Dragon Mine Preliminary Assessment, Site Investigation & Remediation Proposal

Bureau of Land Management.
Ground Guardians LLC.

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CENE 476
(12/06/2024)

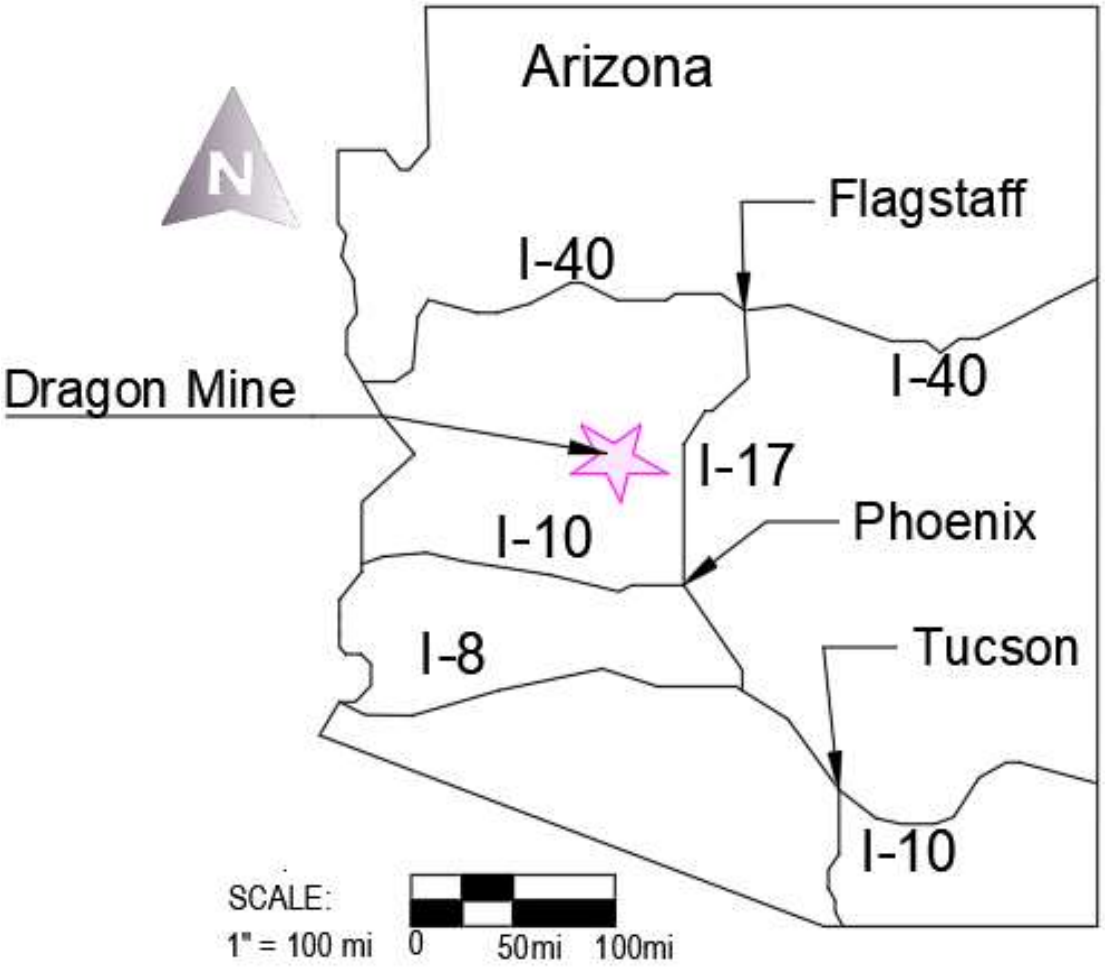

Figure 1: Arizona Location Map [1]

Introduction

Purpose:

Preliminary Assessment and Site Investigation to assess health risks and propose remedial action

Client:

Eric Zielske from the Bureau of Land Management

Background:

Active from 1800s to 1942 produced vanadinite, gold, and silver

Location Map

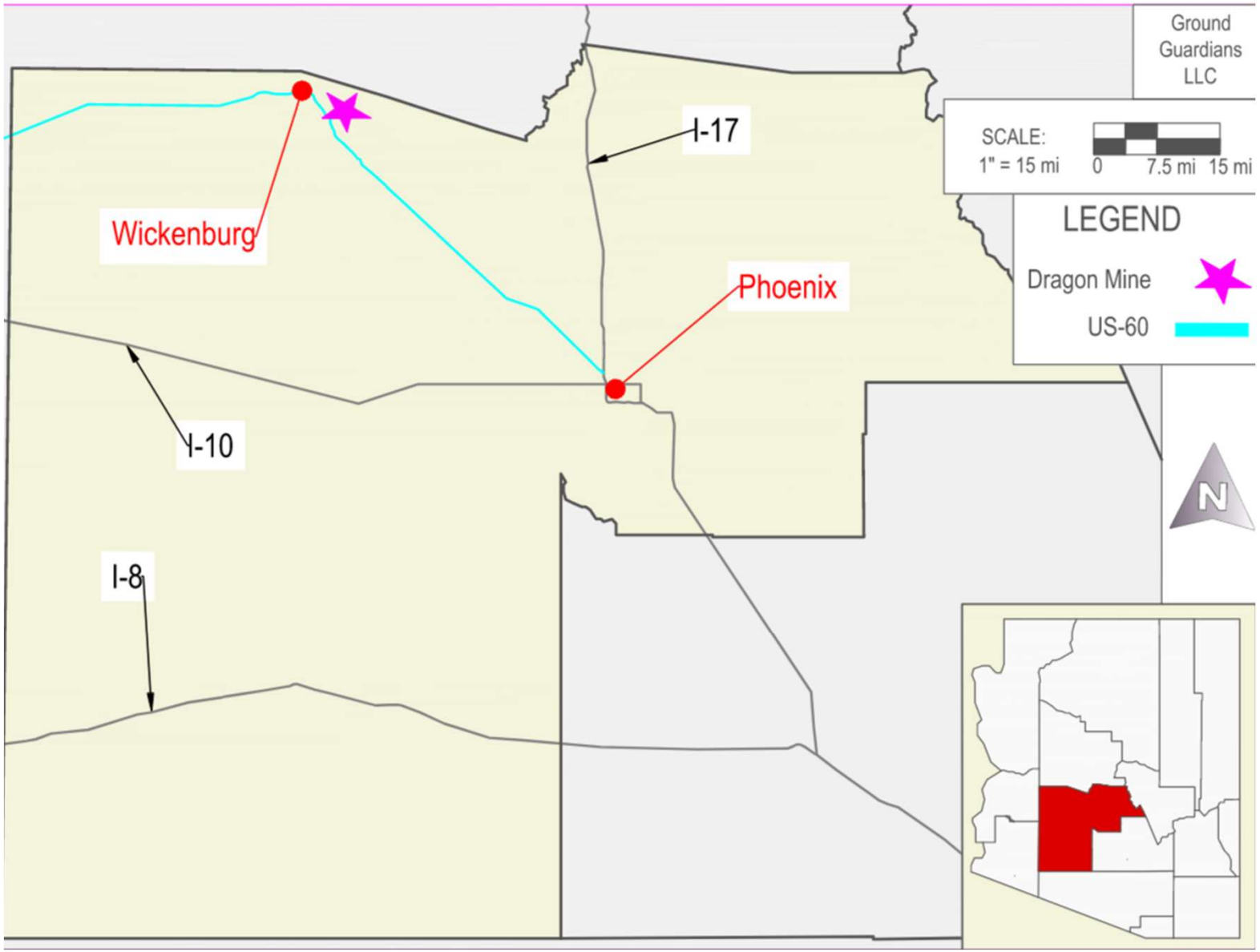

Figure 2: County Location Map [2]

Vicinity Map

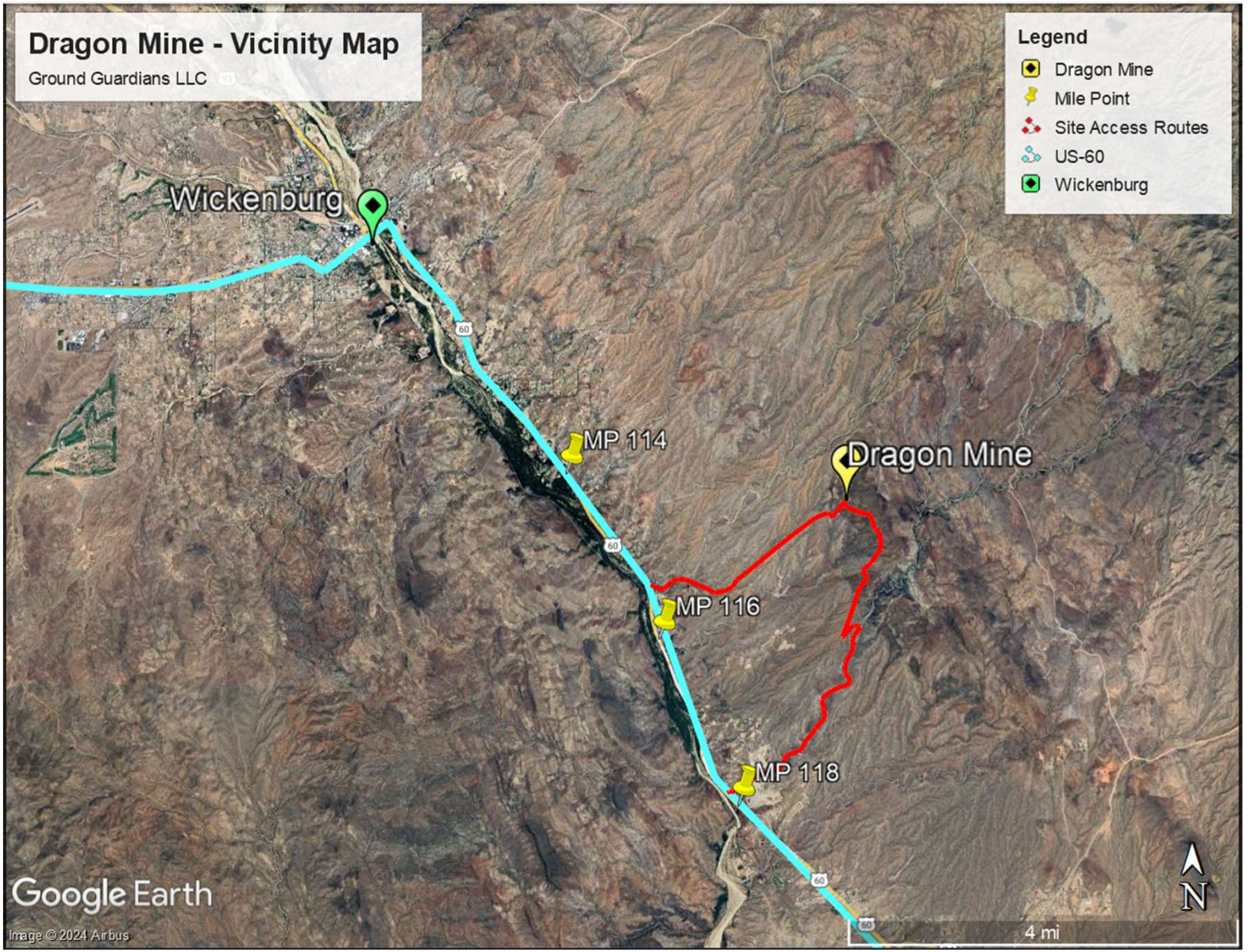

Figure 3: Vicinity Map [3]

Table 1: Contaminants of Concern ECM Site Investigation 2019 [4]

Soil	Antimony	Arsenic	Lead	Molybdenum	Vanadium
Area of Concern	**(mg/kg)**				
Downgradient Debris	<394	5	16	<29	259
Mill Foundation	<437	**10**	**115**	<34	**368**
Water Troughs	<199	**15**	**101**	27	<56
Waste Pile	<368	<28	**667**	<28	**548**
Foundation	<579	**29**	**593**	12	**515**
Conveyor Foundation	<447	**26**	**373**	<35	**409**
Heap Leach?	<396	<24	**414**	<30	**378**
Heap Leach?	<405	9	**141**	<31	295
Heap Leach?	<385	<36	**1062**	17	**455**
Heap Leach?	43	<33	**827**	5	**538**
Waste Rock Pile	<381	<18	**228**	<29	**1241**
Waste Rock Pile	<390	<14	**127**	<31	**347**
Mill Platform	<334	<60	**3967**	88	**581**
Red Tailings	<324	<65	**4894**	102	**440**
Red Tailings near collapsed structure	<226	<83	**10776**	485	**594**
Tailings near mill	<438	<38	**862**	<35	288
Background	<410	7	**91**	<32	**369**
Background	<380	5	49	<30	**432**
Background	<371	**10**	42	<29	**371**
Background	<426	7	57	<33	**335**
Background	<375	5	21	<29	323

Legend

= Above AZ Non-residential Soil Remediation Levels

= Above AZ Residential Soil Remediation Levels

= Above AZ Ecological Soil Remediation Levels

Project Map

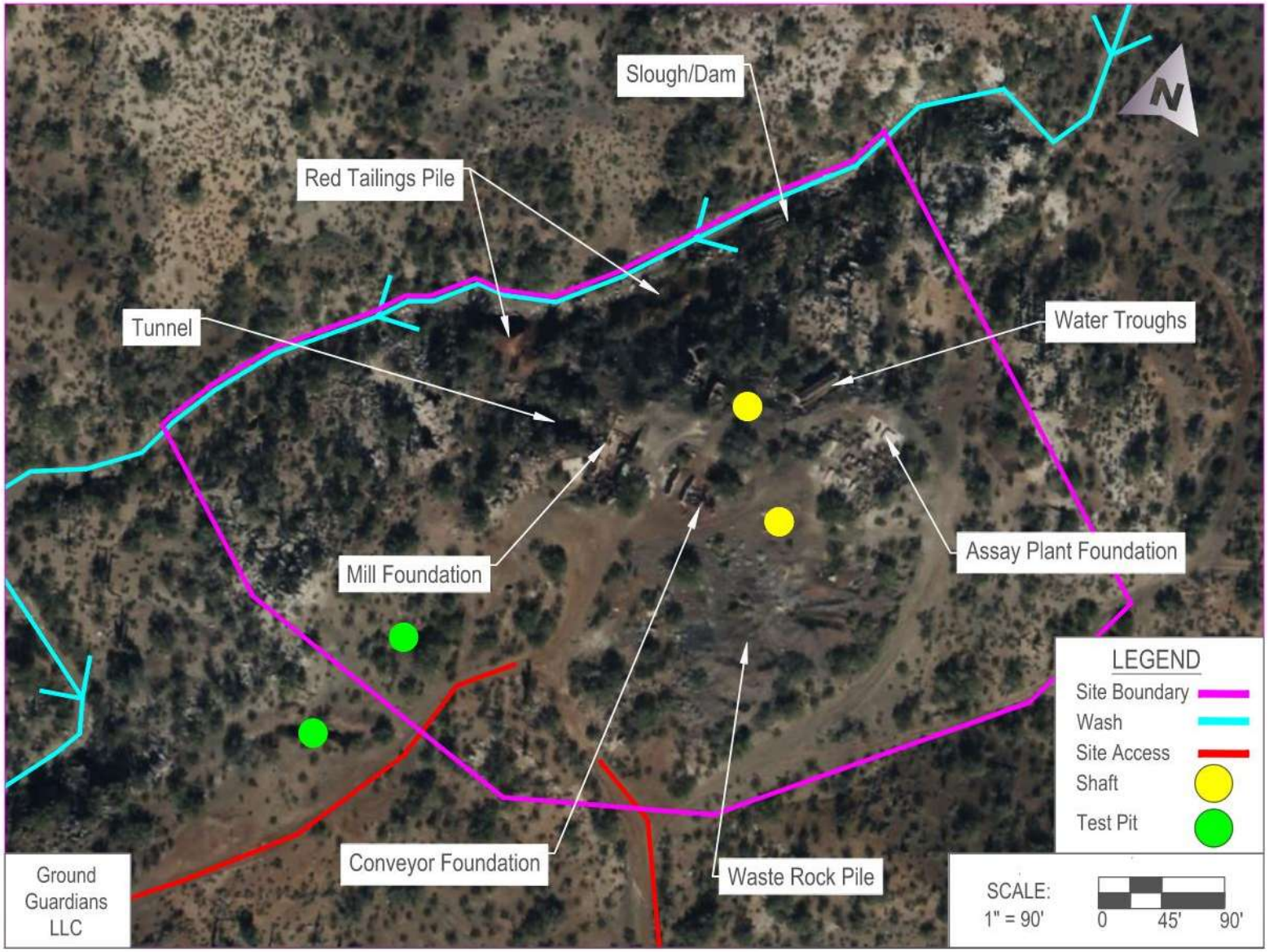

Figure 4: Project map [5]

Task 1: Work Plan

Task 1.1: Sampling and Analysis Plan

Task 1.2: Health and Safety Plan

Task 1.3: Lab Binder/Lab Access

Task 2: Site Investigation

Figure 5: Soil Collection [6]

Task 3: Laboratory Analysis

Task 3.1: Sample Drying

Task 3.2: Sample Sieving

Task 3.3: X-Ray Fluorescence (XRF) Testing

Task 3.4: Acid Digestion

Task 3.5: Flame Atomic Absorption (FAA) / Inductively Coupled Plasma (ICP)

Task 4: Data Analysis

Task 4.1: Identification of Human Health and Ecological Contaminants of Concern (COCs)

Task 4.2: Identify Exposure Point Concentrations for all COCs

Task 4.3: XRF in-situ vs ex-situ Analysis

Task 4.4: XRF ex-situ vs FAA/ICP Analysis

Task 4.5: Quality Assurance & Quality Control Analysis

Task 5: Contaminant Pathways

Task 5.1: Maps of Contaminant Distribution

Task 5.2: Migration Pathways

Task 5.3: Conceptual Site Model (CSM)

Task 6: Human Health Risk Assessment

Task 6.1: Toxicity Assessment

Task 6.2: Exposure Assessment

Task 6.3: Risk Characterization

Task 7: Ecological Risk Assessment

Task 7.1: Identification of Potentially at-risk Species

Task 7.2: Identification of Area Use Factors

Task 7.3: Determination of Ecological Risk

Task 8: Remedial Actions

Task 8.1: Remedial Action Objectives

Task 8.2: Develop Alternatives

Task 8.3: Evaluate Alternatives and Select Preferred Alternative

Task 8.4: Design of Preferred Alternative

Task 9: Project Impacts

Task 10: Project Deliverables

Task 10.1: 30% Report

Task 10.2: 60% Report

Task 10.3: 90% Report

Task 10.4: Final Report

Task 11: Project Management

Task 11.1: Meetings

Task 11.2: Schedule Management

Task 11.3: Resource Management

Exclusions

Water Sampling/Analysis

Air Sampling/Analysis

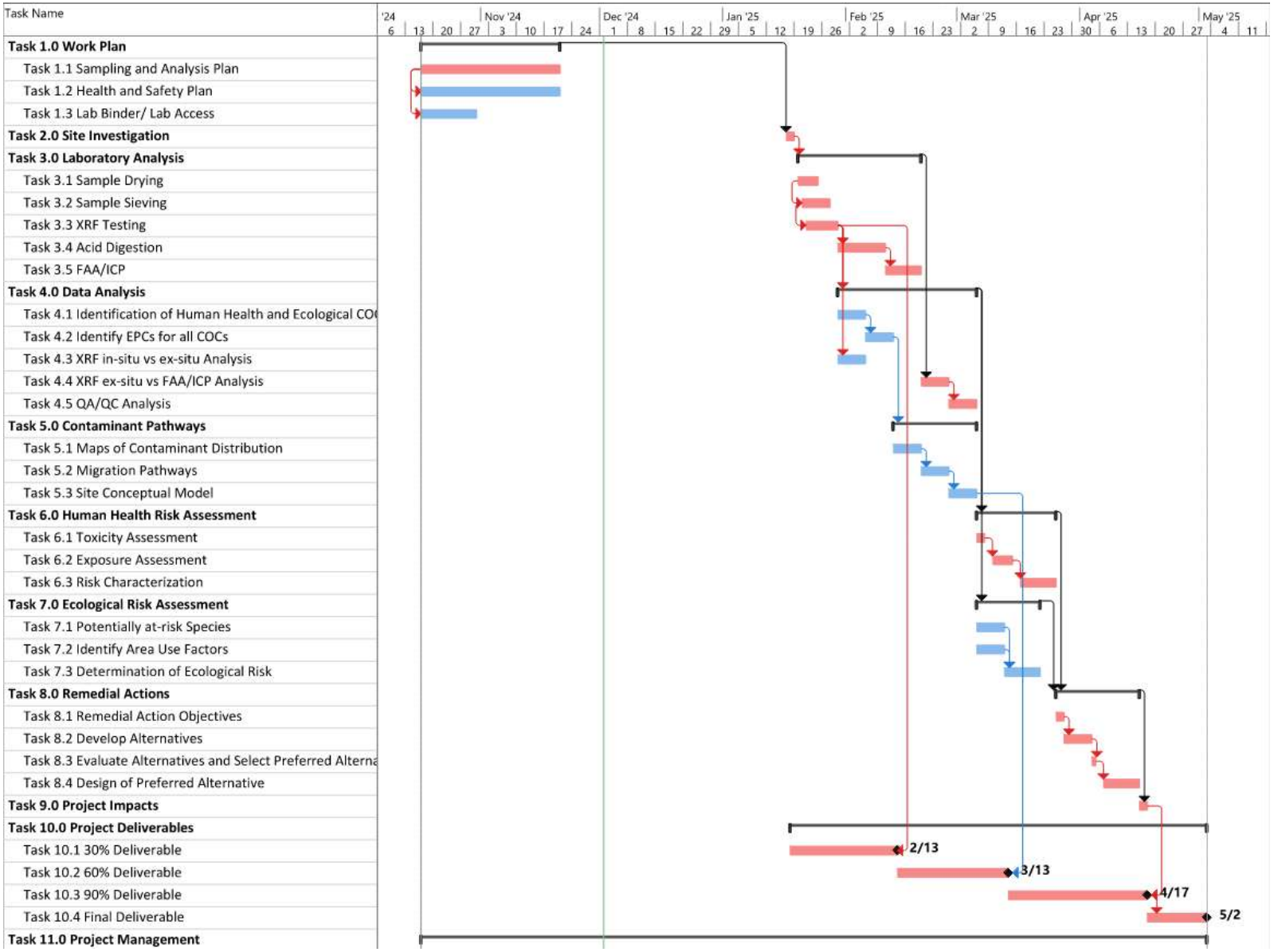

Figure 6: Project Gantt Chart

Staffing

Senior Engineer

- Master's Degree
- Professional Engineer
- 15+ years of experience
- Project Manager

Engineer

- Bachelor's Degree
- Engineer-In-Training
- ~3 years of experience
- Performs majority of project work

Lab Technician

- Performs all laboratory work with supervision of Engineer
- Present during Site Investigation

Staffing

Task	Senior Engineer	Engineer	Lab Technician	Task Total
Task 1.0 Work Plan				
Task 1.1 Sampling and Analysis Plan	5	30	0	35
Task 1.2 Health and Safety Plan	5	15	0	20
Task 1.3 Lab Binder	0	5	15	20
Task 2.0 Site Investigation	25	50	50	125
Task 3.0 Laboratory Analysis				
Task 3.1 Sample Drying	0	2	50	52
Task 3.2 Sample Sieving	0	2	60	62
Task 3.3 XRF Testing	0	2	60	62
Task 3.4 Acid Digestion	0	1	1	2
Task 3.5 FAA/ICP	0	1	1	2
Task 4.0 Data Analysis				
Task 4.1 Identification of Human Health and Ecological COCs	2	5	0	7
Task 4.2 Identification of EPCs for all COCs	2	15	0	17
Task 4.3 XRF In-situ vs Ex-situ analysis	0	10	0	10
Task 4.4 XRF Ex-Situ vs FAA/ICP analysis	0	10	0	10
Task 4.5 QA/QC analysis	2	10	5	17
Task 5.0 Contaminant Pathways				
Task 5.1 Maps of Contaminant Distribution	2	15	0	17
Task 5.2 Migration Pathways	0	2	0	2
Task 5.3 Conceptual Site Model (CSM)	2	4	0	6
Task 6.0 Human Health Risk Assessment				
Task 6.1 Toxicity Assessment	0	8	0	8
Task 6.2 Exposure Assessment	0	20	0	20
Task 6.3 Risk Characterization	2	10	0	12
Task 7.0 Ecological Risk Assessment				
Task 7.1 Identification of Potentially at-risk Species	2	15	0	17
Task 7.2 Identification of Area Use Factors	2	15	0	17
Task 7.3 Determination of Ecological Risk	2	10	0	12
Task 8.0 Remedial Actions				
Task 8.1 Remedial Action Objectives	2	6	0	8
Task 8.2 Develop Alternatives	5	15	0	20
Task 8.3 Evaluate Alternatives and Select Preferred Alternative	1	5	0	6
Task 8.4 Design of Preferred Alternative	5	20	0	25
Task 9.0 Project Impacts	1	3	0	4
Task 10.0 Project Deliverables				
Task 10.1 30%	2	8	0	10
Task 10.2 60%	2	8	0	10
Task 10.3 90%	2	8	0	10
Task 10.4 Final	2	8	0	10
Task 11.0 Project Management				
Task 11.1 Meetings	30	60	30	120
Task 11.2 Schedule Management	10	5	0	15
Task 11.3 Resource Management	2	2	0	4
Subtotal Hours	117	405	272	
Total Hours	**794**			

Cost of Engineering Services

Project Costs Summary					
Subsection	**Classification**	**Qty**	**Rate**	**Unit**	**Cost**
Personnel	Senior Engineer	117	$300	$/hr	$35,100
	Engineer	405	$135	$/hr	$54,675
	Lab Technician	272	$35	$/hr	$9,520
	Total Personnel				**$99,295**
Travel	NAU Mileage Rate	300	$0.40	$/mile	$120
	Rental: NAU Suburban	2	$65	$/day	$130
	Hotel 1 Night	5	$100	$/room	$500
	PerDiem; 5 persons	2 days	$30	$/day-person	$300
	Total Travel				**$1,050**

- Personnel = $99,295
- Travel = $1,050
- Supplies = $5,937
- Total = $107,282

Supplies	Ziplock Gallon Freezer Bags, 120 ct	1	$16	$/pack	$16
	Trowel	8	$10	EA	$80
	Rental: 2 GPS devices	2 days	$120	$/device-day	$480
	Soap	1	$6	$/bottle	$6
	Marker Flags, 50 pack	2	$7	$/pack	$14
	Plastic Bins, 2 pack	2	$57	$/pack	$114
	5 gal Buckets	4	$7	EA	$28
	Water, 12 pack	2	$4	$/pack	$8
	Paper Towels, 2 pack	1	$7	$/pack	$7
	Sharpie, 5 pack	1	$5	$/pack	$5
	Nitrile Gloves, 1000 pack	1	$45	$/pack	$45
	Trash Bags, 74 pack	1	$20	$/pack	$20
	Clipboards, 6 pack	1	$12	$/pack	$12
	Logbooks	2	$5	EA	$10
	Measuring Tapes	4	$20	EA	$80
	Scrub Brushes	4	$3	EA	$12
	Rental: NAU Soils Lab	20	$100	$/day	$2,000
	Rental: XRF Device	10	$300	$/day	$3,000
	Total Supplies				**$5,937**
Subcontract	Western Technologies	10	$100	$/sample	$1,000
Total Cost					**$107,282**

References

[1] J. Whitcher, "Dragon Mine: Preliminary Assessment Location Map," AUTOCAD, 2024.

[2] A G. Rico, "Dragon Mine: Preliminary Assessment Location Map," AUTOCAD, 2024.

[3] A. G. Rico, Google Earth , 2024.

[4] ECM Consultants, "Site Summary Report for the Dragon Mine," ECM Consultants, 2020.

[5] G. G. LLC, "Dragon Mine: Preliminary Assessment Project Map," AUTOCAD, 2024.

[6] "Redevelopment Site Assessments," *Environmental Site Assessment and Environmental Due Diligence*, Aug. 29, 2024. https://www.aeasinc.com/redevelopment

QUESTIONS?