

# The Lee Ranch Mine's Use Attainability Analysis for the San Isidro Arroyo and Its Tributaries

Peabody Natural Resources Company's Petition for Regulatory Changes

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Water Quality Control Commission Hearing

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# Qualifications: Education & Experience

- Education
  - B.S. from Indiana University, Environmental Science, Minors in Geology and Mathematics
  - M.S. from Indiana University, Geological Science
- Licensed Professional Geologist, Indiana
- Work History:
  - May 2019-Present: Director, Environmental, Regulatory and Permitting (Peabody Energy)
  - May 2016-April 2019: Senior Manager, Environmental (Peabody Energy)
  - January 2012-April 2016: Manager, Environmental (Peabody Energy)
  - September 2005-September 2010: Manager, Hydrology (Peabody Energy)

# The Lee Ranch Mine Work Plan

- Objectives
  - Determine proper hydrologic regime
  - Assess results to support development of UAA
- Background Evaluation of Watershed Characteristics and Boundaries
  - Evaluation of topography, geology, soil, vegetation, ecoregional classification, relative location of the mining operation in the watershed, and the location of hydrologic features.
  - Two primary areas of the watershed: upper canyons and lower rolling hills.
  - Primary hydrologic features of the watershed include San Isidro Arroyo, Mullatto Canyon, Arroyo Tinaja, and Doctor Arroyo

# Watershed Approach

- Genesis of the watershed approach
- San Isidro watershed subdivided into three tiers of watersheds
  - Tier 1: smallest of the watershed tiers; includes headwater areas
  - Tier 2: intermediate watershed; includes three Tier 1 watersheds
  - Tier 3: largest watershed; includes all of San Isidro Arroyo prior to its confluence with Arroyo Chico

# LRM's Work Plan Sampling Sites

- Site Reconnaissance
  - Peabody staff field investigation
- Sampling Locations
  - Ten Hydrology Protocol (“HP”) sampling sites
  - Thirty two photo point (“PP”) sites
- Stakeholder Participation
  - NMED and EPA provided input on various versions of draft work plans
  - Final version of work plan approved June 2017

# Overview of NMED's Hydrology Protocol

- Quantitative method of evaluating the hydrologic regime of a stream
- Uses field-based observations for a set of biological, hydrologic, and geomorphic indicators, each indicator has a range of potential scores that are totaled to classify each stream as either ephemeral, intermittent, or perennial

# Hydrology Protocol Level 1 Indicators

- HP includes the following fourteen Level 1 indicators:
  - 1) presence of water in a channel,
  - 2) presence of fish,
  - 3) presence of benthic macroinvertebrates,
  - 4) presence of filamentous algae and periphyton,
  - 5) differences in vegetation,
  - 6) absence of rooted upland plants in streambed,
  - 7) sinuosity,
  - 8) floodplain and channel dimensions,
  - 9) in-channel structure,
  - 10) particle size and stream substrate sorting,
  - 11) hydric soils,
  - 12) sediment on plants or debris,
  - 13) seeps and springs, and
  - 14) iron oxidizing bacteria

# Hydrology Protocol: Scoring Results

- LRM, in compliance with the work plan, evaluated for all fourteen Level 1 indicators.
- Following evaluation of waterways for all fourteen Level 1 indicators, the score of all fourteen indicators is summed. The total is used to determine the appropriate stream classification as follows:
  - Total < 9: ephemeral
  - Total  $\geq 9$  and < 12: recognized as intermittent until further analysis indicates ephemeral
  - Total  $\geq 12$  and  $\leq 19$ : intermittent
  - Total > 19 and  $\leq 22$ : recognized as perennial until further analysis indicates intermittent
  - Total > 22: perennial
  - If, after completing the Level 1 indicators, a hydrological determination cannot be made because more information is required, a Level 2 evaluation must be completed. All of the streams in LRM study were accurately characterized following completion of the Level 1 indicators and no site was required to continue with the Level 2 indicators.



# LRM's Hydrology Protocol Results

- Level 1 Office Procedures
- Field Work: June 19-21, 2017
  - Sampling team
  - NMED onsite visit
- LRM's sampling team's conservative approach
  - Elevated scores in Difference in Vegetation (Tamarisk)
  - Elevated scores in Rooted Upland Plants (sand beds)
  - Elevated Bankfull / Floodplain Ratio indicator

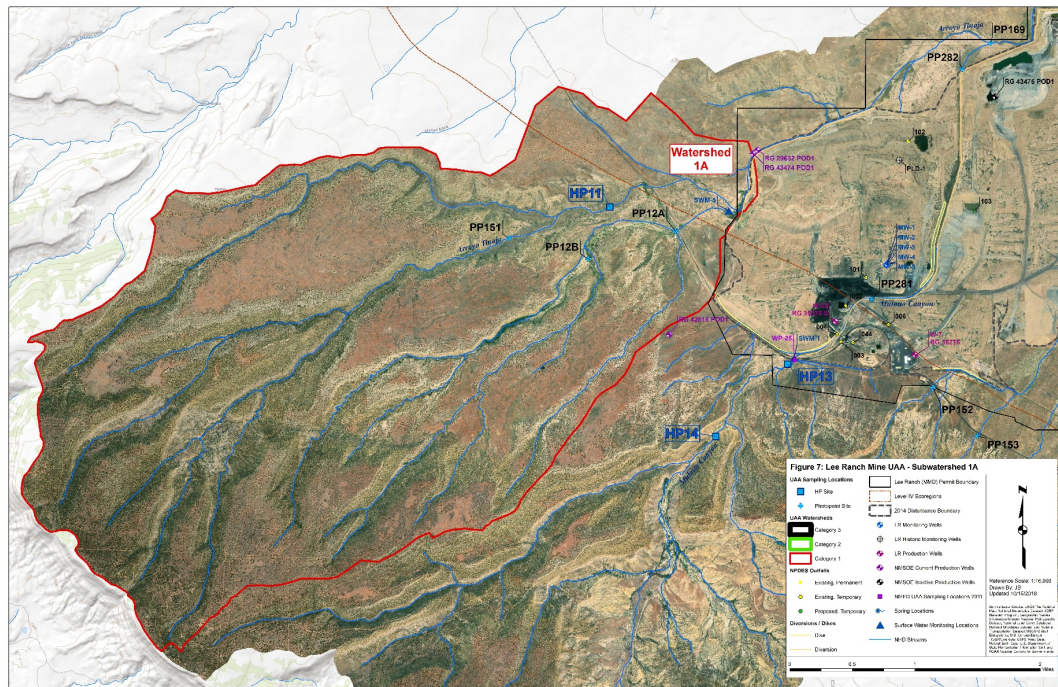


# LRM's Hydrology Protocol Results: Upper Canyon Tier 1 Watersheds 1A and 1B

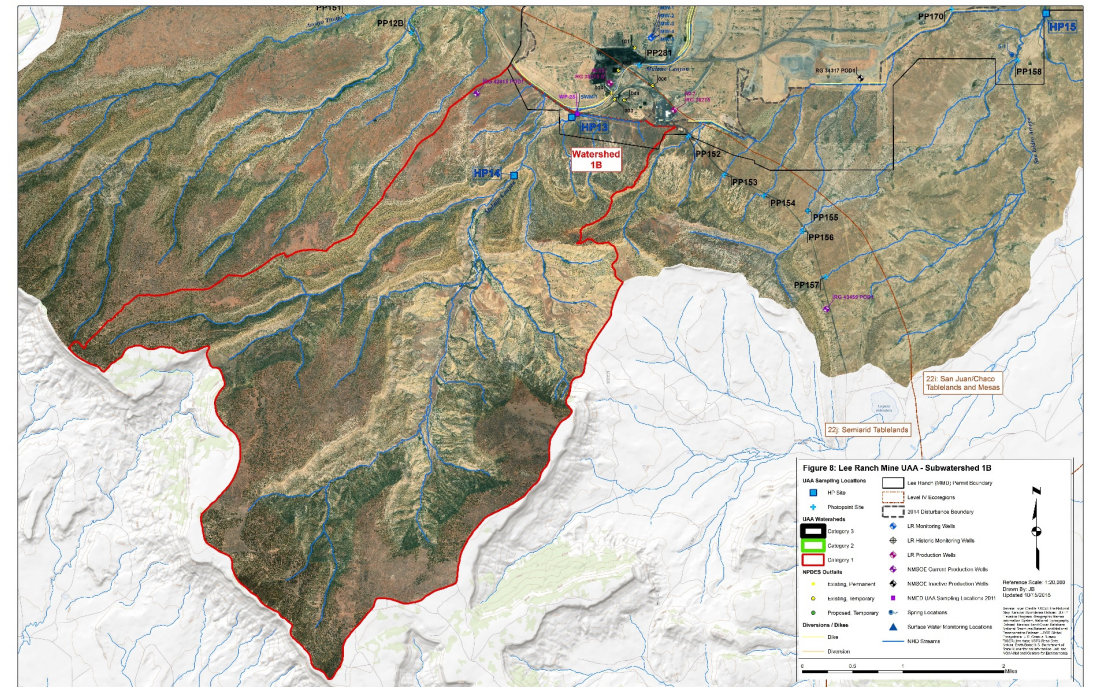
- Upper Canyon Tier 1 Watershed 1A: Arroyo Tinaja
- Upper Canyon Tier 1 Watershed 1B: Mulatto Canyon
- HP 11, HP 13, and HP 14
  - PP 151, PP12A, PP12B
- Highest elevation watersheds
- Channels showed clear characteristics of ephemeral channels at both the photo points and the Hydrology Protocol locations.
- There were no signs that indicate these channels are intermittent streams, which would show signs of prolonged flow due to a connection with the water table.
- There was no evidence of water or aquatic life and the channels showed ephemeral channel morphologies and vegetation characteristics.

# Watersheds 1A and 1B Maps

## Watershed 1A



## Watershed 1B



# Watersheds 1A and 1B Photos

## HP11 Upstream



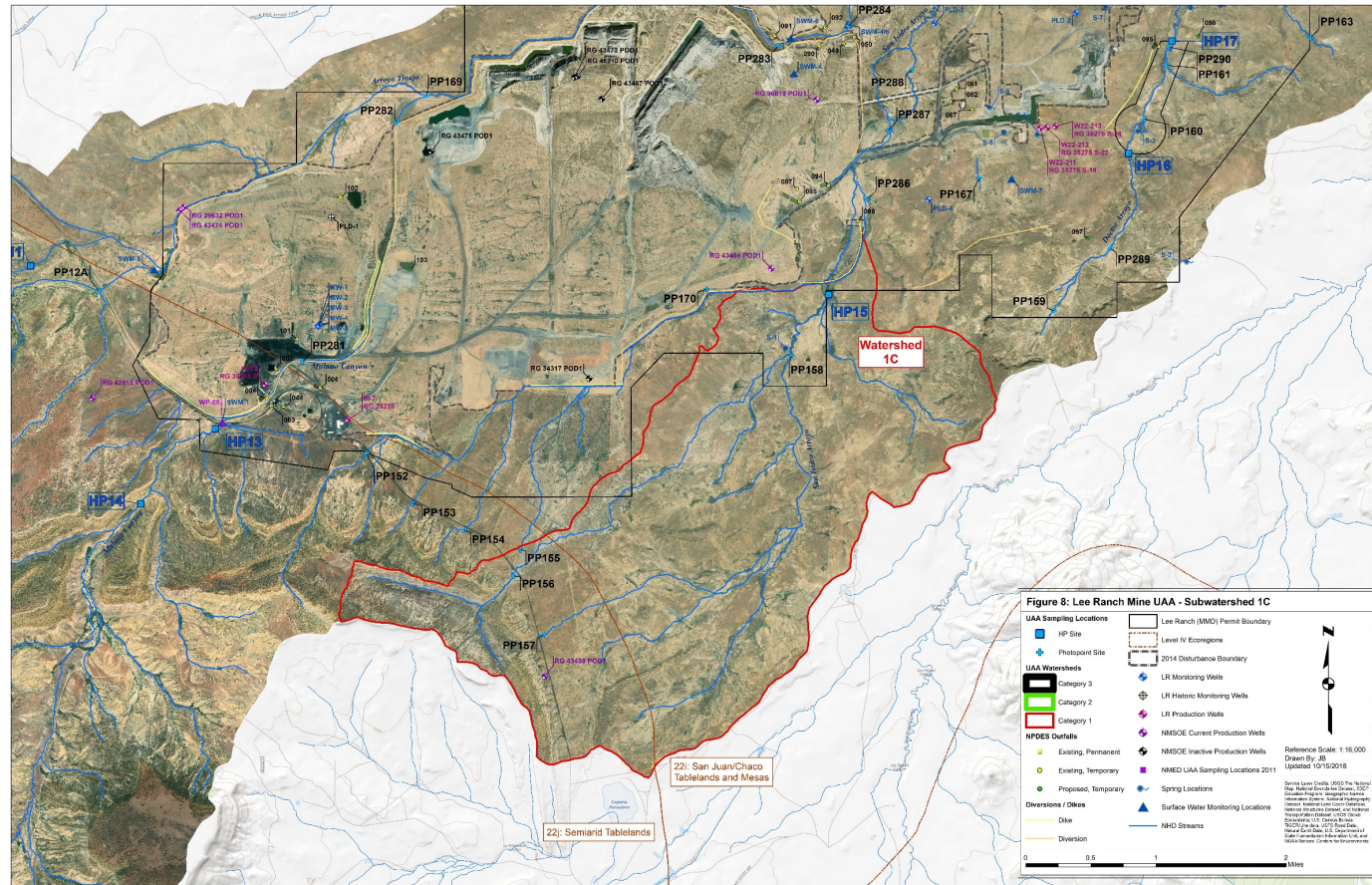
## HP13 Bankfull



# LRM's Hydrology Protocol Results: Tier 1 Watershed 1C

- Tier 1 Watershed 1C: San Isidro Arroyo
- Mid-elevation; lower slopes; rolling hills
- HP 15; PP 156, PP 157, PP 158
- All sites within this watershed are characteristic ephemeral streams.
- One stream again showed a discontinuous nature typical of the scour-transport-fill landform sequence.
- The primary HP site showed artificially elevated score for three of the indicators due to the conservative approach used by Peabody sampling staff, but still resulted in a total score characteristic of ephemeral streams.
- Photo points located higher in the watershed showed stream characteristics consistent with the results of the Hydrology Protocol sampling location.

# Watershed 1C Map



# Watershed 1C Photos

## HP15 Upstream



## PP158 Upstream





# LRM's Hydrology Protocol Results: Tier 2 Watershed 2ABC

- Includes drainage from Tier 1 Watersheds 1A, 1B, and 1C
- HP 21: located in rolling hills topography following the confluence of three major tributaries, San Isidro, Tinaja, and Mulatto, where there is the highest potential for non-ephemeral flow
- PP152, PP153, PP154, PP170, PP286, PP287, PP281 a PP282, PP169, PP283, PP284, and PP285
- Results indicate that the San Isidro Arroyo is an ephemeral stream at this point in the watershed.
  - It displays classic ephemeral characteristics, with incised channels in areas of scour and nearly no visible channel in areas of fill or deposition.
  - The scores resulting from the Hydrology Protocol validate that the proper classification for this stream is ephemeral and the photo points verify that there are no isolated areas of abnormal hydrologic characteristics that are not already accurately represented by the HP sites that were chosen.



# Watershed 2ABC Photos

## HP21 Upstream



## PP287 Downstream



# LRM's Hydrology Protocol Results: Tier 1 Watershed 1D

- Tier 1 Watershed 1D: Doctor Arroyo
- From headwaters to mouth, this watershed is located in the lower valley and is characterized by the rolling hills topography
- Doctor Springs, located approximately midway between the headwaters and the confluence with San Isidro Arroyo, is not an ephemeral feature and has been excluded from this Hydrology Protocol evaluation
- HP 16, HP 17, HP 18
- PP159, PP160, PP161, PP290, PP291, PP168, PP292, PP163, PP164, and PP166
- These photos indicate that all intermediate portions of Doctor Arroyo and contributing tributaries exhibit consistent ephemeral characteristics and were accurately represented by the chosen HP sites.
- The only site that exhibited non-ephemeral characteristics is PP160, which is located immediately downstream of Doctor Springs and is being excluded from this UAA.



# Watershed 1D Photos

## HP16 Rooted Plants



## HP17 Soil Profile



# LRM's Hydrology Protocol Results: Tier 3 Watershed 3ABCD

- Tier 3 Watershed 3ABCD: San Isidro Arroyo
- HP31: Characteristics consistent with HP21 and HP18
- Total score 7: Moderate scores for differences in vegetation, floodplain and channel dimensions, and absence of rooted upland plants. All indicators were characteristic of ephemeral streams.
- This site has a higher potential for showing intermittent characteristics due to the large drainage area capturing surface water runoff, with potential to sustain intermittent flows, and the lower position in the watershed, giving it a higher potential for intercepting the water table if alluvial groundwater exists.





# Watershed 3ABCD Photos

## HP18 Upstream



## HP31 Downstream



# Summary of HP Results

- All sites scored within the ephemeral stream category after completing the entire Level 1 evaluation.
- The large number of photo points used at sites not subject to the Hydrology Protocol showed characteristics consistent with the Hydrology Protocol locations.
- The one sampling location that exhibits intermitted characteristics was Doctor Springs, and the limitations of the intermittent characteristics were accurately delineated by the Hydrology Protocol locations bounding both the upstream and downstream limits of the spring.

# Lee Ranch Mine's Use Attainability Analysis

- UAA = Results of HP and Level 1 Office Procedures
- Developed in coordination with USEPA and NMED
  - 6/26/2018: Draft UAA was completed and submitted to NMED and EPA
  - 8/24/2018: NMED provided comments on August 24, 2018
  - 9/6/2018: EPA provided comments via email (letter received 9/25/2018)
  - 11/6/2018: Peabody revised the UAA into its final form and provided a response to technical comments received
- Public Notice
  - Published in Albuquerque Journal and Gallup Independent
  - Letters mailed
  - Posted Notice
  - Public Meeting

# Lee Ranch Mine's Use Attainability Analysis

- UAA provides a comprehensive hydrologic analysis of the waters within the San Isidro watershed.
- The UAA provides abundant scientific support for classifying waters within the San Isidro watershed as ephemeral streams, including Arroyo Tinaja, Mulatto Canyon, San Isidro Arroyo, and Doctor Arroyo, and all tributaries to these waters, excluding the specific areas delineated by the regulatory language.

Thank you!