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Project 5 – Task 2
Climate Resiliency and Long-Term Surveillance of DOE-LM Disposal Cells

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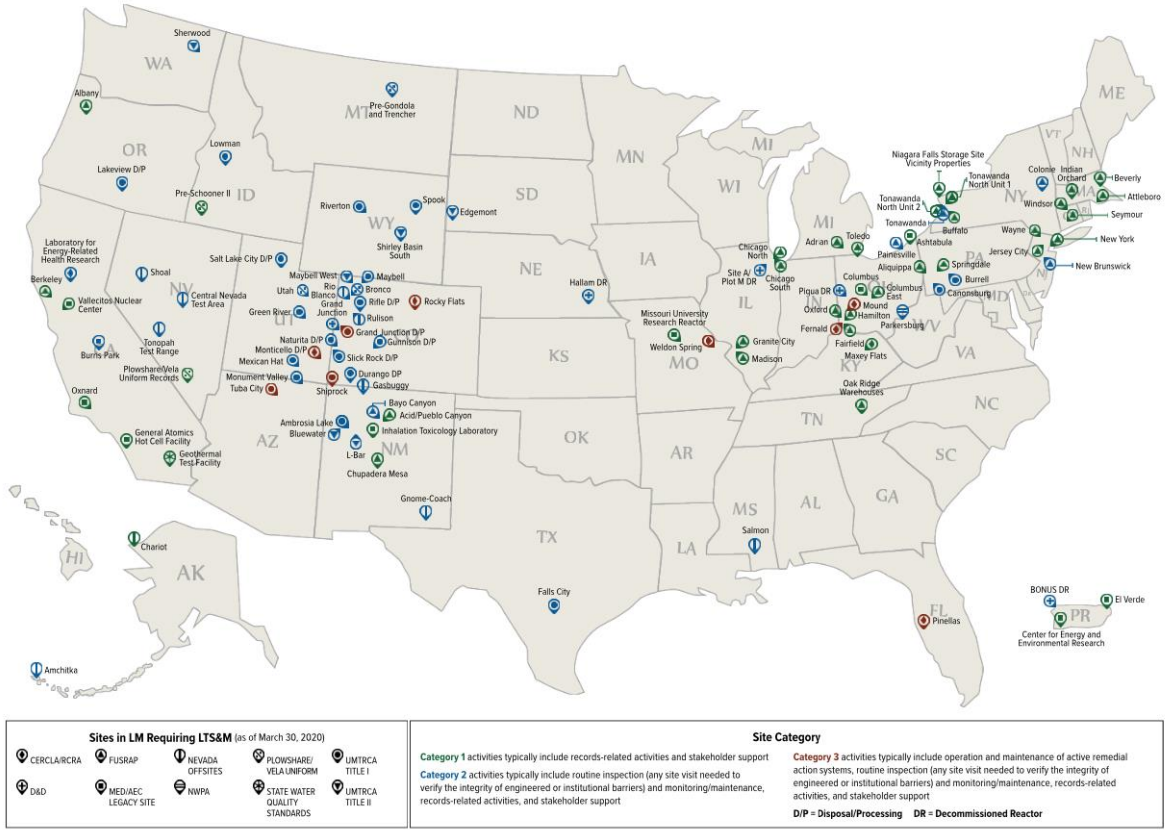
Introduction

DOE-LM is charged with the responsibility for the long-term surveillance and maintenance, restructure, land use planning, and community assistance for **101 sites** in the United States and the territory of Puerto Rico.



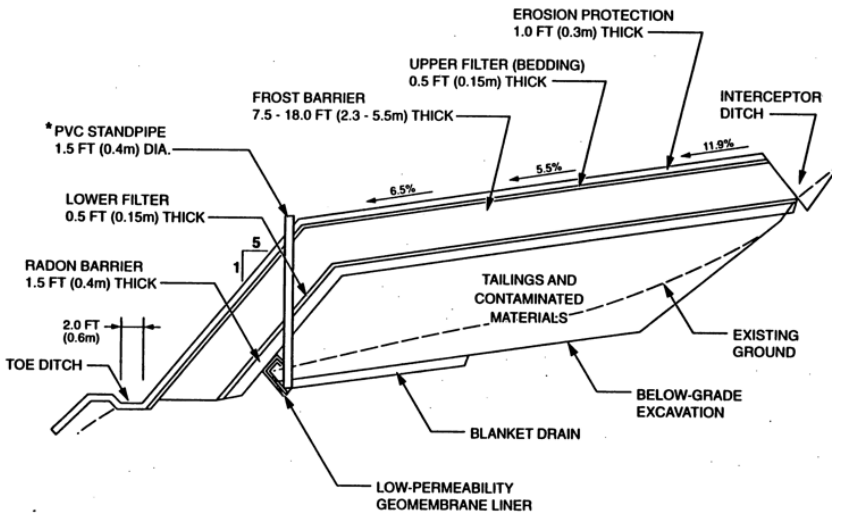
Objective:

- Evaluate the feasibility of utilizing traditional geophysical survey sensors and state-of-the-art sensory for a cost-effective approach to characterize and monitor the conditions of LM's disposal cells.
- Compile precipitation and temperature timeseries to compare the historical climate impact on the hydrology of the DOE-LM site.

Introduction

Disposal Cell Characterization

- The Rifle disposal cell is roughly triangular and measures approximately 3,000 ft on each side.
- Encompasses an area of 71-acres on the 205-acre site.
- 3.5 million cubic yards of contaminated materials with a total activity of 2,738 curies of radium-226.



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Introduction

Erosion Complications

- During the 2017 annual inspection, erosion was discovered at the Mexican Hat cell in Utah.
- Erosion manifested itself towards the surface, near the top rock cover layer.

Climate Resiliency Studies

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Rifle, Co Climate Trend Analysis

- Climate change is the variation in average temperature and precipitation.
- The change in these climate variables can affect different aspects in the world including **infrastructure**, **food**, and **human health**.

Objective

Asses how climate change could potentially alter the system performance of LM's disposal cells.

Publicly Available Resources

Analysis of Record for Calibration

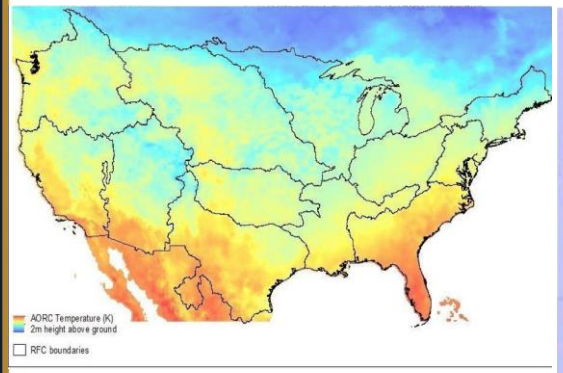
+

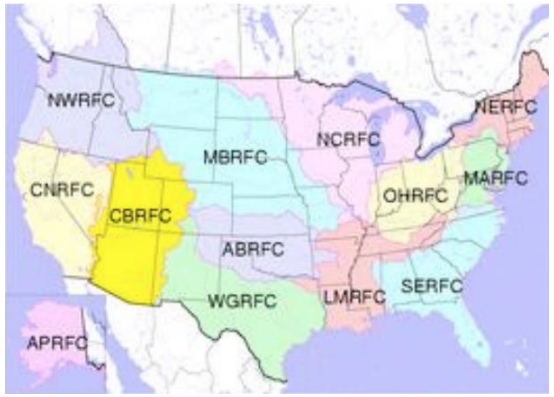
BERKELEY LAB
LAWRENCE BERKELEY NATIONAL LABORATORY

Resources-Background

Analysis of Record for Calibration

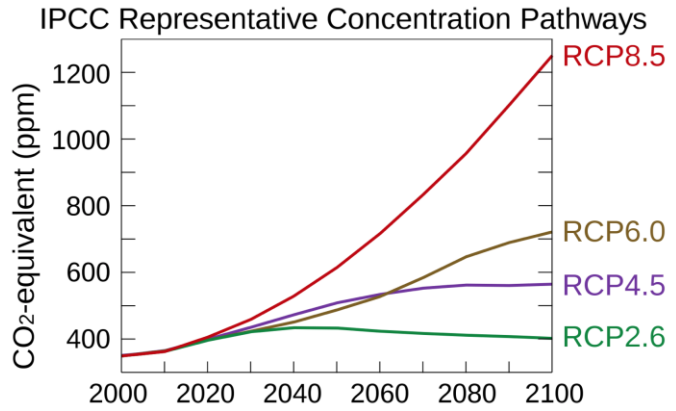
- Gridded record of near-surface weather conditions.
- Defined on a latitude/longitude special grid.
- Includes hourly total precipitation and temperature.
- Spans from the period of 1979 to the near present.





Lawrence Berkely National Laboratory

- Provides a GitHub Repository of climate datasets of 71 DOE-LM sites.
- Historical climate variables span 56 years from the period 1950 to 2005.
- Future prediction Rcp45 & Rcp85 scenarios span 94 years 2006 to 2099.
- Uses the Coupled Model Intercomparison Project (CMIP) climate models.



Data Analysis Approach

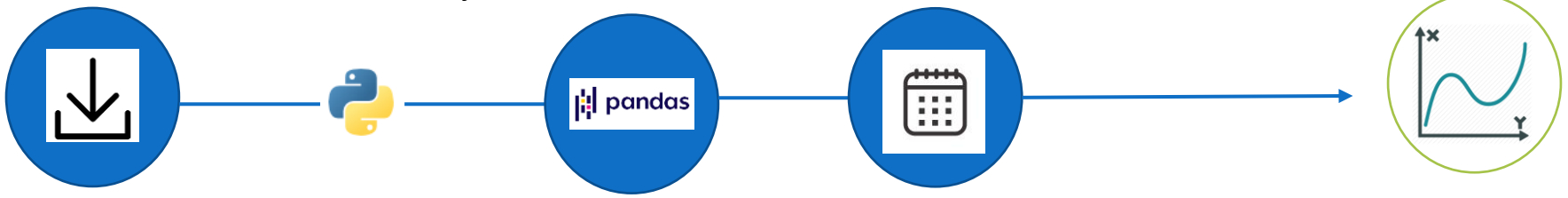
Lawrence Berkley National Laboratory

Import Raw ".csv" files

String to datetime object

Daily to yearly mean conversion

Time Series Plot

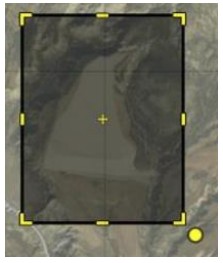


Analysis of Record for Calibration

Netcdf4 files Download

Find the disposal cell

Index	Grid Point	Longitude	Latitude
0	TMPCBRFC1	39.599216	-107.7676
1	TMPCBRFC2	39.632548	-107.8009
2	TMPCBRFC3	39.66588	-107.8342
3	TMPCBRFC4	39.699212	-107.8676



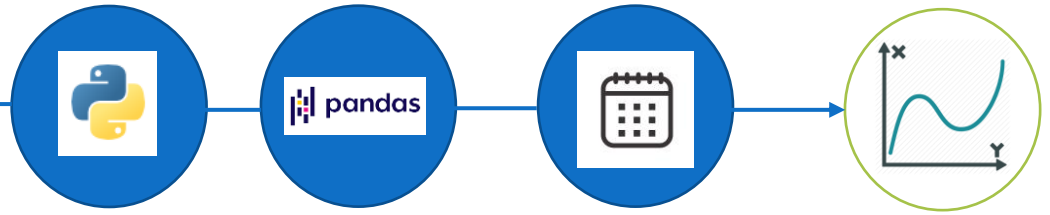
LAT: -107.80694 to -107.7933
LONG: 39.6236 to 39.61

Filter the temp/prec from CBRFC

String to datetime object

Daily to yearly mean conversion

Time Series Plot



Climate Trend Analysis Data Output

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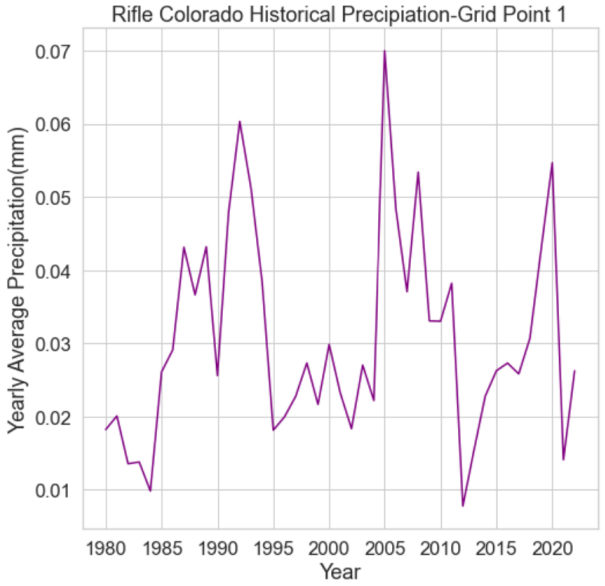
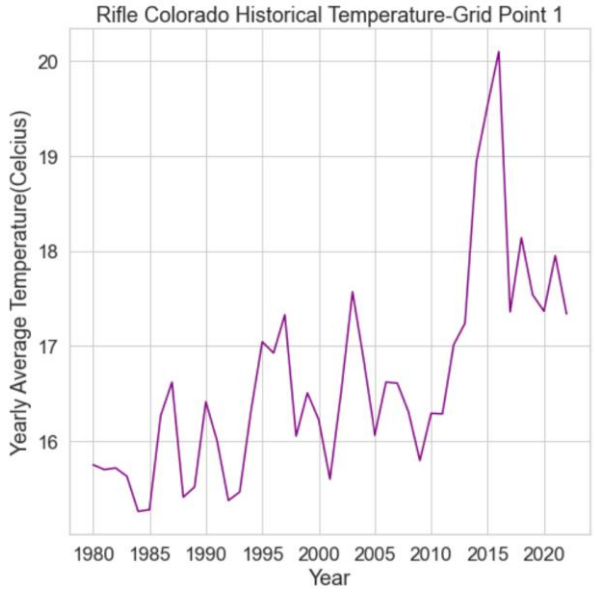
AORC





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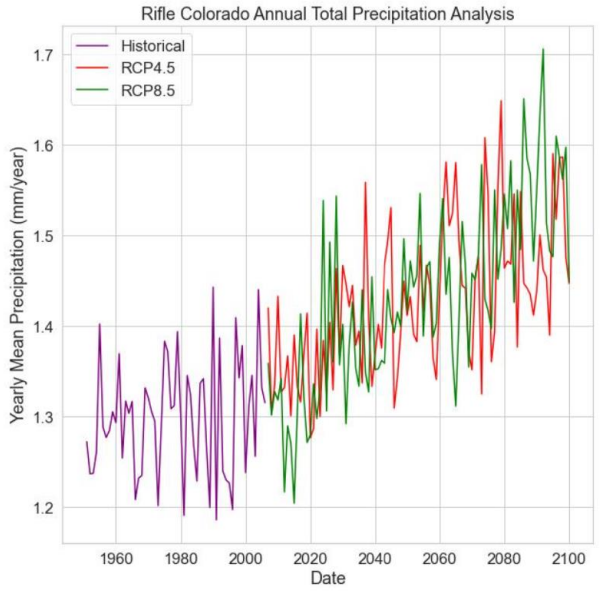
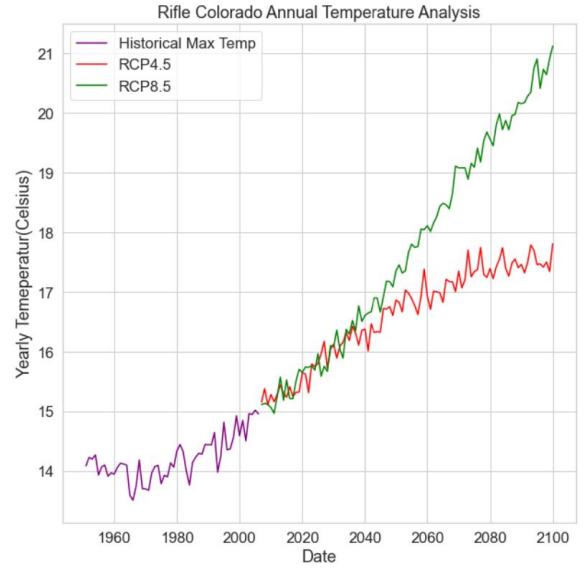
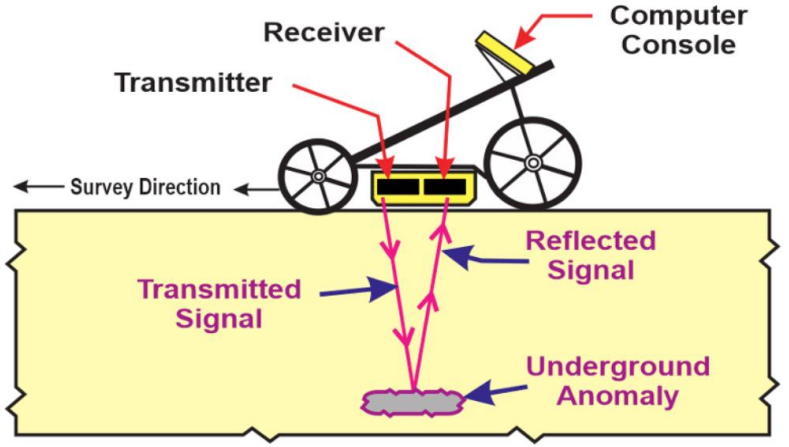




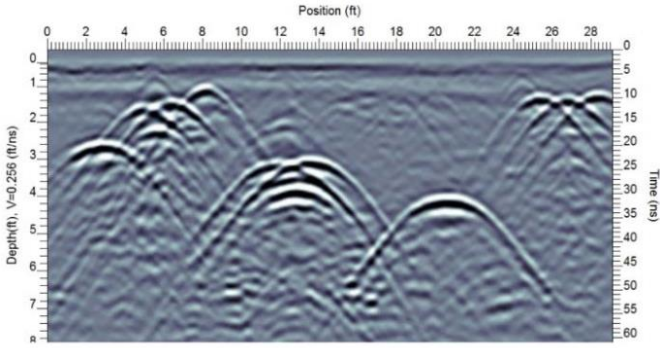
Ground Penetrating Radar

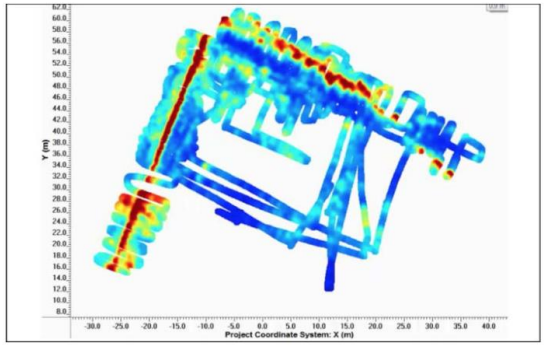
Ground Penetrating Radar

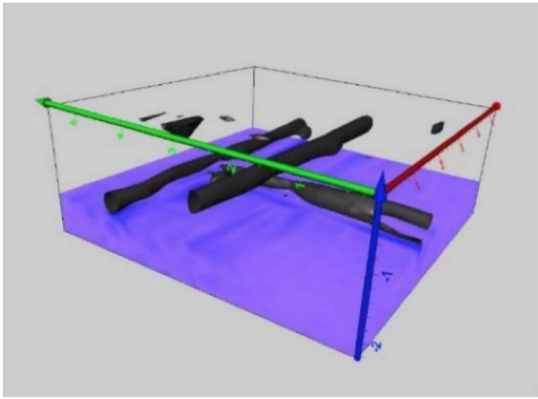
- Is a non-destructive geophysical survey imaging method.
- Sends high-frequency electromagnetic waves into the surface.
- The reflected signal returns to the radar's receiver antenna.



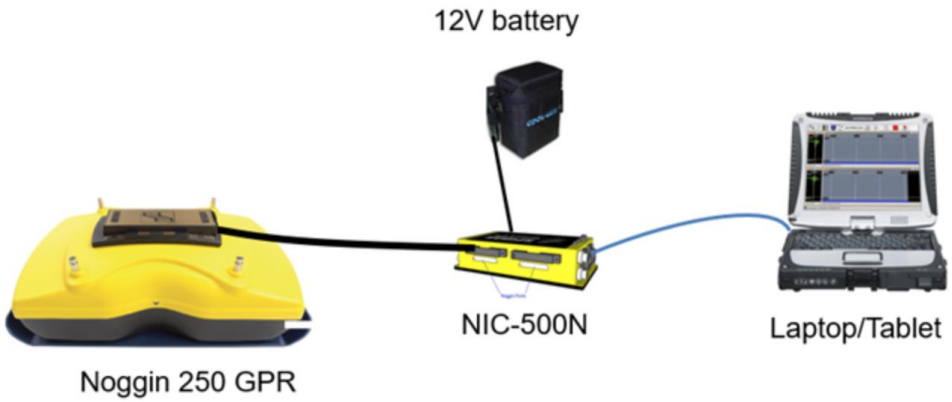
Data Visualization



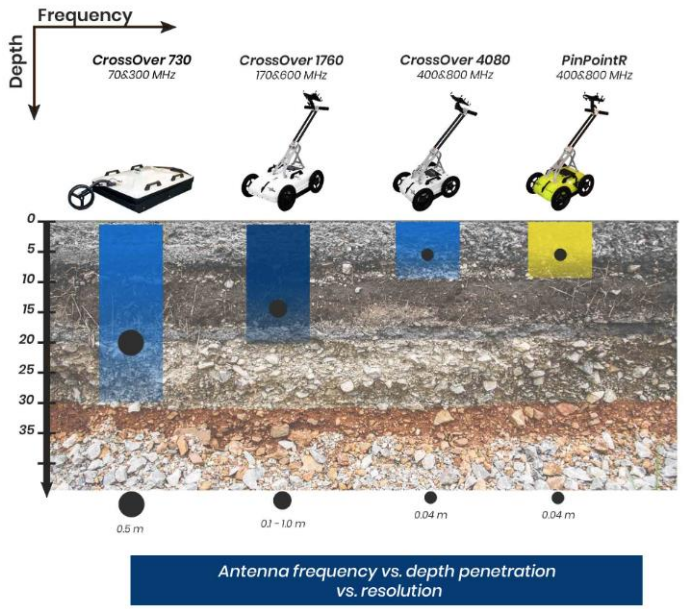




Ground Penetrating Radar



SENSORS & SOFTWARE
from RADIODETECTION



Objective

Use the GPR sensor as a cost-effective way for subsurface mapping of LM's disposal cell sites.

"The best antenna for a job is the one with the highest frequency that can still detect at the desired depth"
-Geophysical Survey Systems (GSSI)

- Lower the Frequency of the GPR antenna, the deeper the signal can penetrate.
- GPR antennas come in different shapes and sizes

Annual Inspection Site Visits

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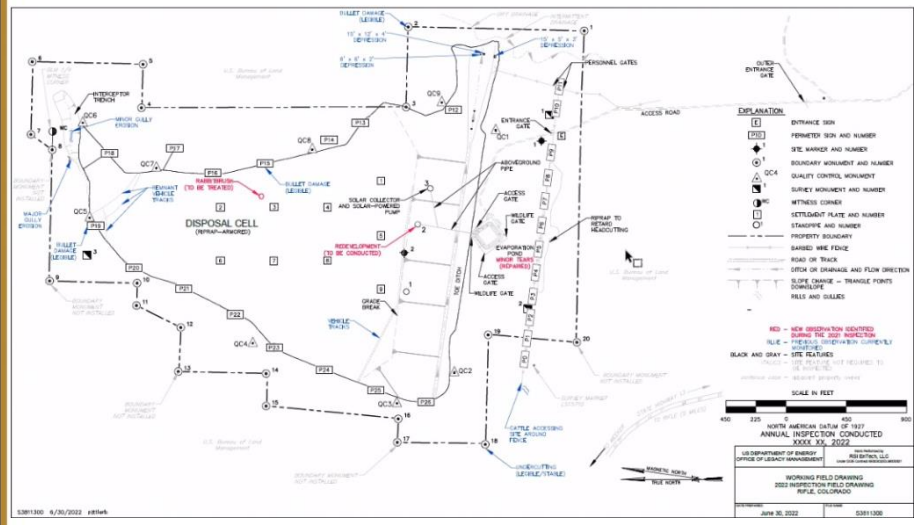
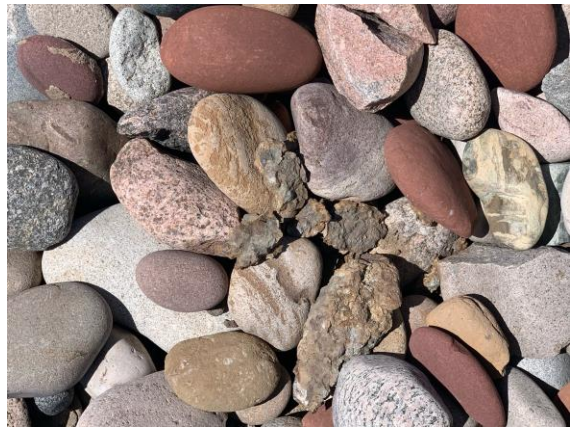
Rifle Disposal Cell Inspection

Inspection Checklist Rifle, Colorado

- Safety protocols
- Specific site surveillance features
- Disposal cell and interceptor trench
- Toe ditch and toe ditch outlet

Rifle Disposal Cell Inspection



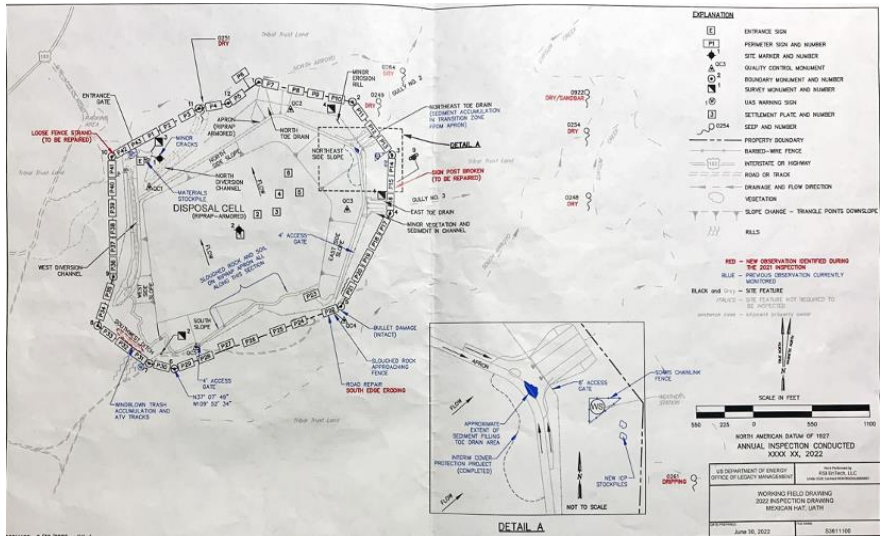


Mexican Hat Disposal Cell Inspection

Inspection Checklist Mexican Hat, Utah

- Safety protocols
- Specific site surveillance features
- Disposal cell and interceptor trench
- Toe ditch and toe ditch outlet

Mexican Hat Disposal Cell Inspection



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Future Development

Future work

Ground Platform:

- In House Testing
- Increase tire diameter
- Sensor integration
- Suspension Mechanism
- Increase Payload
- Weather Resistant
- Survey Planning
- Autonomous
- Summer 23’ Deployment

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Thank You. Questions?