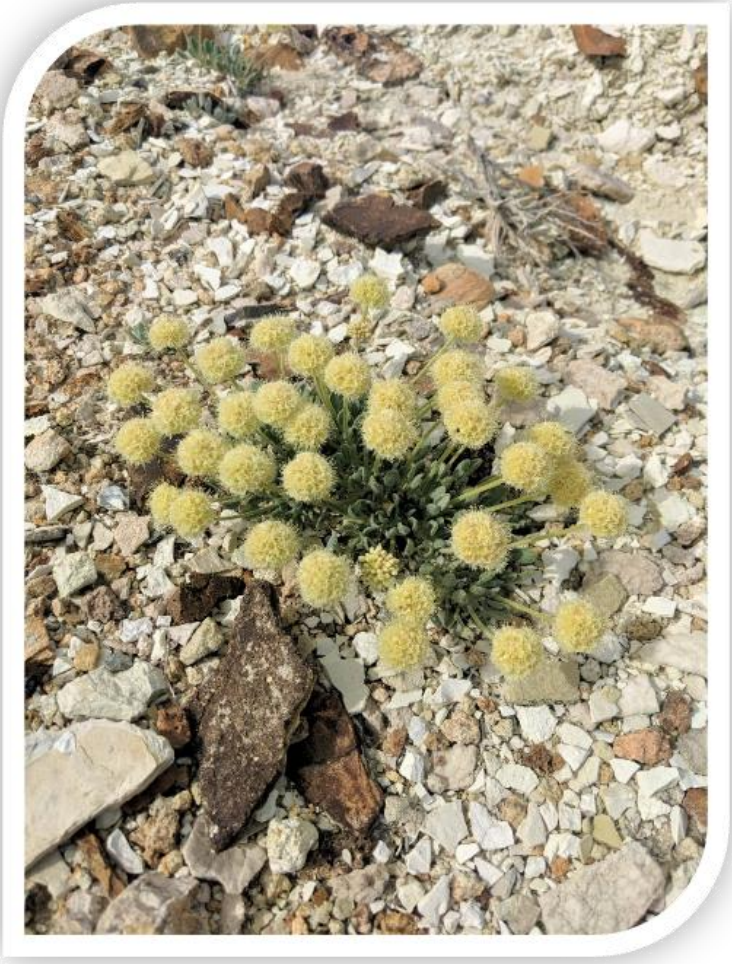
Tiehm's Buckwheat (*Eriogonum tiehmii*) Protection Plan

Draft

May 2020



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IONEER USA CORPORATION

RHYOLITE RIDGE LITHIUM-BORON PROJECT
ESMERALDA COUNTY, NEVADA

Tiehm's Buckwheat (*Eriogonum tiehmii*) Protection Plan

Draft
May 2020

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RHYOLITE RIDGE LITHIUM-BORON PROJECT
THIEM'S BUCKWHEAT (*ERIOGONUM TIEHMII*) PROTECTION PLAN

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EXECUTIVE SUMMARY

The purpose of this Protection Plan is to describe the applicant-committed environmental protection measures for Tiehm's buckwheat (*Eriogonum tiehmii*) that have either been implemented, or are proposed, for the Rhyolite Ridge Lithium-Boron Project (Project) by the Project proponent, Ioneer USA Corporation (Ioneer).

Tiehm's buckwheat is a Bureau of Land Management (BLM) sensitive species with a known global distribution that is limited to a single population within the Rhyolite Ridge area. The protection measures described in this Plan are intended to minimize potential impacts to Tiehm's buckwheat associated with Project development and increase the likelihood of the survival of this species in its natural habitat into the foreseeable future.

Summary of Tiehm's Buckwheat Protection Measures:

1. **Avoidance, Protection, and Awareness and Education.** Avoidance of subpopulations and habitat where possible, protection of existing subpopulations with fencing and signage, and awareness and education for all individuals involved in the Rhyolite Ridge Project.
2. **Field Survey for New Populations.** Development of a Habitat Suitability Model to increase understanding of Tiehm's buckwheat distribution, identify additional potential habitat, and direct continued surveys to identify new populations.
3. **Seed Collection and Banking.** Seed collection for use in cultivation, propagation, research, and seed banking for genetic conservation.
4. **Seeding.** Seeding of unoccupied habitat.
5. **Propagation and Transplanting.** Propagation and transplanting of seedlings into suitable unoccupied habitat.
6. **Salvage.** Salvage of plants removed during Project development and relocation into unoccupied habitat.
7. **Demographic Monitoring and Population Modeling.** An evaluation of the stability of existing subpopulations and quantification of the dynamics of existing and new populations.
8. **Climate Monitoring.** Establishment of weather stations to correlate any changes in Tiehm's buckwheat density, growth, or productivity with seasonal weather patterns.
9. **Research on Plant-Soil Relationships.** Evaluate soil preference and determine causal limits to occupied range and distribution of this species.
10. **Pollinator Assessment. I**dentify pollinators and determine if Tiehm's buckwheat is capable of self-pollination.
11. **Genetic Analysis.** Quantify genetic structure and diversity within and between subpopulations.

The proposed schedule for the implementation of the Tiehm's buckwheat protection measures is presented in the Table ES-1.

Table ES-1. Protection Measure Schedule and Frequency

Proposed Protection Measures	Frequency	Year Implemented	
		Actual	Proposed[1]
Avoidance, Protection, and Awareness and Education Program	Continuous	-	Project Year 1
Field Survey for New Populations	Annual	2018	-
Seed Collection and Banking	Annual	2019	-
Seeding	Periodic	-	2020 Fall
Propagation and Transplanting	Periodic	2019	-
Salvage	Periodic	-	Project Year 1
Demographic Monitoring and Population Modeling	Annual	2019	-
Climate Monitoring	Monthly	-	2020
Research on plant-soil relationships	Once	2020	-
Pollinator Assessment	Once	2020	2020
Research on a Genetic Analysis of the Population	Once	2019	-

[1] Project Year 1 denotes the year that project activities could begin following National Environmental Policy Act (NEPA) requirements, including a Record of Decision and mine permitting and bonding.

Ioneer has already begun implementing many of these protection measures and will continue to consider the protection of this species throughout the life of the Project. Ioneer will continue to work closely with the BLM, the Nevada Division of Forestry (NDF), and the United States Fish and Wildlife Service, Reno Fish and Wildlife Office (USFWS) to further knowledge of the plant's biology, demography, and ecology. Future site management and Project development will consider the results of implementing the voluntary protection measures in this plan, and other related studies.

1 INTRODUCTION

The purpose of this protection plan is to describe the applicant-committed environmental protection measures for Tiehm's buckwheat (*Eriogonum tiehmii*) that have been implemented or are proposed for the Rhyolite Ridge Lithium-Boron Project (Project) by the Project proponent, Ioneer USA Corporation (Ioneer). The goal of these voluntary protection measures is to ensure that the plant and its habitat are protected such that population and habitat degradation caused by development of the Project do not occur to the point that federal listing under the Endangered Species Act (ESA) is required.

This plan includes a summary of information on Tiehm's buckwheat from previous surveys and publications and incorporates the findings from the baseline field studies completed at the site in 2018 and 2019 by EM Strategies, Inc. (EMS 2020). Existing information on the species, along with the results from other endemic buckwheat protection efforts within the State of Nevada (BMP Ecosciences 2002, McClinton unpubl.), guided the development of the protection measures in this plan. Any field activities carried out under this plan would be conducted under a 2920-1 Land Use Application and Permit, or as otherwise authorized by the Bureau of Land Management (BLM).

2 SPECIES INFORMATION

The information presented in this section is a summary of existing literature (Reveal 1985), previous surveys and status reports (Tiehm 1994, Morefield 1995), information from the Nevada Division of Natural Heritage (NDNH), and a baseline survey conducted by EMS for Ioneer in 2019.

2.1 Legal or Formal Status

Tiehm's buckwheat is a Sensitive Species. The BLM Manual Section 6840 (Manual) defines Sensitive Species as "species that require special management or considerations to avoid potential future listing under the ESA…" (BLM 2008). One of the criteria for defining BLM sensitive species is:

> *"The species depends on ecological refugia or specialized or unique habitats on BLM administered lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk."*

The stated objective for sensitive species is to initiate proactive conservation measures that reduce or eliminate threats to minimize the likelihood of and need for listing (BLM 2008, 6840.02). Conservation, as it applies to BLM sensitive species, is defined as "the use of programs, plans, and management practices to reduce or eliminate threats affecting the status of the species, or improve the condition of the species' habitat on BLM-administered lands" (BLM 2008).

The United States Fish and Wildlife Service, Reno Fish and Wildlife Office (USFWS) received an emergency petition to list Tiehm's buckwheat under the ESA as an endangered or threatened

species and to concurrently designate critical habitat on October 7, 2019. The Nevada Division of Forestry (NDF) received a petition to add Tiehm's buckwheat to the State list of fully protected species of native flora in Nevada Administrative Code (NAC) 527.010, also on October 7, 2019. Both agencies are currently in the process of reviewing the species for listing.

2.2 Species Description

Tiehm's buckwheat is a low, cushion-forming perennial herb with a branched, woody caudex (basal stem structure). Individual mats can be up to 12 inches in diameter and most plants are less than ten inches high. Each plant bears many inflorescences (flower heads including stem, stalks, bracts and flowers) (NDNH 2001). The characters used to identify Tiehm's buckwheat are related to its floral structure; therefore, the plants need to be flowering (typically late April to June) to obtain a positive identification. It is the only buckwheat known to have well-defined stipitate (stalked) glands on the outer surface of the tepals (Morefield 1995; Reveal 1985). Other morphological characteristics that distinguish it from other buckwheats include:

1. Tepals are monomorphic (uniform);
2. Flowers are hairless;
3. Involucres (bracts surrounding a flower head) are large, lobed, rigid, and tubular;
4. Scapes (flower stalks) are hairy or covered with wooly tufts; and
5. Flowers are cream-colored, sometimes with a faint reddish midrib.

2.3 Taxonomy

Tiehm's buckwheat was first collected by Arnold Tiehm in 1983 and later described and named as a new species by James Reveal (1985).

2.4 Phenology and Life History

Like other cushion buckwheats, Tiehm's buckwheat is likely a long-lived species with high flower production, low germination rates, high seedling mortality, and high variability of growth between individuals and between years. 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. The flowers turn reddish as they age. Plants may look reddish in color and desiccated through the late fall and winter when they are dormant.

The reproduction and seed dispersal of Tiehm's buckwheat have not been studied, but buckwheats in general are sexual reproducers and insects are the most common pollinators. The primary seed dispersal agents are gravity, wind, and water. Upon maturation of the fruit, seeds are likely to fall to the ground in the immediate vicinity of parent plants and become lodged in broken rock on the soil surface. It's possible that limited seed dispersal may explain the static distribution of the plant and the lack of colonization of nearby seemingly suitable, but unoccupied habitat. It is also possible that seed is well-dispersed across the site, but the microenvironments suitable for germination are patchily distributed.

2.5 Range and Distribution

Tiehm's buckwheat occurs as a single population within the Rhyolite Ridge area. The plants occur in nine discrete sites, identified as subpopulations 1-5, 6a, 6b, and 7-8 (Figure 1). Subpopulation 8 is composed of a single plant and may be regarded as an incidental occurrence. All nine subpopulations are within a 1.5 square-mile area, and collectively cover approx. 10 acres. There are various hypotheses for the limited distribution of the species, including substrate specificity, and lack of competitive ability.

The boundaries of all subpopulations were walked and mapped using a global positioning system (GPS) instrument in the 2019 field survey. The size of the area occupied by the entire known Tiehm's buckwheat population increased by approximately 14 percent since the boundaries were last mapped by Jim Morefield in 2008-2010 (Table 1). It cannot be said definitively whether this indicates an increase in the amount of area occupied by Tiehm's buckwheat, since the observers and the instrumentation used were not the same between years.

Table 1. Area Occupied by Tiehm's Buckwheat Subpopulations

Subpopulation	Area (Acres)	
	2008 / 2010	2019
1	4.71	4.81
2	1.17	1.56
3	0.62	0.63
4	0.58	1.04
5	0.03	0.05
6 (a, b)	1.64	1.88
7	n/a	0.007
8	n/a	(1 plant)
Total	8.75	9.98

2.6 Habitat

2.6.1 Topography

The known elevational range of Tiehm's buckwheat is between 5,906 and 6,234 feet amsl. It occurs on all aspects and on slopes from zero to 50 percent.

2.6.2 Soils

Tiehm's buckwheat is 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 lithium clay in exposed lake beds.

Soil samples were collected at subpopulations 1, 2, and 6b during the 2018 survey. Additional soil samples were collected at subpopulations 7 and 8 in 2019. The results of the soil analyses are included in Appendix H of the baseline survey report (EMS 2020). Boron and carbonates were commonly present at excessive levels; sulfur, calcium, and potassium were commonly present at high levels. Soil pH ranged from 7.64 to 8.76 (Table 2). Additional soil sampling was conducted in 2020 as part of the plant/soil relationship study described in Section 4.9. All subpopulations were sampled. The results of those analyses are still pending as of the date of this report.

2.6.3 Vegetation Associations

Vegetation surrounding the subpopulations consists of shadscale (*Atriplex confertifolia/Sarcobatus baileyi*) or black sagebrush (*Artemisia nova*) shrub associations (Morefield 1995). The subpopulations themselves are basically monocultures of scattered, low-growing Tiehm's buckwheat. The distinct light color of the soil and the lack of vegetation cover made potential habitat readily identifiable in the field.

Table 2. Soil Analysis Summary at Tiehm's Buckwheat Populations

Subpopulation	Sample Site	Excessive	High	pH
1 (White soil)	1	Boron, carbonates	Sulfur, potassium	8.76
1 (Non-white soil)	2	Boron	Sulfur, potassium, calcium	8.21
2	3	Boron, chloride	Sulfur, potassium, calcium, nitrate	8.42
6	4	n/a	Calcium, potassium	8.00
7	5	n/a	Calcium, potassium, carbonates	7.64
8	6	Boron, carbonates	Sulfur, potassium, calcium	8.54

2.6.4 Climate

The climate in the Project Area is typical of the southwestern part of the Great Basin, characterized by cold winters, warm summers, and low precipitation. Temperatures vary widely with the lowest and highest temperatures occurring in January and July, respectively. HydroGeoLogica (HGL) (2018) estimated site-specific temperatures based on data from the Dyer meteorological station. Summer high temperatures within the Project Area range from 79.5°F to 89.6°F, with winter low temperatures averaging between 13.0°F to 19.3°F during December, January and February. Freezing temperatures typically begin in October and may last until April. Average winter temperature at the Project Area is 30.1°F with an average minimum winter temperature of 15.2°F; while, average summer temperature and average maximum summer temperature is 68.1°F and 86.8°F, respectively.

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 HGL (2018) indicates that precipitation at the Project Area ranges between 5.5 and 8.1 inches per year. The winter of 2018-2019 was characterized by heavy snow and precipitation, resulting in a productive year for the buckwheat.

2.7 Abundance and Population Trend

The number of plants in each subpopulation was estimated in 1994; during the period of 2008-2010; and in 2019 (Table 3). Given that the estimation methods differed between all surveys, direct comparisons of the subpopulation numbers between years cannot be made. Permanent belt transects were established in 2019 so that data collection can be repeatable for direct comparisons in the future (EMS 2020). Transect locations, photo points, and field data for the 2019 survey are documented in the Baseline Biology Report prepared for the BLM (EMS 2020). Belt transects were set up and sampled according to the following steps:

1. A rectangle was drawn around the widest and longest extents of each of the subpopulations as they were mapped in 2008 to 2010.

2. Equally spaced transect points were established for each subpopulation along the longest rectangle axis, starting from a randomly generated point along the line. Each transect end point was marked with rebar, labeled, and photographed. The number of transects necessary to sample each subpopulation was statistically determined with a simulation model based on previously reported densities and a distribution of plant sizes.

3. Transects, 100 meters in length, were run perpendicular to the long axes of the subpopulation. All plants within one meter to the right of the tape were counted and their length and width recorded.

4. The plants along a subset of the transects in subpopulations 1, 2, and 3 were permanently marked with numbered metal coin tags, and the number of inflorescences and an estimate of the percent of the plant that was dead were recorded.

Constraints to obtaining accurate estimates include the patchy nature of the subpopulations, and the difficulty of determining what constitutes an individual plant in high density areas. For the purposes of the 2019 survey, plants that were separated by more than five centimeters were considered separate individuals, as was done for the study of Steamboat buckwheat (*Eriogonum ovalifolium* var. *williamsiae*) by BMP Ecosciences (2002).

2.8 Current Demographic Status of Subpopulations

2.8.1 Size Classes

A total of 1,813 plants were measured for length and width and categorized by size (Table 4) during the baseline survey in 2019 (EMS 2020). The area of the plants was calculated using the

Table 3. Estimated Number of Individual Tiehm's Buckwheat Plants by Subpopulation

Subpopulation	Estimated Number of Plants (Percent of Population)		
	1994[a]	2008 / 2010[b]	2019[c]
1	7,000+ (41%)	15,380 (42%)	9,240 (21%)
2	3,000+ (18%)	4,000 (11%)	4,541 (10%)
3	500+ (3%)	4,000 (11%)	1,860 (4%)
4	500+ (3%)	1,960 (5%)	8,159 (19%)
5	15 (<1%)	100 (<1%)	199[d] (1%)
6 (a, b)	6,000+ (35%)	11,100 (30%)	19,871 (45%)
7	n/a	n/a	50[d] (<1%)
8	n/a	n/a	1[d] (<1%)
Total	17,015	36,540	43,921

[a] Ocular estimate
[b] Method employed: "Estimating Population Size Based on Average Central Density" (Morefield 2004)
[c] Method employed: A modification of the density quadrat sampling methodology in the BLM technical references "Sampling Vegetation Attributes" (BLM 1999) and "Measuring and Monitoring Plant Subpopulations" (Elzinga et al. 1998)
[d] Direct count

Table 4. Size Classes of Tiehm's Buckwheat Subpopulations

Sub-population	Size Class (basal area cm^2)[a]								Cover Estimate (m^2)
	0-5	6-80	81-325	326-725	726 -1,260	1,261 - 2,000	2,001 - 3,000	3,001+	
1	5	77	93	27	4	1	0	1	160.6
2	14	96	47	7	1	0	0	0	45.7
3	5	20	12	1	1	0	0	0	25.3
4	38	149	34	1	0	0	0	0	22.3
5	18	141	38	2	0	0	0	0	1.1
6 (a,b)	82	576	251	19	1	0	0	0	140.9
7	5	33	12	0	0	0	0	0	0.2
8	0	0	1	0	0	0	0	0	-
Total	167	1092	488	57	7	1	0	1	406

[a] Size class reported by basal area calculated using the formula for an ellipse. Roughly, the size classes represent plants with the following length and width: 0-5cm^2 (seedlings); 6-80 cm^2 (plants to 5 x 5 cm); 81-325 cm^2 (plants to 10 x 10 cm); 326-725 cm^2 (plants to 15 x 15 cm); 726-1260 cm^2 (plants to 20 x 20 cm); 1261-2000 cm^2 (plants to 25 x 25cm); 2001-3000 cm^2 (plants to 30 x 30 cm).

formula for the area of an ellipse. Although there are fewer plants in the smallest size class (0-5 cm2) than would be expected in a typical size distribution, recruitment is occurring in all subpopulations. Populations of long-lived species with low adult mortality can survive with relatively low recruitment rates (Harper 1977). The two subpopulations where a complete plant

count was performed (5 and 7) had smaller plants than many of the larger subpopulations. Proportionally, Subpopulation 1 had the largest plants.

2.8.2 Inflorescences and Dead Tissue

The number of inflorescences was recorded for a subsample of plants (578) along select transects in five subpopulations. These plants were marked with numbered metal coin tags so that they can be monitored over time. Across all subpopulations, 31 to 70 percent of plants were in a reproductive state at the time of the survey (Table 5). Development of inflorescences within Subpopulation 2 lagged behind the other subpopulations. This may be due to a colder microclimate at its location in a drainage on a north-facing slope.

Table 5. Inflorescence and Dead Material Coefficients by Subpopulation

Subpopulation	Percent (%) of Plants with Inflorescences	Coefficient for Inflorescence Number and Area	Coefficient for Dead Percent and Area (cm)
1	64.7	0.013	0.02
2	31.3	0.016	0.05
3	69.2	0.051	Nonsignificant
5	70.4	0.08	0.16
7	64.0	0.10	Nonsignificant

Across all subpopulations the number of inflorescences was positively correlated with the basal area of the plant. Overall, larger plants were also more likely to have an increased amount of dead tissue, but this relationship was not strong and was not detected in two of the measured subpopulations.

2.9 Potential Threats

Tiehm's buckwheat has a very restricted distribution and specialized habitat requirements, as described above, which makes it vulnerable to natural events as (e.g. climatic shifts, droughts) as well as anthropogenic disturbance. Direct and indirect threats to the species briefly evaluated in this report include: 1) nonnative, invasive plant species; 2) wildland fire; 3) herbivory and trampling; 4) OHV use and road development; and 5) mining exploration and development.

2.9.1 Nonnative, Invasive Plant Species

Halogeton (*Halogeton glomeratus*) was the only invasive species found within some of the Tiehm's buckwheat subpopulations (EMS 2020), where it was sparse and likely limited by an intolerance of the high levels of boron in the soil. It is unlikely that halogeton or any other invasive species could displace Tiehm's buckwheat from its habitat for that reason. Invasive species, although ubiquitous, have not formed monocultures in the Rhyolite Ridge area and are not a significant component of the vegetation communities that are present. Therefore, they would not contribute significantly to the spread of wildfire. Conservation measures designed to reduce the threat of nonnative, invasive plant species are addressed in the Noxious and Invasive Weed

Management Plan for the Rhyolite Ridge Lithium-Boron Project (Newfields 2019). For these reasons, nonnative, invasive plant species pose a minimal threat to Tiehm's buckwheat.

2.9.2 Wildland Fire

Tiehm's buckwheat occurs on sparsely vegetated, rocky habitat, and would likely only be impacted by a high-severity fire. A high-severity wildland fire could kill Tiehm's buckwheat individuals and seedbanks, resulting in reduced likelihood of regeneration and recruitment in affected subpopulations. Fuel load accumulations in the Rhyolite Ridge area are low, reducing the chance of a high-severity fire. Wildland fire, therefore, poses a minimal risk to the Tiehm's buckwheat population.

2.9.3 Herbivory and Trampling

The most common herbivores in the area are the bighorn sheep, feral horse, black-tailed jackrabbit, desert cottontail, and ground squirrel (EMS 2020). Livestock grazing is not occurring within or near Tiehm's buckwheat populations. There was no sign of herbivory and very little wildlife sign in buckwheat subpopulations noted during the 2019 survey (EMS 2020). Due to the low compact growth habit of the plant and its occurrence in sparsely vegetated areas, herbivory and trampling pose a minimal threat to the plant.

2.9.4 Off-Road Vehicle Traffic

There is off-highway vehicle (OHV) traffic associated with hunting and recreational activities in the Rhyolite Ridge area. In addition, a county road runs between subpopulations 1 and 3, and subpopulations 2, 5, and 8 are adjacent to dirt roads. OHV damage to Tiehm's buckwheat plants was documented in Subpopulation 1 in December 2019. Mining and mineral exploration activities in the area have created, reopened, or improved roads in the area, allowing easier and greater access to OHV use. In addition to direct impacts on individual plants, OHV use can lead to the introduction or spread of nonnative invasive species and increased fire frequency. OHV traffic poses a significant threat to Tiehm's buckwheat.

2.9.5 Mining and Mineral Exploration Activities

Most of the subpopulations have been impacted by disturbance from soil sampling associated with past mineral exploration activities. Tiehm's buckwheat has colonized several soil sample trenches that are estimated to be between 40 and 80 years old in subpopulations 1, 2, 3, 4, and 6a. The potential impact of the Project on the Tiehm's buckwheat population is discussed in Section 3.

3 RHYOLITE RIDGE LITHIUM-BORON PROJECT

3.1 Project Description

Rhyolite Ridge holds the largest known lithium and boron deposit in North America. Ioneer is seeking to develop a lithium and boron quarry on land administered by the U.S Department of

the Interior, BLM, Tonopah Field Office. Proposed primary Project facilities within the Project Area are expected to disturb approximately 830 acres.

The current Project plan involves construction, operation, reclamation, and closure of a surface quarry from which the resource would be extracted using conventional excavators. Overburden rock and ore would be transported from the quarry using haul trucks with the ore directed to a processing facility and the overburden rock to a storage area. The process residues would be directed to a spent ore storage facility. The operational phase of the Project will be for a period of approximately four to five years, beginning after construction of the initial facilities; reclamation would occur after this operational period.

3.2 Location and Size

Ioneer's proposed Project is located approximately 40 miles southwest of Tonopah and 13 miles northeast of Dyer (Figure 2). The proposed Project is located on public lands administered by the BLM in Sections 19 through 23, and 26 through 35, Township 1 South, Range 37 East (T1S, R37E), and Sections 2, 3, and 4, T2S, R37E, Mount Diablo Base and Meridian (Figure 3). The Project Area encompasses approximately 4,580 acres.

3.3 Species Occurrence and Impact

The only known Tiehm's buckwheat population is entirely within the Project Area. The proposed Project would result in direct disturbance to plants and habitat in subpopulations 4, 5, 6a, 6b, and 7 (Figure 4). Based on the 2019 density and acreage estimates, this disturbance would impact 65% of the plants and 30% of the total occupied habitat.

4 PROTECTION MEASURES

The protection measures described in this section are intended to minimize potential impacts to Tiehm's buckwheat associated with Project development and increase the likelihood of the survival of this species in its natural habitat into the foreseeable future.

4.1 Avoidance, Protection, and Awareness and Education Program

Subpopulations 1, 2, 3, and 8 will be avoided and left undisturbed by Project activities. Subpopulations 1 and 2 will be fenced with signage (Vegetation Control Areas - No Admittance) to prevent disturbance from OHV traffic, ungulates, and pedestrians. Subpopulation 3 is within a steep, rocky area that is not visible from the County road, and therefore is already afforded a degree of protection from disturbance. The type of fencing will be subject to approval by the Nevada Department of Wildlife (NDOW). A buffer will be created between the fence and the perimeter of the subpopulations. The size of the buffer will be large enough that any construction activities and disturbance associated with the fence installation is not detrimental to Tiehm's buckwheat or its habitat. . A biologist will be on-site during fence installation and Tiehm's buckwheat individuals near the fence's perimeter will be flagged to ensure minimal disturbance to the species and its habitat. Ioneer will maintain the fencing for the life of the Project. In addition, Ioneer will develop an employee training program that includes information on Tiehm's

buckwheat identification and the procedures for reporting a suspected sighting to appropriate personnel.

4.2 Field Survey to Identify New Populations

Morefield (1995) reported that the likelihood of finding new populations was very low to non-existent, based on the number of sites (33) that were surveyed in 1994, which represented all potential habitat in western Nevada, without finding additional populations. Morefield surveyed other areas sporadically between 1995 and 2018 looking for Tiehm's buckwheat with similar results (J. Morefield, pers. comm., June 28, 2018). Morefield (1995) theorized that "absence of the species from numerous apparently suitable sites provides circumstantial evidence that the species may have undergone population declines at least during prehistoric times, and/or that it may have limited ability to disperse to and establish in unoccupied habitat."

Considering the difficulty of finding new populations, a Habitat Suitability Model (HSM) was developed to identify potential habitat for Tiehm's buckwheat within a ten-mile radius of the Project Area utilizing ArcGIS and remote sensing data (geosUAS 2018). Initial statistics indicated that soil units and geologic units were the best predictors of the presence or absence of Tiehm's buckwheat. The HSM identified twenty sites comprising 1,126 acres as warranting field investigation for the presence of Tiehm's buckwheat based on the intersection of geologic and soil parameters. In addition, Ioneer staff identified 24 potential sites based on professional knowledge of the geology, geomorphology, and soils of the surrounding area.

EM Strategies conducted a survey of potential habitat during the months of May, June, and September 2019. Two additional small subpopulations were found (7 and 8) within the Project Area. No new populations of Tiehm's buckwheat were found outside of the Project Area. Potential habitat identified by applying the HSM and expert opinion will continue to be surveyed during the life of the Project to identify additional, currently unknown populations.

The HSM methodology, data search, GIS database and map-set developed for Ioneer that identifies potential Tiehm's buckwheat habitat in the Silver Peak Range will be made available to researchers and regulatory agencies. This information will be useful in efforts to identify new populations, or areas that could be successful propagation or salvage sites.

4.3 Seed Collection and Banking

Seed from the Tiehm's buckwheat population will be collected over multiple years for long-term storage (seed banking) and to provide a seed supply that would be available to the BLM as well as other approved nurseries, researchers, agencies, and non-government organizations (NGO's) with an interest in conservation, propagation, and study of Tiehm's buckwheat. A portion of the seed will be used for seeding, propagation, and research as discussed in sections 5.1.3 to 5.1.5.

4.3.1 2019 Seed Collection

Tiehm's buckwheat seed was collected and tested for germination and viability. Seed collection was authorized by the BLM as "Casual Use" (BLM letter 8372 [NVB0200]). Seed collection followed the guidelines established by the storage facility, the Rae Selling Berry Seed Bank (RSBSB) at Oregon State University, Portland, titled "Collecting Seeds for Genetic Conservation"

Seed was collected from 300 plants in subpopulations 1 through 7, representing less than one percent of the total number of plants in the entire population. The seed production in 2019 was uncharacteristically high because of the large number of plants that flowered as a result of heavy snowfall and precipitation in the winter of 2018-2019.

The seed was collected by Mr. Ed Kleiner of Comstock Seed, under contract to EM Strategies, in July 2019. A sample of the seed was submitted to the Nevada Department of Agriculture (NDA) for viability testing. The remainder of the seed was accessioned at the RSBSB for storage. NDA performed a tetrazolium chloride (TZ) test on the seed. The TZ test is a chemical test used to determine seed viability. The seeds were 16 percent viable, which is slightly lower than an average 20 percent for native buckwheats (pers. comm. Russell Wilhelm, NDA, September 18, 2019).

The total number of seeds collected was 8,790. After cleaning and processing by Comstock Seed and RSBSB, 6,197 seeds were determined to be mature. A subset of 3,275 seeds were sent to UNR for the propagation trial discussed in Section 5.1.4. The remainder of the seed (2,922) remains in storage at RSBSB for use in the soil preference trial discussed in Section 5.1.5.

4.3.2 Future Seed Collections

Currently, seed collection is permitted under a 2920 Land Use Application and Permit issued by the BLM, which allows for X, Y, Z. Any permit application(s) for future seed collections will state the number of plants to be sampled, the source subpopulations, and the proposed use of the seed. Likely probable future needs and uses include seed banking and research activities such as propagation and seeding studies.

The current permit was granted for seed collection in 2020. Seed will be collected from the existing subpopulations (except for Subpopulation 8 because it is regarded as an incidental occurrence). The seed will be used for establishing seed plots and seed banking. Funding was provided by Ioneer to the Rae Selling Berry Seed Bank and Plant Conservation Program (RSBSB) for both short-term and long-term storage of Tiehm's buckwheat seeds in 2019. A portion of the seed collected in 2020 will be sent to RSBSB to replenish the seed that was removed from storage and used in research activities at the University of Nevada, Reno (UNR) in 2019 and 2020.

Seed collection procedures will follow the collection guidelines in Center for Plant Conservation (CPC) Best Plant Conservation Practices to Support Species Survival in the Wild (CPC 2019). CPC recommends collecting no more than 10% of an individual or population seed production in one season and no more than five years out of ten. An attempt will be made to collect genetically representative samples by collecting from scattered individuals throughout the subpopulation.

4.4 Seeding

A portion of the seed collected in 2019 will be used in a trial seeding project. The results of the trial will provide information on the efficacy of seeding in the recovery of the species at the site. Seeding will be conducted in unoccupied habitat that is outside of the Project Area or within the Project Area yet outside of the proposed disturbance. Seeding will occur in August to resemble natural seeding. The target seeding rate per square foot will be based on the germination and spacing considerations. The seed will be raked to cover.

Plots that are seeded will be monitored over a period of years to determine if natural germination and establishment are successful. The plants must reach reproductive maturity and produce viable seed to be established. If the trial is unsuccessful and the cause of the failure either cannot be identified or remedied, no additional seeding trials will be conducted.

4.5 Propagation and Transplanting

In 2019, Ioneer contracted with UNR to conduct a propagation and transplant trial to test transplant methods in the field to evaluate the possibility of propagating seedlings into unoccupied habitat. UNR personnel, Dr. Elizabeth Leger and Jamey McClinton, conducted a similar trial with another mat buckwheat - Crosby's buckwheat (*Eriogonum crosbyae*) - in northern Nevada in 2018 and early 2019. The survival rate after the period of May to August was 63% (Wilcher and Leger, unpubl.) The same methods will be used to test the propagation and transplanting success for Tiehm's buckwheat.

UNR received 3,275 seeds from RSBSB for propagation, with the goal of producing 500 seedlings. In the fall of 2019, UNR collected soil from Subpopulation 6b, where soil analyses (Section 2.6.2) showed the lowest boron content of any of the soil sample sites. Subpopulation 6b has a high density of plants, possibly because the soil is more conducive to growth. The seeds will be planted in a 50/50 mix of field soil and washed decomposed granite (DG) in 5.5" supercells. Based on previous experience with Crosby's buckwheat, a 50/50 mix of field soil with washed DG will provide an appropriate texture for seedling growth. Planting was done in January 2020. The plants are housed in a greenhouse at UNR.

Plants will be moved outside to harden off after about two months of growth, then transplanted to unoccupied habitat in the spring of 2020; the timing will be dependent on spring weather and site accessibility. Three sites for transplant were selected in cooperation with the BLM and with approval from USFWS. The criteria for site selection was based on information in the HSM; soil analysis; elevation; proximity to existing subpopulations; geologic unit; accessibility; and level of protection from future disturbance.

Terra cotta clay pots will be used to deliver water slowly to the root system of transplanted seedlings. Pots will be buried in the soil and covered with removable foil lids weighted with rocks. One to three plants will be planted on the outside of the perimeter of each pot, with a goal of 100 pots per site. Pots will be filled with water every two weeks over the summer to facilitate seedling establishment. Data on seedling survival will be recorded during each watering and at the end of the growing season. This methodology was used for a transplant study on Crosby's

buckwheat in 2019. The survival rate of the seedlings was 63 percent at the end of the first growing season (Leger and McClinton, unpubl.)

The establishment and survival of transplants should be viewed as short-term success. Long-term success will be accomplished when new populations are self-sustaining (increasing in number, producing viable seed, minimal intervention requirements). The results of the propagation/transplant trial will be used to develop strategies for using propagation to establish self-sustaining populations under natural conditions. Monitoring will occur over two or more subsequent reproductive cycles to determine whether the transplants can attract pollinators, set seed, and produce plants that subsequently produce seed. Seedling transplants will be marked with a numbered tag. A complete census of the transplants will be conducted every spring for five years, to track survival over time. After the first five years, monitoring will continue every 3-5 years for a minimum of 20 years to document persistence and recruitment. For a subset of plants per site (up to 100), size, flower production, seed output, and seed viability will be recorded. A complete census of the site will be performed during each monitoring session to track for the presence of new plants. New plants will be assigned a numbered tag when first observed so that recruitment per session can be recorded.

4.6 Salvage

The proposed Project development would remove the plants in subpopulations 4, 5, 6a, 6b, and 7. Ioneer proposes to salvage these plants prior to disturbance to the greatest degree possible. Plant salvage is predicated on approval of a salvage plan by the BLM, USFWS, and NDF.

In general, salvage would follow the following steps. The plants would be moved while they are dormant. Plants will be placed in nylon planting bags for transport. The bags will have native soils. No soil amendments will be used. Plants will be watered after initial planting and will receive supplemental watering (one gallon of water per plant) two weeks after transplanting. Supplemental watering will be conducted periodically throughout the growing season as needed based on current weather conditions.

The transplant location(s) would be approved by BLM, NDF, and USFWS. The criteria for selecting a transplant location would include soil chemistry and characteristics; level of protection from foreseeable disturbance; elevation; geomorphology; and ease of access.

The plants would be monitored annually for a minimum of five years post-transplanting. The number of living and dead plants would be counted and live plants appearing stressed or showing signs of probable mortality would be noted. Monitoring will determine whether the salvaged plants can persist, attract pollinators and reproduce through viable seed production and recruitment. The monitoring period will be extended beyond five years if required; if for example, if the plants survive, but do not flower or produce seed during that time.

4.7 Demographic Monitoring and Population Modeling

In order to evaluate the stability of the Tiehm's buckwheat population, a demographic monitoring program will be designed to detect and document trends in 1) numbers; 2) acres

inhabited; 3) size class distribution; and 3) cover for all existing subpopulations and any new populations that are identified. EM Strategies established permanent monitoring transects in subpopulations 1, 2, 3, 4, 6a, and 6b in 2019 for the purpose of collecting baseline data and establishing a means of monitoring population changes over time (sections 2.7 and 2.8). Along a subset of transects in subpopulations 1, 2, 3 plants were marked with numbered tags to monitor changes in individuals.

After an initial assessment in 2020, additional plants may be tagged subpopulations 1, 2, and 3 to ensure coverage of a range of representative sizes for demographic monitoring. For each marked plant, demographic rates will be recorded annually, including size, survival, reproductive output (number of flowers, numbers of seeds per flower), seed viability (measured via emergence in a controlled lab setting), and the presence of new germinants. Demographic rates provide information crucial to understand the mechanisms driving population density changes. Monitoring will occur over a period of five years.

Population density and demographic data will be integrated to 1) estimate population trajectories of newly founded populations relative to existing populations; 2) identify the demographic rates most important in driving population changes; and 3) describe the likelihood of newly established populations persisting into the future.

4.8 Climate Monitoring

A weather center will be set up in the Project area at Subpopulation 1 to record precipitation, temperature, and wind speed and direction. Soil moisture content will be measured in the subpopulations and changes will be tracked over time. The data will be used to correlate any changes in Tiehm's buckwheat occurrence or productivity with natural environmental variability.

4.9 Research on Plant/Soil Relationships

The relationship between Tiehm's buckwheat and its habitat remain obscure. Over long periods of time, extreme soil parameters can select for tolerant genotypes, promoting the evolution of endemic and highly restricted species. Adaptations of soil specialists include high root-to-shoot allocation; development of obligate mycorrhizal relationships; tolerance of salinity or heavy metals; and an ability to accumulate excessive or deficient nutrients in plant tissues. These plants are often not found on other more hospitable soils, presumably because the adaptations required to live on challenging soils have costs that reduce the capacity for specialized plants to be competitive in more hospitable sites. Thus, defining potential habitat for these soil specialists requires defining the limits of their tolerance (i.e. understanding the conditions under which they can grow, and those they cannot tolerate), as well as measuring the abundance of potential competitors. Research will be conducted to attempt to link substrate characteristics to Tiehm's buckwheat distribution and vigor.

UNR will research the plant-soil relationship to look for patterns in soil preferences and community composition to help identify suitable transplant or relocation sites. The performance of Tiehm's buckwheat will be evaluated when grown on soils from currently occupied sites,

nearby unoccupied sites, and on soils that have been disturbed as part of exploratory mining activities.

To test plant responses to different types of field soil, the experiment will focus on soils from known subpopulations, from multiple (three to five) promising unoccupied sites, and from sites likely to resemble the composition and texture of disturbed areas (approximately five sites, focusing on historically disturbed sites within occupied and unoccupied habitats). At each location, 40 sub-samples of soil will be collected and analyzed. Physical and chemical properties, including soil depth, texture, moisture content, pH, conductivity, cation exchange capacity, organic content and specific elements (including N, P, S, B, Ca, Mg, Na, K, and Al) will be measured from areas differing in the presence and growth of Tiehm's buckwheat.

Using seeds from the 2019 collection, plants will be sown in field-soil replicates (ideally, 20-40 per soil type) in small pots to test seed emergence, survival, growth, and root allocation. Seeds will be planted late February-early March 2020. Plants will be housed in a greenhouse at UNR. Ideally, 200 to 300 seedlings will be produced.

Seed emergence and survival will be monitored weekly. Above-ground plant size will be measured in April. Half will be harvested after six months of growth, separating, drying, and weighing above and below ground growth, and half will be allowed to continue growing, to allow for measurements of juvenile plant traits. The plants will be chosen randomly. This information will be used to analyze effects of different soil types on seed emergence and survival, plant biomass (above and below ground), and on root:shoot allocation.

4.10 Pollinator Assessment

Understanding what pollinates rare plants is important because self-sustaining populations depend not just on finding habitat for plants, but also on the presence of the right pollinators. UNR will conduct an assessment in 2020 that attempts to answer the following questions:

- How many taxa are observed visiting Tiehm's buckwheat flowers?
- Are the pollinators generalists or specialists?
- Are flowers capable of self-pollination?

Biologists will visit two Tiehm's buckwheat subpopulations and two nearby non-habitat sites. Sites will be visited three times each, at the beginning, middle, and end of the flowering season, to survey for pollinators. Pollinators visiting either Tiehm's buckwheat or other flowering plants (in the nearby sites) will be recorded over a period of two days, collecting a sample of observed pollinators during four separate 20-minute sampling periods. The insects will be collected with nets and traps (bright bowls with soapy water). Collections will be identified to family, genus, or species (depending on what is possible for each group). Observational surveys will be conducted in between sampling, noting the number of visits for a sample of plants, and identifying pollinators by morphological group or species, as possible. The pollinator community composition and turnover between sites and at different times in the flowering season, will be analyzed.

To determine the importance of pollinators for seed-set, biologists will cover 30 inflorescences with unopened flowers at two sites using mesh bags, aiming for two bags per plant (15 plants at each site), on the first and second sampling trips. At the same time, two inflorescences will be marked on the same plant that are open to insect visitors with a small string tag. On a subsequent trip, when flowers have senesced, open-pollinated inflorescences will be bagged, to prevent seed loss upon ripening. Finally, on the last trip, the bagged and unbagged flowers will be collected, and the seed set will be compared. This will provide information on the importance of pollinators for seed set in Tiehm's buckwheat.

4.11 Genetic Analysis

Ioneer funded research conducted by Texas A&M in 2019 that resulted in the creation of a reference genome for Tiehm's buckwheat (EMS 2020). As an extension of that research, the genetic structure and diversity of Tiehm's buckwheat subpopulations will be quantified to analyze the genetic variation within and between subpopulations. At each subpopulation, leaves of 15-20 individuals will be collected. DNA will be extracted according to lab protocols. Individual plants will be genotyped. The genetic structure of the subpopulations will be modeled to characterize the levels of genetic differentiation among and diversity within subpopulations.

The work will be phased to make sure adequate results can be obtained to make conclusions. The first phase will be conducted in 2020 and will be six months in duration. The work will be conducted by a lab at an accredited university with experience in working with rare plant species. The methodology for the genetic analyses will be approved by the USFWS.

4.12 Protection Measure Schedule and Frequency

The proposed schedule for the implementation of the Tiehm's buckwheat protection measures is presented in Table 6.

5 CONCLUSION

The protection measures described in this plan are designed to minimize impacts to the Tiehm's buckwheat population and increase the likelihood of the survival of the species in its natural habitat into the foreseeable future. Several of the measures have been implemented pre-Project, and others are part of the proposed Project operations (Table 6). Ioneer will continue to research the plant and follow the guidance of the BLM, NDF, and USFWS. Future site management and Project development will be adjusted according to the results of the implementation of the protection measures in this plan and other related studies in consultation with the BLM.

Table 6. Protection Measure Schedule and Frequency

Proposed Protection Measures	Frequency	Year Implemented	
		Actual	Proposed[1]
Avoidance, Protection, and Awareness and Education Program	Continuous	-	Project Year 1
Field Survey for New Populations	Annual	2018	-
Seed Collection and Banking	Annual	2019	-
Seeding	Periodic	-	2020 Fall
Propagation and Transplanting	Periodic	2019	-
Salvage	Periodic		Project Year 1
Demographic Monitoring and Population Modeling	Annual	2019	-
Climate Monitoring	Monthly	-	2020
Research on plant-soil relationships	Once	2020	-
Pollinator Assessment	Once	2020	2020
Research on a Genetic Analysis of the Population	Once	2019	-

[1] Project Year 1 denotes the year that project activities could begin following National Environmental Policy Act (NEPA) requirements, including a Record of Decision and mine permitting and bonding.

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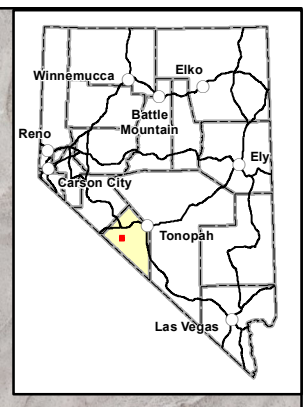
FIGURES



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Explanation

Project Area

Subpopulation

Existing Road

Land Status: All BLM

0 500 1,000 Feet

N

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RHYOLITE RIDGE PROJECT

Tiehm's Buckwheat Subpopulations 2019

Label: Figure 1	Drawn By: MJR/JDB
Date: 10/16/2019	Project No.: 3944
Base Map: ESRI World Imagery(Clarity)	
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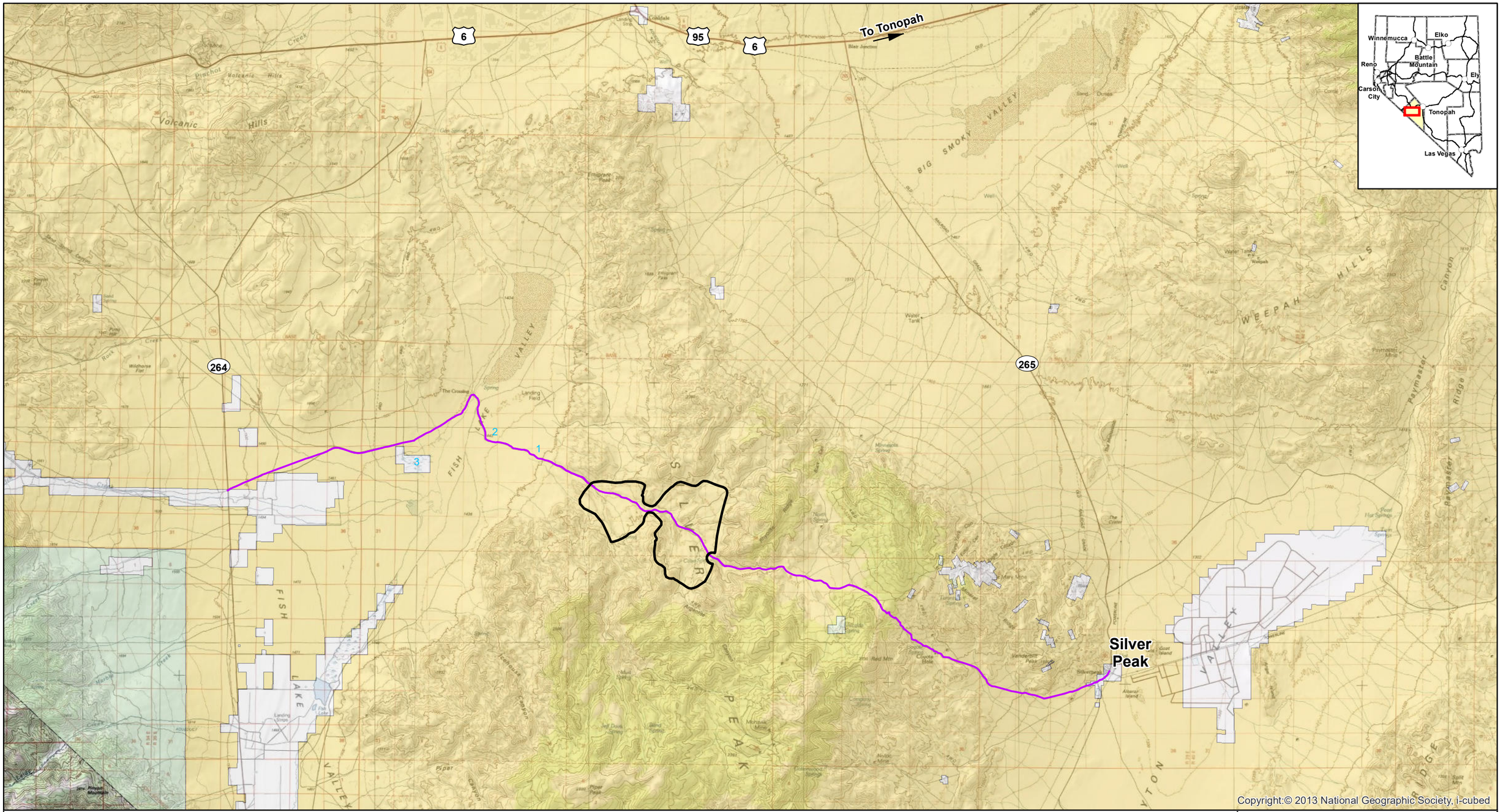
EM STRATEGIES



Explanation

- Access Road
- Project Area

Land Status

- Bureau of Land Management
- Forest Service
- Private

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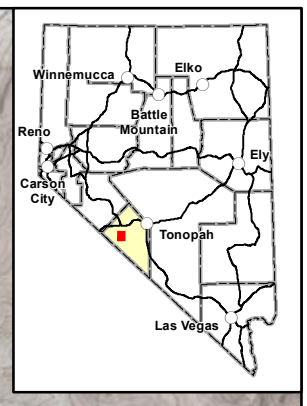
RHYOLITE RIDGE LITHIUM-BORON PROJECT

Project Location, Access, and Land Status

Label: Figure 2	Drawn By: MJR
Date: 12/13/2019	Project No.: 3944
Base Map: USGS 100K quads: Benton Range, Goldfield	
File Name: 3944M_RR_Fig1_Location.mxd	

EM STRATEGIES



Explanation

- Project Area Boundary
- Existing Road

Buckwheat

- Subpopulation 1 (4.81 acres)
- Subpopulation 2 (1.56 acres)
- Subpopulation 3 (0.63 acre)
- Subpopulation 4 (1.04 acres)
- Subpopulation 5 (0.05 acre)
- Subpopulation 6a (1.22 acres)
- Subpopulation 6b (0.66 acre)
- Subpopulation 7 (0.007 acre)
- Subpopulation 8 (One plant)

Land Status: All BLM

0 0.5 1 Miles

N

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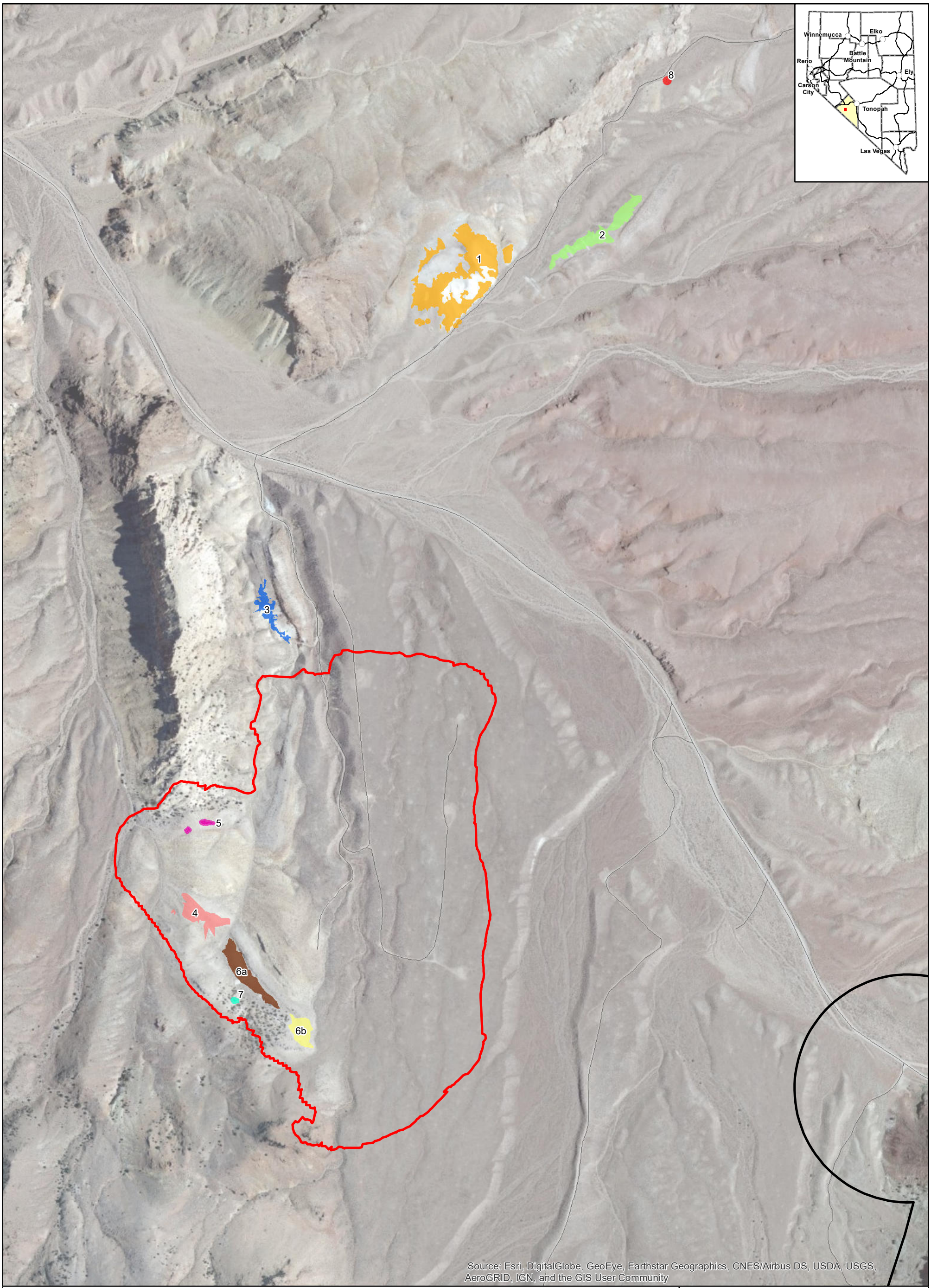
RHYOLITE RIDGE LITHIUM-BORON PROJECT

Tiehm's Buckwheat Subpopulations and Project Area

Label: Figure 3	Drawn By: MJR/JDB
Date: 12/13/2019	Project No.: 3944
Base Map: USGS 7.5' quads: Rhyolite Ridge, Rhyolite Ridge SW	
File Name: 3944M_Rhyolite_Stage1_Disturbance.mxd	

EM STRATEGIES



Explanation

- Project Area Boundary
- Stage 1 Quarry Crest
- Existing Road

Buckwheat

- Subpopulation 1 (4.81 acres)
- Subpopulation 2 (1.56 acres)
- Subpopulation 3 (0.63 acre)
- Subpopulation 4 (1.04 acres)
- Subpopulation 5 (0.05 acre)
- Subpopulation 6a (1.22 acres)
- Subpopulation 6b (0.66 acre)
- Subpopulation 7 (0.007 acre)
- Subpopulation 8 (One plant)

Land Status: All BLM

0 500 1,000 Feet

N

IONEER USA CORPORATION

RHYOLITE RIDGE LITHIUM-BORON PROJECT

Tiehm's Buckwheat Subpopulations and Proposed Quarry

Label: Figure 1	Drawn By: MJR/JDB
Date: 02/25/2020	Project No.: 3944
Base Map: ESRI World Imagery (Clarity)	
File Name: 3944M_Rhyolite_Disturbance.mxd	

EM STRATEGIES