alluvium	granitic	playa	Calc. fines	10.54	14.17	12.76	0.029	0.039	0.035
T33	512	alluvium	mixed	playa	calcareous fines	10.25	9.27	10.82	0.028	0.025	0.030
T34	525	playa	Calc. fines	alluvium	limestone	12.77	16.16	15.26	0.035	0.044	0.042
T61	1431	alluvium	rhyolitic	bedrock	basaltic	9.53	7.85	15.15	0.026	0.021	0.041

The primary area of concern that has been identified in communications with USFWS is surface disturbance within 300 feet of Tiehm's buckwheat (USFWS 2021c). The focus for this analysis is the haul road that would be used to transport ore to the processing facility and the north OSF and will be proximate to Tiehm's buckwheat Subpopulations 3 and 6. Models were run based on the expected number of round trips per day for the haul trucks for year 3 and year 11, which will average 2 and 525 round trips per day, respectively (**Table 9**). Three different control efficiencies, 75, 85 and 95 percent, and two different assumptions about average silt content of roadway materials, 1.7 and 6.4 percent to bracket the likely range of potential conditions to be experienced by these subpopulations.

Table 9. Average Daily Haul Truck Roundtrips Past Subpopulation 3 Per Plan of Operation Implementation Year

Year of PoO Implementation	Average Round Trips per Day Past Sub Population 3
YR 01	0
YR 02	2
YR 03	2
YR 04	3
YR 05	11
YR 06	12
YR 07	17
YR 08	33
YR 09	41
YR 10	124
YR 11	525
YR 12	275
YR 13	383
YR 14	434
YR 15	253
YR 16	136
YR 17	66

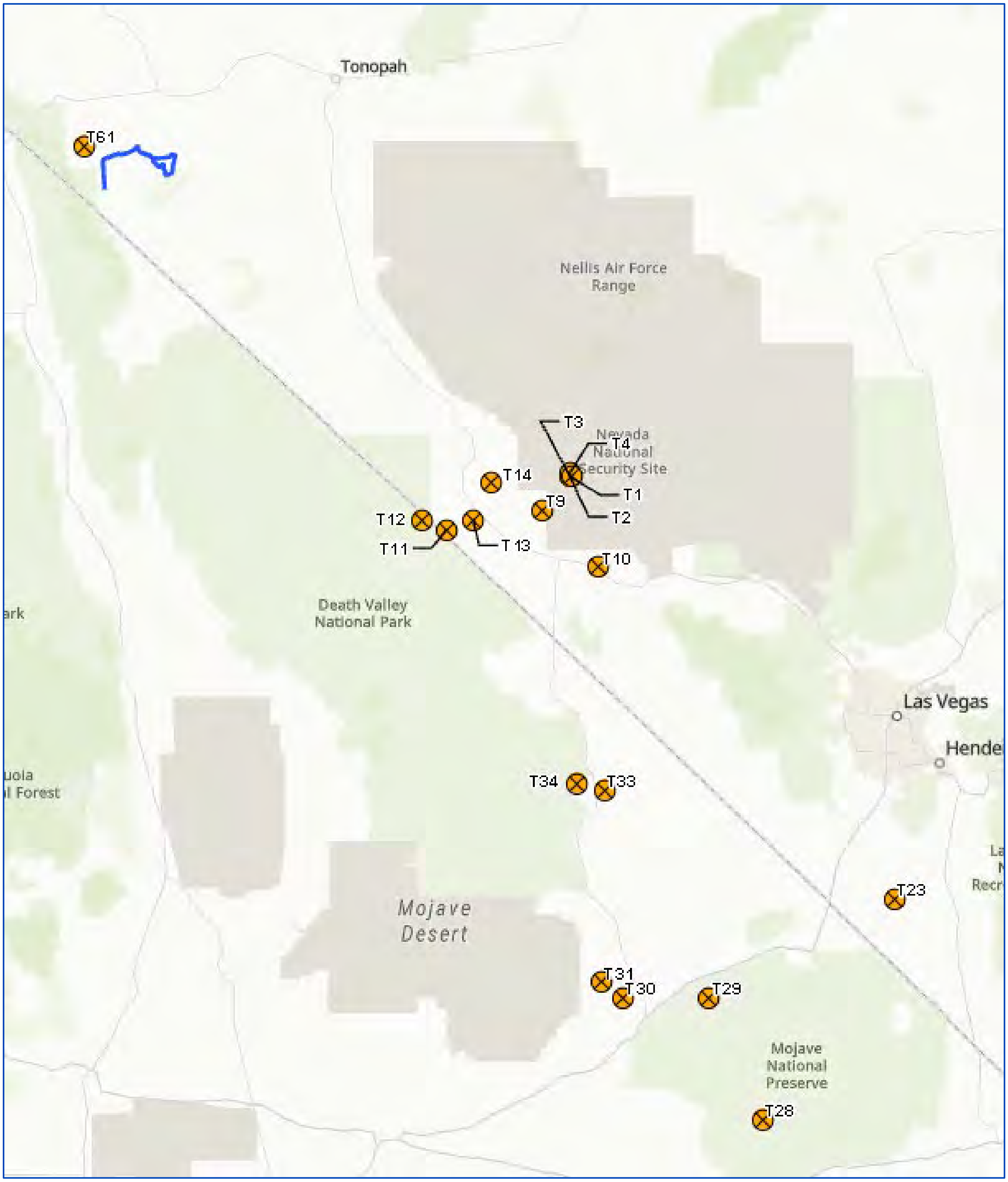

Figure 18. Dust Trap Locations for Background Dust Data in Nevada and California

The following is a summary of key assumptions used to complete analysis of fugitive dust emissions regarding the silt content as well as associated technical considerations:

- The emission calculations associated with the haul road were completed based on the methodology in EPA's AP-42, Section 13.2.2 (November 2006).
- This methodology assumes a range of surface material silt content and is not based on actual field sampling.[4] At the low end of the range considered, modeling utilized EPA AP-42, Section 13.2.2, Nevada state-wide average silt content of 1.7 percent in the emissions calculations of particulate matter due to traffic on unpaved roads as developed by the EPA (https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-section-1322-unpaved-roads-related-information-0). Based upon ongoing discussions with EPA and the BLM, silt content for impact assessment was also modeled at 6.4 percent. The 6.4 percent is based upon the "gravel road" silt content utilized in the Arizona Department of Environmental Quality (ADEQ), State Implementation Plan Revision: Regional Haze Program (2018-2028), dated August 15, 2022.
- Haul roads for the project will utilize larger size category material, such as gravel or alternative road-base materials. The materials have less silt/fines than the other roads in the state of Nevada. Therefore, the selection of the state of Nevada surface material silt content is conservative.

A more detailed description of the modeling efforts is provided in **Attachment D**. **Table 10** summarizes the model predicted dust deposition during Year 3 and Year 11 (peak year of haul truck traffic) at 75 percent, 85 percent, and 95 percent control efficiency and assuming 1.7 percent silt content. **Table 11** summarizes the model predicted dust deposition during Year 3 and Year 11 (peak year of haul truck traffic) at 75 percent, 85 percent, and 95 percent control efficiency and 6.4 percent silt content in the haul roads to bracket the likely effects to be experienced during Quarry operations. Achieving 75 percent control efficiency in year 11 with just water application would require application of 0.8 L/m^2 every 2.92 hours in the winter and 2.2 hours in the summer. Achieving 95 percent control efficiency with just water application would require application of 0.8 L/m^2 every 35 minutes in the winter and 26 minutes in the summer.

[4] Field sampling of the silt content to establish existing site conditions will not yield representative values for modeling to predict impacts during mining activities. Factors that influence this conclusion are first that the road surfaces will represent varies lithologies as the Quarry progresses, so sampling of those surfaces is not possible. Further, native surface soils and the deeper material that will be used will be subject to construction activities, gravel cover, and dust suppression techniques such as watering which will significantly alter silt content from the pre-mining condition. For these reasons the best available data for this determination are the data adopted by regulatory agencies, in this case the EPA and ADEQ.

Table 10. Model Results for Haul Road Dust Emissions for Year 3 and 11 Using 75% and 95% Control Efficiency Assuming 1.7% Silt Content

150-ton haul trucks, 2 and 525 round trips per day for year 3 and year 11, respectively.

Control Efficiency	Year	Max PM Impacts at All Populations			Population 3 Area Average of the Peak Modeled PM Impacts		
		($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
75%	3	0.00014	0.0025	0.031	0.0001	0.0013	0.021
	11	0.036	0.55	86.07	0.023	0.35	56.13
85%	3	0.000090	0.0015	0.19	0.000063	0.00081	0.12
	11	0.022	0.33	51.53	0.014	0.21	33.60
95%	3	0.00003	0.00056	0.064	0.000021	0.00030	0.042
	11	0.0073	0.11	17.24	0.0047	0.072	11.25

Table 11. Model Results for Haul Road Dust Emissions for Year 3 and 11 Using 75% and 95% Control Efficiency and 6.4% Silt Content

150-ton haul trucks, 2 and 525 round trips per day for year 3 and year 11, respectively.

Control Efficiency	Year	Max PM Impacts at All Populations			Population 3 Area Average of the Peak Modeled PM Impacts		
		($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
75%	3	0.00036	0.0061	0.78	0.0026	0.0033	0.52
	11	0.091	1.40	217.63	0.58	0.90	141.93
85%	3	0.00022	0.0037	0.47	0.00016	0.0020	0.31
	11	0.055	0.84	130.69	0.035	0.54	85.23
95%	3	0.00008	0.0013	0.16	0.000054	0.00069	0.10
	11	0.018	0.28	43.47	0.012	0.18	28.35

Table 12 provides a summary of maximum dust flux from the haul road plus the assumed background dust flux to estimate total peak dust deposition for the 1.7 percent and 6.4 percent silt content at 75 percent, 85 percent, and 95 percent control efficiencies.

Table 12. Total Maximum Dust Flux plus Assumed Background Dust Flux 0.057 $g/m^2/d$ the Maximum Reported from Three Years of Data at 19 Sites in Nevada and California at 1.7% and 6.4% Silt Content at 75, 85, and 95% Control Efficiency

Control Efficiency	Year	Daily Dust Flux ($g/m^2/d$)					
		Background	Max PM Impacts @1.7% Silt	Max PM Impacts @ 6.4% Silt	Total background plus range of model predicted deposition rates (1.7% to 6.4% Silt content)		
75%	3	0.0570	0.0025	0.0061	0.0595	to	0.0631
	11	0.0570	0.5500	1.4000	0.6070	to	1.4570
85%	3	0.0570	0.0015	0.0037	0.0585	to	0.0607
	11	0.0570	0.3300	0.8400	0.3870	to	0.8970
95%	3	0.0570	0.0006	0.0013	0.0576	to	0.0583
	11	0.0570	0.1100	0.2800	0.1670	to	0.3370

Ioneer is committing to implementation of a 95 percent control efficiency as part of the overall Air Quality Impact Assessment. The expected total maximum dust flux for all populations in the peak year of operation, including assumed maximum background levels are expected to range from 0.1670 to 0.3370 g/m^2/d at 95 percent control efficiency at 1.7 to 6.4 percent silt deposition, respectively. These values are 3.6 to 12.0 times smaller than the lowest daily flux rate reported in Lewis et al. (2017) and Wijayratne (2009). These values are significantly below the threshold level selected to trigger management strategies outlined in APCM-9. While some physiological impacts could be experienced by these plants from the increase above baseline, the effects are not expected to be detectable and are not expected to result in population level effects. Notably, Wijayratne (2009) reported that for the Lane milkvetch subject to substantially higher dust flux than calculated here, the effects noted in their study were not apparent in plants the following year. As a perennial herb we suspect Tiehm’s buckwheat will have the same resilience. Tiehm’s buckwheat’s resilience was evidenced by the recovery of many plants that had been impacted by rodent herbivory in 2020.

Because of the small potential for adverse impacts to physiological processes and the primary productivity of Tiehm’s buckwheat from increased dust deposition, Ioneer incorporated a monitoring program and management provisions to enhance control of fugitive dust emissions proximate to Tiehm’s buckwheat populations. As outlined in APCM-9, dust control activities will include monitoring of fugitive dust emissions at Tiehm’s buckwheat subpopulations to ensure that control measures implemented along the haul road are sufficient to manage dust flux from the road at 95 percent control efficiency to stay within the levels of effect evaluated here. These control measures will include regular watering of the haul roads (currently scheduled for approximately 40-minute intervals). In addition, NDEP/BLM approved dust suppressants will be used when evaporation rates or other factors are required to maintain appropriate levels of control. As outlined in APCM-9, should monitoring indicate that threshold levels of average daily dust flux measured as trailing 12-month average in any population exceeding the 4g/m^2/day threshold identified in APCM-9 additional controls will be required as described in APCM-9.

4.3.2. Reduced Availability of Pollinators

Pollinators for Tiehm’s buckwheat belong to a rich and diverse guild and aside from the loss of habitat discussed above, Project operations could result in additional impacts. None of these potential effects are expected to significantly impact the availability of pollinators to Tiehm’s buckwheat. Potential sources of adverse impact from construction of the haul road and realignment of Cave Springs Road can include the direct impacts to insects during road construction, loss of habitat, and creation of barriers to movement for some. During operations impacts could include direct mortality from vehicle impact, light attraction, and trapping, and from the effects of noise and dust.

While the effects of habitat loss from Project development on potential pollinators is discussed in the prior section, addressing habitat loss effects from Project development on critical habitat PBF2 (pollinators), Project operations can also differentially impact the members of the diverse guild of insects that provide pollinator services to Tiehm's buckwheat. While the literature regarding road impacts for invertebrates is not as well developed as the literature related to vertebrate mortality along roadways, the factors that influence the degree of road mortality to invertebrates are expected to be similar and affected by speed, traffic volume, road width, time of day or year, and the characteristics of the habitat along the roadway. These potential effects have also been reported to differ between and within insect groups as the species within groups has been shown to respond differently to roads (Muñoz et al. 2014). The impacts of roads on pollinators have generally been found restricted to a narrow band and in one study pollinator visitation to flowers in road verges was found to be unimpacted outside of plants within two meters of the road edge (Phillips et al. 2021). Due to the low speed and relatively low volume of traffic on the haul road, the effects of direct mortality from collision with haul trucks is expected to be a small fraction of the total loss from habitat removal prior to restoration and is not expected to result in loss of pollinator services for Tiehm's buckwheat.

Broad spectrum lights at night have negative impacts on many plant pollinators and may also impact daytime pollination if effects carry over (Giavi et al. 2021). There have been many theories about why insects are "attracted" to light. Fabian et al. (2023, a preprint paper not certified by peer review) argue that "dorsal tilting" by insects is a highly conserved trait that allows insects to orient their flight behavior in natural light conditions. This behavior in the presence of artificial light at night "traps" the insect in an erratic flight path near artificial light sources (Fabian et al. 2023). Fabian et al. (2023) also argues that their data suggests that artificial light traps passing insects rather than attracting them directly. Considering the limited light sources during night time operations at the Quarry, the distance of the processing plant from Tiehm's buckwheat critical habitat, that most data indicate that the diverse guild of potential Tiehm's buckwheat pollinators are diurnal, and the dissimilarity of the potential pollinator communities across subpopulations and within critical habitat the potential adverse impacts from light on pollinators providing service to subpopulations of Tiehm's buckwheat is relatively small. However, the potential adverse effects of increased nighttime lighting would be mitigated by the development of a light management plan (APCM 8) including the use of 500nm filtered LED fixtures or pure narrow-band amber LED lamps or their equivalent for vehicle task lighting.

4.3.3. Direct Impacts from Flyrock

Control of flyrock is of critical concern in blast design and of critical safety concern. The Trim Blasting techniques described above that will be used to minimize the amount of energy that is transmitted into the Quarry highwall and maximize the efficiency of the use of energy to fragment rock for Quarry excavation can also minimize flyrock. There is a direct correlation between the efficiency of the energy used to fragment rock for excavation and flyrock. Control of flyrock distance can be done through proper blast design, delay sequencing and its implementation under strict supervision in the field by competent authority. However, in the case of controlling flyrock within short distances, additional measures to physically arrest flyrock by muffling/covering the blasting area by heavy rubber mats/wire rope mats with other covering materials have led in minimizing the flyrock distance within 20 m.

The Rhyolite Ridge Project will follow best practices for all blasting activities in accordance with MSHA standards. In addition to appropriate blasting techniques that minimize the potential for flyrock, all blasting activities planned within 100 meters of any sensitive resource that cannot be relocated prior to blasting, including Tiehm's buckwheat subpopulations, will use blasting mats as described above to minimize the risk of flyrock leaving the blasting area.

4.3.4. Cumulative Effects

The Action Area is largely BLM and all lands proposed for development of Project facilities within the Operations Area are public lands managed by the BLM. We are aware of no actions within critical habitat authorized by the BLM that are not related to Project activities. Any activity having the potential to adversely affect Tiehm's buckwheat or its critical habitat that requires approval by from the BLM would trigger substantive protections required by Section 7 of the ESA and would therefore not be an action that requires cumulative effects analysis under Section 7 consultation. Ongoing vegetation monitoring activities within critical habitat, including habitat actually occupied by Tiehm's buckwheat, is not expected to result in any adverse impacts to this species and its critical habitat. The proposed Project activities and the necessary limitation of dispersed recreational activities within the critical habitat (see APCM 4 and APCM 5) for all practical purposes eliminate other non-federal actions and cumulative adverse effects are anticipated that require further analysis.

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______2023b. Tiehm's Buckwheat Subpopulations in Relation to Existing Disturbance. A Technical Memorandum Prepared for Ioneer USA Corporation. September 26, 2023.

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ATTACHMENT A
2023 Tiehm's Buckwheat Census Summary

Tiehm's Buckwheat Population Count Status Report

Prepared for: Rebecca Sawyer, Ioneer USA

CC: Jim Tress, WestLand Engineering & Environmental Services
David Cerasale, WestLand Engineering & Environmental Services

Prepared by: Kris Kuyper, WestLand Engineering & Environmental Services

Date: June 15, 2023

Project Number: 2198.01

Rev	Document No.	Date	Prepared by	Approved	Revision
0	RR30-0013-00-EN-MEM-00024	15/6/2023	Kris Kuyper		For Use

1. OBJECTIVE

A comprehensive count of all Tiehm's buckwheat (*Eriogonum tiehmii*) (ERTI) in known subpopulations at the Rhyolite Ridge Lithium-Boron Project was conducted during the period of May 25 to June 7, 2023. This memo covers the methods and results of the complete count.

In addition to the count, subpopulation boundaries were remapped, and the acreage of all occupied habitat calculated. Belt transects were resampled to produce a population estimate and collect data on the size class distribution, flower production, and percent ERTI plant cover of each subpopulation. The population estimate was compared to the direct count as an evaluation of the estimate's accuracy. The methods and results of the mapping, estimate, and demographic analysis will be reported in a separate memo.

2. METHODOLOGY

Complete Plant Count

Detection calibration: A test small plot was established prior to large plot counts to determine observer accuracy. The test plot had a known quantity of plants. "Individuals" were defined as plants that were separated by 5cm or more. "Dead" was established as plants with no live material even if the base was intact.

Pre-existing transect markers were used to delineate large plots in subpopulations 2, 3, 4, and 6. Fluorescent rope was secured to the transect markers and laid along the ground following the transect lines. An alternative grid system with plots measuring 100 ft^2 was established in subpopulation 1 due to its large size. In subpopulations with high plant density (6 and 1) the large plots were subdivided into smaller lanes 1 to 2 meters wide, delineated by measuring tapes and/or pin flags.

Surveyors counted all individual ERTI using one of several methods. In subpopulations 2, 3, 4, and 5, each plant was marked with a pin flag or a small metal coin marker and a GPS point was taken; or, in the case of large clusters of plants, a flag was placed in the middle of the cluster, a GPS point was taken, and the number of plants in the cluster were recorded. Individual plants in a cluster were tagged with small metal markers so that the surveyor could keep track of which plants had been counted. In subpopulations 6 and 1, surveyors used a handheld clicker counter to record individual plants as they walked lanes that were 1-2 meters wide. A GPS point was recorded in each plot with the total number of plants recorded. In all subpopulations, GPS points were recorded for individual plants on the boundaries. All pin flags, ropes, and metal coins were removed after the count was completed for each subpopulation.

3. RESULTS

The results of the complete plant count are summarized in Table 1.

Tiehm's Buckwheat Subpopulation Count 2023

Subpopulation	Number of Plants
1	5,600
2	4,190
3	1,943
4	1,888
5	31
6a (incl. 7)	7,784
6b	3,476
8	4
Total	**24,916**

ATTACHMENT B
Technical Review of Tiehm's Buckwheat Ecology

(INCLUDED BY REFERENCE PROVIDED IN RECORD DOCUMENT)

ATTACHMENT C
2023 Tiehm's Buckwheat Subpopulations and Disturbance

Tiehm's Buckwheat Subpopulations in Relation to Existing Disturbance

Prepared for: Ioneer, Rhyolite Ridge LLC

Prepared by: WestLand Engineering & Environmental Services

Date: September 26, 2023

Project Number: 2198.01

Rev	Document No.	Date	Prepared by	Approved	Revision
0	RR30-0013-00-EN-MEM-00027	26/9/2023	WestLand		For Use

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Tables

Figures

(follow text)

1. INTRODUCTION

A comprehensive count of all Tiehm's buckwheat (*Eriogonum tiehmii*; ERTI) in known subpopulations at the Rhyolite Ridge Lithium-Boron Project was conducted during the period of May 25 to June 7, 2023. Using the result of the comprehensive count, this memo provides information on the spatial relationship between Tiehm's buckwheat and existing disturbance within subpopulations, mainly trenches and adits from historical mining and exploration activities.

2. METHODOLOGY

2.1. COMPLETE PLANT COUNT

Detection calibration: A test small plot was established prior to large plot counts to determine observer accuracy. The test plot had a known quantity of plants. "Individuals" were defined as plants that were separated by 5cm or more. "Dead" was established as plants with no live material even if the base was intact.

Pre-existing transect markers were used to delineate large plots in subpopulations 2, 3, 4, and 6. Fluorescent rope was secured to the transect markers and laid along the ground following the transect lines. An alternative grid system with plots measuring 100 ft2 was established in subpopulation 1 due to its large size. In subpopulations with high plant density (6 and 1) the large plots were subdivided into smaller lanes 1 to 2 meters wide, delineated by measuring tapes and/or pin flags.

Surveyors counted all individual ERTI using one of several methods. In subpopulations 2, 3, 4, and 5, each plant was marked with a pin flag or a small metal coin marker and a GPS point was taken; or, in the case of large clusters of plants, a flag was placed in the middle of the cluster, a GPS point was taken, and the number of plants in the cluster were recorded. Individual plants in a cluster were tagged with small metal markers so that the surveyor could keep track of which plants had been counted. In subpopulations 6 and 1, surveyors used a handheld clicker counter to record individual plants as they walked lanes that were 1-2 meters wide. A GPS point was recorded in each plot with the total number of plants recorded. In all subpopulations, GPS points were recorded for individual plants on the boundaries. All pin flags, ropes, and metal coins were removed after the count was completed for each subpopulation.

3. RESULTS

The results of the complete plant count are summarized in Table 1.

Table 1. Tiehm's Buckwheat Subpopulation Count 2023

Subpopulation	Number of Plants	Estimated Area of Occupied Habitat (acres)	Density (plants/acre)
1	5,600	4.82	1,162
2	4,190	1.56	2,686
3	1,943	0.63	3,084
4	1,888	1.05	1,815
5	31	0.04	775
6a, 6b, 7	11,260	1.88	5,989
8	4	-	-
Total	**24,916**	**9.98**[1]	**2,497**

[1] This estimate differs slightly from FWS (2023)[1], likely due to rounding differences.

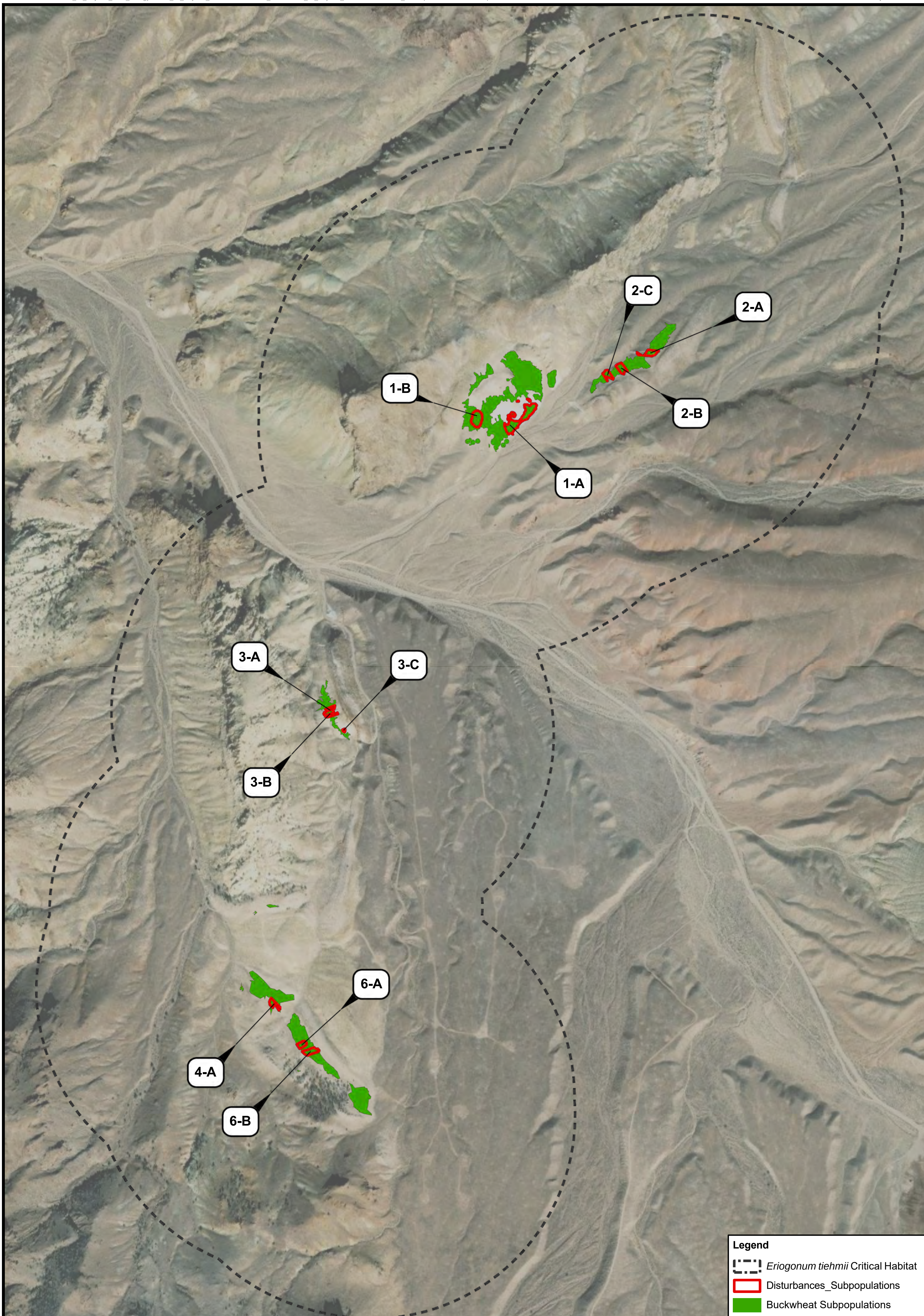
Within subpopulations, there are areas of historical disturbance associated with mineral mining and exploration. In particular, there are 2 trenches and adits within subpopulation 1, 3 within subpopulation 2, 3 within subpopulation 3, 1 within subpopulation 4, and 2 within subpopulation 6 (6a, 6b, and 7 combined; **Figure 1**). The density of Tiehm's buckwheat at and in the vicinity of these historical disturbances is often considerably higher than the density within the subpopulation as a whole. **Table 2** demonstrates this phenomenon, with several disturbed areas within subpopulations 1, 2, and 3 having substantially higher densities than the subpopulations as a whole. Note that disturbed portions within subpopulation 6 also have densities comparable to the overall density within the subpopulation.

Table 2. Tiehm's Buckwheat Densities within Disturbed Areas

Subpopulation	Disturbance Area (Figure 1)	Density of plants within 25 ft of disturbance (plants/acre)	Density of subpopulation (plants/acre)
1	1-A	28.6	1,162
1	1-B	0	1,162
2	2-A	620	2,686
2	2-B	3,490	2,686
2	2-C	4,375	2,686
3	3-A	6,986	3,084
3	3-B	5,178	3,084
3	3-C	1,400	3,084
4	4-A	171	1,815
6	6-A	4,700	5,989
6	6-B	5,918	5,989

[1] U.S. Fish and Wildlife Service. 2022. Special status assessment report for *Eriogonum tiehmii* (Tiehm's buckwheat), Version 2.0. Department of the Interior California-Great Basin Region. Sacramento, California. May, 2022.

FIGURE



T1S, R37E, Portion(s) of Sections(s) 28 and 34,
T2S, R37E, Portion(s) of Section(s) 3,
Esmerelda County, Nevada,
Rhyolite Ridge USGS 7.5' Quadrangle
Projection: NAD 1983 UTM Zone 11N
Image Source: Maxar WorldView2 11/5/2022

N

0 500 1,000 Feet

0 150 300 Meters

WestLand Engineering & Environmental Services
100% EMPLOYEE OWNED

IONEER RHYOLITE RIDGE LLC
Location and
Report Type

PROJECT LOCATION
Figure 1

ATTACHMENT D
Cedar Creek Plant Cover Memoranda

Cedar Creek Associates, Inc. 2021. Revised 2023. “Vegetation Cover Sampling in the Eriogonum tiehmii Subpopulations.” A Technical Memorandum Prepared for WestLand Engineering and Environmental Services.

______2023. “Vegetation Cover Sampling in the Eriogonum tiehmii Critical Habitat. A Technical Memorandum Prepared for WestLand Engineering and Environmental Services.

Technical Memo

PO Box 272150,
Fort Collins, CO 80527
(303) 818-1978

Date: November 29, 2021, Revised September 23, 2023
To: Westland Resources
From: Cedar Creek Associates, Inc.
Subject: Vegetation Cover Sampling in the *Eriogonum tiehmii* Sub-populations

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Cedar Creek Associates, Inc. (Cedar Creek) was contracted to evaluate vegetation cover within the sub-populations of *Eriogonum tiehmii* (ETRI) near Dyer, Nevada. Tiehm's buckwheat occurs as a single population within the Rhyolite Ridge area. The plants occur in nine discrete sites, identified as sub-populations 1-5 and 6a & 6b. Sub-populations 7 and 8 were too small for this survey. All subpopulations are within a 1.5 square-mile area, and collectively cover approx. 10 acres. The goal of this survey is to characterize the vegetation community assemblage which grows with ERTI within the sub-populations.

Methods

A total of 45 sample sites were generated on a systematic grid across all the sub-populations. Sampling sites are shown on Figures 1-3. This sampling approach created unbiased vegetation evaluation sites which are proportionally distributed across the sub-populations based on size. This approach resulted in sample sites along the edges and in the core of the different sub-populations. A qualified ecologist and/or botanist located the origin of each sample site using a GPS. At each sample site vegetation canopy cover by species and ground cover were evaluated with ocular estimates within a 3-meter radius plot. To achieve this, the qualified surveyor used 3-meter reference tool to determine the edge of the sampling plot. For the protection of critical habitat, no ground disturbing equipment was used for the vegetation sampling. Within the sample site, the qualified surveyor systematically traversed the plot to inventory every species. Suitable botanical guides were used to properly identify each species. For each species encountered in the inventory, the qualified surveyor estimated canopy cover using ocular estimates of live vegetation to the nearest half percent within the plot. Scale references for 1% and 5% cover should be used to estimate cover. If a plant only had one (or two occurrences) in the plot and amounted to negligible cover, it was given a trace value. Once all the vegetation canopy cover was accounted for, the qualified surveyor estimated the remaining litter, rock, and bare soil ground cover to sum to 100%.

Findings

Table 1 displays the absolute vegetation cover results for each sample sub-population and entire population from this study. The raw data from each sub-population can be found attached to this memo. ERTI was detected in sub-populations 1, 2, 3, 4 and 6a &6b, a single sampling site in sub-population 5 did not detect ERTI. Table 2 displays the relative vegetation cover results for each sample sub-population and entire population from this study. Relative cover for ERTI ranged from 4.3% to 10.5% in the sub-populations with a population relative cover of 7.5%. This demonstrates that ERTI is commonly found with other species. The other notable findings regarding vegetation community assemblages from this study include:

- When ERTI occurred in the plot:
  - o Perennial grasses were encountered in the plot 69% of the time.
  - o Saltlover (*Halogeton glomerata*) was encountered in the plot 66% of the time.
  - o Shadescale (*Atriplex confertifolia*) was encountered in the plot 86% of the time.
  - o It was the only species in the plot 3% of the time.

Table 1 Rhyolite Ridge - Vegetation Cover - 2021

Average Cover Summary

Percent Cover Based on Ocular Estimates

				1	2	3	4	5	6a & 6B	All
			Sub-population -->	**1**	**2**	**3**	**4**	**5**	**6a & 6B**	**All**
			Acres -->	4.82	1.56	0.63	1.04	0.05	1.88	9.98
			Number of Samples -->	22	6	2	4	1	10	45
Grasses and Grass-likes										
N	P	*Achnatherum hymenoides*	indian ricegrass	0.1	0.2	0.3	0.8	0.5	0.4	0.2
N	P	*Hilaria jamesii*	galleta	0.8	0.3	0.3	2.6	3.0	5.1	1.9
N	P	*Sporobolus airoides*	alkali sacaton	1.9	4.0	-	0.5	1.0	1.2	1.8
Forbs										
N	P	*Enceliopsis nudicaulis*	nakedstem sunray	0.3	-	-	0.5	-	-	0.2
N	P	*Eriogonum nummulare*	money buckwheat	-	-	-	0.1	0.5	0.1	0.0
N	P	*Eriogonum tiehmii*	Tiehm's buckwheat	0.8	0.3	0.8	0.5	-	1.0	0.7
I	A	*Halogeton glomerata*	saltlover	1.5	0.3	0.8	0.1	1.0	1.2	1.1
Shrubs & Sub-shrubs										
N	P	*Artemisia nova*	black sagebrush	-	-	7.5	1.5	3.0	2.3	1.0
N	P	*Atriplex confertifolia*	shadescale	1.1	2.5	1.5	0.5	-	0.5	1.1
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush	0.0	-	1.0	-	-	0.8	0.2
N	P	*Ephedra nevadensis*	Nevada jointfir	0.4	-	1.0	0.1	1.0	0.9	0.4
N	P	*Gutierrezia sarothrae*	broom snakeweed	0.0	-	-	-	-	0.4	0.1
N	P	*Krascheninnikovia lanata*	winterfat	0.1	-	-	-	-	0.1	0.1
N	P	*Lycium andersonii*	water jacket	-	-	-	-	-	0.1	0.0
N	P	*Menodora spinescens*	spiny menodora	0.2	-	-	1.5	5.5	0.3	0.4
				Mean						
			Total Plant Cover	**7.1**	**7.7**	**13.0**	**8.8**	**15.5**	**14.1**	**9.3**
			Rock	78.4	69.4	52.0	55.4	51.0	50.9	67.3
			Litter	1.2	1.1	4.0	1.3	3.0	1.7	1.5
			Bare Ground	13.3	21.8	31.0	34.6	30.5	33.4	22.0
			Tiehm's Buckwheat Presence (%)	**68.2**	**83.3**	**50.0**	**50.0**	**0.0**	**60.0**	**64.4**
Summary by Lifeform:			Perennial Grasses	2.8	4.5	0.5	3.9	4.5	6.6	3.9
			Perennial Forbs	1.0	0.3	0.8	1.1	0.5	1.1	0.9
			Shrubs & Sub-shrubs	1.8	2.5	11.0	3.6	9.5	5.3	3.4
			Annual Grasses	-	-	-	-	-	-	-
			Annual & Biennial Forbs	1.5	0.3	0.8	0.1	1.0	1.2	1.1

N=Native, I=Introduced, X-Noxious
A=Annual, B=Biennial, P=Perennial

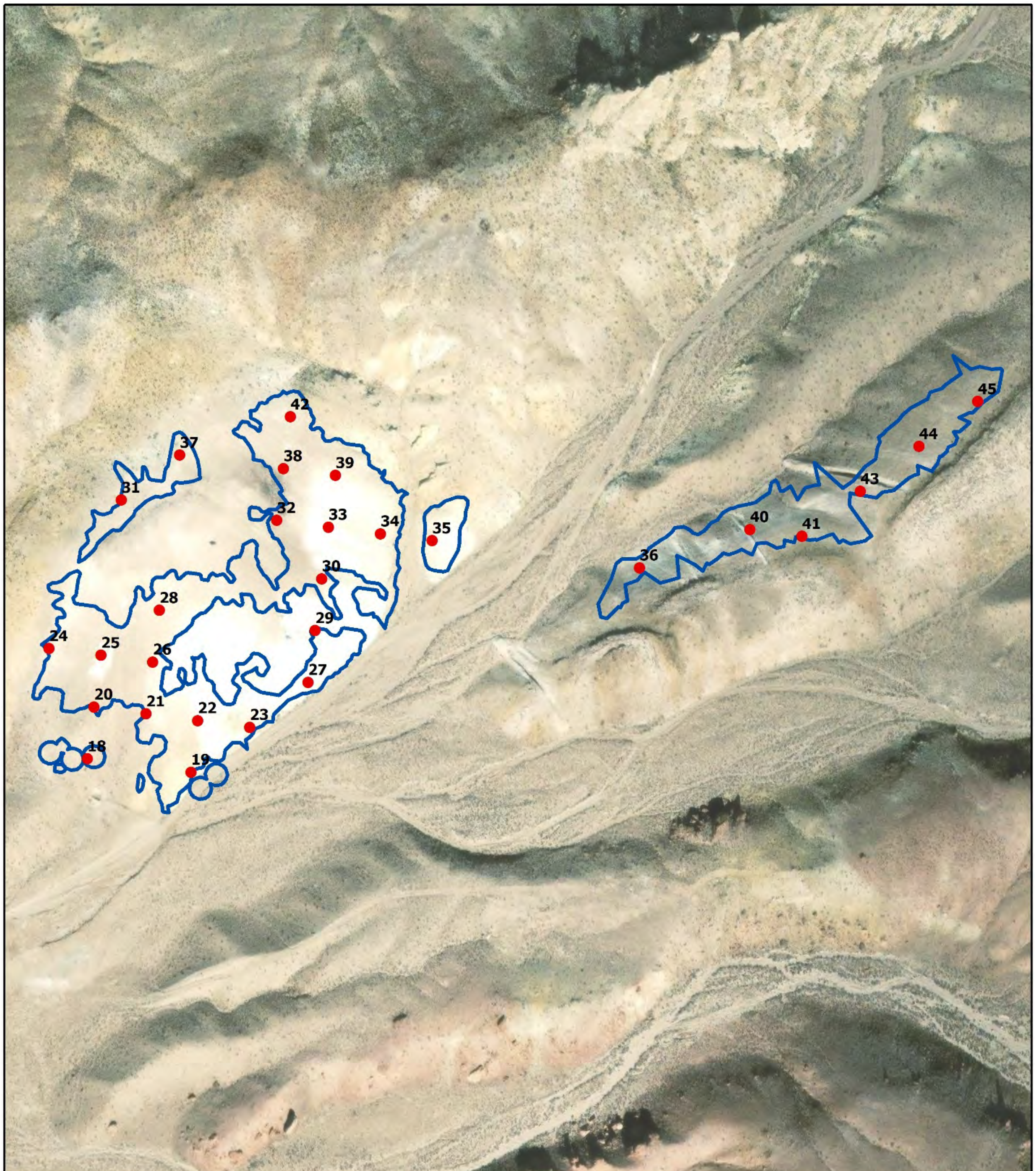
Table 2 Rhyolite Ridge - Vegetation Cover - 2021

Relative Cover Summary

Percent Cover Based on Ocular Estimates

				1	2	3	4	5	6a & 6B	All
			Sub-population -->	1	2	3	4	5	6a & 6B	All
			Acres -->	4.82	1.56	0.63	1.04	0.05	1.88	9.98
			Number of Samples -->	22	6	2	4	1	10	45
Grasses and Grass-likes										
N	P	*Achnatherum hymenoides*	indian ricegrass	1.0	2.2	1.9	8.6	3.2	2.8	2.5
N	P	*Hilaria jamesii*	galleta	11.5	4.3	1.9	30.0	19.4	35.9	20.1
N	P	*Sporobolus airoides*	alkali sacaton	26.4	52.2	-	5.7	6.5	8.2	19.0
Forbs										
N	P	*Enceliopsis nudicaulis*	nakedstem sunray	3.8	-	-	5.7	-	-	1.9
N	P	*Eriogonum nummulare*	money buckwheat	-	-	-	1.4	3.2	0.7	0.5
N	P	*Eriogonum tiehmii*	Tiehm's buckwheat	10.5	4.3	5.8	5.7	-	6.8	7.5
I	A	*Halogeton glomerata*	saltlover	21.3	4.3	5.8	1.4	6.5	8.2	11.9
Shrubs & Sub-shrubs										
N	P	*Artemisia nova*	black sagebrush	-	-	57.7	17.1	19.4	16.4	11.2
N	P	*Atriplex confertifolia*	shadescale	15.9	32.6	11.5	5.7	-	3.6	11.9
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush	0.6	-	7.7	-	-	5.7	2.6
N	P	*Ephedra nevadensis*	Nevada jointfir	5.1	-	7.7	1.4	6.5	6.0	4.8
N	P	*Gutierrezia sarothrae*	broom snakeweed	0.6	-	-	-	-	2.8	1.2
N	P	*Krascheninnikovia lanata*	winterfat	1.0	-	-	-	-	0.7	0.6
N	P	*Lycium andersonii*	water jacket	-	-	-	-	-	0.4	0.1
N	P	*Menodora spinescens*	spiny menodora	2.2	-	-	17.1	35.5	1.8	4.2
Summary by Lifeform:			Perennial Grasses	38.9	58.7	3.8	44.3	29.0	47.0	41.7
			Perennial Forbs	14.3	4.3	5.8	12.9	3.2	7.5	9.9
			Shrubs & Sub-shrubs	25.5	32.6	84.6	41.4	61.3	37.4	36.5
			Annual Grasses	-	-	-	-	-	-	-
			Annual & Biennial Forbs	21.3	4.3	5.8	1.4	6.5	8.2	11.9

N=Native, I=Introduced, X-Noxious
A=Annual, B=Biennial, P=Perennial



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N
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Legend

Vegetation Sampling Sites

Tiehm's Buckwheat Sub-populations

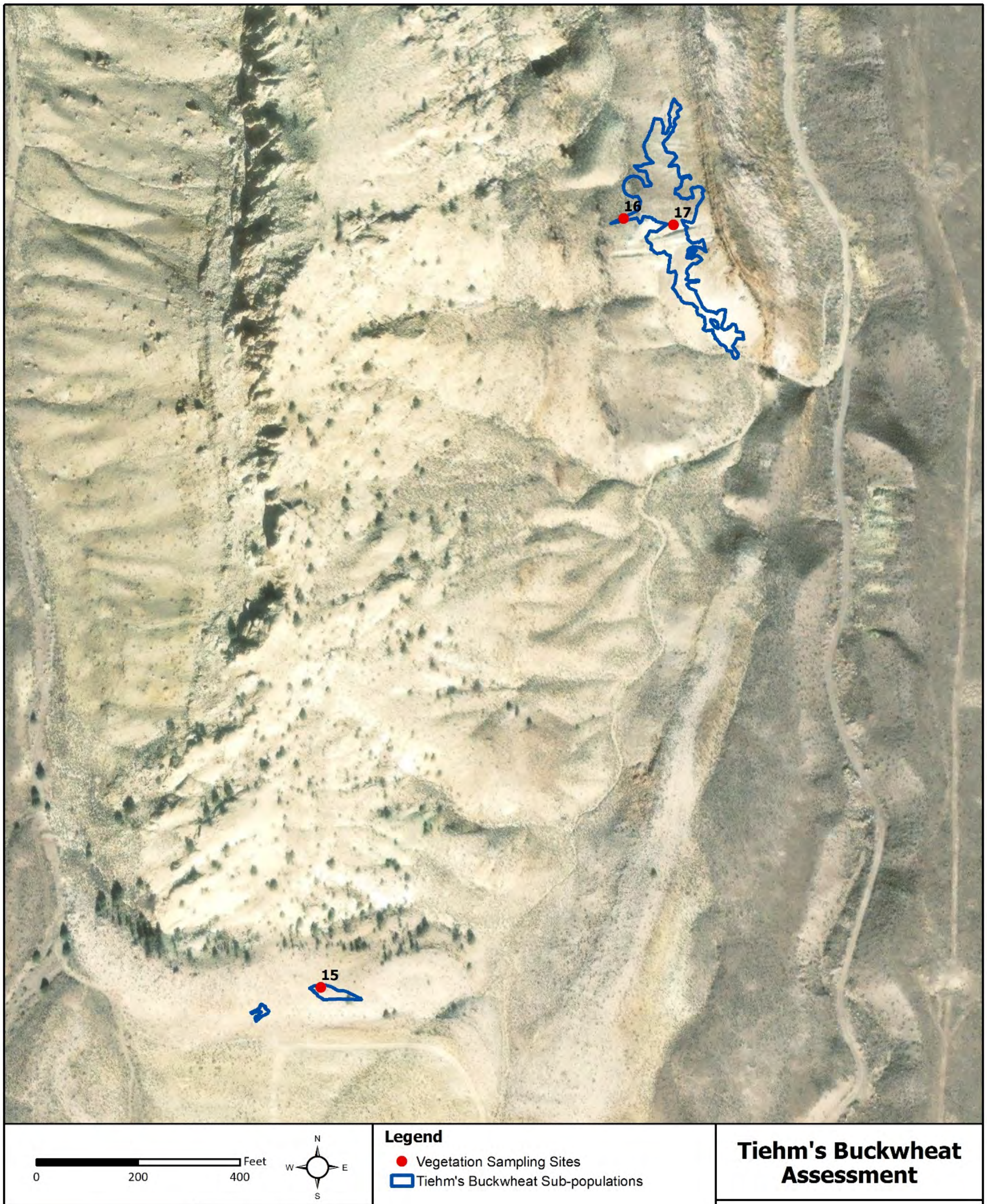
Tiehm's Buckwheat Assessment

CEDAR CREEK ASSOCIATES, INC.

Coordinate System: NAD83 Z13N

Sources: Cedar Creek

Figure 1: Sample Sites On Sub-populations 1&2



Tiehm's Buckwheat Assessment

Figure 2:
Sample Sites On
Sub-populations 3&5

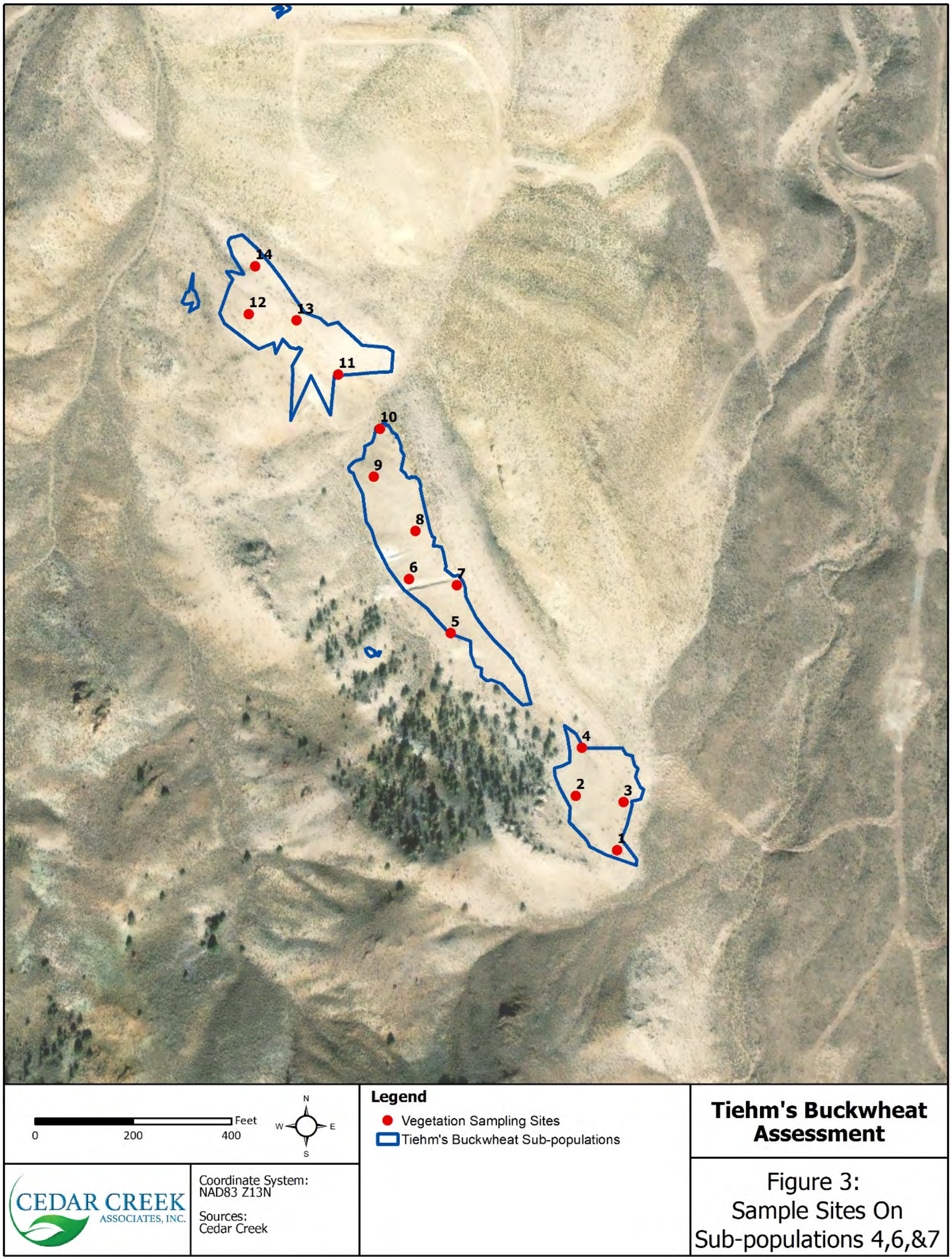


Figure 3: Sample Sites On Sub-populations 4,6,&7

Table 3 Rhyolite Ridge - Vegetation Cover - 2021

Sub-Population Vegetation Cover

			Transect No.——>	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	37	38	39	42	36	40	41	43	44	45	16	17	11
			Sub-population——>	1																						2						3		
Grasses and Grass-likes																																		
N	P	*Achnatherum hymenoides*	indian ricegrass											1						T					0.5		1					0.5		
N	P	*Elymus elymoides*	squirreltail																								T							
N	P	*Hilaria jamesii*	galleta	3		1				4							5				1		1		3	2					T	0.5		5
N	P	*Sporobolus airoides*	alkali sacaton	1.5		1.5	10	2.5		3	0.5	5		0.5				5			4	2	5		1	12					12			
N	P	*Sporobolus cryptandrus*	sand dropseed																															
Forbs																																		
N	P	*Astragalus newberryi*	Newberry's milkvetch														T																	
N	P	*Castilleja chromosa*	indian paintbrush																															
N	P	*Cryptantha sp.*	cryptantha					T																										
N	P	*Dalea searlsiae*	Searls' prairie clover																								T							
N	P	*Enceliopsis nudicaulis*	nakedstem sunray	0.5				1.5		T				1			T	T					1	2	T									
N	P	*Eriogonum nummulare*	money buckwheat																															
N	A	*Eriogonum deflexum*	flatcrown buckwheat														T					T												
N	P	*Eriogonum tiehmii*	Tiehm's buckwheat				T	2	2.5		1.5	1	4	1	T	T		1	T	2.5	1		T		T	1.5	0.5	T		T	T		1.5	T
N	P	*Eremogone kingii*	King's sandwort																															
N	P	*Chamaesyce fendleri*	Fendler's sandmat																															
I	A	*Halogeton glomerata*	saltlover	7	1	15	4	0.5		1	T	0.5		T			0.5	T		T	1	2.5	T		0.5	T			2	T	T	1.5		0.5
N	P	*Hymenopappus filifolius*	fineleaf hymenopappus														T																	
N	P	*Penstemon barnebyi*	Barneby's beardtongue																															
N	P	*Phlox stansburyi*	cold desert phlox																															
N	P	*Stanleya pinnata*	desert princesplume																													T		
Shrubs & Sub-shrubs																																		
N	P	*Artemisia nova*	black sagebrush																													15		
N	P	*Atriplex confertifolia*	shadescale	0.5	0.5			0.5	1	1	3	2	0.5	1	5	0.5	0.5	0.5		6	2	T	0.5	0.5	T	2	5	1.5	2	2.5	2	1	2	0.5
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush														1															2		
N	P	*Ephedra nevadensis*	Nevada jointfir	1		5																1		1								2		
N	P	*Gutierrezia sarothrae*	broom snakeweed														0.5							0.5										
N	P	*Krascheninnikovia lanata*	winterfat																			1.5												
N	P	*Lycium andersonii*	water jacket																															
N	P	*Menodora spinescens*	spiny menodora	0.5													3																	
			Total Plant Cover	**14.0**	**1.5**	**22.5**	**14.0**	**7.0**	**3.5**	**9.0**	**5.0**	**8.0**	**4.5**	**4.5**	**5.0**	**0.5**	**10.5**	**6.5**	**0.0**	**8.5**	**9.0**	**7.0**	**7.5**	**4.0**	**5.0**	**17.5**	**6.5**	**1.5**	**4.0**	**2.5**	**14.0**	**22.5**	**3.5**	**6.0**
			Rock	75.0	89.0	45.0	66.0	78.0	89.0	82.0	85.0	88.0	92.0	83.0	92.0	89.5	52.0	85.0	96.0	78.0	81.0	49.0	71.5	91.0	68.0	73.0	69.0	89.0	64.5	65.0	56.0	57.5	46.5	50.0
			Litter	3.0	0.5	8.0	3.0	1.0	2.0	1.0	T	T	T	T	2.0	T	1.5	T	2.0	T	T	1.0	T	1.0	T	T	T	T	0.5	1.0	5.0	8.0	T	1.0
			Bare ground	8.0	9.0	24.5	17.0	14.0	5.5	8.0	10.0	4.0	3.5	12.5	1.0	10.0	36.0	8.5	2.0	13.5	10.0	43.0	21.0	4.0	27.0	9.5	24.5	9.5	31.0	31.5	25.0	12.0	50.0	43.0
			Tiehm's Buckwheat Presence				**x**	**x**	**x**		**x**	**x**	**x**	**x**	**x**	**x**		**x**	**x**	**x**	**x**		**x**		**x**	**x**	**x**	**x**		**x**	**x**		**x**	**x**
Average Cover by Lifeform			**Perennial Grasses**	4.5	-	2.5	10.0	2.5	-	7.0	0.5	5.0	-	1.5	-	-	5.0	5.0	-	-	5.0	2.0	6.0	-	4.5	14.0	1.0	-	-	-	12.0	1.0	-	5.0
			Perennial Forbs	0.5	-	-	-	3.5	2.5	-	1.5	1.0	4.0	2.0	-	-	-	1.0	-	2.5	1.0	-	1.0	2.0	-	1.5	0.5	-	-	-	-	-	1.5	-
			Shrubs & Sub-shrubs	2.0	0.5	5.0	-	0.5	1.0	1.0	3.0	1.5	0.5	1.0	5.0	0.5	5.0	0.5	-	6.0	2.0	2.5	0.5	2.0	-	2.0	5.0	1.5	2.0	2.5	2.0	20.0	2.0	0.5
			Annual Grasses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Annual Forbs	7.0	1.0	15.0	4.0	0.5	-	1.0	-	0.5	-	-	-	-	0.5	-	-	-	1.0	2.5	-	-	0.5	-	-	-	2.0	-	-	1.5	-	0.5

N=Native, I=Introduced, X-Noxious

A=Annual, B=Biennial, P=Perennial

Technical Memo

PO Box 272150
Fort Collins, CO 80527
(303) 818-1978

Date: September 23, 2023
To: Westland Resources
From: Cedar Creek Associates, Inc.
Subject: Vegetation Cover Sampling in the *Eriogonum tiehmii* Critical Habitat

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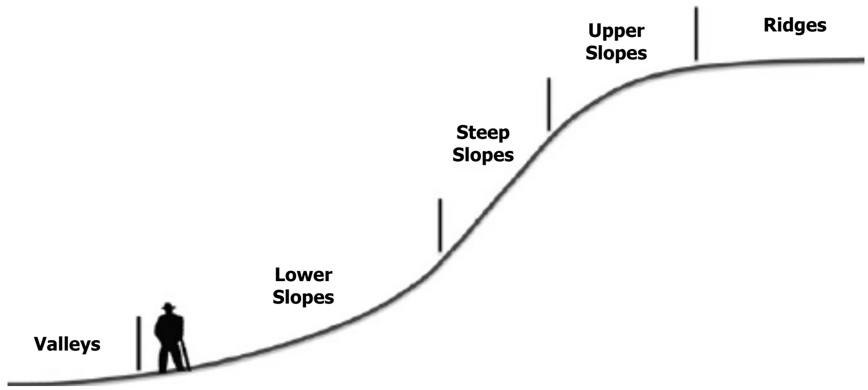
Cedar Creek Associates, Inc. (Cedar Creek) was contracted to evaluate vegetation cover within the proposed critical habitat of *Eriogonum tiehmii* (ETRI) near Dyer, Nevada. Tiehm's buckwheat occurs as a single population, occurring in nine discrete sub-populations, within the Rhyolite Ridge area. The plants occur in nine discrete sites, identified as sub-populations 1-5, 6a & 6b, 7 and 8. The proposed critical habitat includes the physical footprint of where the plants currently occur, as well as their immediate surroundings out to 1,640 ft (500 m) in every direction from the periphery of each subpopulation, which comprises approximately 910 acres. The goal of this survey is to characterize the vegetation community assemblage within the critical habitat.

<u>Methods</u>

A total of 83 vegetation sample sites, which are co-located with pollinator evaluation sites, were generated on a systematic grid across critical habitat, including the sub-populations. Vegetation sampling sites are shown on Figures 1. This sampling approach created unbiased vegetation assessment sites which are proportionally distributed across the critical habitat.

A qualified ecologist and/or botanist located the origin of each sample site using a GPS. At each sample site vegetation canopy cover by species and ground cover were evaluated with ocular estimates within a 3-meter radius plot. To achieve this, the qualified surveyor used 3-meter reference tool to determine the edge of the sampling plot. For the protection of critical habitat, no ground disturbing equipment was used for the vegetation sampling. Within the sample site, the qualified surveyor systematically traversed the plot to inventory every species. Suitable botanical guides were used to properly identify each species. For each species encountered in the inventory, the qualified surveyor estimated canopy cover using ocular estimates of live vegetation to the nearest half percent within the plot. Scale references for 1% and 5% cover should be used to estimate cover. If a plant only had one (or two occurrences) in the plot and amounted to negligible cover, it was given a trace value. Once all the vegetation canopy cover was accounted for, the qualified surveyor estimated the remaining litter, rock, and bare soil ground cover to sum to 100%.

GIS mapping was used to categorize sample sites based on slope position; valley, lower slopes, steep slopes, upper slopes, and ridges. To understand the nature of vegetation communities outside of the subpopulations data have also been compiled using only the 83 plots located outside of the delineated subpopulations by slope position.



Findings

Table 1 displays the absolute vegetation cover results for each slope position in the critical habitat along with all 83 samples collected in critical habitat area. The topographical analysis yielded 26 valley bottom samples, 10 lower slopes samples, 28 steep slopes samples, 4 upper slopes samples, and 15 ridges samples.

- The valley bottoms within critical habitat exhibited a total vegetation cover of 22.98 percent, where shrubs and sub-shrubs were the dominant lifeform with 16.56 percent cover. The dominant vegetation community included the native shrub black sagebrush (6.52 percent), the native perennial grass galleta (3.46 percent; *Pleuraphis jamesii*), and the native shrubs Nevada jointfir (2.48 percent; *Ephedra nevadensis*) and fourwing Saltbush (1.25 percent; *Atriplex canescens*);

- The lower slopes exhibited a total vegetation cover of 20.70 percent, where shrubs and sub-shrubs were the dominant lifeform with 12.50 percent cover. The dominant vegetation community included the native shrub black sagebrush (5.20 percent), the native perennial grass galleta (3.55 percent), and the native shrubs spiny hopsage (1.70 percent; *Grayia spinosa*) and fourwing saltbush (1.15 percent);

- The steep slopes exhibited a total vegetation cover of 20.77 percent, where shrubs and sub-shrubs were the dominant lifeform with 13.30 percent cover. The dominant vegetation community included the native perennial grass galleta (5.25 percent) and the native shrubs black sagebrush (2.59 percent), spiny menodora (2.30 percent; *Menodora spinescens*) and Nevada jointfir (2.05 percent);

- The upper slopes exhibited a total vegetation cover of 18.53 percent, where shrubs and sub-shrubs were the dominant lifeform with 11.63 percent cover. The dominant vegetation community included the native perennial grass galleta (6.00 percent), the native shrubs Nevada jointfir (4.38 percent) and spiny hopsage (2.50 percent), and the nonnative forb saltlover (1.13 percent cover); and,

- The ridges exhibited a total vegetation cover of 18.53 percent, where shrubs and sub-shrubs were the dominant lifeform with 12.93 percent cover. The dominant vegetation community included the native shrubs black sagebrush (4.63 percent) and the native perennial grass galleta (3.73 percent), and shadescale (2.17 percent; *Atriplex confertifolia*), and Nevada jointfir (1.90 percent).

Overall, the vegetation assemblage of critical habitat outside of the delineated subpopulations area differs from occupied Tiehm's buckwheat habitat. Valleys exhibit the greatest vegetation cover and species diversity.

In comparison, the sub-populations were evaluated in a previous study with 45 sample points (Cedar Creek 2021) and exhibited 9.33% total cover, where perennial grasses were the dominant lifeform with 3.89%. Black sagebrush (*Artemisia nova*) was the dominant species with 4.23% cover throughout the critical habitat. This differs from the sub-population vegetation community, where galleta (*Pleuraphis jamesii*) was the dominant species with 1.88% cover. Overall, the vegetation assemblage of the critical habitat area differs from the delineated sub-population vegetation community since it exhibits significantly greater species cover, diversity, and lifeform composition.

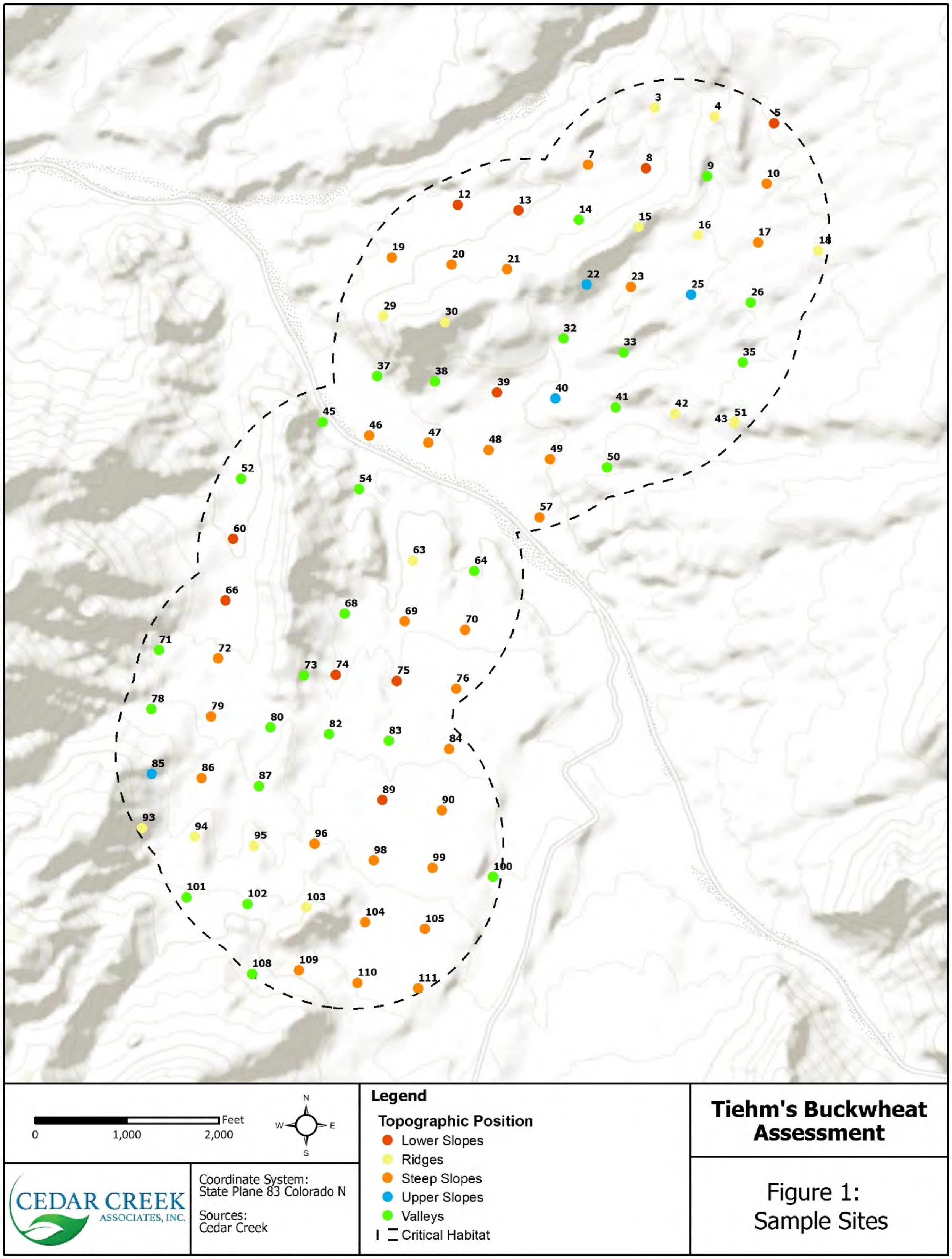
Table 1 ERTI Critical Habitat Vegetation Assessment

Average Cover Summary

Percent Cover

			Slope Position -->	Valleys	Lower Slopes	Steep Slopes	Upper Slopes	Ridges	All
			Number of Samples -->	26	10	28	4	15	83
Grasses and Grass-likes									
N	P	*Achnatherum hymenoides*	indian ricegrass	0.33	0.35	0.16	-	0.13	0.22
N	P	*Achnatherum thurberianum*	Thurber's needlegrass	0.33	0.20	0.07	-	0.17	0.18
N	P	*Aristida purpurea*	purple threeawn	0.15	0.10	0.13	0.25	0.23	0.16
I	A	*Bromus tectorum*	cheatgrass	0.17	0.05	0.14	-	0.20	0.14
N	P	*Elymus elymoides*	squirreltail	0.08	0.20	0.09	-	0.07	0.09
N	P	*Festuca sp.*	Fescue sp.	0.48	-	0.18	-	0.27	0.26
N	P	*Hesperostipa comata*	needle and thread grass	0.06	0.20	-	-	-	0.04
N	P	*Pleuraphis jamesii*	galleta	3.46	3.55	5.25	6.00	3.73	4.25
N	P	*Poa secunda*	Sandberg bluegrass	0.12	0.05	-	-	-	0.04
N	P	*Sporobolus airoides*	alkali sacaton	0.02	-	0.07	-	-	0.03
N	P	*Sporobolus cryptandrus*	sand dropseed	-	-	0.04	-	-	0.01
Forbs									
I	A	*Alyssum alyssoides*	desert alyssum	0.02	-	-	-	-	0.01
N	P	*Caulanthus pilosus*	hairy wild cabbage	-	-	-	-	0.03	0.01
N	A	*Collinsia parviflora*	maiden blue eyed Mary	0.02	-	-	-	-	0.01
N	A	*Cryptantha sp.*	unidentifiable cryptantha sp.	-	-	0.02	-	-	0.01
N	P	*Eriogonum inflatum*	desert trumpet	-	-	0.11	0.13	0.33	0.10
N	A	*Eriogonum brachyanthum*	shortflower buckwheat	0.04	0.05	0.07	-	-	0.04
N	P	*Eriogonum ovalifolium*	cushion buckwheat	0.08	-	0.02	-	-	0.03
N	A	*Chamaesyce fendleri*	Fendler's sandmat	-	0.10	-	-	-	0.01
I	A	*Halogeton glomeratus*	saltlover	0.71	2.70	0.54	1.13	0.23	0.83
N	P	*Linum lewisii*	Lewis flax	0.08	-	-	-	-	0.02
I	A	*Neokochia americana*	green molly	0.08	0.10	0.21	0.13	0.20	0.15
N	P	*Physaria sp.*	bladderpod sp.	0.02	-	-	-	-	0.01
I	A	*Salsola tragus*	russian thistle	0.17	0.45	0.36	-	-	0.23
N	P	*Sphaeralcea ambigua*	desert globemallow	-	0.05	-	-	-	0.01
N	A	*Unidentifiable sp.*	unidentifiable annual sp.	0.02	0.05	-	-	-	0.01
N	P	*Unidentifiable sp.*	unknown perennial sp.	-	-	0.02	-	-	0.01
Shrubs, Sub-shrubs, & Cacti									
N	P	*Artemisia nova*	black sagebrush	6.52	5.20	2.59	1.25	4.63	4.44
N	P	*Artemisia spinescens*	budsage	0.04	-	1.46	-	0.67	0.63
N	P	*Atriplex canescens*	four-wing saltbush	1.25	1.15	0.73	-	0.03	0.78
N	P	*Atriplex confertifolia*	shadescale	0.33	0.35	0.64	0.63	2.17	0.78
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush	0.79	1.30	1.59	1.00	1.30	1.22
N	P	*Cylindropuntia echinocarpa*	siver cholla	-	-	0.11	-	-	0.04
N	P	*Echinocereus engelmannii*	strawberry hedgehog	-	-	0.05	-	-	0.02
N	P	*Ephedra nevadensis*	Nevada jointfir	2.48	1.15	2.05	4.38	1.90	2.16
N	P	*Ericameria nauseosa*	rubber rabbitbrush	0.81	0.40	0.11	-	-	0.34
N	P	*Grayia spinosa*	spiny hopsage	0.98	1.70	0.75	2.50	0.33	0.95
N	P	*Gutierrezia sarothrae*	broom snakeweed	0.04	-	-	-	-	0.01
N	P	*Juniperus osteosporum*	Utah juniper	0.08	-	-	-	-	0.02
N	P	*Krascheninnikovia lanata*	winterfat	0.27	0.30	0.16	-	0.17	0.20
N	P	*Lycium andersonii*	water jacket	0.04	-	-	0.50	0.13	0.06
N	P	*Menodora spinescens*	spiny menodora	0.85	0.95	2.30	1.13	0.93	1.38
N	P	*Opuntia polyacantha*	plains prickly pear	0.06	-	-	-	-	0.02
N	P	*Pinus monophylla*	singleleaf pinyon	1.27	-	0.68	-	-	0.63
N	P	*Purshia glandulosa*	desert bitterbrush	0.65	-	-	-	-	0.20
N	P	*Tetradymia canescens*	spineless horsebrush	-	-	0.07	0.25	0.60	0.14
N	P	*Tetradymia glabrata*	littleleaf horsebrush	0.12	-	-	-	0.07	0.05
				Mean					
			Total Plant Cover	**22.98**	**20.70**	**20.77**	**19.25**	**18.53**	**20.98**
			Rock	46.00	49.05	47.50	50.75	57.17	49.12
			Litter	10.23	8.60	10.16	8.25	6.97	9.33
			Bare Ground	20.79	21.65	21.57	21.75	17.33	20.58
			Desirable Cover (excluding Nuisance and Noxious Weeds)	21.83	17.40	19.52	18.00	17.90	19.62
Summary by Lifeform:			Perennial Grasses	5.02	4.65	5.98	6.25	4.60	5.28
			Perennial Forbs	0.17	0.05	0.14	0.13	0.37	0.18
			Shrubs, Sub-shrubs, & Cacti	16.56	12.50	13.30	11.63	12.93	14.08
			Annual Grasses	0.17	0.05	0.14	-	0.20	0.14
			Annual & Biennial Forbs	1.06	3.45	1.20	1.25	0.43	1.29
Species Richness (including trace values)			Grasses	10	8	10	2	8	11
			Forbs	16	10	15	7	9	24
			Shrubs, Sub-shrubs, & Cacti	17	9	15	8	13	20
			Total Species Richness	43	27	40	17	30	55

N=Native, I=Introduced, X-Noxious
A=Annual, B=Biennial, P=Perennial



Tiehm's Buckwheat Assessment

Figure 1:
Sample Sites

Attached Raw Data

Table 2 ERTI Critical Habitat Vegetation Assessment

Valleys - Slope Position Vegetation Cover

Percent Ground Cover Based on Visual Estimates of 3 Meter Radius from Sample Point

		Transect No.——>	9	14	26	32	33	35	37	38	41	45	50	52	54	64	68	71	73	78	80	82	83	87	100	101	102	108	Average Cover (%)	Relative Cover (%)	Freq. (%)
Grasses and Grass-likes																													
N P	*Achnatherum hymenoides*	indian ricegrass	2.0					0.5					1.0		T	1.0	T		1.0		T	0.5		1.0	0.5	1.0			**0.33**	**1.42**	**46**
N P	*Achnatherum thurberianum*	Thurber's needlegrass														2.0										0.5	4.0	2.0	**0.33**	**1.42**	**15**
N P	*Aristida purpurea*	purple threeawn											0.5					0.5	1.0								2.0		**0.15**	**0.67**	**15**
I A	*Bromus tectorum*	cheatgrass	2.0															2.0							0.5				**0.17**	**0.75**	**12**
N P	*Elymus elymoides*	squirreltail	T											0.5		1.0						0.5		T					**0.08**	**0.33**	**19**
N P	*Festuca sp.*	Fescue sp.																								0.5	5.0	7.0	**0.48**	**2.09**	**15**
N P	*Hesperostipa comata*	needle and thread grass																						1.5					**0.06**	**0.25**	**4**
N P	*Pleuraphis jamesii*	galleta		2.0	8.0		13.0	13.5	0.5	3.0				3.0		15.0	0.5	9.0	1.0		0.5	0.5	12.0	4.5	1.0	2.0		1.0	**3.46**	**15.06**	**69**
N P	*Poa secunda*	Sandberg bluegrass	T													3.0													**0.12**	**0.50**	**8**
N P	*Sporobolus airoides*	alkali sacaton									0.5																		**0.02**	**0.08**	**4**
Forbs																													
I A	*Alyssum alyssoides*	desert alyssum									T					0.5													**0.02**	**0.08**	**8**
N P	*Castilleja angustifolia*	northwestern Indian paintbrush																									T		**0.00**	**0.00**	**4**
N A	*Collinsia parviflora*	maiden blue eyed Mary				0.5								T											T				**0.02**	**0.08**	**12**
N A	*Descurainia pinnata*	western tansymustard	T										T																**0.00**	**0.00**	**8**
N P	*Enceliopsis nudicaulis*	nakedstem sunray		T																									**0.00**	**0.00**	**4**
N P	*Eriogonum inflatum*	desert trumpet							T									T											**0.00**	**0.00**	**8**
N A	*Eriogonum brachyanthum*	shortflower buckwheat							T		T		T			0.5		0.5						T					**0.04**	**0.17**	**23**
N P	*Eriogonum ovalifolium*	cushion buckwheat														2.0													**0.08**	**0.33**	**4**
I A	*Halogeton glomeratus*	saltlover		3.0	0.5	8.0	T		T	1.0		4.0	T	T		0.5	0.5	1.0	T		T								**0.71**	**3.10**	**54**
N P	*Linum lewisii*	Lewis flax	2.0																										**0.08**	**0.33**	**4**
I A	*Neokochia americana*	green molly		2.0																									**0.08**	**0.33**	**4**
N P	*Physaria sp.*	bladderpod sp.									0.5																		**0.02**	**0.08**	**4**
I A	*Salsola tragus*	russian thistle	0.5	T		1.0									T			2.0						1.0					**0.17**	**0.75**	**23**
N P	*Sphaeralcea ambigua*	desert globemallow		T									T																**0.00**	**0.00**	**8**
N A	*Unidentifiable sp.*	unidentifiable annual sp.				0.5						T												T	T				**0.02**	**0.08**	**15**
N P	*Unidentifiable sp.*	unknown perennial sp.														T													**0.00**	**0.00**	**4**
Shrubs, Sub-shrubs, & Cacti																													
N P	*Artemisia nova*	black sagebrush	1.0	0.5				8.5			12.0		1.0	19.0	13.0		14.0		7.0	12.0	16.0	14.0	2.0	11.5		14.0	8.0	16.0	**6.52**	**28.37**	**65**
N P	*Artemisia spinescens*	budsage																					1.0						**0.04**	**0.17**	**4**
N P	*Atriplex canescens*	four-wing saltbush	15.0			T	0.5		5.0		2.5	5.0	3.5		1.0														**1.25**	**5.44**	**31**
N P	*Atriplex confertifolia*	shadescale		2.0	0.5								2.5	1.0					1.0				1.0					0.5	**0.33**	**1.42**	**27**
N P	*Chrysothamnus greenei*	Greene's rabbitbrush			T	1.0				1.0	0.5	2.0	4.5		7.0				1.0		1.0	2.0			0.5				**0.79**	**3.43**	**42**
N P	*Ephedra nevadensis*	Nevada jointfir	T	2.0	7.0		0.5		4.0	6.0		2.0		3.0	4.0	1.0	3.0	4.0	2.0	3.0	0.5	3.0	3.0		4.5	11.0		1.0	**2.48**	**10.79**	**77**
N P	*Ericameria nauseosa*	rubber rabbitbrush	14.0									7.0																	**0.81**	**3.51**	**8**
N P	*Grayia spinosa*	spiny hopsage			1.0					2.0				2.0		0.5		4.0						3.5	7.5	5.0			**0.98**	**4.27**	**31**
N P	*Gutierrezia sarothrae*	broom snakeweed	1.0																										**0.04**	**0.17**	**4**
N P	*Juniperus osteosporum*	Utah juniper																	2.0										**0.08**	**0.33**	**4**
N P	*Krascheninnikovia lanata*	winterfat								0.5			2.0			2.0					2.0			0.5					**0.27**	**1.17**	**19**
N P	*Lycium andersonii*	water jacket																									1.0		**0.04**	**0.17**	**4**
N P	*Menodora spinescens*	spiny menodora		2.0	0.5		1.0			3.0							0.5		6.0	2.0	1.0	3.0	3.0						**0.85**	**3.68**	**38**
N P	*Opuntia polyacantha*	plains prickly pear																							1.0			0.5	**0.06**	**0.25**	**8**
N P	*Pinus monophylla*	singleleaf pinyon													2.0					20.0							11.0		**1.27**	**5.52**	**12**
N P	*Purshia glandulosa*	desert bitterbrush																								5.0	12.0		**0.65**	**2.85**	**8**
N P	*Tetradymia glabrata*	littleleaf horsebrush										3.0																	**0.12**	**0.50**	**4**
																												Mean		
		Total Plant Cover	**37.5**	**13.5**	**17.5**	**11.0**	**15.0**	**22.5**	**9.5**	**16.5**	**16.0**	**23.0**	**15.0**	**28.5**	**27.0**	**29.0**	**18.5**	**23.0**	**22.0**	**37.0**	**21.0**	**23.5**	**22.0**	**23.5**	**15.5**	**39.0**	**43.0**	**28.0**	**22.98**		
		Rock	46.0	65.0	46.0	71.0	52.0	54.5	56.5	50.0	43.0	19.0	65.0	35.5	50.0	42.0	63.5	41.0	38.0	29.0	25.0	54.0	51.0	26.5	53.5	37.0	40.0	42.0	**46.00**		
		Litter	8.0	10.0	11.5	15.0	2.0	18.0	8.0	11.0	23.0	10.0	12.0	4.0	4.0	8.0	6.0	6.0	9.0	9.0	24.0	2.5	10.0	21.0	16.0	8.0	7.0	3.0	**10.23**		
		Bare ground	8.5	11.5	25.0	3.0	31.0	5.0	26.0	22.5	18.0	48.0	8.0	32.0	19.0	21.0	12.0	30.0	31.0	25.0	30.0	20.0	17.0	29.0	15.0	16.0	10.0	27.0	**20.79**		
		Desirable Cover (excluding Nuisance and Noxious Weeds)	35.0	8.5	17.0	2.0	15.0	22.5	9.5	15.5	16.0	19.0	15.0	28.5	27.0	28.0	18.0	18.0	22.0	37.0	21.0	23.5	22.0	22.5	15.0	39.0	43.0	28.0	**21.83**		
Average Cover by Lifeform		**Perennial Grasses**	2.0	2.0	8.0	-	13.0	14.0	0.5	3.0	0.5	-	1.5	3.5	-	22.0	0.5	9.5	3.0	-	0.5	1.5	12.0	7.0	1.5	4.0	11.0	10.0	**5.0**		
		Perennial Forbs	2.0	-	-	-	-	-	-	-	0.5	-	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	**0.2**		
		Shrubs & Sub-shrubs	31.0	6.5	9.0	1.0	2.0	8.5	9.0	12.5	15.0	19.0	13.5	25.0	27.0	3.5	17.5	8.0	19.0	37.0	20.5	22.0	10.0	15.5	13.5	35.0	32.0	18.0	**16.6**		
		Annual Grasses	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	-	-	-	-	0.5	-	-	-	**0.2**		
		Annual Forbs	0.5	5.0	0.5	10.0	-	-	-	1.0	-	4.0	-	-	-	1.5	0.5	3.5	-	-	-	-	-	1.0	-	-	-	-	**1.1**		
			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			

N=Native, I=Introduced, X=Noxious
A=Annual, B=Biennial, P=Perennial

Table 3 ERTI Critical Habitat Vegetation Assessment

Lower Slopes - Slope Position Vegetation Cover

Percent Ground Cover Based on Visual Estimates of 3 Meter Radius from Sample Point

			Transect No.——>	5	8	12	13	39	60	66	74	75	89	Average Cover (%)	Relative Cover (%)	Freq. (%)
Grasses and Grass-likes																
N	P	*Achnatherum hymenoides*	indian ricegrass	0.5					1.0			2.0		**0.35**	**1.69**	**30**
N	P	*Achnatherum thurberianum*	Thurber's needlegrass							1.0		1.0		**0.20**	**0.97**	**20**
N	P	*Aristida purpurea*	purple threeawn							1.0				**0.10**	**0.48**	**10**
I	A	*Bromus tectorum*	cheatgrass							0.5				**0.05**	**0.24**	**10**
N	P	*Elymus elymoides*	squirreltail						2.0			T		**0.20**	**0.97**	**20**
N	P	*Hesperostipa comata*	needle and thread grass										2.0	**0.20**	**0.97**	**10**
N	P	*Pleuraphis jamesii*	galleta			4.0	9.0			5.0	2.0	8.0	7.5	**3.55**	**17.15**	**60**
N	P	*Poa secunda*	Sandberg bluegrass							0.5				**0.05**	**0.24**	**10**
Forbs																
N	P	*Chaenactis douglasii*	Douglas' dustymaiden						T	T				**0.00**	**0.00**	**20**
N	A	*Eriogonum brachyanthum*	shortflower buckwheat										0.5	**0.05**	**0.24**	**10**
N	P	*Eriogonum ovalifolium*	cushion buckwheat										T	**0.00**	**0.00**	**10**
N	A	*Chamaesyce fendleri*	Fendler's sandmat						1.0					**0.10**	**0.48**	**10**
I	A	*Halogeton glomeratus*	saltlover		T	0.5		26.5			T			**2.70**	**13.04**	**40**
I	A	*Neokochia americana*	green molly		0.5	0.5								**0.10**	**0.48**	**20**
I	A	*Salsola tragus*	russian thistle					T	1.0		2.0		1.5	**0.45**	**2.17**	**40**
N	P	*Sphaeralcea ambigua*	desert globemallow							0.5				**0.05**	**0.24**	**10**
N	A	*Unidentifiable sp.*	unidentifiable annual sp.										0.5	**0.05**	**0.24**	**10**
N	P	*Unidentifiable sp.*	unknown perennial sp.		T			T						**0.00**	**0.00**	**20**
Shrubs, Sub-shrubs, & Cacti																
N	P	*Artemisia nova*	black sagebrush	14.0		2.5			2.0	13.0	12.0	8.0	0.5	**5.20**	**25.12**	**70**
N	P	*Atriplex canescens*	four-wing saltbush	4.0				1.5			6.0			**1.15**	**5.56**	**30**
N	P	*Atriplex confertifolia*	shadescale		3.0								0.5	**0.35**	**1.69**	**20**
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush	4.0		0.5		0.5	4.0		2.0	2.0		**1.30**	**6.28**	**60**
N	P	*Ephedra nevadensis*	Nevada jointfir		1.0	2.0				5.0			3.5	**1.15**	**5.56**	**40**
N	P	*Ericameria nauseosa*	rubber rabbitbrush						4.0					**0.40**	**1.93**	**10**
N	P	*Grayia spinosa*	spiny hopsage				13.0					4.0		**1.70**	**8.21**	**20**
N	P	*Krascheninnikovia lanata*	winterfat			T	2.0					1.0		**0.30**	**1.45**	**30**
N	P	*Menodora spinescens*	spiny menodora		0.5	1.0							8.0	**0.95**	**4.59**	**30**
														Mean		
			Total Plant Cover	**22.5**	**5.0**	**11.0**	**24.0**	**28.5**	**15.0**	**26.5**	**24.0**	**26.0**	**24.5**	**20.70**		
			Rock	46.0	82.0	62.0	40.0	40.5	45.0	48.5	34.0	42.0	50.5	**49.05**		
			Litter	12.0	3.0	8.0	12.0	2.0	5.0	6.0	8.0	10.0	20.0	**8.60**		
			Bare ground	19.5	10.0	19.0	24.0	29.0	35.0	19.0	34.0	22.0	5.0	**21.65**		
			Desirable Cover (excluding Nuisance and Noxious Weeds)	22.5	4.5	10.0	24.0	2.0	14.0	26.0	22.0	26.0	23.0	**17.40**		
Average Cover by Lifeform			**Perennial Grasses**	0.5	-	4.0	9.0	-	3.0	7.5	2.0	11.0	9.5	**4.7**		
			Perennial Forbs	-	-	-	-	-	-	0.5	-	-	-	**0.1**		
			Shrubs & Sub-shrubs	22.0	4.5	6.0	15.0	2.0	10.0	18.0	20.0	15.0	12.5	**12.5**		
			Annual Grasses	-	-	-	-	-	-	0.5	-	-	-	**0.1**		
			Annual Forbs	-	0.5	1.0	-	26.5	2.0	-	2.0	-	2.5	**3.5**		

N=Native, I=Introduced, X=Noxious A=Annual, B=Biennial, P=Perennial

Table 4 ERTI Critical Habitat Vegetation Assessment

Steep Slopes - Slope Position Vegetation Cover

Percent Ground Cover Based on Visual Estimates of 3 Meter Radius from Sample Point

			Transect No.——>	7	10	17	19	20	21	23	46	47	48	49	57	69	70	72	76	79	84	86	90	96	98	99	104	105	109	110	111	Average Cover (%)	Relative Cover (%)	Freq. (%)
Grasses and Grass-likes																																		
N	P	*Achnatherum hymenoides*	indian ricegrass					1.0	T										0.5			0.5		0.5	T				2.0			**0.16**	**0.77**	**25**
N	P	*Achnatherum thurberianum*	Thurber's needlegrass														1.0	1.0														**0.07**	**0.34**	**7**
N	P	*Aristida purpurea*	purple threeawn															2.0				1.0			0.5							**0.13**	**0.60**	**11**
I	A	*Bromus tectorum*	cheatgrass															1.0		1.0		2.0								T		**0.14**	**0.69**	**14**
N	P	*Elymus elymoides*	squirreltail				0.5		0.5											1.0		0.5			T							**0.09**	**0.43**	**18**
N	P	*Festuca sp.*	Fescue sp.																										3.0	2.0		**0.18**	**0.86**	**7**
N	P	*Hesperostipa comata*	needle and thread grass											T																		**0.00**	**0.00**	**4**
N	P	*Pleuraphis jamesii*	galleta	4.0	12.0	11.0	6.0	1.0	0.5	13.0	2.0	5.5	2.0	0.5	5.0	12.0	13.0	4.0	7.0	3.0	3.0		5.0	1.5	5.0	5.0	7.5	5.5	2.0	7.0	4.0	**5.25**	**25.28**	**96**
N	P	*Sporobolus airoides*	alkali sacaton													2.0																**0.07**	**0.34**	**4**
N	P	*Sporobolus cryptandrus*	sand dropseed							1.0																						**0.04**	**0.17**	**4**
Forbs																																		
I	A	*Alyssum alyssoides*	desert alyssum			T																										**0.00**	**0.00**	**4**
N	A	*Amsinckia tessellata*	bristly fiddleneck									T																				**0.00**	**0.00**	**4**
N	P	*Astragalus sp.*	milkvetch			T																										**0.00**	**0.00**	**4**
N	P	*Castilleja angustifolia*	northwestern Indian paintbrush																					T								**0.00**	**0.00**	**4**
N	A	*Collinsia parviflora*	maiden blue eyed Mary																											T		**0.00**	**0.00**	**4**
N	A	*Cryptantha sp.*	unidentifiable cryptantha sp.									0.5	T	T											T							**0.02**	**0.09**	**14**
N	P	*Eriogonum inflatum*	desert trumpet	3.0																												**0.11**	**0.52**	**4**
N	A	*Eriogonum brachyanthum*	shortflower buckwheat			0.5							T	0.5	T			1.0														**0.07**	**0.34**	**18**
N	P	*Eriogonum ovalifolium*	cushion buckwheat																					0.5	T							**0.02**	**0.09**	**7**
I	A	*Halogeton glomeratus*	saltlover		0.5	0.5	0.5		0.5		4.0	T	0.5	T	0.5	1.5	1.0	2.0		1.0			0.5								2.0	**0.54**	**2.58**	**54**
I	A	*Neokochia americana*	green molly		1.0		2.0			2.0							1.0															**0.21**	**1.03**	**14**
I	A	*Salsola tragus*	russian thistle	T								T	1.5		0.5			3.0				1.0				T					4.0	**0.36**	**1.72**	**29**
N	P	*Sphaeralcea ambigua*	desert globemallow			T																										**0.00**	**0.00**	**4**
N	A	*Unidentifiable sp.*	unidentifiable annual sp.			T																										**0.00**	**0.00**	**4**
N	P	*Unidentifiable sp.*	unknown perennial sp.						0.5																							**0.02**	**0.09**	**4**
Shrubs, Sub-shrubs, & Cacti																																		
N	P	*Artemisia nova*	black sagebrush		0.5			12.0	3.0	2.0		0.5								9.0		4.0		4.0	13.5				21.0	3.0		**2.59**	**12.47**	**39**
N	P	*Artemisia spinescens*	budsage		0.5											2.0	1.0		2.0	0.5	6.0		2.5			12.0	5.0	6.0		3.0	0.5	**1.46**	**7.05**	**43**
N	P	*Atriplex canescens*	four-wing saltbush	4.0	1.0						1.0	0.5	1.0	7.0	2.0			4.0														**0.73**	**3.53**	**29**
N	P	*Atriplex confertifolia*	shadescale	2.0	0.5	1.5				0.5						2.0	1.0		1.0				2.0			2.5		0.5		0.5	4.0	**0.64**	**3.10**	**43**
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush				2.0	0.5	2.0		3.0	25.0			1.0							4.0		2.5				0.5	4.0			**1.59**	**7.65**	**36**
N	P	*Cylindropuntia echinocarpa*	siver cholla																T		0.5							T		0.5	2.0	**0.11**	**0.52**	**18**
N	P	*Echinocereus engelmannii*	strawberry hedgehog																0.5		0.5					0.5						**0.05**	**0.26**	**11**
N	P	*Ephedra nevadensis*	Nevada jointfir		0.5	1.5	2.0				2.0				5.0	2.0			4.0	11.0	2.0		0.5	0.5	8.5	2.5	0.5	5.0		5.0	5.0	**2.05**	**9.89**	**61**
N	P	*Ericameria nauseosa*	rubber rabbitbrush																			3.0										**0.11**	**0.52**	**4**
N	P	*Grayia spinosa*	spiny hopsage			9.0				1.0		6.5		1.5				2.0				1.0										**0.75**	**3.61**	**21**
N	P	*Krascheninnikovia lanata*	winterfat				0.5				0.5		1.5											T	2.0							**0.16**	**0.77**	**18**
N	P	*Menodora spinescens*	spiny menodora		2.0			0.5	0.5	2.0						0.5	7.0	1.0	7.0		15.0		18.5			1.0	1.0	7.5			1.0	**2.30**	**11.09**	**50**
N	P	*Opuntia polyacantha*	plains prickly pear																								T					**0.00**	**0.00**	**4**
N	P	*Pinus monophylla*	singleleaf pinyon																			18.0		1.0								**0.68**	**3.27**	**7**
N	P	*Tetradymia canescens*	spineless horsebrush							2.0																						**0.07**	**0.34**	**4**
																																	Mean	
			Total Plant Cover	**13.0**	**18.5**	**24.0**	**13.5**	**15.0**	**7.5**	**23.5**	**12.5**	**38.5**	**6.5**	**9.5**	**14.0**	**22.0**	**25.0**	**21.0**	**22.0**	**26.5**	**27.0**	**35.0**	**29.0**	**10.5**	**29.5**	**23.5**	**14.0**	**25.0**	**32.0**	**21.0**	**22.5**		**20.77**	
			Rock	41.0	46.0	52.0	62.5	53.0	69.5	47.0	50.0	39.5	53.5	41.5	33.0	60.0	45.0	56.0	47.0	49.0	58.0	37.0	51.0	76.5	29.5	40.0	34.0	40.0	49.0	42.0	27.5		**47.50**	
			Litter	6.0	12.0	9.0	9.0	5.0	15.0	7.0	13.0	14.0	25.0	18.0	6.0	6.0	8.0	5.0	10.0	7.0	4.0	5.0	12.0	8.0	18.0	21.5	12.0	9.0	5.0	7.0	8.0		**10.16**	
			Bare ground	40.0	23.5	15.0	15.0	27.0	8.0	22.5	24.5	8.0	15.0	31.0	47.0	12.0	22.0	18.0	21.0	17.5	11.0	23.0	8.0	5.0	23.0	15.0	40.0	26.0	14.0	30.0	42.0		**21.57**	
			Desirable Cover (excluding Nuisance and Noxious Weeds)	13.0	17.0	23.5	11.0	15.0	7.0	21.5	8.5	38.5	4.5	9.5	13.0	20.5	23.0	15.0	22.0	24.5	27.0	32.0	28.5	10.5	29.5	23.5	14.0	25.0	32.0	21.0	16.5		**19.52**	
Average Cover by Lifeform			**Perennial Grasses**	4.0	12.0	11.0	6.5	2.0	1.0	14.0	2.0	5.5	2.0	0.5	5.0	14.0	14.0	7.0	7.5	4.0	3.0	2.0	5.0	2.0	5.5	5.0	7.5	5.5	7.0	9.0	4.0		**6.0**	
			Perennial Forbs	3.0	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-		**0.1**	
			Shrubs & Sub-shrubs	6.0	5.0	12.0	4.5	13.0	5.5	7.5	6.5	32.5	2.5	8.5	8.0	6.5	9.0	7.0	14.5	20.5	24.0	30.0	23.5	8.0	24.0	18.5	6.5	19.5	25.0	12.0	12.5		**13.3**	
			Annual Grasses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	1.0	-	2.0	-	-	-	-	-	-	-	T	-		**0.1**	
			Annual Forbs	-	1.5	1.0	2.5	-	0.5	2.0	4.0	0.5	2.0	0.5	1.0	1.5	2.0	6.0	-	1.0	-	1.0	0.5	-	-	-	-	-	-	-	6.0		**1.2**	

N=Native, I=Introduced, X=Noxious A=Annual, B=Biennial, P=Perennial

Table 5 ERTI Critical Habitat Vegetation Assessment

Upper Slopes - Slope Position Vegetation Cover

Percent Ground Cover Based on Visual Estimates of 3 Meter Radius from Sample Point

			Transect No.——>	22	25	40	85	Average Cover (%)	Relative Cover (%)	Freq. (%)
Grasses and Grass-likes										
N	P	*Aristida purpurea*	purple threeawn				1.0	**0.25**	**1.30**	**25**
N	P	*Pleuraphis jamesii*	galleta	2.0	11.0	6.0	5.0	**6.00**	**31.17**	**100**
Forbs										
N	A	*Collinsia parviflora*	maiden blue eyed Mary				T	**0.00**	**0.00**	**25**
N	P	*Eriogonum inflatum*	desert trumpet	0.5				**0.13**	**0.65**	**25**
I	A	*Halogeton glomeratus*	saltlover	0.5	0.5	3.5		**1.13**	**5.84**	**75**
I	A	*Neokochia americana*	green molly		0.5			**0.13**	**0.65**	**25**
I	A	*Salsola tragus*	russian thistle	T		T		**0.00**	**0.00**	**50**
N	P	*Stanleya pinnata*	desert princesplume	T				**0.00**	**0.00**	**25**
N	A	*Unidentifiable sp.*	unidentifiable annual sp.		T			**0.00**	**0.00**	**25**
Shrubs, Sub-shrubs, & Cacti										
N	P	*Artemisia nova*	black sagebrush				5.0	**1.25**	**6.49**	**25**
N	P	*Atriplex confertifolia*	shadescale	1.0	1.0	0.5		**0.63**	**3.25**	**75**
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush		1.0		3.0	**1.00**	**5.19**	**50**
N	P	*Ephedra nevadensis*	Nevada jointfir	2.0	6.0	1.5	8.0	**4.38**	**22.73**	**100**
N	P	*Grayia spinosa*	spiny hopsage	1.0			9.0	**2.50**	**12.99**	**50**
N	P	*Lycium andersonii*	water jacket			2.0		**0.50**	**2.60**	**25**
N	P	*Menodora spinescens*	spiny menodora	1.0	3.0	0.5		**1.13**	**5.84**	**75**
N	P	*Tetradymia canescens*	spineless horsebrush		1.0			**0.25**	**1.30**	**25**
									Mean	
			Total Plant Cover	**8.0**	**24.0**	**14.0**	**31.0**		**19.25**	
			Rock	45.0	50.0	54.0	54.0		**50.75**	
			Litter	10.0	3.0	12.0	8.0		**8.25**	
			Bare ground	37.0	23.0	20.0	7.0		**21.75**	
			Desirable Cover (excluding Nuisance and Noxious Weeds)	7.5	23.0	10.5	31.0		**18.00**	
Average Cover by Lifeform			**Perennial Grasses**	2.0	11.0	6.0	6.0		**6.3**	
			Perennial Forbs	0.5	-	-	-		**0.1**	
			Shrubs & Sub-shrubs	5.0	12.0	4.5	25.0		**11.6**	
			Annual Grasses	-	-	-	-		**0.0**	
			Annual Forbs	0.5	1.0	3.5	-		**1.3**	

N=Native, I=Introduced, X=Noxious A=Annual, B=Biennial, P=Perennial

Table 6 ERTI Critical Habitat Vegetation Assessment

Ridges - Slope Position Vegetation Cover

Percent Ground Cover Based on Visual Estimates of 3 Meter Radius from Sample Point

			Transect No.——>	3	4	15	16	18	29	30	42	43	51	63	93	94	95	103	Average Cover (%)	Relative Cover (%)	Freq. (%)
Grasses and Grass-likes																					
N	P	*Achnatherum hymenoides*	indian ricegrass	1.0	0.5												0.5		**0.13**	**0.72**	**20**
N	P	*Achnatherum thurberianum*	Thurber's needlegrass			2.0										0.5			**0.17**	**0.90**	**13**
N	P	*Aristida purpurea*	purple threeawn			0.5									3.0				**0.23**	**1.26**	**13**
I	A	*Bromus tectorum*	cheatgrass												3.0				**0.20**	**1.08**	**7**
N	P	*Elymus elymoides*	squirreltail													1.0			**0.07**	**0.36**	**7**
N	P	*Festuca sp.*	Fescue sp.													2.0		2.0	**0.27**	**1.44**	**13**
N	P	*Pleuraphis jamesii*	galleta	9.0	3.0		5.0	5.0	0.5	9.0	2.0	2.0	8.5	8.0	2.0	2.0			**3.73**	**20.14**	**80**
N	P	*Poa secunda*	Sandberg bluegrass														T		**0.00**	**0.00**	**7**
Forbs																					
N	P	*Boechera pulchra*	beautiful rockcress														T		**0.00**	**0.00**	**7**
N	P	*Caulanthus pilosus*	hairy wild cabbage		0.5														**0.03**	**0.18**	**7**
N	P	*Eriogonum inflatum*	desert trumpet	0.5							3.5	0.5	0.5						**0.33**	**1.80**	**27**
N	A	*Eriogonum brachyanthum*	shortflower buckwheat										T						**0.00**	**0.00**	**7**
I	A	*Halogeton glomeratus*	saltlover	0.5			1.0		T		T		T	2.0					**0.23**	**1.26**	**40**
I	A	*Neokochia americana*	green molly				0.5	0.5				2.0							**0.20**	**1.08**	**20**
I	A	*Salsola tragus*	russian thistle	T															**0.00**	**0.00**	**7**
N	A	*Unidentifiable sp.*	unidentifiable annual sp.				T	T											**0.00**	**0.00**	**13**
N	P	*Unidentifiable sp.*	unknown perennial sp.	T	T														**0.00**	**0.00**	**13**
Shrubs, Sub-shrubs, & Cacti																					
N	P	*Artemisia nova*	black sagebrush			3.0									4.0	19.0	19.5	24.0	**4.63**	**25.00**	**33**
N	P	*Artemisia spinescens*	budsage											10.0					**0.67**	**3.60**	**7**
N	P	*Atriplex canescens*	four-wing saltbush	0.5															**0.03**	**0.18**	**7**
N	P	*Atriplex confertifolia*	shadescale	1.0	2.0	1.0	5.0	1.0		4.0	1.5	5.0	6.5	2.5	3.0				**2.17**	**11.69**	**73**
N	P	*Chrysothamnus greenei*	Greene's rabbitbrush	4.0	T	2.0		0.5	3.0	1.0					9.0				**1.30**	**7.01**	**47**
N	P	*Cylindropuntia echinocarpa*	siver cholla		T														**0.00**	**0.00**	**7**
N	P	*Ephedra nevadensis*	Nevada jointfir		4.0	2.0		2.0	5.0	9.0	1.0		1.5	0.5	2.0	1.0	T	0.5	**1.90**	**10.25**	**80**
N	P	*Grayia spinosa*	spiny hopsage	2.0						1.0					2.0				**0.33**	**1.80**	**20**
N	P	*Krascheninnikovia lanata*	winterfat		1.0		T		1.5										**0.17**	**0.90**	**20**
N	P	*Lycium andersonii*	water jacket			2.0													**0.13**	**0.72**	**7**
N	P	*Menodora spinescens*	spiny menodora		3.0	4.0	2.0	3.0		0.5			0.5				1.0		**0.93**	**5.04**	**47**
N	P	*Tetradymia canescens*	spineless horsebrush				3.0	6.0											**0.60**	**3.24**	**13**
N	P	*Tetradymia glabrata*	littleleaf horsebrush		1.0														**0.07**	**0.36**	**7**
																				Mean	
			Total Plant Cover	**18.5**	**15.0**	**16.5**	**16.5**	**18.0**	**10.0**	**24.5**	**8.0**	**9.5**	**17.5**	**23.0**	**28.0**	**25.5**	**21.0**	**26.5**		**18.53**	
			Rock	29.5	58.0	80.0	56.0	59.0	58.0	60.0	77.0	76.5	62.5	32.0	56.0	55.0	35.0	63.0		**57.17**	
			Litter	9.0	2.0	1.5	6.0	3.0	2.0	6.0	10.0	12.0	8.0	15.0	5.0	3.0	18.0	4.0		**6.97**	
			Bare ground	43.0	25.0	2.0	21.5	20.0	30.0	9.5	5.0	2.0	12.0	30.0	11.0	16.5	26.0	6.5		**17.33**	
			Desirable Cover (excluding Nuisance and Noxious Weeds)	18.0	15.0	16.5	15.0	17.5	10.0	24.5	8.0	7.5	17.5	21.0	25.0	25.5	21.0	26.5		**17.90**	
Average Cover by Lifeform			**Perennial Grasses**	10.0	3.5	2.5	5.0	5.0	0.5	9.0	2.0	2.0	8.5	8.0	5.0	5.5	0.5	2.0		**4.6**	
			Perennial Forbs	0.5	0.5	-	-	-	-	-	3.5	0.5	0.5	-	-	-	-	-		**0.4**	
			Shrubs & Sub-shrubs	7.5	11.0	14.0	10.0	12.5	9.5	15.5	2.5	5.0	8.5	13.0	20.0	20.0	20.5	24.5		**12.9**	
			Annual Grasses	-	-	-	-	-	-	-	-	-	-	-	3.0	-	-	-		**0.2**	
			Annual Forbs	0.5	-	-	1.5	0.5	-	-	-	2.0	-	2.0	-	-	-	-		**0.4**	

N=Native, I=Introduced, X=Noxious A=Annual, B=Biennial, P=Perennial

ATTACHMENT E
Tiehm's Buckwheat Pollinator Sampling Study

Ioneer: Tiehm's buckwheat (*Eriogonum tiehmii*) Pollinator Sampling

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Appendices

1. INTRODUCTION

Tiehm's buckwheat (*Eriogonum tiehmii*) is a low matted perennial herb with light yellow to cream colored clusters of flowers at the end of slender stalks held above the leaves (**Appendix A**, **Photo 1**) (USFWS 2021). Tiehm's buckwheat is only known from a single population with eight subpopulations in the Rhyolite Ridge area of the Silver Peak Range in Nevada, and is listed as endangered under the ESA with designated critical habitat which extends 500 m from perimeter of each subpopulation (USFWS 2022 87 FR 77368). "This essential habitat configuration was based on the best available nesting, egg-laying, and foraging information for the bee, wasp, beetle, and fly pollinators and insect visitors of Tiehm's buckwheat" (USFWS 2022 87 FR 77368, p. 77392). It is evident that, aside from protection from physical disturbance of the subpopulations, the USFWS considers maintenance of the local pollinator community to be of upmost importance for the conservation of Tiehm's buckwheat.

The only knowledge of the insect community within or adjacent to Tiehm's buckwheat was provided by the work of McClinton et al. (2020, 2022). They used pitfall traps, that capture day-flying and ground-dwelling insects, and floral observations to document the insect community. The spatial sampling was limited, encompassing only two subpopulations and two nearby locations (60 -100m) outside of the subpopulations. Nonetheless, McClinton et al. (2022) detected substantial variation in the insect community among their four sampling locations. Given the variability in the insect community among even adjacent areas, additional study was needed to adequately characterize the community of potential pollinators of Tiehm's buckwheat across its 368-hectare critical habitat and provide adequate scientific basis for management decisions.

On behalf of Ioneer Rhyolite Ridge (Ioneer), WestLand Engineering & Environmental Services (WestLand) surveyed potential pollinating flying insects within and around Tiehm's buckwheat (*Eriogonum tiehmii*) designated critical habitat. This survey was designed to inform management decisions regarding the pollinator community. Data from the survey allows description of the potential pollinator community within the survey area and between the Tiehm's buckwheat population and the surrounding critical habitat (**Figure 1**). Understanding the ecological processes that cause variation in potential pollinator community composition across the critical habitat can inform and guide management strategies to maintain an adequate pool of potential pollinators for Tiehm's buckwheat. Additionally, robustly surveying the potential pollinator community before ecological disturbance associated with mine construction and operation will provide important baseline information to detect any trends in pollinator abundance and diversity through time. This document provides a primer on how communities of species can be described and compared (**Section 2**), describes our survey methods (**Section 3**), reports survey results (**Section 4**), discusses and interprets the results (**Section 5**), makes concluding statements (**Section 6**) and provides references cited (**Section 7**).

2. DESCRIPTION AND COMPARISON OF SPECIES COMMUNITIES

A species community is a group of individuals of different species that occur together at a given place and time. How the composition and abundance of species communities vary across the landscape or through time is a fundamental question of ecology and is of primary importance to land and wildlife managers who seek to maintain or alter species communities under their purview. Species communities are frequently described in terms of diversity which has two components: the number of species (i.e., richness) and their relative abundance (i.e., evenness). Species diversity is a fundamental determinant of ecosystem dynamics and function (e.g., Tilman et al. 2014) and can be measured directly at the local (i.e., alpha diversity) or regional level (i.e., gamma diversity) (Whittaker 1960). A third measure, beta-diversity, cannot be measured directly but rather is derived from alpha and gamma diversity and accounts for differences between local and regional diversity (Whittaker 1960). Because we are interested in describing the community of potential insect pollinators and how this community might vary across the critical habitat of Tiehm's buckwheat, the focus of this study is on alpha- and beta-diversity and the processes that underlie differences in diversity across the critical habitat.

There are many ways to calculate alpha-diversity, however, over the last decade, Hill numbers has emerged as a preferred method because they can encompass species, phylogenetic and functional diversity under a single framework (Chao et al. 2014). Hill numbers are a type of average measuring mean rarity of species in the sample that proffers different leverage to rare species in the sample (Hill 1973, Jost 2006, Roswell et al. 2021). When the q exponent of the Hill diversity index equals zero (equation not shown, see Hill 1973 or Jost 2006), rare species have high leverage and Hill diversity in equivalent to species richness (i.e., the number of species observed at a given location). When q = 2, rare species are afforded low leverage and Hill diversity is equivalent to the traditional Simpson Diversity index. When q = 1, rare species have intermediate levels of leverage and Hill diversity is equivalent to the traditional Shannon Index of diversity.

Variation in species composition and relative abundance among locations or different periods in time is called beta diversity (Whittaker 1960). Differences in species composition are underlain by two distinct processes. The first process, species replacement, also called turnover, occurs when species replace each other between two sampling periods or locations (Baselga 2010, 2012). In the simplest scenario, when comparing two samples, the first contains only species 'A' and the second contains only species 'B'. The second process contributing to differences species composition between samples, richness differences, sometimes called nestedness, occurs when a less species rich sample contains a strict subset of the species that occur at the more species rich sample (Baselga 2010, 2012). For example, sample one might contain only species 'A' whereas sample two contains species 'A', 'B', and 'C'.

Patterns in variation in species abundance are similarly underlain by two distinct processes: balanced and unidirectional abundance gradients (Baselga 2013, Legendre 2014). Balanced abundance gradients are directly analogous to species replacement. Extending the scenario described above, the number individuals of species 'A' in sample one would be equivalent to the number of individuals of species 'B' in the second sample. Unidirectional abundance gradients occur when there are differences in abundances of species between samples. This is considered to be equivalent to nestedness as some individuals are lost between samples without species replacement (Baselga 2013). Species replacement and nestedness or their abundance-based analogs often co-occur, with both variation in species composition and their relative abundance contributing to differences between samples.

Beta-diversity and its components are calculated from dissimilarity indices. Total dissimilarity in species composition or both species composition and abundance between sites are described by Sørensen and Bray-Curtis indices, respectively (Baselga 2013, Legendre and Cáceres 2013). Both indices are pairwise comparisons between samples and vary between zero and one (Baselga 2013, Legendre and Cáceres 2013). A dissimilarity value of zero indicates that the community composition in the two samples are identical whereas a value of one indicates that there are no species that occur in both samples. For example, a Sørensen dissimilarity value of 0.25 indicates that 25% of the species occur at only one of the two locations. Bray-Curtis dissimilarity is a quantitative extension of the Sørensen index and accounts for both species composition and abundance. Bray-Curtis dissimilarity increases when there are either fewer shared species between sites or lower abundance of the shared species, or both conditions co-occur.

3. METHODS

3.1. INSECT SAMPLING

Pan-trapping was used to capture day-flying, flower-visiting insects. Traps consisted of small portion cups (Solo™ Model P325N) that were translucent white or painted fluorescent yellow or blue (Krylon™ K03104777 and K03107777). The color of these traps attracts day-flying insects which mistake them for food resources. Pan traps readily capture flower visiting Coleoptera, Diptera, and Hymenoptera, but Lepidopterans are typically underrepresented (Vrdoljak and Samways 2012) (Montgomery et al. 2021). At each site, traps of alternating color, filled with soapy water were placed every three meters along the direction of travel until three of each color had been deployed (i.e., a total of 9 traps, **Appendix A**, **Photos 2-3**). Approximately 24 hours later, the contents of traps were strained through fine-mesh and then transferred to 70% ethanol. To ensure adequate preservation of specimens, within a day of the initial collection, the samples were again strained, and fresh ethanol was added. The straining and washing procedure may have resulted in the loss of some very small insects (i.e., 2mm or less), including thrips (Thysanoptera) and potentially minute hymenopterans. While thrips may transfer pollen and are known pollinators of some species of cycads, their potential role as pollinators may be outweighed by their feeding damage on plant tissues, including pollen (Mound 2005). Minute hymenopterans are typically parasites or parasitoids and unlikely to be important members of the pollinator community (Triplehorn et al. 2005).

Throughout the 368-ha critical habitat, sampling occurred in a 200-m by 200-m grid pattern, with the exception of three locations occurring along an inaccessible rocky ridge, south of Cave Springs Road bisecting the critical habitat and west of subpopulation three. Three additional sampling locations, approximately 100-m from another location, were added to ensure adequate sampling within the boundaries of the Tiehm's buckwheat subpopulations. In total, six sampling locations occurred within the boundaries of Tiehm's buckwheat subpopulations (i.e., 1, 2, 3, 4, 6a and 6b), and 95 locations outside of the subpopulations but within the critical habitat. Due to their small spatial extent, no attempt was made to sample within subpopulations 5, 7 and 8. To account for potential temporal changes in the pollinator community, each location was sampled twice during the flowering period of Tiehm's buckwheat (May 17-21 and 31 May-1 June 2022) and data from each time period pooled by survey location prior to analysis. Preliminary processing of samples indicated a large number of specimens were collected. Thus, to reduce processing time, a subset of samples was selected for identification (n = 51). The subset retained all samples from within the boundaries of Tiehm's buckwheat subpopulations and a checkerboard of samples within or immediately adjacent to the boundaries of critical habitat.

3.2. INSECT IDENTIFICATION

For each sample, Coleoptera, Diptera, Hymenoptera and Lepidoptera were separated, and either retained in ethanol, or mounted as needed for identification to morphospecies. Generic identification was attempted but was not always possible using primary insect identification sources (Arnett et al. 2002) (Coleoptera), McAlpine et al. (1981), (1987) (Diptera), Goulet and Huber (1993) Michener (2007) (Hymenoptera) and Triplehorn et al. (2005) and Glassberg (2001) (Lepidoptera).

3.3. DATA ANALYSIS

All analyses were completed in R v 4.2.2. (R Core Team 2021). To allow meaningful comparison among locations, diversity metrics were standardized by coverage. Coverage is a measure of how well a sample represents the true species diversity at that location (Roswell et al. 2021). Coverage ranges between 0 and 1, with a measure of 0.95 indicating that 5 percent of individuals is a community belong to a species not represented in the sample. Coverage is a preferred method of standardization because it results in smaller underestimates of diversity in more diverse communities than alternative methods such as effort-based or sample size-based standardization (Roswell et al. 2021). Coverage was standardized to the minimum coverage value among samples extrapolated to double the size of the reference value (i.e., number of specimens) and diversity indices were calculated using the estimated function in the iNEXT R package (Hsieh et al. 2022). Standardizing to this level of coverage allows accurate estimation of the various diversity indices (i.e., Hill numbers), whereas extrapolation beyond double the reference sample size results in biased diversity estimates (Chao et al. 2014). Confidence intervals for diversity indices were calculated using 1000 bootstrap replicates. Measures of evenness, the differences in abundance among observed species, were calculated using the iNEXT.4steps R package (Chao and Hu 2023).

To determine if abundance and coverage-standardized diversity of potential pollinators were associated with geographic or ecological characteristics we regressed abundance and diversity indices on easting, northing, elevation, and the percent of grasses, forbs, and shrubs using the lm function in R. Vegetative data was available for all survey sites except one on the south side of the road bisecting the critical habitat (Cedar Creek & Associates, unpublished data). Where necessary to improve normality, variables were log or log(x+1) transformed. Full models were initially fit, with explanatory variables removed in a stepwise manner when $p>0.05$.

To determine the variation in potential pollinator communities across the survey area, multisite beta diversity and its components of species replacement and nestedness were calculated using the beta.multi and beta.multi.abund functions of the betapart R package (Baselga et al. 2023). To examine how the potential pollinator community of each sampled subpopulation of Tiehm's buckwheat differed from the other survey locations, pairwise Sørensen and Bray-Curtis dissimilarity matrices and their decompositions were calculated using beta.part and beta.part.abund functions. Additionally, to account for differences in the number of species or total abundance, we randomly subsampled species composition and abundance tables (1,000 permutations) standardized to minimum sample size and then calculated average dissimilarities for each pairwise comparison between sampling locations using the avgdist function in the vegan R package (Oksanen et al. 2022). While coverage-based standardization would be preferred, this method has not yet been extended to dissimilarity indices (Roswell et al. 2021). To visualized pairwise dissimilarity between the Tiehm's buckwheat subpopulations and the other survey locations, Voronoi tessellation was used to divide the survey area into polygons with edges equidistant to the two nearest survey locations (Pebesma 2018, Pebesma and Bivand 2023). The boundaries of the polygons are not based on ecological or abiotic features of the landscape but are nonetheless useful for the visualization of data across the survey area.

Generalized dissimilarity modeling was used to test for an association between ecological parameters and dissimilarity among survey locations , which is an extension of matrix regression (Ferrier et al. 2007). Ecological parameters included geographic distance, elevation, and percent cover of bare ground, rock, litter, grasses, forbs and shrubs. Cover data was obtained from Cedar Creek & Associates (unpublished data). Generalized dissimilarity modeling was implemented in the gmd R package (Fitzpatrick et al. 2022). Matrix permutation (n=1000) was used to evaluate model and parameter significance.

Hellinger distance was used to determine which species were most influential in contributing to differences among sites (Legendre and Cáceres 2013). Further, the influence of relative abundance and occupancy (i.e., proportion of sites where a species was detected) (Cribari-Neto and Zeileis 2010) on individual species contribution to beta diversity was tested using beta regression with a log link function, which is appropriate for proportion based dependent variables, as implemented in the betareg R package (Cribari-Neto and

Zeileis 2010). Beta regression uses maximum likelihood to estimate parameters and this consequently sensitive to inflation of parameter estimates when multicollinearity is present (Abonazel et al. 2022).

4. RESULTS

Across the 51 sites within the survey area, 11,049 specimens from 293 morphospecies were detected (**Table 1; Appendix B**). Approximately 72% of morphospecies were rare to uncommon, with less than 10 individuals recorded, and accounted for 5% of the total specimens collected across the survey area. In contrast, less than 6% of morphospecies were very common, with 100 or more individuals, yet accounted for approximately 78% of the total specimens collected during the survey.

Table 1. Abundance and morphospecies across the entire survey area

Order	Morphospecies					Number of specimens
	Rare (1 specimen)	Uncommon (2 to 9 specimens)	Common (10-99 specimens)	Very common (100 or more)	Total	
Coleoptera	13	8	8	3	**32**	6,845
Diptera	36	38	18	7	**99**	1,963
Hymenoptera	37	66	36	6	**145**	2,123
Lepidoptera	7	6	4	0	**17**	118
Total	93	118	66	16	**293**	11,049

4.1. PROMINENT TAXONOMIC GROUPS PRESENT IN SURVEY AREA

Two morphospecies of the soft-winged flower beetle (Melyridae) genus *Eudasytes* were the most commonly encountered species (56% of all specimens) and accounted for the vast majority of both soft-winged flower beetles and coleopterans encountered in the survey area. *Eudasytes* beetles were important contributors to differences in total abundance specimens collected between sites, with some sites recording hundreds of these beetles. Bee flies (Diptera: Bombyliidae) were the second most abundant family within the survey area and accounted for 11% of all specimens. Bees belonging to Apidae (Hymenoptera) accounted for 5% of all specimens. All remaining insect families were less abundant, with each accounting for less than 5% of total specimens captured in the survey area (**Appendix C**).

4.2. INCIDENTAL OBSERVATIONS OF FLORAL VISITORS

While the survey did not attempt to quantify floral visitors, surveyors made a few incidental observations of insects on Tiehm's buckwheat (**Appendix A**, **Photos 4-6**). Additionally, publicly available photos have occasionally shown floral visitors to Tiehm's buckwheat (**Appendix A**, **Photos 7-11**). While there is limited photographic documentation of floral visitors to Tiehm's buckwheat, the available data shows taxonomic groups (bees, flies and beetles) which are well represented in our pan-trap survey.

4.3. ALPHA DIVERSITY: SITE LEVEL SPECIES COMPOSITION AND ABUNDANCE

The numbers of coleopteran, dipteran, hymenopteran and lepidopteran specimens collected varied more than tenfold across sites from a low of 47 to a high of 620 individuals. Abundance was typically higher in the eastern portion of the survey area (**Figure 2**). Abundance had no association with northing, elevation or the cover of grasses, forbs or shrubs (all p>0.05), however, abundance was positively associated with easting and location relative to Tiehm's buckwheat (ln abundance = easting + location, $F_{2, 48}$ = 17.71, R^2 = 0.42, p >0.001, **Figure 3**). After controlling for the effects of easting, Tiehm's buckwheat survey locations had an estimated marginal mean of 93 specimens (95% CI: 64 to 134) whereas locations outside of the Tiehm's buckwheat subpopulations had an estimated marginal mean of 202 specimens (95% CI: 178 to 233). For most locations, beetles were more numerous than other groups, and at all locations, Lepidoptera were the least numerous. These trends are also evident when sites are group by location within or outside of Tiehm's buckwheat subpopulations, however, the relative abundance of the orders is dependent upon location (X^2=71.39, df = 3, p<0.001, **Figure 4**), with samples from Tiehm's buckwheat populations having less beetles and more flies and hymenopteran than expected.

In our survey area, when the number of specimens collected was low, coverage[1] was also relatively low (**Figure 5**). However, the relationship between abundance and coverage becomes asymptotic as the number of specimens collected increases. Species richness varied from 21 to 70 morphospecies between sites. Because abundance differences can influence how well a given sample estimates the true diversity at that location, we standardized by coverage to permit comparisons of alpha diversity. Standardization occurred to a coverage level of 0.74 (see Methods for details). This level of coverage indicates that 26% of individuals in the community belong to an undetected species. After standardization, three diversity indices for each site were calculated, which differ in the relative leverage afforded to rare species. Hill-richness (i.e., q = 0) only reflects species numbers, whereas Hill-Shannon (q = 1) and Hill-Simpson (q = 2) values are differentially weighted by species richness and the relative abundance of the species, with the Hill-Simpson index the least influenced by rare species. None of the three diversity indices showed a clear spatial pattern of potential pollinator diversity (**Figures 6-8**).

Coverage-standardized diversity measures, were not significantly associated with easting, northing, location relative to Tiehm's buckwheat, elevation, shrubs or forbs (all p > 0.05). A one percent increase in grass cover, however, was associated with a 0.37 to 0.39 percent decrease in diversity indices, but the association was weak (**Table 2**). As grasses do not provide nectar, they are generally of limited value to most pollinator species (NRCS 2009) and likely underlies decreased diversity with increasing grass cover.

[1] Coverage is the proportion of individuals in a community represented by species present in a sample from that community.

Table 2. Linear regression of abundance or diversity with explanatory variables.

Model	R^2	F-value$_{1,48}$ (p)	$\beta_{grasses}$ (95% CI)
ln Richness = β_0 + ln grasses	0.09	4.91 (0.03)	-0.39 (-0.75 to -0.04)
ln Hill-Shannon = β_0 + ln grasses	0.12	6.63 (0.01)	-0.39 (-0.69 to -0.09)
ln Hill-Simpson = β_0 + ln grasses	0.14	8.02 (<0.01)	-0.37 (-0.63 to -0.11)

4.3.1. Diversity in the Tiehm's buckwheat population versus the surrounding area

To examine potential differences in potential pollinator diversity inside the Tiehm's buckwheat population versus the surrounding area, samples were grouped accordingly and standardized by coverage (coverage = 0.95). Species richness did not differ between the Tiehm's buckwheat population and the surrounding area. Based on non-overlapping 95% confidence intervals, Hill-Shannon and Hill-Simpson diversity are greater in the Tiehm's buckwheat population than the surrounding area (**Figure 9**). This indicates that the potential pollinator community in the Tiehm's buckwheat population is composed of species that are, on average, more rare than species in the surrounding area. However, differences in coverage standardized diversity were not apparent when the data were not pooled by location (see **Section 4.3**). Further, due to the presence of some species occurring at high frequency (e.g., *Eudasytes* beetles) in the area surrounding the Tiehm's buckwheat population that were not similarly dominant in the Tiehm's buckwheat population resulted in lower measures of evenness in the surrounding area (**Table 3**), although 95% CI intervals indicate that the differences in species evenness is only significant for one measure of evenness.

Table 3. Evenness of species abundance in and surrounding the Tiehm's buckwheat population standardized to 0.95 coverage. Pielou's J is a common measure of evenness based on Shannon's Diversity index and varies between 0 and 1, with 1 representing community where all observed species are equally abundant. Chao and Ricotta (2019) developed an evenness measure based on Hill numbers and the slope between q = 0 and other values of q normalized to a range of 0 to 1.

Location	Pielou's J (95% CI)	Chao-Ricotta slope of diversity profile (95% CI)	
		q=1	q=2
Tiehm's buckwheat population	0.66 (0.63-0.69)	0.19 (0.16-0.22)	0.05 (0.03-0.06)
Surrounding area	0.59 (0.56-0.62)	0.14 (0.10-0.17)	0.04 (0.03-0.05)

4.4. BETA DIVERSITY: DIFFERENCES AMONG AND BETWEEN SITES

Across the survey area, species replacement and nestedness accounted for 98% and 2% variance in diversity among sites, respectively. Similarly, balanced and unidirectional abundance gradients accounted for 96% and 4% of the variation in the relative abundance of species.

Tiehm's buckwheat subpopulations varied substantially from nearby locations and from each other (**Figure 10**). Median Sørensen dissimilarity between a given Tiehm's buckwheat subpopulation and all other survey locations was equal or greater than 0.59 (i.e., a median of 59% or more species different between sites). The minimum Sørensen dissimilarity in the species community composition between a Tiehm's buckwheat subpopulation and another survey location was 0.44 and the maximum was 0.80. Dissimilarity based on both species composition and their relative abundances (i.e., Bray-Curtis dissimilarity) showed similar results, with a median dissimilarity equal to or greater than 0.63. However, there was greater variability in dissimilarity between sites, with a minimum Bray-Curtis dissimilarity of 0.26 and a maximum of 0.94 (**Figure 11**). Rarefaction based on the minimum number of species or minimum number of individuals observed produced qualitatively similar dissimilarities (not shown). Neither geographic distance, elevation or percent cover of rock, litter, bare ground, grasses, forbs nor shrubs significantly explained either Sørensen or Bray-Curtis dissimilarities between survey locations (full models explained only 9.8 and 8.9% of deviance, respectively, and all parameters $p > 0.05$).

Individual species contributions to beta diversity among sites varied over four orders of magnitude (median and range, 7.8×10^{-4}, 7.4×10^{-5} to 1.3×10^{-1}), with four species having an outlying influence and collectively accounted for 28.4% of beta diversity. The most influential species included two morphospecies of *Eudastyes* soft-winged flower beetles, a small bee fly[2] and a member of *Ischyropalpus*, an ant-like flower beetle (**Appendix D**). Species contribution to beta diversity is associated with both abundance and occupancy and these two characteristics are highly correlated (Spearman's Correlation = 0.98). To avoid biases in parameter estimation due to multicollinearity, we regressed species contribution to beta diversity on a linear combination of relative abundance and occupancy (model: species contribution to beta diversity = 2.93*linear combination - 3.51e-04*linear combination^{-2}, Pseudo-R^2 = 0.82). Species contribution to beta diversity is positively associated with relative abundance and occupancy, with all parameters statistically significant ($p<0.001$).

5. DISCUSSION

Day-flying potential insect pollinator species were most abundant in the eastern portion of the survey area and lower inside of Tiehm's buckwheat subpopulations than in the surrounding area. Beetles were the predominate group, accounting for 62% of all specimens. Flies and hymenopterans had similar abundance, accounting for 18 and 19% percent of specimens respectively. Despite similar abundance across the survey area, hymentoperans were represented by nearly 50% more morphospecies than dipterans. While this indicates increased species richness relative to Diptera, it does not imply greater or lesser pollination service. Moths and butterflies were rarely trapped, and accounted for 1% of total specimens. Lepidoptera are often underrepresented in pan traps (Vrdoljak and Samways 2012). Within the study area, however, lepidopterans were rarely observed by surveyors (personal observation and communication) suggesting that low trap catch reflects low abundance of butterflies and day-flying moths. It is unlikely that day-flying lepidopterans are important component of the pollinator community in the area. When compared to the remainder of the critical habitat, Tiehm's buckwheat subpopulations had less beetles than expected,

2 Using McAlpine et al. (1981), this morphospecies (D-059) keys to *Phthiria*. However, all North American species previously in *Phthiria* have been reassigned to different genera (Evenhuis and Greathead 2015).

although they were still the most common group, and more flies and hymenopterans than expected. This likely contributed to the increased evenness of the community of potential pollinators observed in the Tiehm's buckwheat subpopulations.

This study recorded a notably higher proportion of beetles and a lower proportion hymenopterans than a previous study of Tiehm's buckwheat potential pollinators (McClinton et al. 2022). Spatial differences in sample and temporal variation in insect communities may explain some of the differences between our findings and that of McClinton et al. (2022). We suspect, however, that some of the relative increase in coleopteran representation is attributable to differences in trap attractiveness and catch bias between the studies. McClinton et al. (2022) used traps painted yellow to approximate human visual perception of Tiehm's buckwheat flowers. In addition to high reflectance colors (i.e., yellow and white), this study incorporated traps attractive for insects attracted to short wavelengths of light (i.e., blue) and the use of fluorescence. The use of traps attractive across a broader visual spectrum is expected to increase the diversity of taxa captured by the traps (Shrestha et al. 2019, van der Kooi et al. 2021, Vrdoljak and Samways 2012).

5.1. IMPORTANT TAXONOMIC GROUPS WITHIN THE SURVEY AREA

Below, we provide a brief discussion of the most abundant insect families within the survey area, including spatial distribution and basic ecology of the taxa. Such information can be informative for potential pollinator conservation efforts.

5.1.1. Melyridae

Soft-winged flower beetles (Melyridae), were the most numerous of all taxonomic groups observed, accounting for 57% of total specimens. This family was ubiquitous, with at least one morphospecies occurring at every survey location. Most adult Melyridae feed on pollen, nectar and small arthropods and often form large feeding aggregations (Mayor 2002). The ecology of larval Melyridae is poorly known, but the existing evidence suggests they are predators or scavengers, consuming small arthropods, fungi and detritus (Mayor 2002). In general, beetle pollination services are very poorly characterized and have received little research effort or funding (Bernhardt 2000). Despite being frequent floral visitors, very few studies have attempted to quantify the role of soft-winged flower beetles in pollination (e.g., Pierre and Hofs 2010, Silval et al. 2011). Given that soft-winged flower beetles are typically densely pubescent and have been observed to retain pollen in museum collections and to transport pollen in the field, Mawdsley (2003) proposed that members of the Dasytinae subfamily are important pollinators in Western North America. In the survey area, *Eudasytes* (Melyridae: Dasytinae) were the dominant morphospecies, comprising more than half of all specimens, and might be an important component of the local pollinator community. Flight distance of soft-winged flower beetles are largely unknown, but *Astylus atromaculatus*, a known pollinator two to three times larger than *Eudastyes*, moves primarily locally, averaging less than 20 m in 48 hours

(Pierre and Hofs 2010). Widespread distribution suggests the entire survey area is capable of supporting *Eudasytes*. While the flight distances of *Eudasytes* is unknown, if it is similar to that of *Astylus*, habitat disturbance is likely to have only localized effects on *Eudastyes* abundance.

5.1.2. Bombyliidae

After soft-winged flower beetles, bee flies (Bombyliidae) were the second most abundant insect family and accounted for 11% of the total specimens. Bee flies are common floral visitors where they consume nectar, and occasionally pollen (e.g., Inouye et al. 2015, Larson et al. 2001). Under some conditions, bee flies may exhibit floral constancy (i.e., foraging on a specific type of flower) equivalent to bees, supporting their role as important pollinators (Inouye et al. 2015). Flight distances of pollinating flies is poorly known, but flight distance between plants is usually short (Inouye et al. 2015). Larval bee flies are parasites or egg predators of bees, wasps, flies, moths or orthopterans (Yeates and Greathead 1997).

Most of the abundant bee fly morphospecies were widely distributed across the survey area. However, one small bee fly, that was a relatively large contributor diversity among sites, was more commonly observed south of the road bisecting critical habitat. A congeneric morphospecies with similar total abundance was present at 49 of 51 sites. Further study would be required to understand what underlies this skewed distribution. Generally, however, bee flies did not show recognizable patterns of spatial distribution across the survey area. Thus, within the survey area, there are no regions demonstrably more important than others for the maintenance and protection of bombyliids.

5.1.3. Apidae

Accounting for 5% of the total specimens, Apidae (Hymenoptera) was the third most abundant insect family observed in our survey. Most Apidae bees are relatively large, hairy and fast flying (Wilson and Carril 2016). Apidae is the most intensively studied group of Hymenopter and are widely recognized as important pollinators (Danforth, Minckley, and Neff 2019). The family includes social, solitary and many brood parasitic lineages (Danforth, Minckley, and Neff 2019). Most members of Apidae nest in the ground (Danforth, Minckley, and Neff 2019, Wilson and Carril 2016). While social bees can forage at great distances from their nest location, most solitary bees visit flowers less than 500m from their nest sites (Danforth, Minckley, and Neff 2019).

Five morphospecies of Apidae were represented by 20 or more total specimens, and occurred at 14 to 43 of 51 sites, including at least some of the Tiehm's subpopulations. One of these morphospecies belonged to the genus *Diadasia* and remaining four morphospecies were not identified to genus. *Diadasia* nest in the ground, either solitarily or forming large nest aggregations (Wilson and Carril 2016) Members of North American *Diadasia* specialize on flowers primarily from Malvaceae, Cactaeae, and less frequently on Asteraceae, Onagraceae, and Convolvulaceae (Sipes and Tepedino 2005). Pure or nearly pure pollen loads from their preferred floral host taxon were found on 17 of 25 species, whereas the remaining 8 species had reduced floral specificity (Sipes and Tepedino 2005). No species, however, is known regularly visit flowers of Polygonaceae (Sipes and Tepedino 2005), making members of *Diadasia* unlikely to provide pollination services to Tiehm's buckwheat.

5.2. BUCKWHEAT FLORAL VISTORS

Eriogogum flowers are visited by many insect species and are typically pollinated by generalists (i.e., species that visit many flower species) (Anderson 2004, 2006, Tepedino, Bowlin, and Griswold 2011). Clay-loving and Brandgee's buckwheat (*E. pelinophilum* and *E. brandegeei*, respectively) flowers are known to be visited by bees, wasps, ants and flies (Anderson 2006, Tepedino, Bowlin, and Griswold 2011). Tiehm's buckwheat flowers are known to be visited by beetles in addition to hymenopterans and flies. A previous study of Tiehm's buckwheat indicated that flowers were by visited equally by hymenopterans (bees and wasps) and beetles, with flies visiting less than half as frequently as the former taxa across combined sampling periods, (McClinton et al. 2022). Beetles and flies were also incidentally observed on Tiehm's buckwheat flowers by surveyors in this study. High rates of Tiehm's buckwheat floral visitation by beetles and their abundance supports the role of beetles as important as potential pollinators in the survey area.

5.3. DIVERSITY WITHIN AND BETWEEN SURVEY LOCATIONS

Coverage standardized indices of local diversity (i.e., Hill numbers) revealed no apparent spatial structuring of diversity across the survey area. As a whole, however, there is a greater diversity of potential pollinators present within the Tiehm's buckwheat population than in the surrounding critical habitat despite low total plant cover within the population (Cedar Creek & Associates, unpublished data). However, caution should be exercised when making conclusions regarding differences in diversity and its components between the species communities of potential pollinators in Tiehms' buckwheat versus the remainder of the critical habitat. Such differences are only detectable in coverage standardized diversity measures when data grouped by location and not on a per site basis (see **Section 4.3** and **4.3.1**).

The drivers of differences in diversity among sites, species replacement, where species replace each other over an ecological gradient, and differences in richness, where less diverse sites contain a subset of species occurring at high diversity sites can help guide conservation decisions (Socolar et al. 2016). For example, if species replacement was the most important determinant of inter-site differences, conservation efforts with the goal of maintaining diversity should ensure that areas targeted for conservation adequately capture the ecological gradient underlying species replacement. Conversely, if differences in richness are the primary determinant of inter-site diversity, conservation efforts should target areas of high diversity for conservation (Socolar et al. 2016).

Intermediate to moderately highly levels of dissimilarity were observed in the potential pollinator community and relative abundance of species between and among sites within the critical habitat of Tiehm's buckwheat. Across the Tiehm's buckwheat critical habitat, species replacement was the dominant contributor to inter-site differences. Ecological characteristics examined in this study (geographic distance, elevation and ground cover characteristics, including the proportion and type of vegetation), however, failed to explain inter-site species community differences. For example, Tiehm's buckwheat populations 4, 6a and 6b share less than approximately half of their potential pollinator despite being immediately adjacent to one another and sharing similar vegetative characteristics. Elevated dissimilarity, driven by species replacement, in the absence of identifiable ecological gradients suggests the community of potential pollinator species is assembled locally and does not identify regions of special importance for maintenance of regional pollinator diversity (i.e., across the critical habitat).

6. CONCLUSION

Tiehm's buckwheat critical habitat supports a species rich community of potential pollinators. Among these potential pollinators, soft-winged flower beetles were particularly abundant. However, because the identity of species pollinating Tiehm's buckwheat are not confirmed, conservation measures should focus on maintaining the current diversity of potential pollinators within the subpopulations. Outside of the subpopulations, there was no clear spatial pattern of potential pollinator diversity and survey locations adjacent to Tiehm's buckwheat subpopulations often had notably different community compositions. This suggests that potential pollinator communities are assembled based on environmental or other conditions at a local scale (i.e., sampling location).

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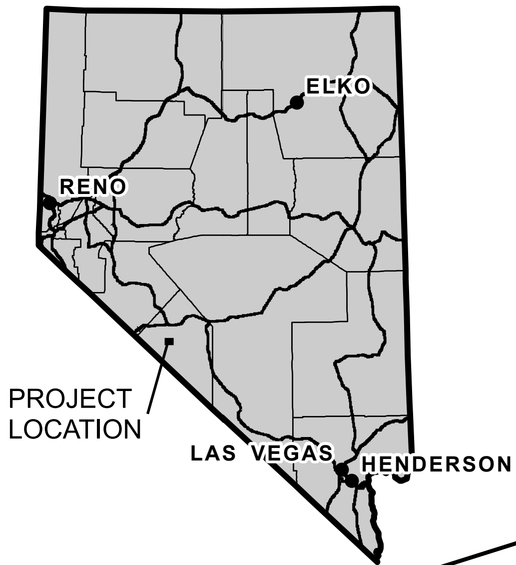
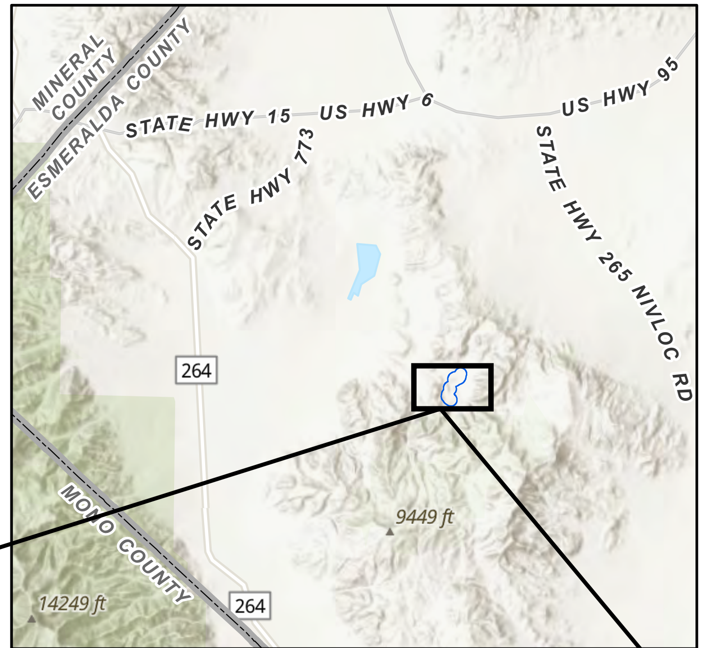
FIGURES

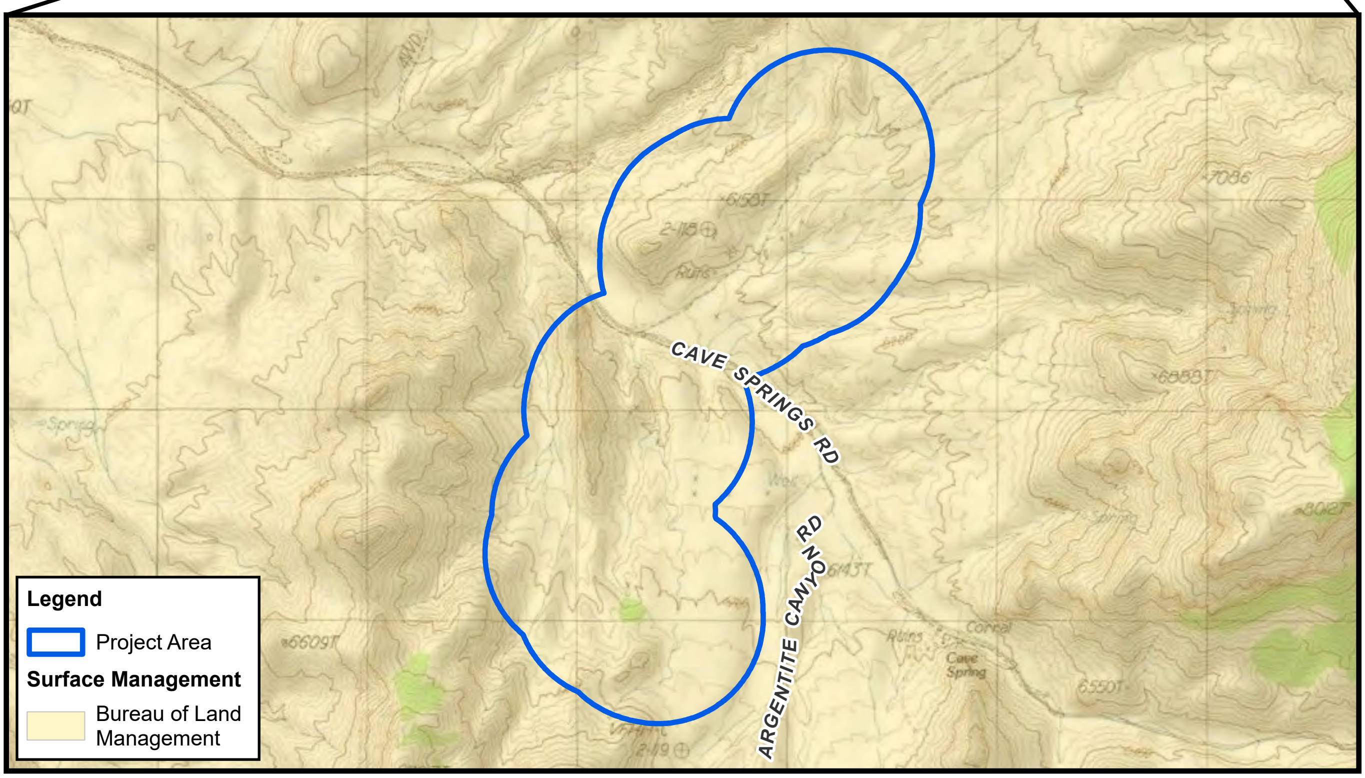
NEVADA



PROJECT VICINITY



Approximate Scale 1 inch equals 10 miles



T1S, R37E, Portions of Sections 27 and 34,
T2S, R37E, Portions of Section 3,
Esmeralda County, Nevada,
Projection: NAD 1983 UTM Zone 11N
Rhyolite Ridge USGS 7.5' Quadrangle
Surface Management: BLM 2021
Image Source: ArcGIS Online, World Topographic Map

N

0 1,500 3,000 Feet
0 500 1,000 Meters

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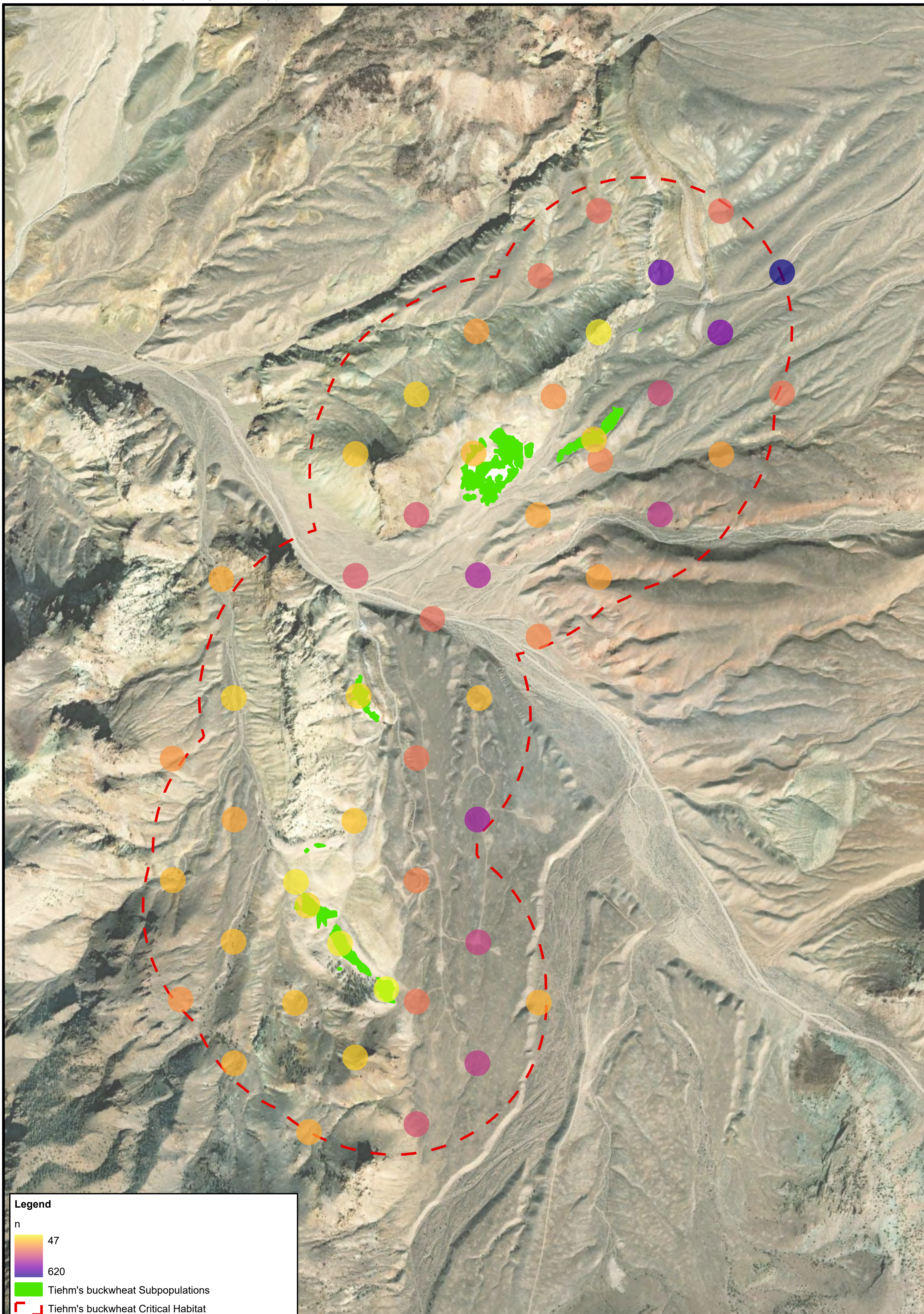
IONEER RHYOLITE RIDGE LLC
Tiehm's buckwheat Pollinator Sampling

VICINITY MAP
Figure 1



T1S, R37E, Portions of Sections 27 and 34,
T2S, R37E, Portions of Section 3,
Esmeralda County, Nevada,
Image Source: ArcGIS Online 6/26/2021

N

0 500 1,000 Feet

0 150 300 Meters

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Tiehm's buckwheat Pollinator Sampling

Total abundance of day flying, flower visiting, Coleoptera, Diptera, Hymenoptera and Lepidoptera

Figure 2

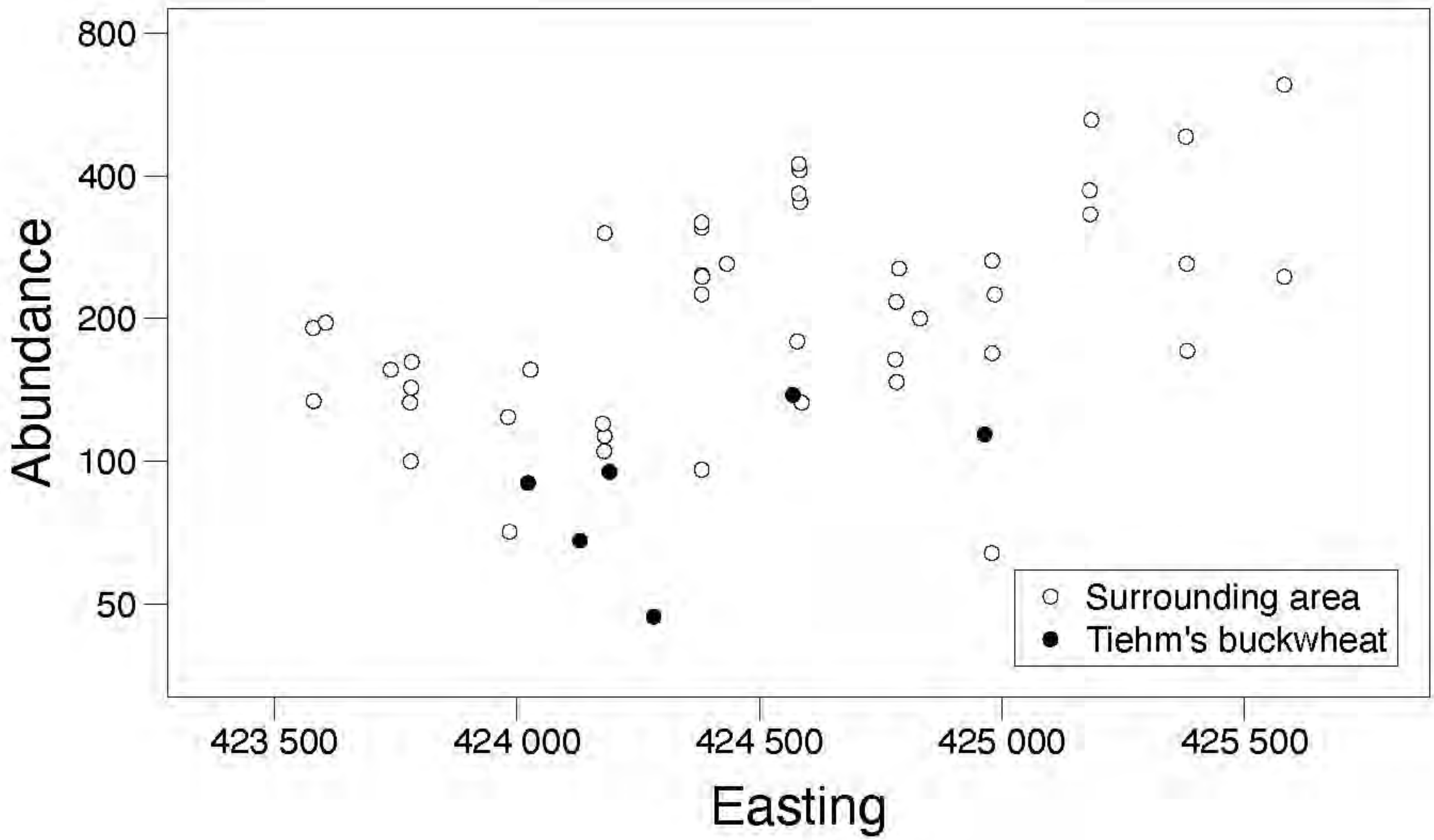


Figure 3. Abundance of potential pollinators inside and outside of Tiehm's buckwheat populations. Total abundance of potential pollinators (y-axis, log scaled) was higher in the eastern portions of the survey areas (x-axis NAD83 UTM zone 11N easting).

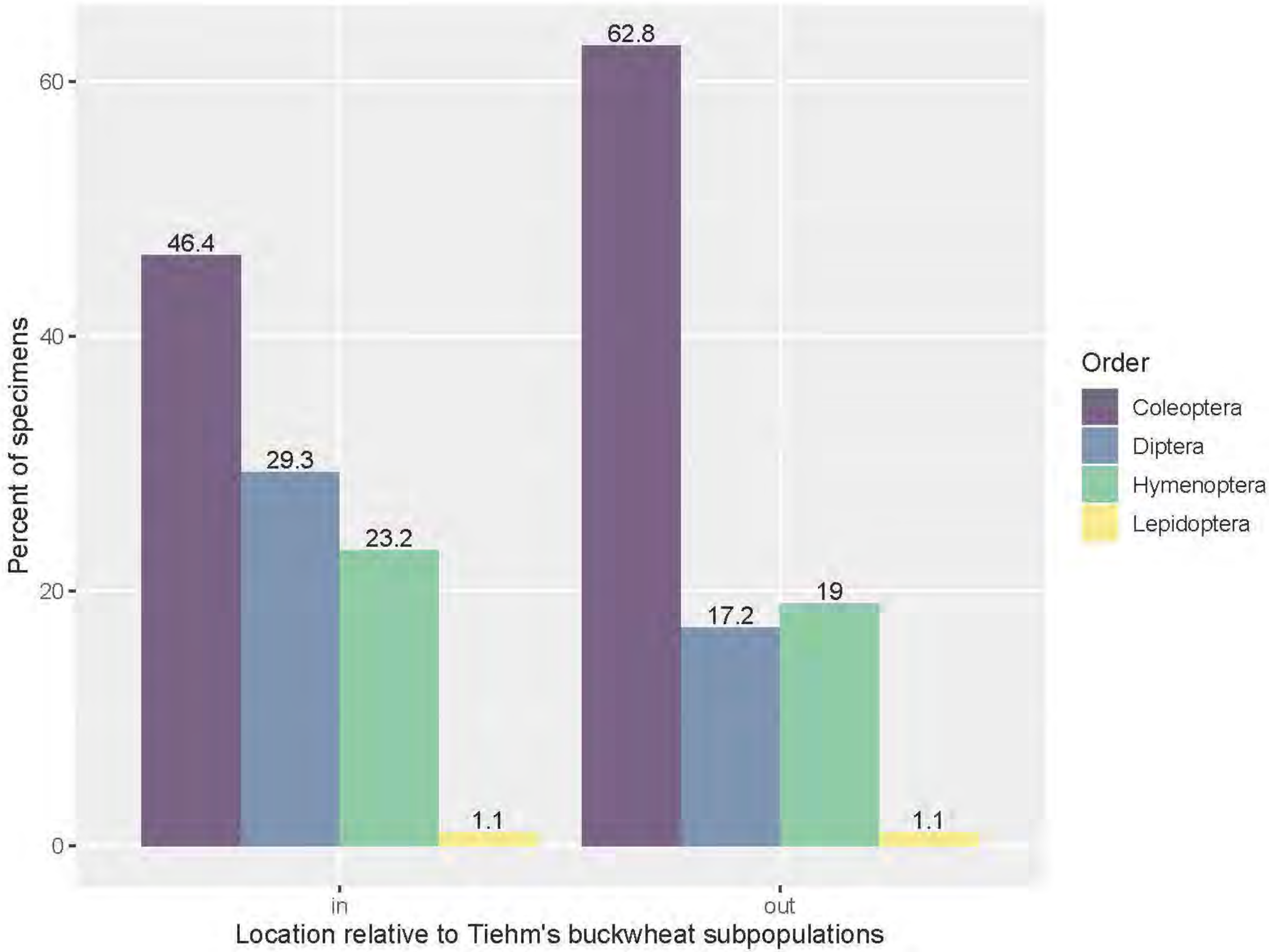


Figure 4. Percent of specimens from different orders of flower-visiting, day-flying insects within and outside of Tiehm's buckwheat populations.

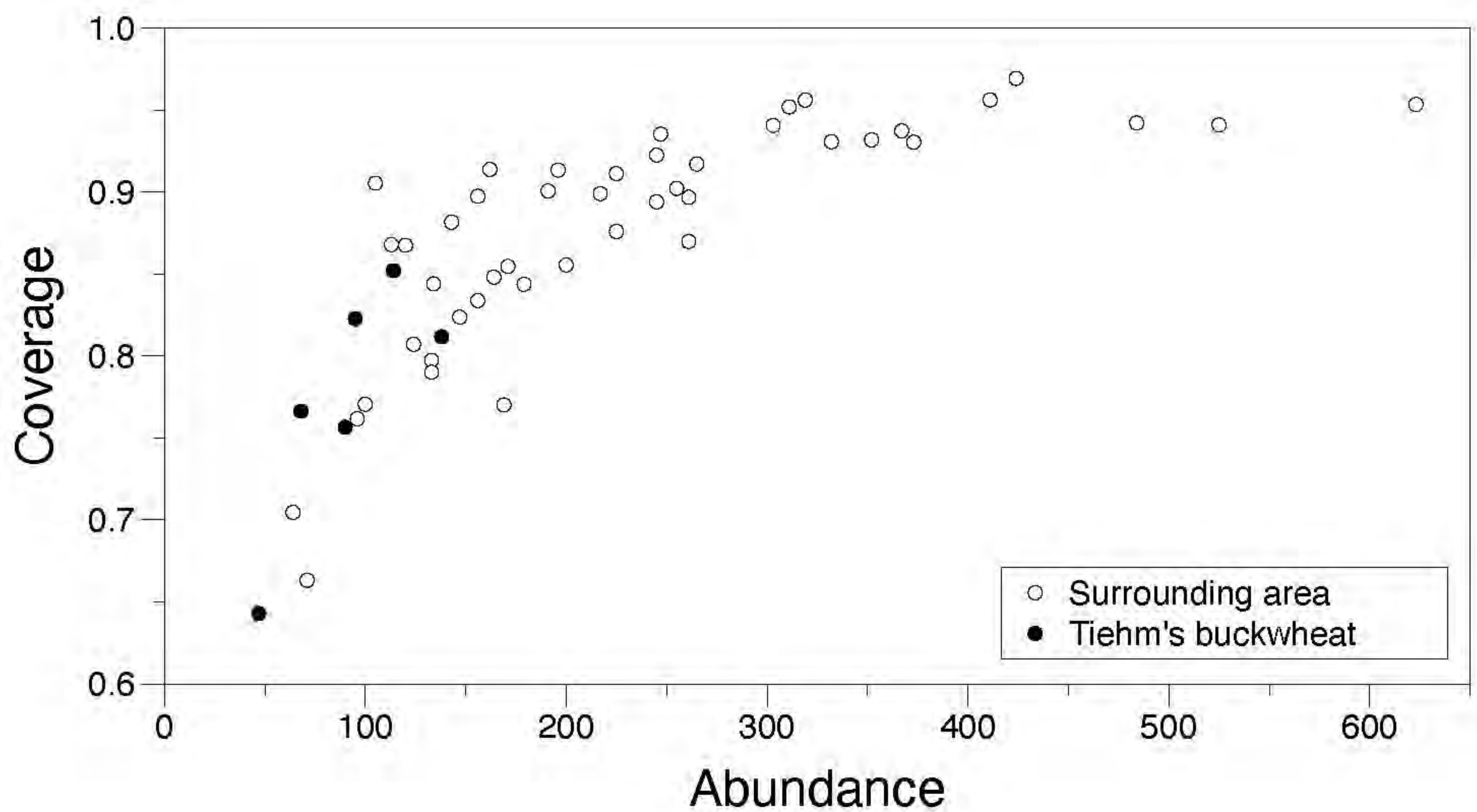
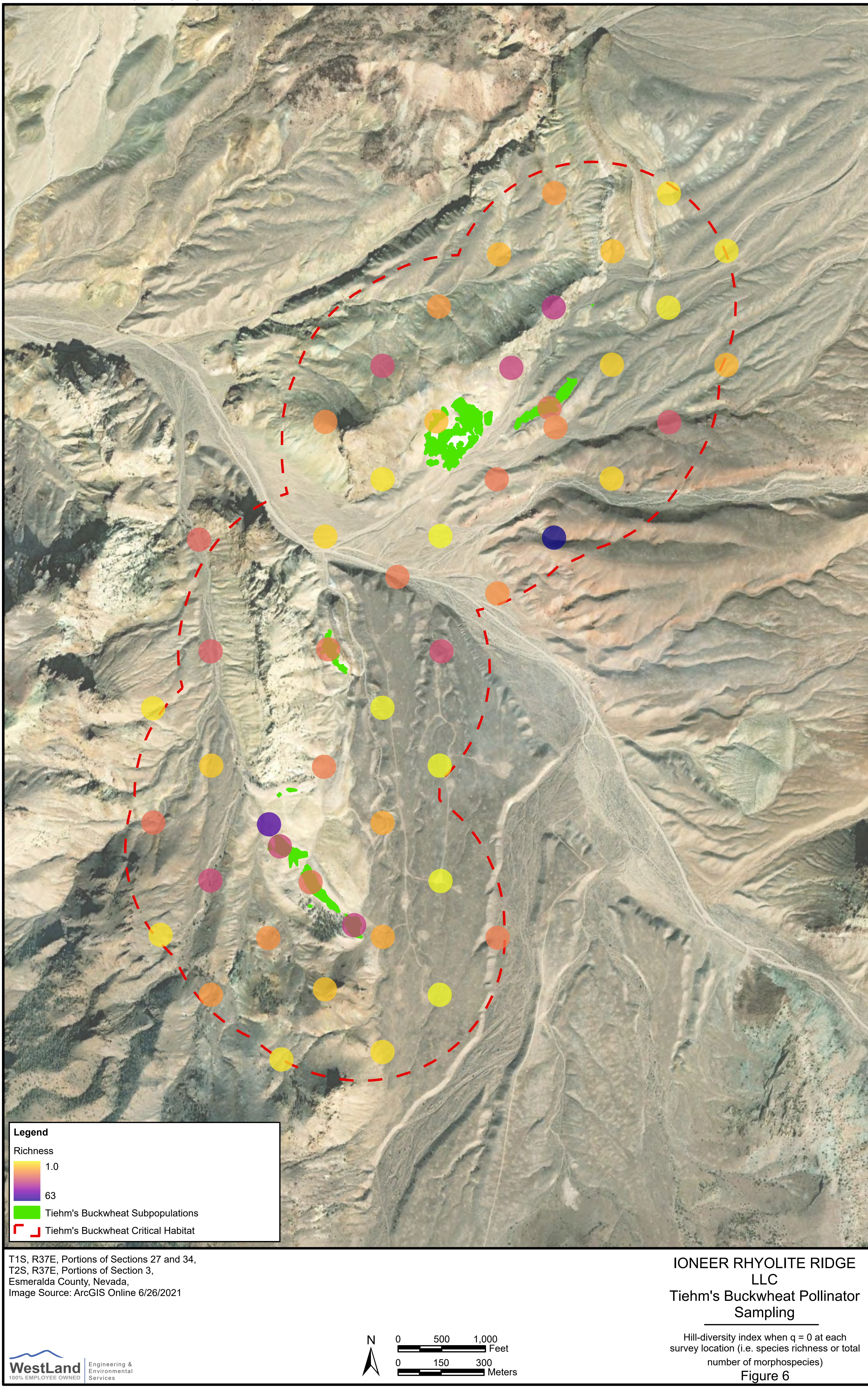


Figure 5. Relationship between abundance (number of specimens observed) and coverage. Sites within Tiehm's buckwheat subpopulations typically had a lower abundance of potential pollinators. When numerous different species are present and the total number of specimens collected is relatively low, the sample will more poorly represent the true species diversity at that location.



T1S, R37E, Portions of Sections 27 and 34,
T2S, R37E, Portions of Section 3,
Esmeralda County, Nevada,
Image Source: ArcGIS Online 6/26/2021

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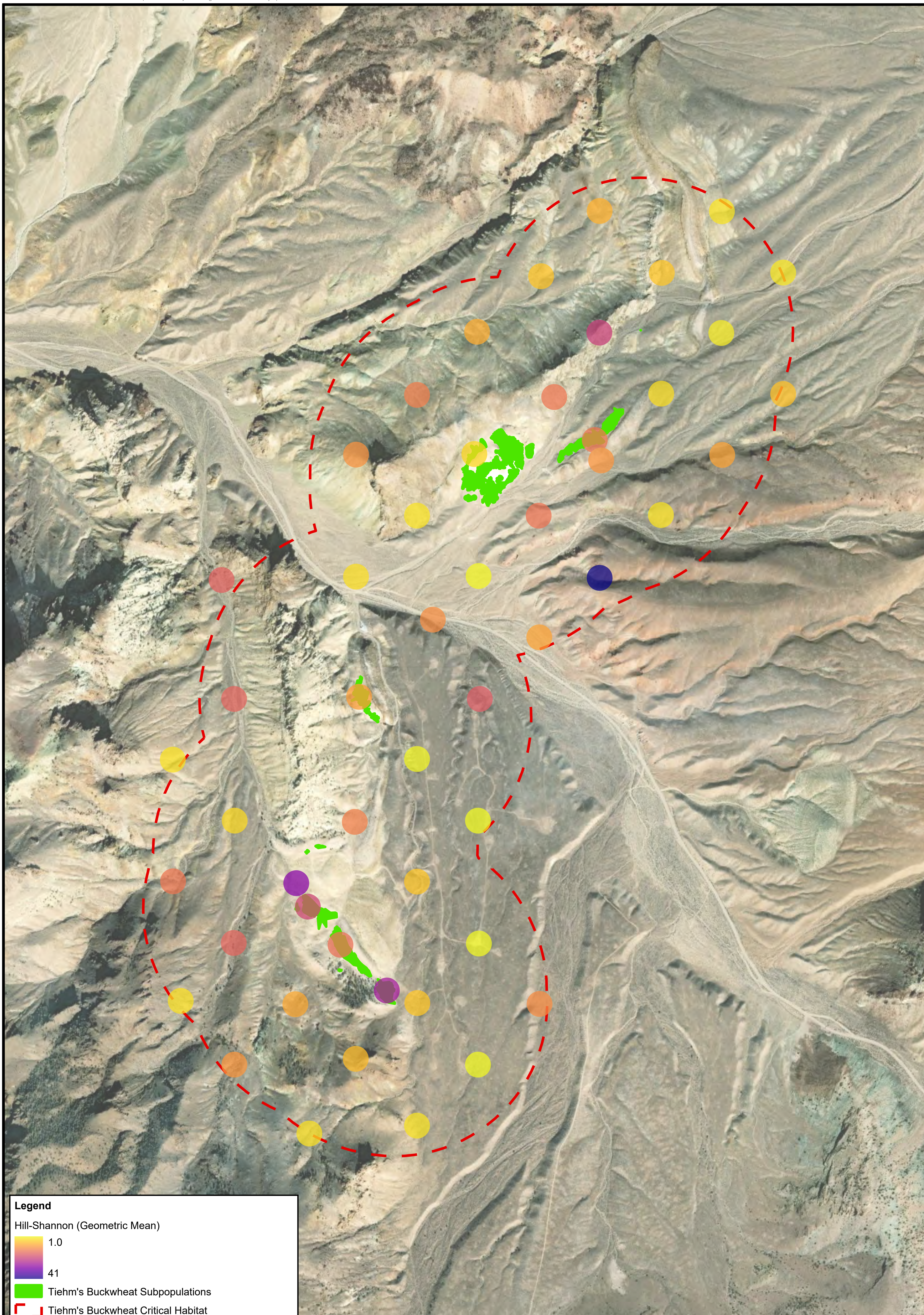
Tiehm's Buckwheat Pollinator Sampling

Hill-diversity index when q = 0 at each survey location (i.e. species richness or total number of morphospecies)

Figure 6



T1S, R37E, Portions of Sections 27 and 34,
T2S, R37E, Portions of Section 3,
Esmeralda County, Nevada,
Image Source: ArcGIS Online 6/26/2021

N

0 500 1,000 Feet

0 150 300 Meters

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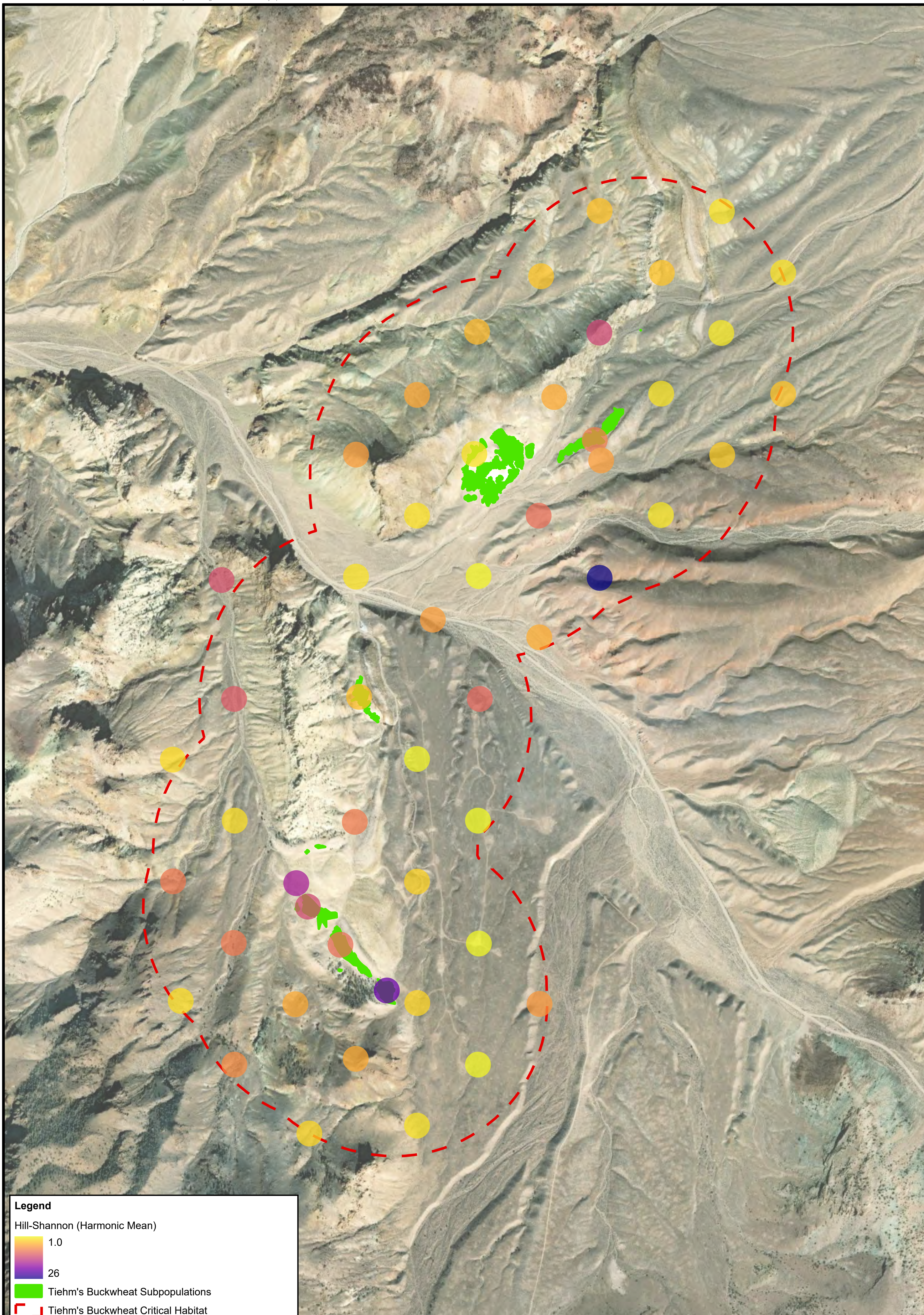
Tiehm's Buckwheat Pollinator Sampling

Hill-diversity index when q = 1 at each survey location (i.e. Hill-Shannon or Shannon diversity)

Figure 7



T1S, R37E, Portions of Sections 27 and 34,
T2S, R37E, Portions of Section 3,
Esmeralda County, Nevada,
Image Source: ArcGIS Online 6/26/2021

N

0 500 1,000 Feet

0 150 300 Meters

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Tiehm's Buckwheat Pollinator Sampling

Hill-diversity index when q = 2 at each survey location (i.e., Hill-Simpson or Simpson diversity).

Figure 8

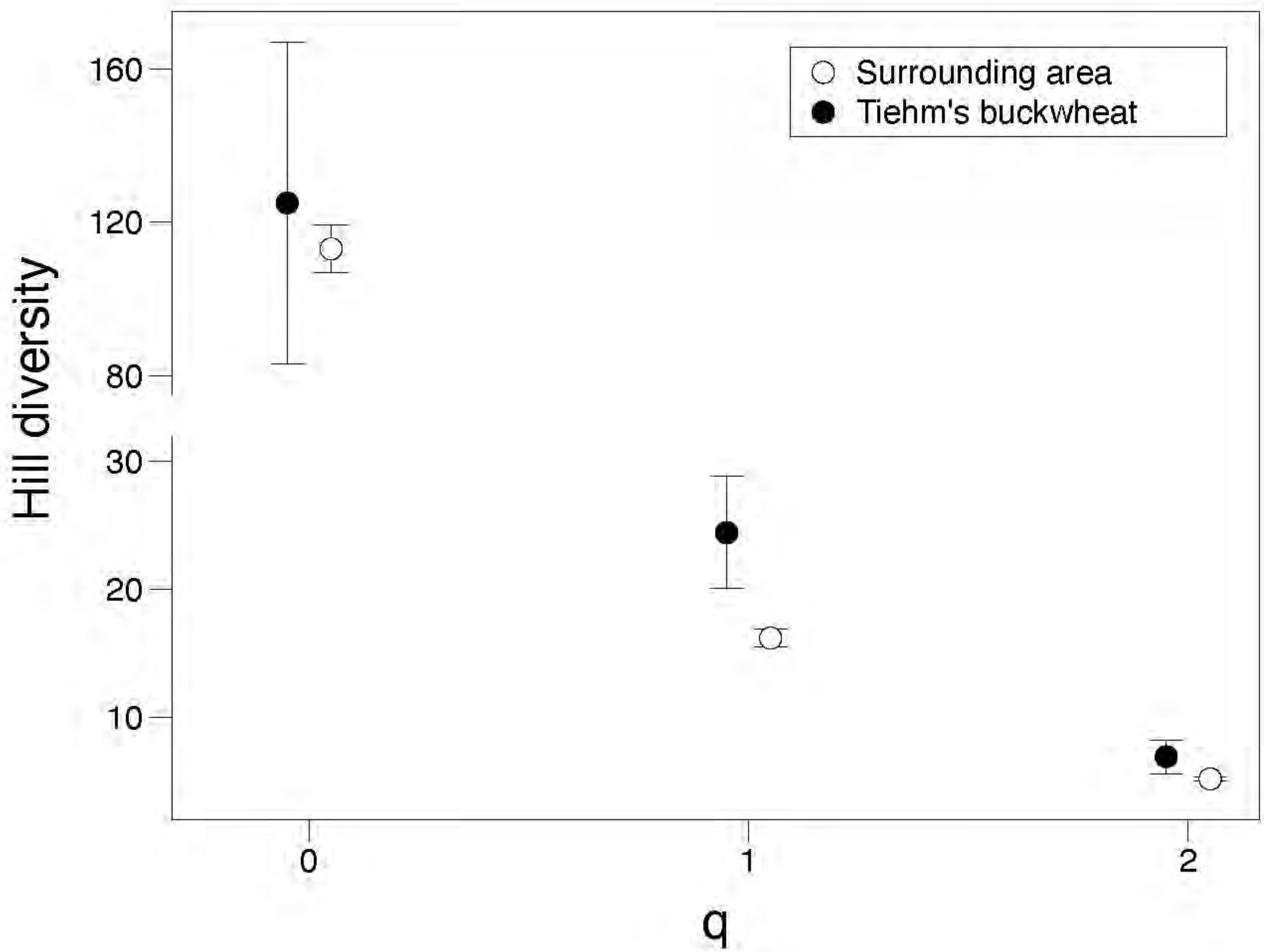

Figure 9. Estimated Hill diversity, standardized by coverage, inside and outside of the Tiehm's buckwheat subpopulations with 95% confidence intervals. q = 0 is equivalent to species richness. q = 1 is equivalent to Shannon diversity and q = 2 is equivalent to Simpson diversity. While there is no difference in species richness, both the Hill-Shannon and Hill-Simpson indices indicate higher diversity of potential pollinators within the Tiehm's buckwheat subpopulation than in the surrounding areas.

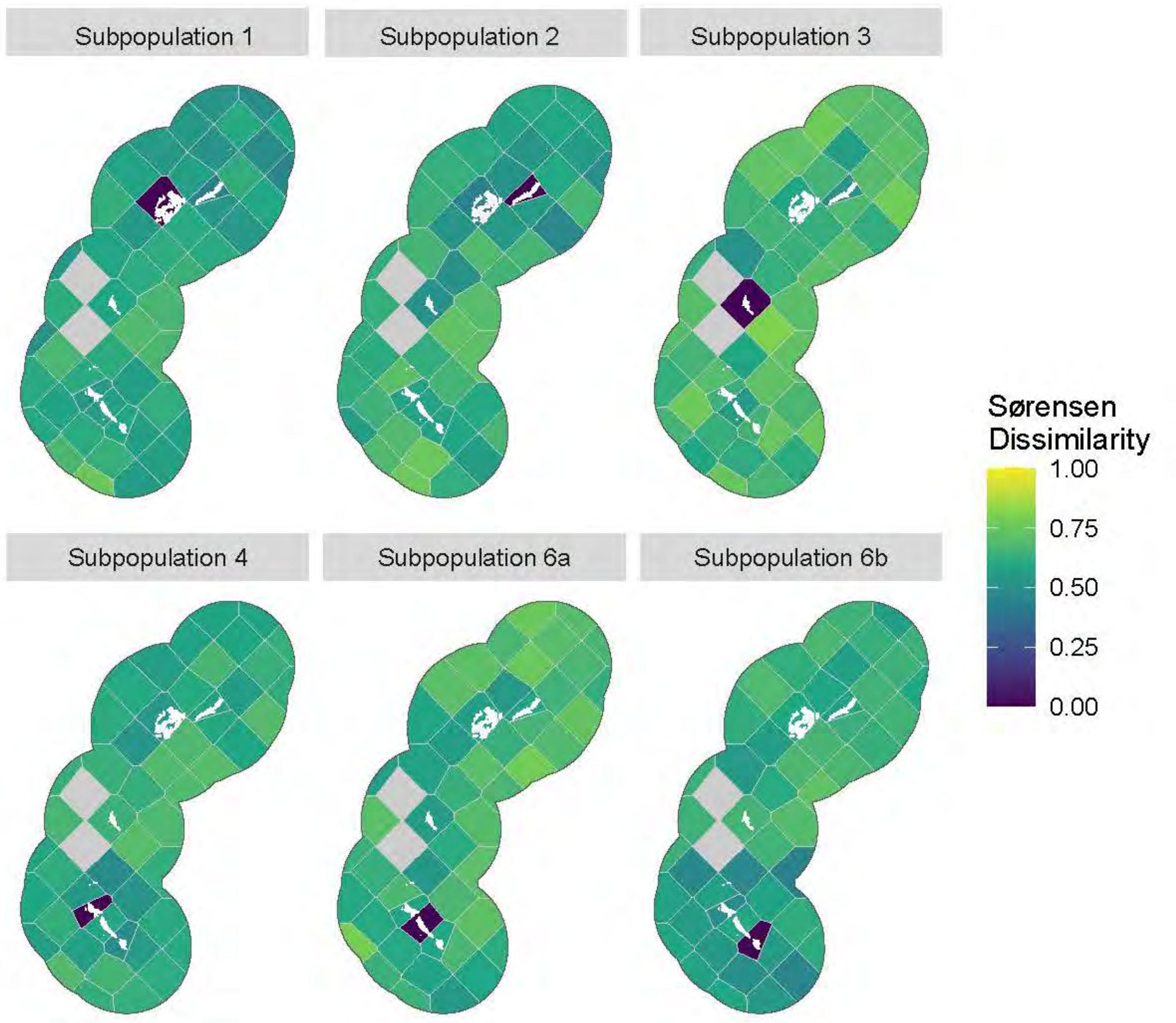

Figure 10. Dissimilarity based on the species composition of the potential pollinator community in Tiehm's buckwheat subpopulations and the remainder of the survey locations. Subpopulations are shown in white. Fill color of Voronoi polygons contains Sørensen dissimilarity. Dissimilarity is a pairwise comparison where a value of zero (shown in purple) indicates the species communities are identical, only occurring in our survey area when a location is compared to itself. A dissimilarity value of 0.5 indicates that 50% of the species occur at both locations and a value of one (shown in yellow) indicates that there are no species shared between the locations. Two survey locations occurred on a rocky ridgeline that could not be safely surveyed (missing data shown in grey).

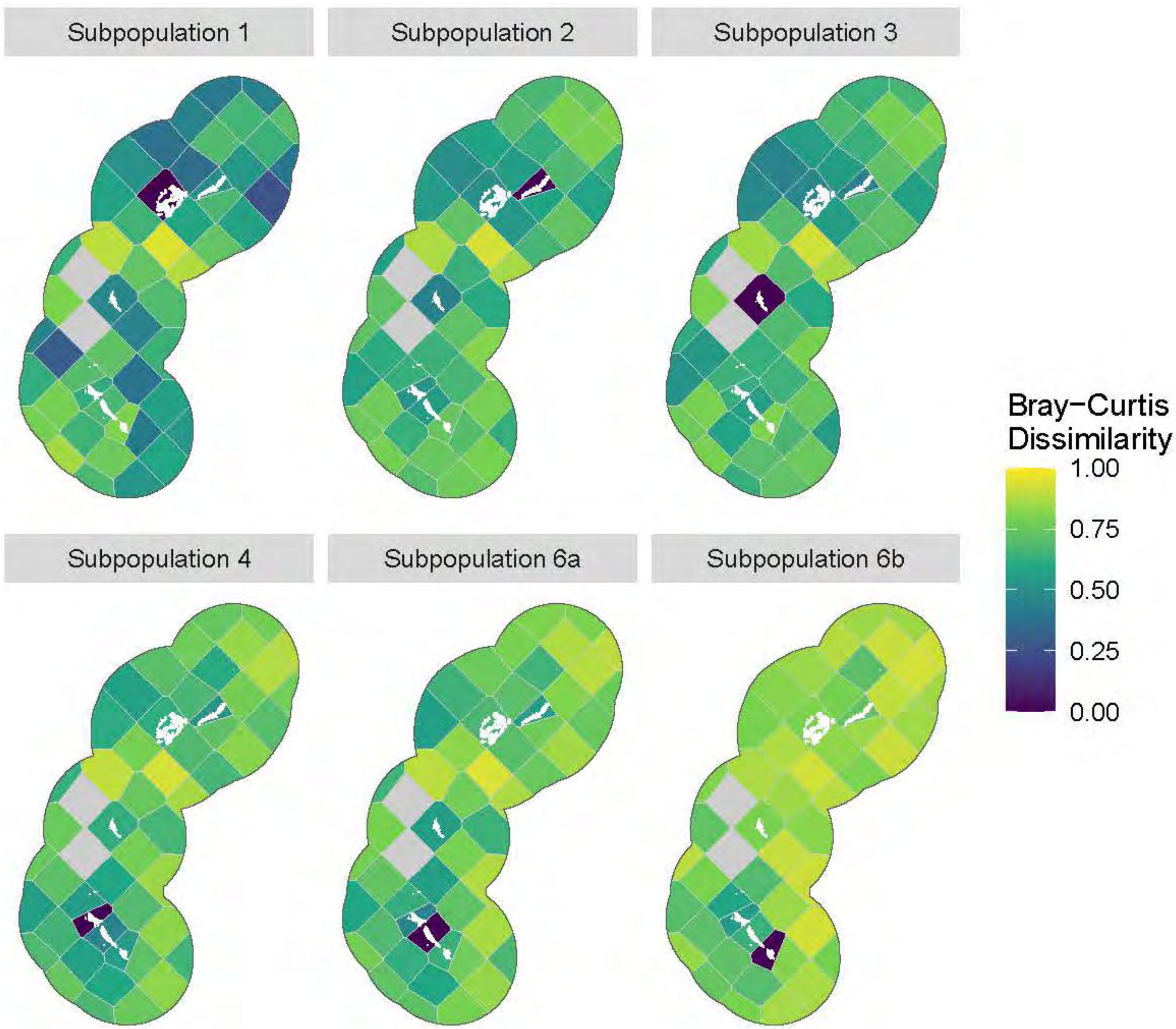

Figure 11. Dissimilarity based on the species composition and their relative abundance in Tiehm's buckwheat subpopulations and the remainder of the survey locations. Subpopulations are shown in white. Fill color of Voronoi polygons contains Bray-Curtis dissimilarity. Missing data shown in grey.

APPENDIX A
Photo pages

Photo 1.
Flowering Tiehm's buckwheat (*Eriogonum tiehmii).*

Photo 2.
Trap series in subpopulation 6a on June 1, 2022. Nine traps (alternating fluorescent blue, fluorescent yellow and translucent white) were placed approximately three meters apart at each survey site. Not all traps are visible in photo.

Photo 3.
Yellow pollinator pan trap on May 18, 2022, round 1 sampling collection period. Beetles, flies, bees and one micro-lepidopteran are visible.

Photo 4.
Incidental observation of a beetle (Melyridae: Malachiinae: probable *Attalus*) on Tiehm's buckwheat on May 31, 2022.

Photo 5.
Incidental observation of dipteran on Tiehm's buckwheat on May 17, 2022.

Photo 6.
Incidental observation of a beetle (Melyridae: Dasytinae: probable *Eudasytes*) on Tiehm's buckwheat on May 31, 2022.

Photo 7.
Widely published photo by Patrick Donnelly of Tiehm's buckwheat floral visitors. The coleopteran visitor cannot be definitely identified from this photo, but the dipteran visitor (Tachnidae: Dexiinae: *Nimioglossa*) was well represented in our survey, occurring at 39 of 51 sites. As larvae, tachinids are parasitic on other insects and adults are frequent floral visitors.

Photo 8.
Photo by Jim Morefield of a dipteran (probable Bombyliidae) floral visitor in May 2021 (sourced from iNaturalist).

Photo 9.
Photo by Naomi Fraga, posted on Twitter June 13, 2020 of a small bee visiting Tiehms's buckwheat.

Photo 10.
Photo by Naomi Fraga, posted on Twitter June 13, 2020 of a large bee fly (Bombyliidae) visiting Tiehm's buckwheat.

Photo 11.
Photo by Patrick Donnelly posted on the internet, captioned "Tiehm's buckwheat and a couple of its pollinator friends, June 3, 2021". Evident in the photo are two beetle floral visitors, one of which is identifiable to family (Buprestidae).

APPENDIX B
Potential pollinator abundance data

Appendix B. Potential Pollinator Abundance Data

Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	3	11S 424980 4186802	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	3
18.v.2022	out	3	11S 424980 4186802	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsuus	14
18.v.2022	out	3	11S 424980 4186802	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	110
18.v.2022	out	3	11S 424980 4186802	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	13
18.v.2022	out	3	11S 424980 4186802	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
18.v.2022	out	3	11S 424980 4186802	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
18.v.2022	out	3	11S 424980 4186802	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	5
18.v.2022	out	3	11S 424980 4186802	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
18.v.2022	out	3	11S 424980 4186802	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	5
18.v.2022	out	3	11S 424980 4186802	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	3
18.v.2022	out	3	11S 424980 4186802	D-022	Diptera	Bombyliidae	Ecliminae	Thevenemyia?	sp	1
18.v.2022	out	3	11S 424980 4186802	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	3	11S 424980 4186802	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	3	11S 424980 4186802	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	3	11S 424980 4186802	D-028	Diptera	Bombyliidae	Anthracinae	Epacmus?	sp	1
18.v.2022	out	3	11S 424980 4186802	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	3
18.v.2022	out	3	11S 424980 4186802	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
18.v.2022	out	3	11S 424980 4186802	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
18.v.2022	out	3	11S 424980 4186802	D-051	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp3	1
18.v.2022	out	3	11S 424980 4186802	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
18.v.2022	out	3	11S 424980 4186802	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	5
18.v.2022	out	3	11S 424980 4186802	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	2
18.v.2022	out	3	11S 424980 4186802	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Form6	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	7
18.v.2022	out	3	11S 424980 4186802	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
18.v.2022	out	3	11S 424980 4186802	Hym-Mega4	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Unk14	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	3	11S 424980 4186802	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	3	11S 424980 4186802	Hym-Unk4	Hymenoptera	unknown	unknown	unknown	unknown	4
18.v.2022	out	3	11S 424980 4186802	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	3	11S 424980 4186802	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	3	11S 424980 4186802	L-003	Lepidoptera	Pieridae	Pierinae	Pontia	beckerii?	1
18.v.2022	out	3	11S 424980 4186802	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
18.v.2022	out	5	11S 425381 4186801	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	3
18.v.2022	out	5	11S 425381 4186801	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	102
18.v.2022	out	5	11S 425381 4186801	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	2
18.v.2022	out	5	11S 425381 4186801	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	1
18.v.2022	out	5	11S 425381 4186801	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
18.v.2022	out	5	11S 425381 4186801	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
18.v.2022	out	5	11S 425381 4186801	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	5	11S 425381 4186801	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	5	11S 425381 4186801	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1

Appendix B. Potential Pollinator Abundance Data

Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	5	11S 425381 4186801	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	2
18.v.2022	out	5	11S 425381 4186801	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
18.v.2022	out	5	11S 425381 4186801	D-097	Diptera	Sarcophagidae	Miltogramminae	unknown	sp8	1
18.v.2022	out	5	11S 425381 4186801	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	5	11S 425381 4186801	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	5	11S 425381 4186801	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
18.v.2022	out	5	11S 425381 4186801	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	5	11S 425381 4186801	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	4
18.v.2022	out	7	11S 424788 4186588	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	51
18.v.2022	out	7	11S 424788 4186588	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	74
18.v.2022	out	7	11S 424788 4186588	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	7
18.v.2022	out	7	11S 424788 4186588	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
18.v.2022	out	7	11S 424788 4186588	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	1
18.v.2022	out	7	11S 424788 4186588	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
18.v.2022	out	7	11S 424788 4186588	C-011	Coleoptera	Melyridae	Dasytinae	Listrus	sp4	1
18.v.2022	out	7	11S 424788 4186588	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	3
18.v.2022	out	7	11S 424788 4186588	D-005	Diptera	Bombyliidae	Mythicomyiinae	Empidideicus	sp2	1
18.v.2022	out	7	11S 424788 4186588	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
18.v.2022	out	7	11S 424788 4186588	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	7	11S 424788 4186588	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
18.v.2022	out	7	11S 424788 4186588	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	2
18.v.2022	out	7	11S 424788 4186588	D-049	Diptera	Bombyliidae	Phthirinae	Phthiria	sp	1
18.v.2022	out	7	11S 424788 4186588	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
18.v.2022	out	7	11S 424788 4186588	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Anthid1	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	2
18.v.2022	out	7	11S 424788 4186588	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Api4	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	7	11S 424788 4186588	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	2
18.v.2022	out	7	11S 424788 4186588	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	7
18.v.2022	out	7	11S 424788 4186588	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	3
18.v.2022	out	7	11S 424788 4186588	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Ha1	Hymenoptera	Halictidae	Halictinae	Halictus	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	7	11S 424788 4186588	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	7	11S 424788 4186588	Hym-Unk17	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	7	11S 424788 4186588	Hym-Unk22	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	7	11S 424788 4186588	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	7	11S 424788 4186588	Hym-Unk6	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	7	11S 424788 4186588	Hym-W7	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	7	11S 424788 4186588	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	1
18.v.2022	out	7	11S 424788 4186588	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
18.v.2022	out	9	11S 425184 4186599	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	5
18.v.2022	out	9	11S 425184 4186599	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	54
18.v.2022	out	9	11S 425184 4186599	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	76
18.v.2022	out	9	11S 425184 4186599	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
18.v.2022	out	9	11S 425184 4186599	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	5
18.v.2022	out	9	11S 425184 4186599	C-016	Coleoptera	Buprestidae	Buprestinae	unknown	sp	1
18.v.2022	out	9	11S 425184 4186599	C-017	Coleoptera	Chrysomelidae	Galeurcinae	unknown	sp	1
18.v.2022	out	9	11S 425184 4186599	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	25
18.v.2022	out	9	11S 425184 4186599	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	12
18.v.2022	out	9	11S 425184 4186599	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	2
18.v.2022	out	9	11S 425184 4186599	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	9	11S 425184 4186599	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	9	11S 425184 4186599	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	9	11S 425184 4186599	D-028	Diptera	Bombyliidae	Anthracinae	Epacmus?	sp	2
18.v.2022	out	9	11S 425184 4186599	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
18.v.2022	out	9	11S 425184 4186599	D-038	Diptera	Syrphidae	Syrphinae	Syrphus	sp	1
18.v.2022	out	9	11S 425184 4186599	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	3
18.v.2022	out	9	11S 425184 4186599	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	3
18.v.2022	out	9	11S 425184 4186599	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
18.v.2022	out	9	11S 425184 4186599	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	1
18.v.2022	out	9	11S 425184 4186599	Hym-A5	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Ag1	Hymenoptera	Halictidae	Halictinae	Agapostemon	unknown	2
18.v.2022	out	9	11S 425184 4186599	Hym-Anthid1	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Anthid2	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	9	11S 425184 4186599	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	2
18.v.2022	out	9	11S 425184 4186599	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Crab17	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	6
18.v.2022	out	9	11S 425184 4186599	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	8
18.v.2022	out	9	11S 425184 4186599	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	6
18.v.2022	out	9	11S 425184 4186599	Hym-Form4	Hymenoptera	Formicidae	unknown	unknown	unknown	15
18.v.2022	out	9	11S 425184 4186599	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
18.v.2022	out	9	11S 425184 4186599	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
18.v.2022	out	9	11S 425184 4186599	Hym-M1	Hymenoptera	Mutilidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	4
18.v.2022	out	9	11S 425184 4186599	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	9	11S 425184 4186599	Hym-Nom1	Hymenoptera	Halictidae	Nomiinae	Nomia	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Per4	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	3
18.v.2022	out	9	11S 425184 4186599	Hym-Pomp3	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Sph3	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	24
18.v.2022	out	9	11S 425184 4186599	Hym-Unk17	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Unk18	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Unk6	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Ves10	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	Hym-Ves4	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	9	11S 425184 4186599	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	3
18.v.2022	out	9	11S 425184 4186599	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
18.v.2022	out	11	11S 425582 4186600	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
18.v.2022	out	11	11S 425582 4186600	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	104
18.v.2022	out	11	11S 425582 4186600	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	311
18.v.2022	out	11	11S 425582 4186600	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	4
18.v.2022	out	11	11S 425582 4186600	C-018	Coleoptera	Melyridae	Dasytinae	Listrus	sp2	1
18.v.2022	out	11	11S 425582 4186600	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	6
18.v.2022	out	11	11S 425582 4186600	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
18.v.2022	out	11	11S 425582 4186600	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	11	11S 425582 4186600	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	22
18.v.2022	out	11	11S 425582 4186600	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	11	11S 425582 4186600	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
18.v.2022	out	11	11S 425582 4186600	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
18.v.2022	out	11	11S 425582 4186600	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
18.v.2022	out	11	11S 425582 4186600	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	3
18.v.2022	out	11	11S 425582 4186600	D-053	Diptera	Sepsidae	Sepsinae	Saltella	sphondylii	1
18.v.2022	out	11	11S 425582 4186600	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	2
18.v.2022	out	11	11S 425582 4186600	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
18.v.2022	out	11	11S 425582 4186600	Hym-A1	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	5
18.v.2022	out	11	11S 425582 4186600	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	11	11S 425582 4186600	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	8
18.v.2022	out	11	11S 425582 4186600	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	4
18.v.2022	out	11	11S 425582 4186600	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-Dr1	Hymenoptera	Dryinidae	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-Ha1	Hymenoptera	Halictidae	Halictinae	Halictus	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	5
18.v.2022	out	11	11S 425582 4186600	Hym-Unk17	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	11	11S 425582 4186600	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	8
18.v.2022	out	11	11S 425582 4186600	Hym-Unk22	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-Unk23	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-W16	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	11	11S 425582 4186600	Hym-W9	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	11	11S 425582 4186600	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
18.v.2022	out	13	11S 424578 4186406	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
18.v.2022	out	13	11S 424578 4186406	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	6
18.v.2022	out	13	11S 424578 4186406	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	38
18.v.2022	out	13	11S 424578 4186406	C-012	Coleoptera	Melyridae	Dasytina	Listrus	sp1	1
18.v.2022	out	13	11S 424578 4186406	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
18.v.2022	out	13	11S 424578 4186406	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
18.v.2022	out	13	11S 424578 4186406	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
18.v.2022	out	13	11S 424578 4186406	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	13	11S 424578 4186406	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	13	11S 424578 4186406	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	3
18.v.2022	out	13	11S 424578 4186406	D-042	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp	1
18.v.2022	out	13	11S 424578 4186406	D-046	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp2	1
18.v.2022	out	13	11S 424578 4186406	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	3
18.v.2022	out	13	11S 424578 4186406	D-076	Diptera	Bombyliidae	Bombyliinae	Triploechus?	sp2	1
18.v.2022	out	13	11S 424578 4186406	D-110	Diptera	Muscidae	Faniidae	Fannia	sp	1
18.v.2022	out	13	11S 424578 4186406	Hym-A1	Hymenoptera	Apidae	Apinae	unknown	unknown	2
18.v.2022	out	13	11S 424578 4186406	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	3
18.v.2022	out	13	11S 424578 4186406	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	13	11S 424578 4186406	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	6
18.v.2022	out	13	11S 424578 4186406	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	13	11S 424578 4186406	Hym-Ves10	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-W11	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-W15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-W17	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	13	11S 424578 4186406	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	15	11S 424979 4186403	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
18.v.2022	out	15	11S 424979 4186403	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
18.v.2022	out	15	11S 424979 4186403	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	7
18.v.2022	out	15	11S 424979 4186403	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	1
18.v.2022	out	15	11S 424979 4186403	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
18.v.2022	out	15	11S 424979 4186403	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	3
18.v.2022	out	15	11S 424979 4186403	D-029	Diptera	Bombyliidae	Usiinae	Apolysis	sp4	1
18.v.2022	out	15	11S 424979 4186403	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
18.v.2022	out	15	11S 424979 4186403	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	2
18.v.2022	out	15	11S 424979 4186403	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	1
18.v.2022	out	15	11S 424979 4186403	D-053	Diptera	Sepsidae	Sepsinae	Saltella	sphondylii	1
18.v.2022	out	15	11S 424979 4186403	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	15	11S 424979 4186403	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	out	15	11S 424979 4186403	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	15	11S 424979 4186403	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
18.v.2022	out	15	11S 424979 4186403	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	15	11S 424979 4186403	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	6
18.v.2022	out	15	11S 424979 4186403	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	7
18.v.2022	out	15	11S 424979 4186403	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
18.v.2022	out	15	11S 424979 4186403	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	15	11S 424979 4186403	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
18.v.2022	out	15	11S 424979 4186403	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	15	11S 424979 4186403	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	4
18.v.2022	out	15	11S 424979 4186403	Hym-Unk23	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	15	11S 424979 4186403	Hym-W4	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	15	11S 424979 4186403	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
18.v.2022	out	15	11S 424979 4186403	L-010	Lepidoptera	unknown	unknown	unknown	sp6	1
18.v.2022	out	17	11S 425379 4186402	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	2
18.v.2022	out	17	11S 425379 4186402	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	92
18.v.2022	out	17	11S 425379 4186402	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	271
18.v.2022	out	17	11S 425379 4186402	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	18
18.v.2022	out	17	11S 425379 4186402	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
18.v.2022	out	17	11S 425379 4186402	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	2
18.v.2022	out	17	11S 425379 4186402	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	17	11S 425379 4186402	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	4
18.v.2022	out	17	11S 425379 4186402	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	17	11S 425379 4186402	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
18.v.2022	out	17	11S 425379 4186402	D-046	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp2	1
18.v.2022	out	17	11S 425379 4186402	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	2
18.v.2022	out	17	11S 425379 4186402	Hym-A5	Hymenoptera	Apidae	Apinae	unknown	unknown	3
18.v.2022	out	17	11S 425379 4186402	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	5
18.v.2022	out	17	11S 425379 4186402	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	17	11S 425379 4186402	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	4
18.v.2022	out	17	11S 425379 4186402	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Crab22	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
18.v.2022	out	17	11S 425379 4186402	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	6
18.v.2022	out	17	11S 425379 4186402	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	17	11S 425379 4186402	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	17	11S 425379 4186402	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	1
18.v.2022	out	20	11S 424381 4186199	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
18.v.2022	out	20	11S 424381 4186199	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
18.v.2022	out	20	11S 424381 4186199	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	20
18.v.2022	out	20	11S 424381 4186199	D-010	Diptera	Chironomidae	unknown	unknown	sp	1

Appendix B. Potential Pollinator Abundance Data

Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	20	11S 424381 4186199	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
18.v.2022	out	20	11S 424381 4186199	D-039	Diptera	Asilidae	Asilinae	Efferia	sp	1
18.v.2022	out	20	11S 424381 4186199	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	3
18.v.2022	out	20	11S 424381 4186199	Hym-Anthid1	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
18.v.2022	out	20	11S 424381 4186199	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	20	11S 424381 4186199	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	20	11S 424381 4186199	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	out	20	11S 424381 4186199	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	20	11S 424381 4186199	Hym-Crab7	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	20	11S 424381 4186199	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	3
18.v.2022	out	20	11S 424381 4186199	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
18.v.2022	out	22	11S 424831 4186192	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
18.v.2022	out	22	11S 424831 4186192	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
18.v.2022	out	22	11S 424831 4186192	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	38
18.v.2022	out	22	11S 424831 4186192	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
18.v.2022	out	22	11S 424831 4186192	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
18.v.2022	out	22	11S 424831 4186192	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	2
18.v.2022	out	22	11S 424831 4186192	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
18.v.2022	out	22	11S 424831 4186192	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	3
18.v.2022	out	22	11S 424831 4186192	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	22	11S 424831 4186192	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	2
18.v.2022	out	22	11S 424831 4186192	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	22	11S 424831 4186192	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	22	11S 424831 4186192	D-031	Diptera	Ulididae	Otinae	Haigia	nevadana	1
18.v.2022	out	22	11S 424831 4186192	D-040	Diptera	Tachinidae	Tachininae	Peleteria	sp	1
18.v.2022	out	22	11S 424831 4186192	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
18.v.2022	out	22	11S 424831 4186192	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
18.v.2022	out	22	11S 424831 4186192	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
18.v.2022	out	22	11S 424831 4186192	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	1
18.v.2022	out	22	11S 424831 4186192	Hym-A7	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	3
18.v.2022	out	22	11S 424831 4186192	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	22	11S 424831 4186192	Hym-Crab20	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
18.v.2022	out	22	11S 424831 4186192	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	3
18.v.2022	out	22	11S 424831 4186192	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	2
18.v.2022	out	22	11S 424831 4186192	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
18.v.2022	out	22	11S 424831 4186192	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	3
18.v.2022	out	22	11S 424831 4186192	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	22	11S 424831 4186192	Hym-Unk17	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	22	11S 424831 4186192	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	22	11S 424831 4186192	Hym-Unk23	Hymenoptera	unknown	unknown	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	22	11S 424831 4186192	Hym-W3	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	in	24	11S 424964 4186051	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
18.v.2022	in	24	11S 424964 4186051	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	17
18.v.2022	in	24	11S 424964 4186051	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	3
18.v.2022	in	24	11S 424964 4186051	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
18.v.2022	in	24	11S 424964 4186051	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	1
18.v.2022	in	24	11S 424964 4186051	D-014	Diptera	Cecidomyiidae	Cecidomyiinae	unknown	sp	1
18.v.2022	in	24	11S 424964 4186051	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
18.v.2022	in	24	11S 424964 4186051	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	3
18.v.2022	in	24	11S 424964 4186051	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	2
18.v.2022	in	24	11S 424964 4186051	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	2
18.v.2022	in	24	11S 424964 4186051	D-031	Diptera	Ulididae	Otinae	Haigia	nevadana	2
18.v.2022	in	24	11S 424964 4186051	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	2
18.v.2022	in	24	11S 424964 4186051	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
18.v.2022	in	24	11S 424964 4186051	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
18.v.2022	in	24	11S 424964 4186051	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp1	2
18.v.2022	in	24	11S 424964 4186051	Hym-A2	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	in	24	11S 424964 4186051	Hym-Anthid1	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
18.v.2022	in	24	11S 424964 4186051	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	in	24	11S 424964 4186051	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	in	24	11S 424964 4186051	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	in	24	11S 424964 4186051	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
18.v.2022	in	24	11S 424964 4186051	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	in	24	11S 424964 4186051	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	in	24	11S 424964 4186051	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	4
18.v.2022	in	24	11S 424964 4186051	Hym-Unk21	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	in	24	11S 424964 4186051	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	25	11S 425182 4186203	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
18.v.2022	out	25	11S 425182 4186203	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	8
18.v.2022	out	25	11S 425182 4186203	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	197
18.v.2022	out	25	11S 425182 4186203	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	10
18.v.2022	out	25	11S 425182 4186203	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
18.v.2022	out	25	11S 425182 4186203	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
18.v.2022	out	25	11S 425182 4186203	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	2
18.v.2022	out	25	11S 425182 4186203	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	25	11S 425182 4186203	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	25	11S 425182 4186203	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
18.v.2022	out	25	11S 425182 4186203	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
18.v.2022	out	25	11S 425182 4186203	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	4
18.v.2022	out	25	11S 425182 4186203	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	25	11S 425182 4186203	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	25	11S 425182 4186203	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	25	11S 425182 4186203	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	3
18.v.2022	out	25	11S 425182 4186203	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Co1	Hymenoptera	Megachilidae	Megachilinae	Coelioxys	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	15

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	25	11S 425182 4186203	Hym-Di1	Hymenoptera	Megachilidae	Megachilinae	Dianthidium	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	6
18.v.2022	out	25	11S 425182 4186203	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
18.v.2022	out	25	11S 425182 4186203	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	4
18.v.2022	out	25	11S 425182 4186203	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	3
18.v.2022	out	25	11S 425182 4186203	L-019	Lepidoptera	unknown	unknown	unknown	sp22	1
18.v.2022	out	27	11S 425582 4186202	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	2
18.v.2022	out	27	11S 425582 4186202	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	31
18.v.2022	out	27	11S 425582 4186202	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	92
18.v.2022	out	27	11S 425582 4186202	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
18.v.2022	out	27	11S 425582 4186202	C-018	Coleoptera	Melyridae	Dasytinae	Listrus	sp2	1
18.v.2022	out	27	11S 425582 4186202	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	8
18.v.2022	out	27	11S 425582 4186202	D-005	Diptera	Bombyliidae	Mythicomyiinae	Empidideicus	sp2	1
18.v.2022	out	27	11S 425582 4186202	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	3
18.v.2022	out	27	11S 425582 4186202	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	5
18.v.2022	out	27	11S 425582 4186202	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	27	11S 425582 4186202	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	3
18.v.2022	out	27	11S 425582 4186202	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	2
18.v.2022	out	27	11S 425582 4186202	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
18.v.2022	out	27	11S 425582 4186202	D-042	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp	2
18.v.2022	out	27	11S 425582 4186202	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
18.v.2022	out	27	11S 425582 4186202	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	4
18.v.2022	out	27	11S 425582 4186202	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	27	11S 425582 4186202	Hym-A5	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	out	27	11S 425582 4186202	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	27	11S 425582 4186202	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	6
18.v.2022	out	27	11S 425582 4186202	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	5
18.v.2022	out	27	11S 425582 4186202	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	3
18.v.2022	out	27	11S 425582 4186202	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	27	11S 425582 4186202	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	8
18.v.2022	out	27	11S 425582 4186202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	4
18.v.2022	out	27	11S 425582 4186202	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	27	11S 425582 4186202	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	27	11S 425582 4186202	Hym-W1	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	27	11S 425582 4186202	Hym-W3	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	29	11S 424181 4186003	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
18.v.2022	out	29	11S 424181 4186003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	14
18.v.2022	out	29	11S 424181 4186003	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	9
18.v.2022	out	29	11S 424181 4186003	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	6
18.v.2022	out	29	11S 424181 4186003	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
18.v.2022	out	29	11S 424181 4186003	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
18.v.2022	out	29	11S 424181 4186003	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	3
18.v.2022	out	29	11S 424181 4186003	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
18.v.2022	out	29	11S 424181 4186003	D-045	Diptera	Bombyliidae	Mythicomyiinae	Empidideicus	sp	1
18.v.2022	out	29	11S 424181 4186003	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	3

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	29	11S 424181 4186003	D-103	Diptera	Anthomyiidae	Anthomyiinae	Hydrophoria?	sp	1
18.v.2022	out	29	11S 424181 4186003	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	29	11S 424181 4186003	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	29	11S 424181 4186003	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
18.v.2022	out	29	11S 424181 4186003	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	5
18.v.2022	out	29	11S 424181 4186003	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
18.v.2022	out	29	11S 424181 4186003	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	4
18.v.2022	out	29	11S 424181 4186003	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	5
18.v.2022	out	29	11S 424181 4186003	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	29	11S 424181 4186003	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	29	11S 424181 4186003	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	in	31	11S 424569 4186005	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	40
18.v.2022	in	31	11S 424569 4186005	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
18.v.2022	in	31	11S 424569 4186005	C-023	Coleoptera	Melyridae	Dasytinae	Vectura	sp	1
18.v.2022	in	31	11S 424569 4186005	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
18.v.2022	in	31	11S 424569 4186005	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
18.v.2022	in	31	11S 424569 4186005	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
18.v.2022	in	31	11S 424569 4186005	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
18.v.2022	in	31	11S 424569 4186005	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
18.v.2022	in	31	11S 424569 4186005	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	1
18.v.2022	in	31	11S 424569 4186005	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	1
18.v.2022	in	31	11S 424569 4186005	Hym-Ag1	Hymenoptera	Halictidae	Halictinae	Agapostemon	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	3
18.v.2022	in	31	11S 424569 4186005	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	4
18.v.2022	in	31	11S 424569 4186005	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-H1	Hymenoptera	Mellitidae	Dasypodainae	Hesperapis	unknown	2
18.v.2022	in	31	11S 424569 4186005	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	in	31	11S 424569 4186005	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	in	31	11S 424569 4186005	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
18.v.2022	out	33	11S 424985 4185984	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	3
18.v.2022	out	33	11S 424985 4185984	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	33
18.v.2022	out	33	11S 424985 4185984	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	20
18.v.2022	out	33	11S 424985 4185984	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
18.v.2022	out	33	11S 424985 4185984	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
18.v.2022	out	33	11S 424985 4185984	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	2
18.v.2022	out	33	11S 424985 4185984	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	33	11S 424985 4185984	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	12
18.v.2022	out	33	11S 424985 4185984	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	13
18.v.2022	out	33	11S 424985 4185984	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
18.v.2022	out	33	11S 424985 4185984	D-045	Diptera	Bombyliidae	Phthiriinae	Empidideicus	sp	1
18.v.2022	out	33	11S 424985 4185984	D-046	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp2	1
18.v.2022	out	33	11S 424985 4185984	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	2
18.v.2022	out	33	11S 424985 4185984	D-075	Diptera	Bombyliidae	Lordotinae	Lordotus	sp2	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	33	11S 424985 4185984	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	out	33	11S 424985 4185984	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	out	33	11S 424985 4185984	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Crab18	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	33	11S 424985 4185984	Hym-Crab21	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
18.v.2022	out	33	11S 424985 4185984	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	4
18.v.2022	out	33	11S 424985 4185984	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Sph4	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Unk19	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-Unk3	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	33	11S 424985 4185984	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	33	11S 424985 4185984	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	Hym-W15	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	33	11S 424985 4185984	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	33	11S 424985 4185984	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	2
18.v.2022	out	35	11S 425382 4186002	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
18.v.2022	out	35	11S 425382 4186002	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	46
18.v.2022	out	35	11S 425382 4186002	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	2
18.v.2022	out	35	11S 425382 4186002	D-010	Diptera	Chironomidae		unknown	sp	1
18.v.2022	out	35	11S 425382 4186002	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
18.v.2022	out	35	11S 425382 4186002	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	3
18.v.2022	out	35	11S 425382 4186002	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	35	11S 425382 4186002	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	35	11S 425382 4186002	D-039	Diptera	Asilidae	Asilinae	Efferia	sp	1
18.v.2022	out	35	11S 425382 4186002	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
18.v.2022	out	35	11S 425382 4186002	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	3
18.v.2022	out	35	11S 425382 4186002	Hym-A4	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-A5	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	35	11S 425382 4186002	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	3
18.v.2022	out	35	11S 425382 4186002	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	out	35	11S 425382 4186002	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	out	35	11S 425382 4186002	Hym-Beth3	Hymenoptera	Bethylidae	unknown	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Crab15	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Crab17	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Crab18	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	35	11S 425382 4186002	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
18.v.2022	out	35	11S 425382 4186002	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	35	11S 425382 4186002	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
18.v.2022	out	35	11S 425382 4186002	Hym-Os2	Hymenoptera	Megachilidae	Megachilinae	Osmia	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Sph3	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	35	11S 425382 4186002	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	35	11S 425382 4186002	Hym-Unk3	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	38	11S 424381 4185803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	6
18.v.2022	out	38	11S 424381 4185803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	52
18.v.2022	out	38	11S 424381 4185803	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	158
18.v.2022	out	38	11S 424381 4185803	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	2
18.v.2022	out	38	11S 424381 4185803	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	3
18.v.2022	out	38	11S 424381 4185803	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	5
18.v.2022	out	38	11S 424381 4185803	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	2
18.v.2022	out	38	11S 424381 4185803	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	38	11S 424381 4185803	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
18.v.2022	out	38	11S 424381 4185803	D-045	Diptera	Bombyliidae		Empidideicus	sp	2
18.v.2022	out	38	11S 424381 4185803	D-046	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp2	1
18.v.2022	out	38	11S 424381 4185803	D-107	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1
18.v.2022	out	38	11S 424381 4185803	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	38	11S 424381 4185803	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	38	11S 424381 4185803	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	38	11S 424381 4185803	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	15
18.v.2022	out	38	11S 424381 4185803	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	38	11S 424381 4185803	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	38	11S 424381 4185803	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	38	11S 424381 4185803	Hym-Sph2	Hymenoptera	Sphecidae	unknown	unknown	unknown	2
18.v.2022	out	38	11S 424381 4185803	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	38	11S 424381 4185803	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	38	11S 424381 4185803	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
18.v.2022	out	40	11S 424780 4185803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	6
18.v.2022	out	40	11S 424780 4185803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	20
18.v.2022	out	40	11S 424780 4185803	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	2
18.v.2022	out	40	11S 424780 4185803	D-006	Diptera	Phoridae	Metopininae	unknown	sp	1
18.v.2022	out	40	11S 424780 4185803	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	40	11S 424780 4185803	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	40	11S 424780 4185803	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
18.v.2022	out	40	11S 424780 4185803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	3
18.v.2022	out	40	11S 424780 4185803	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	8
18.v.2022	out	40	11S 424780 4185803	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	9
18.v.2022	out	40	11S 424780 4185803	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Crab18	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	7
18.v.2022	out	40	11S 424780 4185803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	8
18.v.2022	out	40	11S 424780 4185803	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	40	11S 424780 4185803	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	3
18.v.2022	out	40	11S 424780 4185803	Hym-Unk11	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	40	11S 424780 4185803	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	5
18.v.2022	out	40	11S 424780 4185803	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	40	11S 424780 4185803	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
18.v.2022	out	40	11S 424780 4185803	L-018	Lepidoptera	Noctuidae	unknown	unknown	sp10	1
18.v.2022	out	42	11S 425181 4185805	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	2
18.v.2022	out	42	11S 425181 4185805	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	211
18.v.2022	out	42	11S 425181 4185805	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	6
18.v.2022	out	42	11S 425181 4185805	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	2
18.v.2022	out	42	11S 425181 4185805	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
18.v.2022	out	42	11S 425181 4185805	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
18.v.2022	out	42	11S 425181 4185805	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
18.v.2022	out	42	11S 425181 4185805	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	7
18.v.2022	out	42	11S 425181 4185805	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp	1
18.v.2022	out	42	11S 425181 4185805	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	42	11S 425181 4185805	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	2
18.v.2022	out	42	11S 425181 4185805	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	17
18.v.2022	out	42	11S 425181 4185805	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	3
18.v.2022	out	42	11S 425181 4185805	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
18.v.2022	out	42	11S 425181 4185805	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp1	1
18.v.2022	out	42	11S 425181 4185805	D-050	Diptera	Sphaeroceridae	unknown	unknown	sp	1
18.v.2022	out	42	11S 425181 4185805	D-103	Diptera	Anthomyiidae	Anthomyiinae	Hydrophoria?	sp	1
18.v.2022	out	42	11S 425181 4185805	D-104	Diptera	Ulididae	Ulidiinae	Acrosticta	sp	1
18.v.2022	out	42	11S 425181 4185805	D-105	Diptera	Anthomyiidae	Anthomyiinae	unknown	sp3	1
18.v.2022	out	42	11S 425181 4185805	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	42	11S 425181 4185805	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	5
18.v.2022	out	42	11S 425181 4185805	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	9
18.v.2022	out	42	11S 425181 4185805	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Eu2	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
18.v.2022	out	42	11S 425181 4185805	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Unk6	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	Hym-Ves11	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	42	11S 425181 4185805	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
18.v.2022	out	44	11S 423740 4185592	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	13
18.v.2022	out	44	11S 423740 4185592	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	2
18.v.2022	out	44	11S 423740 4185592	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp	1
18.v.2022	out	44	11S 423740 4185592	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	11
18.v.2022	out	44	11S 423740 4185592	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
18.v.2022	out	44	11S 423740 4185592	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	44	11S 423740 4185592	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	44	11S 423740 4185592	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	44	11S 423740 4185592	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	out	44	11S 423740 4185592	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	44	11S 423740 4185592	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	44	11S 423740 4185592	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	7
18.v.2022	out	44	11S 423740 4185592	Hym-Eu1	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	10
18.v.2022	out	44	11S 423740 4185592	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	9
18.v.2022	out	44	11S 423740 4185592	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	44	11S 423740 4185592	Hym-Unk18	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	Hym-Ves3	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	44	11S 423740 4185592	L-016	Lepidoptera	unknown	unknown	unknown	sp8	1
18.v.2022	out	46	11S 424181 4185603	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	2
18.v.2022	out	46	11S 424181 4185603	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	6
18.v.2022	out	46	11S 424181 4185603	C-022	Coleoptera	Chrysomelidae	Galeurcinae	unknown	sp	1
18.v.2022	out	46	11S 424181 4185603	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	3
18.v.2022	out	46	11S 424181 4185603	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
18.v.2022	out	46	11S 424181 4185603	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	6
18.v.2022	out	46	11S 424181 4185603	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
18.v.2022	out	46	11S 424181 4185603	D-033	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp4	1
18.v.2022	out	46	11S 424181 4185603	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
18.v.2022	out	46	11S 424181 4185603	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	3
18.v.2022	out	46	11S 424181 4185603	D-052	Diptera	Anthomyiidae	Anthomyiinae	Crinurina??	sp	1
18.v.2022	out	46	11S 424181 4185603	D-074	Diptera	Muscidae	Muscinae	Neomyia	sp	1
18.v.2022	out	46	11S 424181 4185603	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	17
18.v.2022	out	46	11S 424181 4185603	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
18.v.2022	out	46	11S 424181 4185603	L-010	Lepidoptera	unknown	unknown	unknown	sp6	3
18.v.2022	out	48	11S 424583 4185605	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	3
18.v.2022	out	48	11S 424583 4185605	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	18
18.v.2022	out	48	11S 424583 4185605	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
18.v.2022	out	48	11S 424583 4185605	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	2
18.v.2022	out	48	11S 424583 4185605	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	2
18.v.2022	out	48	11S 424583 4185605	D-007	Diptera	Chloropidae	Oscinellinae	unknown	sp2	1
18.v.2022	out	48	11S 424583 4185605	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	2
18.v.2022	out	48	11S 424583 4185605	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	3
18.v.2022	out	48	11S 424583 4185605	D-051	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp3	1
18.v.2022	out	48	11S 424583 4185605	D-053	Diptera	Sepsidae	Sepsinae	Saltella	sphondylii	3

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	48	11S 424583 4185605	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	16
18.v.2022	out	48	11S 424583 4185605	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	48	11S 424583 4185605	Hym-Crab21	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	48	11S 424583 4185605	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
18.v.2022	out	48	11S 424583 4185605	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-Eu2	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-F1	Hymenoptera	Figitidae	unknown	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
18.v.2022	out	48	11S 424583 4185605	Hym-Lasio3	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
18.v.2022	out	48	11S 424583 4185605	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
18.v.2022	out	48	11S 424583 4185605	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	48	11S 424583 4185605	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	48	11S 424583 4185605	Hym-Unk4	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	48	11S 424583 4185605	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-Unk7	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	Hym-W14	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	48	11S 424583 4185605	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	1
18.v.2022	out	48	11S 424583 4185605	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
18.v.2022	out	50	11S 424980 4185599	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	2
18.v.2022	out	50	11S 424980 4185599	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	6
18.v.2022	out	50	11S 424980 4185599	C-017	Coleoptera	Chrysomelidae	Galeurcinae	Phyllotreta?	sp	2
18.v.2022	out	50	11S 424980 4185599	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	3
18.v.2022	out	50	11S 424980 4185599	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
18.v.2022	out	50	11S 424980 4185599	D-008	Diptera	Bombyliidae	Anthracinae	Anthrax	sp2	1
18.v.2022	out	50	11S 424980 4185599	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp	1
18.v.2022	out	50	11S 424980 4185599	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	3
18.v.2022	out	50	11S 424980 4185599	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	50	11S 424980 4185599	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
18.v.2022	out	50	11S 424980 4185599	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	50	11S 424980 4185599	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	17
18.v.2022	out	50	11S 424980 4185599	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Crab18	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Crab20	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	50	11S 424980 4185599	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
18.v.2022	out	50	11S 424980 4185599	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
18.v.2022	out	50	11S 424980 4185599	Hym-Eu2	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Ich2	Hymenoptera	Ichnuemonidae	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Lasio3	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
18.v.2022	out	50	11S 424980 4185599	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	5

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	50	11S 424980 4185599	Hym-Os3	Hymenoptera	Megachilidae	Megachilinae	Osmia	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	13
18.v.2022	out	50	11S 424980 4185599	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	6
18.v.2022	out	50	11S 424980 4185599	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	Hym-Unk21	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	50	11S 424980 4185599	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	50	11S 424980 4185599	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
18.v.2022	out	50	11S 424980 4185599	L-005	Lepidoptera	Pieridae	Pierinae	Pontia	sp	1
18.v.2022	out	55	11S 424433 4185462	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	3
18.v.2022	out	55	11S 424433 4185462	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	16
18.v.2022	out	55	11S 424433 4185462	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	4
18.v.2022	out	55	11S 424433 4185462	D-009	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp5	1
18.v.2022	out	55	11S 424433 4185462	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	11
18.v.2022	out	55	11S 424433 4185462	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
18.v.2022	out	55	11S 424433 4185462	D-028	Diptera	Bombyliidae	Anthracinae	Epacmus?	sp	1
18.v.2022	out	55	11S 424433 4185462	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
18.v.2022	out	55	11S 424433 4185462	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
18.v.2022	out	55	11S 424433 4185462	D-046	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp2	1
18.v.2022	out	55	11S 424433 4185462	D-051	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp3	1
18.v.2022	out	55	11S 424433 4185462	D-053	Diptera	Sepsidae	Sepsinae	Saltella	sphondylii	1
18.v.2022	out	55	11S 424433 4185462	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	2
18.v.2022	out	55	11S 424433 4185462	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	1
18.v.2022	out	55	11S 424433 4185462	D-100	Diptera	Anthomyiidae	Miltogramminae	Senotainia?	sp	1
18.v.2022	out	55	11S 424433 4185462	D-105	Diptera	Anthomyiidae	Anthomyiinae	unknown	sp3	1
18.v.2022	out	55	11S 424433 4185462	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	55	11S 424433 4185462	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
18.v.2022	out	55	11S 424433 4185462	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
18.v.2022	out	55	11S 424433 4185462	Hym-Unk17	Hymenoptera	unknown	unknown	unknown	unknown	3
18.v.2022	out	55	11S 424433 4185462	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	23
18.v.2022	out	55	11S 424433 4185462	Hym-Unk22	Hymenoptera	unknown	unknown	unknown	unknown	4
18.v.2022	out	55	11S 424433 4185462	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	55	11S 424433 4185462	Hym-Ves9	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	21
18.v.2022	out	57	11S 424782 4185404	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	6
18.v.2022	out	57	11S 424782 4185404	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
18.v.2022	out	57	11S 424782 4185404	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	4
18.v.2022	out	57	11S 424782 4185404	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
18.v.2022	out	57	11S 424782 4185404	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
18.v.2022	out	57	11S 424782 4185404	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	2
18.v.2022	out	57	11S 424782 4185404	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
18.v.2022	out	57	11S 424782 4185404	D-033	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp4	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	57	11S 424782 4185404	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
18.v.2022	out	57	11S 424782 4185404	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2?	1
18.v.2022	out	57	11S 424782 4185404	D-053	Diptera	Sepsidae	Sepsinae	Saltella	sphondylii	1
18.v.2022	out	57	11S 424782 4185404	D-054	Diptera	Sciaridae	unknown	Eugnoriste	sp	2
18.v.2022	out	57	11S 424782 4185404	D-055	Diptera	Anthomyiidae	unknown	unknown	sp	1
18.v.2022	out	57	11S 424782 4185404	Hym-Ag1	Hymenoptera	Halictidae	Halictinae	Agapostemon	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	57	11S 424782 4185404	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	4
18.v.2022	out	57	11S 424782 4185404	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	2
18.v.2022	out	57	11S 424782 4185404	Hym-Crab12	Hymenoptera	Crabronidae	unknown	unknown	unknown	5
18.v.2022	out	57	11S 424782 4185404	Hym-Crab21	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	7
18.v.2022	out	57	11S 424782 4185404	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Eu4	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Sph5	Hymenoptera	Sphecidae	unknown	unknown	unknown	2
18.v.2022	out	57	11S 424782 4185404	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Unk17	Hymenoptera	unknown	unknown	unknown	unknown	5
18.v.2022	out	57	11S 424782 4185404	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	16
18.v.2022	out	57	11S 424782 4185404	Hym-Unk22	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	57	11S 424782 4185404	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	57	11S 424782 4185404	L-019	Lepidoptera	unknown	unknown	unknown	sp22	1
20.v.2022	out	60	11S 423781 4185202	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
20.v.2022	out	60	11S 423781 4185202	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
20.v.2022	out	60	11S 423781 4185202	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
20.v.2022	out	60	11S 423781 4185202	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
20.v.2022	out	60	11S 423781 4185202	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
20.v.2022	out	60	11S 423781 4185202	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	14
20.v.2022	out	60	11S 423781 4185202	D-039	Diptera	Asilidae	Asilinae	Efferia	sp	1
20.v.2022	out	60	11S 423781 4185202	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
20.v.2022	out	60	11S 423781 4185202	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	3
20.v.2022	out	60	11S 423781 4185202	D-057	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp1	1
20.v.2022	out	60	11S 423781 4185202	D-058	Diptera	Bombyliidae	Mythicomyiinae	Glabellula	sp	1
20.v.2022	out	60	11S 423781 4185202	D-069	Diptera	Bombyliidae	Bombyliinae	Lordotus	sp	1
20.v.2022	out	60	11S 423781 4185202	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	60	11S 423781 4185202	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
20.v.2022	out	60	11S 423781 4185202	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	60	11S 423781 4185202	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	60	11S 423781 4185202	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	60	11S 423781 4185202	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
20.v.2022	out	60	11S 423781 4185202	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	10
20.v.2022	out	60	11S 423781 4185202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	60	11S 423781 4185202	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	in	62	11S 424191 4185209	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	36
20.v.2022	in	62	11S 424191 4185209	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
20.v.2022	in	62	11S 424191 4185209	C-023	Coleoptera	Melyridae	Dasytinae	Vectura	sp	1
20.v.2022	in	62	11S 424191 4185209	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
20.v.2022	in	62	11S 424191 4185209	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	2
20.v.2022	in	62	11S 424191 4185209	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	3
20.v.2022	in	62	11S 424191 4185209	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
20.v.2022	in	62	11S 424191 4185209	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	2
20.v.2022	in	62	11S 424191 4185209	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	in	62	11S 424191 4185209	D-057	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp1	1
20.v.2022	in	62	11S 424191 4185209	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
20.v.2022	in	62	11S 424191 4185209	D-060	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp3	1
20.v.2022	in	62	11S 424191 4185209	D-094	Diptera	Sarcophagidae		unknown	sp6	1
20.v.2022	in	62	11S 424191 4185209	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	in	62	11S 424191 4185209	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	in	62	11S 424191 4185209	Hym-H1	Hymenoptera	Mellitidae	Dasypodainae	Hesperapis	unknown	1
20.v.2022	in	62	11S 424191 4185209	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	in	62	11S 424191 4185209	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	in	62	11S 424191 4185209	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	in	62	11S 424191 4185209	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	30
18.v.2022	out	64	11S 424587 4185202	C-018	Coleoptera	Melyridae	Dasytinae	Listrus	sp2	2
18.v.2022	out	64	11S 424587 4185202	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	2
18.v.2022	out	64	11S 424587 4185202	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	2
18.v.2022	out	64	11S 424587 4185202	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
18.v.2022	out	64	11S 424587 4185202	D-082	Diptera	Tachinidae	Tachininae	Paradidyma	sp1	1
18.v.2022	out	64	11S 424587 4185202	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	1
18.v.2022	out	64	11S 424587 4185202	D-098	Diptera	Muscidae		Limnophora?	sp	1
18.v.2022	out	64	11S 424587 4185202	D-110	Diptera	Muscidae	Fanniinae	Fannia	sp	1
18.v.2022	out	64	11S 424587 4185202	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	3
18.v.2022	out	64	11S 424587 4185202	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Ca1	Hymenoptera	Andrenidae	Panurginae	Calliopsis	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	4
18.v.2022	out	64	11S 424587 4185202	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Eu5	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	4
18.v.2022	out	64	11S 424587 4185202	Hym-Per5	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	2
18.v.2022	out	64	11S 424587 4185202	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Ves10	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Ves11	Hymenoptera	Vespidae	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	Hym-Ves7	Hymenoptera	Vespidae	unknown	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	64	11S 424587 4185202	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	64	11S 424587 4185202	L-007	Lepidoptera	unknown		unknown	sp3	4
18.v.2022	out	64	11S 424587 4185202	L-011	Lepidoptera	Hesperiidae	Hesperiinae	Hesperia	sp	1
20.v.2022	out	65	11S 423580 4185003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	68
20.v.2022	out	65	11S 423580 4185003	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	45
20.v.2022	out	65	11S 423580 4185003	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
20.v.2022	out	65	11S 423580 4185003	C-024	Coleoptera	Chrysomelidae	Galeurcinae	Psylliodes	sp	2
20.v.2022	out	65	11S 423580 4185003	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
20.v.2022	out	65	11S 423580 4185003	D-010	Diptera	Chironomidae		unknown	sp	1
20.v.2022	out	65	11S 423580 4185003	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
20.v.2022	out	65	11S 423580 4185003	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	out	65	11S 423580 4185003	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
20.v.2022	out	65	11S 423580 4185003	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	65	11S 423580 4185003	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	65	11S 423580 4185003	Hym-Api7	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	65	11S 423580 4185003	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
20.v.2022	out	65	11S 423580 4185003	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	3
20.v.2022	out	65	11S 423580 4185003	Hym-Form3	Hymenoptera	Formicidae	unknown	unknown	unknown	1
20.v.2022	out	65	11S 423580 4185003	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	65	11S 423580 4185003	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
20.v.2022	out	69	11S 424381 4185005	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
20.v.2022	out	69	11S 424381 4185005	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	181
20.v.2022	out	69	11S 424381 4185005	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	3
20.v.2022	out	69	11S 424381 4185005	D-045	Diptera	Bombyliidae		Empidideicus	sp	1
20.v.2022	out	69	11S 424381 4185005	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	69	11S 424381 4185005	Hym-A1	Hymenoptera	Apidae	Apinae	unknown	unknown	1
20.v.2022	out	69	11S 424381 4185005	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	69	11S 424381 4185005	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	69	11S 424381 4185005	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	69	11S 424381 4185005	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	69	11S 424381 4185005	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
20.v.2022	out	69	11S 424381 4185005	Hym-Form3	Hymenoptera	Formicidae	unknown	unknown	unknown	1
20.v.2022	out	69	11S 424381 4185005	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
20.v.2022	out	69	11S 424381 4185005	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	69	11S 424381 4185005	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	2
20.v.2022	out	69	11S 424381 4185005	Hym-Unk7	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	69	11S 424381 4185005	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	69	11S 424381 4185005	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	69	11S 424381 4185005	L-006	Lepidoptera	Tortricidae?		unknown	sp2	1
20.v.2022	out	72	11S 423783 4184803	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
20.v.2022	out	72	11S 423783 4184803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
20.v.2022	out	72	11S 423783 4184803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	88
20.v.2022	out	72	11S 423783 4184803	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
20.v.2022	out	72	11S 423783 4184803	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
20.v.2022	out	72	11S 423783 4184803	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
20.v.2022	out	72	11S 423783 4184803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	7
20.v.2022	out	72	11S 423783 4184803	D-058	Diptera	Bombyliidae	Mythicomyiinae	Glabellula	sp	1
20.v.2022	out	72	11S 423783 4184803	D-107	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
20.v.2022	out	72	11S 423783 4184803	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	72	11S 423783 4184803	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	4
20.v.2022	out	72	11S 423783 4184803	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	72	11S 423783 4184803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
20.v.2022	out	72	11S 423783 4184803	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
20.v.2022	out	72	11S 423783 4184803	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	4
20.v.2022	out	72	11S 423783 4184803	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	out	72	11S 423783 4184803	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
20.v.2022	out	72	11S 423783 4184803	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
20.v.2022	out	74	11S 424177 4184799	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
20.v.2022	out	74	11S 424177 4184799	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	14
20.v.2022	out	74	11S 424177 4184799	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
20.v.2022	out	74	11S 424177 4184799	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	3
20.v.2022	out	74	11S 424177 4184799	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
20.v.2022	out	74	11S 424177 4184799	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	3
20.v.2022	out	74	11S 424177 4184799	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	out	74	11S 424177 4184799	D-045	Diptera	Bombyliidae	Mythicomyiinae	Empidideicus	sp	1
20.v.2022	out	74	11S 424177 4184799	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	3
20.v.2022	out	74	11S 424177 4184799	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
20.v.2022	out	74	11S 424177 4184799	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
20.v.2022	out	74	11S 424177 4184799	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
20.v.2022	out	74	11S 424177 4184799	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	74	11S 424177 4184799	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
20.v.2022	out	74	11S 424177 4184799	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
20.v.2022	out	74	11S 424177 4184799	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	27
20.v.2022	out	74	11S 424177 4184799	Hym-Form3	Hymenoptera	Formicidae	unknown	unknown	unknown	1
20.v.2022	out	74	11S 424177 4184799	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	74	11S 424177 4184799	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	74	11S 424177 4184799	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
20.v.2022	out	74	11S 424177 4184799	L-010	Lepidoptera	unknown	unknown	unknown	sp6	1
20.v.2022	out	76	11S 424581 4184803	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	3
20.v.2022	out	76	11S 424581 4184803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	367
20.v.2022	out	76	11S 424581 4184803	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	2
20.v.2022	out	76	11S 424581 4184803	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
20.v.2022	out	76	11S 424581 4184803	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	5
20.v.2022	out	76	11S 424581 4184803	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
20.v.2022	out	76	11S 424581 4184803	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
20.v.2022	out	76	11S 424581 4184803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
20.v.2022	out	76	11S 424581 4184803	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	76	11S 424581 4184803	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
20.v.2022	out	76	11S 424581 4184803	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
20.v.2022	out	76	11S 424581 4184803	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	4
20.v.2022	out	76	11S 424581 4184803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	3
20.v.2022	out	76	11S 424581 4184803	Hym-Form4	Hymenoptera	Formicidae	unknown	unknown	unknown	1
20.v.2022	out	76	11S 424581 4184803	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	out	76	11S 424581 4184803	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
20.v.2022	out	76	11S 424581 4184803	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	8
20.v.2022	out	76	11S 424581 4184803	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
20.v.2022	out	76	11S 424581 4184803	Hym-W4	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	76	11S 424581 4184803	Hym-W7	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	76	11S 424581 4184803	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
20.v.2022	out	76	11S 424581 4184803	L-006	Lepidoptera	Tortricidae?	unknown	unknown	sp2	2
20.v.2022	out	78	11S 423581 4184604	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	22
20.v.2022	out	78	11S 423581 4184604	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
20.v.2022	out	78	11S 423581 4184604	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
20.v.2022	out	78	11S 423581 4184604	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	6
20.v.2022	out	78	11S 423581 4184604	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
20.v.2022	out	78	11S 423581 4184604	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	78	11S 423581 4184604	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	2
20.v.2022	out	78	11S 423581 4184604	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	4
20.v.2022	out	78	11S 423581 4184604	D-064	Diptera	Bombyliidae	Usiinae	Apolysis	sp4	1
20.v.2022	out	78	11S 423581 4184604	D-078	Diptera	Tachinidae	Tachininae	Peleteria	sp2	1
20.v.2022	out	78	11S 423581 4184604	D-088	Diptera	Sarcophagidae	Miltogramminae	unknown	sp2	1
20.v.2022	out	78	11S 423581 4184604	D-099	Diptera	Muscidae	Coenosiinae	Lispe	sp	1
20.v.2022	out	78	11S 423581 4184604	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
20.v.2022	out	78	11S 423581 4184604	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	78	11S 423581 4184604	Hym-Beth1	Hymenoptera	Bethylidae	unknown	unknown	unknown	1
20.v.2022	out	78	11S 423581 4184604	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
20.v.2022	out	78	11S 423581 4184604	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
20.v.2022	out	78	11S 423581 4184604	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
20.v.2022	out	78	11S 423581 4184604	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	4
20.v.2022	out	78	11S 423581 4184604	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	2
20.v.2022	out	78	11S 423581 4184604	Hym-Ha1	Hymenoptera	Halictidae	Halictinae	Halictus	unknown	1
20.v.2022	out	78	11S 423581 4184604	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	5
20.v.2022	out	78	11S 423581 4184604	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	out	78	11S 423581 4184604	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	78	11S 423581 4184604	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
20.v.2022	out	80	11S 423985 4184598	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	5
20.v.2022	out	80	11S 423985 4184598	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	1
20.v.2022	out	80	11S 423985 4184598	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
20.v.2022	out	80	11S 423985 4184598	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	2
20.v.2022	out	80	11S 423985 4184598	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
20.v.2022	out	80	11S 423985 4184598	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
20.v.2022	out	80	11S 423985 4184598	D-031	Diptera	Ulididae	Otinae	Haigia	nevadana	1
20.v.2022	out	80	11S 423985 4184598	D-038	Diptera	Syrphidae	Syrphinae	Syrphus	sp	1
20.v.2022	out	80	11S 423985 4184598	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	out	80	11S 423985 4184598	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	4
20.v.2022	out	80	11S 423985 4184598	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	80	11S 423985 4184598	Hym-Beth1	Hymenoptera	Bethylidae	unknown	unknown	unknown	1
20.v.2022	out	80	11S 423985 4184598	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	80	11S 423985 4184598	Hym-Crab4	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	80	11S 423985 4184598	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	80	11S 423985 4184598	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	1
20.v.2022	out	80	11S 423985 4184598	Hym-Sph4	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
20.v.2022	in	81	11S 424023 4184521	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
20.v.2022	in	81	11S 424023 4184521	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	10

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
20.v.2022	in	81	11S 424023 4184521	C-009	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp2	1
20.v.2022	in	81	11S 424023 4184521	C-025	Coleoptera	Melyridae	Malachiinae	Collops	sp1	2
20.v.2022	in	81	11S 424023 4184521	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
20.v.2022	in	81	11S 424023 4184521	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
20.v.2022	in	81	11S 424023 4184521	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	in	81	11S 424023 4184521	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
20.v.2022	in	81	11S 424023 4184521	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	2
20.v.2022	in	81	11S 424023 4184521	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	in	81	11S 424023 4184521	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	in	81	11S 424023 4184521	Hym-Beth1	Hymenoptera	Bethylidae	unknown	unknown	unknown	1
20.v.2022	in	81	11S 424023 4184521	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	in	81	11S 424023 4184521	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	in	81	11S 424023 4184521	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	2
20.v.2022	out	83	11S 424381 4184603	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	3
20.v.2022	out	83	11S 424381 4184603	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
20.v.2022	out	83	11S 424381 4184603	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	110
20.v.2022	out	83	11S 424381 4184603	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
20.v.2022	out	83	11S 424381 4184603	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
20.v.2022	out	83	11S 424381 4184603	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
20.v.2022	out	83	11S 424381 4184603	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	7
20.v.2022	out	83	11S 424381 4184603	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
20.v.2022	out	83	11S 424381 4184603	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	83	11S 424381 4184603	Hym-Anthid2	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
20.v.2022	out	83	11S 424381 4184603	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	83	11S 424381 4184603	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	2
20.v.2022	out	83	11S 424381 4184603	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	4
20.v.2022	out	83	11S 424381 4184603	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	83	11S 424381 4184603	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
20.v.2022	out	83	11S 424381 4184603	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
20.v.2022	out	83	11S 424381 4184603	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
20.v.2022	out	83	11S 424381 4184603	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	5
20.v.2022	out	83	11S 424381 4184603	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	3
20.v.2022	out	83	11S 424381 4184603	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	5
20.v.2022	out	83	11S 424381 4184603	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
20.v.2022	out	83	11S 424381 4184603	Hym-Os2	Hymenoptera	Megachilidae	Megachilinae	Osmia	unknown	1
20.v.2022	out	83	11S 424381 4184603	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	5
20.v.2022	out	83	11S 424381 4184603	Hym-Per5	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	83	11S 424381 4184603	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
20.v.2022	out	83	11S 424381 4184603	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
20.v.2022	out	83	11S 424381 4184603	L-007	Lepidoptera	unknown	unknown	unknown	sp3	1
20.v.2022	out	86	11S 423780 4184402	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
20.v.2022	out	86	11S 423780 4184402	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	4
20.v.2022	out	86	11S 423780 4184402	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	6
20.v.2022	out	86	11S 423780 4184402	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
20.v.2022	out	86	11S 423780 4184402	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
20.v.2022	out	86	11S 423780 4184402	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	2
20.v.2022	out	86	11S 423780 4184402	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	86	11S 423780 4184402	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	3

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
20.v.2022	out	86	11S 423780 4184402	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	2
20.v.2022	out	86	11S 423780 4184402	D-062	Diptera	Sepsidae	Sepsinae	Sespsis	sp	1
20.v.2022	out	86	11S 423780 4184402	D-066	Diptera	Conopidae	Myopinae	Thecophora	sp	1
20.v.2022	out	86	11S 423780 4184402	D-088	Diptera	Sarcophagidae	Miltogramminae	unknown	sp2	2
20.v.2022	out	86	11S 423780 4184402	Hym-Anthid1	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
20.v.2022	out	86	11S 423780 4184402	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	86	11S 423780 4184402	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	86	11S 423780 4184402	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
20.v.2022	out	86	11S 423780 4184402	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	2
20.v.2022	out	86	11S 423780 4184402	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	86	11S 423780 4184402	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
20.v.2022	out	86	11S 423780 4184402	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	4
20.v.2022	out	86	11S 423780 4184402	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	8
20.v.2022	out	86	11S 423780 4184402	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	86	11S 423780 4184402	Hym-Unk13	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	86	11S 423780 4184402	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	1
20.v.2022	in	88	11S 424130 4184396	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	12
20.v.2022	in	88	11S 424130 4184396	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
20.v.2022	in	88	11S 424130 4184396	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	in	88	11S 424130 4184396	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	2
20.v.2022	in	88	11S 424130 4184396	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
20.v.2022	in	88	11S 424130 4184396	D-061	Diptera	Chloropidae	Oscinellinae	Olecella	sp	1
20.v.2022	in	88	11S 424130 4184396	D-082	Diptera	Tachinidae	Tachininae	Paradidyma	sp1	1
20.v.2022	in	88	11S 424130 4184396	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	2
20.v.2022	in	88	11S 424130 4184396	D-095	Diptera	Sarcophagidae	Sarcophaginae	Blaesoxipha (Acridiophaga)??	sp	1
20.v.2022	in	88	11S 424130 4184396	D-101	Diptera	Anthomyiidae	unknown	unknown	sp1	1
20.v.2022	in	88	11S 424130 4184396	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	in	88	11S 424130 4184396	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	in	88	11S 424130 4184396	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	in	88	11S 424130 4184396	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	in	88	11S 424130 4184396	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	in	88	11S 424130 4184396	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	3
20.v.2022	in	88	11S 424130 4184396	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	2
20.v.2022	in	88	11S 424130 4184396	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	284
20.v.2022	out	90	11S 424584 4184400	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	6
20.v.2022	out	90	11S 424584 4184400	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
20.v.2022	out	90	11S 424584 4184400	C-026	Coleoptera	Cleriidae	Clerinae	Aulicus	antennatus?	1
20.v.2022	out	90	11S 424584 4184400	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	3
20.v.2022	out	90	11S 424584 4184400	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
20.v.2022	out	90	11S 424584 4184400	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
20.v.2022	out	90	11S 424584 4184400	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
20.v.2022	out	90	11S 424584 4184400	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	5
20.v.2022	out	90	11S 424584 4184400	Hym-Crab4	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
20.v.2022	out	90	11S 424584 4184400	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
20.v.2022	out	90	11S 424584 4184400	Hym-Per5	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-Unk20	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-W10	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	90	11S 424584 4184400	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	1
20.v.2022	out	90	11S 424584 4184400	L-006	Lepidoptera	Tortricidae?	unknown	unknown	sp2	1
20.v.2022	out	93	11S 423606 4184212	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	21
20.v.2022	out	93	11S 423606 4184212	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	35
20.v.2022	out	93	11S 423606 4184212	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
20.v.2022	out	93	11S 423606 4184212	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
20.v.2022	out	93	11S 423606 4184212	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
20.v.2022	out	93	11S 423606 4184212	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
20.v.2022	out	93	11S 423606 4184212	D-014	Diptera	Cecidomyiidae	Cecidomyiinae	unknown	sp	1
20.v.2022	out	93	11S 423606 4184212	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
20.v.2022	out	93	11S 423606 4184212	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
20.v.2022	out	93	11S 423606 4184212	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	out	93	11S 423606 4184212	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	2
20.v.2022	out	93	11S 423606 4184212	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	93	11S 423606 4184212	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
20.v.2022	out	93	11S 423606 4184212	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	54
20.v.2022	out	93	11S 423606 4184212	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	sp	2
20.v.2022	out	93	11S 423606 4184212	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	93	11S 423606 4184212	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	93	11S 423606 4184212	L-019	Lepidoptera	unknown	unknown	unknown	sp22	1
20.v.2022	out	95	11S 423982 4184201	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
20.v.2022	out	95	11S 423982 4184201	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
20.v.2022	out	95	11S 423982 4184201	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	20
20.v.2022	out	95	11S 423982 4184201	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
20.v.2022	out	95	11S 423982 4184201	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
20.v.2022	out	95	11S 423982 4184201	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	95	11S 423982 4184201	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	2
20.v.2022	out	95	11S 423982 4184201	Hym-Api2	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	95	11S 423982 4184201	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	95	11S 423982 4184201	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	95	11S 423982 4184201	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	95	11S 423982 4184201	Hym-F1	Hymenoptera	Figitidae	unknown	unknown	unknown	1
20.v.2022	out	95	11S 423982 4184201	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	out	95	11S 423982 4184201	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	out	95	11S 423982 4184201	L-007	Lepidoptera	unknown	unknown	unknown	sp3	1
21.v.2022	in	97	11S 424282 4184246	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	1
21.v.2022	in	97	11S 424282 4184246	C-025	Coleoptera	Melyridae	Malachiinae	Collops	sp1	2
21.v.2022	in	97	11S 424282 4184246	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
21.v.2022	in	97	11S 424282 4184246	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
21.v.2022	in	97	11S 424282 4184246	D-069	Diptera	Bombyliidae	Bombyliinae	Lordotus	sp	1
21.v.2022	in	97	11S 424282 4184246	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
21.v.2022	in	97	11S 424282 4184246	D-088	Diptera	Sarcophagidae	Miltogramminae	unknown	sp2	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
21.v.2022	in	97	11S 424282 4184246	D-107	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1
21.v.2022	in	97	11S 424282 4184246	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
21.v.2022	in	97	11S 424282 4184246	Hym-Form4	Hymenoptera	Formicidae	unknown	unknown	unknown	1
21.v.2022	in	97	11S 424282 4184246	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	7
20.v.2022	out	98	11S 424382 4184205	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	3
20.v.2022	out	98	11S 424382 4184205	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	127
20.v.2022	out	98	11S 424382 4184205	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
20.v.2022	out	98	11S 424382 4184205	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	3
20.v.2022	out	98	11S 424382 4184205	D-015	Diptera	Asilidae	Asilinae	unknown	sp	1
20.v.2022	out	98	11S 424382 4184205	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp	1
20.v.2022	out	98	11S 424382 4184205	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
20.v.2022	out	98	11S 424382 4184205	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	6
20.v.2022	out	98	11S 424382 4184205	D-039	Diptera	Asilidae	Asilinae	Efferia	sp	1
20.v.2022	out	98	11S 424382 4184205	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	out	98	11S 424382 4184205	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	98	11S 424382 4184205	D-070	Diptera	Bombyliidae	Bombyliinae	Triploechus?	sp1	1
20.v.2022	out	98	11S 424382 4184205	Hym-A2	Hymenoptera	Apidae	Apinae	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-A5	Hymenoptera	Apidae	Apinae	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	4
20.v.2022	out	98	11S 424382 4184205	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	98	11S 424382 4184205	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-Crab18	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	6
20.v.2022	out	98	11S 424382 4184205	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	98	11S 424382 4184205	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
20.v.2022	out	98	11S 424382 4184205	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-Per5	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	98	11S 424382 4184205	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
18.v.2022	out	100	11S 424783 4184202	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	13
18.v.2022	out	100	11S 424783 4184202	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	39
18.v.2022	out	100	11S 424783 4184202	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
18.v.2022	out	100	11S 424783 4184202	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
18.v.2022	out	100	11S 424783 4184202	D-078	Diptera	Tachinidae	Tachininae	Peleteria	sp2	1
18.v.2022	out	100	11S 424783 4184202	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	1
18.v.2022	out	100	11S 424783 4184202	Hym-A2	Hymenoptera	Apidae	Apinae	unknown	unknown	1
18.v.2022	out	100	11S 424783 4184202	Hym-Ag1	Hymenoptera	Halictidae	Halictinae	Agapostemon	unknown	1
18.v.2022	out	100	11S 424783 4184202	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
18.v.2022	out	100	11S 424783 4184202	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	9
18.v.2022	out	100	11S 424783 4184202	Hym-Crab10	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
18.v.2022	out	100	11S 424783 4184202	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
18.v.2022	out	100	11S 424783 4184202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
18.v.2022	out	100	11S 424783 4184202	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
18.v.2022	out	100	11S 424783 4184202	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
18.v.2022	out	100	11S 424783 4184202	Hym-Os2	Hymenoptera	Megachilidae	Megachilinae	Osmia	unknown	1
18.v.2022	out	100	11S 424783 4184202	Hym-Per5	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	2
18.v.2022	out	100	11S 424783 4184202	Hym-Unk15	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	100	11S 424783 4184202	Hym-Unk21	Hymenoptera	unknown	unknown	unknown	unknown	1
18.v.2022	out	100	11S 424783 4184202	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	2
18.v.2022	out	100	11S 424783 4184202	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	101	11S 423782 4184003	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	4
20.v.2022	out	101	11S 423782 4184003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	2
20.v.2022	out	101	11S 423782 4184003	C-027	Coleoptera	Scarabaeidae	Melolonthinae	Phyllophaga	sp	1
20.v.2022	out	101	11S 423782 4184003	C-028	Coleoptera	Scarabaeidae	Aphodinae	Dichelonyx	sp	2
20.v.2022	out	101	11S 423782 4184003	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
20.v.2022	out	101	11S 423782 4184003	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
20.v.2022	out	101	11S 423782 4184003	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	3
20.v.2022	out	101	11S 423782 4184003	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	out	101	11S 423782 4184003	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
20.v.2022	out	101	11S 423782 4184003	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	20
20.v.2022	out	101	11S 423782 4184003	D-080	Diptera	Tachinidae	Dexiinae	Ptilodexia?	sp1	2
20.v.2022	out	101	11S 423782 4184003	D-101	Diptera	Anthomyiidae	unknown	unknown	sp1	3
20.v.2022	out	101	11S 423782 4184003	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	101	11S 423782 4184003	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	11
20.v.2022	out	101	11S 423782 4184003	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	101	11S 423782 4184003	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	101	11S 423782 4184003	Hym-Os2	Hymenoptera	Megachilidae	Megachilinae	Osmia	unknown	1
20.v.2022	out	101	11S 423782 4184003	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	101	11S 423782 4184003	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	101	11S 423782 4184003	Hym-W4	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	103	11S 424180 4184022	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	9
20.v.2022	out	103	11S 424180 4184022	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	1
20.v.2022	out	103	11S 424180 4184022	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
20.v.2022	out	103	11S 424180 4184022	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
20.v.2022	out	103	11S 424180 4184022	D-035	Diptera	Asilidae	Stenopogoniae	Coleomyia?	sp	1
20.v.2022	out	103	11S 424180 4184022	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	103	11S 424180 4184022	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	8
20.v.2022	out	103	11S 424180 4184022	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
20.v.2022	out	103	11S 424180 4184022	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	103	11S 424180 4184022	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	103	11S 424180 4184022	Hym-Pomp2	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
20.v.2022	out	105	11S 424581 4184003	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	3
20.v.2022	out	105	11S 424581 4184003	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	4
20.v.2022	out	105	11S 424581 4184003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	281
20.v.2022	out	105	11S 424581 4184003	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
20.v.2022	out	105	11S 424581 4184003	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
20.v.2022	out	105	11S 424581 4184003	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
20.v.2022	out	105	11S 424581 4184003	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	3
20.v.2022	out	105	11S 424581 4184003	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
20.v.2022	out	105	11S 424581 4184003	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
20.v.2022	out	105	11S 424581 4184003	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
20.v.2022	out	105	11S 424581 4184003	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
20.v.2022	out	105	11S 424581 4184003	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	17
20.v.2022	out	105	11S 424581 4184003	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
20.v.2022	out	105	11S 424581 4184003	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	105	11S 424581 4184003	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
20.v.2022	out	105	11S 424581 4184003	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
20.v.2022	out	105	11S 424581 4184003	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	3
20.v.2022	out	105	11S 424581 4184003	L-013	Lepidoptera	Lycaenidae	Polyommatinae	Euphilotes or Plebejus	sp	1
20.v.2022	out	108	11S 424028 4183777	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	5
20.v.2022	out	108	11S 424028 4183777	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	39
20.v.2022	out	108	11S 424028 4183777	D-038	Diptera	Syrphidae	Syrphinae	Syrphus	sp	1
20.v.2022	out	108	11S 424028 4183777	D-042	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp	1
20.v.2022	out	108	11S 424028 4183777	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	25
20.v.2022	out	108	11S 424028 4183777	D-101	Diptera	Anthomyiidae	unknown	unknown	sp1	1
20.v.2022	out	108	11S 424028 4183777	Hym-Anthid3	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
20.v.2022	out	108	11S 424028 4183777	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	3
20.v.2022	out	108	11S 424028 4183777	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
20.v.2022	out	108	11S 424028 4183777	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
20.v.2022	out	108	11S 424028 4183777	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	3
20.v.2022	out	108	11S 424028 4183777	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
20.v.2022	out	108	11S 424028 4183777	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	3
20.v.2022	out	108	11S 424028 4183777	Hym-Sph4	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
20.v.2022	out	108	11S 424028 4183777	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
20.v.2022	out	110	11S 424381 4183803	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
20.v.2022	out	110	11S 424381 4183803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	6
20.v.2022	out	110	11S 424381 4183803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	193
20.v.2022	out	110	11S 424381 4183803	C-010	Coleoptera	Melyridae	Malachiinae	Attalus	sp3	1
20.v.2022	out	110	11S 424381 4183803	D-004	Diptera	Sciaridae	unknown	Scatopsciara??	sp	3
20.v.2022	out	110	11S 424381 4183803	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	4
20.v.2022	out	110	11S 424381 4183803	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
20.v.2022	out	110	11S 424381 4183803	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
20.v.2022	out	110	11S 424381 4183803	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
20.v.2022	out	110	11S 424381 4183803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
20.v.2022	out	110	11S 424381 4183803	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	8
20.v.2022	out	110	11S 424381 4183803	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
20.v.2022	out	110	11S 424381 4183803	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	7
20.v.2022	out	110	11S 424381 4183803	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
20.v.2022	out	110	11S 424381 4183803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	4
20.v.2022	out	110	11S 424381 4183803	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	1
20.v.2022	out	110	11S 424381 4183803	Hym-Form3	Hymenoptera	Formicidae	unknown	unknown	unknown	2
20.v.2022	out	110	11S 424381 4183803	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
20.v.2022	out	110	11S 424381 4183803	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
20.v.2022	out	110	11S 424381 4183803	Hym-M2	Hymenoptera	Mutilidae	unknown	unknown	unknown	1
20.v.2022	out	110	11S 424381 4183803	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	2
20.v.2022	out	110	11S 424381 4183803	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	3
20.v.2022	out	110	11S 424381 4183803	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
20.v.2022	out	110	11S 424381 4183803	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
20.v.2022	out	110	11S 424381 4183803	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	3	11S 424980 4186802	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	3	11S 424980 4186802	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	13
01.vi.2022	out	3	11S 424980 4186802	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	9
01.vi.2022	out	3	11S 424980 4186802	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
01.vi.2022	out	3	11S 424980 4186802	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
01.vi.2022	out	3	11S 424980 4186802	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
01.vi.2022	out	3	11S 424980 4186802	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	5
01.vi.2022	out	3	11S 424980 4186802	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
01.vi.2022	out	3	11S 424980 4186802	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	5
01.vi.2022	out	3	11S 424980 4186802	D-084	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	2
01.vi.2022	out	3	11S 424980 4186802	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	3	11S 424980 4186802	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	3	11S 424980 4186802	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	3	11S 424980 4186802	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	3	11S 424980 4186802	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	3	11S 424980 4186802	Hym-Eu3	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
01.vi.2022	out	3	11S 424980 4186802	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	3	11S 424980 4186802	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	3	11S 424980 4186802	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	2
01.vi.2022	out	3	11S 424980 4186802	Hym-Unk8	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	3	11S 424980 4186802	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
01.vi.2022	out	5	11S 425381 4186801	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	5	11S 425381 4186801	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	39
01.vi.2022	out	5	11S 425381 4186801	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	53
01.vi.2022	out	5	11S 425381 4186801	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
01.vi.2022	out	5	11S 425381 4186801	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	5	11S 425381 4186801	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	5	11S 425381 4186801	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	5
01.vi.2022	out	5	11S 425381 4186801	D-036	Diptera	Bombyliidae	Heterotropinae	Prorates	sp	1
01.vi.2022	out	5	11S 425381 4186801	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	out	5	11S 425381 4186801	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	2
01.vi.2022	out	5	11S 425381 4186801	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
01.vi.2022	out	5	11S 425381 4186801	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	2
01.vi.2022	out	5	11S 425381 4186801	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	5	11S 425381 4186801	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Crab4	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-W1	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	5	11S 425381 4186801	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	4
01.vi.2022	out	5	11S 425381 4186801	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	7	11S 424788 4186588	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	35

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	7	11S 424788 4186588	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	9
01.vi.2022	out	7	11S 424788 4186588	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	7	11S 424788 4186588	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
01.vi.2022	out	7	11S 424788 4186588	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
01.vi.2022	out	7	11S 424788 4186588	D-049	Diptera	Bombyliidae	Bombyliidae	Phthiria	sp2	6
01.vi.2022	out	7	11S 424788 4186588	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	7	11S 424788 4186588	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	7	11S 424788 4186588	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	7	11S 424788 4186588	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
01.vi.2022	out	9	11S 425184 4186599	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	9	11S 425184 4186599	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	155
01.vi.2022	out	9	11S 425184 4186599	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	39
01.vi.2022	out	9	11S 425184 4186599	C-031	Coleoptera	Melyridae	Dasytinae	Vecturoides	sp	1
01.vi.2022	out	9	11S 425184 4186599	D-004	Diptera	Sciaridae	unknown	Scatopsciara?	sp	1
01.vi.2022	out	9	11S 425184 4186599	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	6
01.vi.2022	out	9	11S 425184 4186599	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	6
01.vi.2022	out	9	11S 425184 4186599	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	2
01.vi.2022	out	9	11S 425184 4186599	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	9	11S 425184 4186599	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	2
01.vi.2022	out	9	11S 425184 4186599	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	3
01.vi.2022	out	9	11S 425184 4186599	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	9	11S 425184 4186599	Hym-Beth2	Hymenoptera	Bethylidae	unknown	unknown	unknown	1
01.vi.2022	out	9	11S 425184 4186599	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	9	11S 425184 4186599	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	9	11S 425184 4186599	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	9	11S 425184 4186599	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	11	11S 425582 4186600	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	2
01.vi.2022	out	11	11S 425582 4186600	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	44
01.vi.2022	out	11	11S 425582 4186600	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	17
01.vi.2022	out	11	11S 425582 4186600	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	1
01.vi.2022	out	11	11S 425582 4186600	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	3
01.vi.2022	out	11	11S 425582 4186600	C-029	Coleoptera	Chrysomelidae	unknown	unknown	sp	1
01.vi.2022	out	11	11S 425582 4186600	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	2
01.vi.2022	out	11	11S 425582 4186600	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	5
01.vi.2022	out	11	11S 425582 4186600	D-037	Diptera	Bombyliidae	Toxophorinae	Geron	sp	1
01.vi.2022	out	11	11S 425582 4186600	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	11	11S 425582 4186600	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
01.vi.2022	out	11	11S 425582 4186600	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	7
01.vi.2022	out	11	11S 425582 4186600	D-054	Diptera	Sciaridae	NA	Eugnoriste	sp	1
01.vi.2022	out	11	11S 425582 4186600	D-084	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	7
01.vi.2022	out	11	11S 425582 4186600	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	2
01.vi.2022	out	11	11S 425582 4186600	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
01.vi.2022	out	11	11S 425582 4186600	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	11	11S 425582 4186600	Hym-Crab6	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	11	11S 425582 4186600	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	11	11S 425582 4186600	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	11	11S 425582 4186600	Hym-Mega1	Hymenoptera	Megachilidae	unknown	unknown	unknown	1
01.vi.2022	out	11	11S 425582 4186600	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	4

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	11	11S 425582 4186600	Hym-Ves1	Hymenoptera	Vespidae	unknown	unknown	unknown	2
01.vi.2022	out	11	11S 425582 4186600	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	2
01.vi.2022	out	11	11S 425582 4186600	Hym-W3	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	11	11S 425582 4186600	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	1
01.vi.2022	out	13	11S 424578 4186406	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	21
01.vi.2022	out	13	11S 424578 4186406	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	34
01.vi.2022	out	13	11S 424578 4186406	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	7
01.vi.2022	out	13	11S 424578 4186406	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
01.vi.2022	out	13	11S 424578 4186406	C-025	Coleoptera	Melyridae	Malachiinae	Collops	sp1	1
01.vi.2022	out	13	11S 424578 4186406	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	13	11S 424578 4186406	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
01.vi.2022	out	13	11S 424578 4186406	D-037	Diptera	Bombyliidae	Toxophorinae	Geron	sp	1
01.vi.2022	out	13	11S 424578 4186406	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	13	11S 424578 4186406	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	13	11S 424578 4186406	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	6
01.vi.2022	out	13	11S 424578 4186406	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	13	11S 424578 4186406	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
01.vi.2022	out	13	11S 424578 4186406	Hym-Api7	Hymenoptera	Apidae	unknown	unknown	unknown	2
01.vi.2022	out	13	11S 424578 4186406	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	13	11S 424578 4186406	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
01.vi.2022	out	13	11S 424578 4186406	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	13	11S 424578 4186406	Hym-Spech1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	13	11S 424578 4186406	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	15	11S 424979 4186403	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	out	15	11S 424979 4186403	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	6
01.vi.2022	out	15	11S 424979 4186403	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
01.vi.2022	out	15	11S 424979 4186403	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	15	11S 424979 4186403	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	15	11S 424979 4186403	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	17	11S 425379 4186402	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	7
01.vi.2022	out	17	11S 425379 4186402	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	13
01.vi.2022	out	17	11S 425379 4186402	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	17	11S 425379 4186402	D-001	Diptera	Stratiomyidae	Nemotelinae	Nemotelus	sp	1
01.vi.2022	out	17	11S 425379 4186402	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	2
01.vi.2022	out	17	11S 425379 4186402	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	3
01.vi.2022	out	17	11S 425379 4186402	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	17	11S 425379 4186402	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	11
01.vi.2022	out	17	11S 425379 4186402	D-072	Diptera	Bombyliidae	Anthracinae	Lepidanthrax?	sp	1
01.vi.2022	out	17	11S 425379 4186402	D-079	Diptera	Tachinidae	Exoristinae	Spallanzania	sp	1
01.vi.2022	out	17	11S 425379 4186402	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	1
01.vi.2022	out	17	11S 425379 4186402	D-084	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1
01.vi.2022	out	17	11S 425379 4186402	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	17	11S 425379 4186402	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	17	11S 425379 4186402	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	17	11S 425379 4186402	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	17	11S 425379 4186402	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	17	11S 425379 4186402	Hym-W4	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	17	11S 425379 4186402	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	20	11S 424381 4186199	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	out	20	11S 424381 4186199	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	17
01.vi.2022	out	20	11S 424381 4186199	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	2
01.vi.2022	out	20	11S 424381 4186199	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
01.vi.2022	out	20	11S 424381 4186199	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
01.vi.2022	out	20	11S 424381 4186199	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	20	11S 424381 4186199	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	4
01.vi.2022	out	20	11S 424381 4186199	D-031	Diptera	Ulididae	Otinae	Haigia	nevadana	1
01.vi.2022	out	20	11S 424381 4186199	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
01.vi.2022	out	20	11S 424381 4186199	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
01.vi.2022	out	20	11S 424381 4186199	D-037	Diptera	Bombyliidae	Toxophorinae	Geron	sp	1
01.vi.2022	out	20	11S 424381 4186199	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	20	11S 424381 4186199	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	out	20	11S 424381 4186199	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	5
01.vi.2022	out	20	11S 424381 4186199	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	2
01.vi.2022	out	20	11S 424381 4186199	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	2
01.vi.2022	out	20	11S 424381 4186199	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	20	11S 424381 4186199	Hym-Ich1	Hymenoptera	Ichnuemonidae	unknown	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	20	11S 424381 4186199	L-019	Lepidoptera	unknown	unknown	unknown	sp22	1
01.vi.2022	out	22	11S 424831 4186192	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	out	22	11S 424831 4186192	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	41
01.vi.2022	out	22	11S 424831 4186192	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	4
01.vi.2022	out	22	11S 424831 4186192	D-001	Diptera	Stratiomyidae	Nemotelinae	Nemotelus	sp	1
01.vi.2022	out	22	11S 424831 4186192	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	5
01.vi.2022	out	22	11S 424831 4186192	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	4
01.vi.2022	out	22	11S 424831 4186192	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	22	11S 424831 4186192	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
01.vi.2022	out	22	11S 424831 4186192	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	2
01.vi.2022	out	22	11S 424831 4186192	D-033	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp4	2
01.vi.2022	out	22	11S 424831 4186192	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	8
01.vi.2022	out	22	11S 424831 4186192	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	7
01.vi.2022	out	22	11S 424831 4186192	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	2
01.vi.2022	out	22	11S 424831 4186192	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	22	11S 424831 4186192	D-051	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp3	7
01.vi.2022	out	22	11S 424831 4186192	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
01.vi.2022	out	22	11S 424831 4186192	D-082	Diptera	Tachinidae	Tachininae	Paradidyma	sp1	1
01.vi.2022	out	22	11S 424831 4186192	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	1
01.vi.2022	out	22	11S 424831 4186192	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	2
01.vi.2022	out	22	11S 424831 4186192	D-107	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1
01.vi.2022	out	22	11S 424831 4186192	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	22	11S 424831 4186192	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	22	11S 424831 4186192	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	3
01.vi.2022	out	22	11S 424831 4186192	Hym-Mega1	Hymenoptera	Megachilidae	unknown	unknown	unknown	1
01.vi.2022	out	22	11S 424831 4186192	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	22	11S 424831 4186192	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	22	11S 424831 4186192	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
01.vi.2022	out	22	11S 424831 4186192	Hym-Unk1	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	22	11S 424831 4186192	Hym-W7	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	22	11S 424831 4186192	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	in	24	11S 425030 4186110	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	14
01.vi.2022	in	24	11S 425030 4186110	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	2
01.vi.2022	in	24	11S 425030 4186110	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	in	24	11S 425030 4186110	C-023	Coleoptera	Melyridae	Dasytinae	Vectura	sp	1
01.vi.2022	in	24	11S 425030 4186110	C-025	Coleoptera	Melyridae	Malachiinae	Collops	sp1	2
01.vi.2022	in	24	11S 425030 4186110	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
01.vi.2022	in	24	11S 425030 4186110	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	6
01.vi.2022	in	24	11S 425030 4186110	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	in	24	11S 425030 4186110	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	8
01.vi.2022	in	24	11S 425030 4186110	D-084	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1
01.vi.2022	in	24	11S 425030 4186110	D-094	Diptera	Sarcophagidae	unknown	unknown	sp6	1
01.vi.2022	in	24	11S 425030 4186110	D-107	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1
01.vi.2022	in	24	11S 425030 4186110	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	in	24	11S 425030 4186110	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	in	24	11S 425030 4186110	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	in	24	11S 425030 4186110	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	11
01.vi.2022	in	24	11S 425030 4186110	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	out	25	11S 425182 4186203	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	16
01.vi.2022	out	25	11S 425182 4186203	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	2
01.vi.2022	out	25	11S 425182 4186203	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	3
01.vi.2022	out	25	11S 425182 4186203	D-026	Diptera	Agromyzidae	Phytomyzinae	Calycomyza?	sp	1
01.vi.2022	out	25	11S 425182 4186203	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	9
01.vi.2022	out	25	11S 425182 4186203	Hym-A3	Hymenoptera	Apidae	Apinae	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	Hym-Anthid1	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
01.vi.2022	out	25	11S 425182 4186203	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
01.vi.2022	out	25	11S 425182 4186203	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	25	11S 425182 4186203	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	25	11S 425182 4186203	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	8
01.vi.2022	out	25	11S 425182 4186203	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	Hym-Ves7	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	25	11S 425182 4186203	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	25	11S 425182 4186203	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
01.vi.2022	out	27	11S 425582 4186202	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	27	11S 425582 4186202	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	15
01.vi.2022	out	27	11S 425582 4186202	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	11

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	27	11S 425582 4186202	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	1
01.vi.2022	out	27	11S 425582 4186202	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	2
01.vi.2022	out	27	11S 425582 4186202	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
01.vi.2022	out	27	11S 425582 4186202	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	4
01.vi.2022	out	27	11S 425582 4186202	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
01.vi.2022	out	27	11S 425582 4186202	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	out	27	11S 425582 4186202	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	5
01.vi.2022	out	27	11S 425582 4186202	D-077	Diptera	Bombyliidae	Phthiriinae	Lordotus	sp3	1
01.vi.2022	out	27	11S 425582 4186202	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	2
01.vi.2022	out	27	11S 425582 4186202	D-106	Diptera	Tachinidae	unknown	unknown	sp1	1
01.vi.2022	out	27	11S 425582 4186202	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	27	11S 425582 4186202	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	27	11S 425582 4186202	Hym-Ich1	Hymenoptera	Ichnuemonidae	unknown	unknown	unknown	1
01.vi.2022	out	27	11S 425582 4186202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	27	11S 425582 4186202	Hym-Mega1	Hymenoptera	Megachilidae	unknown	unknown	unknown	1
01.vi.2022	out	29	11S 424181 4186003	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	out	29	11S 424181 4186003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	24
01.vi.2022	out	29	11S 424181 4186003	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
01.vi.2022	out	29	11S 424181 4186003	C-014	Coleoptera	Tenebrionidae	Pimeliinae	Alaephus	sp	1
01.vi.2022	out	29	11S 424181 4186003	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
01.vi.2022	out	29	11S 424181 4186003	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	2
01.vi.2022	out	29	11S 424181 4186003	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	29	11S 424181 4186003	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	29	11S 424181 4186003	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	out	29	11S 424181 4186003	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	3
01.vi.2022	out	29	11S 424181 4186003	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp	1
01.vi.2022	out	29	11S 424181 4186003	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	2
01.vi.2022	out	29	11S 424181 4186003	D-064	Diptera	Bombyliidae	Usiinae	Apolysis	sp4	1
01.vi.2022	out	29	11S 424181 4186003	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	29	11S 424181 4186003	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
01.vi.2022	out	29	11S 424181 4186003	Hym-Crab13	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	29	11S 424181 4186003	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	29	11S 424181 4186003	Hym-Hy1	Hymenoptera	Colletidae	Hylaeinae	Hylaeus	unknown	1
01.vi.2022	out	29	11S 424181 4186003	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	29	11S 424181 4186003	L-008	Lepidoptera	unknown		unknown	sp5	1
01.vi.2022	in	31	11S 424569 4186005	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	in	31	11S 424569 4186005	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	48
01.vi.2022	in	31	11S 424569 4186005	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
01.vi.2022	in	31	11S 424569 4186005	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	1
01.vi.2022	in	31	11S 424569 4186005	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
01.vi.2022	in	31	11S 424569 4186005	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
01.vi.2022	in	31	11S 424569 4186005	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	in	31	11S 424569 4186005	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	in	31	11S 424569 4186005	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	4
01.vi.2022	in	31	11S 424569 4186005	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	in	31	11S 424569 4186005	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	4
01.vi.2022	in	31	11S 424569 4186005	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	3
01.vi.2022	in	31	11S 424569 4186005	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	in	31	11S 424569 4186005	Hym-Mega5	Hymenoptera	Megachilidae	unknown	unknown	unknown	1
01.vi.2022	in	31	11S 424569 4186005	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	33	11S 424985 4185984	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	4
01.vi.2022	out	33	11S 424985 4185984	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	39
01.vi.2022	out	33	11S 424985 4185984	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	11
01.vi.2022	out	33	11S 424985 4185984	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	33	11S 424985 4185984	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	33	11S 424985 4185984	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	3
01.vi.2022	out	33	11S 424985 4185984	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	8
01.vi.2022	out	33	11S 424985 4185984	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
01.vi.2022	out	33	11S 424985 4185984	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
01.vi.2022	out	33	11S 424985 4185984	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	33	11S 424985 4185984	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	2
01.vi.2022	out	33	11S 424985 4185984	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	11
01.vi.2022	out	33	11S 424985 4185984	D-062	Diptera	Sepsidae	Sepsinae	Sespsis	sp	1
01.vi.2022	out	33	11S 424985 4185984	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	2
01.vi.2022	out	33	11S 424985 4185984	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	1
01.vi.2022	out	33	11S 424985 4185984	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	33	11S 424985 4185984	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	33	11S 424985 4185984	Hym-Ha1	Hymenoptera	Halictidae	Halictinae	Halictus	unknown	1
01.vi.2022	out	33	11S 424985 4185984	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	33	11S 424985 4185984	Hym-W9	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	33	11S 424985 4185984	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	35	11S 425382 4186002	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	42
01.vi.2022	out	35	11S 425382 4186002	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	2
01.vi.2022	out	35	11S 425382 4186002	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
01.vi.2022	out	35	11S 425382 4186002	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	35	11S 425382 4186002	D-042	Diptera	Bombyliidae	Lomatiinae	Aphoebantus	sp	1
01.vi.2022	out	35	11S 425382 4186002	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
01.vi.2022	out	35	11S 425382 4186002	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	4
01.vi.2022	out	35	11S 425382 4186002	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	1
01.vi.2022	out	35	11S 425382 4186002	D-071	Diptera	Bombyliidae	Anthracinae	Anthrax	sp5	1
01.vi.2022	out	35	11S 425382 4186002	D-106	Diptera	Tachinidae	unknown	unknown	sp1	1
01.vi.2022	out	35	11S 425382 4186002	Hym-Anthid3	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
01.vi.2022	out	35	11S 425382 4186002	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	35	11S 425382 4186002	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	2
01.vi.2022	out	35	11S 425382 4186002	Hym-Chry3	Hymenoptera	Chrysididae	unknown	unknown	unknown	2
01.vi.2022	out	35	11S 425382 4186002	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	35	11S 425382 4186002	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
01.vi.2022	out	35	11S 425382 4186002	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	35	11S 425382 4186002	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	35	11S 425382 4186002	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	35	11S 425382 4186002	Hym-W9	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	35	11S 425382 4186002	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
01.vi.2022	out	35	11S 425382 4186002	L-010	Lepidoptera	unknown		unknown	sp6	1
01.vi.2022	out	38	11S 424381 4185803	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	38	11S 424381 4185803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	out	38	11S 424381 4185803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	7

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	38	11S 424381 4185803	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	11
01.vi.2022	out	38	11S 424381 4185803	C-013	Coleoptera	Bruchidae	Amblycerinae	Zabrotes	sp	1
01.vi.2022	out	38	11S 424381 4185803	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	38	11S 424381 4185803	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	2
01.vi.2022	out	38	11S 424381 4185803	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	10
01.vi.2022	out	38	11S 424381 4185803	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	4
01.vi.2022	out	38	11S 424381 4185803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
01.vi.2022	out	38	11S 424381 4185803	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	2
01.vi.2022	out	38	11S 424381 4185803	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
01.vi.2022	out	38	11S 424381 4185803	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	38	11S 424381 4185803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	38	11S 424381 4185803	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	38	11S 424381 4185803	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	38	11S 424381 4185803	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	40	11S 424780 4185803	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	40	11S 424780 4185803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	13
01.vi.2022	out	40	11S 424780 4185803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	17
01.vi.2022	out	40	11S 424780 4185803	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	7
01.vi.2022	out	40	11S 424780 4185803	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	2
01.vi.2022	out	40	11S 424780 4185803	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
01.vi.2022	out	40	11S 424780 4185803	D-006	Diptera	Phoridae	Metopininae	unknown	sp	1
01.vi.2022	out	40	11S 424780 4185803	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	40	11S 424780 4185803	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	40	11S 424780 4185803	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
01.vi.2022	out	40	11S 424780 4185803	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	40	11S 424780 4185803	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	out	40	11S 424780 4185803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	10
01.vi.2022	out	40	11S 424780 4185803	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	1
01.vi.2022	out	40	11S 424780 4185803	D-084	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	2
01.vi.2022	out	40	11S 424780 4185803	Hym-Api1	Hymenoptera	Apidae	Apinae	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-Api3	Hymenoptera	Apidae	Apinae	unknown	unknown	3
01.vi.2022	out	40	11S 424780 4185803	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-Brac2	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-Sph2	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-Unk5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-W10	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	40	11S 424780 4185803	L-006	Lepidoptera	Tortricidae?	unknown	unknown	sp2	1
01.vi.2022	out	42	11S 425181 4185805	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	42	11S 425181 4185805	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	out	42	11S 425181 4185805	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	40
01.vi.2022	out	42	11S 425181 4185805	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	1
01.vi.2022	out	42	11S 425181 4185805	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	2
01.vi.2022	out	42	11S 425181 4185805	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
01.vi.2022	out	42	11S 425181 4185805	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	42	11S 425181 4185805	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	2
01.vi.2022	out	42	11S 425181 4185805	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	3
01.vi.2022	out	42	11S 425181 4185805	D-033	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp4	1
01.vi.2022	out	42	11S 425181 4185805	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	42	11S 425181 4185805	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	4
01.vi.2022	out	42	11S 425181 4185805	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	42	11S 425181 4185805	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	42	11S 425181 4185805	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	2
01.vi.2022	out	42	11S 425181 4185805	D-057	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp1	1
01.vi.2022	out	42	11S 425181 4185805	D-068	Diptera	Bombyliidae	Anthracinae	Anthrax	sp4	1
01.vi.2022	out	42	11S 425181 4185805	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	42	11S 425181 4185805	Hym-Api7	Hymenoptera	Apidae	unknown	unknown	unknown	2
01.vi.2022	out	42	11S 425181 4185805	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	42	11S 425181 4185805	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	42	11S 425181 4185805	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	42	11S 425181 4185805	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	42	11S 425181 4185805	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	42	11S 425181 4185805	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	Megachile	unknown	1
01.vi.2022	out	42	11S 425181 4185805	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	2
01.vi.2022	out	42	11S 425181 4185805	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
01.vi.2022	out	42	11S 425181 4185805	L-009	Lepidoptera	unknown	unknown	unknown	sp7	1
01.vi.2022	out	44	11S 423740 4185592	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	3
01.vi.2022	out	44	11S 423740 4185592	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	12
01.vi.2022	out	44	11S 423740 4185592	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
01.vi.2022	out	44	11S 423740 4185592	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	4
01.vi.2022	out	44	11S 423740 4185592	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	3
01.vi.2022	out	44	11S 423740 4185592	D-031	Diptera	Ulididae	Otinae	Haigia	nevadana	2
01.vi.2022	out	44	11S 423740 4185592	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	3
01.vi.2022	out	44	11S 423740 4185592	D-048	Diptera	Empididae	Tachydromiinae	unknown	sp	1
01.vi.2022	out	44	11S 423740 4185592	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	18
01.vi.2022	out	44	11S 423740 4185592	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	44	11S 423740 4185592	D-057	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp1	1
01.vi.2022	out	44	11S 423740 4185592	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
01.vi.2022	out	44	11S 423740 4185592	D-082	Diptera	Tachinidae	Tachininae	Paradidyma	sp1	1
01.vi.2022	out	44	11S 423740 4185592	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	1
01.vi.2022	out	44	11S 423740 4185592	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	13
01.vi.2022	out	44	11S 423740 4185592	D-091	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Neobellieria)??	sp	1
01.vi.2022	out	44	11S 423740 4185592	D-097	Diptera	Sarcophagidae	Miltogramminae	unknown	sp8	1
01.vi.2022	out	44	11S 423740 4185592	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	44	11S 423740 4185592	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	44	11S 423740 4185592	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	44	11S 423740 4185592	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	44	11S 423740 4185592	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	46	11S 424181 4185603	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	7
01.vi.2022	out	46	11S 424181 4185603	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	181
01.vi.2022	out	46	11S 424181 4185603	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	1
01.vi.2022	out	46	11S 424181 4185603	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
01.vi.2022	out	46	11S 424181 4185603	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	46	11S 424181 4185603	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	12
01.vi.2022	out	46	11S 424181 4185603	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	3
01.vi.2022	out	46	11S 424181 4185603	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	46	11S 424181 4185603	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	8
01.vi.2022	out	46	11S 424181 4185603	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
01.vi.2022	out	46	11S 424181 4185603	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	1
01.vi.2022	out	46	11S 424181 4185603	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	2
01.vi.2022	out	46	11S 424181 4185603	D-093	Diptera	Sarcophagidae	Sarcophaginae	unknown	sp5	1
01.vi.2022	out	46	11S 424181 4185603	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	3
01.vi.2022	out	46	11S 424181 4185603	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	46	11S 424181 4185603	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	46	11S 424181 4185603	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	7
01.vi.2022	out	46	11S 424181 4185603	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	10
01.vi.2022	out	46	11S 424181 4185603	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	46	11S 424181 4185603	Hym-Ich1	Hymenoptera	Ichnuemonidae	unknown	unknown	unknown	1
01.vi.2022	out	46	11S 424181 4185603	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	46	11S 424181 4185603	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	Megachile	unknown	2
01.vi.2022	out	46	11S 424181 4185603	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	2
01.vi.2022	out	46	11S 424181 4185603	Hym-Spech1	Hymenoptera	Sphecidae	unknown	unknown	unknown	2
01.vi.2022	out	46	11S 424181 4185603	Hym-Ves1	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	48	11S 424583 4185605	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	299
01.vi.2022	out	48	11S 424583 4185605	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	48	11S 424583 4185605	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	48	11S 424583 4185605	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	3
01.vi.2022	out	48	11S 424583 4185605	D-062	Diptera	Sepsidae	Sepsinae	Sespsis	sp	4
01.vi.2022	out	48	11S 424583 4185605	D-074	Diptera	Muscidae	Muscinae	Neomyia	sp	4
01.vi.2022	out	48	11S 424583 4185605	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	10
01.vi.2022	out	48	11S 424583 4185605	D-101	Diptera	Anthomyiidae	unknown	unknown	sp1	1
01.vi.2022	out	48	11S 424583 4185605	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	48	11S 424583 4185605	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	48	11S 424583 4185605	Hym-Eu4	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	50	11S 424980 4185599	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	out	50	11S 424980 4185599	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	15
01.vi.2022	out	50	11S 424980 4185599	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
01.vi.2022	out	50	11S 424980 4185599	C-010	Coleoptera	Melyridae	Malachiinae	Attalus	sp3	2
01.vi.2022	out	50	11S 424980 4185599	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	4
01.vi.2022	out	50	11S 424980 4185599	C-030	Coleoptera	Chrysomelidae	Cryptochephalinae	Pachybrachis	sp	1
01.vi.2022	out	50	11S 424980 4185599	C-032	Coleoptera	Chrysomelidae	Galeurcinae	Chaetocnema?	sp	1
01.vi.2022	out	50	11S 424980 4185599	D-006	Diptera	Phoridae	Metopininae	unknown	sp	2
01.vi.2022	out	50	11S 424980 4185599	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
01.vi.2022	out	50	11S 424980 4185599	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	3
01.vi.2022	out	50	11S 424980 4185599	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	50	11S 424980 4185599	D-028	Diptera	Bombyliidae	Anthracinae	Epacmus?	sp	1
01.vi.2022	out	50	11S 424980 4185599	D-037	Diptera	Bombyliidae	Toxophorinae	Geron	sp	1
01.vi.2022	out	50	11S 424980 4185599	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	3
01.vi.2022	out	50	11S 424980 4185599	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
01.vi.2022	out	50	11S 424980 4185599	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	50	11S 424980 4185599	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	50	11S 424980 4185599	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	2
01.vi.2022	out	50	11S 424980 4185599	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	1
01.vi.2022	out	50	11S 424980 4185599	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	2
01.vi.2022	out	50	11S 424980 4185599	D-106	Diptera	Tachinidae	unknown	unknown	sp1	1
01.vi.2022	out	50	11S 424980 4185599	Hym-A1	Hymenoptera	Apidae	Apinae	Anthophora	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Brach1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Crab15	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Crab7	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	50	11S 424980 4185599	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Eu2	Hymenoptera	Encyrtidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	50	11S 424980 4185599	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Unk3	Hymenoptera	unknown	unknown	unknown	unknown	3
01.vi.2022	out	50	11S 424980 4185599	Hym-Unk4	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-Ves1	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	4
01.vi.2022	out	50	11S 424980 4185599	Hym-W9	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	50	11S 424980 4185599	L-001	Lepidoptera	Hesperiidae	Pyrginae	Hesperopsis	alpheus	1
01.vi.2022	out	50	11S 424980 4185599	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	55	11S 424433 4185462	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	55	11S 424433 4185462	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	83
01.vi.2022	out	55	11S 424433 4185462	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	14
01.vi.2022	out	55	11S 424433 4185462	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	2
01.vi.2022	out	55	11S 424433 4185462	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	2
01.vi.2022	out	55	11S 424433 4185462	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	4
01.vi.2022	out	55	11S 424433 4185462	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	8
01.vi.2022	out	55	11S 424433 4185462	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	2
01.vi.2022	out	55	11S 424433 4185462	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	7
01.vi.2022	out	55	11S 424433 4185462	D-031	Diptera	Ulididae	Otinae	Haigia	nevadana	1
01.vi.2022	out	55	11S 424433 4185462	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	2
01.vi.2022	out	55	11S 424433 4185462	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
01.vi.2022	out	55	11S 424433 4185462	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	9
01.vi.2022	out	55	11S 424433 4185462	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
01.vi.2022	out	55	11S 424433 4185462	D-083	Diptera	Tachinidae	Exoristinae	Chetogena	sp	2
01.vi.2022	out	55	11S 424433 4185462	D-085	Diptera	Tachinidae	Dexiinae	Periscepsia	sp	1
01.vi.2022	out	55	11S 424433 4185462	D-100	Diptera	Anthomyiidae	Miltogramminae	Senotainia?	sp	1
01.vi.2022	out	55	11S 424433 4185462	Hym-A6	Hymenoptera	Apidae	Apinae	unknown	unknown	1
01.vi.2022	out	55	11S 424433 4185462	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	55	11S 424433 4185462	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	2

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	55	11S 424433 4185462	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
01.vi.2022	out	55	11S 424433 4185462	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	4
01.vi.2022	out	55	11S 424433 4185462	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	55	11S 424433 4185462	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	55	11S 424433 4185462	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	55	11S 424433 4185462	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	55	11S 424433 4185462	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	3
01.vi.2022	out	55	11S 424433 4185462	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	55	11S 424433 4185462	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	55	11S 424433 4185462	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	2
01.vi.2022	out	55	11S 424433 4185462	Hym-Unk21	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	55	11S 424433 4185462	Hym-W13	Hymenoptera	unknown	unknown	unknown	unknown	2
01.vi.2022	out	55	11S 424433 4185462	L-005	Lepidoptera	Pieridae	Pierinae	Pontia	sp	1
01.vi.2022	out	57	11S 424782 4185404	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	54
01.vi.2022	out	57	11S 424782 4185404	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	1
01.vi.2022	out	57	11S 424782 4185404	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	57	11S 424782 4185404	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
01.vi.2022	out	57	11S 424782 4185404	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	2
01.vi.2022	out	57	11S 424782 4185404	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	57	11S 424782 4185404	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	57	11S 424782 4185404	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	40
01.vi.2022	out	57	11S 424782 4185404	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	57	11S 424782 4185404	L-014	Lepidoptera	Geometridae	unknown	unknown	sp1	1
01.vi.2022	out	60	11S 423781 4185202	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	13
01.vi.2022	out	60	11S 423781 4185202	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
01.vi.2022	out	60	11S 423781 4185202	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	60	11S 423781 4185202	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
01.vi.2022	out	60	11S 423781 4185202	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
01.vi.2022	out	60	11S 423781 4185202	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	6
01.vi.2022	out	60	11S 423781 4185202	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	60	11S 423781 4185202	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	12
01.vi.2022	out	60	11S 423781 4185202	D-057	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp1	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Api4	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	60	11S 423781 4185202	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Ich2	Hymenoptera	Ichnuemonidae	unknown	unknown	unknown	1
01.vi.2022	out	60	11S 423781 4185202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	60	11S 423781 4185202	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	3
01.vi.2022	out	60	11S 423781 4185202	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	in	62	11S 424191 4185209	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	in	62	11S 424191 4185209	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	7
01.vi.2022	in	62	11S 424191 4185209	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	2
01.vi.2022	in	62	11S 424191 4185209	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	3
01.vi.2022	in	62	11S 424191 4185209	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
01.vi.2022	in	62	11S 424191 4185209	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
01.vi.2022	in	62	11S 424191 4185209	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	in	62	11S 424191 4185209	D-048	Diptera	Empididae	Tachydromiinae	unknown	sp	1
01.vi.2022	in	62	11S 424191 4185209	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	4
01.vi.2022	in	62	11S 424191 4185209	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	2
01.vi.2022	in	62	11S 424191 4185209	D-089	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Beracaeopsis)??	sp	2
01.vi.2022	in	62	11S 424191 4185209	D-093	Diptera	Sarcophagidae	Sarcophaginae	unknown	sp5	1
01.vi.2022	in	62	11S 424191 4185209	Hy-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	2
01.vi.2022	in	62	11S 424191 4185209	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	in	62	11S 424191 4185209	Hym-W4	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	in	62	11S 424191 4185209	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	2
01.vi.2022	in	62	11S 424191 4185209	L-006	Lepidoptera	Tortricidae?	unknown	unknown	sp2	1
01.vi.2022	out	64	11S 424587 4185202	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	out	64	11S 424587 4185202	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	1
01.vi.2022	out	64	11S 424587 4185202	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	10
01.vi.2022	out	64	11S 424587 4185202	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	64	11S 424587 4185202	D-006	Diptera	Phoridae	Metopininae	unknown	sp	1
01.vi.2022	out	64	11S 424587 4185202	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	64	11S 424587 4185202	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	64	11S 424587 4185202	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
01.vi.2022	out	64	11S 424587 4185202	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
01.vi.2022	out	64	11S 424587 4185202	D-037	Diptera	Bombyliidae	Toxophorinae	Geron	sp	1
01.vi.2022	out	64	11S 424587 4185202	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	64	11S 424587 4185202	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	64	11S 424587 4185202	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
01.vi.2022	out	64	11S 424587 4185202	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	2
01.vi.2022	out	64	11S 424587 4185202	Hym-Brac2	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	3
01.vi.2022	out	64	11S 424587 4185202	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	64	11S 424587 4185202	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	64	11S 424587 4185202	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	64	11S 424587 4185202	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	64	11S 424587 4185202	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	18
01.vi.2022	out	64	11S 424587 4185202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	5
01.vi.2022	out	64	11S 424587 4185202	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	64	11S 424587 4185202	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	64	11S 424587 4185202	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	64	11S 424587 4185202	L-007	Lepidoptera	unknown		unknown	sp3	1
01.vi.2022	out	65	11S 423580 4185003	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	out	65	11S 423580 4185003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	6
01.vi.2022	out	65	11S 423580 4185003	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	20
01.vi.2022	out	65	11S 423580 4185003	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	7

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	65	11S 423580 4185003	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
01.vi.2022	out	65	11S 423580 4185003	C-015	Coleoptera	Tenebrionidae	Pimeliinae	Triorophus	sp	1
01.vi.2022	out	65	11S 423580 4185003	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
01.vi.2022	out	65	11S 423580 4185003	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	5
01.vi.2022	out	65	11S 423580 4185003	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	65	11S 423580 4185003	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	out	65	11S 423580 4185003	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	65	11S 423580 4185003	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	65	11S 423580 4185003	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	65	11S 423580 4185003	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	5
01.vi.2022	out	65	11S 423580 4185003	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	65	11S 423580 4185003	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	5
01.vi.2022	out	65	11S 423580 4185003	L-020	Lepidoptera	unknown		unknown	sp21	1
01.vi.2022	out	69	11S 424381 4185005	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	69	11S 424381 4185005	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	8
01.vi.2022	out	69	11S 424381 4185005	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	5
01.vi.2022	out	69	11S 424381 4185005	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	3
01.vi.2022	out	69	11S 424381 4185005	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	6
01.vi.2022	out	69	11S 424381 4185005	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	2
01.vi.2022	out	69	11S 424381 4185005	Hym-Anthid3	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
01.vi.2022	out	69	11S 424381 4185005	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	69	11S 424381 4185005	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	69	11S 424381 4185005	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	69	11S 424381 4185005	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	3
01.vi.2022	out	69	11S 424381 4185005	Hym-Per2	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	2
01.vi.2022	out	69	11S 424381 4185005	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	69	11S 424381 4185005	Hym-Sph3	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	69	11S 424381 4185005	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	72	11S 423783 4184803	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	72	11S 423783 4184803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	5
01.vi.2022	out	72	11S 423783 4184803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	9
01.vi.2022	out	72	11S 423783 4184803	D-014	Diptera	Cecidomyiidae	Cecidomyiinae	unknown	sp	1
01.vi.2022	out	72	11S 423783 4184803	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	72	11S 423783 4184803	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	5
01.vi.2022	out	72	11S 423783 4184803	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	72	11S 423783 4184803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	6
01.vi.2022	out	72	11S 423783 4184803	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	2
01.vi.2022	out	72	11S 423783 4184803	Hym-Brac2	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	72	11S 423783 4184803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	72	11S 423783 4184803	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	2
01.vi.2022	out	72	11S 423783 4184803	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	72	11S 423783 4184803	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	72	11S 423783 4184803	Hym-Mega2	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	72	11S 423783 4184803	Hym-W10	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	72	11S 423783 4184803	L-010	Lepidoptera	unknown	unknown	unknown	sp6	1
01.vi.2022	out	74	11S 424177 4184799	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	2
01.vi.2022	out	74	11S 424177 4184799	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	7
01.vi.2022	out	74	11S 424177 4184799	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	3

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	74	11S 424177 4184799	C-010	Coleoptera	Melyridae	Malachiinae	Attalus	sp3	1
01.vi.2022	out	74	11S 424177 4184799	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	2
01.vi.2022	out	74	11S 424177 4184799	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
01.vi.2022	out	74	11S 424177 4184799	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	3
01.vi.2022	out	74	11S 424177 4184799	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	74	11S 424177 4184799	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	13
01.vi.2022	out	74	11S 424177 4184799	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
01.vi.2022	out	74	11S 424177 4184799	D-086	Diptera	Sarcophagidae	Sarcophaginae	Ravinia	sp1	1
01.vi.2022	out	74	11S 424177 4184799	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	74	11S 424177 4184799	D-089	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Beracaeopsis)??	sp	3
01.vi.2022	out	74	11S 424177 4184799	Hym-Anthid1	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
01.vi.2022	out	74	11S 424177 4184799	Hym-Chal3	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	74	11S 424177 4184799	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	74	11S 424177 4184799	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	74	11S 424177 4184799	Hym-Di1	Hymenoptera	Megachilidae	Megachilinae	Dianthidium	unknown	2
01.vi.2022	out	74	11S 424177 4184799	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	74	11S 424177 4184799	Hym-W5	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	74	11S 424177 4184799	Hym-W9	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	76	11S 424581 4184803	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	76	11S 424581 4184803	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	76	11S 424581 4184803	D-037	Diptera	Bombyliidae	Toxophorinae	Geron	sp	1
01.vi.2022	out	76	11S 424581 4184803	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	76	11S 424581 4184803	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	3
01.vi.2022	out	76	11S 424581 4184803	Hym-Crab3	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	76	11S 424581 4184803	Hym-Lasio4	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	76	11S 424581 4184803	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	78	11S 423581 4184604	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	8
01.vi.2022	out	78	11S 423581 4184604	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	12
01.vi.2022	out	78	11S 423581 4184604	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	78	11S 423581 4184604	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	12
01.vi.2022	out	78	11S 423581 4184604	D-031	Diptera	Ulididae	Otinae	Haigia	nevadana	2
01.vi.2022	out	78	11S 423581 4184604	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	2
01.vi.2022	out	78	11S 423581 4184604	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	4
01.vi.2022	out	78	11S 423581 4184604	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	78	11S 423581 4184604	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	11
01.vi.2022	out	78	11S 423581 4184604	D-063	Diptera	Bombyliidae	Bombyliinae	Triploechus?	sp	1
01.vi.2022	out	78	11S 423581 4184604	D-073	Diptera	Therevidae	Therevinae	Arenigena	sp	1
01.vi.2022	out	78	11S 423581 4184604	D-096	Diptera	Sarcophagidae	unknown	unknown	sp7	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Crab14	Hymenoptera	Crabronidae	Astatinae	Astata?	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Ha1	Hymenoptera	Halictidae	Halictinae	Halictus	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Unk16	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	78	11S 423581 4184604	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	3

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	78	11S 423581 4184604	L-011	Lepidoptera	Hesperiidae	Hesperiinae	Hesperia	sp	1
01.vi.2022	out	80	11S 423985 4184598	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	6
01.vi.2022	out	80	11S 423985 4184598	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	6
01.vi.2022	out	80	11S 423985 4184598	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
01.vi.2022	out	80	11S 423985 4184598	C-010	Coleoptera	Melyridae	Malachiinae	Attalus	sp3	1
01.vi.2022	out	80	11S 423985 4184598	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	3
01.vi.2022	out	80	11S 423985 4184598	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	80	11S 423985 4184598	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	3
01.vi.2022	out	80	11S 423985 4184598	D-030	Diptera	Syrphidae	Eristalinae	Eristalis	sp	1
01.vi.2022	out	80	11S 423985 4184598	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	5
01.vi.2022	out	80	11S 423985 4184598	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	80	11S 423985 4184598	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	5
01.vi.2022	out	80	11S 423985 4184598	D-058	Diptera	Bombyliidae	Mythicomyiinae	Glabellula	sp	1
01.vi.2022	out	80	11S 423985 4184598	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	1
01.vi.2022	out	80	11S 423985 4184598	D-066	Diptera	Conopidae	Myopinae	Thecophora	sp	1
01.vi.2022	out	80	11S 423985 4184598	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	1
01.vi.2022	out	80	11S 423985 4184598	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	80	11S 423985 4184598	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	80	11S 423985 4184598	Hym-Chal4	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	80	11S 423985 4184598	Hym-Form5	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	80	11S 423985 4184598	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	80	11S 423985 4184598	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	2
01.vi.2022	out	80	11S 423985 4184598	L-006	Lepidoptera	Tortricidae?	unknown	unknown	sp2	1
01.vi.2022	in	81	11S 424080 4184512	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	in	81	11S 424080 4184512	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	9
01.vi.2022	in	81	11S 424080 4184512	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	3
01.vi.2022	in	81	11S 424080 4184512	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	1
01.vi.2022	in	81	11S 424080 4184512	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	4
01.vi.2022	in	81	11S 424080 4184512	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	in	81	11S 424080 4184512	C-025	Coleoptera	Melyridae	Malachiinae	Collops	sp1	1
01.vi.2022	in	81	11S 424080 4184512	D-011	Diptera	Asilidae	Asilinae	unknown	sp	1
01.vi.2022	in	81	11S 424080 4184512	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	in	81	11S 424080 4184512	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	in	81	11S 424080 4184512	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
01.vi.2022	in	81	11S 424080 4184512	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	5
01.vi.2022	in	81	11S 424080 4184512	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
01.vi.2022	in	81	11S 424080 4184512	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	7
01.vi.2022	in	81	11S 424080 4184512	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	in	81	11S 424080 4184512	D-089	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Beracaeopsis)??	sp	1
01.vi.2022	in	81	11S 424080 4184512	D-102	Diptera	Anthomyiidae	unknown	unknown	sp2	1
01.vi.2022	in	81	11S 424080 4184512	D-105	Diptera	Anthomyiidae	Anthomyiinae	unknown	sp3	1
01.vi.2022	in	81	11S 424080 4184512	Hym-Anthid2	Hymenoptera	Megachilidae	Megachilinae	Anthidium	unknown	1
01.vi.2022	in	81	11S 424080 4184512	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	3
01.vi.2022	in	81	11S 424080 4184512	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	in	81	11S 424080 4184512	Hym-Di1	Hymenoptera	Megachilidae	Megachilinae	Dianthidium	unknown	1
01.vi.2022	in	81	11S 424080 4184512	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	5
01.vi.2022	in	81	11S 424080 4184512	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	in	81	11S 424080 4184512	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	in	81	11S 424080 4184512	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	4
01.vi.2022	in	81	11S 424080 4184512	Hym-Unk8	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	in	81	11S 424080 4184512	L-020	Lepidoptera	unknown	unknown	unknown	sp21	1
01.vi.2022	out	83	11S 424381 4184603	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	83	11S 424381 4184603	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	9
01.vi.2022	out	83	11S 424381 4184603	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
01.vi.2022	out	83	11S 424381 4184603	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
01.vi.2022	out	83	11S 424381 4184603	C-006	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp1	2
01.vi.2022	out	83	11S 424381 4184603	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	83	11S 424381 4184603	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	83	11S 424381 4184603	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	21
01.vi.2022	out	83	11S 424381 4184603	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	2
01.vi.2022	out	83	11S 424381 4184603	D-057	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp1	1
01.vi.2022	out	83	11S 424381 4184603	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	3
01.vi.2022	out	83	11S 424381 4184603	Hym-Api5	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Brac2	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Crab4	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Crab6	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	83	11S 424381 4184603	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	83	11S 424381 4184603	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	86	11S 423780 4184402	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	31
01.vi.2022	out	86	11S 423780 4184402	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	7
01.vi.2022	out	86	11S 423780 4184402	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
01.vi.2022	out	86	11S 423780 4184402	C-008	Coleoptera	Cleriidae	Clerinae	Trichodes	ornatus	1
01.vi.2022	out	86	11S 423780 4184402	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	2
01.vi.2022	out	86	11S 423780 4184402	C-033	Coleoptera	Buprestidae	Polycestinae	Anambodera	sp2	1
01.vi.2022	out	86	11S 423780 4184402	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
01.vi.2022	out	86	11S 423780 4184402	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	86	11S 423780 4184402	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	2
01.vi.2022	out	86	11S 423780 4184402	D-038	Diptera	Syrphidae	Syrphinae	Syrphus	sp	1
01.vi.2022	out	86	11S 423780 4184402	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
01.vi.2022	out	86	11S 423780 4184402	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	15
01.vi.2022	out	86	11S 423780 4184402	D-082	Diptera	Tachinidae	Tachininae	Paradidyma	sp1	1
01.vi.2022	out	86	11S 423780 4184402	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	3
01.vi.2022	out	86	11S 423780 4184402	D-109	Diptera	Tachinidae	Dexiinae	unknown	sp2	1
01.vi.2022	out	86	11S 423780 4184402	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	out	86	11S 423780 4184402	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	86	11S 423780 4184402	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	3
01.vi.2022	out	86	11S 423780 4184402	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	86	11S 423780 4184402	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	86	11S 423780 4184402	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	86	11S 423780 4184402	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	86	11S 423780 4184402	Hym-Sph4	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	86	11S 423780 4184402	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	in	88	11S 424130 4184396	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	in	88	11S 424130 4184396	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	5
01.vi.2022	in	88	11S 424130 4184396	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	in	88	11S 424130 4184396	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
01.vi.2022	in	88	11S 424130 4184396	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
01.vi.2022	in	88	11S 424130 4184396	D-045	Diptera	Bombyliidae	Mythicomyiinae	Empidideicus	sp	1
01.vi.2022	in	88	11S 424130 4184396	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	4
01.vi.2022	in	88	11S 424130 4184396	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	4
01.vi.2022	in	88	11S 424130 4184396	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	in	88	11S 424130 4184396	D-089	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Beracaeopsis)??	sp	3
01.vi.2022	in	88	11S 424130 4184396	D-091	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Neobellieria)??	sp	1
01.vi.2022	in	88	11S 424130 4184396	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
01.vi.2022	in	88	11S 424130 4184396	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	4
01.vi.2022	in	88	11S 424130 4184396	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	4
01.vi.2022	out	90	11S 424584 4184400	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	90	11S 424584 4184400	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	out	90	11S 424584 4184400	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	5
01.vi.2022	out	90	11S 424584 4184400	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	2
01.vi.2022	out	90	11S 424584 4184400	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	90	11S 424584 4184400	D-014	Diptera	Cecidomyiidae	Cecidomyiinae	unknown	sp	1
01.vi.2022	out	90	11S 424584 4184400	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	4
01.vi.2022	out	90	11S 424584 4184400	Hym-Api3	Hymenoptera	Apidae	unknown	unknown	unknown	2
01.vi.2022	out	90	11S 424584 4184400	Hym-Brach1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	90	11S 424584 4184400	Hym-Brach2	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	90	11S 424584 4184400	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	90	11S 424584 4184400	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	90	11S 424584 4184400	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
01.vi.2022	out	90	11S 424584 4184400	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
01.vi.2022	out	90	11S 424584 4184400	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	90	11S 424584 4184400	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	90	11S 424584 4184400	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	90	11S 424584 4184400	Hym-W3	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	93	11S 423606 4184212	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	2
01.vi.2022	out	93	11S 423606 4184212	C-004	Coleoptera	Anthicidae	Anthicinae	Ischyropalpus	sp	1
01.vi.2022	out	93	11S 423606 4184212	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	2
01.vi.2022	out	93	11S 423606 4184212	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	93	11S 423606 4184212	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
01.vi.2022	out	93	11S 423606 4184212	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	4
01.vi.2022	out	93	11S 423606 4184212	D-021	Diptera	Bombyliidae	Usiinae	Apolysis	sp3	1
01.vi.2022	out	93	11S 423606 4184212	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	3
01.vi.2022	out	93	11S 423606 4184212	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	2
01.vi.2022	out	93	11S 423606 4184212	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	45
01.vi.2022	out	93	11S 423606 4184212	D-064	Diptera	Bombyliidae	Usiinae	Apolysis	sp4	2
01.vi.2022	out	93	11S 423606 4184212	D-084	Diptera	Tachinidae	Dexiinae	Microchaetina	sp1	1
01.vi.2022	out	93	11S 423606 4184212	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	93	11S 423606 4184212	D-102	Diptera	Anthomyiidae	unknown	unknown	sp2	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	93	11S 423606 4184212	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	93	11S 423606 4184212	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	95	11S 423982 4184201	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	28
01.vi.2022	out	95	11S 423982 4184201	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	12
01.vi.2022	out	95	11S 423982 4184201	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	1
01.vi.2022	out	95	11S 423982 4184201	C-028	Coleoptera	Scarabaeidae	Aphodinae	Dichelonyx	sp	1
01.vi.2022	out	95	11S 423982 4184201	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	2
01.vi.2022	out	95	11S 423982 4184201	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	95	11S 423982 4184201	D-025	Diptera	Empididae	Tachydromiinae	Micrempis?	sp	1
01.vi.2022	out	95	11S 423982 4184201	D-034	Diptera	Heleomyzidae	Heleomyzinae	Pseudoleria	sp	1
01.vi.2022	out	95	11S 423982 4184201	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
01.vi.2022	out	95	11S 423982 4184201	D-043	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp1	1
01.vi.2022	out	95	11S 423982 4184201	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	95	11S 423982 4184201	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	95	11S 423982 4184201	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	21
01.vi.2022	out	95	11S 423982 4184201	D-064	Diptera	Bombyliidae	Usiinae	Apolysis	sp4	2
01.vi.2022	out	95	11S 423982 4184201	D-081	Diptera	Tachinidae	Dexiinae	Ptilodexia?	sp2	1
01.vi.2022	out	95	11S 423982 4184201	D-088	Diptera	Sarcophagidae	Miltogramminae	unknown	sp2	1
01.vi.2022	out	95	11S 423982 4184201	D-090	Diptera	Sarcophagidae	Miltogramminae	unknown	sp3	1
01.vi.2022	out	95	11S 423982 4184201	Hym-Chal1	Hymenoptera	Chalcididae	unknown	unknown	unknown	2
01.vi.2022	out	95	11S 423982 4184201	Hym-Crab16	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	95	11S 423982 4184201	Hym-Crab4	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	95	11S 423982 4184201	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	2
01.vi.2022	out	95	11S 423982 4184201	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	95	11S 423982 4184201	Hym-Mega3	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	95	11S 423982 4184201	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	95	11S 423982 4184201	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
01.vi.2022	in	97	11S 424282 4184246	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	2
01.vi.2022	in	97	11S 424282 4184246	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	5
01.vi.2022	in	97	11S 424282 4184246	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	1
01.vi.2022	in	97	11S 424282 4184246	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	3
01.vi.2022	in	97	11S 424282 4184246	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	2
01.vi.2022	in	97	11S 424282 4184246	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	in	97	11S 424282 4184246	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	4
01.vi.2022	in	97	11S 424282 4184246	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	in	97	11S 424282 4184246	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	in	97	11S 424282 4184246	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	4
01.vi.2022	in	97	11S 424282 4184246	Hym-Chal4	Hymenoptera	Chalcididae	unknown	unknown	unknown	1
01.vi.2022	in	97	11S 424282 4184246	Hym-Chry1	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	in	97	11S 424282 4184246	Hym-Crab5	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	in	97	11S 424282 4184246	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	in	97	11S 424282 4184246	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	in	97	11S 424282 4184246	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	3
01.vi.2022	in	97	11S 424282 4184246	Hym-Ves9	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	in	97	11S 424282 4184246	L-010	Lepidoptera	unknown	unknown	unknown	sp6	1
01.vi.2022	out	98	11S 424382 4184205	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	98	11S 424382 4184205	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	13
01.vi.2022	out	98	11S 424382 4184205	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	5

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	98	11S 424382 4184205	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	2
01.vi.2022	out	98	11S 424382 4184205	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	1
01.vi.2022	out	98	11S 424382 4184205	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	98	11S 424382 4184205	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	11
01.vi.2022	out	98	11S 424382 4184205	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	1
01.vi.2022	out	98	11S 424382 4184205	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
01.vi.2022	out	98	11S 424382 4184205	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	98	11S 424382 4184205	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	2
01.vi.2022	out	98	11S 424382 4184205	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	3
01.vi.2022	out	98	11S 424382 4184205	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	98	11S 424382 4184205	D-092	Diptera	Sarcophagidae	Sarcophaginae	unknown	sp4	1
01.vi.2022	out	98	11S 424382 4184205	D-093	Diptera	Sarcophagidae	Sarcophaginae	unknown	sp5	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Api1	Hymenoptera	Apidae	unknown	unknown	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	4
01.vi.2022	out	98	11S 424382 4184205	Hym-Brac2	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	2
01.vi.2022	out	98	11S 424382 4184205	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	98	11S 424382 4184205	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-Unk1-2	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	98	11S 424382 4184205	Hym-W12	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	100	11S 424783 4184202	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	1
01.vi.2022	out	100	11S 424783 4184202	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	8
01.vi.2022	out	100	11S 424783 4184202	C-005	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp1	1
01.vi.2022	out	100	11S 424783 4184202	C-009	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	sp2	1
01.vi.2022	out	100	11S 424783 4184202	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
01.vi.2022	out	100	11S 424783 4184202	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	5
01.vi.2022	out	100	11S 424783 4184202	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	12
01.vi.2022	out	100	11S 424783 4184202	D-037	Diptera	Bombyliidae	Toxophorinae	Geron	sp	1
01.vi.2022	out	100	11S 424783 4184202	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	100	11S 424783 4184202	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	1
01.vi.2022	out	100	11S 424783 4184202	D-087	Diptera	Sarcophagidae	Miltogramminae	unknown	sp1	1
01.vi.2022	out	100	11S 424783 4184202	D-093	Diptera	Sarcophagidae	Sarcophaginae	unknown	sp5	1
01.vi.2022	out	100	11S 424783 4184202	Hym-A4	Hymenoptera	Apidae	Apinae	unknown	unknown	1
01.vi.2022	out	100	11S 424783 4184202	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	3
01.vi.2022	out	100	11S 424783 4184202	Hym-Brac1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	100	11S 424783 4184202	Hym-Cera1	Hymenoptera	Apidae	Xylocopinae	Ceratina	unknown	1
01.vi.2022	out	100	11S 424783 4184202	Hym-Crab2	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	100	11S 424783 4184202	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	4
01.vi.2022	out	100	11S 424783 4184202	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	1
01.vi.2022	out	100	11S 424783 4184202	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	7
01.vi.2022	out	100	11S 424783 4184202	Hym-Lasio4	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	100	11S 424783 4184202	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	100	11S 424783 4184202	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	100	11S 424783 4184202	Hym-Unk8	Hymenoptera	unknown	unknown	unknown	unknown	1

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Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	100	11S 424783 4184202	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	2
01.vi.2022	out	101	11S 423782 4184003	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	29
01.vi.2022	out	101	11S 423782 4184003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	2
01.vi.2022	out	101	11S 423782 4184003	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
01.vi.2022	out	101	11S 423782 4184003	D-014	Diptera	Cecidomyiidae	Cecidomyiinae	unknown	sp	1
01.vi.2022	out	101	11S 423782 4184003	D-020	Diptera	Bombyliidae	Usiinae	Apolysis	sp2	1
01.vi.2022	out	101	11S 423782 4184003	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	101	11S 423782 4184003	D-041	Diptera	Tachinidae	Dexiinae	Nimioglossa	sp	2
01.vi.2022	out	101	11S 423782 4184003	D-047	Diptera	Bombyliidae	Anthracinae	Anthrax	sp1	1
01.vi.2022	out	101	11S 423782 4184003	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	101	11S 423782 4184003	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	23
01.vi.2022	out	101	11S 423782 4184003	D-064	Diptera	Bombyliidae	Usiinae	Apolysis	sp4	2
01.vi.2022	out	101	11S 423782 4184003	D-067	Diptera	Bombyliidae	Anthracinae	Anthrax	sp3	1
01.vi.2022	out	101	11S 423782 4184003	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	101	11S 423782 4184003	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	101	11S 423782 4184003	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	101	11S 423782 4184003	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	4
01.vi.2022	out	101	11S 423782 4184003	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	4
01.vi.2022	out	101	11S 423782 4184003	Hym-Per1	Hymenoptera	Andrenidae	Panurginae	unknown	unknown	1
01.vi.2022	out	101	11S 423782 4184003	Hym-Ves1	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	101	11S 423782 4184003	Hym-Ves2	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	101	11S 423782 4184003	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
01.vi.2022	out	101	11S 423782 4184003	L-010	Lepidoptera	unknown	unknown	unknown	sp	1
01.vi.2022	out	103	11S 424180 4184022	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	21
01.vi.2022	out	103	11S 424180 4184022	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	5
01.vi.2022	out	103	11S 424180 4184022	C-012	Coleoptera	Melyridae	Dasytinae	Listrus	sp1	5
01.vi.2022	out	103	11S 424180 4184022	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	2
01.vi.2022	out	103	11S 424180 4184022	D-032	Diptera	Chloropidae	Oscinellinae	Rhopalopterum	sp	1
01.vi.2022	out	103	11S 424180 4184022	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	6
01.vi.2022	out	103	11S 424180 4184022	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	17
01.vi.2022	out	103	11S 424180 4184022	D-064	Diptera	Bombyliidae	Usiinae	Apolysis	sp4	1
01.vi.2022	out	103	11S 424180 4184022	D-089	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Beracaeopsis)??	sp	1
01.vi.2022	out	103	11S 424180 4184022	D-091	Diptera	Sarcophagidae	Sarcophaginae	Sarcophaga (Neobellieria)??	sp	1
01.vi.2022	out	103	11S 424180 4184022	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	103	11S 424180 4184022	Hym-Form2	Hymenoptera	Formicidae	unknown	unknown	unknown	10
01.vi.2022	out	103	11S 424180 4184022	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	3
01.vi.2022	out	103	11S 424180 4184022	L-004	Lepidoptera	Gelechiidae	unknown	unknown	sp20	1
01.vi.2022	out	103	11S 424180 4184022	L-010	Lepidoptera	unknown	unknown	unknown	sp	1
01.vi.2022	out	105	11S 424581 4184003	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	105	11S 424581 4184003	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	4
01.vi.2022	out	105	11S 424581 4184003	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	7
01.vi.2022	out	105	11S 424581 4184003	C-020	Coleoptera	Melyridae	Dasytinae	Listrus	sp3	1
01.vi.2022	out	105	11S 424581 4184003	C-021	Coleoptera	Melyridae	Malachiinae	Attalus	sp1	2
01.vi.2022	out	105	11S 424581 4184003	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	3
01.vi.2022	out	105	11S 424581 4184003	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	105	11S 424581 4184003	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	3
01.vi.2022	out	105	11S 424581 4184003	Hym-A1	Hymenoptera	Apidae	Apinae	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Api6	Hymenoptera	Apidae	unknown	unknown	unknown	1

Appendix B. Potential Pollinator Abundance Data

Date	Thiem's buckwheat location?	Site	UTM	Morphospecies	Order	Family	Subfamily	Genus	Species	Abundance
01.vi.2022	out	105	11S 424581 4184003	Hym-Brach2	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Chry2	Hymenoptera	Chrysididae	unknown	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Crab9	Hymenoptera	Crabronidae	unknown	unknown	unknown	2
01.vi.2022	out	105	11S 424581 4184003	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Form1	Hymenoptera	Formicidae	unknown	unknown	unknown	2
01.vi.2022	out	105	11S 424581 4184003	Hym-Form4	Hymenoptera	Formicidae	unknown	unknown	unknown	2
01.vi.2022	out	105	11S 424581 4184003	Hym-Lasio1	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Mega5	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Pomp1	Hymenoptera	Pompilidae	unknown	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Unk9	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-Ves9	Hymenoptera	Vespidae	unknown	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-W7	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	Hym-W9	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	105	11S 424581 4184003	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	105	11S 424581 4184003	L-010	Lepidoptera	unknown	unknown	unknown	sp6	1
01.vi.2022	out	108	11S 424028 4183777	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	108	11S 424028 4183777	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	36
01.vi.2022	out	108	11S 424028 4183777	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	1
01.vi.2022	out	108	11S 424028 4183777	C-019	Coleoptera	Coccinellidae	Scyminae	Hyperaspidius	sp	1
01.vi.2022	out	108	11S 424028 4183777	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	1
01.vi.2022	out	108	11S 424028 4183777	D-044	Diptera	Bombyliidae	Mythicomyiinae	Mythicomyia	sp2	1
01.vi.2022	out	108	11S 424028 4183777	D-056	Diptera	Heleomyzidae	Trixoscelidinae	Trixoscelis	sp2	1
01.vi.2022	out	108	11S 424028 4183777	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	22
01.vi.2022	out	108	11S 424028 4183777	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	108	11S 424028 4183777	Hym-Sph1	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	108	11S 424028 4183777	Hym-Sph3	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	108	11S 424028 4183777	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	1
01.vi.2022	out	110	11S 424381 4183803	C-001	Coleoptera	Buprestidae	Polycestinae	Acmaeodera	spp	1
01.vi.2022	out	110	11S 424381 4183803	C-002	Coleoptera	Melyridae	Dasytinae	Eudasytes	hirsutus	18
01.vi.2022	out	110	11S 424381 4183803	C-003	Coleoptera	Melyridae	Dasytinae	Eudasytes	grandicollis	7
01.vi.2022	out	110	11S 424381 4183803	D-010	Diptera	Chironomidae	unknown	unknown	sp	1
01.vi.2022	out	110	11S 424381 4183803	D-023	Diptera	Bombyliidae	Bombyliinae	Geminaria	sp	5
01.vi.2022	out	110	11S 424381 4183803	D-024	Diptera	Pipuncuildae	Pipunculinae	Tomosvaryella	sp	1
01.vi.2022	out	110	11S 424381 4183803	D-049	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp2	1
01.vi.2022	out	110	11S 424381 4183803	D-059	Diptera	Bombyliidae	Phthiriinae	Phthiria	sp3	16
01.vi.2022	out	110	11S 424381 4183803	D-101	Diptera	Anthomyiidae	unknown	unknown	sp1	1
01.vi.2022	out	110	11S 424381 4183803	Hym-A1	Hymenoptera	Apidae	Apinae	unknown	unknown	1
01.vi.2022	out	110	11S 424381 4183803	Hym-Brach1	Hymenoptera	Braconidae	Cheloninae	unknown	unknown	2
01.vi.2022	out	110	11S 424381 4183803	Hym-Crab1	Hymenoptera	Crabronidae	unknown	unknown	unknown	1
01.vi.2022	out	110	11S 424381 4183803	Hym-Dia1	Hymenoptera	Apidae	Apinae	Diadasia	unknown	2
01.vi.2022	out	110	11S 424381 4183803	Hym-Lasio2	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	1
01.vi.2022	out	110	11S 424381 4183803	Hym-Lasio4	Hymenoptera	Halictidae	Halictinae	Lasioglossum	unknown	2
01.vi.2022	out	110	11S 424381 4183803	Hym-Mega1	Hymenoptera	Megachilidae	Megachilinae	unknown	unknown	1
01.vi.2022	out	110	11S 424381 4183803	Hym-Sph2	Hymenoptera	Sphecidae	unknown	unknown	unknown	1
01.vi.2022	out	110	11S 424381 4183803	Hym-W2	Hymenoptera	unknown	unknown	unknown	unknown	1
01.vi.2022	out	110	11S 424381 4183803	L-002	Lepidoptera	Gelechiidae	unknown	unknown	sp19	3

APPENDIX C
Abundance by taxonomic family

Appendix C. Abundance by Taxonomic Family

Order	Family	Morphospecies	Abundance	% of Total Specimens
Coleoptera	Melyridae	11	6,280	56.84
Coleoptera	Anthicidae	1	362	3.28
Coleoptera	Buprestidae	6	126	1.14
Coleoptera	Cleriidae	2	43	0.39
Coleoptera	Coccinellidae	1	18	0.16
Coleoptera	Chrysomelidae	6	9	0.08
Coleoptera	Scarabaeidae	2	4	0.04
Coleoptera	Tenebrionidae	2	2	0.02
Coleoptera	Bruchidae	1	1	0.01
Diptera	Bombyliidae	34	1,193	10.80
Diptera	Tachinidae	13	166	1.50
Diptera	Empididae	2	153	1.38
Diptera	Sciaridae	2	110	1.00
Diptera	Sarcophagidae	12	89	0.81
Diptera	Pipuncuildae	1	70	0.63
Diptera	Heleomyzidae	3	48	0.43
Diptera	Chloropidae	3	25	0.23
Diptera	Anthomyiidae	7	18	0.16
Diptera	Agromyzidae	1	15	0.14
Diptera	Chironomidae	1	15	0.14
Diptera	Sepsidae	2	13	0.12
Diptera	Ulididae	2	11	0.10
Diptera	Muscidae	4	9	0.08
Diptera	Asilidae	4	7	0.06
Diptera	Cecidomyiidae	1	5	0.05
Diptera	Phoridae	1	5	0.05
Diptera	Syrphidae	2	5	0.05
Diptera	Conopidae	1	2	0.02
Diptera	Stratiomyidae	1	2	0.02
Diptera	Sphaeroceridae	1	1	0.01
Diptera	Therevidae	1	1	0.01
Hymenoptera	Apidae	16	524	4.74
Hymenoptera	Crabronidae	19	376	3.40
Hymenoptera	unknown	36	344	3.11
Hymenoptera	Formicidae	6	214	1.94
Hymenoptera	Halictidae	7	175	1.58
Hymenoptera	Andrenidae	6	160	1.45
Hymenoptera	Megachilidae	12	146	1.32
Hymenoptera	Chrysididae	3	32	0.29
Hymenoptera	Braconidae	4	30	0.27
Hymenoptera	Sphecidae	6	30	0.27
Hymenoptera	Vespidae	8	30	0.27

Appendix C. Abundance by Taxonomic Family

Order	Family	Morphospecies	Abundance	% of Total Specimens
Hymenoptera	Chalcididae	3	20	0.18
Hymenoptera	Pompilidae	3	14	0.13
Hymenoptera	Encyrtidae	5	9	0.08
Hymenoptera	Bethylidae	3	5	0.05
Hymenoptera	Ichnuemonidae	2	5	0.05
Hymenoptera	Mellitidae	1	3	0.03
Hymenoptera	Figitidae	1	2	0.02
Hymenoptera	Mutilidae	2	2	0.02
Hymenoptera	Colletidae	1	1	0.01
Hymenoptera	Dryinidae	1	1	0.01
Lepidoptera	Gelechiidae	2	64	0.58
Lepidoptera	unknown	7	27	0.24
Lepidoptera	Hesperiidae	2	14	0.13
Lepidoptera	Tortricidae	1	7	0.06
Lepidoptera	Pieridae	2	3	0.03
Lepidoptera	Geometridae	1	1	0.01
Lepidoptera	Lycaenidae	1	1	0.01
Lepidoptera	Noctuidae	1	1	0.01

APPENDIX D
Abundance of morphospecies

Order	Family	Genus	Morphospecies	Total Abundance	Proportional abundance	Occurrence (% of sites)	Species contribution to beta-diversity
Diptera	Agromyzidae	Calycomyza?	D-026	15	0.001357589	27.5	2.61E-03
Hymenoptera	Andrenidae	unknown	Hym-Per1	77	0.006968956	45.1	1.74E-02
Hymenoptera	Andrenidae	Calliopsis	Hym-Ca1	19	0.001719613	23.5	3.37E-03
Hymenoptera	Andrenidae	unknown	Hym-Per2	52	0.004706308	17.6	9.87E-03
Hymenoptera	Andrenidae	unknown	Hym-Per5	7	0.000633541	9.8	1.71E-03
Hymenoptera	Andrenidae	unknown	Hy-Per1	2	0.000181012	2.0	9.67E-04
Hymenoptera	Andrenidae	unknown	Hym-Per4	3	0.000271518	2.0	2.62E-04
Coleoptera	Anthicidae	Ischyropalpus	C-004	362	0.032763146	33.3	5.42E-02
Diptera	Anthomyiidae	unknown	D-101	7	0.000633541	9.8	2.05E-03
Diptera	Anthomyiidae	unknown	D-105	3	0.000271518	5.9	7.82E-04
Diptera	Anthomyiidae	Hydrophoria?	D-103	2	0.000181012	3.9	5.21E-04
Diptera	Anthomyiidae	Senotainia?	D-100	2	0.000181012	2.0	3.52E-04
Diptera	Anthomyiidae	unknown	D-055	1	9.05059E-05	2.0	2.12E-04
Diptera	Anthomyiidae	Crinurina??	D-052	1	9.05059E-05	2.0	1.52E-04
Diptera	Anythomyiidae	unknown	D-102	2	0.000181012	3.9	7.31E-04
Hymenoptera	Apidae	Diadasia	Hym-Dia1	135	0.0122183	84.3	1.16E-02
Hymenoptera	Apidae	unknown	Hym-Api3	104	0.009412617	82.4	7.09E-03
Hymenoptera	Apidae	unknown	Hym-Api6	155	0.014028419	74.5	1.42E-02
Hymenoptera	Apidae	unknown	Hym-Api1	36	0.003258213	49.0	5.55E-03
Hymenoptera	Apidae	Anthophora	Hym-A1	19	0.001719613	31.4	3.11E-03
Hymenoptera	Apidae	unknown	Hym-Api2	40	0.003620237	27.5	6.20E-03
Hymenoptera	Apidae	Ceratina	Hym-Cera1	12	0.001086071	21.6	2.93E-03
Hymenoptera	Apidae	unknown	Hym-A5	7	0.000633541	9.8	9.38E-04
Hymenoptera	Apidae	unknown	Hym-Api7	5	0.00045253	5.9	9.62E-04
Hymenoptera	Apidae	unknown	Hym-A2	3	0.000271518	5.9	8.68E-04
Hymenoptera	Apidae	unknown	Hym-Api4	2	0.000181012	3.9	6.28E-04
Hymenoptera	Apidae	unknown	Hym-A4	2	0.000181012	3.9	5.70E-04
Hymenoptera	Apidae	unknown	Hym-Eu4	2	0.000181012	3.9	3.17E-04
Hymenoptera	Apidae	unknown	Hym-A7	1	9.05059E-05	2.0	2.30E-04
Hymenoptera	Apidae	unknown	Hym-Api5	1	9.05059E-05	2.0	2.04E-04
Hymenoptera	Apidae	unknown	Hym-A6	1	9.05059E-05	2.0	1.76E-04
Hymenoptera	Apidae	unknown	Hym-A3	1	9.05059E-05	2.0	1.38E-04
Diptera	Asilidae	Efferia	D-039	4	0.000362024	7.8	1.31E-03
Diptera	Asilidae	unknown	D-011	1	9.05059E-05	2.0	5.10E-04
Diptera	Asilidae	Coleomyia?	D-035	1	9.05059E-05	2.0	4.37E-04
Diptera	Asilidae	unknown	D-015	1	9.05059E-05	2.0	1.87E-04
Hymenoptera	Bethylidae	unknown	Hym-Beth1	3	0.000271518	5.9	1.44E-03
Hymenoptera	Bethylidae	unknown	Hym-Beth3	1	9.05059E-05	2.0	2.69E-04
Hymenoptera	Bethylidae	unknown	Hym-Beth2	1	9.05059E-05	2.0	8.75E-05
Diptera	Bombyliidae	Phthiria	D-049	303	0.027423296	96.1	2.26E-02
Diptera	Bombyliidae	Geminaria	D-023	213	0.019277763	94.1	1.05E-02
Diptera	Bombyliidae	Apolysis	D-020	109	0.009865146	68.6	1.09E-02
Diptera	Bombyliidae	Apolysis	D-021	63	0.005701873	52.9	8.93E-03
Diptera	Bombyliidae	Mythicomyia	D-044	44	0.003982261	52.9	6.46E-03
Diptera	Bombyliidae	Mythicomyia	D-043	41	0.003710743	43.1	7.01E-03
Diptera	Bombyliidae	Anthrax	D-047	15	0.001357589	23.5	2.52E-03
Diptera	Bombyliidae	Anthrax	D-067	13	0.001176577	17.6	2.94E-03
Diptera	Bombyliidae	Geron	D-037	7	0.000633541	13.7	1.64E-03
Diptera	Bombyliidae	Apolysis	D-064	9	0.000814553	11.8	2.74E-03
Diptera	Bombyliidae	Empidideicus	D-045	7	0.000633541	11.8	1.95E-03
Diptera	Bombyliidae	Aphoebantus	D-046	5	0.00045253	9.8	8.11E-04
Diptera	Bombyliidae	Mythicomyia	D-051	10	0.000905059	7.8	1.99E-03
Diptera	Bombyliidae	Aphoebantus	D-042	5	0.00045253	7.8	1.12E-03
Diptera	Bombyliidae	Mythicomyia	D-033	6	0.000543036	7.8	1.10E-03
Diptera	Bombyliidae	Epacmus?	D-028	5	0.00045253	7.8	7.49E-04
Diptera	Bombyliidae	Glabellula	D-058	3	0.000271518	5.9	1.34E-03

Order	Family	Genus	Morphospecies	Total Abundance	Proportional abundance	Occurrence (% of sites)	Species contribution to beta-diversity
Diptera	Bombyliidae	Lordotus	D-069	2	0.000181012	3.9	1.41E-03
Diptera	Bombyliidae	Empidideicus	D-005	2	0.000181012	3.9	3.60E-04
Diptera	Bombyliidae	Apolysis	D-029	1	9.05059E-05	2.0	7.18E-04
Diptera	Bombyliidae	Aphoebantus	D-060	1	9.05059E-05	2.0	4.84E-04
Diptera	Bombyliidae	Triploechus?	D-063	1	9.05059E-05	2.0	3.43E-04
Diptera	Bombyliidae	Anthrax	D-008	1	9.05059E-05	2.0	2.72E-04
Diptera	Bombyliidae	Anthrax	D-071	1	9.05059E-05	2.0	2.69E-04
Diptera	Bombyliidae	Triploechus?	D-076	1	9.05059E-05	2.0	2.57E-04
Diptera	Bombyliidae	Triploechus?	D-070	1	9.05059E-05	2.0	1.87E-04
Diptera	Bombyliidae	Mythicomyia	D-009	1	9.05059E-05	2.0	1.76E-04
Diptera	Bombyliidae	Prorates	D-036	1	9.05059E-05	2.0	1.76E-04
Diptera	Bombyliidae	Thevenemyia?	D-022	1	9.05059E-05	2.0	1.73E-04
Diptera	Bombyliidae	Anthrax	D-068	1	9.05059E-05	2.0	1.23E-04
Diptera	Bombyliidae	Lepidanthrax?	D-072	1	9.05059E-05	2.0	9.49E-05
Hymenoptera	Braconidae	unknown	Hym-Brac1	17	0.001538601	15.7	2.96E-03
Hymenoptera	Braconidae	unknown	Hym-Brac2	7	0.000633541	9.8	1.86E-03
Hymenoptera	Braconidae	unknown	Hym-Brach1	4	0.000362024	5.9	6.64E-04
Hymenoptera	Braconidae	unknown	Hym-Brach2	2	0.000181012	3.9	2.51E-04
Coleoptera	Bruchidae	Zabrotes	C-013	1	9.05059E-05	2.0	1.48E-04
Coleoptera	Buprestidae	Acmaeodera	C-001	89	0.008055028	66.7	7.85E-03
Coleoptera	Buprestidae	Acmaeodera	C-005	22	0.00199113	25.5	5.31E-03
Coleoptera	Buprestidae	Anambodera	C-006	11	0.000995565	17.6	2.95E-03
Coleoptera	Buprestidae	Acmaeodera	C-009	2	0.000181012	3.9	8.07E-04
Coleoptera	Buprestidae	Anambodera	C-033	1	9.05059E-05	2.0	3.45E-04
Coleoptera	Buprestidae	unknown	C-016	1	9.05059E-05	2.0	8.75E-05
Diptera	Cecidomyiidae	unknown	D-014	5	0.00045253	9.8	1.27E-03
Hymenoptera	Chalcididae	unknown	Hym-Chal1	17	0.001538601	27.5	3.75E-03
Hymenoptera	Chalcididae	unknown	Hym-Chal4	2	0.000181012	3.9	1.59E-03
Hymenoptera	Chalcididae	unknown	Hym-Chal3	1	9.05059E-05	2.0	3.83E-04
Diptera	Chironomidae	unknown	D-010	15	0.001357589	23.5	3.32E-03
Diptera	Chloropidae	Rhopalopterum	D-032	23	0.002081636	23.5	6.10E-03
Diptera	Chloropidae	Olecella	D-061	1	9.05059E-05	2.0	6.76E-04
Diptera	Chloropidae	unknown	D-007	1	9.05059E-05	2.0	1.12E-04
Hymenoptera	Chrysididae	unknown	Hym-Chry1	12	0.001086071	15.7	3.70E-03
Hymenoptera	Chrysididae	unknown	Hym-Chry3	11	0.000995565	15.7	2.79E-03
Hymenoptera	Chrysididae	unknown	Hym-Chry2	9	0.000814553	15.7	1.81E-03
Coleoptera	Chrysomelidae	Phyllotreta?	C-017	3	0.000271518	3.9	6.22E-04
Coleoptera	Chrysomelidae	Psylliodes	C-024	2	0.000181012	2.0	4.81E-04
Coleoptera	Chrysomelidae	Pachybrachis	C-030	1	9.05059E-05	2.0	2.72E-04
Coleoptera	Chrysomelidae	Chaetocnema?	C-032	1	9.05059E-05	2.0	2.72E-04
Coleoptera	Chrysomelidae	unknown	C-022	1	9.05059E-05	2.0	1.52E-04
Coleoptera	Chrysomelidae	unknown	C-029	1	9.05059E-05	2.0	7.37E-05
Coleoptera	Cleriidae	Trichodes	C-008	42	0.003801249	33.3	5.81E-03
Coleoptera	Cleriidae	Aulicus	C-026	1	9.05059E-05	2.0	1.30E-04
Coleoptera	Coccinellidae	Hyperaspidius	C-019	18	0.001629107	19.6	5.29E-03
Hymenoptera	Colletidae	Hylaeus	Hym-Hy1	1	9.05059E-05	2.0	4.07E-04
Diptera	Conopidae	Thecophora	D-066	2	0.000181012	3.9	9.73E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab5	206	0.018644221	86.3	1.12E-02
Hymenoptera	Crabronidae	unknown	Hym-Crab9	28	0.002534166	35.3	4.66E-03
Hymenoptera	Crabronidae	unknown	Hym-Crab3	35	0.003167707	31.4	4.63E-03
Hymenoptera	Crabronidae	unknown	Hym-Crab1	19	0.001719613	31.4	3.51E-03
Hymenoptera	Crabronidae	unknown	Hym-Crab12	28	0.002534166	25.5	3.69E-03
Hymenoptera	Crabronidae	unknown	Hym-Crab2	16	0.001448095	23.5	2.92E-03
Hymenoptera	Crabronidae	unknown	Hym-Crab16	14	0.001267083	17.6	3.64E-03
Hymenoptera	Crabronidae	unknown	Hym-Crab4	5	0.00045253	9.8	1.42E-03
Hymenoptera	Crabronidae	unknown	Hym-Crab18	6	0.000543036	9.8	1.31E-03

Order	Family	Genus	Morphospecies	Total Abundance	Proportional abundance	Occurrence (% of sites)	Species contribution to beta-diversity
Hymenoptera	Crabronidae	unknown	Hym-Crab21	4	0.000362024	5.9	6.14E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab20	3	0.000271518	3.9	7.59E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab7	2	0.000181012	3.9	7.36E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab15	2	0.000181012	3.9	5.30E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab17	2	0.000181012	3.9	3.50E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab6	2	0.000181012	3.9	2.73E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab13	1	9.05059E-05	2.0	4.07E-04
Hymenoptera	Crabronidae	Astata?	Hym-Crab14	1	9.05059E-05	2.0	3.43E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab10	1	9.05059E-05	2.0	3.12E-04
Hymenoptera	Crabronidae	unknown	Hym-Crab22	1	9.05059E-05	2.0	9.49E-05
Diptera	Bombyliidae	Phthiria	D-059	317	0.028690379	51.0	6.73E-02
Diptera	Bombyliidae	Lordotus	D-075	1	9.05059E-05	2.0	2.04E-04
Diptera	Bombyliidae	Lordotus	D-077	1	9.05059E-05	2.0	1.87E-04
Hymenoptera	Dryinidae	unknown	Hym-Dr1	1	9.05059E-05	2.0	7.37E-05
Diptera	Empididae	Micrempis?	D-025	151	0.013666395	56.9	2.04E-02
Diptera	Empididae	unknown	D-048	2	0.000181012	3.9	7.63E-04
Hymenoptera	Encrytidae	unknown	Hym-Eu2	4	0.000362024	5.9	7.54E-04
Hymenoptera	Encrytidae	unknown	Hym-Eu5	1	9.05059E-05	2.0	3.45E-04
Hymenoptera	Encyrtidae	unknown	Hym-Eu1	1	9.05059E-05	2.0	2.94E-04
Hymenoptera	Encyrtidae	unknown	Hym-Eu3	1	9.05059E-05	2.0	1.73E-04
Hymenoptera	Figitidae	unknown	Hym-F1	2	0.000181012	3.9	4.74E-04
Hymenoptera	Formicidae	unknown	Hym-Form1	113	0.01022717	43.1	2.44E-02
Hymenoptera	Formicidae	unknown	Hym-Form2	39	0.003529731	25.5	1.28E-02
Hymenoptera	Formicidae	unknown	Hym-Form5	37	0.003348719	21.6	9.86E-03
Hymenoptera	Formicidae	unknown	Hym-Form4	19	0.001719613	7.8	2.53E-03
Hymenoptera	Formicidae	unknown	Hym-Form3	5	0.00045253	7.8	1.03E-03
Hymenoptera	Formicidae	unknown	Hym-Form6	1	9.05059E-05	2.0	1.73E-04
Lepidoptera	Gelechiidae	unknown	L-002	51	0.004615802	52.9	6.17E-03
Lepidoptera	Gelechiidae	unknown	L-004	13	0.001176577	21.6	2.69E-03
Lepidoptera	Geometridae	unknown	L-014	1	9.05059E-05	2.0	2.12E-04
Hymenoptera	Halictidae	Lasioglossum	Hym-Lasio1	116	0.010498688	78.4	1.35E-02
Hymenoptera	Halictidae	Lasioglossum	Hym-Lasio2	41	0.003710743	29.4	6.99E-03
Hymenoptera	Halictidae	Halictus	Hym-Ha1	5	0.00045253	7.8	1.09E-03
Hymenoptera	Halictidae	Agapostemon	Hym-Ag1	5	0.00045253	7.8	9.71E-04
Hymenoptera	Halictidae	Lasioglossum	Hym-Lasio4	4	0.000362024	5.9	6.82E-04
Hymenoptera	Halictidae	Lasioglossum	Hym-Lasio3	3	0.000271518	3.9	4.85E-04
Hymenoptera	Halictidae	Nomia	Hym-Nom1	1	9.05059E-05	2.0	8.75E-05
Diptera	Heleomyzidae	Trixoscelis	D-056	24	0.002172142	29.4	5.13E-03
Diptera	Heleomyzidae	Pseudoleria	D-034	18	0.001629107	17.6	3.86E-03
Diptera	Heleomyzidae	Trixoscelis	D-057	6	0.000543036	9.8	1.88E-03
Lepidoptera	Hesperiidae	Hesperopsis	L-001	12	0.001086071	17.6	1.60E-03
Lepidoptera	Hesperiidae	Hesperia	L-011	2	0.000181012	3.9	6.74E-04
Hymenoptera	Ichnuemonidae	unknown	Hym-Ich1	3	0.000271518	5.9	7.88E-04
Hymenoptera	Ichnuemonidae	unknown	Hym-Ich2	2	0.000181012	3.9	7.17E-04
Lepidoptera	Lycaenidae	Euphilotes or Plebej	L-013	1	9.05059E-05	2.0	1.25E-04
Hymenoptera	Megachilidae	unknown	Hym-Mega1	57	0.005158838	64.7	6.23E-03
Hymenoptera	Megachilidae	unknown	Hym-Mega2	26	0.002353154	37.3	3.72E-03
Hymenoptera	Megachilidae	unknown	Hym-Mega5	21	0.001900624	25.5	4.16E-03
Hymenoptera	Megachilidae	unknown	Hym-Mega3	17	0.001538601	21.6	3.79E-03
Hymenoptera	Megachilidae	Anthidium	Hym-Anthid1	8	0.000724047	13.7	1.95E-03
Hymenoptera	Megachilidae	Osmia	Hym-Os2	4	0.000362024	7.8	1.04E-03
Hymenoptera	Megachilidae	Dianthidium	Hym-Di1	4	0.000362024	5.9	1.37E-03
Hymenoptera	Megachilidae	Anthidium	Hym-Anthid2	3	0.000271518	5.9	7.75E-04
Hymenoptera	Megachilidae	Anthidium	Hym-Anthid3	3	0.000271518	5.9	7.19E-04
Hymenoptera	Megachilidae	Osmia	Hym-Os3	1	9.05059E-05	2.0	2.72E-04
Hymenoptera	Megachilidae	unknown	Hym-Mega4	1	9.05059E-05	2.0	1.73E-04

Order	Family	Genus	Morphospecies	Total Abundance	Proportional abundance	Occurrence (% of sites)	Species contribution to beta-diversity
Hymenoptera	Megachilidae	Coelioxys	Hym-Co1	1	9.05059E-05	2.0	1.38E-04
Hymenoptera	Mellitidae	Hesperapis	Hym-H1	3	0.000271518	3.9	1.13E-03
Coleoptera	Melyrdiae	Vectura	C-023	3	0.000271518	5.9	1.17E-03
Coleoptera	Melyridae	Eudasytes	C-003	4404	0.398588108	96.1	1.28E-01
Coleoptera	Melyridae	Eudasytes	C-002	1759	0.159199928	96.1	1.02E-01
Coleoptera	Melyridae	Attalus	C-021	34	0.003077202	43.1	5.86E-03
Coleoptera	Melyridae	Listrus	C-012	40	0.003620237	37.3	1.10E-02
Coleoptera	Melyridae	Listrus	C-020	21	0.001900624	27.5	5.18E-03
Coleoptera	Melyridae	Collops	C-025	8	0.000724047	7.8	4.31E-03
Coleoptera	Melyridae	Attalus	C-010	5	0.00045253	7.8	1.62E-03
Coleoptera	Melyridae	Listrus	C-018	4	0.000362024	5.9	9.24E-04
Coleoptera	Melyridae	Listrus	C-011	1	9.05059E-05	2.0	1.80E-04
Coleoptera	Melyridae	Vecturoides	C-031	1	9.05059E-05	2.0	8.75E-05
Diptera	Muscidae	Fannia	D-110	2	0.000181012	3.9	5.90E-04
Diptera	Muscidae	Neomyia	D-074	5	0.00045253	3.9	5.88E-04
Diptera	Muscidae	Limnophora?	D-098	1	9.05059E-05	2.0	3.45E-04
Diptera	Muscidae	Lispe	D-099	1	9.05059E-05	2.0	3.43E-04
Hymenoptera	Mutilidae	unknown	Hym-M2	1	9.05059E-05	2.0	1.44E-04
Hymenoptera	Mutilidae	unknown	Hym-M1	1	9.05059E-05	2.0	8.75E-05
Lepidoptera	Noctuidae	unknown	L-018	1	9.05059E-05	2.0	2.80E-04
Diptera	Phoridae	unknown	D-006	5	0.00045253	5.9	1.39E-03
Lepidoptera	Pieridae	Pontia	L-005	2	0.000181012	3.9	4.39E-04
Lepidoptera	Pieridae	Pontia	L-003	1	9.05059E-05	2.0	1.73E-04
Diptera	Pipuncuildae	Tomosvaryella	D-024	70	0.006335415	51.0	8.12E-03
Hymenoptera	Pompilidae	unknown	Hym-Pomp1	12	0.001086071	21.6	2.39E-03
Hymenoptera	Pompilidae	unknown	Hym-Pomp2	1	9.05059E-05	2.0	4.37E-04
Hymenoptera	Pompilidae	unknown	Hym-Pomp3	1	9.05059E-05	2.0	8.75E-05
Diptera	Sarcophagidae	unknown	D-087	38	0.003439225	39.2	8.27E-03
Diptera	Sarcophagidae	Ravinia	D-086	21	0.001900624	15.7	3.87E-03
Diptera	Sarcophagidae	Sarcophaga (Beraca	D-089	10	0.000905059	9.8	4.72E-03
Diptera	Sarcophagidae	unknown	D-088	5	0.00045253	7.8	2.25E-03
Diptera	Sarcophagidae	unknown	D-093	4	0.000362024	7.8	1.07E-03
Diptera	Sarcophagidae	Sarcophaga (Neobe	D-091	3	0.000271518	5.9	1.35E-03
Diptera	Sarcophagidae	unknown	D-094	2	0.000181012	3.9	8.69E-04
Diptera	Sarcophagidae	unknown	D-097	2	0.000181012	3.9	4.61E-04
Diptera	Sarcophagidae	Blaesoxipha (Acridic	D-095	1	9.05059E-05	2.0	6.76E-04
Diptera	Sarcophagidae	unknown	D-090	1	9.05059E-05	2.0	3.70E-04
Diptera	Sarcophagidae	unknown	D-096	1	9.05059E-05	2.0	3.43E-04
Diptera	Sarcophagidae	unknown	D-092	1	9.05059E-05	2.0	1.87E-04
Coleoptera	Scarabaeidae	Dichelonyx	C-028	3	0.000271518	3.9	9.93E-04
Coleoptera	Scarabaeidae	Phyllophaga	C-027	1	9.05059E-05	2.0	3.21E-04
Diptera	Sciaridae	Scatopsciara??	D-004	107	0.009684134	70.6	7.69E-03
Diptera	Sciaridae	Eugnoriste	D-054	3	0.000271518	3.9	4.90E-04
Diptera	Sepsidae	Saltella	D-053	7	0.000633541	9.8	1.41E-03
Diptera	Sepsidae	Sespsis	D-062	6	0.000543036	5.9	9.58E-04
Diptera	Sphaeroceridae	unknown	D-050	1	9.05059E-05	2.0	1.23E-04
Hymenoptera	Sphecidae	unknown	Hym-Sph1	13	0.001176577	19.6	1.84E-03
Hymenoptera	Sphecidae	unknown	Hym-Sph4	4	0.000362024	7.8	1.41E-03
Hymenoptera	Sphecidae	unknown	Hym-Sph3	4	0.000362024	7.8	7.89E-04
Hymenoptera	Sphecidae	unknown	Hym-Sph2	4	0.000362024	5.9	6.92E-04
Hymenoptera	Sphecidae	unknown	Hym-Spech1	3	0.000271518	3.9	5.49E-04
Hymenoptera	Sphecidae	unknown	Hym-Sph5	2	0.000181012	2.0	4.23E-04
Diptera	Stratiomyidae	Nemotelus	D-001	2	0.000181012	3.9	3.19E-04
Diptera	Syrphidae	Syrphus	D-038	4	0.000362024	7.8	1.30E-03
Diptera	Syrphidae	Eristalis	D-030	1	9.05059E-05	2.0	6.47E-04
Diptera	Tachinidae	Nimioglossa	D-041	118	0.0106797	76.5	1.69E-02

Order	Family	Genus	Morphospecies	Total Abundance	Proportional abundance	Occurrence (% of sites)	Species contribution to beta-diversity
Diptera	Tachinidae	Chetogena	D-083	12	0.001086071	17.6	3.06E-03
Diptera	Tachinidae	Microchaetina	D-084	14	0.001267083	11.8	1.96E-03
Diptera	Tachinidae	Microchaetina	D-107	5	0.00045253	9.8	1.90E-03
Diptera	Tachinidae	Paradidyma	D-082	5	0.00045253	9.8	1.75E-03
Diptera	Tachinidae	unknown	D-106	3	0.000271518	5.9	6.99E-04
Diptera	Tachinidae	Peleteria	D-078	2	0.000181012	3.9	6.42E-04
Diptera	Tachinidae	Ptilodexia?	D-080	2	0.000181012	2.0	6.42E-04
Diptera	Tachinidae	Ptilodexia?	D-081	1	9.05059E-05	2.0	3.70E-04
Diptera	Tachinidae	unknown	D-109	1	9.05059E-05	2.0	3.45E-04
Diptera	Tachinidae	Peleteria	D-040	1	9.05059E-05	2.0	2.30E-04
Diptera	Tachinidae	Periscepsia	D-085	1	9.05059E-05	2.0	1.76E-04
Diptera	Tachnididae	Spallanzania	D-079	1	9.05059E-05	2.0	9.49E-05
Coleoptera	Tenebrionidae	Alaephus	C-014	1	9.05059E-05	2.0	4.07E-04
Coleoptera	Tenebrionidae	Triorophus	C-015	1	9.05059E-05	2.0	2.40E-04
Diptera	Therevidae	Arenigena	D-073	1	9.05059E-05	2.0	3.43E-04
Lepidoptera	Tortricidae?	unknown	L-006	7	0.000633541	11.8	1.77E-03
Diptera	Ulididae	Haigia	D-031	10	0.000905059	13.7	3.21E-03
Diptera	Ulididae	Acrosticta	D-104	1	9.05059E-05	2.0	1.23E-04
Hymenoptera	unknown	unknown	Hym-Unk16	68	0.006154403	41.2	8.98E-03
Hymenoptera	unknown	unknown	Hym-Unk20	66	0.005973391	23.5	1.21E-02
Hymenoptera	unknown	unknown	Hym-Unk15	36	0.003258213	23.5	8.04E-03
Hymenoptera	unknown	unknown	Hym-Unk5	21	0.001900624	23.5	4.58E-03
Hymenoptera	unknown	unknown	Hym-W2	22	0.00199113	23.5	4.08E-03
Lepidoptera	unknown	unknown	L-010	11	0.000995565	17.6	3.38E-03
Hymenoptera	unknown	unknown	Hym-W5	9	0.000814553	17.6	1.75E-03
Hymenoptera	unknown	unknown	Hym-W13	12	0.001086071	15.7	2.63E-03
Hymenoptera	unknown	unknown	Hym-Unk9	11	0.000995565	15.7	2.02E-03
Hymenoptera	unknown	unknown	Hym-Unk17	16	0.001448095	11.8	2.58E-03
Hymenoptera	unknown	unknown	Hym-W9	6	0.000543036	11.8	1.20E-03
Hymenoptera	unknown	unknown	Hym-W4	5	0.00045253	9.8	1.61E-03
Hymenoptera	unknown	unknown	Hym-Unk21	5	0.00045253	7.8	1.35E-03
Hymenoptera	unknown	unknown	Hym-Unk22	8	0.000724047	7.8	1.28E-03
Lepidoptera	unknown	unknown	L-019	4	0.000362024	7.8	1.00E-03
Hymenoptera	unknown	unknown	Hym-W7	5	0.00045253	7.8	7.78E-04
Hymenoptera	unknown	unknown	Hym-W3	4	0.000362024	7.8	5.86E-04
Lepidoptera	unknown	unknown	L-007	7	0.000633541	5.9	2.23E-03
Hymenoptera	unknown	unknown	Hym-Unk3	7	0.000633541	5.9	1.69E-03
Hymenoptera	unknown	unknown	Hym-Unk4	8	0.000724047	5.9	1.25E-03
Hymenoptera	unknown	unknown	Hym-Unk23	3	0.000271518	5.9	9.90E-04
Hymenoptera	unknown	unknown	Hym-Unk8	3	0.000271518	5.9	9.59E-04
Hymenoptera	unknown	unknown	Hym-W10	3	0.000271518	5.9	6.68E-04
Hymenoptera	unknown	unknown	Hym-Unk6	4	0.000362024	5.9	5.51E-04
Lepidoptera	unknown	unknown	L-020	2	0.000181012	3.9	7.37E-04
Hymenoptera	unknown	unknown	Hym-W15	3	0.000271518	3.9	6.52E-04
Hymenoptera	unknown	unknown	Hym-Unk18	2	0.000181012	3.9	3.76E-04
Hymenoptera	unknown	unknown	Hym-W1	2	0.000181012	3.9	3.56E-04
Hymenoptera	unknown	unknown	Hym-Unk7	2	0.000181012	3.9	2.92E-04
Hymenoptera	unknown	unknown	Hym-Unk14	3	0.000271518	2.0	5.20E-04
Lepidoptera	unknown	unknown	L-008	1	9.05059E-05	2.0	4.07E-04
Hymenoptera	unknown	unknown	Hym-Unk13	1	9.05059E-05	2.0	3.45E-04
Lepidoptera	unknown	unknown	L-016	1	9.05059E-05	2.0	2.94E-04
Hymenoptera	unknown	unknown	Hym-Unk11	1	9.05059E-05	2.0	2.80E-04
Hymenoptera	unknown	unknown	Hym-W11	1	9.05059E-05	2.0	2.57E-04
Hymenoptera	unknown	unknown	Hym-W17	1	9.05059E-05	2.0	2.57E-04
Hymenoptera	unknown	unknown	Hym-Unk1	1	9.05059E-05	2.0	2.30E-04
Hymenoptera	unknown	unknown	Hym-Unk19	1	9.05059E-05	2.0	2.04E-04

Appendix D. Abundance of morphpspecies

Order	Family	Genus	Morphospecies	Total Abundance	Proportional abundance	Occurrence (% of sites)	Species contribution to beta-diversity
Hymenoptera	unknown	unknown	Hym-Unk1-2	1	9.05059E-05	2.0	1.87E-04
Hymenoptera	unknown	unknown	Hym-W12	1	9.05059E-05	2.0	1.87E-04
Lepidoptera	unknown	unknown	L-009	1	9.05059E-05	2.0	1.23E-04
Hymenoptera	unknown	unknown	Hym-W14	1	9.05059E-05	2.0	1.12E-04
Hymenoptera	unknown	unknown	Hym-W16	1	9.05059E-05	2.0	7.37E-05
Hymenoptera	Vespidae	unknown	Hym-Ves2	13	0.001176577	17.6	3.69E-03
Hymenoptera	Vespidae	unknown	Hym-Ves1	5	0.00045253	7.8	8.41E-04
Hymenoptera	Vespidae	unknown	Hym-Ves9	3	0.000271518	5.9	1.24E-03
Hymenoptera	Vespidae	unknown	Hym-Ves10	3	0.000271518	5.9	6.65E-04
Hymenoptera	Vespidae	unknown	Hym-Ves7	2	0.000181012	3.9	4.75E-04
Hymenoptera	Vespidae	unknown	Hym-Ves11	2	0.000181012	3.9	4.60E-04
Hymenoptera	Vespidae	unknown	Hym-Ves3	1	9.05059E-05	2.0	2.94E-04
Hymenoptera	Vespidae	unknown	Hym-Ves4	1	9.05059E-05	2.0	8.75E-05

ATTACHMENT F
Supplemental Geotechnical Report, Rhyolite Ridge Lithium-Boron Project

IONEER RHYOLITE RIDGE LLC
SUPPLEMENTAL GEOTECHNICAL REPORT

RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

March 2023
PROJECT NO. AS22.1013

SUBMITTED TO:

Ms. Sasha Meyer
Ioneer Rhyolite Ridge LLC
9460 Double R. Blvd., Suite 200
Reno, NV 89521

Geo-Logic ASSOCIATES

PREPARED & SUBMITTED BY:

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Geo-Logic
ASSOCIATES

March 20, 2023
Project No. AS22.1013

Ioneer Rhyolite Ridge LLC
9460 Double R Blvd, Ste. 200
Reno, NV 89521

Attention: Sasha Meyer, Director- Mining Operations

SUBJECT: Supplemental Geotechnical Report
Rhyolite Ridge Lithium-Boron Project
Quarry TR03-D
Esmeralda County, Nevada

Geo-Logic Associates (GLA) is pleased to submit to Ioneer Rhyolite Ridge LLC (Ioneer) this Supplemental Geotechnical Report for the proposed Rhyolite Ridge Lithium-Boron Project, Quarry TR03-D, in Esmeralda County, Nevada. This report supplements the previously submitted Geotechnical Quarry Slope Stability Report, Rhyolite Ridge Lithium-Boron Project, Quarry TR03-D, Esmeralda County, Nevada, July 2022, Revision 3 (GLA 2022) and revises the Supplemental Geotechnical Report, Rhyolite Ridge Lithium-Boron Project, Quarry TR03-D, Esmeralda County, Nevada, February 6, 2023 (GLA 2023). The purpose of this report is to provide additional information related to quarry slope stability, including:

1. General discussion of the factor of safety as it relates to slope stability design criteria.
2. General discussion of common blasting practices.
3. General discussion of the planned slope monitoring program.
4. General discussion of potential adaptive management schemes.
5. Conceptual buttress slope stability assessment, including a discussion of dewatering, surface water infiltration and post-mining quarry lake.

This report along with GLA 2022, document geotechnical evaluations and common mining practices that would be used to protect Tiehm's buckwheat populations proximal to the proposed Quarry TR03-D during and post mining operations.

We trust that the information provided herein meets Ioneer's needs and appreciate the opportunity to be of service to your project. Please do not hesitate to contact us should you have any questions.

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Very respectfully,

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1.0 DESCRIPTION OF FACTOR OF SAFETY AS DESIGN CRITERIA

1.1 Factor of Safety

The factor of safety (FOS) is defined as resisting forces (forces resisting slope failure) divided by driving forces (forces causing slope failure) and can be illustrated by the equation below.

$$FOS = \frac{Resisting\ forces}{Driving\ forces}$$

By definition, if the resisting forces are greater than the driving forces, the slope will not fail and your $FOS \geq 1$. Failure will only occur if your driving forces are greater than your resisting forces which means any $FOS < 1$. If the two are equal, $FOS = 1$, failure will only occur once the driving forces are greater than resisting forces. An example of FOS can be seen in the sliding block example below. If the surface causes enough resisting frictional force compared to the downslope component of the weight of the block (the inclination angle plays a role on the weight of the block as well) the block will not move, but if the weight component of the block is greater than the friction, the block will slide.

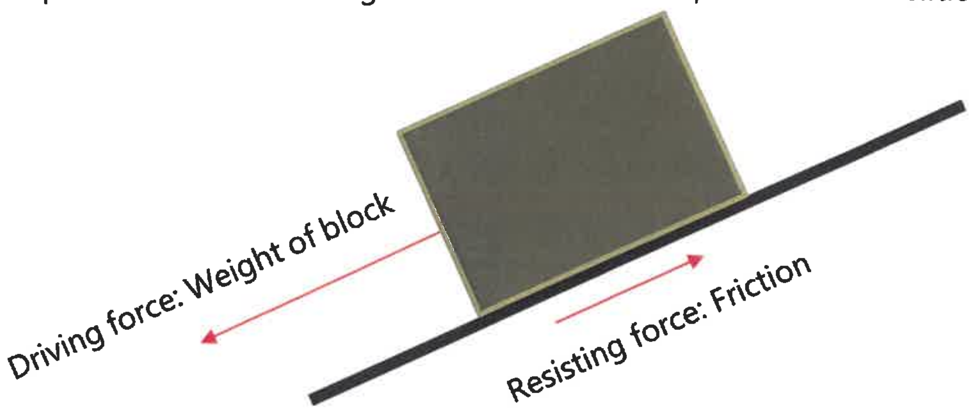

Figure 1 - Sliding Block Example

1.2 Design Criteria

The design criteria applied to mine pit slopes is complex and can vary depending on circumstances and consequences. Criteria applied to civil engineering structures are poor surrogates for mining applications. The nature of acceptance criteria for mine pit slopes is discussed in Chapter 9 of "Guidelines for Open Pit Slope Design" (Read & Stacey, 2009):

> *"In open pit mining slope failure is not easily defined. Whereas in some engineering systems failure occurs immediately and is not reversible (e.g. the buckling of a structural column or the failure of a dam), in an open pit mine*

slope failure may take place gradually so that determining the stage at which the pit wall ceases to perform adequately may be highly subjective.

Inherently, the owners and managers of any open pit mine expect that the system will be optimized to meet the essential needs of safety, ore recovery, financial return, and the environment. Accordingly, the requirement for the pit slope designs involves walls that will be stable for the required life of the open pit which may extend into closure. At the very least, any instability must be manageable at every scale of the walls, from the individual benches to the overall slopes. The owner's acceptance criteria, which form the basis of a slope design, must reflect these requirements in terms of the corporate risk profile."

Design criteria can be expressed in different ways for different applications. For limit equilibrium models (including seismic pseudostatic models) and for some numerical models (finite element or finite difference models) it is commonly expressed as a Factor of Safety (FOS). Design criteria for some numerical models and for seismic displacement models can also be expressed as an acceptable displacement. For stochastic models (i.e., probability-based models) design criteria will be expressed as the probability of failure (PoF) or its compliment the reliability (equal to 1.0 – PoF). The assignment of a design criteria to any given quarry slope sector is typically a function of the potential consequences of failure and for these analyses is a FOS of 1.20 or greater.

2.0 BLASTING PRACTICES AND EXAMPLES OF WALL CONTROL BLASTING

The main purpose of blasting is to fragment the rock to allow the ore to be extracted and processed. The operating costs of both the mine and the processing plant are directly related to the fragmentation achieved during blasting (Bhandari 1997, SME Mining Engineering Handbook 3rd edition, 2011), meaning proper blasting design is extremely important for the success of a mine. Due to the importance of the blast design in terms of production, it is reevaluated throughout production to be as efficient and economical as possible. Therefore, blasting control is a common interest for both production and buckwheat protection.

Some of the materials to be mined within the quarry are expected to be excavated without the need for blasting. This is particularly true of the greater than 100-foot thickness of the surficial alluvium and portions of the M5 lithology. However, many of the materials, particularly those at depth, will require blasting for removal. Control of blasting will be extremely important as production progresses, especially on the west wall of the quarry where steeply dipping M5a material is present. Controlled blasting will also be important during the construction of the ground anchors to maintain their rated loads and design capabilities. Wall control blasting techniques near the final quarry wall should be considered in the normal operations to minimize excess induced fracturing into the quarry wall that could increase rock fall potential and raveling of the bench face. Potential controlled blasting techniques that should be considered include buffer blasting, trim blasting, pre-splitting, post-split blasting, and line drilling. A definition of each can be seen below:

- Buffer Blasting: typically used for weaker rock masses, involves modifications of a typical blast hole pattern to reduce the amount of induced fracturing caused by the blast on the adjacent quarry wall that will remain in place. These modifications can include providing a horizontal relief distance (buffer) from the blast holes to the quarry wall that will remain in place after the blast; reduction in the blast hole pattern width; adjusting the timing of blasts within the blast hole pattern, which controls vibrations and rock mass movements; and adjusting the depth of blast holes so as to not affect the bench that will be left in place below the blast, post-blast.
- Trim Blasting: This is the most common controlled blasting technique. Trim blasts are typically three to five rows deep and are designed to move the material and blast energy toward the open bench face and away from the quarry wall. In adverse geology, extra rows may have to be added to the blast to protect the slope from induced fracturing and vibration caused by the production blast.
- Pre-splitting: In pre-split blasting a single row of blast holes, drilled along the back of the excavation where the quarry wall is intended to remain in place, are detonated first during the blast. This first detonation helps to create a crack in the rock mass prior to the second and main production blast, which reduces the amount of vibration in the rock mass of the quarry wall. The reduction in vibration assists with protecting the adjacent quarry wall that will remain in place by reducing the distance of induced fracturing into the rock mass.
- Post-split blasting: Also known as smooth wall blasting, post-split blasting involves drilling a line of boreholes along the excavation limits closest to the quarry wall, and loading them with a minimal amount of explosives. This line of holes is detonated last to blast loose remaining rock with the lighter charges and to not cause any additional induced fracturing of the quarry wall
- Line drilling: Line drilling involves drilling a single row of closely spaced, unloaded, small diameter holes along the final excavation line (the quarry wall that will remain in place). The boreholes are not loaded with explosives and only serve as a plane of weakness for which the blast can break toward but not pass and assist in

reducing the amount of induced fracturing and vibration caused by the blast on the adjacent quarry wall that will remain in place.

Additionally, adjustments to the blast design, i.e. timing, burden and spacing, and maximum charge per delay to name a few, can be helpful in controlling blasting-induced ground vibrations or fracturing. A blast pattern being drilled can be seen in the figure below.

Figure 2 – Blast pattern with drill holes and drill rigs (U.S. DOI, 2023)

3.0 ADAPTIVE MANAGEMENT AND SLOPE MONITORING PROGRAM SUMMARY

3.1 Adaptive Management

Adaptive management is an iterative alteration to processes in response to new information. The information discussed below in Section 3.2 details some adaptive management processes for slope stability monitoring and management. The majority of the adaptive management plan will be implemented once mining commences to allow for applicable monitoring threshold values and conditions to be established based on the understanding of the quarry stability. Preliminary concepts for adaptive management actions include suspending mining activity, stopping mining activity and implementing mitigation measures in an area if detrimental instability near sensitive habitat is identified, based on monitoring.

3.2 Slope Monitoring Program Summary

It is Ioneer's intention to implement multiple slope monitoring systems to identify and track the development of tension cracks should they occur, monitor and track rock fall into the quarry, monitor surface movement should it occur and monitor subsurface conditions. This will be accomplished through daily visual inspections, mapping of tension cracks if applicable, survey monitoring and subsurface monitoring. Survey monitoring would include monitoring prism targets (Figure 3) with a total station instrument (Figure 4) and more sophisticated monitoring methods such as radar (Figure 5), unmanned aerial vehicle (UAV)/drone surveys (Figure 6) and Interferometric Synthetic Aperture Radar (InSAR) surveys (Figure 7). Subsurface monitoring would incorporate piezometers (Figure 8), inclinometers (Figure 9 & Figure 10), time-domain reflectometers (TDRs-Figure 10) and extensometers (Figure 11). A description of each monitoring method/system is described below.

Prism and Total Station

Figure 3 shows a typical prism that reflects the laser created by the total station shown in Figure 4. The prism is placed on a bench or location of interest and the total station takes readings that return a slope movement value (displacement).

Figure 3 - Total Station Prism (Leica, 2023)

Figure 4 - Total Station inside Survey Shack (Read & Stacey, 2009)

Radar Monitoring System

Some additional details about radar usage is discussed within a later section, but essentially the radar gives similar displacement data as a prism, but over a larger region. The radar can scan entire quarry slopes to detect movement. Figure 5 below shows an example of a mobile radar unit.

Figure 5 - Slope Stability Radar Unit (Read & Stacey, 2009)

UAV/Drone Surveys

Figure 6 shows an example drone that is created for mining applications, however, there are many companies and options to use for drone surveys. Drones have the ability to scan quarries from above and can supply data including quarry scans, design vs. as-built comparisons and aerial imagery to name a few.

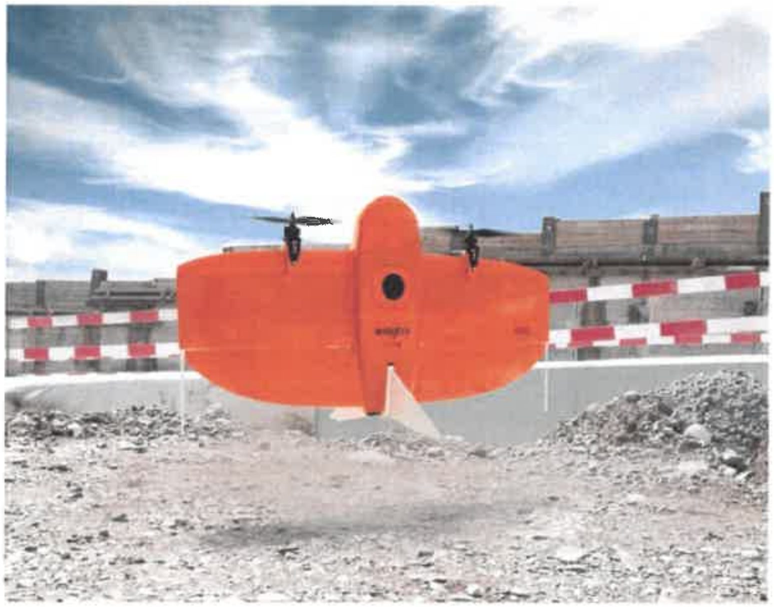

Figure 6 - WingtraOne Drone for surveying (Wingtra, 2023)

InSAR Radar Monitoring

InSAR gives similar displacement data to ground-based radar and prisms, but on a much larger scale. Satellites collect displacement data from space to give an overall comprehensive picture of slope movement across an entire site. Figure 7 gives an example of a SAR image across a mine site.

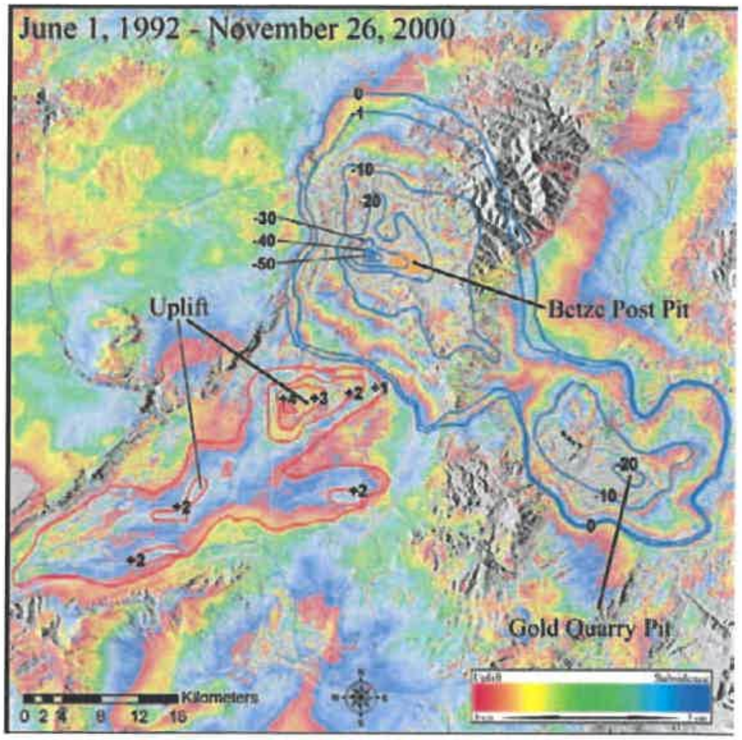

Figure 7 - A SAR-generated interferogram is overlain on a height-displacement map with aerial photo as background

Piezometers

A standard vibrating wire piezometer (VWP) is shown in Figure 8. The VWP is placed down a drill hole and will continuously measure the groundwater pressure, which is equated to groundwater level.

Figure 8 - Vibrating Wire Piezometer (Geokon, 2023)

Inclinometer

Inclinometers are devices that are run through a special drill hole casing to measure the sideways or lateral movement of the soil. Figure 9 shows how the probe is placed down a special casing and Figure 10 shows the usefulness of this measurement. If a slip surface begins to form, the casing will begin to move with the slope and the inclinometer can measure these minute movements. It helps determine the magnitude of slope movement and the depth of slope movement which is valuable for modeling slope stability.

Figure 9 - Portable Inclinometer Probe (Read & Stacey, 2009)

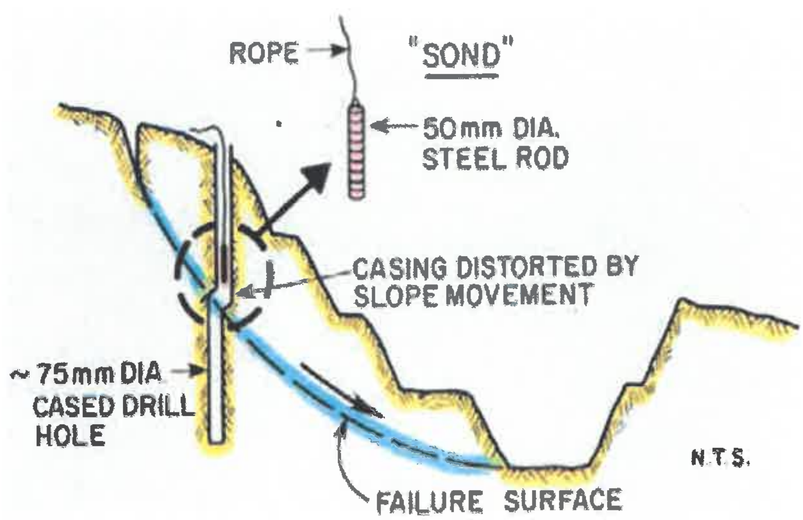

Figure 10 - Shear Probe and methodology behind inclinometer and TDR

TDR Cables

TDR cables function in a similar way when compared to inclinometers, except they are not able to determine magnitude of movement, only slip surface depth. TDR cables are coaxial cables like those used for cable TV. The cable is placed down a drill hole and measurements are taken with a special handheld device that can detect if there are any breaks in the cable. As the slope moves, the cable will get pinched and eventually sheared if there is enough movement, which gives an understanding of where the slip surface is occurring down the drill hole. Figure 10 gives an example of this idea, but a TDR cable is placed down the full length of the borehole instead of a probe.

Extensometers

Extensometers measure changes in the length across a dimension. There are several types but borehole extensometers are placed down the borehole to a known depth and measure distance changes as the soil and rock deforms. An example borehole extensometer can be seen in Figure 11.

Figure 11 - Borehole Extensometer (RST Instruments, 2023)

Large slope displacements do not normally occur without sufficient advanced warning to allow for mitigation prior to detrimental movement developing. Indications of the potential for large slope displacements are typically followed by some measurable displacements, measurable deformations, and other physically observable phenomena. Observable signs occur before major slope instability occurs. Slope monitoring is the means to identify this behavior (EnviroMINE, Dec 2019). Visual inspection will be performed twice daily during operations. This inspection will be performed by trained and experienced persons as required by Section 56/57.3401 (MSHA, 2013). This inspection must also be performed by all employees performing work in the quarry facility. Notification to management will occur of any identified issue so that it can be addressed.

It is Ioneer's intention to deploy an advanced stability radar system that will provide real time monitoring of rock slope behavior. The use of a fast-scanning radar, Real Aperture Radar, is designed to operate in highly volatile atmospheric conditions and is capable of detecting fast- or slow-moving slopes. A unique aspect to Real Aperture Radar technology, is its ability to produce its own high resolution true 3-Dimensional point cloud. Each point is individually resolved in range, azimuth and elevation to the highest degree of accuracy (~+ 0.1mm accuracy) over any range under 3500m. The radar operates with accelerated high-speed data acquisition and processing rates, combined with fast precision analytics, which allows for improved dynamic decision-making capabilities. There are several companies currently operating within the US. Ioneer has identified three potential suppliers: Reutech, IDS, and Group Probe. All three have units currently operating in Nevada and provide teams of geotechnical mining professionals. All are fully qualified, highly experienced engineers and radar operators with extensive radar knowledge. This provides 24-hour real time monitoring.

At Rhyolite Ridge, experience will be required to establish proper responses to measured velocity. It is likely that if failures occur it will occur along the weak M5a unit and may require different responses than failures within stronger rocks. The current mine plan starts south of the sensitive habitat and is not anticipated to reach the sensitive areas for at least 8 years. This will provide ample time for operations to observe the response of the various units, including M5a and develop effective monitoring methods and mitigation measures prior to the quarry advancing to areas adjacent to sensitive buckwheat habitat.

Responses at Rhyolite Ridge will be developed as experience is gained and a trigger action response plan (TARP) will be developed. This TARP will be developed by the Rhyolite Ridge Technical service group with the support of third-party geotechnical experts (EnviroMINE, Dec 2019).

4.0 BUTTRESS SLOPE STABILITY ASSESSMENT

4.1 General

Slope stability analyses, in addition to those documented in GLA 2022, were completed to evaluate factors of safety resulting from the construction of a post-mining buttress along the western quarry wall. Quarry cross sections TR02E-5, 6, 7, 8, 9 and 11 were selected for the evaluation because they required ground anchors to achieve the stability criteria and/or had lower factors of safety relative to the other quarry cross sections as well as being near buckwheat populations. See Figure 12 for the quarry cross section locations.

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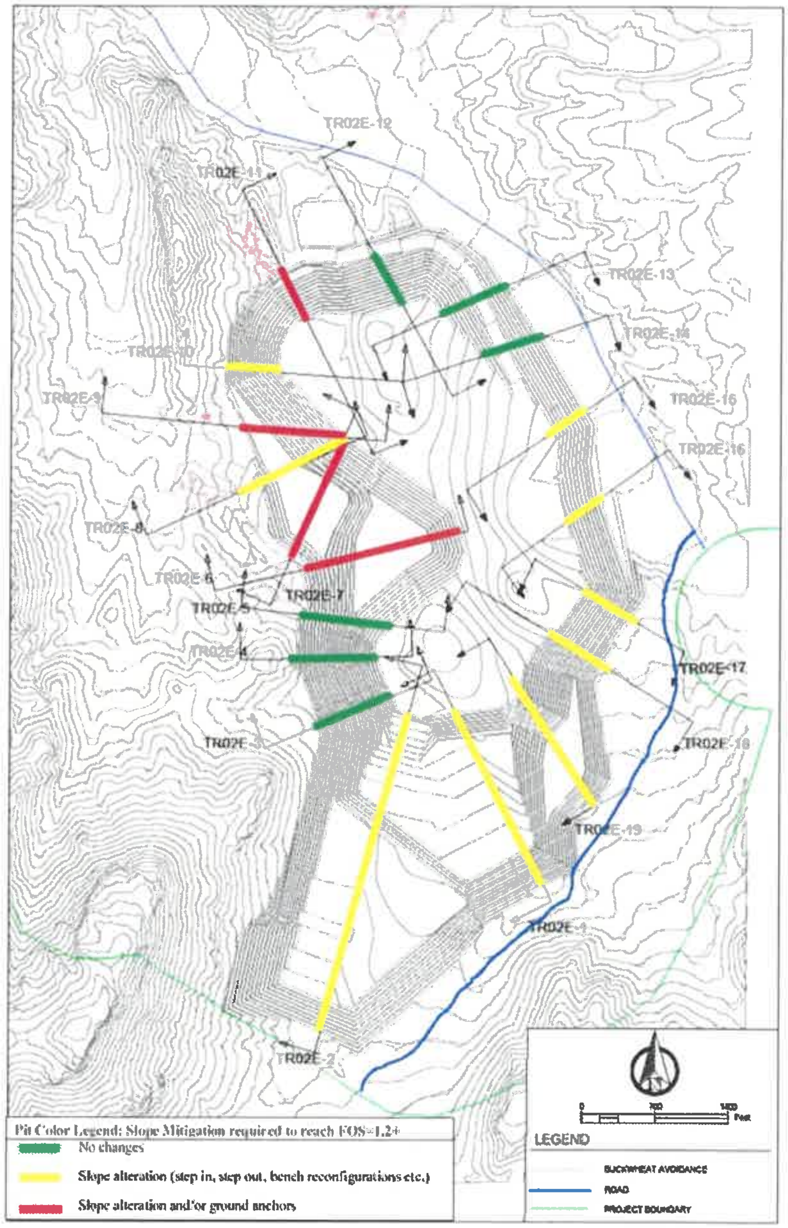

Figure 12 - Quarry TR02-E Plan View and Cross Section Locations

Three (3) conditions were analyzed for each cross section and compared to the Final Slope Configuration FOS (prior to post-mining buttress implementation) from the previous geotechnical report from GLA (2022).

A discussion and example of the results obtained from the Final Slope Configuration FOS and the three conditions analyzed can be seen below. Figure 13 shows the Final Slope Configuration used for comparison to the three conditions.

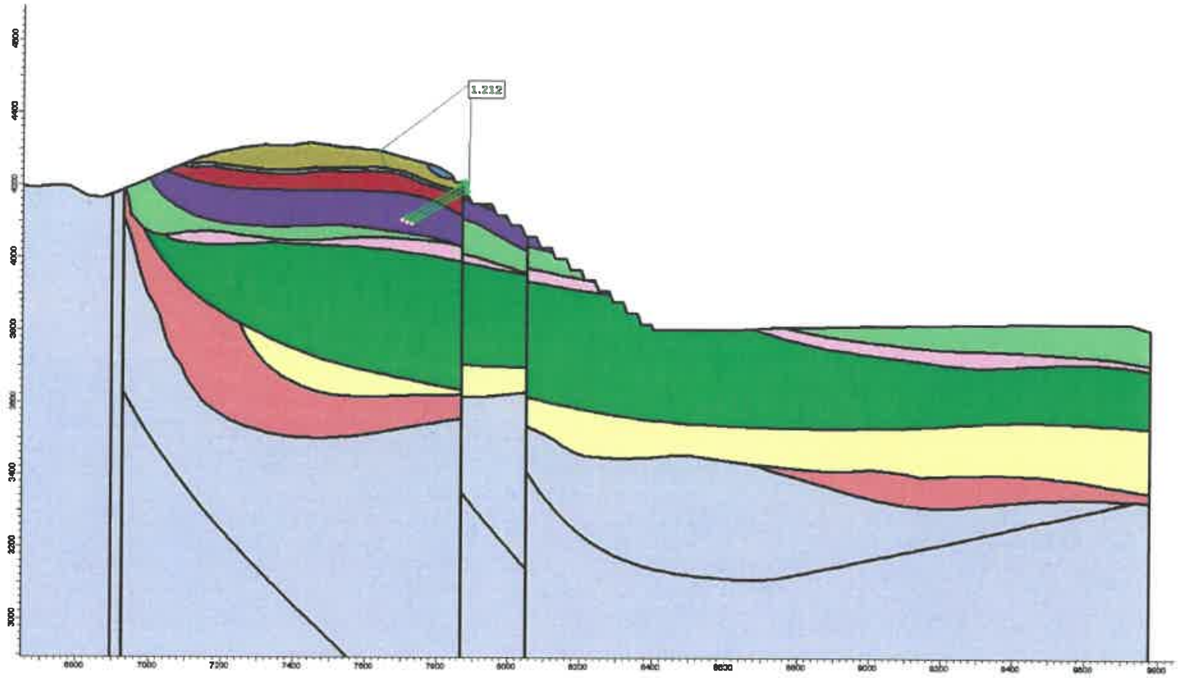

Figure 13 – Final Slope Configuration FOS (Prior to buttress implementation), Section TR02E-11

1. Condition 1 – Post-mining buttress is in place covering ground anchors and the critical failure surface is located entirely within the buttress. See Figure 14 below.

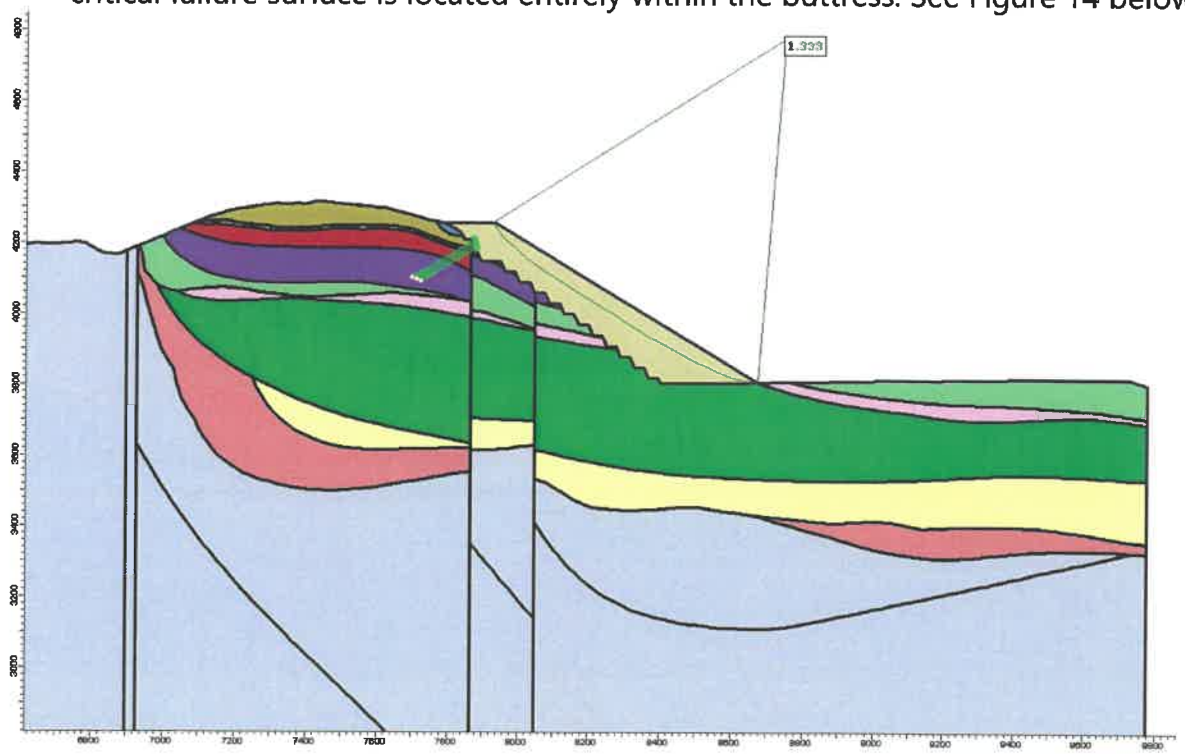

Figure 14 - Condition 1, Section TR02E-11

2. Condition 2 – The same post-mining buttress from Condition 1 is in place and ground anchors are either absent or have become passive (unloaded). See Figure 15 below.

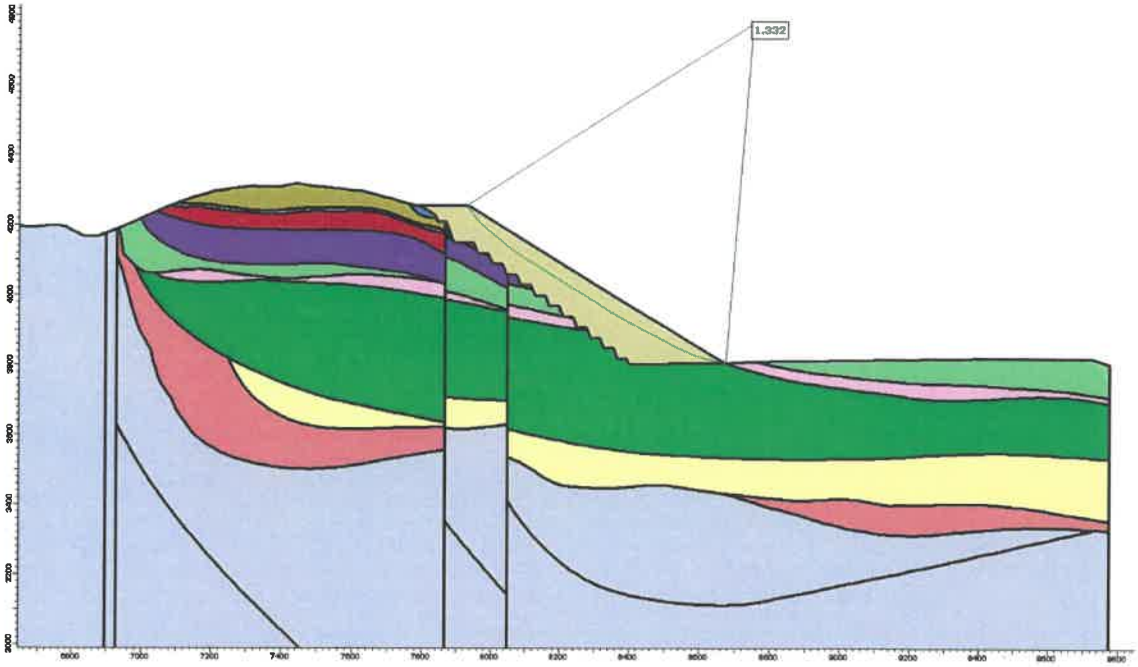

Figure 15 - Condition 2, Section TR02E-11

3. Condition 3 – The same post-mining buttress configuration from Conditions 1 and 2 is analyzed with the exact same minimum slip surface from the Final Slope Configuration FOS. This result shows how the buttress increases the factor of safety along the Final Slope Configuration slip surface. See Figure 16 below.

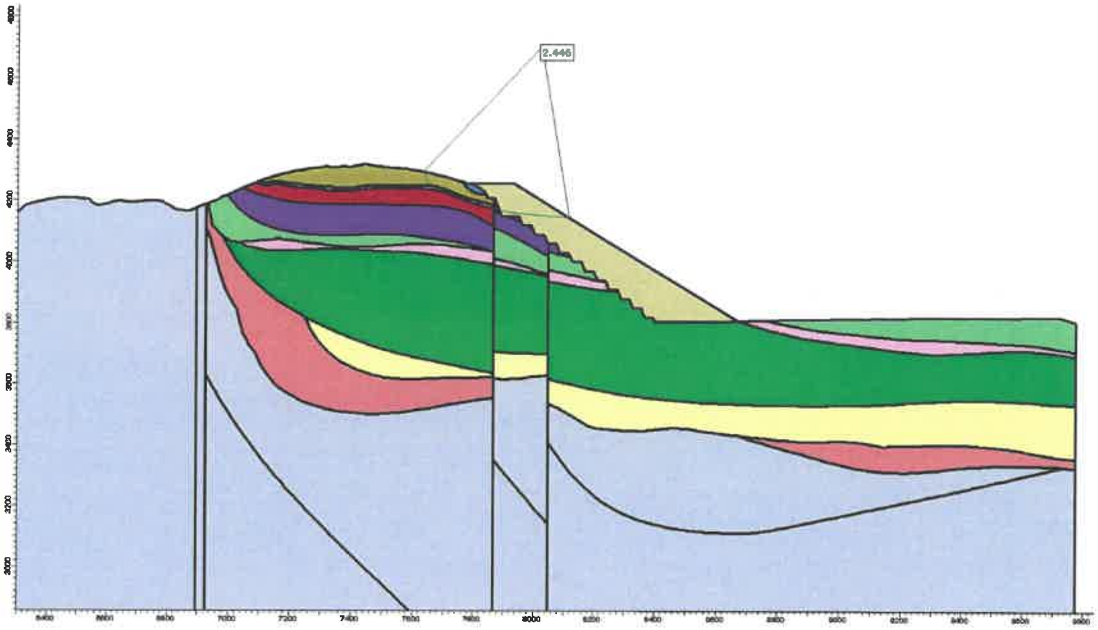

Figure 16 - Condition 3, Section TR02E-11

Running analyses with the post-mining buttress and without ground anchor support illustrates that:

I. The buttressed quarry slopes achieve the stability criteria if the ground anchors were to lose their ability to apply the required design loads over time, and
II. The buttress is a suitable closure or reclamation condition.

4.2 Method of Analysis

For the static stability assessment documented herein, GLA used the conventional limit equilibrium (LE) approach as implemented in the computer program Slide2 Modeler (Slide2), Rocscience (2021), build 9.020. In particular, GLA used the GLE/Morgenstern-Price (1965) limit equilibrium method and the Non-Circular surface type with the Path Search method, as coded in Slide2. Limit equilibrium is only one method of several used to develop complete slope stability recommendations. However, the weakness of M5a makes it likely that limit equilibrium results will control the majority of the slope stability recommendations. Topography and stratigraphy for each section was provided by NewFields in AutoCAD files, which were imported into Slide2. The general stratigraphy is described in EnviroMine (2019) and shown in Figure 17. Some modelling tools used in the limit equilibrium analyses by EnviroMine that were also incorporated within the GLA analyses herein include:

1. M5a being considered a "weak layer" while modeling. Rocscience (2022) defines a weak layer as:

A weak layer polyline has assigned strength properties. Since a weak layer polyline has no physical thickness, it is intended to be used for modelling interfaces, joints or very thin weak layers with negligible thickness, along which sliding might occur.

2. Anisotropic surfaces are assigned to layers S3, M4, M5, B5, S5, L6 and LSI based on the sedimentary nature of the deposits. Anisotropic surfaces account for different shear strengths on different surfaces within the same material, e.g. a bedding surface may have a lower shear strength than the intact rock mass. Slide2 allows the user to define a range of angles from the anisotropic surface at which different shear strengths are applied for a given slice during the LE analysis. Anisotropic surfaces used for the evaluation documented herein were assigned angles of anisotropy of 5 degrees for Parameter A and 10 degrees for Parameter B (consistent with the parameters used in the EnviroMine report from 2019). Parameter A defines an angular range on either side of the bedding plane orientation, for which the bedding plane shear strength only applies (i.e. c1, phi1) and parameter B defines the angle at and above which the intact rock mass shear strength applies (i.e. c2, phi2). The range in between B and A (B - A) is a transition area over which the linear increase from bedding plane to rock mass shear strength takes place (Rocscience, 2022).
3. Slopes and buttresses are considered to be dewatered with no excess pore pressures as indicated by Ioneer and their consultant HydroGeoLogica.

Unit code	Color	Formation	Lithologic description
Ql	Ql	Quaternary alluvium	Young alluvium; unconsolidated coarse gravels, rounded to subangular clasts, dominant volcanic composition
S3	S3	Cave Spring fm.	Siltstone, medium bedded, occasional thin sandstone or gritstone, compact, some silicic zones, gray, green-gray and yellow-gray
G4	G4	Cave Spring fm.	Gritstone; lapilli tuff, fine to coarse, massive to poorly bedded, locally pumice rich, gray to orange, grades upward into siltstone
M4	M4	Cave Spring fm.	Carbonate and marl, dominant white massive limestone or tufa, some zones laminated stromatolite, dense to porous, minor thin siltstone or gritstone interbeds, irregular silicic zones, white, beige
G5	G5	Cave Spring fm.	Gritstone, coarse lapilli tuff, often vuggy and very porous from leached pumice, very rough texture, much friable, angular volcanic fragments in lower portion; dominantly orange to yellow oxidized, some leisegang banding, gray when unaltered
M5	M5	Cave Spring fm.	Claystone and marl, some upper swelling clay locally waxy and friable, thin to medium bedded marl, distinct zone of medium banded gray and white marl, toward base increasing possibility of calcite pseudomorphs after borates; off-white, light gray, beige to tan
B5	B5	Cave Spring fm.	Marl, minor claystone and siltstone, thin to medium bedded, all very fine grained, dense where dominated by searlesite, occasional calcite pseudomorphs after borate, rare ulexite, sedimentary breccia near base; gray to bluish-gray to white
S5	S5	Cave Spring fm.	Siltstone, locally interbedded thin marl, sandstone, medium bedded, some pebbly beds bearing ostracods, brown and tan at top, some thin green layers, rest gray to gray-brown
G6	G6	Cave Spring fm.	Gritstone, sandstone, mostly massive, lapilli tuff and diamictite, locally coarse pumiceous, gray; grades upward into siltstone
L6	L6	Cave Spring fm.	Marl, minor siltstone and claystone, often finely banded, much medium wavy bedded, locally silicic beds, gray, tan, brown, beige, cream; may include sections of gritstone or diamictite
Lsi	Lsi	Cave Spring fm.	Marl, carbonate with abundant silica, medium bedded, siliceous knobs or lenses, gray, white, tan or brown
G7	G7	Cave Spring fm.	Diamictite, massive, some crude bedded sandstone, mixed angular volcanic clasts of all sizes but mostly coarse, occasional carbonate, dark gray to gray
Tlv	Tlv	Argentite Canyon volcanics	Porphyritic latite, massive, dense, commonly large feldspar phenocrysts, often brecciated, may grade into diamictite; gray to dark gray
Tbx	Tbx	Rhyolite Ridge tuff	Tuff breccia, massive, lithic angular volcanic fragments in fine tuffaceous matrix, some crystal fragments, cream, pink, light gray; occasional zones welded tuff to vitrophyre
Z	Z	Silver Peak fm.	Sandstone, siltstone, mostly unsorted, pebbly sandstone or conglomerate, massive to faintly bedded, subrounded clasts, possibly volcanic, brown or gray-brown

Figure 17 – Lithology

4.3 Material Properties

Material parameters were consistent with the prior analyses within GLA 2022 with the addition of the buttress material. Table 1, below, displays the material properties.

Table 1 - Material Properties

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0

4.4 Quarry Dewatering, Surface Water Infiltration & Post-Mining Quarry Lake

4.4.1 Quarry Dewatering and Surface Water Infiltration

The U.S. Fish and Wildlife Service has expressed concerns about the potential effectiveness of the proposed program for dewatering/depressurization of the quarry at Rhyolite Ridge and the potential impact of surface water infiltration during extreme snowmelt events and/or precipitation events on pore pressures and stability. On March 7, 2023 a virtual meeting was held with Geoff Beale of Piteau Associates and Kenneth Myers of The MINES Group/Geo-Logic Associates to discuss these concerns. In that meeting Mr. Beale expressed his confidence in the ability to effectively dewater the quarry using the proposed deep well system and verify/monitor its effectiveness through the installation of instrumentation, such as vibrating wire piezometers that indicate the level of the groundwater. It was agreed that in some areas in the presence of a significant thickness of low permeability clay materials, dewatering/depressurization may require additional measures within bench scale installations of horizontal drains. The monitoring systems would be enhanced in these areas and site-specific thresholds would be developed, as a function of the stability criteria, for the implementation of bench scale installations.

As regards the impact of infiltration during snowmelt or precipitation events, as difficult as it may be to depressurize and remove water from these low permeability clays, it is even more difficult to put it back in. The vast majority of the water applied to the surface will simply become surface runoff. The small fraction that does infiltrate will initially form a shallow saturated wetting front at the surface that will continue to grow as long as the source of water at the surface persists and will exhibit small positive pore water pressures. As soon as the surface water source goes away, the water in the wetting front will continue to redistribute at depth, but now as an unsaturated wetting front with negative pore water pressures (soil suction). The depth of penetration in these low permeability soils will remain very near the surface and the effects of potential evaporation at the surface will eventually remove most if not all of the water in the wetting front as long as it remains above the "extinction depth" (the depth below which potential evaporation at the surface is no longer effective). In summary, there is no risk of any significant volume of water from surface infiltration reaching the deep critical failure planes associated with the weak anisotropic clays that present the most serious stability risk in the quarry.

It is important to remember that the materials present in most of the quarry are rock and contain fractures. These fractures do have the potential to experience significant infiltration and distribute it within the fractures to a significant depth resulting in potential structurally controlled instability. However, this structurally controlled stability risk is addressed in our kinematic analysis at both bench and interramp scale within the quarry and those analyses do assume that those fractures will in fact be saturated to the surface during either snowmelt or precipitation events.

4.4.2 Quarry Slope Stability and Anticipated Post-Mining Quarry Lake

The anticipated final quarry lake elevation ranges from 5,744 ft amsl to 5,621 ft amsl with 5,720 ft amsl being the anticipated equilibrium quarry lake elevation based on sensitivity analyses completed by Piteau (2022). To check the potential for the quarry lake to affect the critical slip surface that intercepts the buckwheat populations, the elevation at the bottom of the critical slip surface from Condition 3 was compared to the maximum predicted quarry lake elevation of 5,744 ft amsl to determine whether or not the quarry lake would interact with the critical slip surface. If the water elevation did not contact the slip surface, there will be no change in the factor of safety along that critical slip surface. The only section in which there is an interaction between the quarry lake elevation and the critical slip surface from Condition 3 is section TR02E-5. As a note, this section does not contain M5a and is not directly below the buckwheat populations. Nevertheless, the stability was checked with the quarry lake scenario to ensure the factor of safety for the critical slip surface met the project stability criteria. The results indicate that the FOS for the critical slip surface is reduced slightly for TR02E-5 from 1.91 (Figure 18) to 1.72 (Figure 19), and the project stability criteria is achieved.

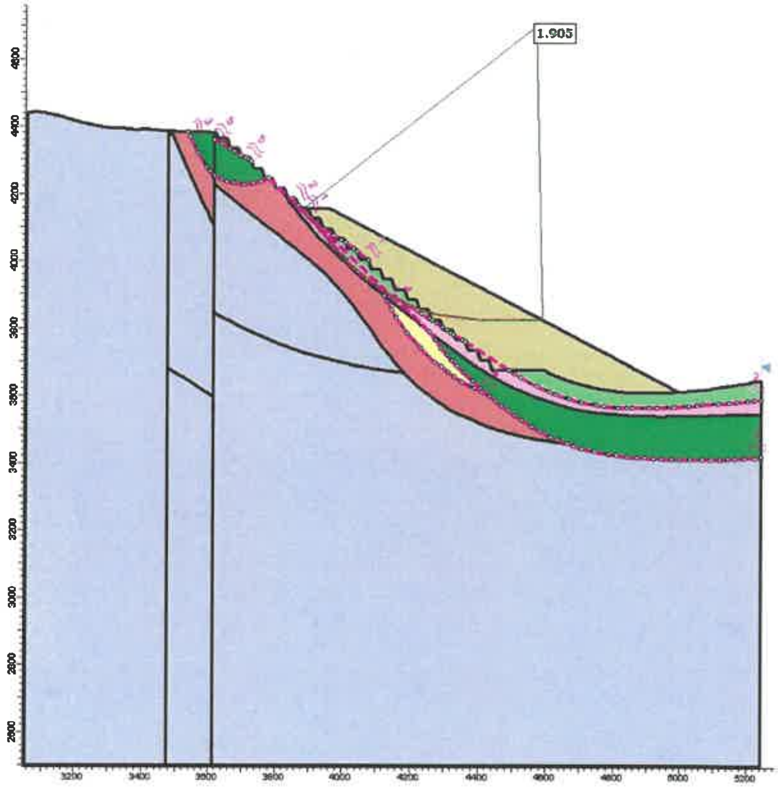

Figure 18 - Condition 3, Section TR02E-5

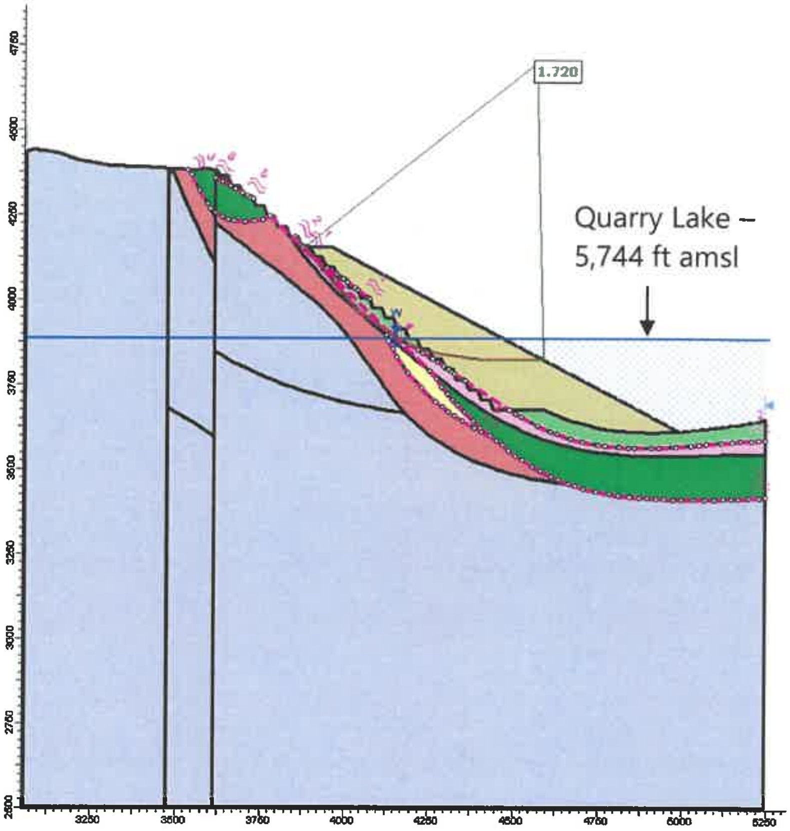

Figure 19 - Condition 3, Section TR02E-5 with Quarry Lake

4.5 Results

Table 2 shows the FOS results for each section analyzed. The sections requiring ground anchors to achieve the stability criteria had a buttress added and evaluations were performed considering support from the ground anchors and considering no support from the ground anchors, with a goal of a FOS>1.2. The buttress configuration consisted of widths ranging from roughly 180 feet to 620 feet and the angle of the buttress ranged from roughly 27°-33° depending on the section. The slope stability analysis results of each section can be found in the appendices. Appendix A shows the results of the final slope configuration before buttress implementation (Final Slope Configuration FOS). Appendix B shows the results of Conditions 1 and 2 and Appendix C shows the results of Condition 3.

Table 2 - Buttress Slope Stability Results

Section	Ground anchors included in section (yes/no)	Final Slope Configuration FOS (Prior to buttress implementation)	FOS for Condition 1*	FOS for Condition 2**	FOS for Condition 3***
TR02E-5	No	1.21	-	1.52	1.91
TR02E-6	Yes	1.24	1.31	1.31	2.71
TR02E-7	Yes	1.26	1.45	1.45	1.81
TR02E-8	No	1.20	-	1.57	1.84
TR02E-9	Yes	1.22	1.25	1.25	2.15
TR02E-11	Yes	1.21	1.33	1.33	2.45

*Condition 1 – Post-mining buttress is in place covering ground anchors and the critical failure surface is located entirely within the buttress.
**Condition 2 – The same post-mining buttress from Condition 1 is in place and ground anchors are either absent or have become passive (unloaded).
***Condition 3 –The same post-mining buttress configuration from Conditions 1 and 2 is analyzed with the exact same minimum slip surface from the Final Slope Configuration FOS. This result shows how the buttress increases the factor of safety along the Final Slope Configuration slip surface below buckwheat areas.

5.0 CONCLUSIONS

The results of these slope stability analyses indicate that the construction of a post-mining buttress will provide quarry slopes that meet the project slope stability criteria of a minimum factor of safety of 1.2 or greater for quarry slopes with and without ground anchor support. The post-mining buttress implementation and final design is dependent upon the volume of material made available for the post-mining buttress construction. Based on these conceptual design analyses, it is anticipated that project slope stability criteria can be readily achieved for long term, post reclamation quarry slopes. Additionally, these analyses illustrate that implementation of a post-mining buttress significantly increases the FOS along the prior minimum failure surfaces below the buckwheat areas.

6.0 REFERENCES

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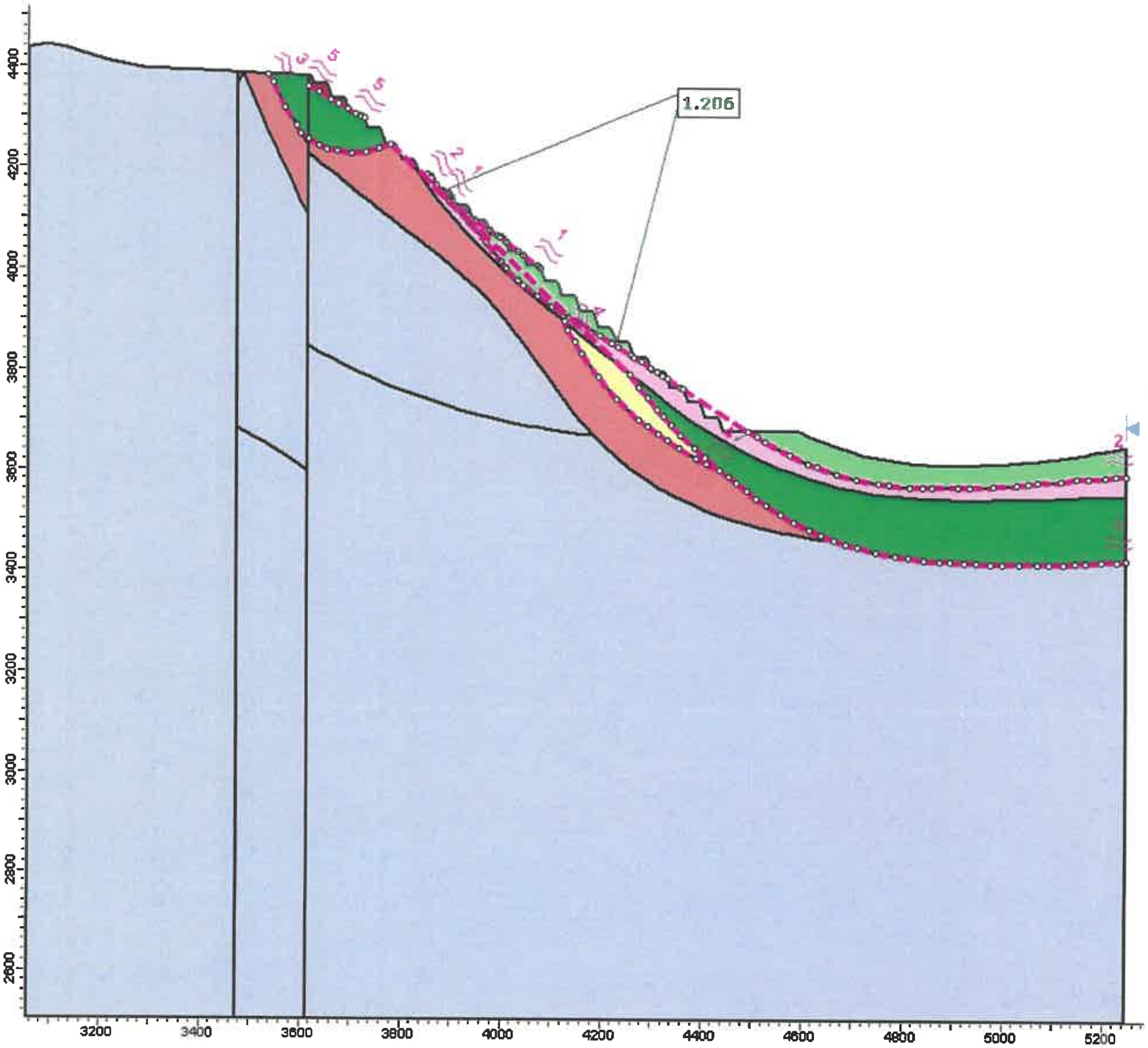
APPENDICES

APPENDIX A



Project Title: Rhyolite Ridge, Section TR02E-5
Analysis Method: GLE/Morgenstern-Price
Search Method: Cuckoo Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4508	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

Legend

- Anisotropic Surface
- Weak Layer

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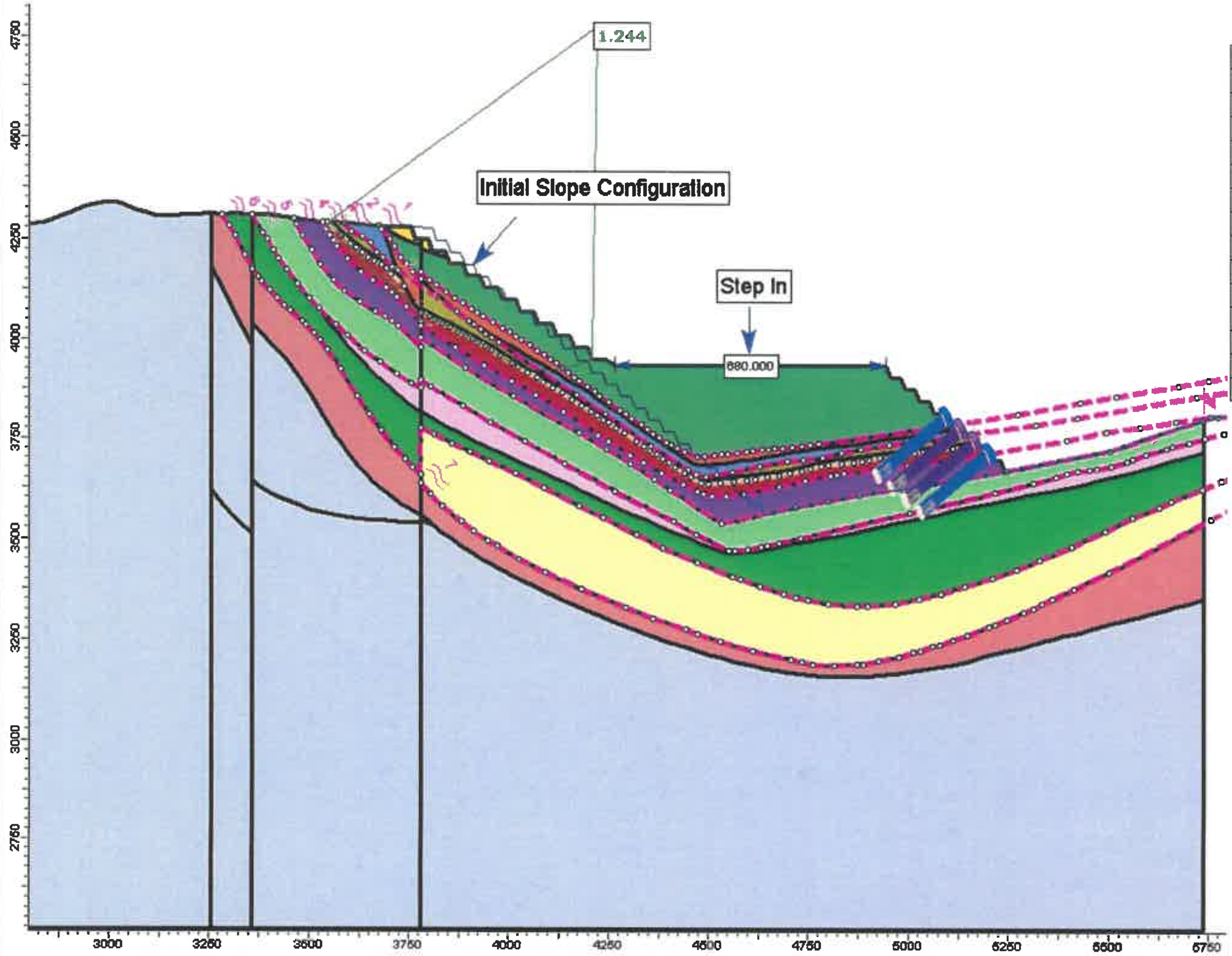
SECTION TR02E-5
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	A1
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-6 Final
Analysis Method: GLE/Morgenstern-Price
Search Method: Cuckoo Search
Failure Direction: Left to Right



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

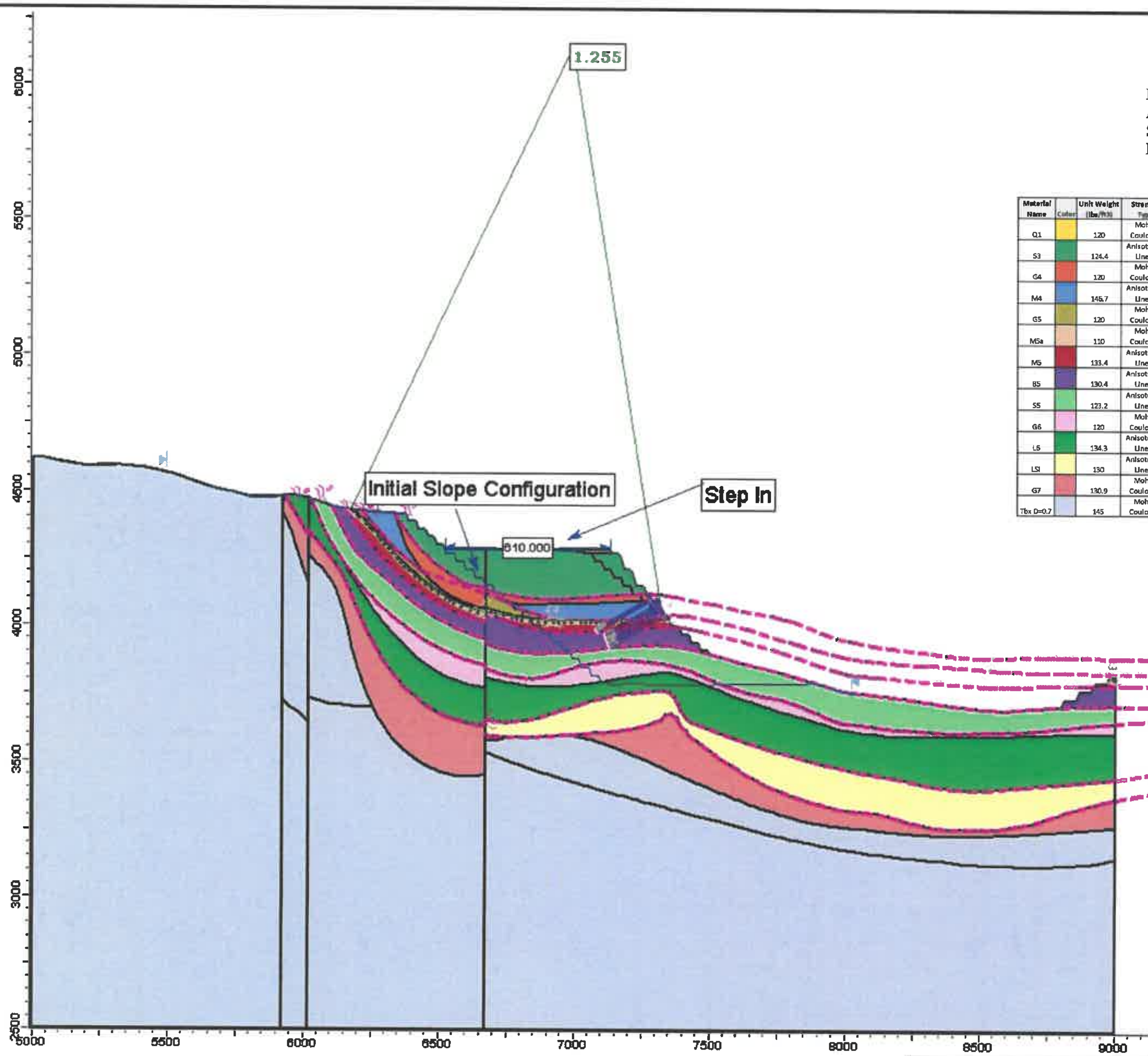
Legend

- Anisotropic Surface
- Weak Layer

Geo-Logic ASSOCIATES

SECTION TR02E-6 FINAL
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	A2
PROJECT NO.	AS22.1013		



Project Title: Rhyolite Ridge, Section TR02E-7 Final
Analysis Method: GLE/Morgenstern-Price
Search Method: Cuckoo Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		145.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

Legend

- Anisotropic Surface
- Weak Layer

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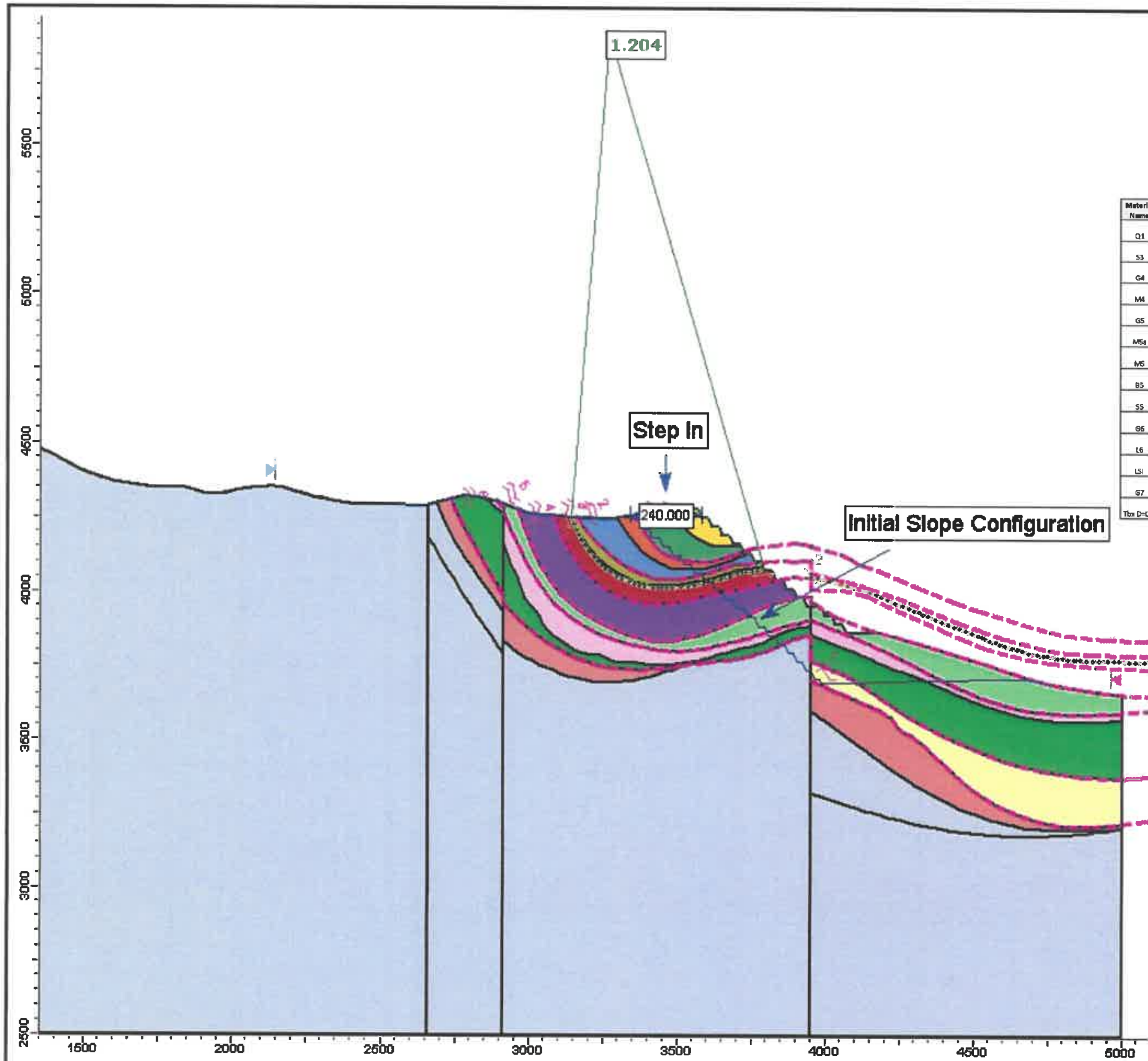
SECTION TR02E-7 FINAL
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	A3
PROJECT NO.	AS22.1013		



Project Title: Rhyolite Ridge, Section TR02E-8 Final
Analysis Method: GLE/Morgenstern-Price
Search Method: Cuckoo Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSi		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

Legend

- Anisotropic Surface
- Weak Layer

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SECTION TR02E-8 FINAL SUPPLEMENTAL GEOTECHNICAL REPORT RHYOLITE RIDGE LITHIUM-BORON PROJECT ESMERALDA COUNTY, NEVADA			
DATE:	March 2023	FIGURE NO.	A4
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-9 Final
Analysis Method: GLE/Morgenstern-Price
Search Method: Cuckoo Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
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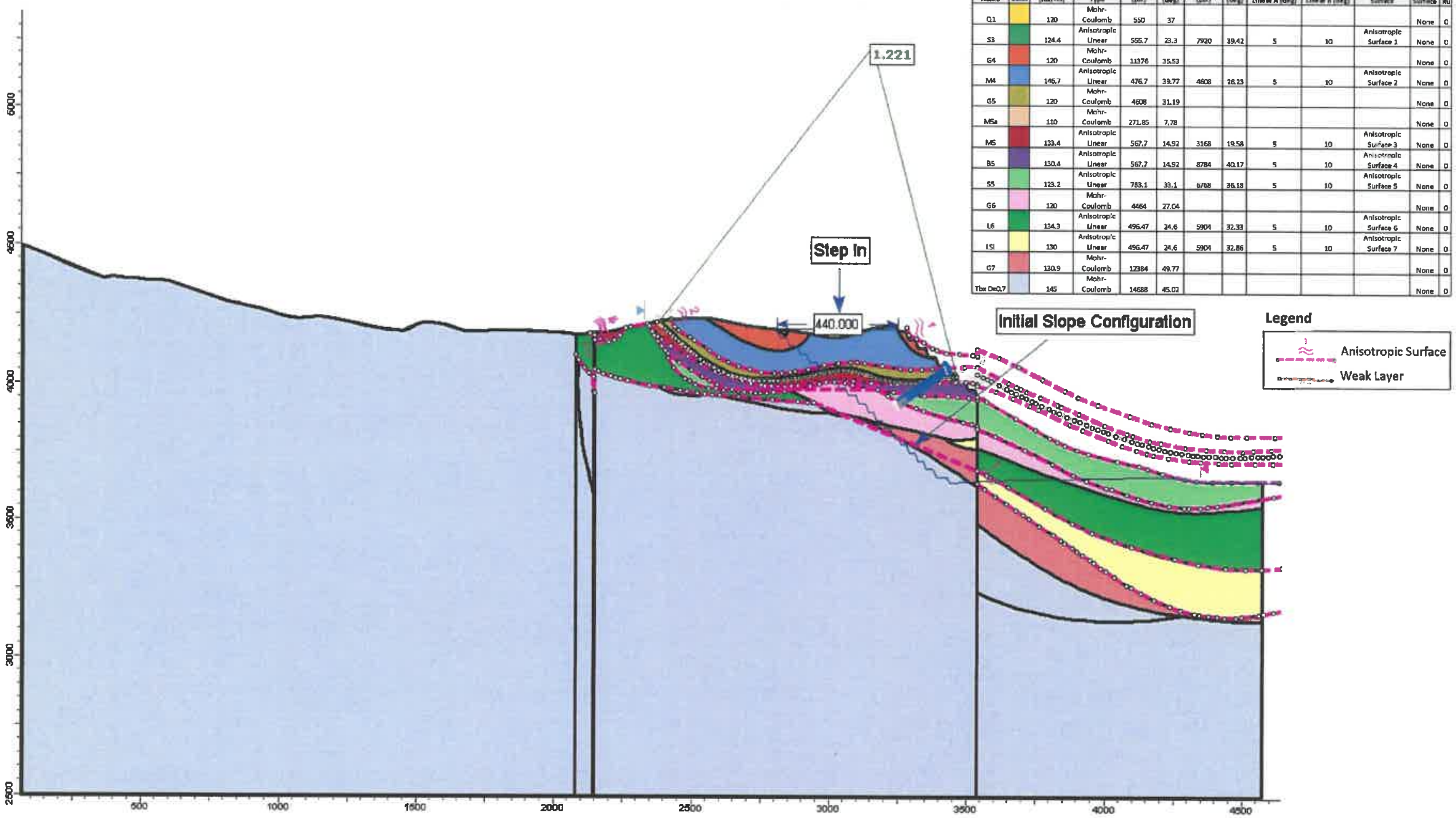


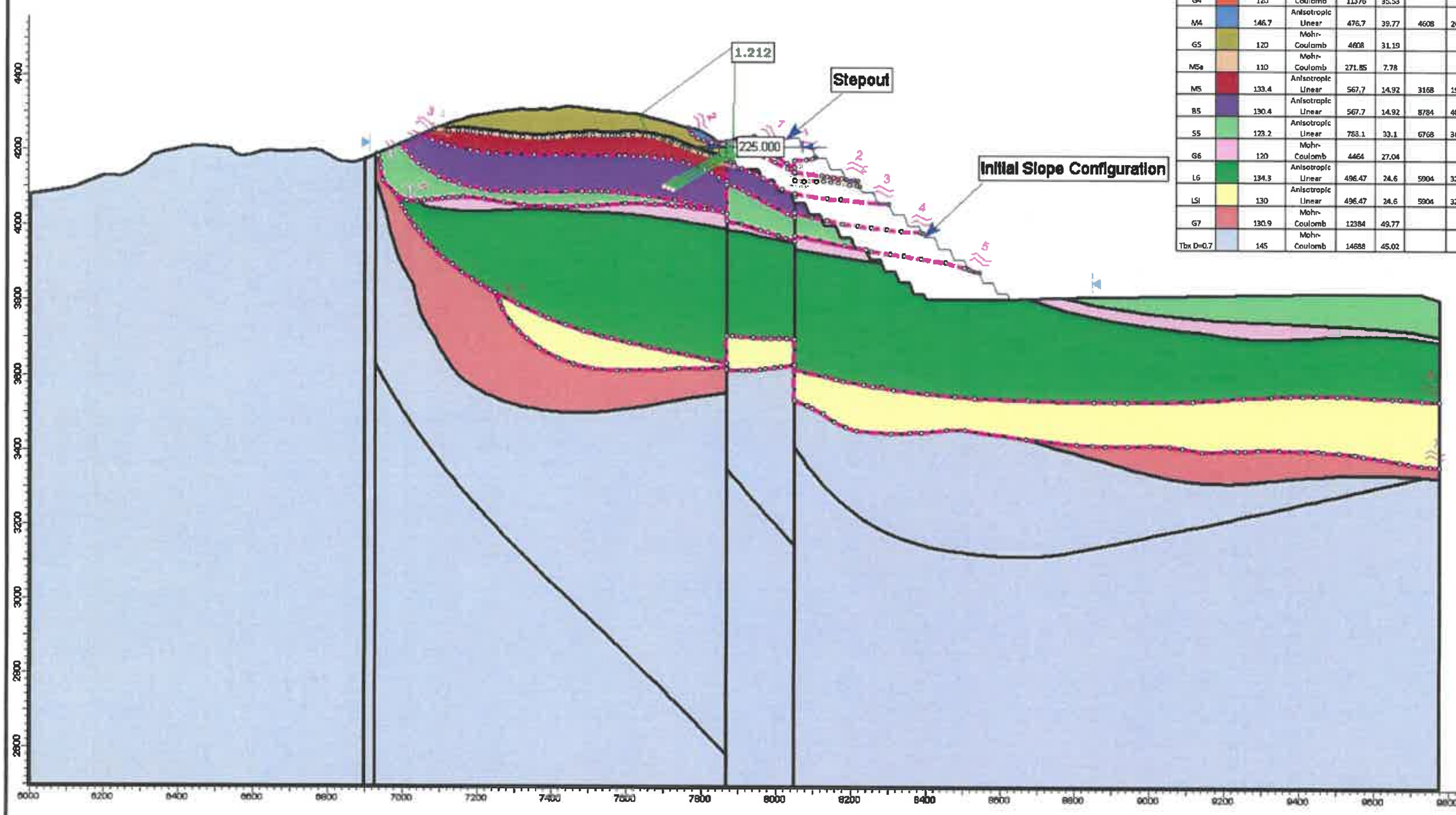
SECTION TR02E-9 FINAL
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	A5
PROJECT NO.	AS22.1013		

Geo-Logic ASSOCIATES

Project Title: Rhyolite Ridge, Section TR02E-11 Final
Analysis Method: GLE/Morgenstern-Price
Search Method: Cuckoo Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0



Legend

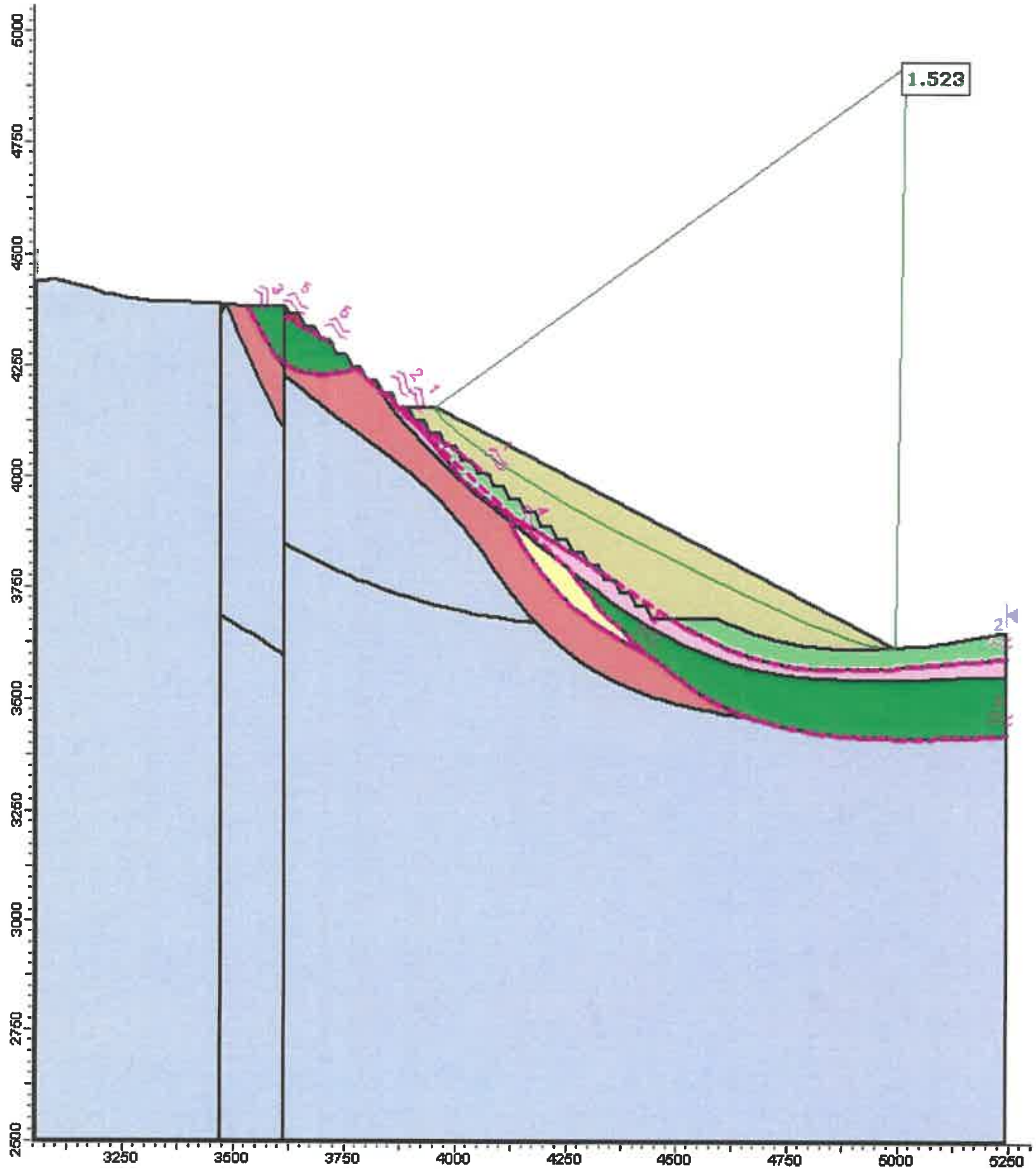
Anisotropic Surface
Weak Layer

Geo-Logic ASSOCIATES

SECTION TR02E-11 FINAL
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	A6
PROJECT NO.	AS22.1013		

APPENDIX B



Project Title: Rhyolite Ridge, Section TR02E-5 Buttress
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

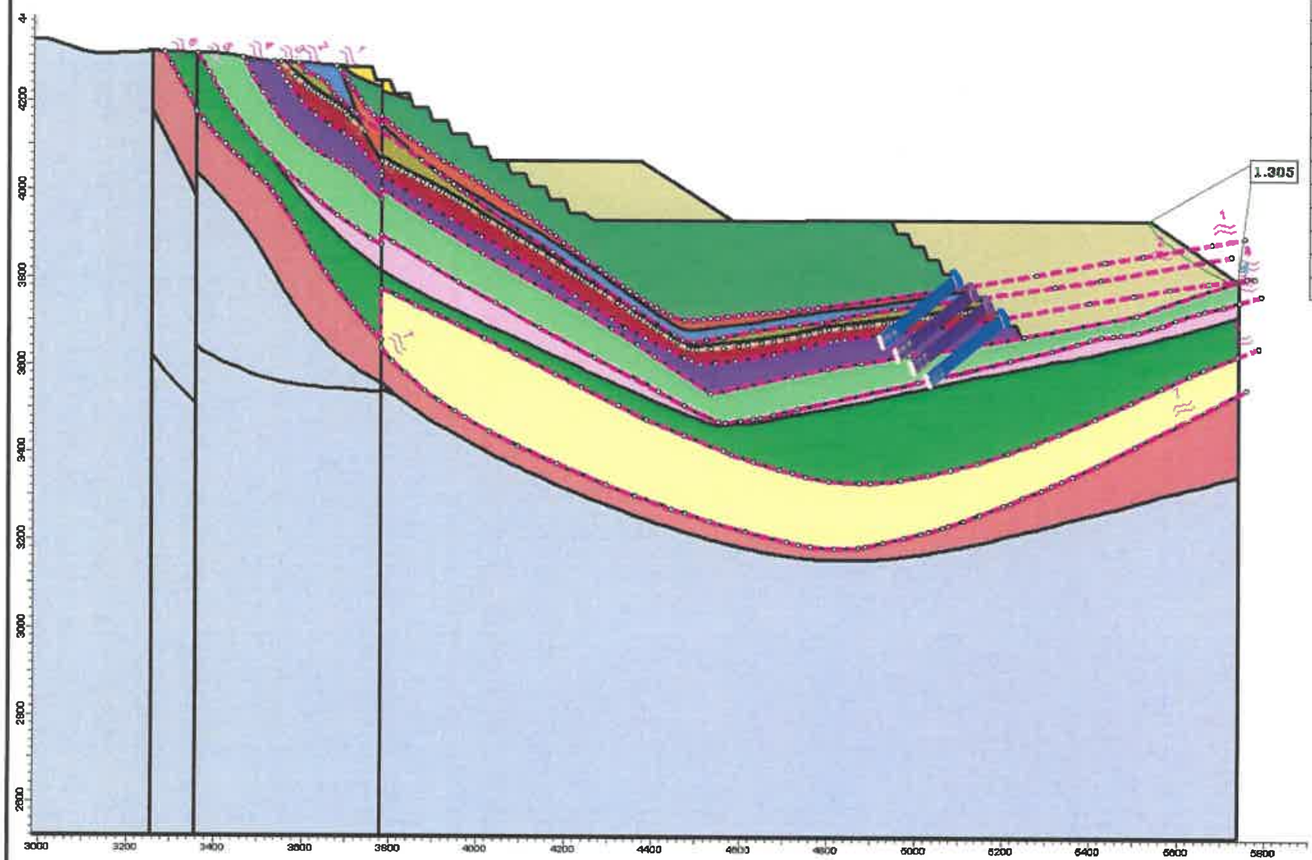
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	38.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0

Legend

Anisotropic Surface
Weak Layer

Geo-Logic
ASSOCIATES

SECTION TR02E-5, BUTTRESS SUPPLEMENTAL GEOTECHNICAL REPORT RHYOLITE RIDGE LITHIUM-BORON PROJECT ESMERALDA COUNTY, NEVADA			
DATE:	March 2023	FIGURE NO.	B1
PROJECT NO.	AS22.1013		



Project Title: Rhyolite Ridge, Section TR02E-6 Buttress Option – W/ Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	768.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSi		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tba D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0

Legend

- Anisotropic Surface
- Weak Layer

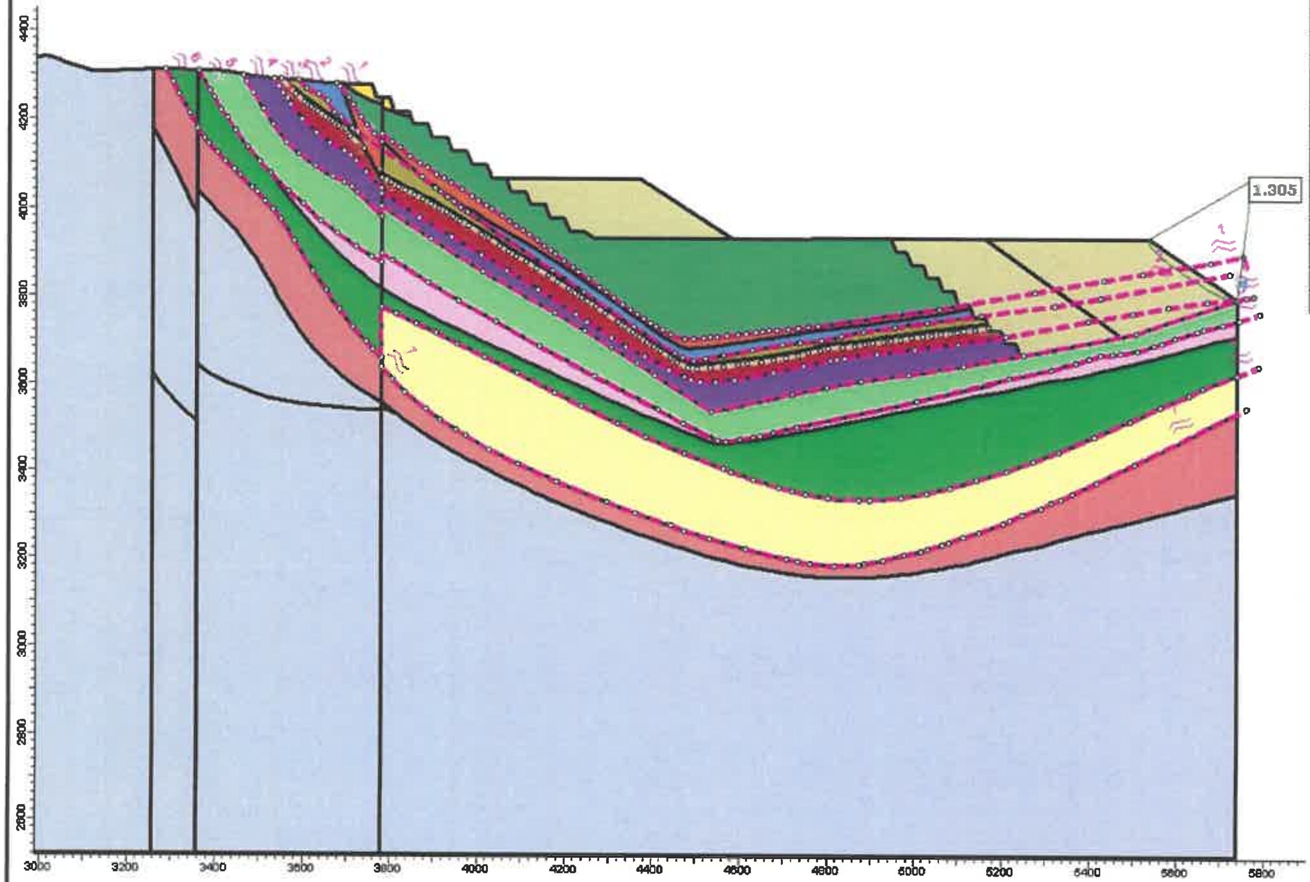
Geo-Logic ASSOCIATES

SECTION TR02E-6, BUTTRESS, W/ ANCHORS, MIN 1.20
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	B2
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-6 Buttress Option – No Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	768.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0



Legend

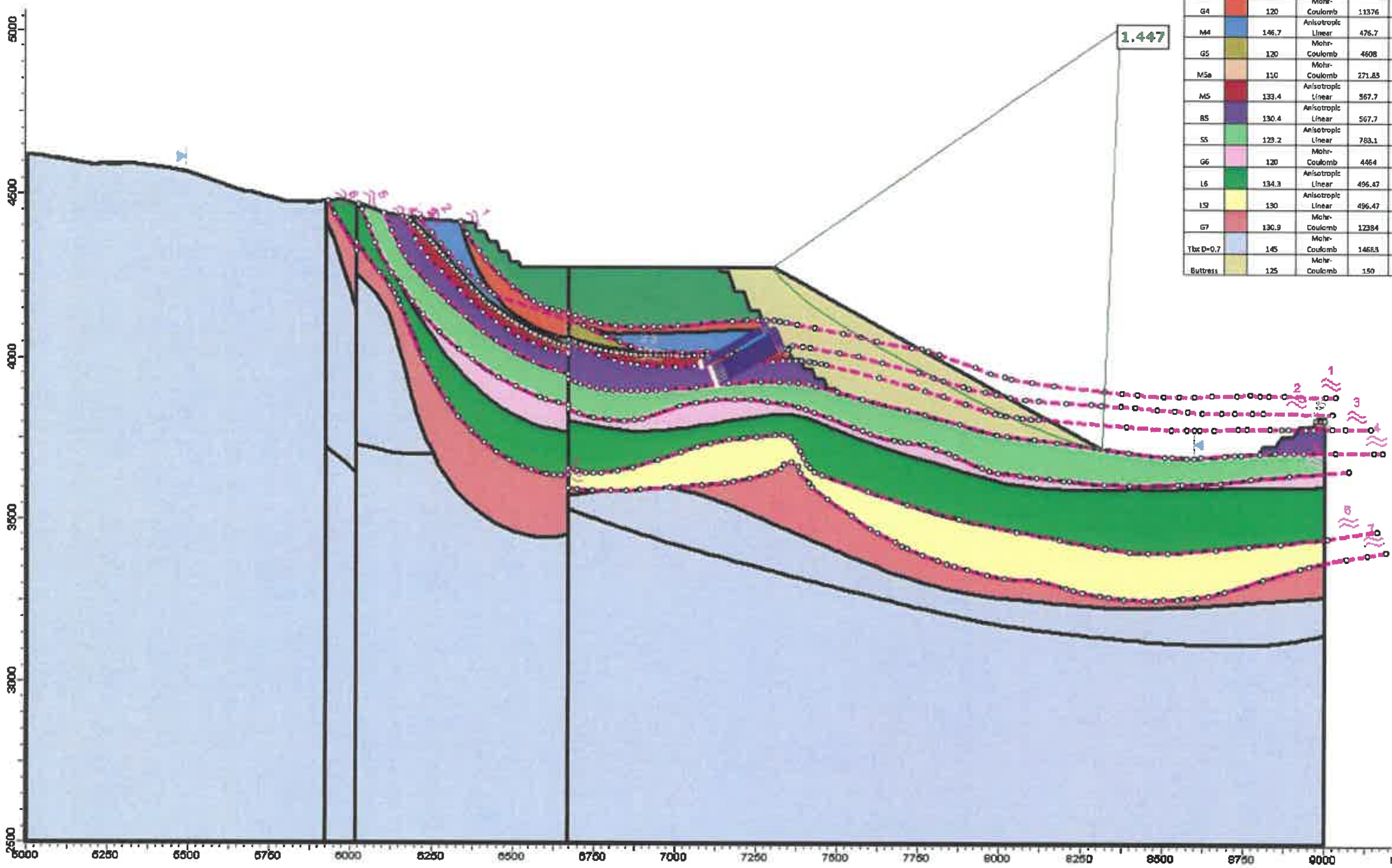
Anisotropic Surface
Weak Layer

Geo-Logic ASSOCIATES

SECTION TR02E-6, BUTTRESS, NO ANCHORS, MIN 1.20 SUPPLEMENTAL GEOTECHNICAL REPORT RHYOLITE RIDGE LITHIUM-BORON PROJECT ESMERALDA COUNTY, NEVADA			
DATE:	March 2023	FIGURE NO.	B3
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-7 Buttress Option – W/ Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.83	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
L5l		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14683	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0



Legend

Anisotropic Surface
Weak Layer

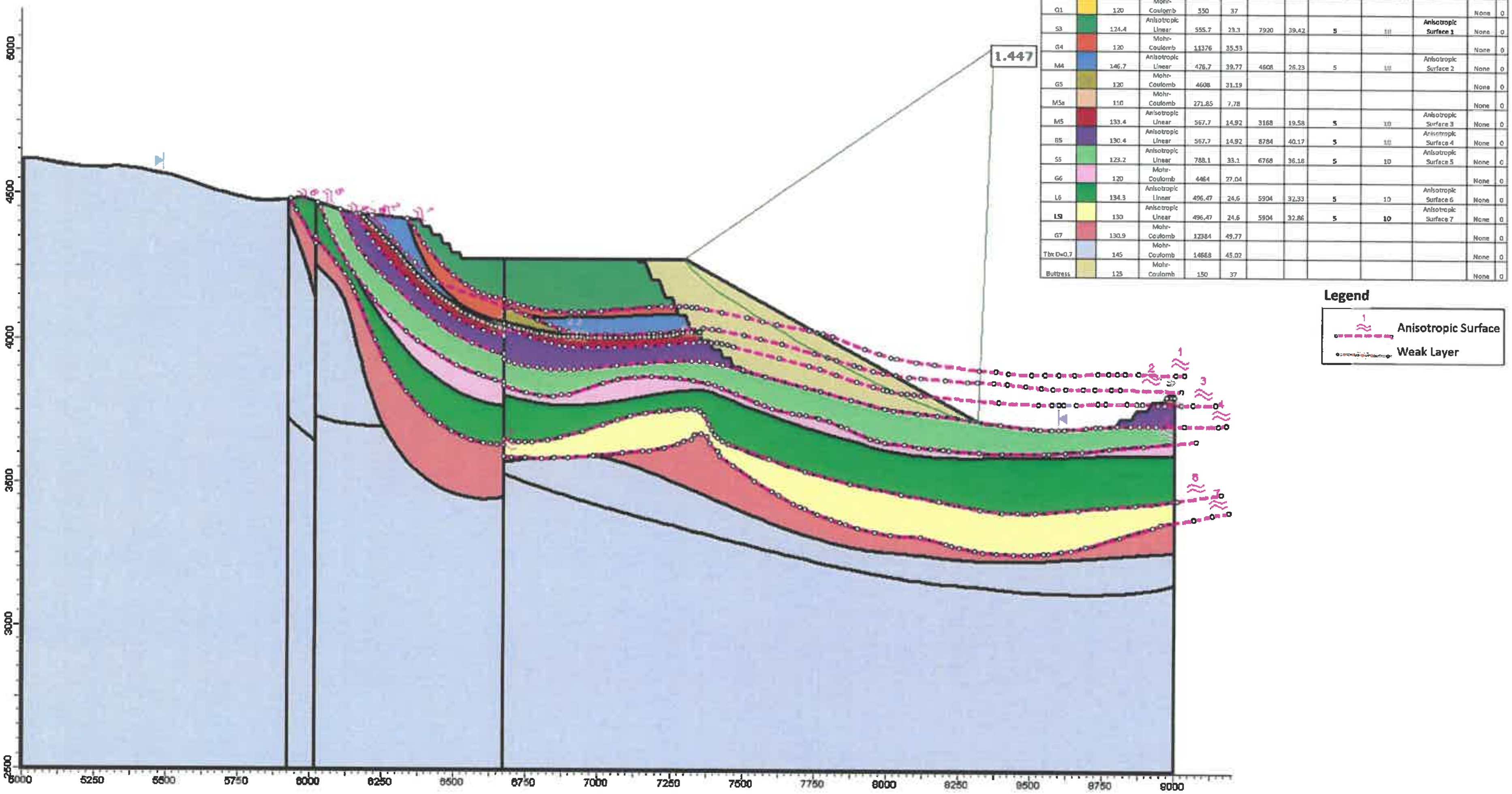
Geo-Logic ASSOCIATES

SECTION TR02E-7, BUTTRESS, W/ ANCHORS, MIN 1.20
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	B4
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-7 Buttress Option – No Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

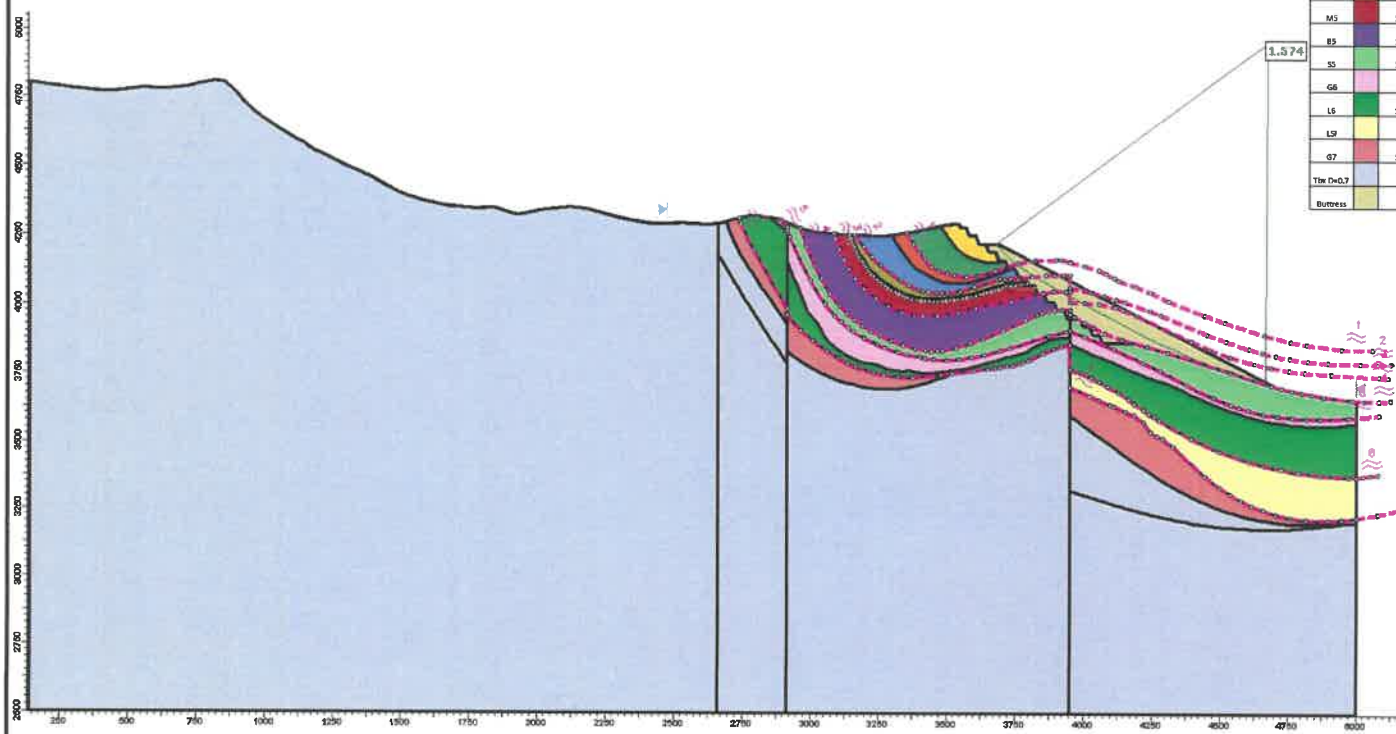
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0



Geo-Logic ASSOCIATES

SECTION TR02E-7, BUTTRESS, NO ANCHORS, MIN 1.20 SUPPLEMENTAL GEOTECHNICAL REPORT RHYOLITE RIDGE LITHIUM-BORON PROJECT ESMERALDA COUNTY, NEVADA			
DATE:	March 2023	FIGURE NO.	B5
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-8 Buttress
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
L5I		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0

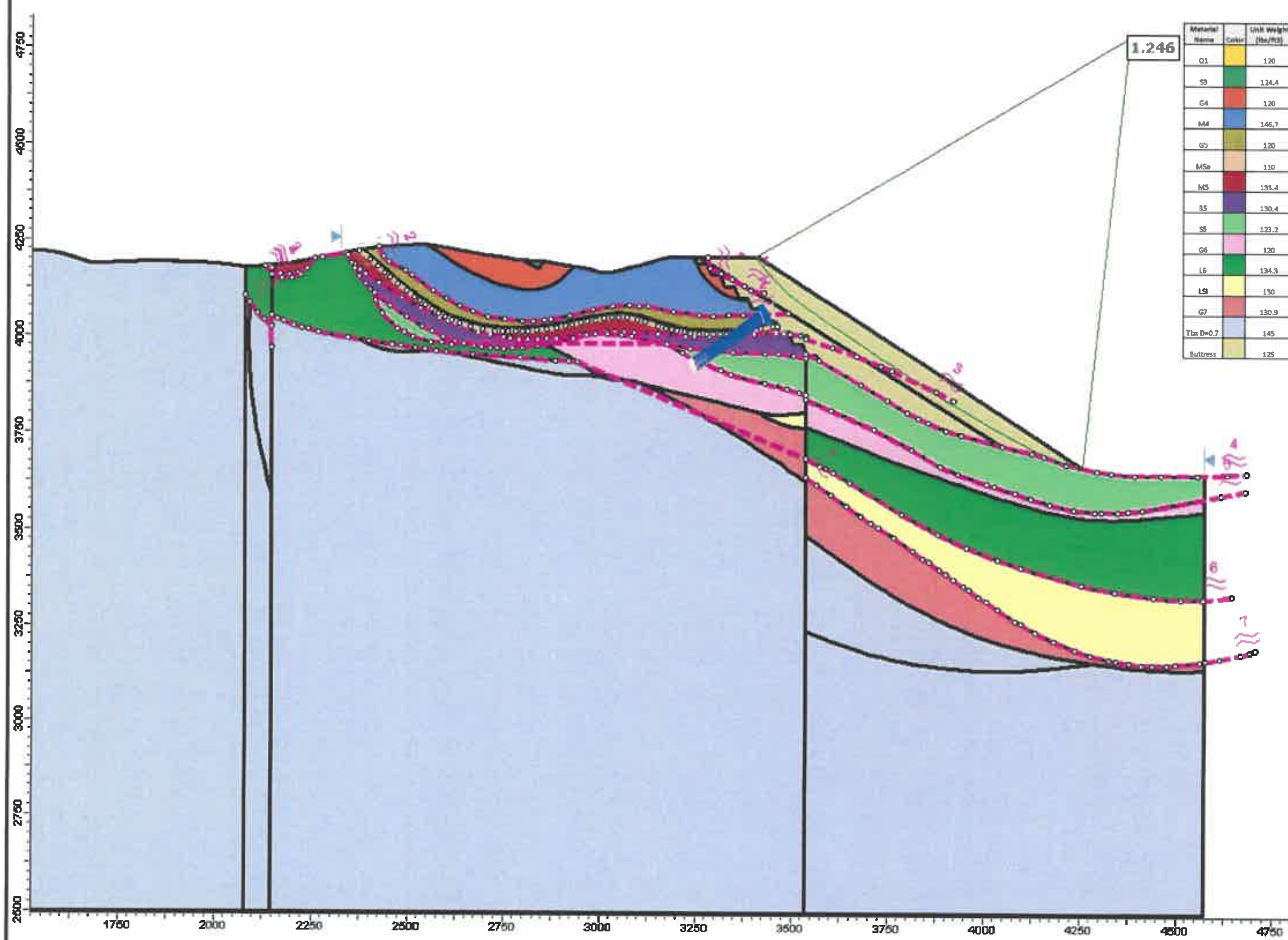
Legend

- Anisotropic Surface
- Weak Layer

SECTION TR02E-8, BUTTRESS
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	B6
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-9 Buttress Option – W/ Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right



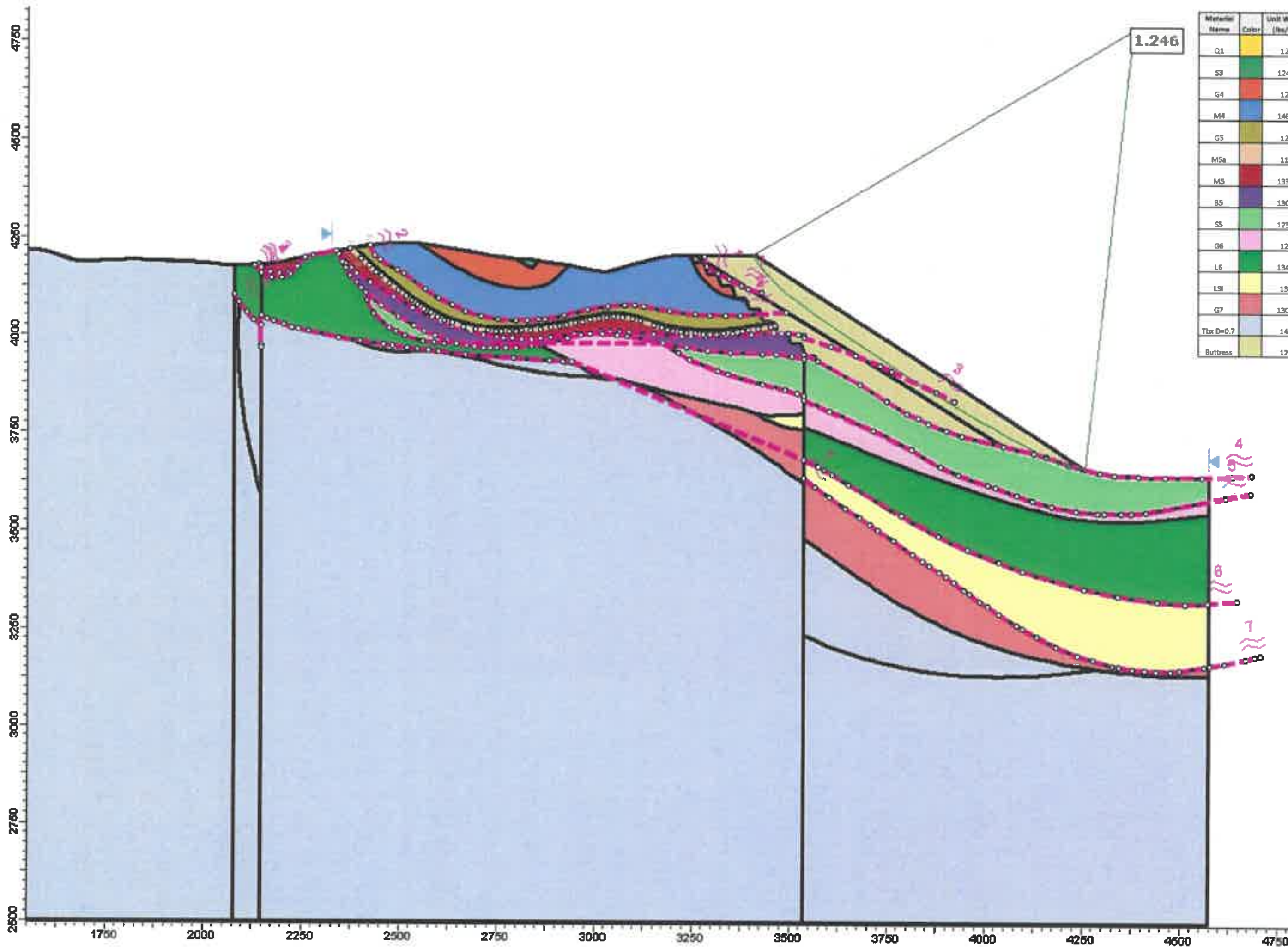
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0

Geo-Logic ASSOCIATES

SECTION TR02E-9, BUTTRESS, W/ ANCHORS, MIN 1.20
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	B7
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-9 Buttress Option – No Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0

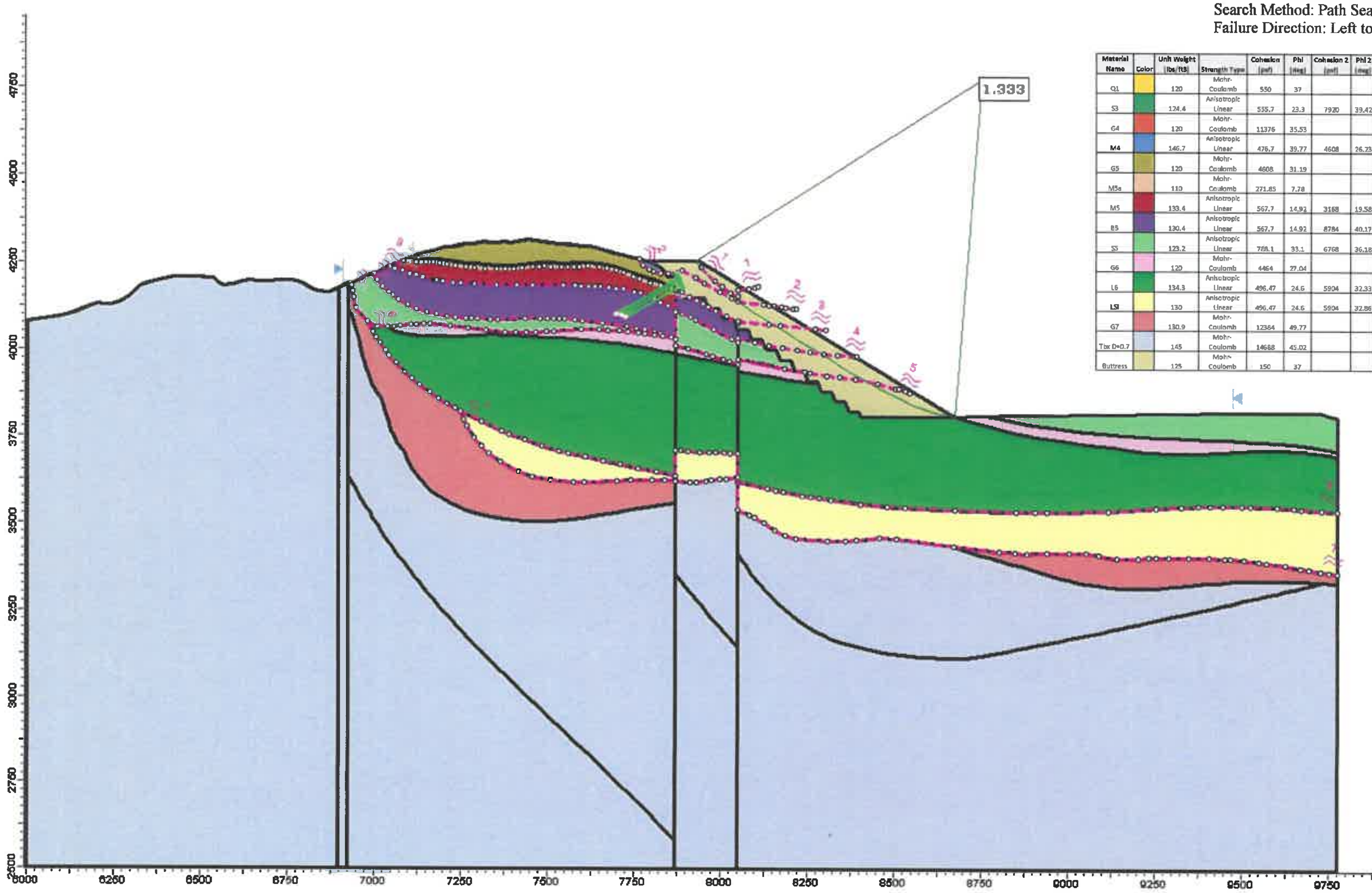
Legend

- Anisotropic Surface
- Weak Layer

Geo-Logic ASSOCIATES

SECTION TR02E-9, BUTTRESS, NO ANCHORS, MIN 1.20 SUPPLEMENTAL GEOTECHNICAL REPORT RHYOLITE RIDGE LITHIUM-BORON PROJECT ESMERALDA COUNTY, NEVADA			
DATE:	March 2023	FIGURE NO.	B8
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-11 Buttress Option – W/ Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0

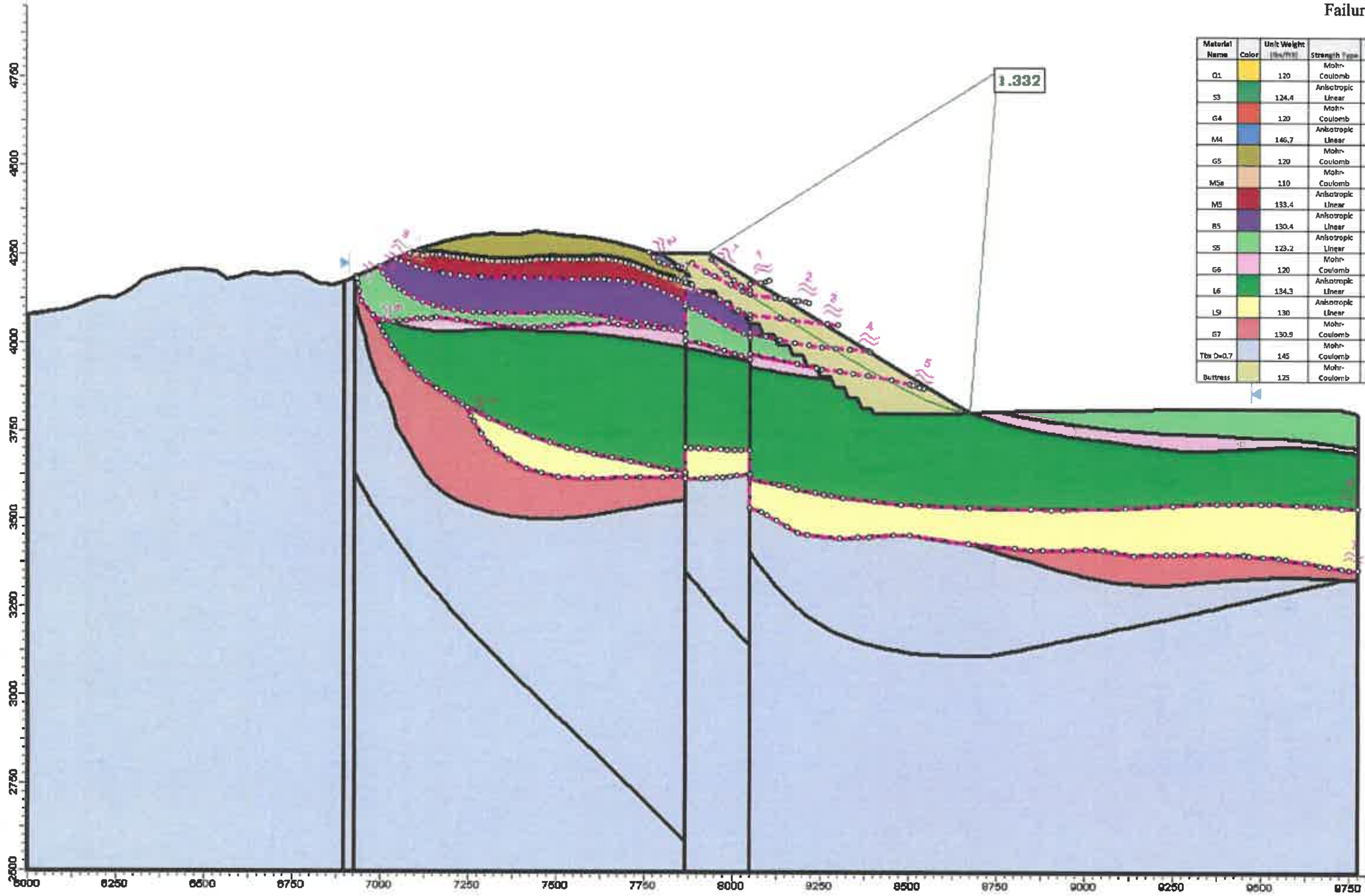
Geo-Logic
ASSOCIATES

SECTION TR02E-11, BUTTRESS, W/ ANCHORS, MIN 1.20
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	B9
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-11 Buttress Option – No Anchors, Min. FS=1.20
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
G1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0
Buttress		125	Mohr-Coulomb	150	37						None	0



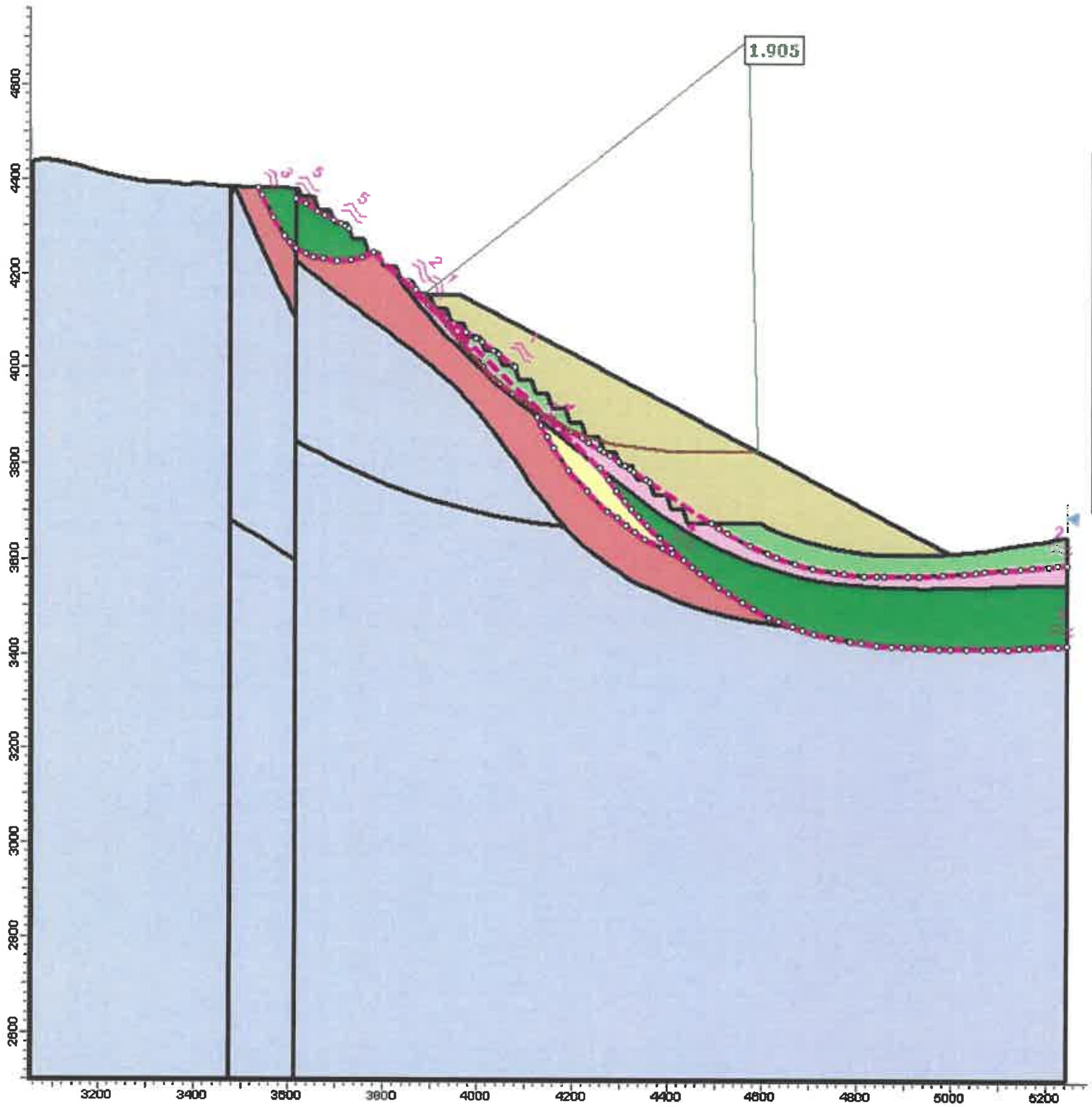
Legend
Anisotropic Surface
Weak Layer

Geo-Logic ASSOCIATES

SECTION TR02E-11, BUTTRESS, NO ANCHORS, MIN 1.20 SUPPLEMENTAL GEOTECHNICAL REPORT RHYOLITE RIDGE LITHIUM-BORON PROJECT ESMERALDA COUNTY, NEVADA			
DATE:	March 2023	FIGURE NO.	B10
PROJECT NO.	AS22.1013		

APPENDIX C

Project Title: Rhyolite Ridge, Section TR02E-5
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right



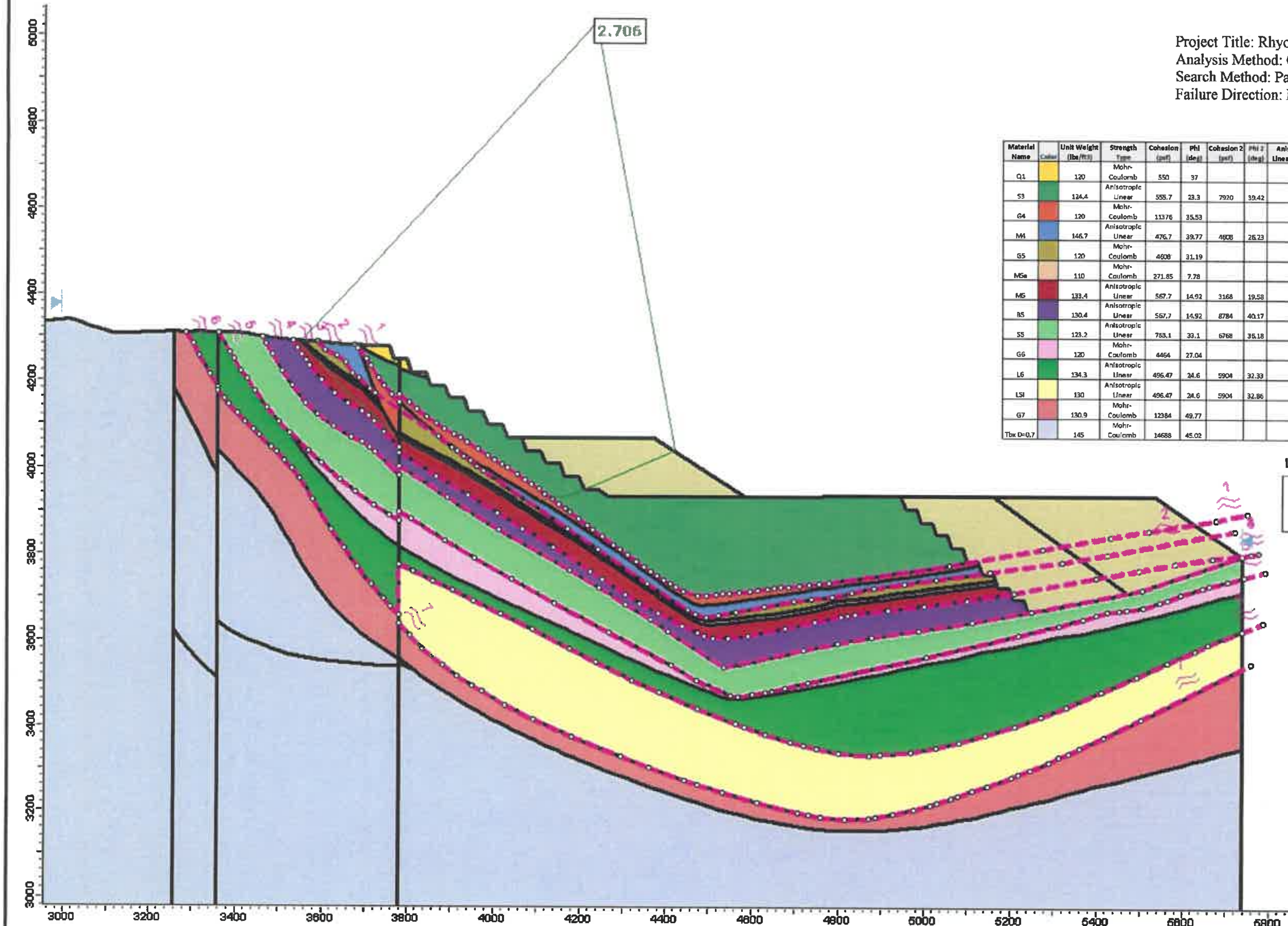
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSi		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

Legend

Anisotropic Surface
Weak Layer

Geo-Logic ASSOCIATES

SECTION TR02E-5, MIN. SLIP SURFACE FROM FINAL SLOPE CONFIG. SUPPLEMENTAL GEOTECHNICAL REPORT RHYOLITE RIDGE LITHIUM-BORON PROJECT ESMERALDA COUNTY, NEVADA			
DATE:	March 2023	FIGURE NO.	C1
PROJECT NO.	AS22.1013		

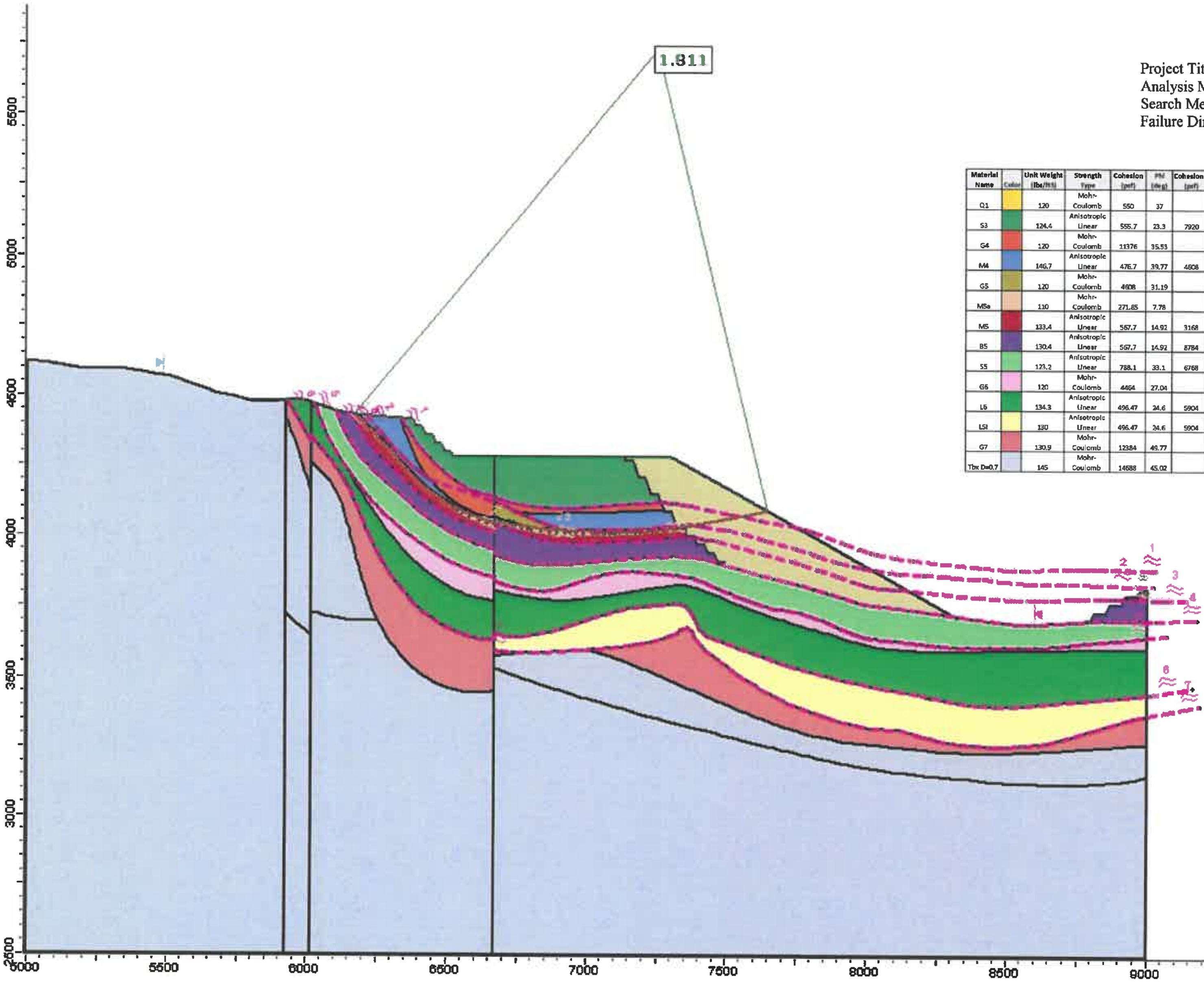


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

Geo-Logic ASSOCIATES

SECTION TR02E-6, MIN. SLIP SURFACE FROM FINAL SLOPE CONFIG.
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	C2
PROJECT NO.	AS22.1013		



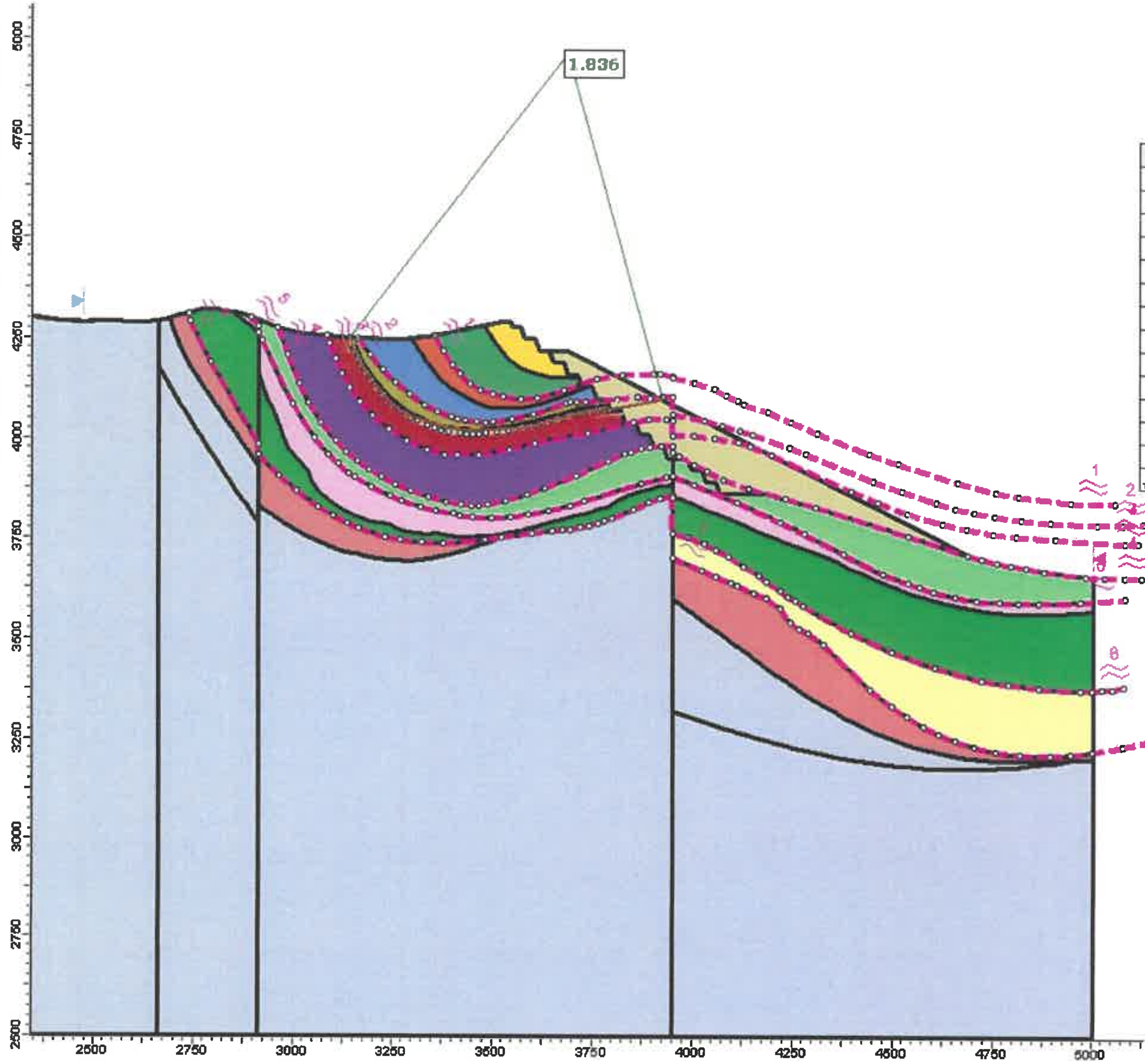
Project Title: Rhyolite Ridge, Section TR02E-7
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

Geo-Logic ASSOCIATES

SECTION TR02E-7, MIN. SLIP SURFACE FROM FINAL SLOPE CONFIG.
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	C3
PROJECT NO.	AS22.1013		



Project Title: Rhyolite Ridge, Section TR02E-8
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	783.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

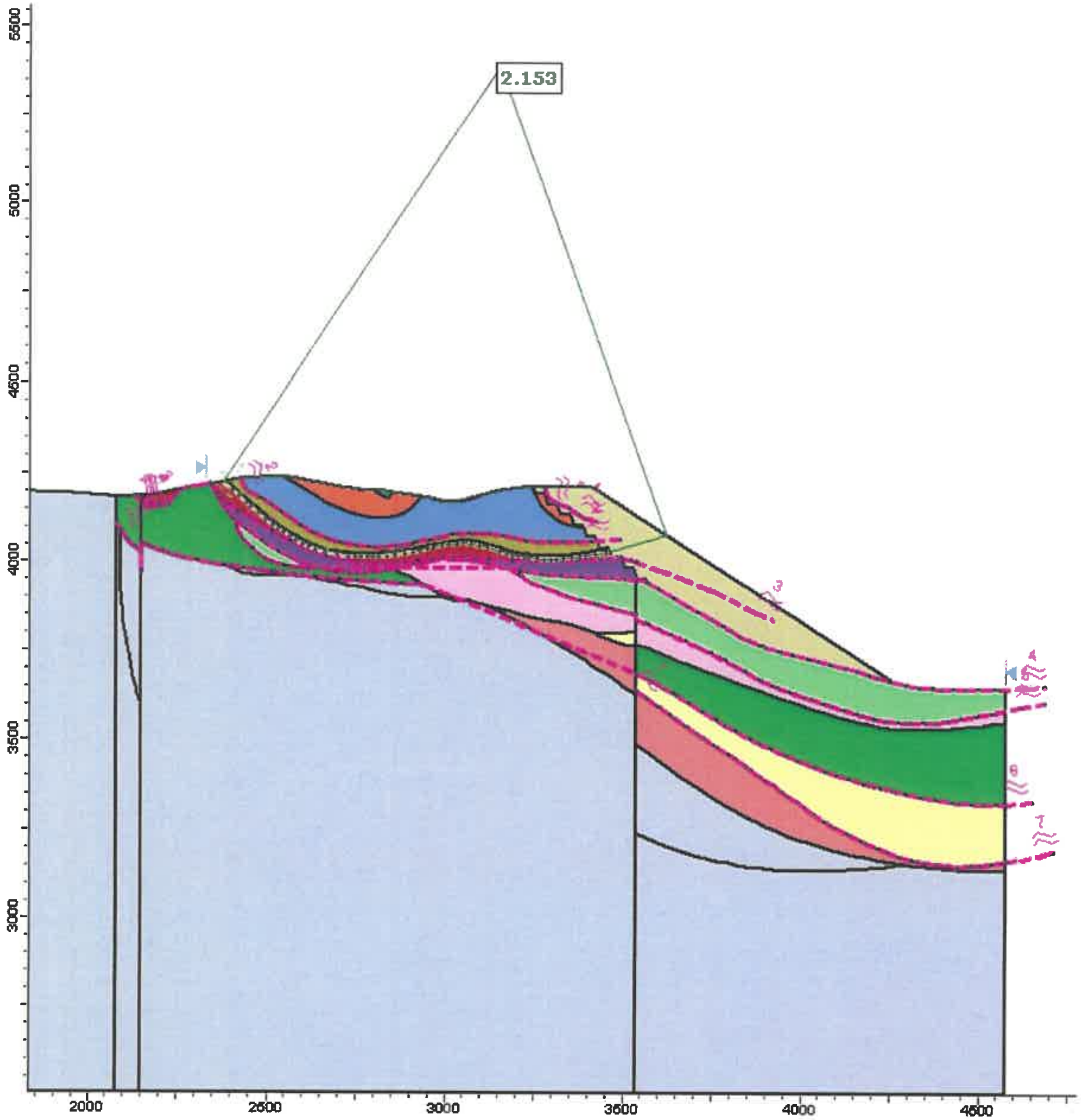
Legend

- Anisotropic Surface
- Weak Layer

Geo-Logic ASSOCIATES

SECTION TR02E-8, MIN. SLIP SURFACE FROM FINAL SLOPE CONFIG.
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	C4
PROJECT NO.	AS22.1013		



Project Title: Rhyolite Ridge, Section TR02E-9
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

Legend

- Anisotropic Surface
- Weak Layer

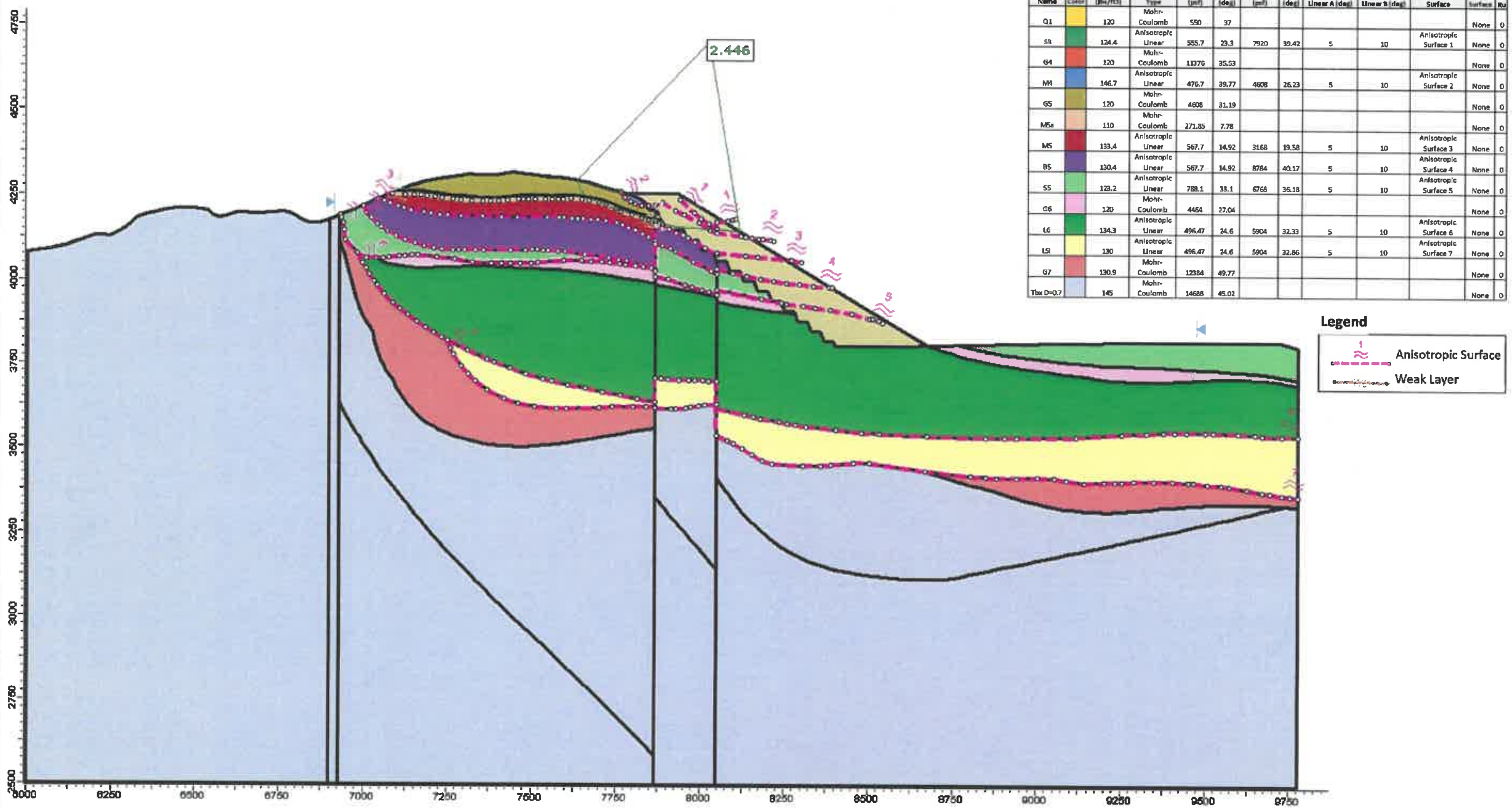
Geo-Logic ASSOCIATES

SECTION TR02E-9, MIN. SLIP SURFACE FROM FINAL SLOPE CONFIG.
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	C5
PROJECT NO.	AS22.1013		

Project Title: Rhyolite Ridge, Section TR02E-11
Analysis Method: GLE/Morgenstern-Price
Search Method: Path Search
Failure Direction: Left to Right

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion 2 (psf)	Phi 2 (deg)	Anisotropic Linear A (deg)	Anisotropic Linear B (deg)	Anisotropic Surface	Water Surface	Ru
Q1		120	Mohr-Coulomb	550	37						None	0
S3		124.4	Anisotropic Linear	555.7	23.3	7920	39.42	5	10	Anisotropic Surface 1	None	0
G4		120	Mohr-Coulomb	11376	35.53						None	0
M4		146.7	Anisotropic Linear	476.7	39.77	4608	26.23	5	10	Anisotropic Surface 2	None	0
G5		120	Mohr-Coulomb	4608	31.19						None	0
M5a		110	Mohr-Coulomb	271.85	7.78						None	0
M5		133.4	Anisotropic Linear	567.7	14.92	3168	19.58	5	10	Anisotropic Surface 3	None	0
B5		130.4	Anisotropic Linear	567.7	14.92	8784	40.17	5	10	Anisotropic Surface 4	None	0
S5		123.2	Anisotropic Linear	788.1	33.1	6768	36.18	5	10	Anisotropic Surface 5	None	0
G6		120	Mohr-Coulomb	4464	27.04						None	0
L6		134.3	Anisotropic Linear	496.47	24.6	5904	32.33	5	10	Anisotropic Surface 6	None	0
LSI		130	Anisotropic Linear	496.47	24.6	5904	32.86	5	10	Anisotropic Surface 7	None	0
G7		130.9	Mohr-Coulomb	12384	49.77						None	0
Tbx D=0.7		145	Mohr-Coulomb	14688	45.02						None	0

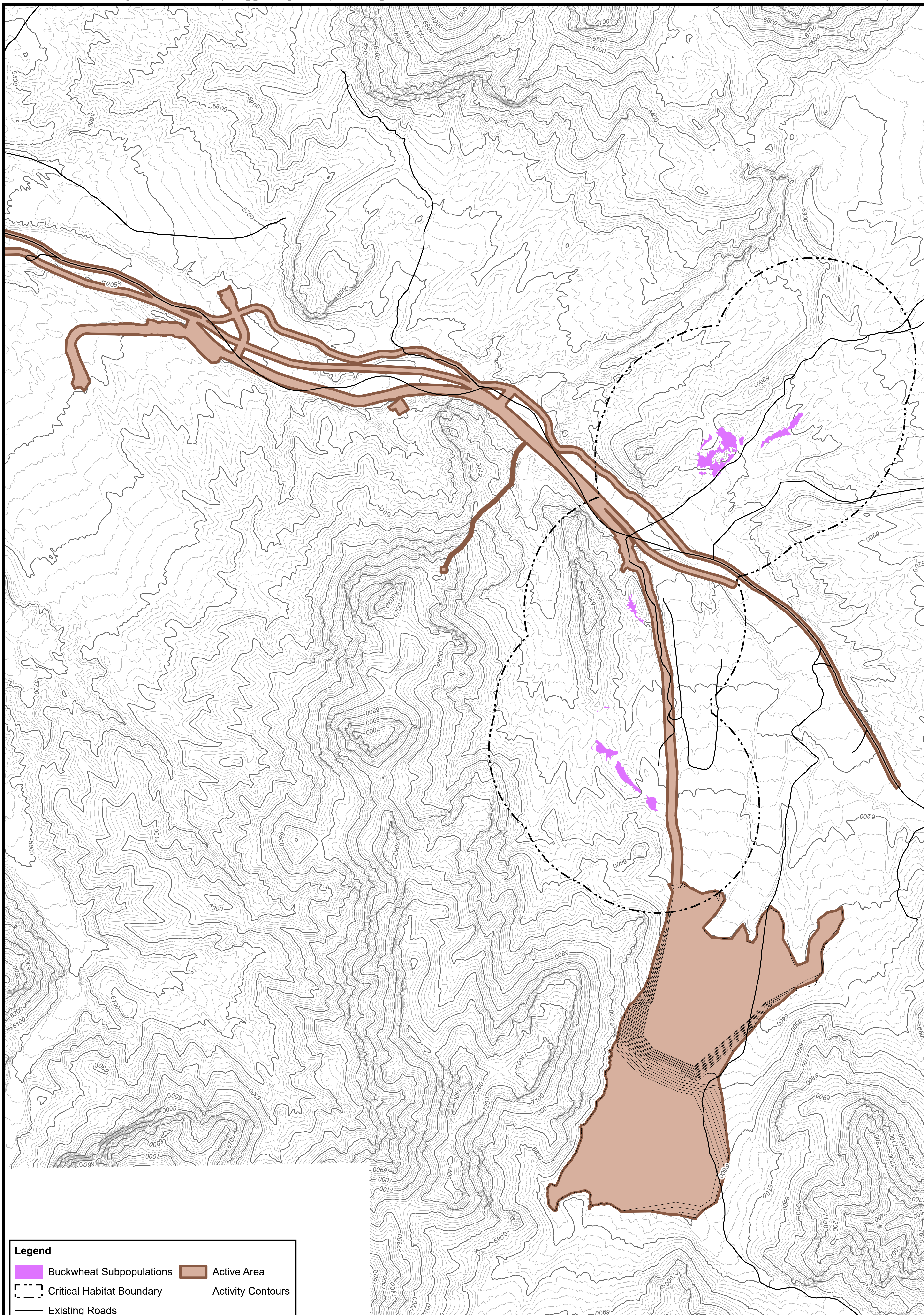


Geo-Logic ASSOCIATES

SECTION TR02E-11, MIN. SLIP SURFACE FROM FINAL SLOPE CONFIG.
SUPPLEMENTAL GEOTECHNICAL REPORT
RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

DATE:	March 2023	FIGURE NO.	C6
PROJECT NO.	AS22.1013		

ATTACHMENT G
Concurrent Reclamation within Tiehm's Buckwheat Critical Habitat



T1S, R37E, Portions of Sections 22, 27-29, 33-35 (Unsurveyed Protracted),
T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N

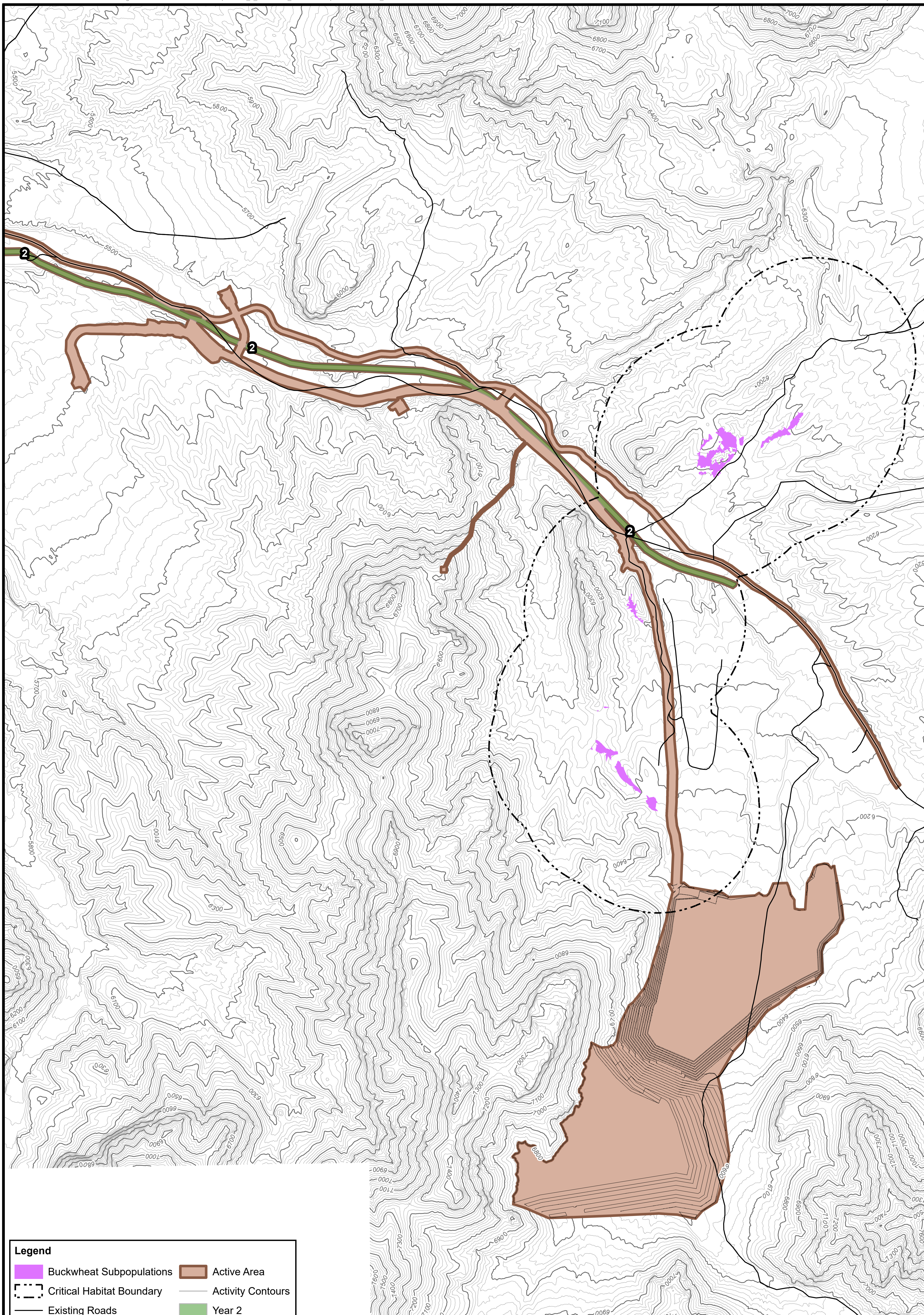
0 750 1,500 Feet

0 250 500 Meters

WestLand 100% EMPLOYEE OWNED Engineering & Environmental Services

IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 1
Attachment G



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T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N
0 750 1,500 Feet
0 250 500 Meters

IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 2
Attachment G

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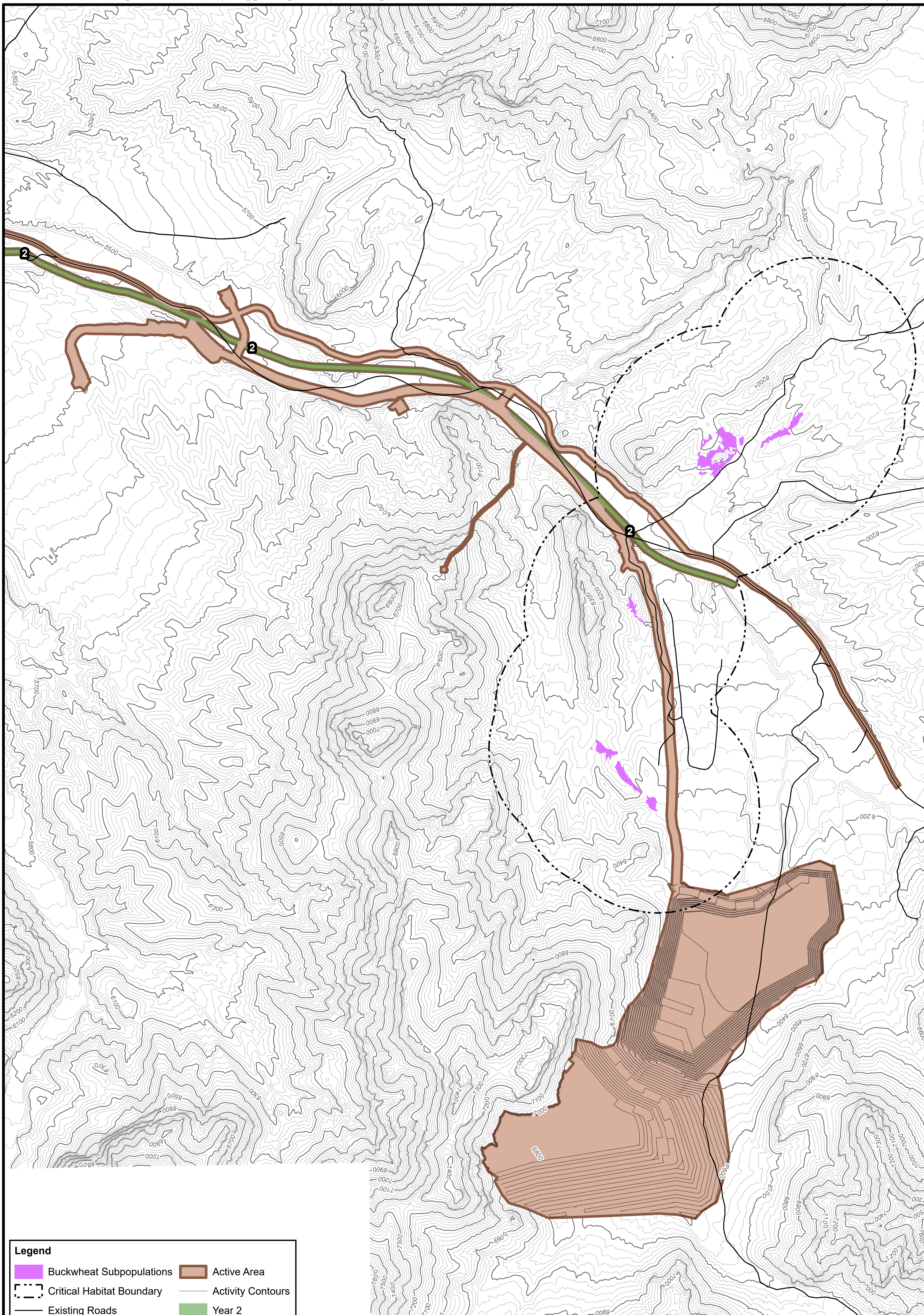

T1S, R37E, Portions of Sections 22, 27-29, 33-35 (Unsurveyed Protracted),
T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N

0 750 1,500 Feet

0 250 500 Meters

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IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 3
Attachment G

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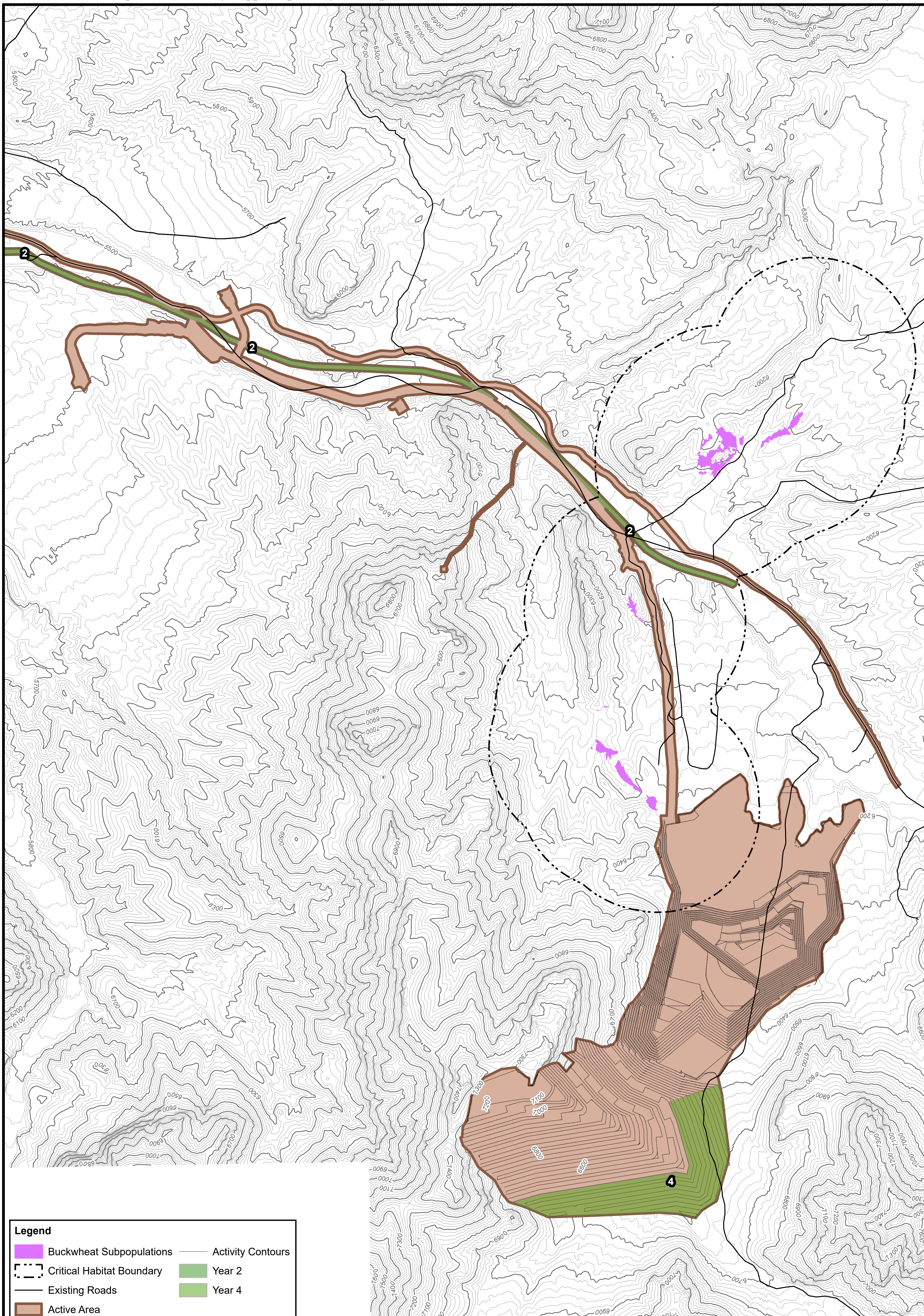

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T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N

0 750 1,500 Feet

0 250 500 Meters

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IONEER RHYOLITE RIDGE LLC

Rhyolite Ridge Lithium-Boron Mine Project

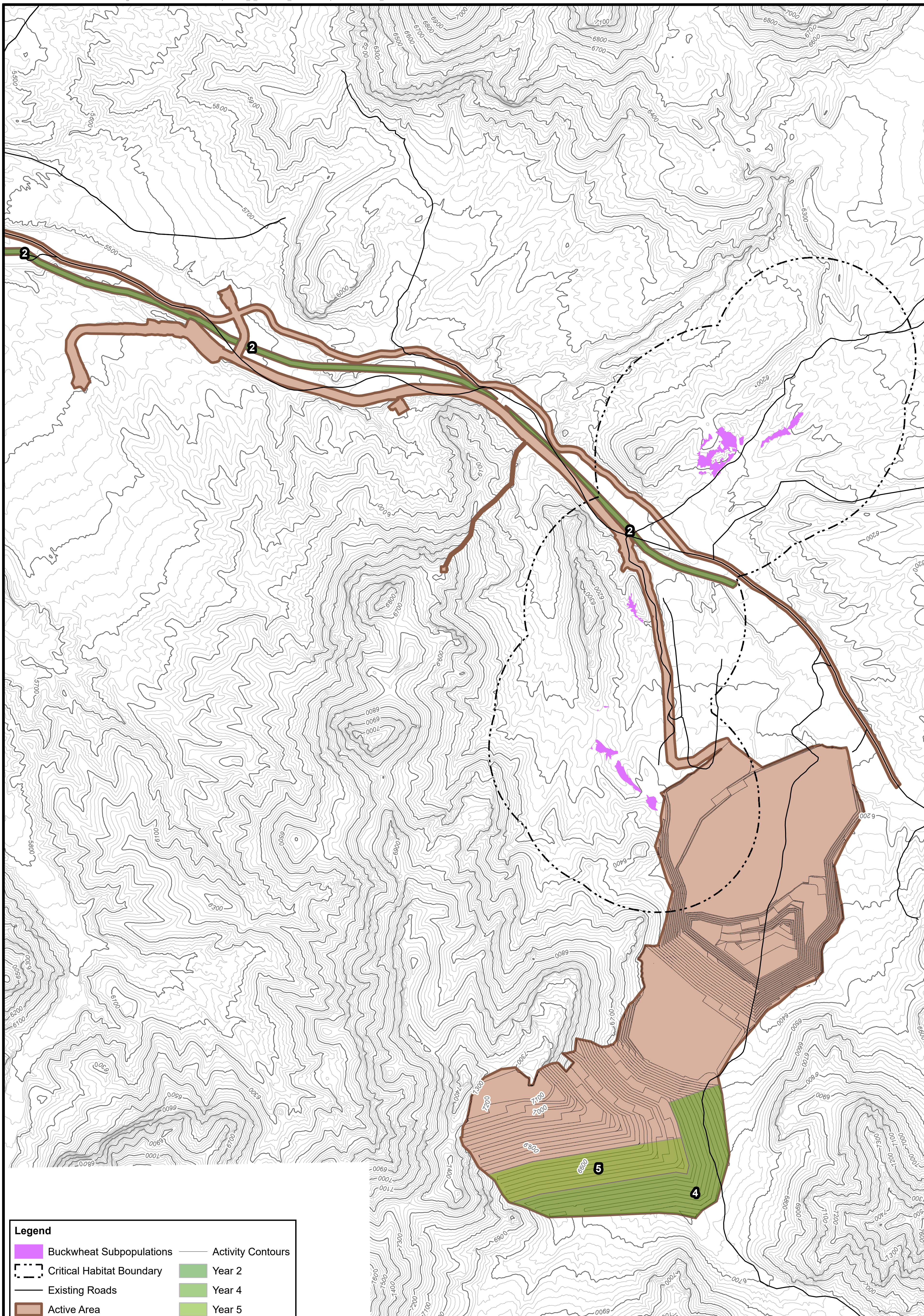
Buckwheat Protection Plan:

Applicant Proposed Conservation Measures

for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 4

Attachment G



T1S, R37E, Portions of Sections 22, 27-29, 33-35 (Unsurveyed Protracted),
T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N 0 750 1,500 Feet
0 250 500 Meters

WestLand 100% EMPLOYEE OWNED Engineering & Environmental Services

IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 5
Attachment G

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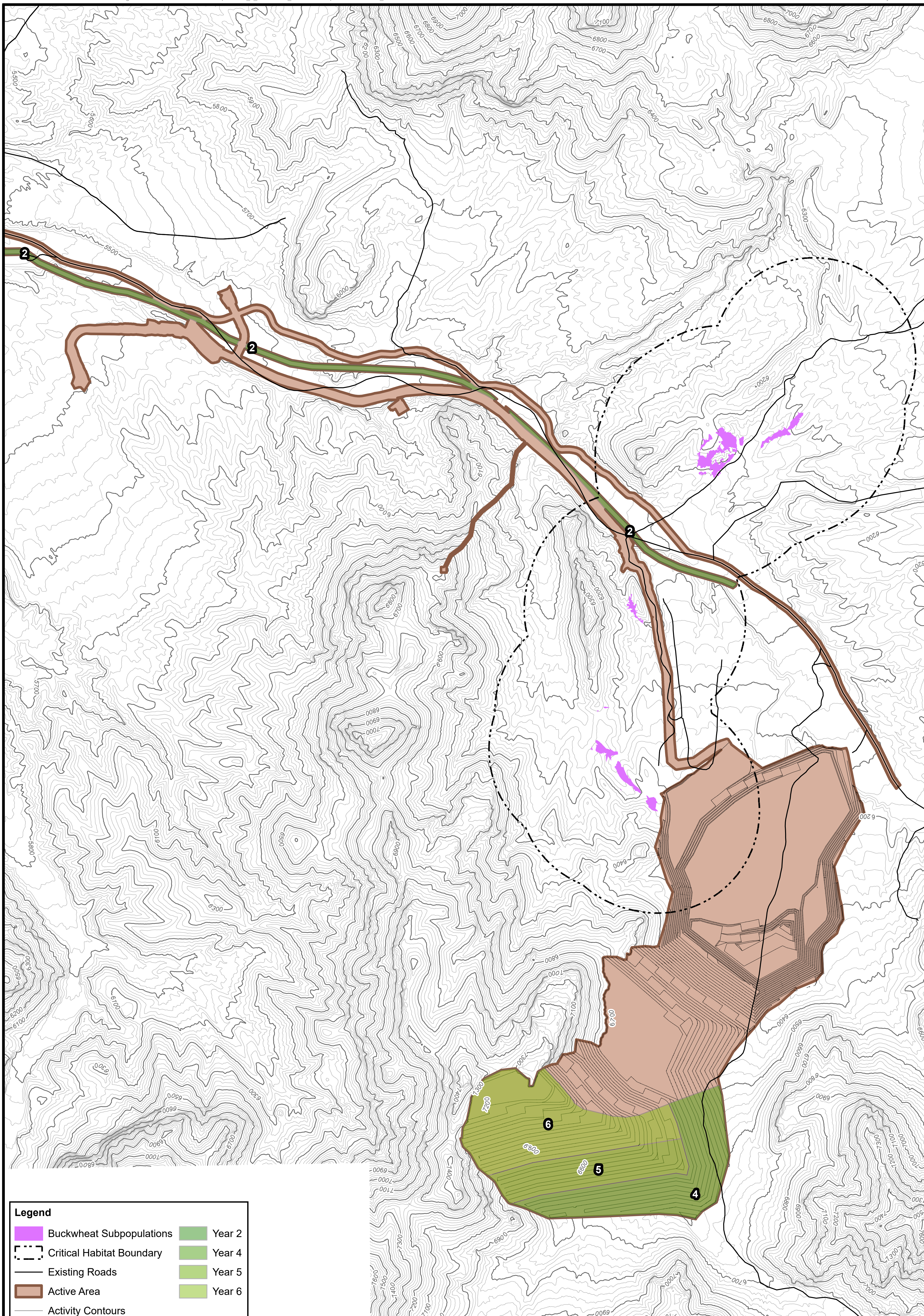

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T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N

0 750 1,500 Feet

0 250 500 Meters

WestLand 100% EMPLOYEE OWNED Engineering & Environmental Services

IONEER RHYOLITE RIDGE LLC

Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 6

Attachment G

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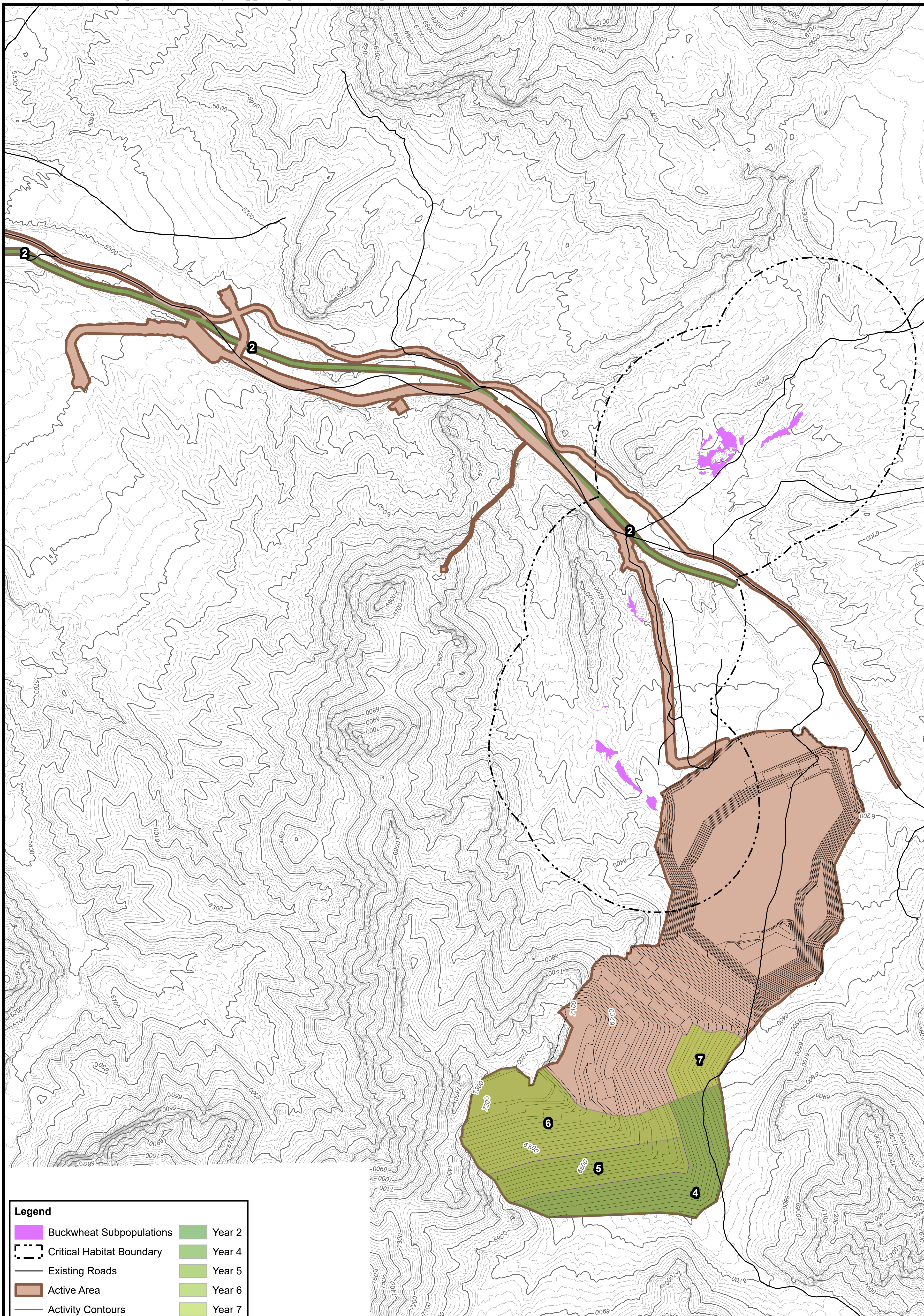

T1S, R37E, Portions of Sections 22, 27-29, 33-35 (Unsurveyed Protracted),
T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N

0 750 1,500 Feet

0 250 500 Meters

WestLand
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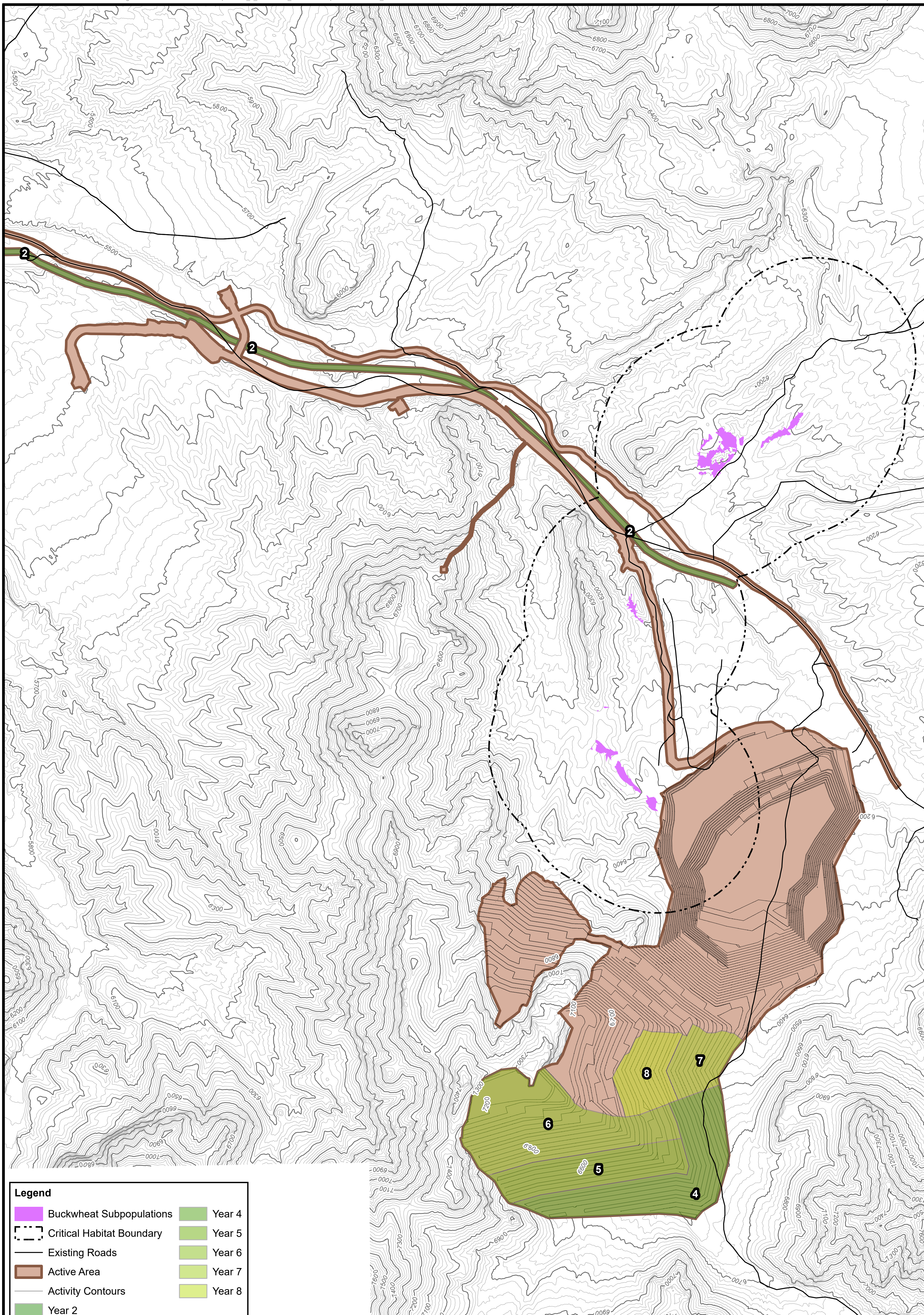
Engineering & Environmental Services

IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 7
Attachment G



T1S, R37E, Portions of Sections 22, 27-29, 33-35 (Unsurveyed Protracted),
T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N

0 750 1,500 Feet

0 250 500 Meters

IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 8
Attachment G

WestLand
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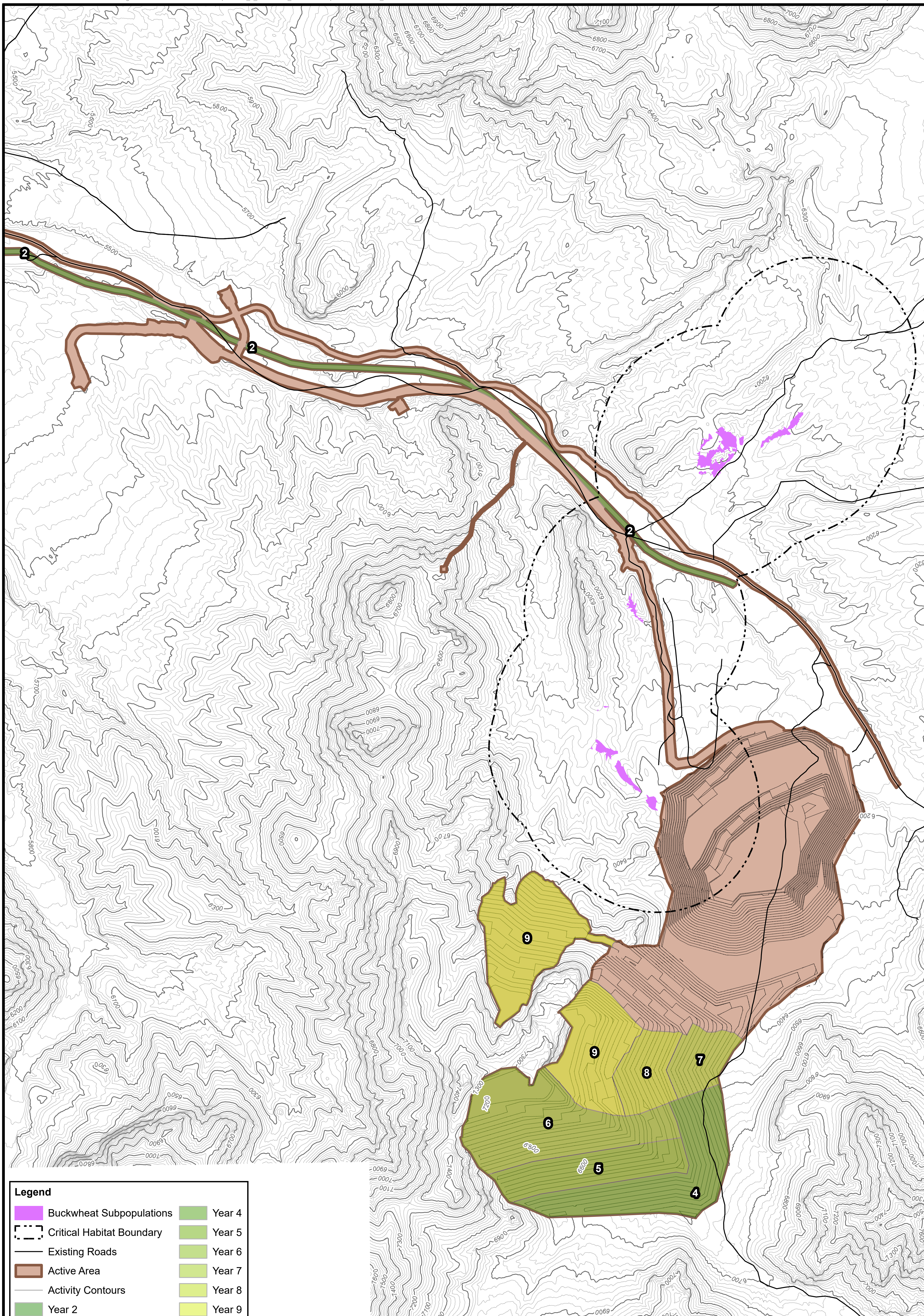

T1S, R37E, Portions of Sections 22, 27-29, 33-35 (Unsurveyed Protracted),
T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N
0 750 1,500 Feet
0 250 500 Meters

WestLand Engineering & Environmental Services
100% EMPLOYEE OWNED

IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 9
Attachment G

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T1S, R37E, Portions of Sections 22, 27-29, 33-35 (Unsurveyed Protracted),
T2S, R37E, Portions of Sections 2-4, 9 and 10 (Unsurveyed Protracted),
Esmeralda County, Nevada
Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

N

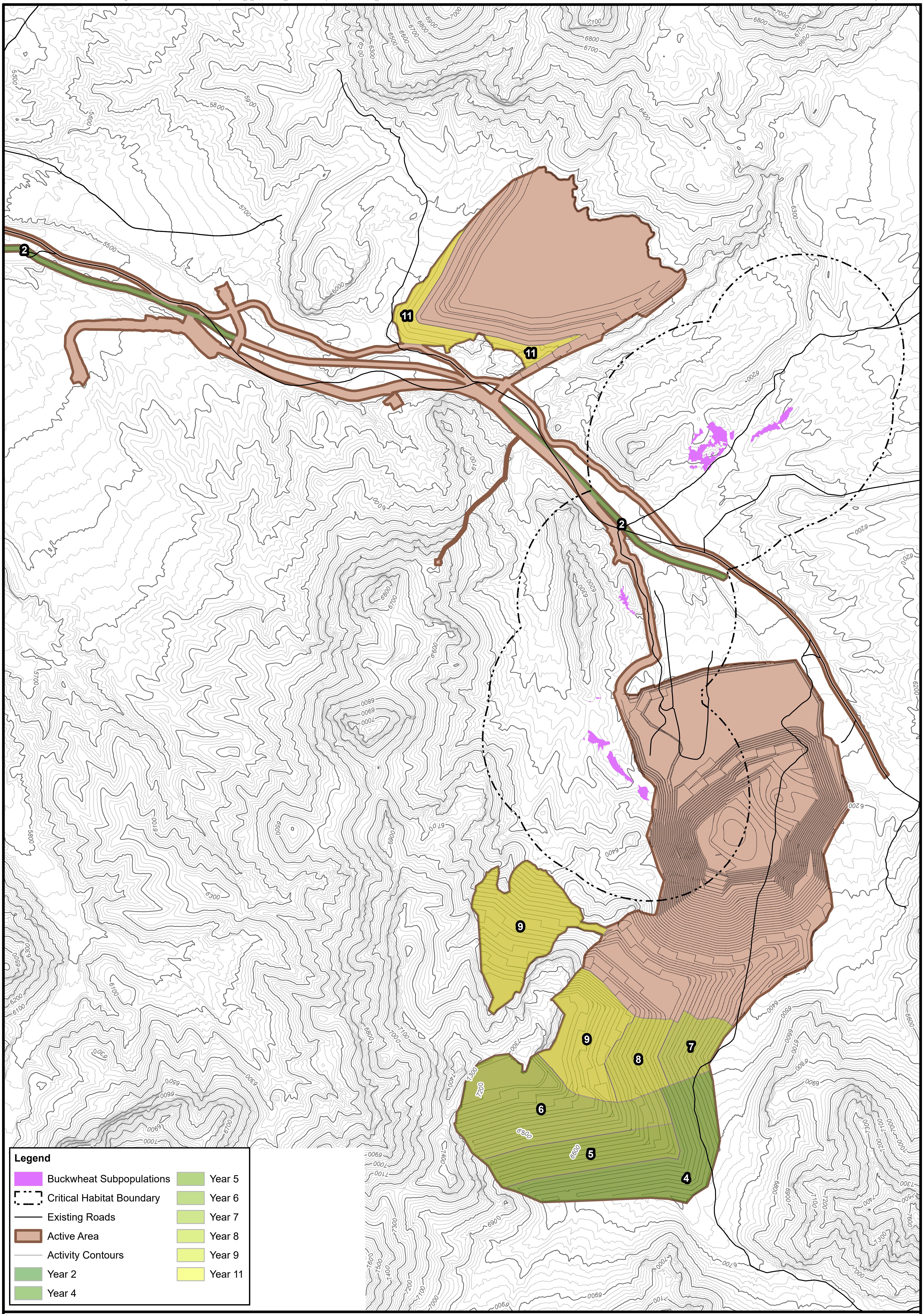
0 750 1,500 Feet

0 250 500 Meters

WestLand
100% EMPLOYEE OWNED
Engineering & Environmental Services

IONEER RHYOLITE RIDGE LLC
Rhyolite Ridge Lithium-Boron Mine Project
Buckwheat Protection Plan:
Applicant Proposed Conservation Measures
for Tiehm's Buckwheat and its Critical Habitat

QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 10
Attachment G



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Rhyolite Ridge and Rhyolite Ridge SW USGS 7.5' Quadrangles
Projection: NAD 1983 StatePlane Nevada West FIPS 2703 Feet
Data Source: Quarry Sequence and Elevation data provided by Ioneer Rhyolite Ridge, LLC

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 11
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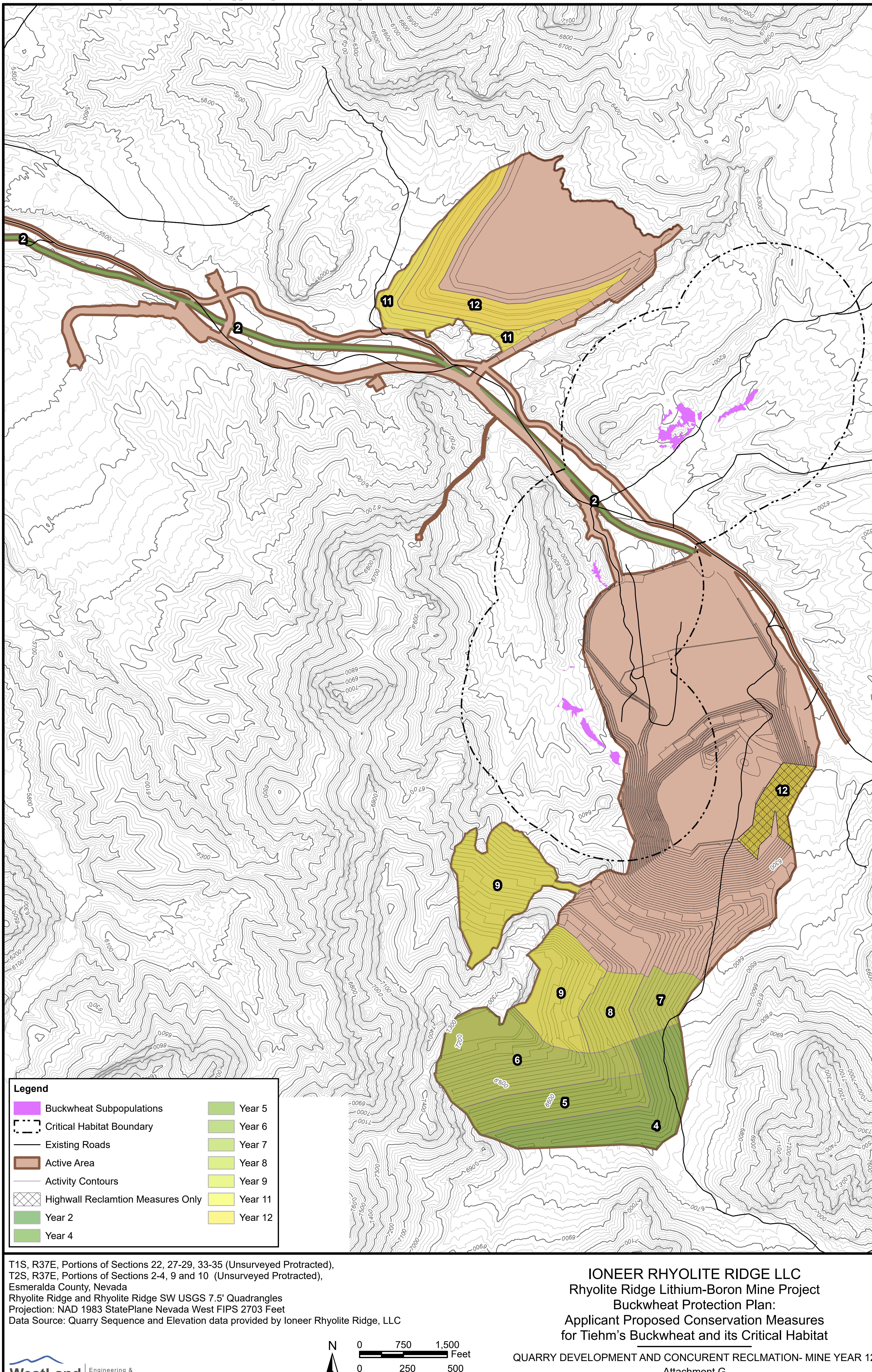

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 12
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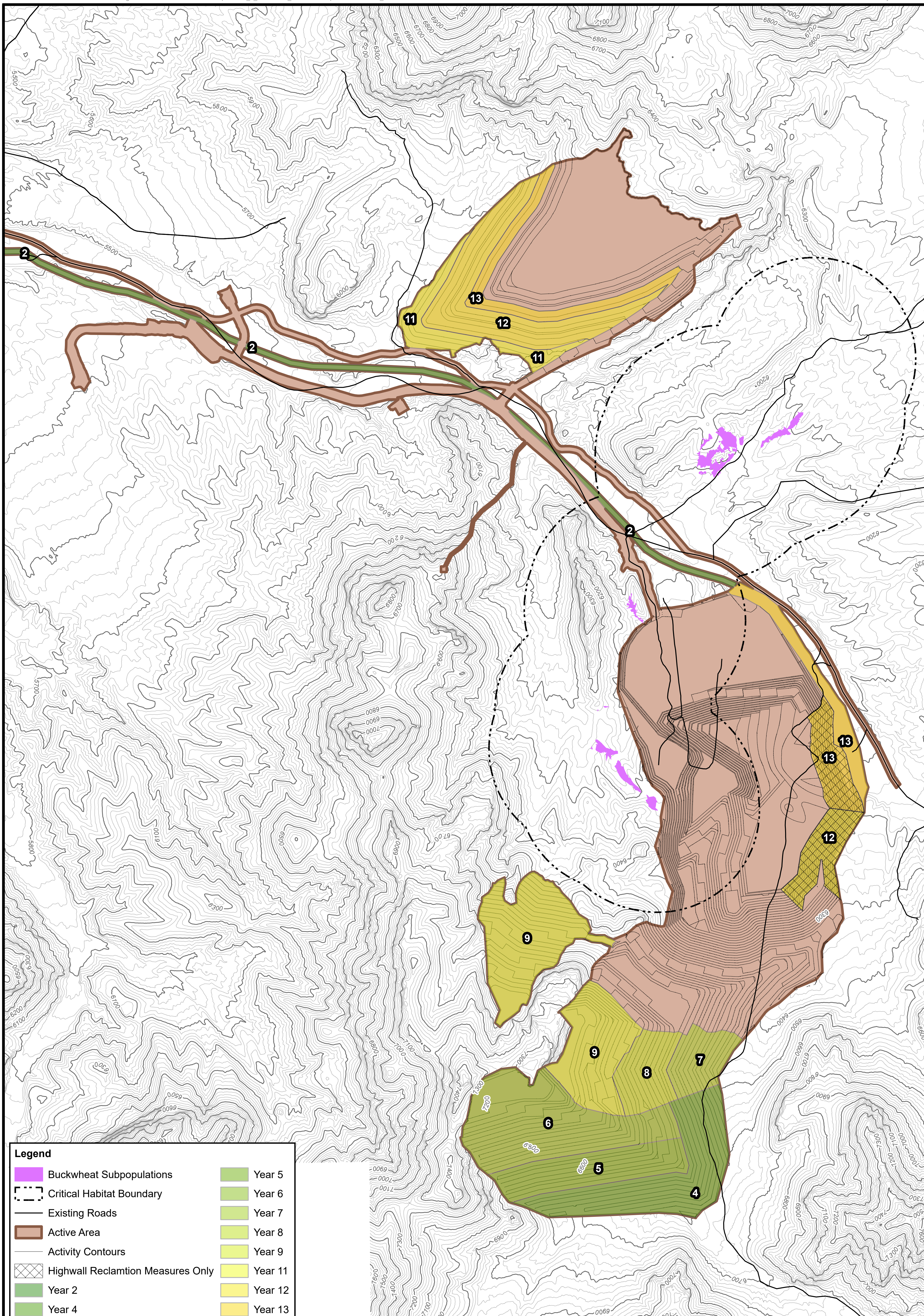

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 13
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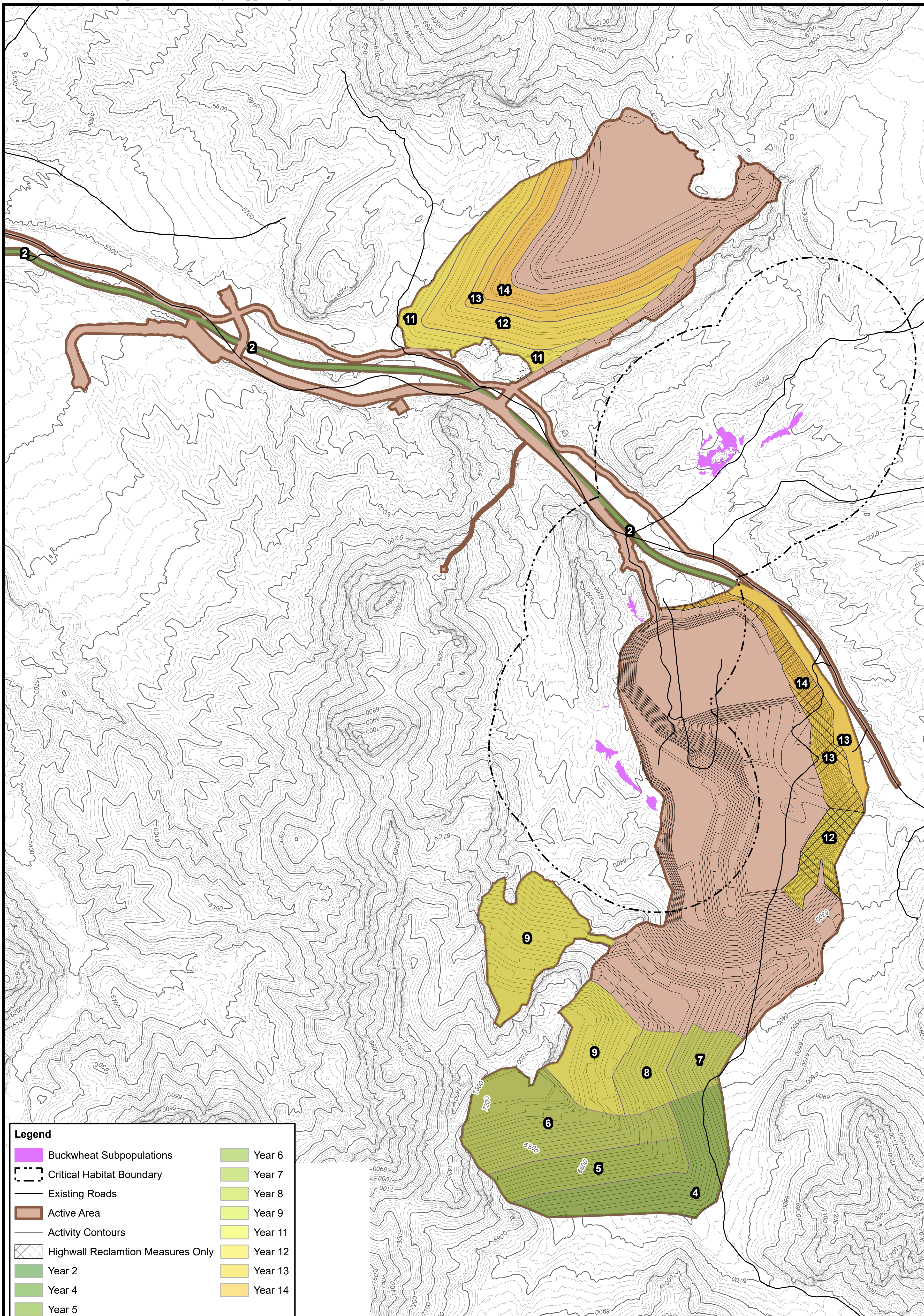

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 14
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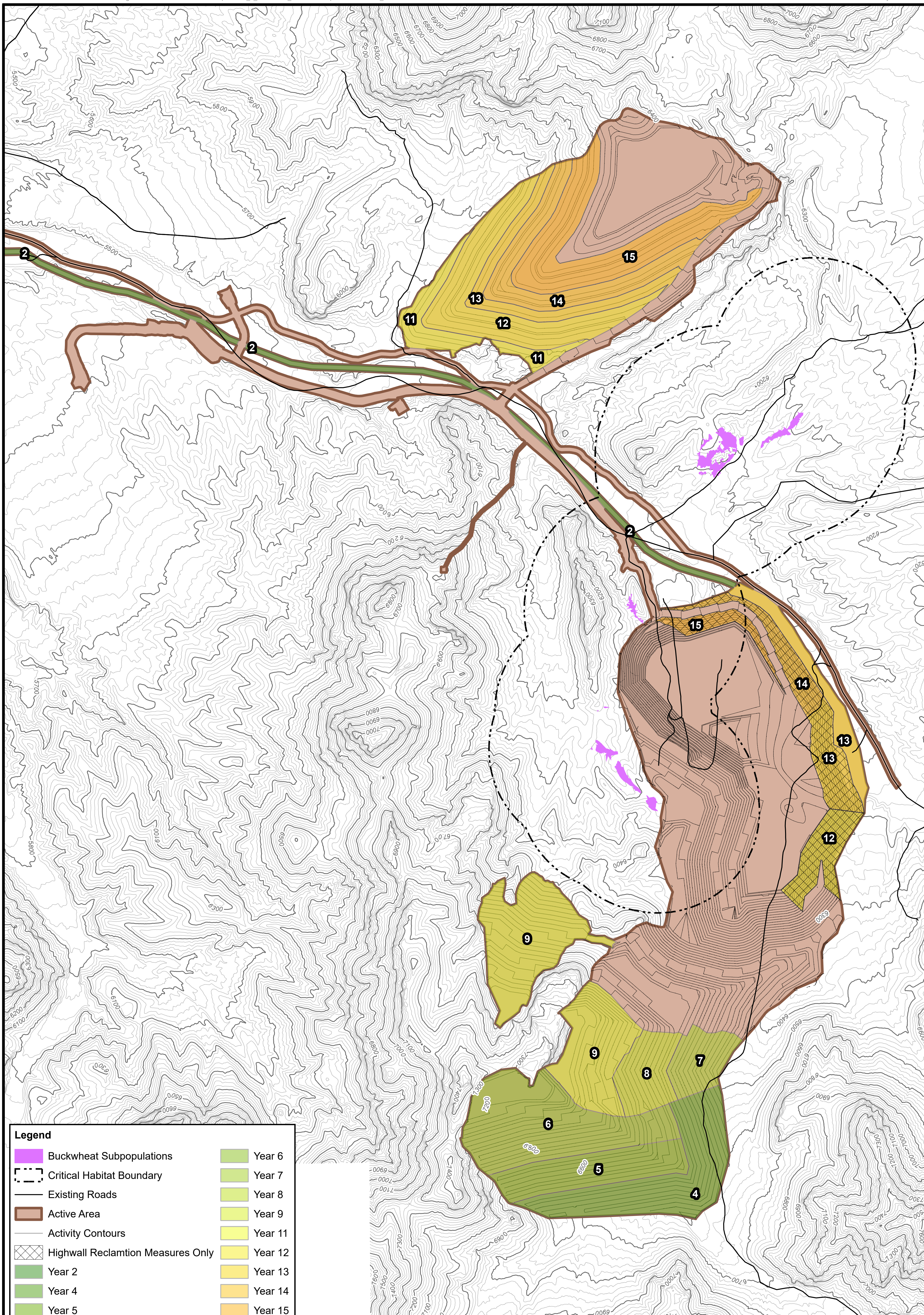

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 15
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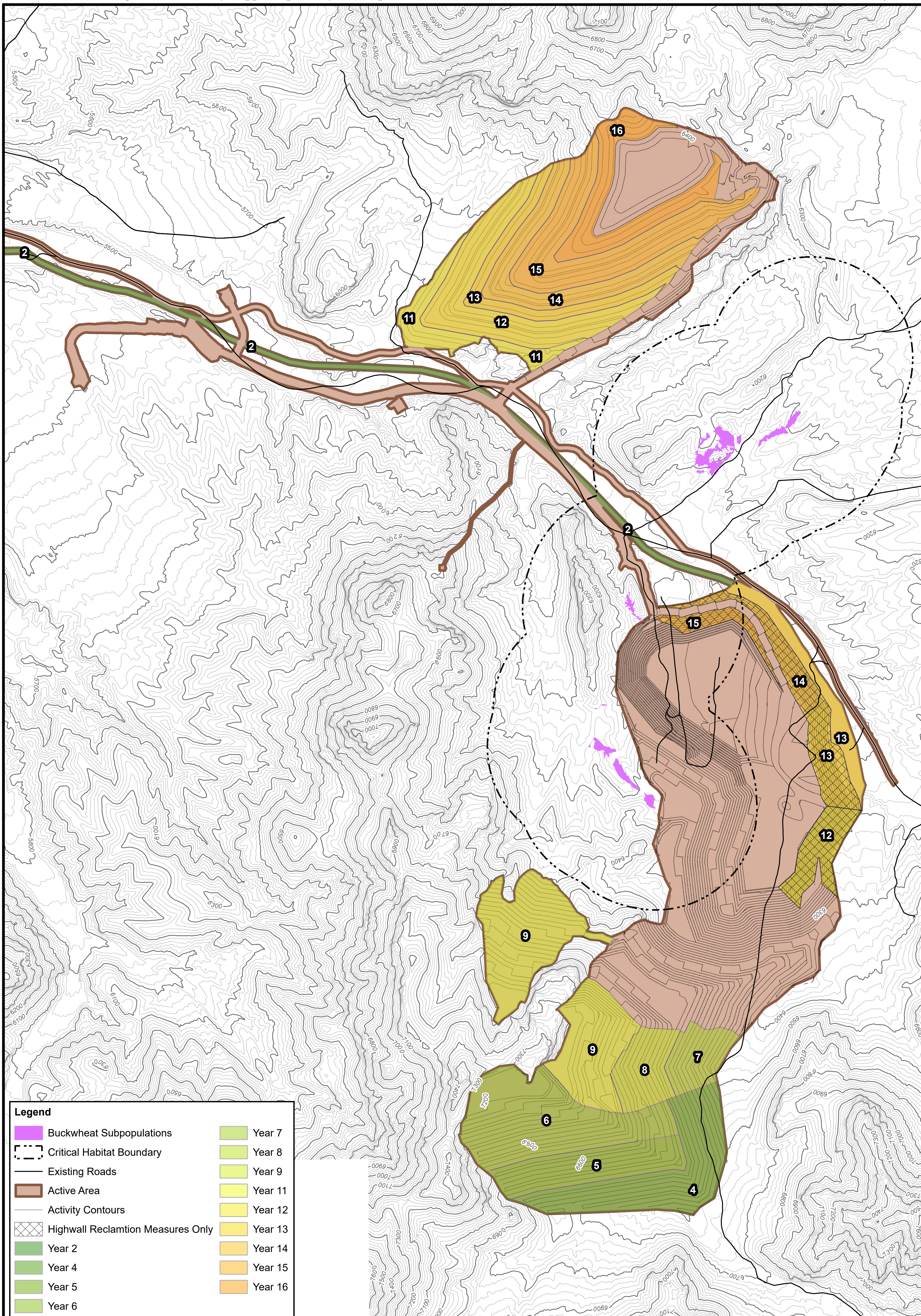

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 16
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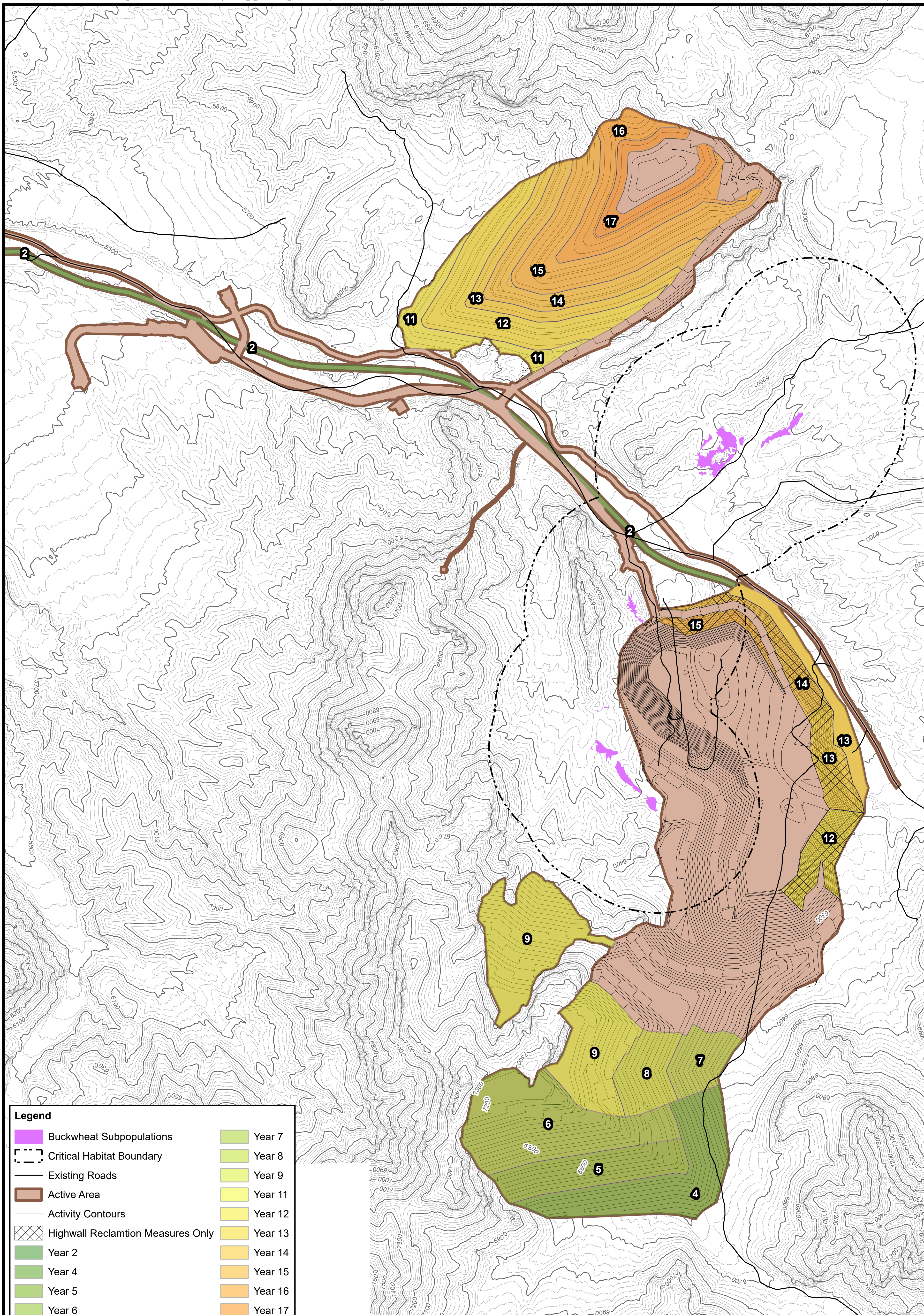

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 17

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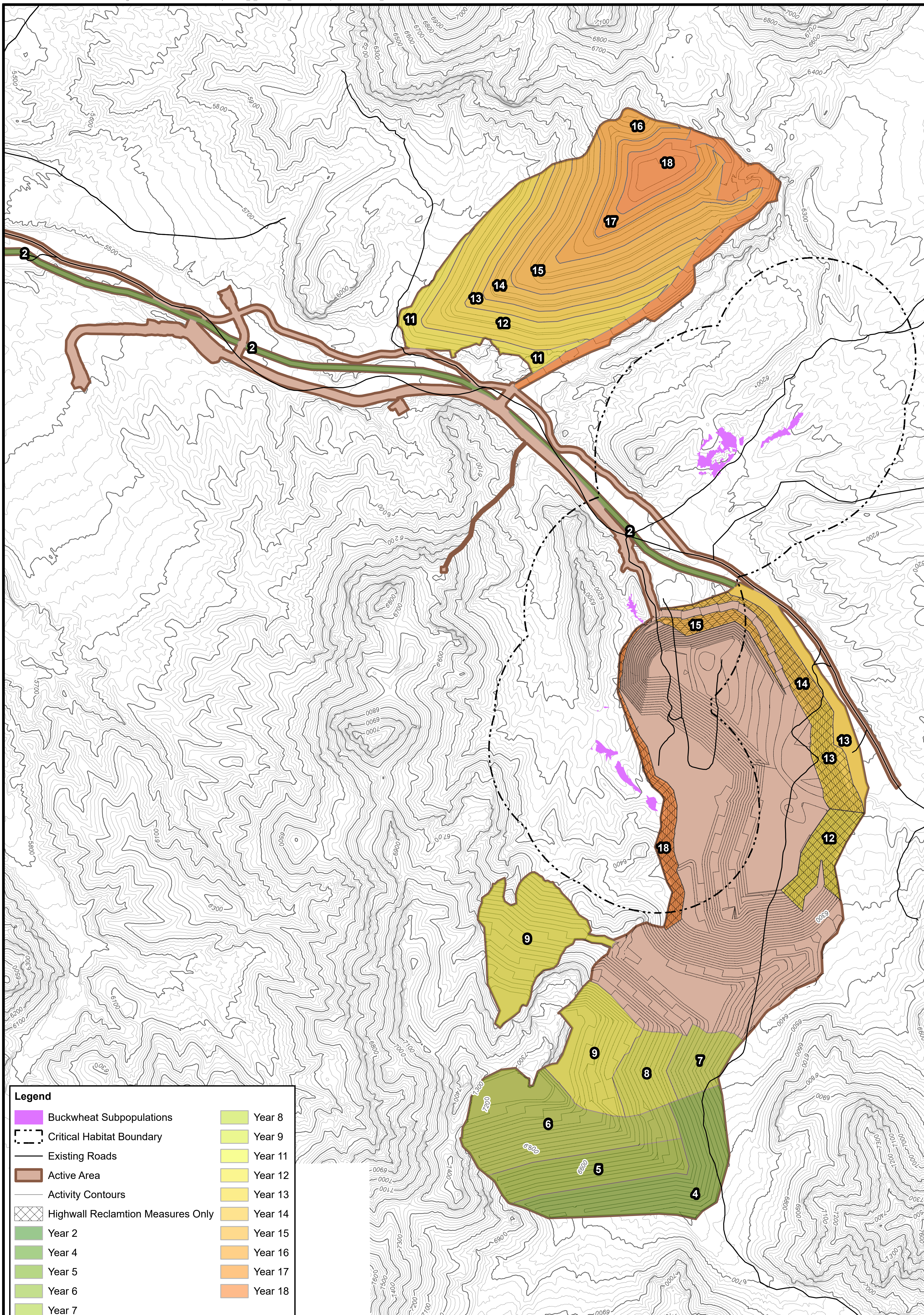

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 18
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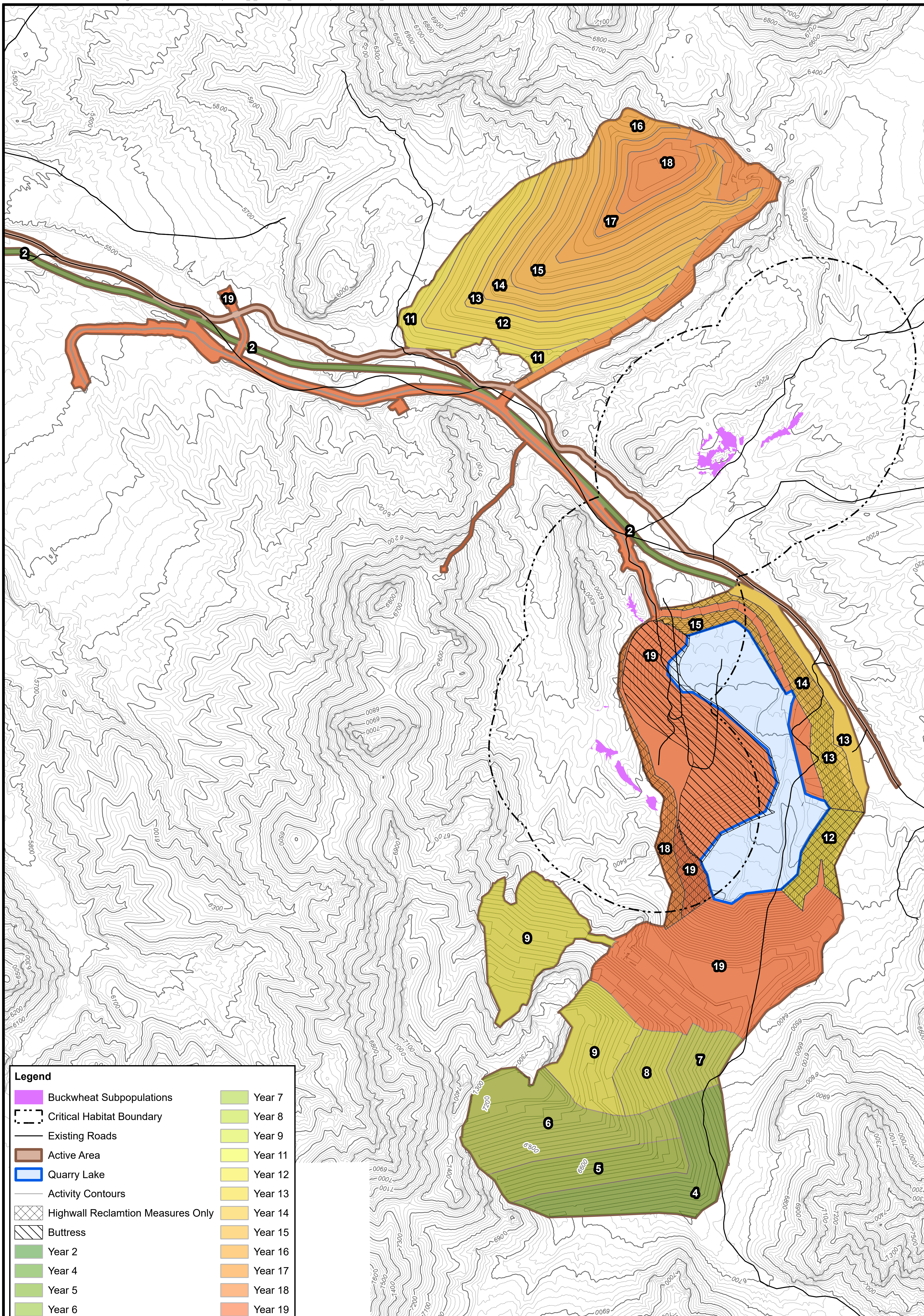

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 19
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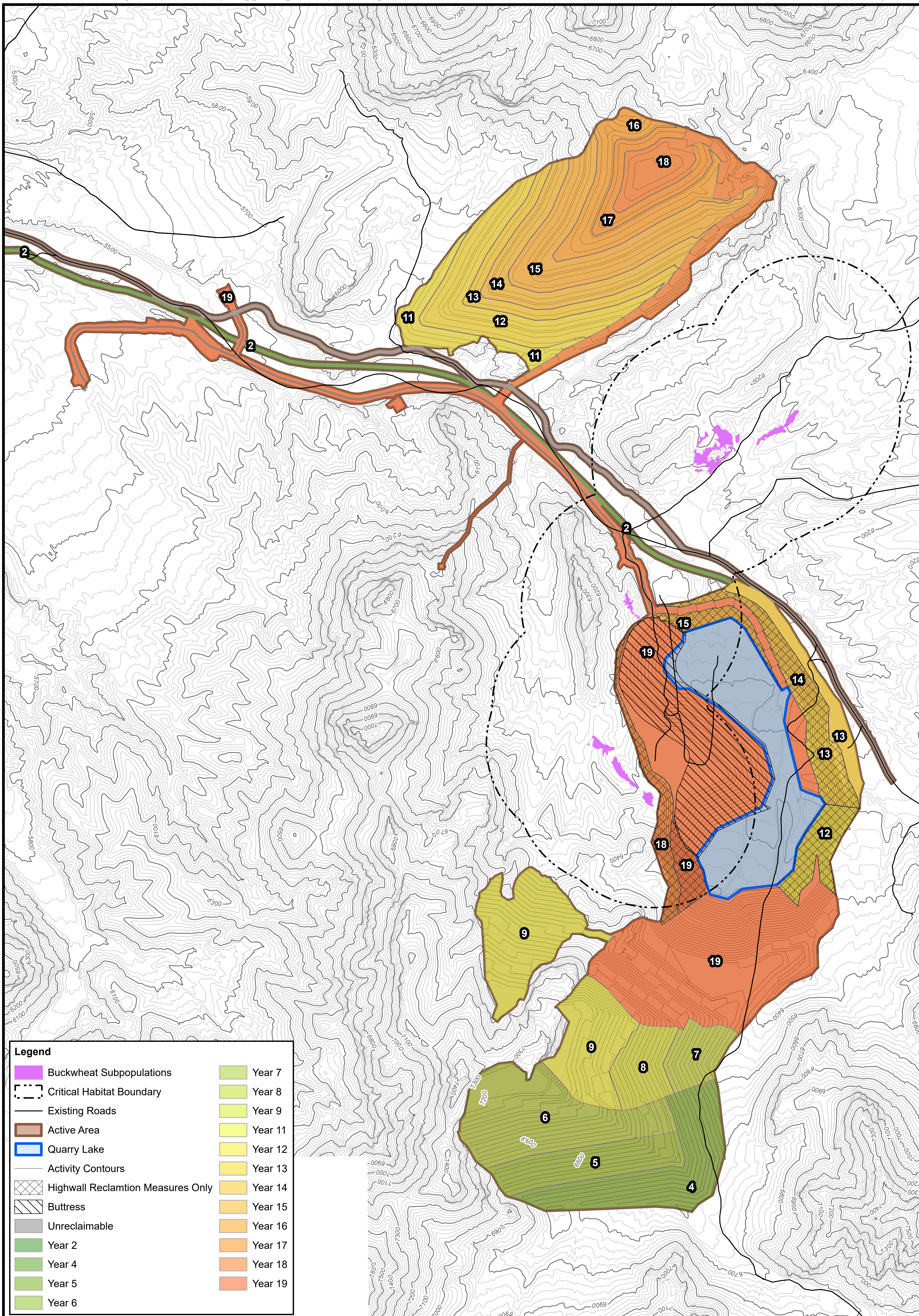

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 20
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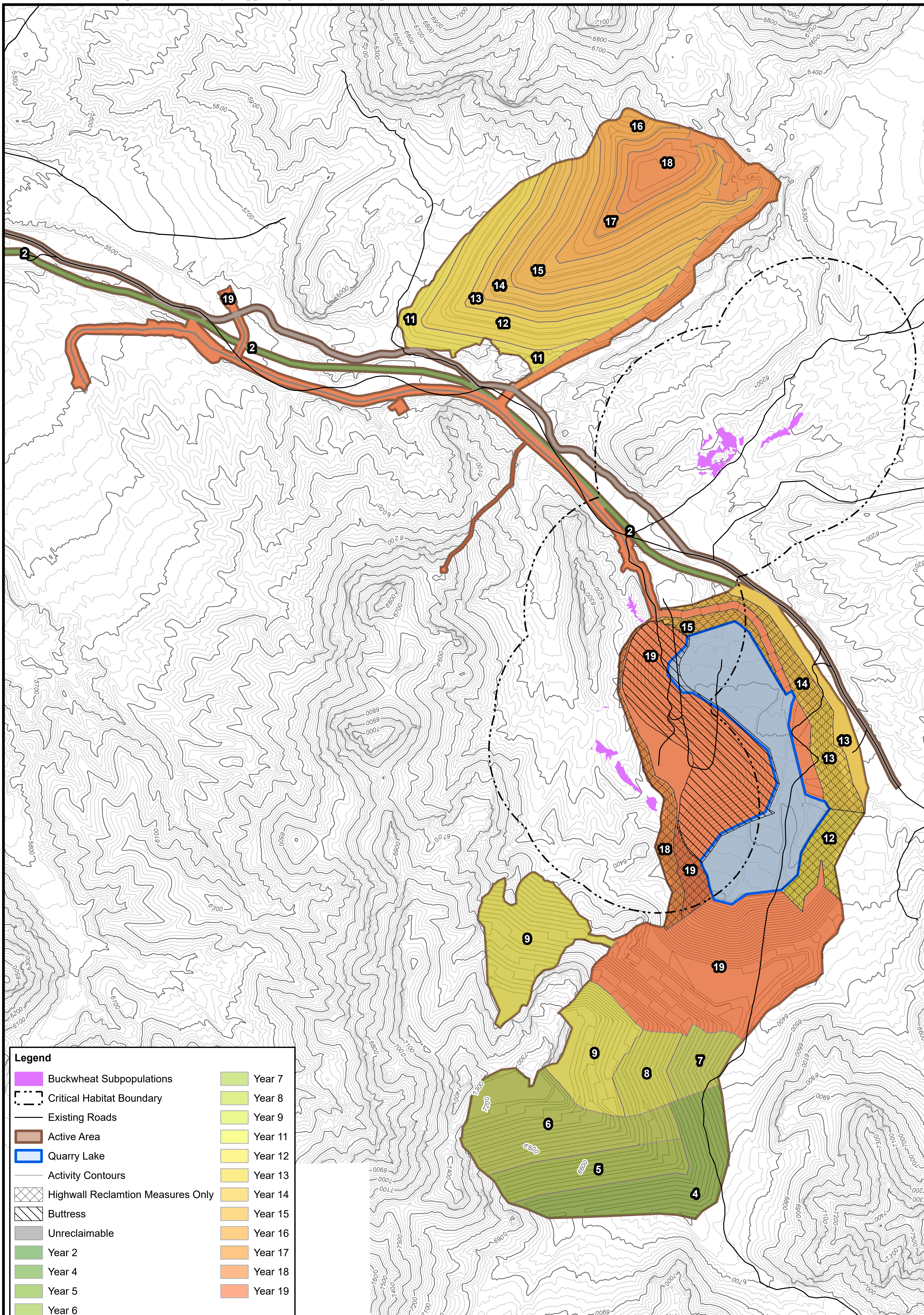

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 21
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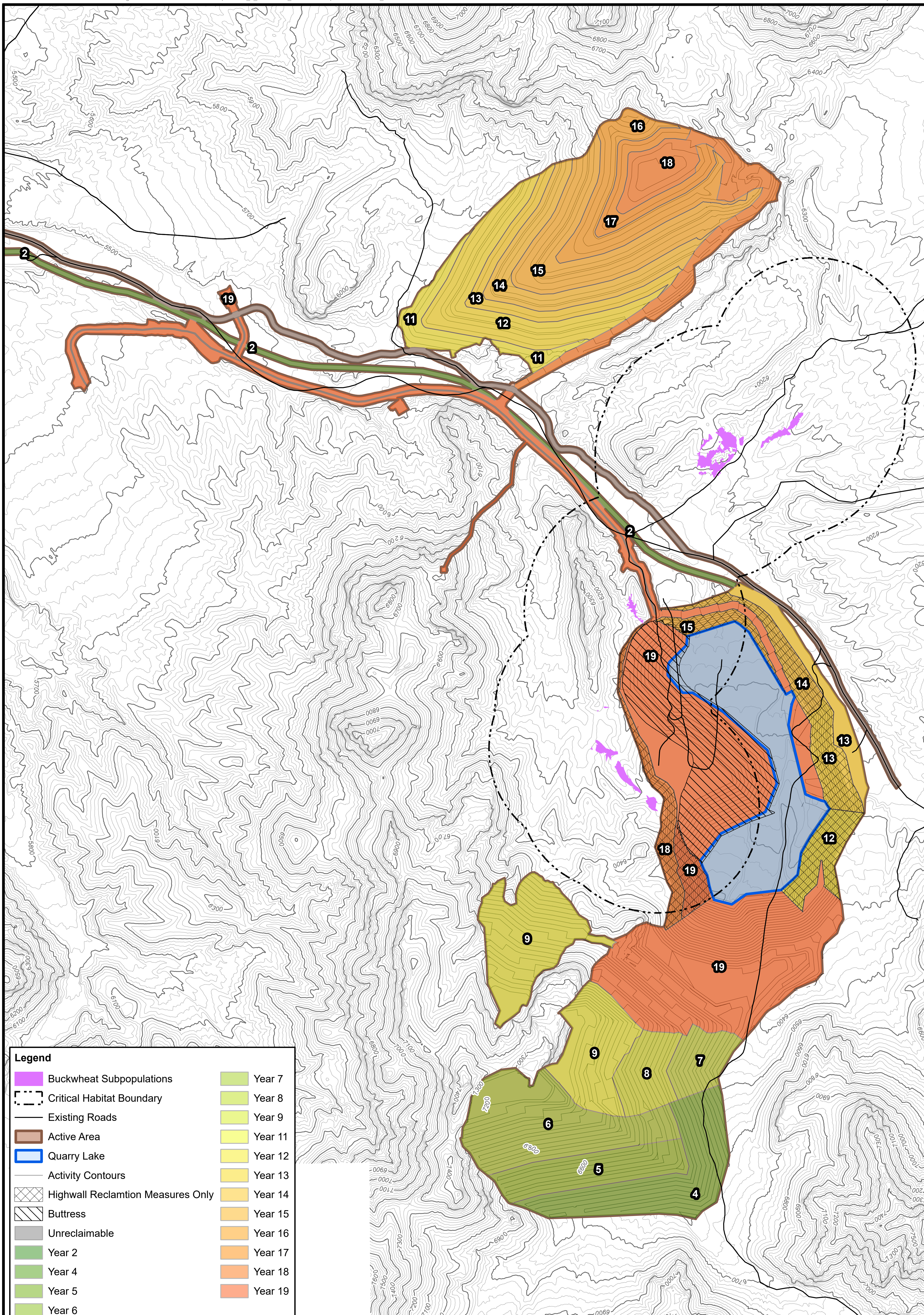

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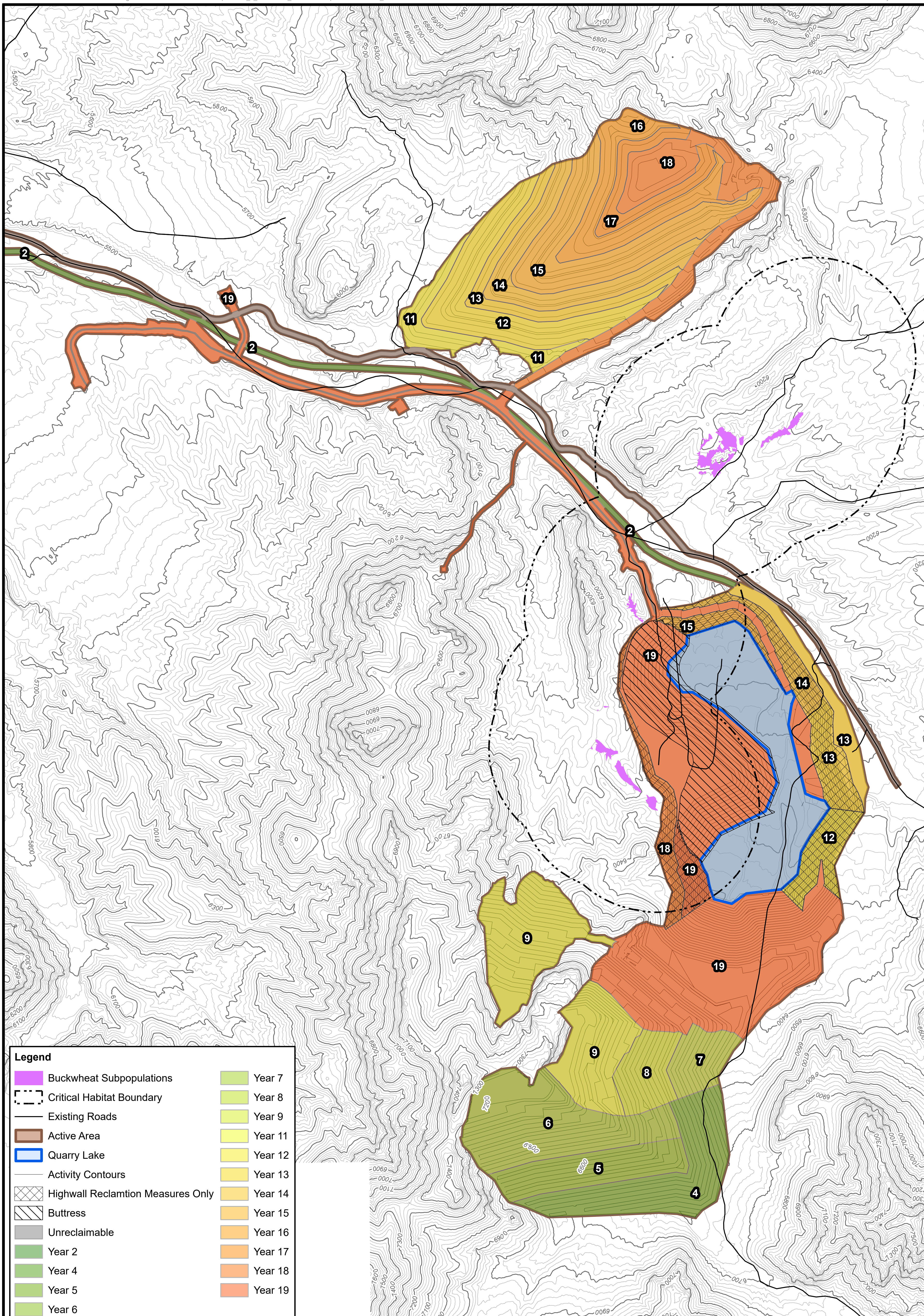

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QUARRY DEVELOPMENT AND CONCURENT RECLMATION- MINE YEAR 23
Attachment G

ATTACHMENT H
Particulate Matter Impact Analysis on Tiehm's Buckwheat

Trinity Consultants. 2023a. Ioneer Rhyolite Ridge – Particulate Matter Impact Analysis on Tiehm's Buckwheat Population Using a Surface Material Silt Content of 1.7%

______ 2023b. Ioneer Rhyolite Ridge – Particulate Matter Impact Analysis on Tiehm's Buckwheat Population Using a Surface Material Silt content of 6.4%

MEMORANDUM

To: Jim Tress (Westland Engineering and Environmental Services)

From: Eddie Al-Rayes (Trinity Consultants)

Date: June 15, 2023

RE: Ioneer Rhyolite Ridge – Particulate Matter Impact Analysis on Tiehm's Buckwheat Population Using a Surface Material Silt Content of 1.7%

Introduction

Trinity Consultants (Trinity) provided support for Westland Engineering and Environmental Services (Westland) and client, Ioneer USA Corporation (ioneer), by completing a determination of potential deposition of particulate matter (PM) from a haul road proximate to the Tiehm's Buckwheat (buckwheat) population located near the Rhyolite Ridge Lithium Boron Project (Project). The analysis considered particulate matter (PM) from the proposed haul road as well as haul truck tailpipe PM emissions. The analysis was conducted based on haul truck traffic during two operation years, Year 3 (2 haul truck round trips per day passing population 3 and 6, and Year 11 (525 haul truck round trips per day passing population 3). The results of the analysis were utilized by Westland to support assessment of the efficacy of Applicant Proposed Conservation Measures to be submitted to the Bureau of Land Management and United States Fish and Wildlife Service in support of ongoing permitting efforts for the Project.

Emission Calculations

Total PM emissions were calculated using road dust and tailpipe emissions. Detailed emission calculations can be found in Appendix A for Year 3 and Year 11. The methodology to calculate road dust and tailpipe emissions are discussed below.

Watering Intensity

The road dust emission calculations are affected by the dust control efficiency due to frequent watering on the haul road. The dust control efficiency is a function of the time between each reapplication of water and can be calculated using the following equation, found in the Air Pollution Engineering Manual, Chapter 4.

$$C = 100 - \left(\frac{0.8pdt}{i}\right)$$

Where:

C = average control efficiency (%)
p = potential average hourly daytime evaporation rate (mm/h)
p = 0.0049 x (Mean Annual Class A Pan Evaporation), for annual conditions
p = 0.0065 x (Mean Annual Class A Pan Evaporation), for summer conditions
Mean Annual Class A Pan Evaporation (inches) is obtained from Figure 4, Air Pollution Engineering Manual , Chapter 4, Fugitive Emissions, and estimated to be 80 inches in the project area
d = average hourly daytime traffic rate (h^{-1})

i = application intensity (L/m^2) = 0.8 L/m^2 for CAT 777, or similar, water truck traveling between 3 and 25 mph [The equipment can apply 0.8L/m^2 of water at speeds from 3 to 25mph. S Meyers (ioneer) pers comm with Jim Tress (WestLand).]

t = time since last application

The time between water truck applications were determined for control efficiencies between 75 and 95 percent for summer and annual periods for Years 3 and 11. A summary of the results can be found in Table 1. A full summary of values can be found in Appendix A.

Table 1. Haul Roads – Water Application Interval

Year	Season	Control Efficiency (%)	Maximum Time Between Water Truck Passes (hr)	(min)
3	Annual	75	765	45,918
3	Summer	75	577	34,615
11	Annual	75	2.92	175
11	Summer	75	2.20	132
3	Annual	80	612	36,735
3	Summer	80	462	27,692
11	Annual	80	2.33	140
11	Summer	80	1.76	105
3	Annual	85	459	27,551
3	Summer	85	346	20,769
11	Annual	85	1.75	105
11	Summer	85	1.32	79
3	Annual	90	306	18,367
3	Summer	90	231	13,846
11	Annual	90	1.17	70
11	Summer	90	0.88	53
3	Annual	93.75	191	11,480
3	Summer	93.75	144	8,654
11	Annual	93.75	0.73	44
11	Summer	93.75	0.55	33
3	Annual	95	153	9,184
3	Summer	95	115	6,923
11	Annual	95	0.58	35
11	Summer	95	0.44	26

Emissions from Tailpipes

The U.S. EPA Office of Transportation and Air Quality (OTAQ) has developed the Motor Vehicle Emission Simulator (MOVES) model as the official regulatory tool for estimating air pollutant emissions from non-road vehicles. The latest version of the model, MOVES3, was used to estimate tailpipe emissions from haul trucks using emission factor runs for Esmerelda County, Nevada in calendar year 2029, where the project is located.

Calendar year 2029 is assumed to be the "worst case year" for emission purposes. Emission factors per unit activity for vehicles and equipment will decrease in the MOVES model for each successive calendar year fleet. Fleet emissions are expected to be lower for more recent calendar years as future regulations continue to reduce fleet emissions. Therefore, calendar year 2029 emission factors in this analysis are conservative. Selection of Esmerelda County follows the accepted practice of utilizing ambient conditions and fuel properties specific to that county that are contained within MOVES and accounts for their localized effects on emissions. Actual engine sizes based on project specific data were utilized rather than MOVES default engine sizes. In the absence of project-specific data, default load factors specific to each equipment type, fuel type and engine size were extracted from MOVES. The emissions factors (grams per hp-hr) were then multiplied by the average engine size (hp) and the appropriate load factor to estimate emissions rates in terms of grams per hour. These emissions rates were in turn multiplied by the hours of anticipated activity for the haul trucks. As a conservative estimate, PM results were set equal to PM_{10}.

Emissions from Road Dust

Fugitive PM dust emissions will be generated during vehicle travel on unpaved roads. Emission from the haul road were based on emission factors, vehicle miles traveled (VMT), and control efficiency.

Emission Factor

Uncontrolled PM emission factors were calculated using the following equation from AP-42, Section 13.2.2 (November 2006):

$$EF_{Short-Term} = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}(1 - Watering\ Efficiency)$$

$$EF_{Annual} = EF_{Short-Term}\left(\frac{365-p}{365}\right)$$

Where:

E = size-specific emission factor (lb per VMT)
k = particle size multiplier, per AP-42 Table 13.2.2-2 (November 2006) = 4.9 for PM
s = surface material silt content (%) = 1.7% based on 2022 Air Quality Impact Analysis (AQIA) for the proposed project.
W = mean vehicle weight (tons)
a, b = constant, per AP-42 Table 13.2.2-2 (November 2006)
p = days per year with > 0.01 in precipitation, per AP-42 Figure 13.2.2-1 (November 2006)

The mean vehicle weight was determined for haul trucks by averaging the weight of empty and full vehicle weight.

Vehicle Miles Travelled

The distance traveled in miles on the haul road for each selected operation year (i.e., Years 3 and 11) is based on facility maps. The number of trips was provided by Westland [S Meyers (ioneer) pers. Com with Jim Tress (WestLand)]. The VMT was calculated by multiplying the number of trips and the road trip distance travelled by the vehicles.

Control Efficiency

Emissions were estimated based on watering control efficiencies of 75%, 85%, and 95% to model a range of likely emissions and deposition rates.

Air Dispersion Model Inputs

The air dispersion modeling evaluation was completed using the U.S. EPA-approved American Meteorological Society (AMS)/U.S. EPA Regulatory Model (AERMOD). The following sections provide the details associated with the modeling evaluation.

Particle Dry Deposition

The Dry Deposition option in AERMOD calculates the fraction of the particulate emissions in the plume that are removed from the plume due to interaction with the ground surface.[1] The use of this option in AERMOD requires particle size distribution data including the following:

- Mean particle diameter;
- Particle density; and
- Mass weighted particle size distribution.

Mean Particle Diameter

EPA modeling guidance does not specify default values for the particle size categories to be used in the AERMOD Dry Deposition option. As a result, the particle size categories contained in Table 2 below were used as these were accepted as part of recent National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) technical evaluations. The expected mean particle diameter of particle size ranges between 0 and 10 microns in diameter was calculated using the following formula.[2]

$$d = \left(\frac{d_1^3 + d_1^2 d_2 + d_1 d_2^2 + d_2^3}{4}\right)^{1/3}$$

where:

d = mean particle diameter
d_1 = low end of particle size category range
d_2 = high end of particle size category range

[1] Per *AERMOD Deposition Algorithms – Science Document (Revised Draft)*, located at http://www.epa.gov/scram001/7thconf/aermod/aer_scid.pdf

[2] Per page 2 of "Basic Principles of Particle Size Analysis" located at http://www.atascientific.com.au/publications/wp-content/uploads/2012/07/Basic_principles_of_particle_size_analysis_MRK034-low_res.pdf

Table 2. Particle Size Distribution - Mean Particle Diameters

Particle Size (μg)		Mean Particle Diameter (μm)
Lower	Upper	
0	3.5	2.20
3.5	5	4.29
5	7	6.06
7	8.5	7.77
8.5	10	9.27

Particle Density

A particle density of 2.798 g/cm^3 was used in the modeling analysis to represents the average density of the materials (sand, silt, and clay) on the haul roads at Ioneer.[3]

Particle Size Distribution

EPA AP-42, Section 13.2.2, provides in Equation 1a a method to calculate emission factors for unpaved industrial roads. The emission factor multipliers for Equation 1a were used to determine the distribution of emissions for PM_{30}, PM_{10}, and $PM_{2.5}$ by calculating the percentage of PM_{30} emissions that can be attributed to PM_{10} and $PM_{2.5}$ emissions. A 2nd degree polynomial equation was used to fit the particle size diameter and particle size multiplier. The resulting mass fractions are presented in Table 3.

Table 3. Haul Road Emissions - Mass Fractions

Particle Size (µm)	Particle Size Multiplier [1, 2]	Size Range (µm)	Particle Diameter (mean) (µm)	Mass Fraction		
				PM	PM_{10}	$PM_{2.5}$
2.5	0.15	<2.5	2.20	0.031	0.1	1
10	1.50	10-2.5	9.27	0.28	0.9	N/A
30	4.90	30-10	-	0.69	N/A	N/A

[1] Particle Size Multiplier Per AP-42 Table 23.2.2-2.

[2] Linear Regression (2nd degree) of particle size multiplier.

Linear Regression (2nd degree)		
a	b	y
-3.64E-04	1.85E-01	-3.09E-01

Using the polynomial, the particle size multiplier for each mean particle diameter was determined and used to develop the particle size distribution in Table 4.

[3] Particle density per https://agriinfo.in/density-of-soil-bulk-density-and-particle-density-260/

Table 4. Haul Road Emissions - Particle Size Distribution

Mean Particle Diameter (µm)	Particle Size Multiplier	% of Emissions	Particle Size Cumulative Distribution	Particle Size Distribution
2.20	0.10	2%	7%	7%
4.29	0.48	10%	35%	28%
6.06	0.80	16%	58%	23%
7.77	1.10	23%	81%	23%
9.27	1.37	28%	100%	19%

Meteorological Data

Meteorological data used in the dispersion modeling analysis was processed and provided by the Nevada Division of Environmental Protection (NDEP). Data was processed by NDEP using the AERMET meteorological preprocessor. The data consists of five years (2014 through 2018) of National Weather Service (NWS) surface data collected at the Tonopah Airport approximately 43 miles northeast of the Facility. Concurrent upper air observations used in AERMET were obtained from the Tonopah Airport in Nevada. The use of that meteorological data for modeling purposes is justified because it is the station with the closest proximity to ioneer. This data was selected as the most representative data undergoing quality assurance.

Terrain Data

Elevations for all modeled receptors were electronically generated through the AERMOD terrain processor, AERMAP, and the applicable United States Geological Survey (USGS) 1/3 arc second resolution National Elevation Dataset (NED). AERMAP determines the elevation of each receptor by interpolation.

Modeling Datum

The modeling datum was set in NAD83, Zone 11 UTM coordinates. All emission sources, receptors, and elevation references are in NAD83, Zone 11 UTM coordinates.

Receptor Grid

Discrete receptors were placed on local buckwheat populations in 5-to-10-meter intervals. Figure 1 and Figure 2 depict the location of the buckwheat populations (especially Population 3, which is closest to the haul road) during Years 3 and 11.

Source Characterization

Volume sources were utilized to model vehicle traffic on roads and tail pipe sources. Volume source parameters and emissions were calculated in accordance with U.S. EPA guidance and the AERMOD user's guide. Figure 1 and Figure 2 depict the location of the haul road volume sources during Years 3 and 11.

Figure 1. Depiction of Buckwheat Populations and Haul Road During Year 3

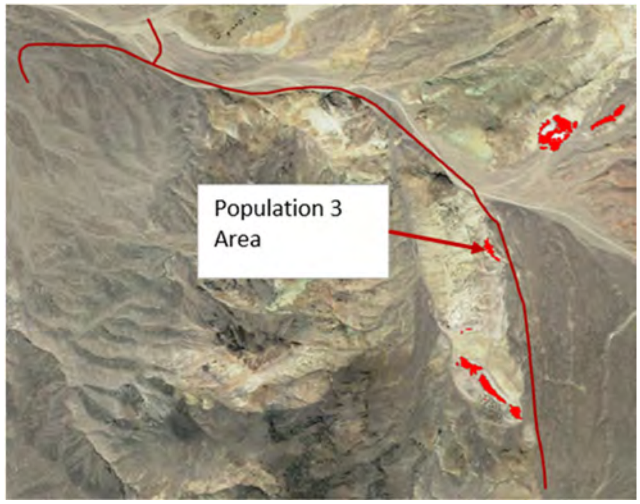
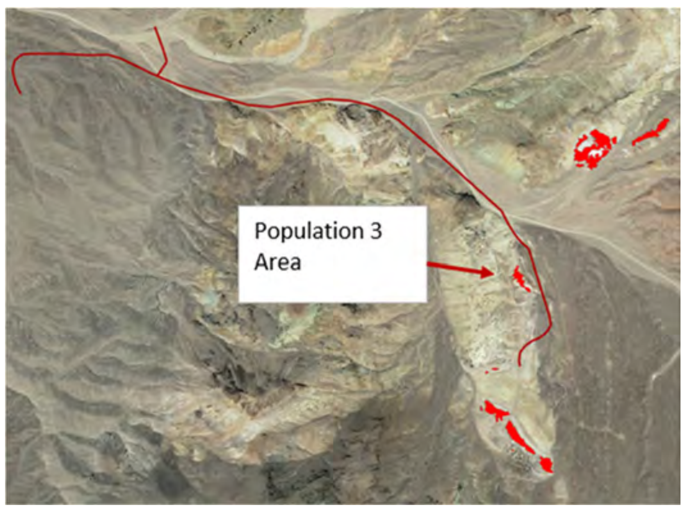


Figure 2. Depiction of Buckwheat Populations and Haul Road During Year 11



Air Dispersion Modeling Analysis Results

The results of the modeling analyses completed pursuant to the methodology and parameters noted in this memorandum are contained in Table 5. Figure 3 through Figure 6 depict the correlation between the watering emissions control efficiency as well as the PM deposition at the buckwheat populations.

Table 5. Haul Road Emissions - Model Results

Year	Control Efficiency	Max PM Impacts at All Populations			Population 3 Area Average of Peak PM Impacts		
		($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
3	75%	0.00014	0.0025	0.31	0.00010	0.0013	0.21
3	85%	0.000090	0.0015	0.19	0.000063	0.00081	0.12
3	95%	0.000030	0.00056	0.064	0.000021	0.00030	0.042
11	75%	0.036	0.55	86.07	0.023	0.35	56.13
11	85%	0.022	0.33	51.53	0.014	0.21	33.60
11	95%	0.0073	0.11	17.24	0.0047	0.072	11.25

Figure 3. Correlation Between Control Efficiency & Year 3 Max PM Impacts at All Populations

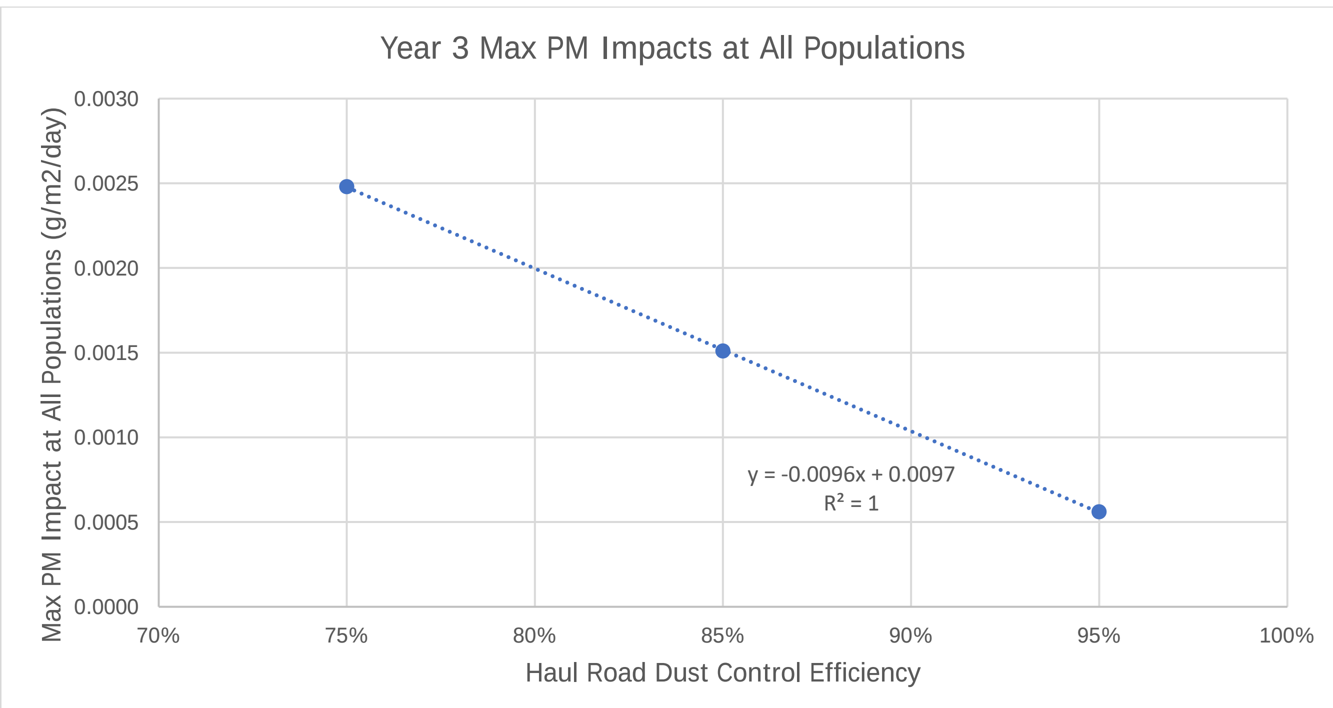


Figure 4. Correlation Between Control Efficiency & Year 3 Population 3 Area Average of Peak PM Impacts

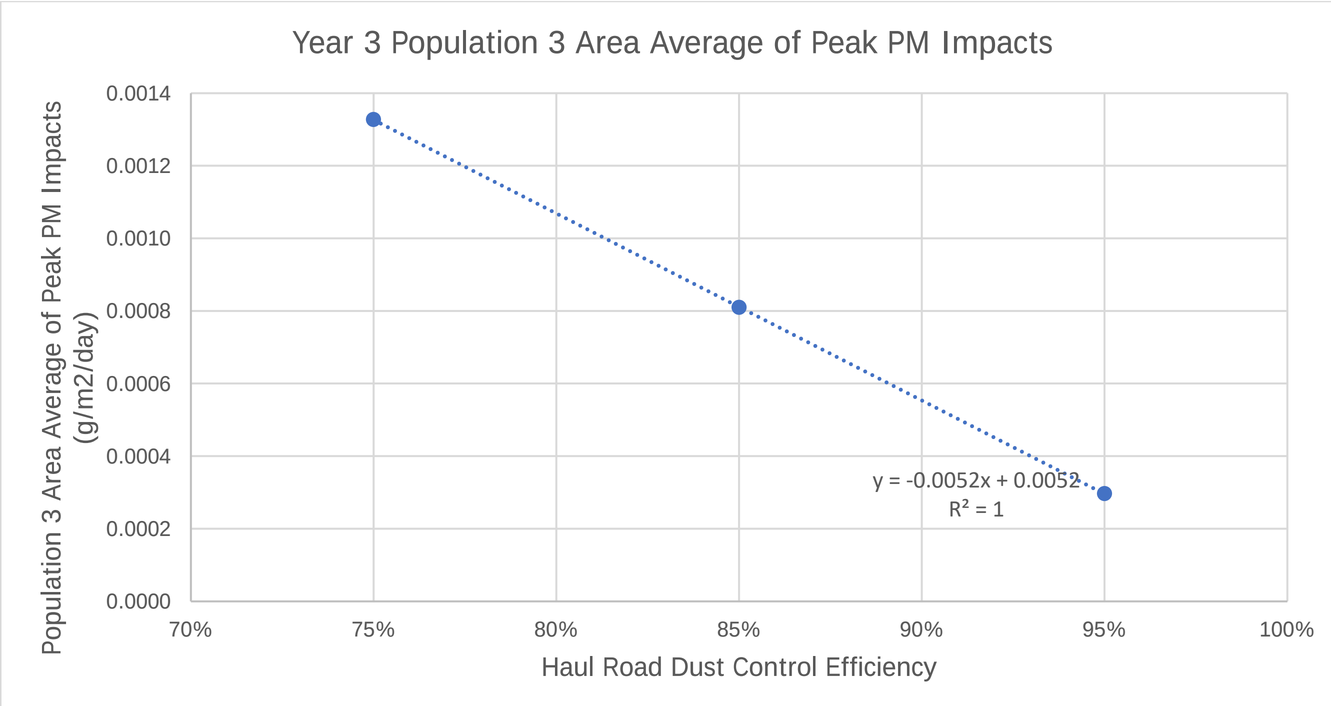


Figure 5. Correlation Between Control Efficiency & Year 11 Max PM Impacts at All Populations

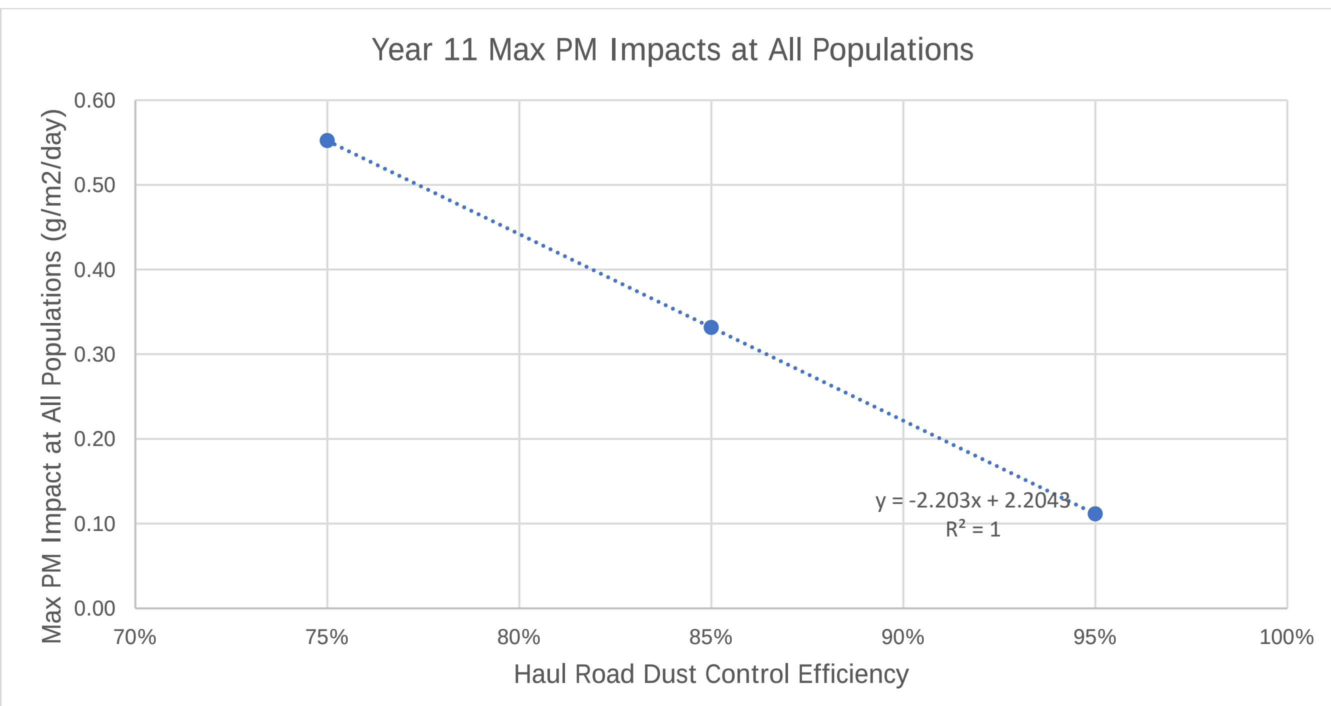
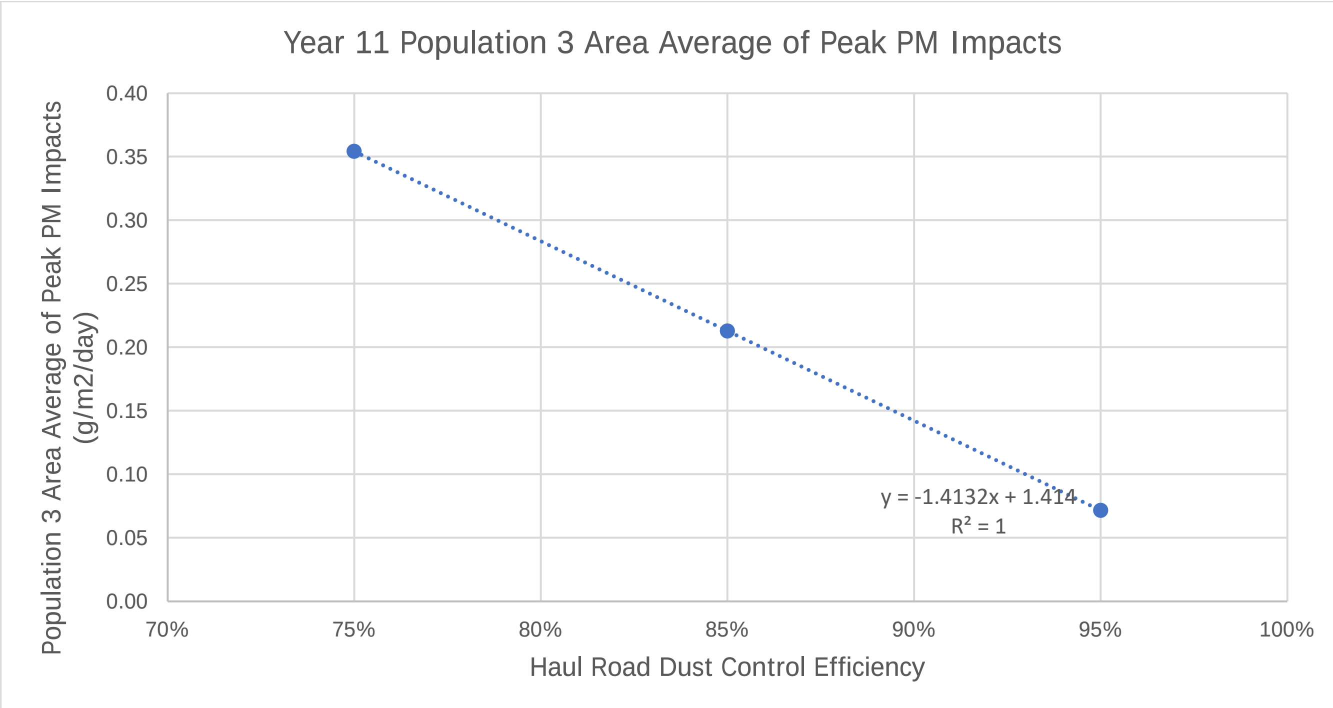


Figure 6. Correlation Between Control Efficiency & Year 11 Population 3 Area Average of Peak PM Impacts



APPENDIX A. DETAILED EMISSION CALCULATIONS

Table 1. Haul Road Emissions - Water Application

Year	Season	Control Efficiency C (%)	Mean Annual Class A Pan Evaporation [1]	Daytime Evaporation Rate [1] p (mm/h)	Average Hourly Traffic Rate (vehicle/day)	d (vehicle/hr)	Application Intensity i (L/m^2)	Maximum Time Between Water Truck Passes [1] t (hr)	(min)
3	Annual	75	80	0.39	2	0.083	0.8	765	45,918
3	Summer	75	80	0.52	2	0.083	0.8	577	34,615
11	Annual	75	80	0.39	525	22	0.8	2.92	175
11	Summer	75	80	0.52	525	22	0.8	2.20	132
3	Annual	80	80	0.39	2	0.083	0.8	612	36,735
3	Summer	80	80	0.52	2	0.083	0.8	462	27,692
11	Annual	80	80	0.39	525	22	0.8	2.33	140
11	Summer	80	80	0.52	525	22	0.8	1.76	105
3	Annual	85	80	0.39	2	0.083	0.8	459	27,551
3	Summer	85	80	0.52	2	0.083	0.8	346	20,769
11	Annual	85	80	0.39	525	22	0.8	1.75	105
11	Summer	85	80	0.52	525	22	0.8	1.32	79
3	Annual	90	80	0.39	2	0.083	0.8	306	18,367
3	Summer	90	80	0.52	2	0.083	0.8	231	13,846
11	Annual	90	80	0.39	525	22	0.8	1.17	70
11	Summer	90	80	0.52	525	22	0.8	0.88	53
3	Annual	93.75	80	0.39	2	0.083	0.8	191	11,480
3	Summer	93.75	80	0.52	2	0.083	0.8	144	8,654
11	Annual	93.75	80	0.39	525	22	0.8	0.73	44
11	Summer	93.75	80	0.52	525	22	0.8	0.55	33
3	Annual	95	80	0.39	2	0.083	0.8	153	9,184
3	Summer	95	80	0.52	2	0.083	0.8	115	6,923
11	Annual	95	80	0.39	525	22	0.8	0.58	35
11	Summer	95	80	0.52	525	22	0.8	0.44	26

[1] Per Air Pollution Engineering Manual , Chapter 4, Fugitive Emissions

$$C = 100 - \left(\frac{0.8\ pdt}{i}\right)$$

where,

C = average control efficiency (%)
p = potential average hourly daytime evaporation rate (mm/h)
p = 0.0049 x (Mean Annual Class A Pan Evaporation), for annual conditions
p = 0.0065 x (Mean Annual Class A Pan Evaporation), for summer conditions
Mean Annual Class A Pan Evaporation (inches) obtained from Figure 4, Air Pollution Engineering Manual , Chapter 4, Fugitive Emissions
d = average hourly daytime traffic rate (h^{-1})
= number of round trips
i = application intensity (L/m^2)
t = time since last application (hours)

Table 2. Haul Road Emissions - Tailpipe Emissions

Vehicle Type	Year	No. of Trucks [1]	Activity Wtd Avg Power (hp)	Load Factor [2]	PM_{10} Emission Factor [3, 4] (g/hp-hr)	Anticipated Operation		PM Tailpipe Emissions		
						(hr/day)	(hr/yr)	(lb/hr)	(lb/day)	(tpy)
Haul Truck	3	1	1,600	0.59	0.018	24	8,760	0.037	0.88	0.037
Haul Truck	11	16	1,600	0.59	0.018	24	8,760	0.58	14.03	0.58

[1] Number of trucks per calls with Jim Tress, Westland Resources, on May 17, 2023

[2] Load Factor is EPA's default estimate equipment/fuel type and engine size category.

[3] Emission factor per output from EPA's MOVES3.03 model for Esmerelda County, Nevada as contained in the September 2022 AQIA.

[4] It is assumed that PM emissions = PM_{10} emissions

Table 3a. Haul Road Emissions - Particle Sizes

Particle Size (μm)		Mean Particle Diameter (μm)
Lower	Upper	
0	3.5	2.20
3.5	5	4.29
5	7	6.06
7	8.5	7.77
8.5	10	9.27

* Per Rosemont Copper Project, AERMOD Modeling Analysis, Appendix A, December 2012.

$$d = \left(\frac{d_1^3 + d_1^2 d_2 + d_1 d_2^2 + d_2^3}{4}\right)^{1/3}$$

Table 3b. Haul Road Emissions - Mass Fractions

Particle Size (μm)	Particle Size Multiplier [1, 3]	Size Range (μm)	Mean Particle Diameter (μm)	Mass Fraction			Particle Density [2] (g/cm³)
				PM	PM_{10}	$PM_{2.5}$	
2.5	0.15	<2.5	2.20	0.031	0.1	1	2.798
10	1.50	10-2.5	9.27	0.28	0.9	N/A	2.798
30	4.90	30-10	-	0.69	N/A	N/A	2.798

1 Particle Size Multiplier Per AP-42 Table 33.2.2-2

2 Particle density obtained from: https://agriinfo.in/density-of-soil-bulk-density-and-particle-density-260/

3 Linear Regression (2nd degree) of particle size multiplier

Linear Regression (2nd degree)		
a	b	y
-3.64E-04	1.85E-01	-3.09E-01

Table 3c. Haul Road Emissions - Particle Size Distribution

Mean Particle Diameter (μm)	Particle Size Multiplier	% of PM Emissions	Particle Size Cumulative Distribution	Particle Size Distribution
2.20	0.10	2%	7%	7%
4.29	0.48	10%	35%	28%
6.06	0.80	16%	58%	23%
7.77	1.10	23%	81%	23%
9.27	1.37	28%	100%	19%

Table 4a. Haul Road Emissions - Road Emissions

Vehicle Type	Year	Road Length (miles)	Road Length (meters)	Road Type	Vehicle Make	Vehicle Model	Vehicle Weight (tons) Empty	Capacity	Full	Mean	PM Emission Factor (lb/VMT) [1] Short-Term	Annual	Vehicle Miles Traveled [2] (VMT) (VMT/hr)	(VMT/day)	(VMT/yr)	PM Road Emissions (lb/hr)	(lb/day)	(tpy)
Haul Truck	3	3.40	5,472	Unpaved	CAT	785	122	153	275	199	2.06	1.72	0.57	13.60	4,964	1.17	27.99	4.27
Haul Truck	11	2.90	4,667	Unpaved	CAT	785	122	153	275	199	2.06	1.72	127	3,045	1,111,425	261	6,267	956

[1] Emission factor for unpaved roads calculated per U.S. EPA, Unpaved Roads, AP-42 Section 13.2.2, Equations 1a and 2

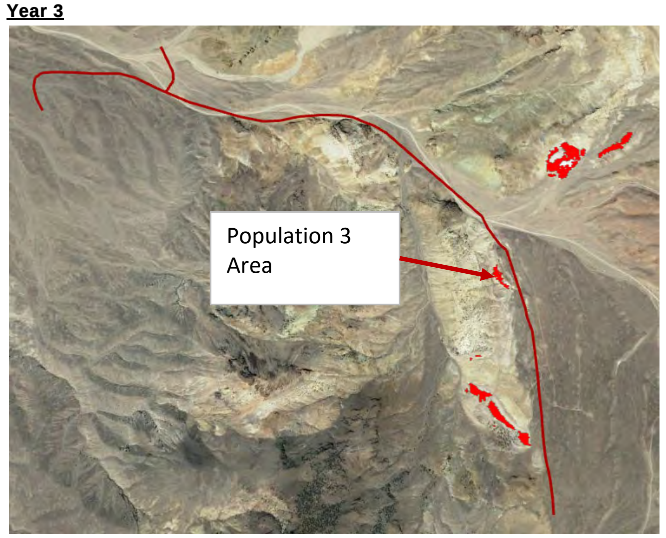
$$EF=k*\left(\frac{s}{12}\right)^a*\left(\frac{W}{3}\right)^b*(365-p)/365$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%) = 1.70 %
W = mean vehicle weight (tons)
k = constant = 4.9 for PM
a = constant = 0.7 for PM
b = constant = 0.45 for PM
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation = 60 days

Watering efficiency: 75% Anticipated control level

[2] Daily vehicle trips as follows (per calls with Jim Tress, Westland Resources, on May 15, 2023):
Year 3 2 truck round trips/day
Year 11 525 truck round trips/day

Year 3



Year 11

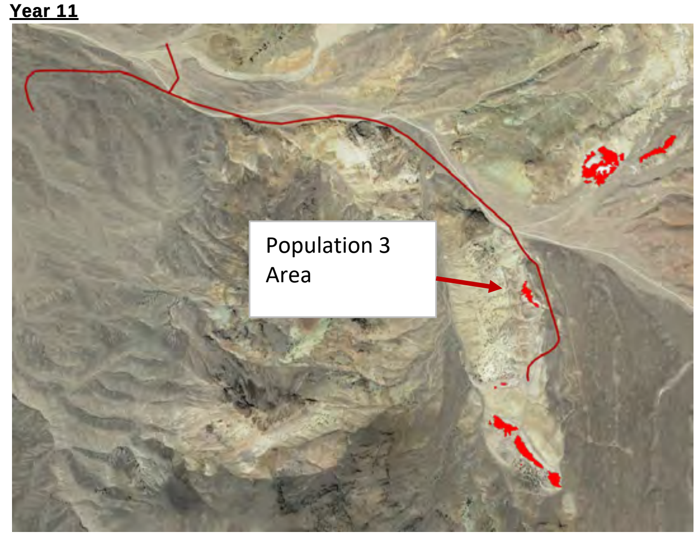


Table 4b. Haul Road Emissions - Model Emissions

Vehicle Type	Year	Total PM Emissions (lb/hr)	(lb/day)	(tpy)	Vehicle Make	Vehicle Model	Vehicle Height (ft)	No. of Volume Sources	PM Emissions (g/sec/volume) 1-hr	24-hr	Annual
Haul Truck	3	1.20	28.87	4.30	CAT	785	17.09	107	1.42E-03	1.42E-03	1.16E-03
Haul Truck	11	262	6,281	956	CAT	785	17.09	92	3.58E-01	3.58E-01	2.99E-01

* Volume source parameters
Actual road width 45 meters
Adjusted width of road = actual road width + 6 meters = 51 meters
Height of volume = 1.7 x average vehicle height = 8.86 meters
Initial horizontal sigma (σyo) = adjusted road width / 2.15 = 23.72 meters
Initial vertical sigma (σzo) = volume height / 2.15 = 4.12 meters
Release height = volume height / 2 = 4.43 meters
Volume elevation = Per AERMAP

Table 4c. Haul Road Emissions - Model Results

Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	Population 3 Area Average of Peak PM Impacts ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
Haul Truck	3	Watering	75%	0.00014	0.0025	0.31	0.00010	0.0013	0.21
Haul Truck	11	Watering	75%	0.036	0.55	86.07	0.023	0.35	56.13

Table 5a. Haul Road Emissions - Road Emissions

Vehicle Type	Year	Road Length (miles)	Road Length (meters)	Road Type	Vehicle Make	Vehicle Model	Vehicle Weight (tons) Empty	Capacity	Full	Mean	PM Emission Factor (lb/VMT)[1] Short-Term	Annual	Vehicle Miles Traveled[2] (VMT) (VMT/hr)	(VMT/day)	(VMT/yr)	PM Road Emissions (lb/hr)	(lb/day)	(tpy)
Haul Truck	3	3.40	5,472	Unpaved	CAT	785	122	153	275	199	1.23	1.03	0.57	13.60	4,964	0.70	16.79	2.56
Haul Truck	11	2.90	4,667	Unpaved	CAT	785	122	153	275	199	1.23	1.03	127	3,045	1,111,425	157	3,760	573

[1] Emission factor for unpaved roads calculated per U.S. EPA, Unpaved Roads, AP-42 Section 13.2.2, Equations 1a and 2

$$EF = k*\left(\frac{s}{12}\right)^a*\left(\frac{W}{3}\right)^b*(365-p)/365$$

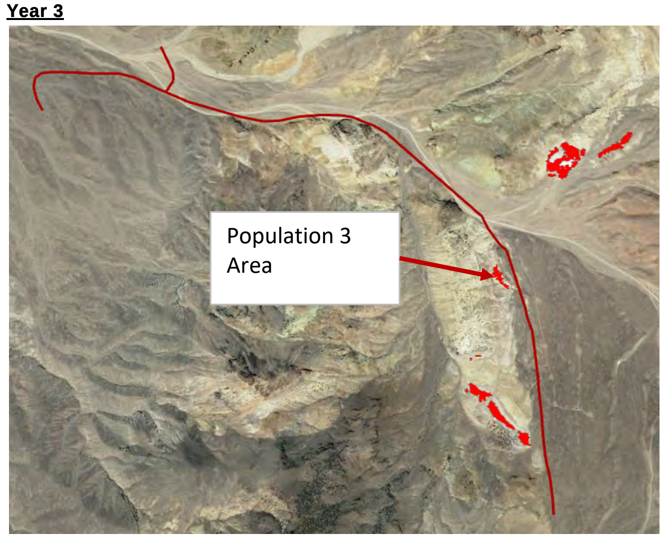
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%) = 1.70 %
W = mean vehicle weight (tons)
k = constant = 4.9 for PM
a = constant = 0.7 for PM
b = constant = 0.45 for PM
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation = 60 days

Watering efficiency: 85% Anticipated control level

[2] Daily vehicle trips as follows (per calls with Jim Tress, Westland Resources, on May 15, 2023):

Year 3 2 truck round trips/day
Year 11 525 truck round trips/day

Year 3



Year 11

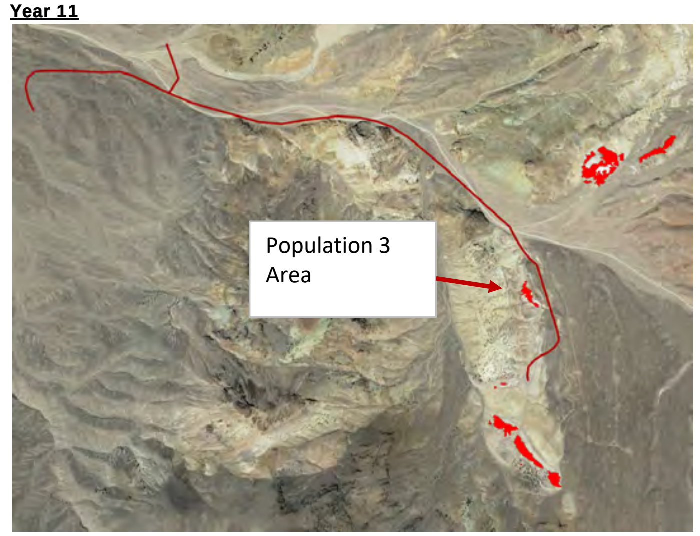


Table 5b. Haul Road Emissions - Model Emissions

Vehicle Type	Year	Total PM Emissions (lb/hr)	(lb/day)	(tpy)	Vehicle Make	Vehicle Model	Vehicle Height (ft)	No. of Volume Sources	PM Emissions (g/sec/volume) 1-hr	24-hr	Annual
Haul Truck	3	0.74	17.67	2.60	CAT	785	17.09	107	8.67E-04	8.67E-04	6.98E-04
Haul Truck	11	157	3,774	574	CAT	785	17.09	92	2.15E-01	2.15E-01	1.79E-01

* Volume source parameters

Actual road width 45 meters
Adjusted width of road = actual road width + 6 meters = 51 meters
Height of volume = 1.7 x average vehicle height = 8.86 meters
Initial horizontal sigma (σyo) = adjusted road width / 2.15 = 23.72 meters
Initial vertical sigma (σzo) = volume height / 2.15 = 4.12 meters
Release height = volume height / 2 = 4.43 meters
Volume elevation = Per AERMAP

Table 5c. Haul Road Emissions - Model Results

Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	Population 3 Area Average of Peak PM Impacts ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
Haul Truck	3	Watering	85%	0.000090	0.0015	0.19	0.000063	0.00081	0.12
Haul Truck	11	Watering	85%	0.022	0.33	51.53	0.014	0.21	33.60

Table 6a. Haul Road Emissions - Road Emissions

Vehicle Type	Year	Road Length (miles)	Road Length (meters)	Road Type	Vehicle Make	Vehicle Model	Vehicle Weight (tons) Empty	Capacity	Full	Mean	PM Emission Factor (lb/VMT) [1] Short-Term	Annual	Vehicle Miles Traveled [2] (VMT) (VMT/hr)	(VMT/day)	(VMT/yr)	PM Road Emissions (lb/hr)	(lb/day)	(tpy)
Haul Truck	3	3.40	5,472	Unpaved	CAT	785	122	153	275	199	0.41	0.34	0.57	13.60	4,964	0.23	5.60	0.85
Haul Truck	11	2.90	4,667	Unpaved	CAT	785	122	153	275	199	0.41	0.34	127	3,045	1,111,425	52	1,253	191

[1] Emission factor for unpaved roads calculated per U.S. EPA, Unpaved Roads, AP-42 Section 13.2.2, Equations 1a and 2

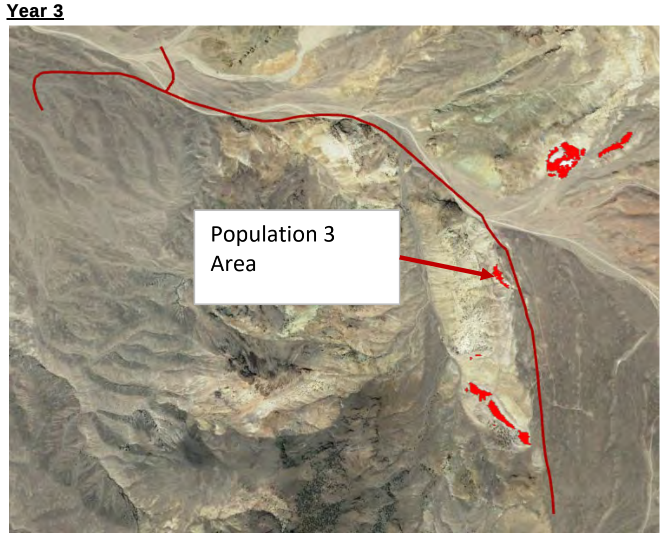
$$EF = k * \left(\frac{s}{12}\right)^a * \left(\frac{W}{3}\right)^b * (365 - p)/365$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%) = 1.70 %
W = mean vehicle weight (tons)
k = constant = 4.9 for PM
a = constant = 0.7 for PM
b = constant = 0.45 for PM
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation = 60 days

Watering efficiency: 95% Anticipated control level

[2] Daily vehicle trips as follows (per calls with Jim Tress, Westland Resources, on May 15, 2023):
Year 3 — 2 truck round trips/day
Year 11 — 525 truck round trips/day

Year 3



Year 11

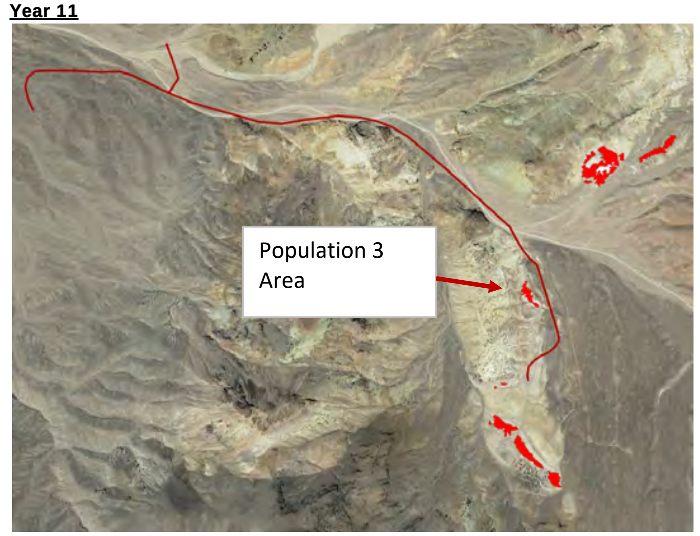


Table 6b. Haul Road Emissions - Model Emissions

Vehicle Type	Year	Total PM Emissions (lb/hr)	(lb/day)	(tpy)	Vehicle Make	Vehicle Model	Vehicle Height (ft)	No. of Volume Sources	PM Emissions (g/sec/volume) 1-hr	24-hr	Annual
Haul Truck	3	0.27	6.47	0.89	CAT	785	17.09	107	3.18E-04	3.18E-04	2.39E-04
Haul Truck	11	53	1,267	192	CAT	785	17.09	92	7.23E-02	7.23E-02	5.99E-02

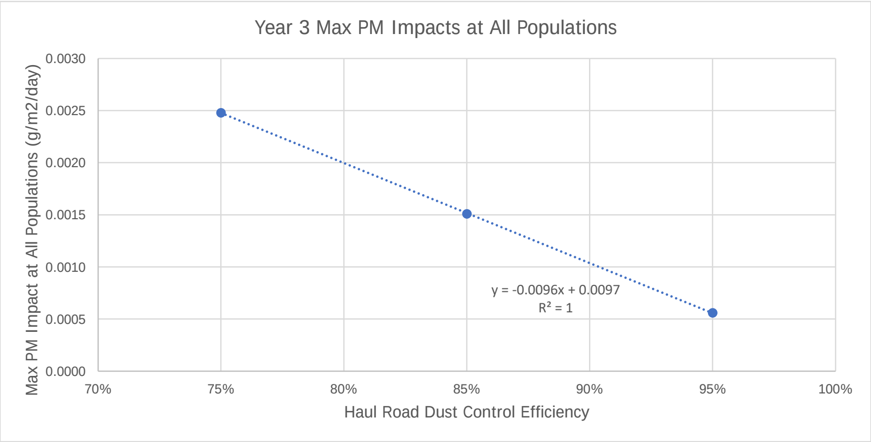
* Volume source parameters
Actual road width — 45 meters
Adjusted width of road = actual road width + 6 meters = 51 meters
Height of volume = 1.7 x average vehicle height = 8.86 meters
Initial horizontal sigma (σyo) = adjusted road width / 2.15 = 23.72 meters
Initial vertical sigma (σzo) = volume height / 2.15 = 4.12 meters
Release height = volume height / 2 = 4.43 meters
Volume elevation = Per AERMAP

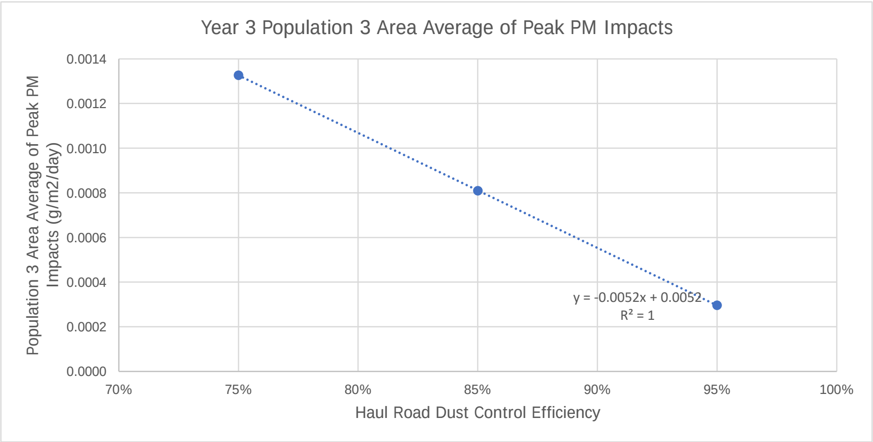
Table 6c. Haul Road Emissions - Model Results

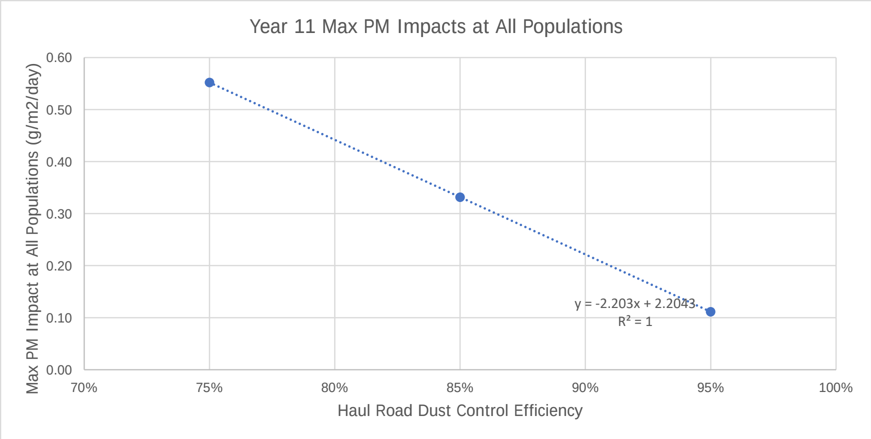
Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	Population 3 Area Average of Peak PM Impacts ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
Haul Truck	3	Watering	95%	0.000030	0.00056	0.064	0.000021	0.00030	0.042
Haul Truck	11	Watering	95%	0.00727	0.11	17.24	0.0047	0.072	11.25

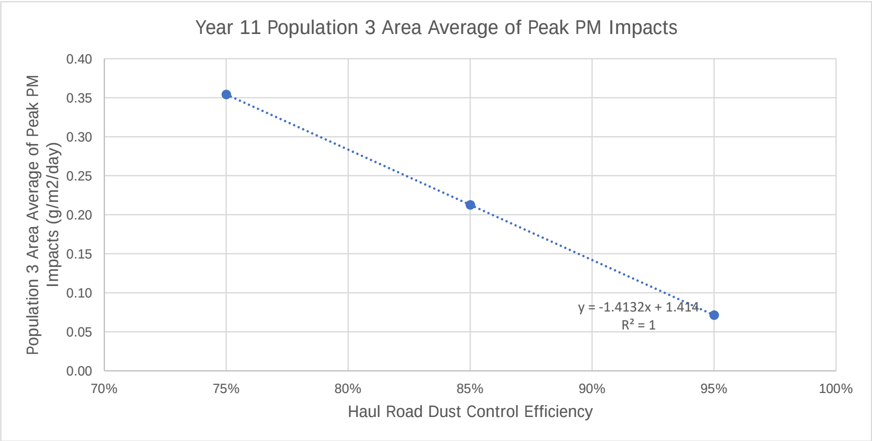
Table 7. Haul Road Emissions - Model Results

Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations			Population 3 Area Average of Peak PM Impacts		
				($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
Haul Truck	3	Watering	75%	0.00014	0.0025	0.31	0.00010	0.0013	0.21
Haul Truck	3	Watering	85%	0.000090	0.0015	0.19	0.000063	0.00081	0.12
Haul Truck	3	Watering	95%	0.000030	0.00056	0.064	0.000021	0.00030	0.042
Haul Truck	11	Watering	75%	0.036	0.55	86.07	0.023	0.35	56.13
Haul Truck	11	Watering	85%	0.022	0.33	51.53	0.014	0.21	33.60
Haul Truck	11	Watering	95%	0.0073	0.11	17.24	0.0047	0.072	11.25









MEMORANDUM

To: Jim Tress (Westland Engineering and Environmental Services)

From: Eddie Al-Rayes (Trinity Consultants)

Date: September 21, 2023

RE: Ioneer Rhyolite Ridge – Particulate Matter Impact Analysis on Tiehm's Buckwheat Population Using a Surface Material Silt Content of 6.4%

Introduction

Trinity Consultants (Trinity) provided support for Westland Engineering and Environmental Services (Westland) and client, Ioneer USA Corporation (ioneer), by completing a determination of potential deposition of particulate matter (PM) from a haul road proximate to the Tiehm's Buckwheat (buckwheat) population located near the Rhyolite Ridge Lithium Boron Project (Project). The analysis considered particulate matter (PM) from the proposed haul road as well as haul truck tailpipe PM emissions. The analysis was conducted based on haul truck traffic during two operation years, Year 3 (2 haul truck round trips per day passing population 3 and 6, and Year 11 (525 haul truck round trips per day passing population 3). The results of the analysis were utilized by Westland to support assessment of the efficacy of Applicant Proposed Conservation Measures to be submitted to the Bureau of Land Management and United States Fish and Wildlife Service in support of ongoing permitting efforts for the Project.

Emission Calculations

Total PM emissions were calculated using road dust and tailpipe emissions. Detailed emission calculations can be found in Appendix A for Year 3 and Year 11. The methodology to calculate road dust and tailpipe emissions are discussed below.

Watering Intensity

The road dust emission calculations are affected by the dust control efficiency due to frequent watering on the haul road. The dust control efficiency is a function of the time between each reapplication of water and can be calculated using the following equation, found in the Air Pollution Engineering Manual, Chapter 4.

$$C = 100 - \left(\frac{0.8pdt}{i}\right)$$

Where:

C = average control efficiency (%)
p = potential average hourly daytime evaporation rate (mm/h)
p = 0.0049 x (Mean Annual Class A Pan Evaporation), for annual conditions
p = 0.0065 x (Mean Annual Class A Pan Evaporation), for summer conditions
Mean Annual Class A Pan Evaporation (inches) is obtained from Figure 4, Air Pollution Engineering Manual , Chapter 4, Fugitive Emissions, and estimated to be 80 inches in the project area
d = average hourly daytime traffic rate (h^{-1})

i = application intensity (L/m^2) = 0.8 L/m^2 for CAT 777, or similar, water truck traveling between 3 and 25 mph [The equipment can apply 0.8 L/m^2 of water at speeds from 3 to 25mph. S Meyers (ioneer) pers comm with Jim Tress (WestLand).]

t = time since last application

The time between water truck applications were determined for control efficiencies between 75 and 95 percent for summer and annual periods for Years 3 and 11. A summary of the results can be found in Table 1. A full summary of values can be found in Appendix A.

Table 1. Haul Roads – Water Application Interval

Year	Season	Control Efficiency (%)	Maximum Time Between Water Truck Passes (hr)	(min)
3	Annual	75	765	45,918
3	Summer	75	577	34,615
11	Annual	75	2.92	175
11	Summer	75	2.20	132
3	Annual	80	612	36,735
3	Summer	80	462	27,692
11	Annual	80	2.33	140
11	Summer	80	1.76	105
3	Annual	85	459	27,551
3	Summer	85	346	20,769
11	Annual	85	1.75	105
11	Summer	85	1.32	79
3	Annual	90	306	18,367
3	Summer	90	231	13,846
11	Annual	90	1.17	70
11	Summer	90	0.88	53
3	Annual	93.75	191	11,480
3	Summer	93.75	144	8,654
11	Annual	93.75	0.73	44
11	Summer	93.75	0.55	33
3	Annual	95	153	9,184
3	Summer	95	115	6,923
11	Annual	95	0.58	35
11	Summer	95	0.44	26

Emissions from Tailpipes

The U.S. EPA Office of Transportation and Air Quality (OTAQ) has developed the Motor Vehicle Emission Simulator (MOVES) model as the official regulatory tool for estimating air pollutant emissions from non-road vehicles. The latest version of the model, MOVES3, was used to estimate tailpipe emissions from haul trucks using emission factor runs for Esmerelda County, Nevada in calendar year 2029, where the project is located.

Calendar year 2029 is assumed to be the "worst case year" for emission purposes. Emission factors per unit activity for vehicles and equipment will decrease in the MOVES model for each successive calendar year fleet. Fleet emissions are expected to be lower for more recent calendar years as future regulations continue to reduce fleet emissions. Therefore, calendar year 2029 emission factors in this analysis are conservative. Selection of Esmerelda County follows the accepted practice of utilizing ambient conditions and fuel properties specific to that county that are contained within MOVES and accounts for their localized effects on emissions. Actual engine sizes based on project specific data were utilized rather than MOVES default engine sizes. In the absence of project-specific data, default load factors specific to each equipment type, fuel type and engine size were extracted from MOVES. The emissions factors (grams per hp-hr) were then multiplied by the average engine size (hp) and the appropriate load factor to estimate emissions rates in terms of grams per hour. These emissions rates were in turn multiplied by the hours of anticipated activity for the haul trucks. As a conservative estimate, PM results were set equal to PM_{10}.

Emissions from Road Dust

Fugitive PM dust emissions will be generated during vehicle travel on unpaved roads. Emission from the haul road were based on emission factors, vehicle miles traveled (VMT), and control efficiency.

Emission Factor

Uncontrolled PM emission factors were calculated using the following equation from AP-42, Section 13.2.2 (November 2006):

$$EF_{Short-Term} = k\left(\frac{s}{12}\right)^{a}\left(\frac{W}{3}\right)^{b}(1 - Watering\ Efficiency)$$

$$EF_{Annual} = EF_{Short-Term}\left(\frac{365 - p}{365}\right)$$

Where:

E = size-specific emission factor (lb per VMT)
k = particle size multiplier, per AP-42 Table 13.2.2-2 (November 2006) = 4.9 for PM
s = surface material silt content (%) = 6.4%, for "gravel road" silt content as contained in the Arizona Department of Environmental Quality, State Implementation Plan Revision: Regional Haze Program (2018-2028), dated August 15, 2022.
W = mean vehicle weight (tons)
a, b = constant, per AP-42 Table 13.2.2-2 (November 2006)
p = days per year with > 0.01 in precipitation, per AP-42 Figure 13.2.2-1 (November 2006)

The mean vehicle weight was determined for haul trucks by averaging the weight of empty and full vehicle weight.

Vehicle Miles Travelled

The distance traveled in miles on the haul road for each selected operation year (i.e., Years 3 and 11) is based on facility maps. The number of trips was provided by Westland [S Meyers (ioneer) pers. Com with Jim Tress (WestLand)]. The VMT was calculated by multiplying the number of trips and the road trip distance travelled by the vehicles.

Control Efficiency

Emissions were estimated based on watering control efficiencies of 75%, 85%, and 95% to model a range of likely emissions and deposition rates.

Air Dispersion Model Inputs

The air dispersion modeling evaluation was completed using the U.S. EPA-approved American Meteorological Society (AMS)/U.S. EPA Regulatory Model (AERMOD). The following sections provide the details associated with the modeling evaluation.

Particle Dry Deposition

The Dry Deposition option in AERMOD calculates the fraction of the particulate emissions in the plume that are removed from the plume due to interaction with the ground surface.[1] The use of this option in AERMOD requires particle size distribution data including the following:

- Mean particle diameter;
- Particle density; and
- Mass weighted particle size distribution.

Mean Particle Diameter

EPA modeling guidance does not specify default values for the particle size categories to be used in the AERMOD Dry Deposition option. As a result, the particle size categories contained in Table 2 below were used as these were accepted as part of recent National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) technical evaluations. The expected mean particle diameter of particle size ranges between 0 and 10 microns in diameter was calculated using the following formula.[2]

$$d = \left(\frac{d_1^3 + d_1^2 d_2 + d_1 d_2^2 + d_2^3}{4} \right)^{1/3}$$

where:

d = mean particle diameter
d_1 = low end of particle size category range
d_2 = high end of particle size category range

[1] Per *AERMOD Deposition Algorithms – Science Document (Revised Draft)*, located at http://www.epa.gov/scram001/7thconf/aermod/aer_scid.pdf

[2] Per page 2 of "Basic Principles of Particle Size Analysis" located at http://www.atascientific.com.au/publications/wp-content/uploads/2012/07/Basic_principles_of_particle_size_analysis_MRK034-low_res.pdf

Table 2. Particle Size Distribution - Mean Particle Diameters

Particle Size (μg)		Mean Particle Diameter (μm)
Lower	Upper	
0	3.5	2.20
3.5	5	4.29
5	7	6.06
7	8.5	7.77
8.5	10	9.27

Particle Density

A particle density of 2.798 g/cm^3 was used in the modeling analysis to represents the average density of the materials (sand, silt, and clay) on the haul roads at Ioneer.[3]

Particle Size Distribution

EPA AP-42, Section 13.2.2, provides in Equation 1a a method to calculate emission factors for unpaved industrial roads. The emission factor multipliers for Equation 1a were used to determine the distribution of emissions for PM_{30}, PM_{10}, and $PM_{2.5}$ by calculating the percentage of PM_{30} emissions that can be attributed to PM_{10} and $PM_{2.5}$ emissions. A 2nd degree polynomial equation was used to fit the particle size diameter and particle size multiplier. The resulting mass fractions are presented in Table 3.

Table 3. Haul Road Emissions - Mass Fractions

Particle Size (μm)	Particle Size Multiplier [1, 2]	Size Range (μm)	Particle Diameter (mean) (μm)	Mass Fraction		
				PM	PM_{10}	$PM_{2.5}$
2.5	0.15	<2.5	2.20	0.031	0.1	1
10	1.50	10-2.5	9.27	0.28	0.9	N/A
30	4.90	30-10	-	0.69	N/A	N/A

[1] Particle Size Multiplier Per AP-42 Table 23.2.2-2.

[2] Linear Regression (2nd degree) of particle size multiplier.

Linear Regression (2nd degree)		
a	b	y
-3.64E-04	1.85E-01	-3.09E-01

Using the polynomial, the particle size multiplier for each mean particle diameter was determined and used to develop the particle size distribution in Table 4.

[3] Particle density per https://agriinfo.in/density-of-soil-bulk-density-and-particle-density-260/

Table 4. Haul Road Emissions - Particle Size Distribution

Mean Particle Diameter (µm)	Particle Size Multiplier	% of Emissions	Particle Size Cumulative Distribution	Particle Size Distribution
2.20	0.10	2%	7%	7%
4.29	0.48	10%	35%	28%
6.06	0.80	16%	58%	23%
7.77	1.10	23%	81%	23%
9.27	1.37	28%	100%	19%

Meteorological Data

Meteorological data used in the dispersion modeling analysis was processed and provided by the Nevada Division of Environmental Protection (NDEP). Data was processed by NDEP using the AERMET meteorological preprocessor. The data consists of five years (2014 through 2018) of National Weather Service (NWS) surface data collected at the Tonopah Airport approximately 43 miles northeast of the Facility. Concurrent upper air observations used in AERMET were obtained from the Tonopah Airport in Nevada. The use of that meteorological data for modeling purposes is justified because it is the station with the closest proximity to ioneer. This data was selected as the most representative data undergoing quality assurance.

Terrain Data

Elevations for all modeled receptors were electronically generated through the AERMOD terrain processor, AERMAP, and the applicable United States Geological Survey (USGS) 1/3 arc second resolution National Elevation Dataset (NED). AERMAP determines the elevation of each receptor by interpolation.

Modeling Datum

The modeling datum was set in NAD83, Zone 11 UTM coordinates. All emission sources, receptors, and elevation references are in NAD83, Zone 11 UTM coordinates.

Receptor Grid

Discrete receptors were placed on local buckwheat populations in 5-to-10-meter intervals. Figure 1 and Figure 2 depict the location of the buckwheat populations (especially Population 3, which is closest to the haul road) during Years 3 and 11.

Source Characterization

Volume sources were utilized to model vehicle traffic on roads and tail pipe sources. Volume source parameters and emissions were calculated in accordance with U.S. EPA guidance and the AERMOD user's guide. Figure 1 and Figure 2 depict the location of the haul road volume sources during Years 3 and 11.

Figure 1. Depiction of Buckwheat Populations and Haul Road During Year 3

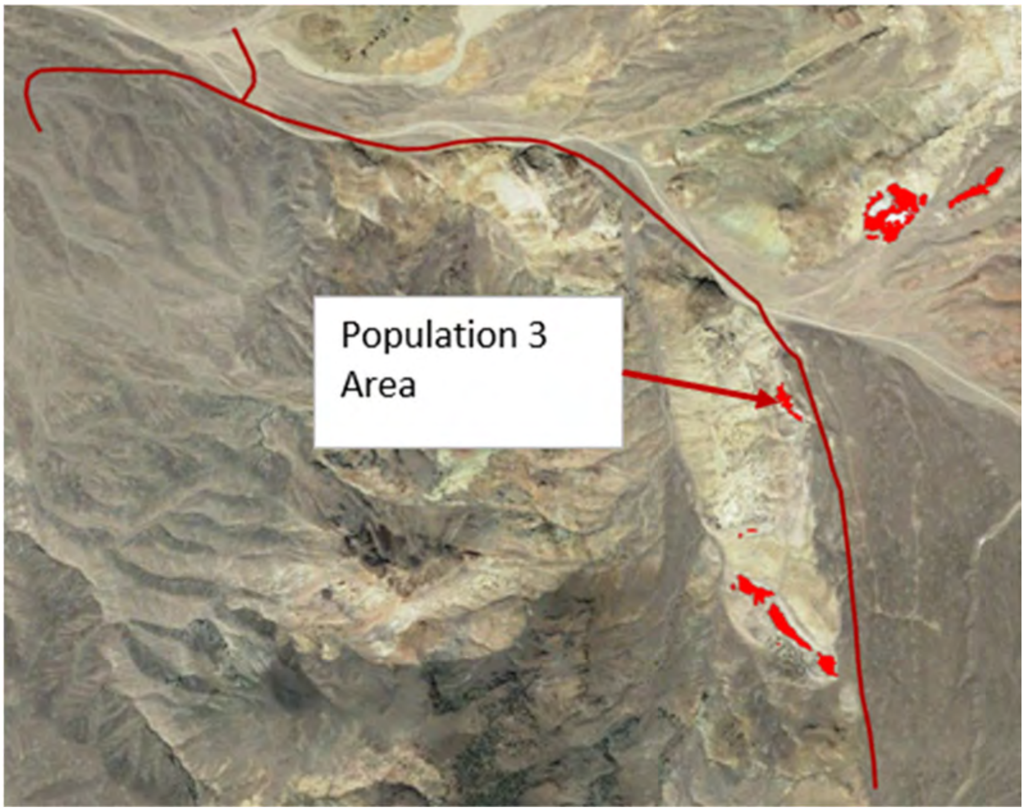
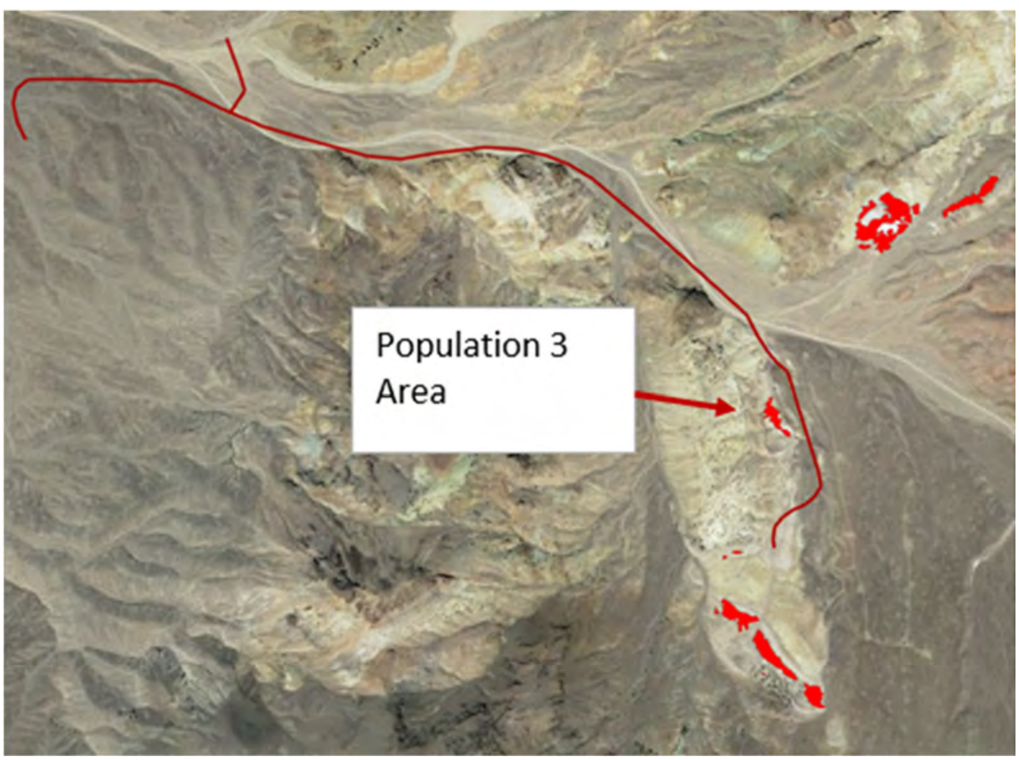


Figure 2. Depiction of Buckwheat Populations and Haul Road During Year 11



Air Dispersion Modeling Analysis Results

The results of the modeling analyses completed pursuant to the methodology and parameters noted in this memorandum are contained in Table 5. Figure 3 through Figure 6 depict the correlation between the watering emissions control efficiency as well as the PM deposition at the buckwheat populations.

Table 5. Haul Road Emissions - Model Results

Year	Control Efficiency	Max PM Impacts at All Populations			Population 3 Area Average of Peak PM Impacts		
		($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
3	75%	0.00036	0.0061	0.78	0.00026	0.0033	0.52
3	85%	0.00022	0.0037	0.47	0.00016	0.0020	0.31
3	95%	0.000080	0.0013	0.16	0.000054	0.00069	0.10
11	75%	0.091	1.40	217.63	0.058	0.90	141.93
11	85%	0.055	0.84	130.69	0.035	0.54	85.23
11	95%	0.018	0.28	43.47	0.012	0.18	28.35

Figure 3. Correlation Between Control Efficiency & Year 3 Max PM Impacts at All Populations

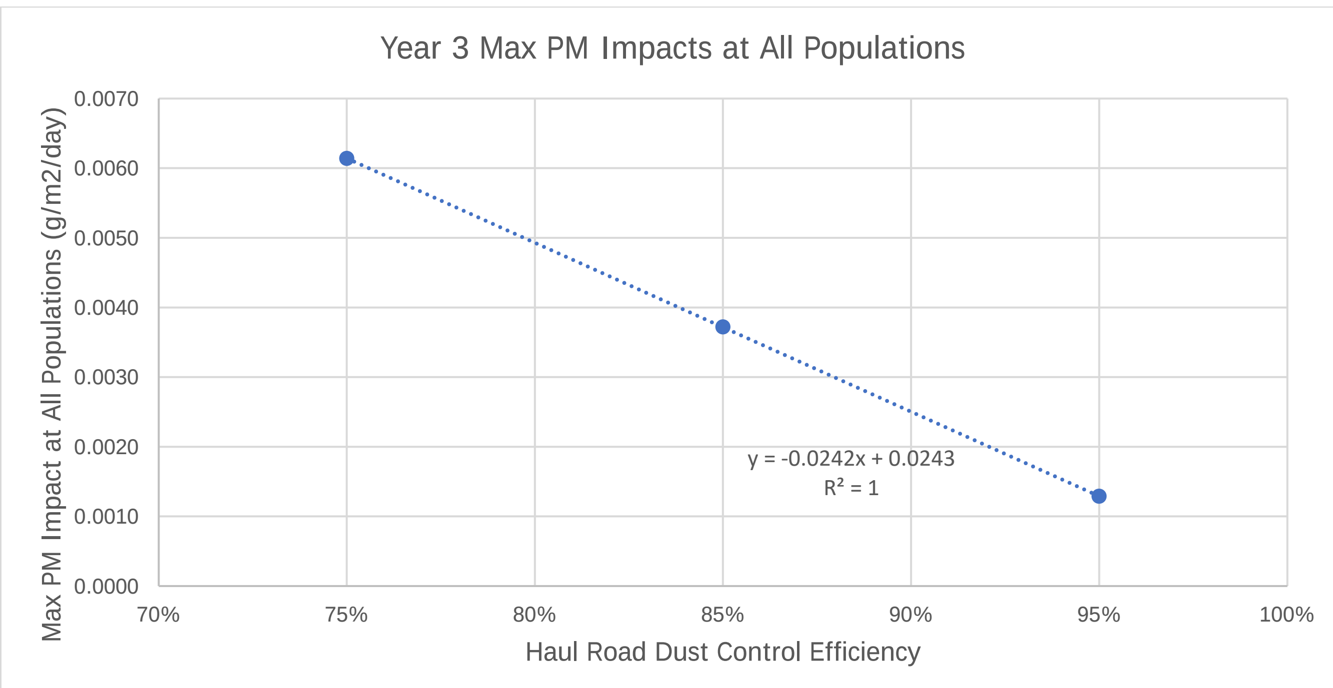


Figure 4. Correlation Between Control Efficiency & Year 3 Population 3 Area Average of Peak PM Impacts

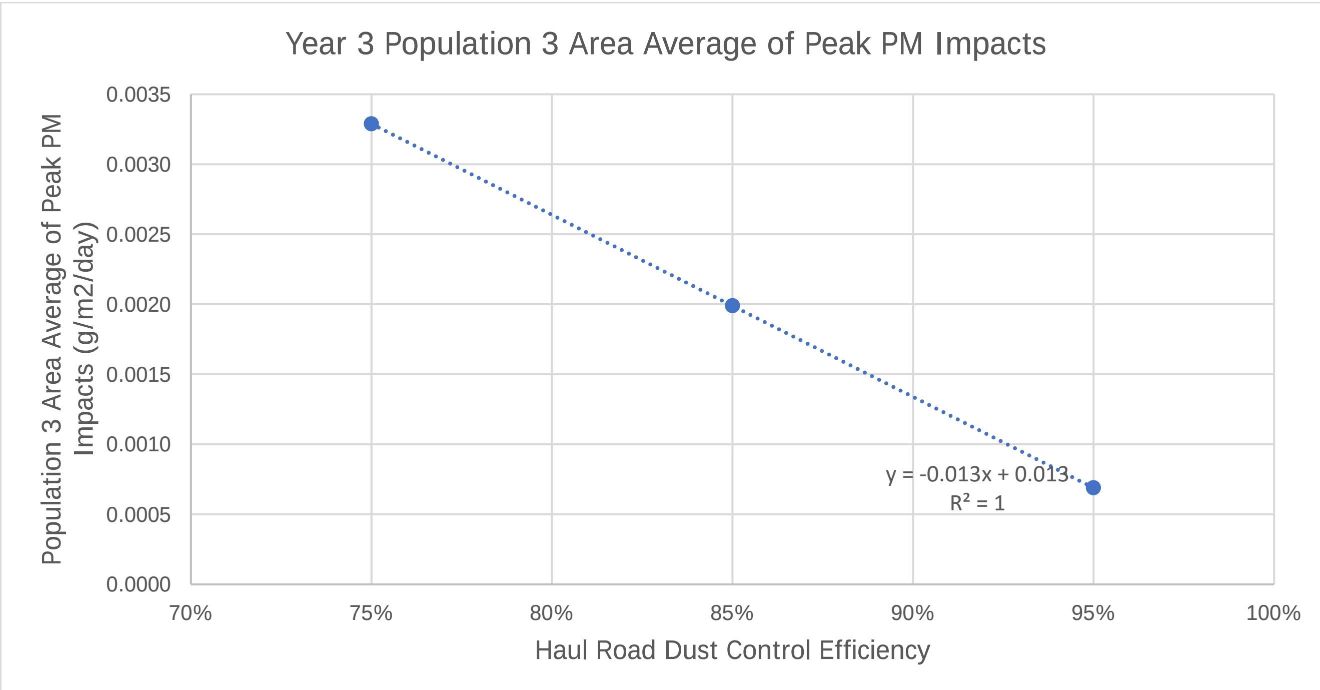


Figure 5. Correlation Between Control Efficiency & Year 11 Max PM Impacts at All Populations

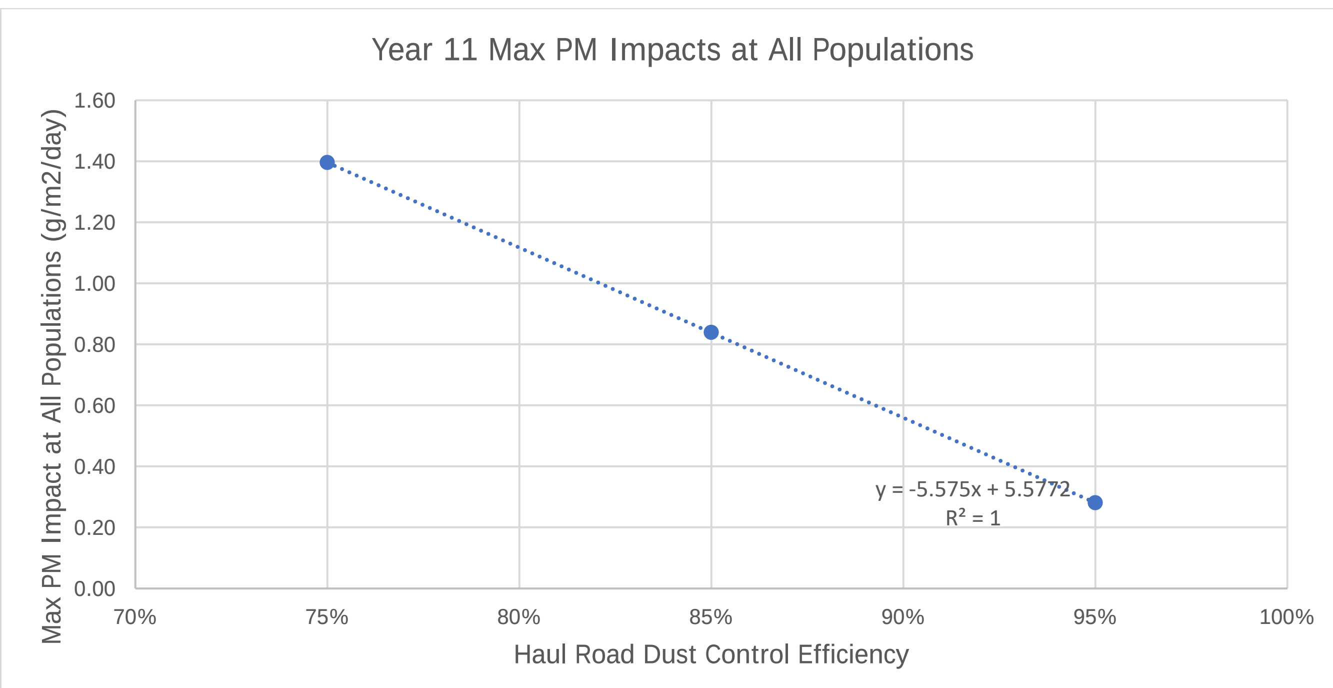
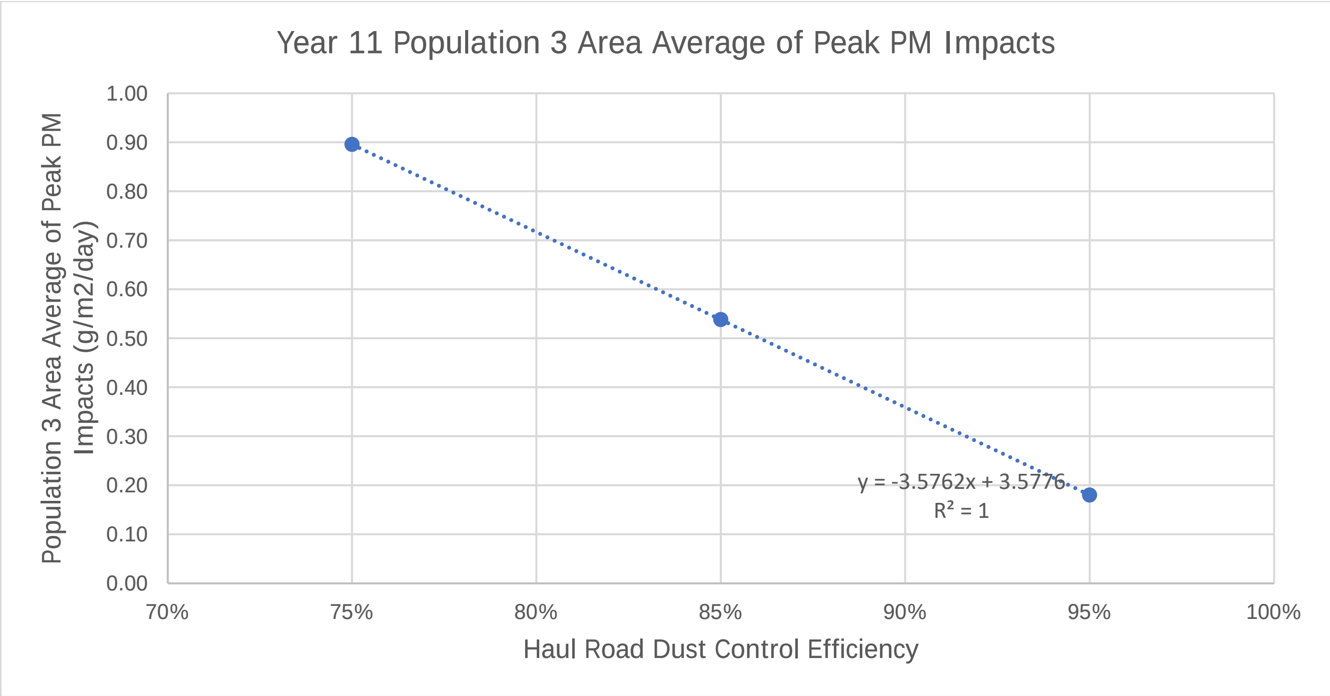


Figure 6. Correlation Between Control Efficiency & Year 11 Population 3 Area Average of Peak PM Impacts



APPENDIX A. DETAILED EMISSION CALCULATIONS

Table 1. Haul Road Emissions - Water Application

Year	Season	Control Efficiency C (%)	Mean Annual Class A Pan Evaporation [1]	Daytime Evaporation Rate [1] p (mm/h)	Average Hourly Traffic Rate (vehicle/day)	Average Hourly Traffic Rate d (vehicle/hr)	Application Intensity i (L/m²)	Maximum Time Between Water Truck Passes [1] t (hr)	Maximum Time Between Water Truck Passes [1] t (min)
3	Annual	75	80	0.39	2	0.083	0.8	765	45,918
3	Summer	75	80	0.52	2	0.083	0.8	577	34,615
11	Annual	75	80	0.39	525	22	0.8	2.92	175
11	Summer	75	80	0.52	525	22	0.8	2.20	132
3	Annual	80	80	0.39	2	0.083	0.8	612	36,735
3	Summer	80	80	0.52	2	0.083	0.8	462	27,692
11	Annual	80	80	0.39	525	22	0.8	2.33	140
11	Summer	80	80	0.52	525	22	0.8	1.76	105
3	Annual	85	80	0.39	2	0.083	0.8	459	27,551
3	Summer	85	80	0.52	2	0.083	0.8	346	20,769
11	Annual	85	80	0.39	525	22	0.8	1.75	105
11	Summer	85	80	0.52	525	22	0.8	1.32	79
3	Annual	90	80	0.39	2	0.083	0.8	306	18,367
3	Summer	90	80	0.52	2	0.083	0.8	231	13,846
11	Annual	90	80	0.39	525	22	0.8	1.17	70
11	Summer	90	80	0.52	525	22	0.8	0.88	53
3	Annual	93.75	80	0.39	2	0.083	0.8	191	11,480
3	Summer	93.75	80	0.52	2	0.083	0.8	144	8,654
11	Annual	93.75	80	0.39	525	22	0.8	0.73	44
11	Summer	93.75	80	0.52	525	22	0.8	0.55	33
3	Annual	95	80	0.39	2	0.083	0.8	153	9,184
3	Summer	95	80	0.52	2	0.083	0.8	115	6,923
11	Annual	95	80	0.39	525	22	0.8	0.58	35
11	Summer	95	80	0.52	525	22	0.8	0.44	26

[1] Per *Air Pollution Engineering Manual* , Chapter 4, Fugitive Emissions

$$C = 100 - \left(\frac{0.8\,pdt}{i}\right)$$

where,

C = average control efficiency (%)
p = potential average hourly daytime evaporation rate (mm/h)
p = 0.0049 x (Mean Annual Class A Pan Evaporation), for annual conditions
p = 0.0065 x (Mean Annual Class A Pan Evaporation), for summer conditions
Mean Annual Class A Pan Evaporation (inches) obtained from Figure 4, *Air Pollution Engineering Manual* , Chapter 4, Fugitive Emissions
d = average hourly daytime traffic rate (h^{-1})
= number of round trips
i = application intensity (L/m^2)
t = time since last application (hours)

Table 2. Haul Road Emissions - Tailpipe Emissions

Vehicle Type	Year	No. of Trucks [1]	Activity Wtd Avg Power (hp)	Load Factor [2]	PM_{10} Emission Factor [3, 4] (g/hp-hr)	Anticipated Operation		PM Tailpipe Emissions		
						(hr/day)	(hr/yr)	(lb/hr)	(lb/day)	(tpy)
Haul Truck	3	1	1,600	0.59	0.018	24	8,760	0.037	0.88	0.037
Haul Truck	11	16	1,600	0.59	0.018	24	8,760	0.58	14.03	0.58

[1] Number of trucks per calls with Jim Tress, Westland Resources, on May 17, 2023

[2] Load Factor is EPA's default estimate equipment/fuel type and engine size category.

[3] Emission factor per output from EPA's MOVES3.03 model for Esmerelda County, Nevada as contained in the September 2022 AQIA.

[4] It is assumed that PM emissions = PM_{10} emissions

Table 3a. Haul Road Emissions - Particle Sizes

Particle Size (µm)		Mean Particle Diameter (µm)
Lower	Upper	
0	3.5	2.20
3.5	5	4.29
5	7	6.06
7	8.5	7.77
8.5	10	9.27

* Per Rosemont Copper Project, AERMOD Modeling Analysis, Appendix A, December 2012.

$$d = \left(\frac{d_1^3 + d_1^2 d_2 + d_1 d_2^2 + d_2^3}{4}\right)^{1/3}$$

Table 3b. Haul Road Emissions - Mass Fractions

Particle Size (µm)	Particle Size Multiplier [1,3]	Size Range (µm)	Mean Particle Diameter (µm)	Mass Fraction			Particle Density [2] (g/cm^3)
				PM	PM_{10}	$PM_{2.5}$	
2.5	0.15	<2.5	2.20	0.031	0.1	1	2.798
10	1.50	10-2.5	9.27	0.28	0.9	N/A	2.798
30	4.90	30-10	-	0.69	N/A	N/A	2.798

1 Particle Size Multiplier Per AP-42 Table 33.2.2-2

2 Particle density obtained from: https://agriinfo.in/density-of-soil-bulk-density-and-particle-density-260/

3 Linear Regression (2nd degree) of particle size multiplier

Linear Regression (2nd degree)		
a	b	y
-3.64E-04	1.85E-01	-3.09E-01

Table 3c. Haul Road Emissions - Particle Size Distribution

Mean Particle Diameter (µm)	Particle Size Multiplier	% of PM Emissions	Particle Size Cumulative Distribution	Particle Size Distribution
2.20	0.10	2%	7%	7%
4.29	0.48	10%	35%	28%
6.06	0.80	16%	58%	23%
7.77	1.10	23%	81%	23%
9.27	1.37	28%	100%	19%

Table 4a. Haul Road Emissions - Road Emissions

Vehicle Type	Year	Road Length		Road Type	Vehicle		Vehicle Weight (tons)				PM Emission Factor (lb/VMT) [1]		Vehicle Miles Traveled [2] (VMT)			PM Road Emissions		
		(miles)	(meters)		Make	Model	Empty	Capacity	Full	Mean	Short-Term	Annual	(VMT/hr)	(VMT/day)	(VMT/yr)	(lb/hr)	(lb/day)	(tpy)
Haul Truck	3	3.40	5,472	Unpaved	CAT	785	122	153	275	199	5.21	4.35	0.57	13.60	4,964	2.95	70.80	10.80
Haul Truck	11	2.90	4,667	Unpaved	CAT	785	122	153	275	199	5.21	4.35	127	3,045	1,111,425	660	15,851	2,417

[1] Emission factor for unpaved roads calculated per U.S. EPA, Unpaved Roads, AP-42 Section 13.2.2, Equations 1a and 2

$$EF = k*\left(\frac{s}{12}\right)^{a}*\left(\frac{W}{3}\right)^{b}*(365-p)/365$$

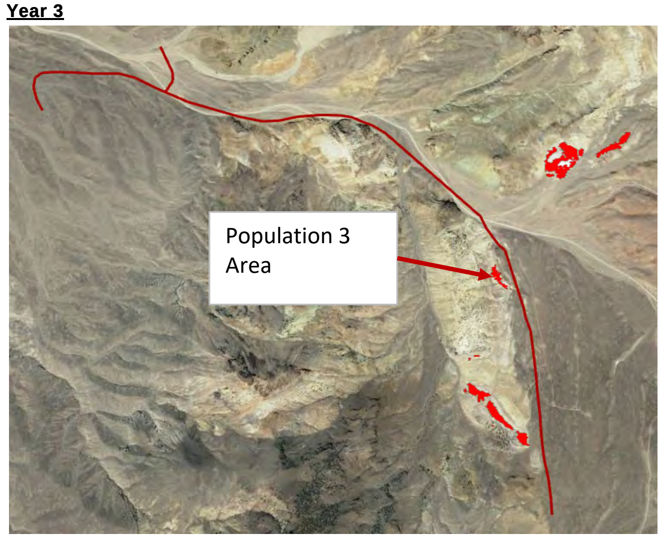
E = size-specific emission factor (lb/VMT)		
s = surface material silt content (%) =	6.40	%
W = mean vehicle weight (tons)		
k = constant =	4.9	for PM
a = constant =	0.7	for PM
b = constant =	0.45	for PM
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation =	60	days

Watering efficiency: 75% Anticipated control level

[2] Daily vehicle trips as follows (per calls with Jim Tress, Westland Resources, on May 15, 2023):

Year 3	2	truck round trips/day
Year 11	525	truck round trips/day

Year 3



Year 11

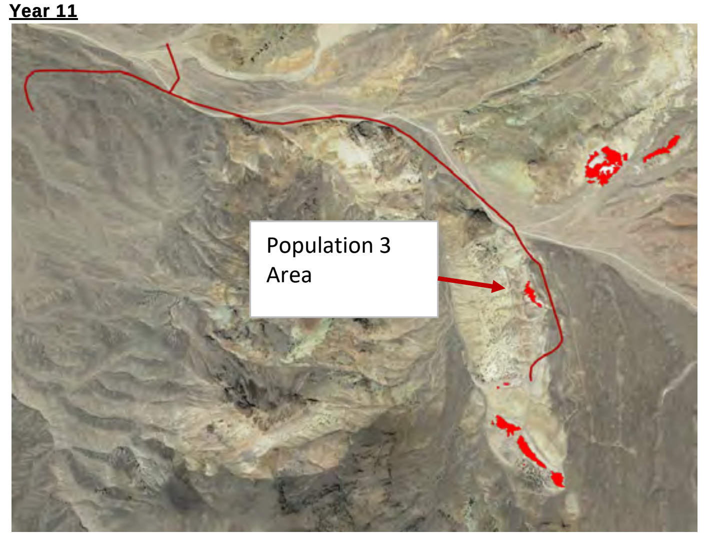


Table 4b. Haul Road Emissions - Model Emissions

Vehicle Type	Year	Total PM Emissions			Vehicle		Vehicle Height	No. of Volume Sources	PM Emissions (g/sec/volume)		
		(lb/hr)	(lb/day)	(tpy)	Make	Model	(ft)		1-hr	24-hr	Annual
Haul Truck	3	2.99	71.67	10.83	CAT	785	17.09	107	3.52E-03	3.52E-03	2.91E-03
Haul Truck	11	661	15,865	2,418	CAT	785	17.09	92	9.05E-01	9.05E-01	7.56E-01

* Volume source parameters

Actual road width	45	meters
Adjusted width of road = actual road width + 6 meters =	51	meters
Height of volume = 1.7 x average vehicle height =	8.86	meters
Initial horizontal sigma (σyo) = adjusted road width / 2.15 =	23.72	meters
Initial vertical sigma (σzo) = volume height / 2.15 =	4.12	meters
Release height = volume height / 2 =	4.43	meters
Volume elevation =	Per AERMAP	

Table 4c. Haul Road Emissions - Model Results

Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations			Population 3 Area Average of Peak PM Impacts		
				($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
Haul Truck	3	Watering	75%	0.00036	0.0061	0.78	0.00026	0.0033	0.52
Haul Truck	11	Watering	75%	0.091	1.40	217.63	0.058	0.90	141.93

Table 5a. Haul Road Emissions - Road Emissions

Vehicle Type	Year	Road Length (miles)	Road Length (meters)	Road Type	Vehicle Make	Vehicle Model	Vehicle Weight (tons) Empty	Vehicle Weight (tons) Capacity	Vehicle Weight (tons) Full	Vehicle Weight (tons) Mean	PM Emission Factor (lb/VMT) [1] Short-Term	PM Emission Factor (lb/VMT) [1] Annual	Vehicle Miles Traveled [2] (VMT) (VMT/hr)	Vehicle Miles Traveled [2] (VMT) (VMT/day)	Vehicle Miles Traveled [2] (VMT) (VMT/yr)	PM Road Emissions (lb/hr)	PM Road Emissions (lb/day)	PM Road Emissions (tpy)
Haul Truck	3	3.40	5,472	Unpaved	CAT	785	122	153	275	199	3.12	2.61	0.57	13.60	4,964	1.77	42.48	6.48
Haul Truck	11	2.90	4,667	Unpaved	CAT	785	122	153	275	199	3.12	2.61	127	3,045	1,111,425	396	9,511	1,450

[1] Emission factor for unpaved roads calculated per U.S. EPA, Unpaved Roads, AP-42 Section 13.2.2, Equations 1a and 2

$$EF = k*\left(\frac{s}{12}\right)^a*\left(\frac{W}{3}\right)^b*(365-p)/365$$

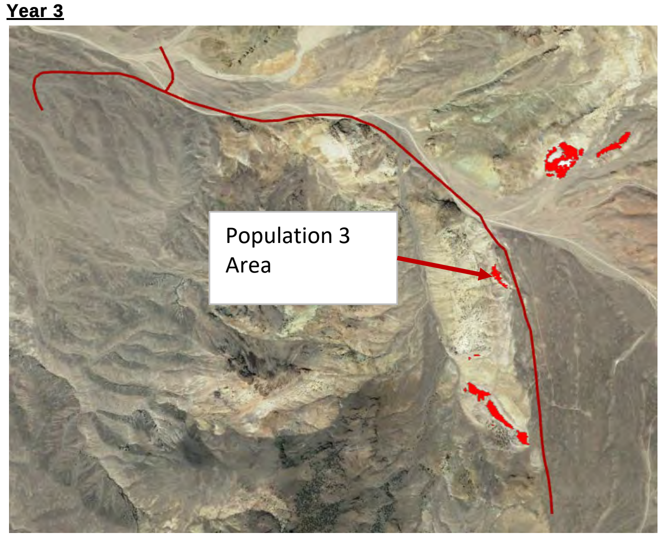
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%) = 6.40 %
W = mean vehicle weight (tons)
k = constant = 4.9 for PM
a = constant = 0.7 for PM
b = constant = 0.45 for PM
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation = 60 days

Watering efficiency: 85% Anticipated control level

[2] Daily vehicle trips as follows (per calls with Jim Tress, Westland Resources, on May 15, 2023):

Year 3 2 truck round trips/day
Year 11 525 truck round trips/day

Year 3



Year 11

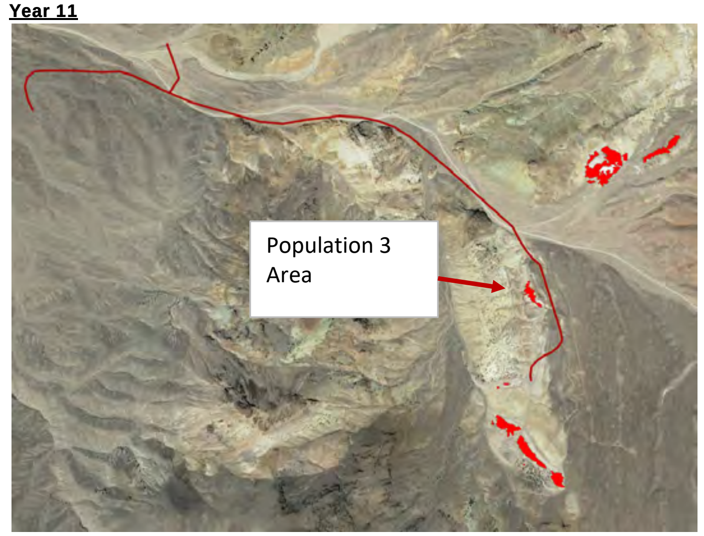


Table 5b. Haul Road Emissions - Model Emissions

Vehicle Type	Year	Total PM Emissions (lb/hr)	Total PM Emissions (lb/day)	Total PM Emissions (tpy)	Vehicle Make	Vehicle Model	Vehicle Height (ft)	No. of Volume Sources	PM Emissions (g/sec/volume) 1-hr	PM Emissions (g/sec/volume) 24-hr	PM Emissions (g/sec/volume) Annual
Haul Truck	3	1.81	43.35	6.51	CAT	785	17.09	107	2.13E-03	2.13E-03	1.75E-03
Haul Truck	11	397	9,525	1,451	CAT	785	17.09	92	5.44E-01	5.44E-01	4.54E-01

* Volume source parameters

Actual road width	45	meters
Adjusted width of road = actual road width + 6 meters =	51	meters
Height of volume = 1.7 x average vehicle height =	8.86	meters
Initial horizontal sigma (σyo) = adjusted road width / 2.15 =	23.72	meters
Initial vertical sigma (σzo) = volume height / 2.15 =	4.12	meters
Release height = volume height / 2 =	4.43	meters
Volume elevation =	Per AERMAP	

Table 5c. Haul Road Emissions - Model Results

Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations ($g/m^2/hr$)	Max PM Impacts At All Populations ($g/m^2/day$)	Max PM Impacts At All Populations ($g/m^2/yr$)	Population 3 Area Average of Peak PM Impacts ($g/m^2/hr$)	Population 3 Area Average of Peak PM Impacts ($g/m^2/day$)	Population 3 Area Average of Peak PM Impacts ($g/m^2/yr$)
Haul Truck	3	Watering	85%	0.00022	0.0037	0.47	0.00016	0.0020	0.31
Haul Truck	11	Watering	85%	0.055	0.84	130.69	0.035	0.54	85.23

Table 6a. Haul Road Emissions - Road Emissions

Vehicle Type	Year	Road Length		Road Type	Vehicle		Vehicle Weight (tons)				PM Emission Factor (lb/VMT) [1]		Vehicle Miles Traveled [2] (VMT)			PM Road Emissions		
		(miles)	(meters)		Make	Model	Empty	Capacity	Full	Mean	Short-Term	Annual	(VMT/hr)	(VMT/day)	(VMT/yr)	(lb/hr)	(lb/day)	(tpy)
Haul Truck	3	3.40	5,472	Unpaved	CAT	785	122	153	275	199	1.04	0.87	0.57	13.60	4,964	0.59	14.16	2.16
Haul Truck	11	2.90	4,667	Unpaved	CAT	785	122	153	275	199	1.04	0.87	127	3,045	1,111,425	132	3,170	483

[1] Emission factor for unpaved roads calculated per U.S. EPA, Unpaved Roads, AP-42 Section 13.2.2, Equations 1a and 2

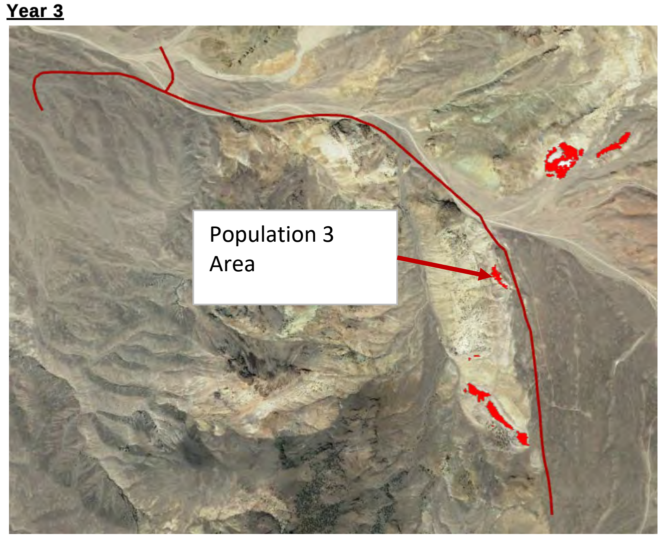
$$EF = k*\left(\frac{s}{12}\right)^{a}*\left(\frac{W}{3}\right)^{b}*(365-p)/365$$

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%) = 6.40 %
W = mean vehicle weight (tons)
k = constant = 4.9 for PM
a = constant = 0.7 for PM
b = constant = 0.45 for PM
P = number of days in a year with at least 0.254 mm (0.01 in) of precipitation = 60 days

Watering efficiency: 95% Anticipated control level

[2] Daily vehicle trips as follows (per calls with Jim Tress, Westland Resources, on May 15, 2023):
Year 3 2 truck round trips/day
Year 11 525 truck round trips/day

Year 3



Year 11

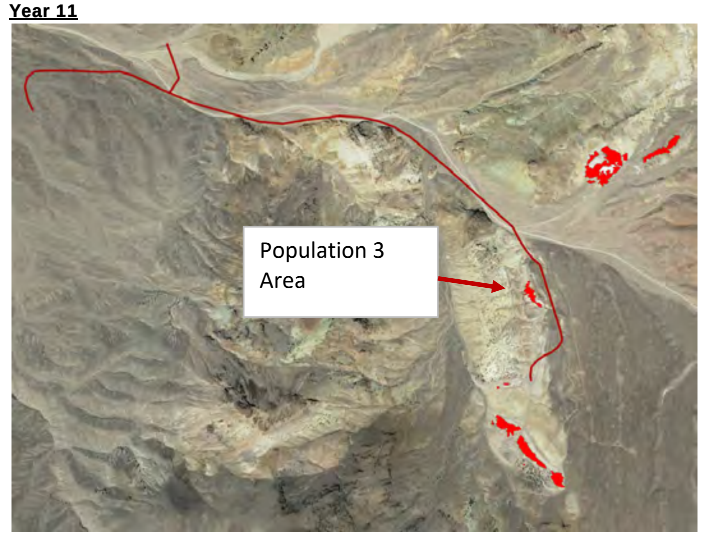


Table 6b. Haul Road Emissions - Model Emissions

Vehicle Type	Year	Total PM Emissions			Vehicle		Vehicle Height	No. of Volume Sources	PM Emissions (g/sec/volume)		
		(lb/hr)	(lb/day)	(tpy)	Make	Model	(ft)		1-hr	24-hr	Annual
Haul Truck	3	0.63	15.04	2.20	CAT	785	17.09	107	7.38E-04	7.38E-04	5.90E-04
Haul Truck	11	133	3,184	484	CAT	785	17.09	92	1.82E-01	1.82E-01	1.51E-01

* Volume source parameters
Actual road width 45 meters
Adjusted width of road = actual road width + 6 meters = 51 meters
Height of volume = 1.7 x average vehicle height = 8.86 meters
Initial horizontal sigma (σyo) = adjusted road width / 2.15 = 23.72 meters
Initial vertical sigma (σzo) = volume height / 2.15 = 4.12 meters
Release height = volume height / 2 = 4.43 meters
Volume elevation = Per AERMAP

Table 6c. Haul Road Emissions - Model Results

Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations			Population 3 Area Average of Peak PM Impacts		
				$(g/m^2/hr)$	$(g/m^2/day)$	$(g/m^2/yr)$	$(g/m^2/hr)$	$(g/m^2/day)$	$(g/m^2/yr)$
Haul Truck	3	Watering	95%	0.000080	0.0013	0.16	0.000054	0.00069	0.10
Haul Truck	11	Watering	95%	0.018	0.28	43.47	0.012	0.18	28.35

Table 7. Haul Road Emissions - Model Results

Vehicle Type	Year	Control Technique	Control Efficiency	Max PM Impacts At All Populations ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)	Population 3 Area Average of Peak PM Impacts ($g/m^2/hr$)	($g/m^2/day$)	($g/m^2/yr$)
Haul Truck	3	Watering	75%	0.00036	0.0061	0.78	0.00026	0.0033	0.52
Haul Truck	3	Watering	85%	0.00022	0.0037	0.47	0.00016	0.0020	0.31
Haul Truck	3	Watering	95%	0.000080	0.0013	0.16	0.000054	0.00069	0.10
Haul Truck	11	Watering	75%	0.091	1.40	217.63	0.058	0.90	141.93
Haul Truck	11	Watering	85%	0.055	0.84	130.69	0.035	0.54	85.23
Haul Truck	11	Watering	95%	0.018	0.28	43.47	0.012	0.18	28.35