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SUBJECT: Report on Yankee Canyon Abandoned Mine Bat Surveys

SURVEY

DATES: November 17-18, 2021

OVERVIEW:

This biological survey project assessed abandoned mines in Yankee Canyon, located on the flanks of Horse Mesa, east of Raton, New Mexico. All sites were surveyed by Bat Conservation International (BCI) staff following standardized protocols and safety procedures for providing subterranean mapping, biological data, and closure recommendations. Mapping efforts focused on accessible workings to determine proximity to road A-25 and a known subsidence in the middle of the roadway. The field project resulted in bat surveys being conducted on two distinct features, comprising two openings to the surface (Figure 1, Table 1). Bat habitat assessments and closure recommendations are provided for all features. A survey summary, full survey results, and a discussion of road A-25 can be referenced on the following pages.

ACKNOWLEDGEMENTS:

BCI wishes to thank Lloyd Moiola for initiating the project and for providing the scope of work and site inventory descriptions. Special thanks to Laurence D'Alessandro for providing on-site navigation, assistance locating features, and serving in the surface safety role during field work. Additional thanks to Yeny Maestas, ENMRD, for joining the crew in the field.

All surveys conducted by BCI Subterranean Team staff: Dillon Metcalfe and Bill Burger. This report was authored by Dillon Metcalfe.

Report and photos submitted February 18, 2021.

BCI FIELD SURVEYS: YANKEE MINE GEOREFERENCE

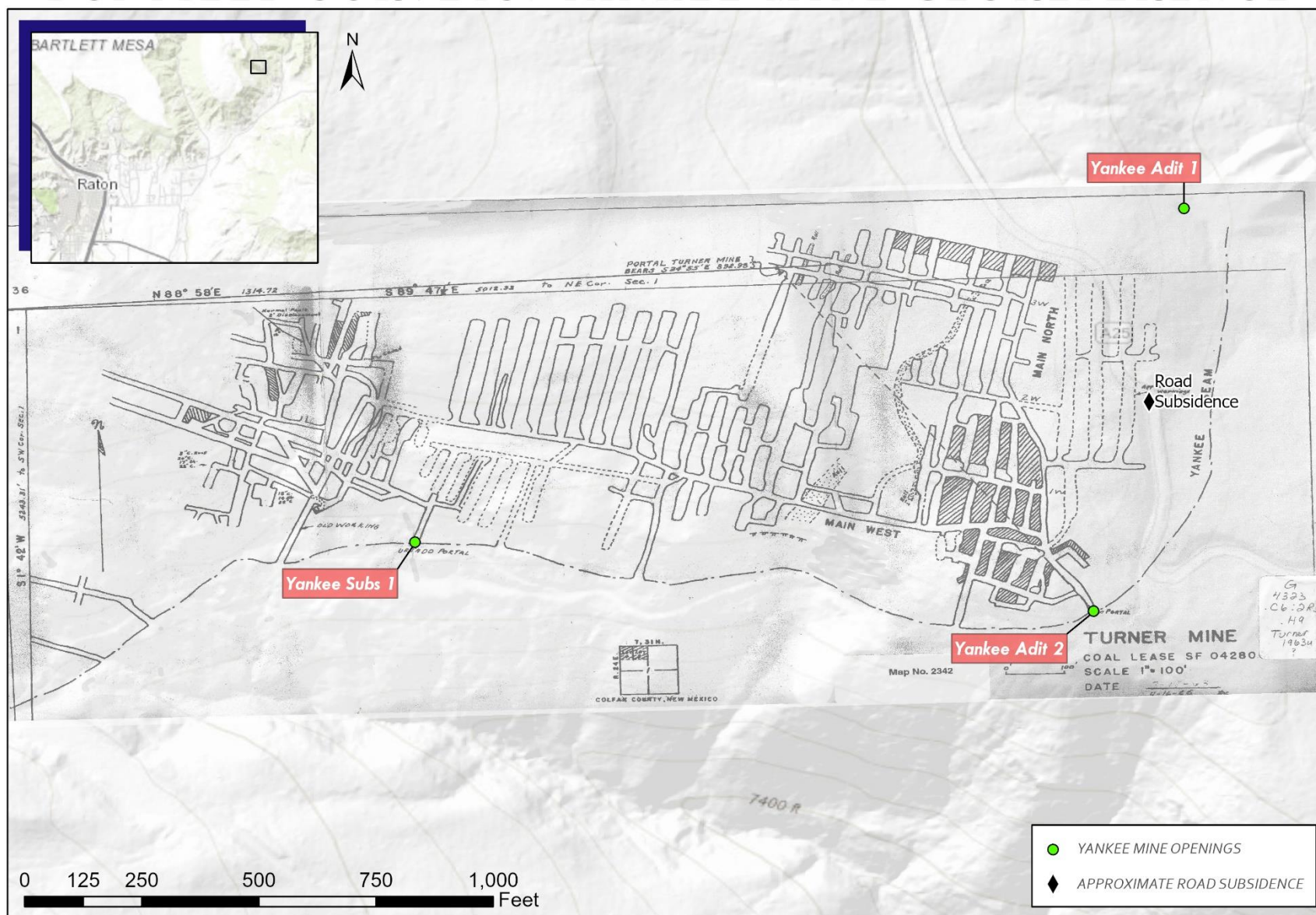


Figure 1: Overview Map of Project Area and Features Surveyed

Table 1. Summary of bat survey results and closure recommendations.

Feature¹	Closure Recommendation²	Live Bats³	Bat Sign	Roost Function	Bat Habitat
Yankee Adit VanLaten01	BCWS	3 COTO	none	hibernaculum	Good
Yankee Adit VanLaten02	DCWS	none	none	none	Moderate

¹Feature: A distinct feature may consist of a single opening, multiple openings interconnected via underground workings, or closely related surface workings. In the “Feature” column, distinct features are separated by solid lines, and associated openings of a feature are separated by dashed lines. A feature contains shared biological and habitat characteristics and is therefore described by a single survey, whereas closure recommendations are unique to each opening.

²Closure recommendations:

<u>Bat-compatible Closures</u>	<u>No Action</u>
BCAT – bat-compatible closure, any time	LAI – leave as is
BCCS – bat-compatible closure, cold season	
BCWS – bat-compatible closure, warm season	
CM – closure modification	
<u>Destructive Closures</u>	<u>Other Closure Type</u>
DCAT – destructive closure, any time	AC – airflow closure
DCWS – destructive closure, warm season	

³Bat species codes: COTO – Townsend's big-eared bat (*Corynorhinus townsendii*)

SECTION 1: SURVEY SUMMARY

BIOLOGICAL SURVEY SUMMARY:

Biological surveys are focused on subterranean habitat, with a primary emphasis on bat use. Surveys attempt to identify bat species present, document other bat sign (e.g., guano, insect parts, roost staining), and determine roost function of the site. Additionally, surveys document other wildlife use of features, evident by live animals, scat, nests, etc. All bat and other wildlife observations inform habitat assessments and closure recommendations.

Bat Use:

Two distinct features¹ received comprehensive biological surveys. Both of these features offered some level of subterranean habitat with potential for bat use. One feature contained three hibernating bats. No other bat sign was observed.

Other Wildlife Use:

Other wildlife sign consisted of a small amount of packrat scat in VanLaten 2.

BAT HABITAT ASSESSMENT SUMMARY:

Bat habitat assessments are determined based on observed bats and bat sign, along with physical characteristics of the site such as complexity and extensiveness of workings, portal size and obstructions, ceiling textures that bats select for, hydrological activity (such as seasonal flooding) that may preclude bat use, and any additional observations that may influence bat use of the site. A bat habitat assessment is applied to each distinct AML feature, which may include multiple openings. See Appendix 2 for additional details on assessment classifications. Bat habitat assessments for this project are summarized in Table 2.

Table 2. Bat habitat assessments for distinct AML features surveyed.

Bat Habitat Assessment	# Features
None	0
Poor	0
Marginal	0
Moderate	1
Good	1
Excellent	0
Unknown	0

¹ A distinct feature may consist of a single opening, multiple openings interconnected via underground workings, or closely related surface workings. Each distinct feature, including associated openings, contains shared biological and habitat characteristics and is therefore described by a single survey.

CLOSURE RECOMMENDATION SUMMARY:

Closure recommendations generally fall into bat-friendly or destructive closure categories and include a seasonal component that recommends the closure to occur either during the warm season, cold season, or at any time. A closure recommendation is provided for each individual opening of an AML feature. See Appendix 3 for additional details on recommendation classifications and Appendix 4 for guidance on conducting exclusion prior to closure. Closure recommendations for this project are summarized in Table 3.

Table 3. Closure recommendations for AML openings surveyed.

Closure Recommendation	Code	# Openings
Bat-compatible Closure, Any Time	BCAT	0
Bat-compatible Closure, Cold Season	BCCS	0
Bat-compatible Closure, Warm Season	BCWS	1
Other Wildlife-compatible Closure	OWC	0
Destructive Closure, Any Time	DCAT	0
Destructive Closure, Warm Season	DCWS	1
Leave As Is	LAI	0
Closure Modification	CM	0
Airflow Closure	AC	0

APPENDICES:

Appendix 1 contains selected photos from this survey project. Appendix 2 describes bat habitat assessment classifications. Appendix 3 describes closure recommendation classifications. Appendix 4 provides guidance on bat exclusion methods when recommended for destructive closures.

SECTION 2: FULL SURVEY RESULTS

Unless otherwise noted, all features are driven in moderate- to good-quality rock (qualitative safety assessment), contain good air*, and exhibit minimal signs of post-mining human disturbance. All feature locations are listed as latitude and longitude (decimal degrees) in the WGS84 datum.

* Good air is defined as no alarm sounding on the Altair 4x Multi-gas Detector carried during all surveys. The detector measures four gases (oxygen, carbon monoxide, hydrogen sulfide, methane) and alarms for gas levels that fall outside of safe thresholds.

Feature: Yankee Adit VanLaten01

Location: 36.95887065, -104.34187169

Date: November 17, 2021

Observations: This feature is a straight adit with a short crosscut that leads to another crosscut parallel to the main adit. Total workings are 457' and together form a capital "H" shape in plan view. The main adit is straight and wide and is 274' long to where it ends in collapse. It is very likely that this feature connected to the known historical workings of the Yankee Mine prior to this collapse. There are plentiful timber stulls fixed with intermittent porcelain knobs for electrical wire. 73' from the portal, a crosscut is driven 32' to the right, where it intersects another crosscut that is driven 89' in one direction and 63' in another. Three hibernating Townsend's big-eared bats were observed in various parts of the mine. No other wildlife sign was observed.

Bat Habitat: Good

Closure Recommendation: Bat-compatible Closure, Warm Season (BCWS)

Feature: Yankee Adit VanLaten02

Location: 36.95651851, -104.34240019

Date: November 17, 2021

Observations: This feature is a backfilled adit that has subsided. It can be identified by a piece of railroad rail that is stuck in the backfill material. The open subsidence is 2' wide and 1.5' high. 112' of workings were surveyed. The adit is driven straight for 55', where an unstable, collapsing area prevented further passage. A very large block of sandstone is precariously balanced on a single old stull, and passage would not be possible without pressing against the block in order to slide past. 29' from the face, a drift is driven to the left for 33' before ending in collapse.

Bat Habitat: Moderate

Closure Recommendation: Destructive Closure, Warm Season with exclusion.

Discussion of county road A-25: Attempts were made to find a connection between the subsidence and either of the accessible portals. Neither Yankee Adit 01 or Yankee Adit 02 connected to the subsidence via accessible subterranean workings. Both features ended in collapse before the large, historically documented workings could be reached. It is likely that the road overlays some historical excavation and that further subsidence is possible. Given the known extent of the historical mine, the road will likely need to be rerouted to the east and north. No major topographical obstacles appear to prevent this reroute, but extensive archeological resources in the vicinity of the portal should be considered before construction. The georeferenced map provided in Figure 1 of this report suggests that rerouting the road anywhere to the west would risk overlaying the historical workings that honeycomb the mesa.

APPENDIX 1

Selected photos from the field project. The full set of photos from all features was provided in digital form with this report.



Yankee Adit 01: Dillon examines the back for bats.
BCI Photo by Bill Burger



Yankee Adit 01: A Townsend's big-eared bat roosts on the ribs.
BCI Photo by Bill Burger



Yankee Adit 01: The coal seam is visible along the ribs.
BCI Photo by Bill Burger



Yankee Adit 02: The dangerous section that prohibited passage. Note the large, rectangular white block balanced on a single old timber stull.

BCI Photo by Bill Burger



Yankee Adit 02: Another view of the dangerous blockage.

BCI Photo by Bill Burger



Yankee Adit 01: Much of the feature required crawling squeezes to negotiate.
BCI Photo by Bill Burger



Yankee Adit 01: Dillon quietly crawls under a hibernating bat.
BCI Photo by Bill Burger

APPENDIX 2

Bat Habitat Assessment Classifications

Bat habitat is assessed for each feature surveyed and describes the value of that feature for bat use. Determining bat habitat is the primary objective of surveys conducted by the BCI Subterranean Program. Survey of a feature results in seven possible bat habitat classifications: excellent, good, moderate, marginal, poor, no habitat, or unknown. Each of these classifications are described below.

Excellent Bat Habitat

Description

Excellent bat habitat is very rare amongst features surveyed. For a feature to be assessed as having excellent habitat, significant bat use, usually by colonies, must be documented. Typically, this occurs when a large single species roost (>20 bats) is identified using the feature for warm season aggregation, usually in conjunction with substantial guano piles. Bats present in lower numbers but representing multi-species use of three or more species also warrants an assessment of excellent habitat. Bats need not be present to identify excellent habitat, as obvious bat sign such as large guano piles, heavily scattered guano along flyways, and roost staining on ceilings are indicators of significant bat use. Major winter use by bats cannot be confirmed during warm season surveys, though features that exhibit cold temperatures, airflow, and a high diversity of microclimates and roosting habitat can be identified as sites with good potential for serving as hibernacula. Features offering excellent bat habitat usually exhibit striking internal complexity, with extensive workings and possibly multiple levels. Due to the extensiveness of underground workings, these features nearly always offer high quality rock habitat. Exceptions, however, include small features used as maternity sites. Feature stability should be good, with little concern for future collapse that could result in loss of the roost.

Closure Recommendation

Features with excellent bat habitat should nearly always be recommended for protection (exceptions include imminent collapse or other major safety hazards). To minimize disturbance while bats are using the feature for a critical life cycle phase, bat-friendly closures should occur during the opposite season of primary use. For example, closure of a feature that hosts a maternity colony should occur during the cold season, and closure of a feature that serves as a hibernaculum should occur during the warm season. For features with multiple entrances, closures should protect all openings that are either used for bat access or necessary to preserve airflow patterns.

Good Bat Habitat

Description

Good bat habitat is represented by features that contain clear signs of persistent bat use but do not exhibit the striking evidence of significant use by bat colonies. These features often support use by one or two species of bats that use the site as a day roost or night roost. Bat sign such as guano, either scattered or in small piles, and insect parts are common in these features. The internal workings usually exhibit moderate complexity, with rock habitat quality that meets the specific needs of day or night roosting bats, such as domes, drill holes, and/or a heavily featured back. Feature stability should be good, with little concern for future collapse that could result in loss of the roost.

Closure Recommendation

Features with good bat habitat should nearly always be recommended for protection (exceptions include imminent collapse or other major safety hazards). Bat-friendly closures can usually occur at any time of the year, as bat use of these sites is persistent but dispersed and does not represent significant use for warm season maternity colony aggregation or cold season hibernation. For features with multiple entrances, closures should protect all openings that are either used for bat access or necessary to preserve airflow patterns.

Moderate Bat Habitat

Description

Moderate bat habitat generally refers to features that exhibit some signs of minor bat use or have potential for bat use due to the level of complexity and/or stable microclimate offered within. Moderate habitat features are often occupied by one or two bats, possibly on a seasonal nature, but will not display any signs of significant bat use. Guano, if present, will be lightly scattered, or in no more than a few very small piles representative of solitary bats of a single species. Insect parts may also be present, indicating night roosting. Bat sign may also be completely absent from these features at the time of survey, either due to extremely limited bat use, suspected winter use that cannot be detected during a warm season survey, or feature conditions such as flooding that may cover or destroy evidence of bat use. Complexity of the feature will range from simple, if combined with other signs of bat use, to moderately complex. Feature stability should be relatively stable, and rock habitat quality should offer some level of suitable roosting surface.

Closure Recommendation

Features with moderate bat habitat fall into the "grey area" where bat use is not necessarily prominent enough to immediately warrant a protective closure, yet the possibility for increased future bat use exists. Generally, a bat-friendly closure should be recommended for features with moderate habitat in order to maintain a conservative approach to habitat protection. Furthermore, the context of the feature relative to the surrounding landscape may elevate its importance if few other suitable habitat options are available. Scenarios that may call for destructive closure recommendations on features that meet the criteria for moderate habitat include unstable internal conditions that suggest future collapse/destruction of the feature or areas in which the feature is eclipsed by numerous other features with superior habitat. If a destructive closure is recommended, it must be accompanied by bat exclusion prior to closure.

Marginal Bat Habitat

Description

Features designated marginal bat habitat generally lack bats and bat sign. Less commonly, these features may exhibit signs of very minor, infrequent use. A single bat may be present, but there may be no accompanying signs that would allow detection if the bat was absent. Guano and insect parts, if present, will be very sparsely scattered and require diligence for detection. Complexity of the feature will always be simple, with no substantial workings; however, these features are usually extensive enough to include a dark zone, and the entire feature is not visible from the portal or collar. Marginal features are often short, simple adits or blind and bald shafts. Feature stability can be stable, but often poor rock conditions contribute to marginal habitat. Rock habitat quality will generally be poor to fair, with less than ideal roosting surfaces.

Closure Recommendation

Features with marginal bat habitat are almost invariably recommended for destructive closure due to these features lacking bat sign and/or containing unstable conditions that threaten collapse. Given the possibility for bats to be present in these features, exclusion is required prior to closures occurring in the warm season when bats are active. In rare circumstances, a protective closure may be warranted to allow for the possibility of future bat use, especially if the feature represents one of the only subterranean habitat options in the area.

Poor Bat Habitat

Description

Features classified as poor bat habitat tend to be very small prospects that exhibit no signs of bat use. While these features offer some level of subterranean habitat, the workings are so limited as to offer no true dark zone and no area of stable subterranean microclimate. Usually, the entire feature will be visible from the portal or collar. These features are so small that structural stability is often quite good, but they may also be in a state of collapse. Rock habitat quality can range the entire spectrum, but this assessment is largely irrelevant in such small features that offer little physical area from which bats can select roosting spots that have a stable microclimate.

Closure Recommendation

Features with poor bat habitat are recommended for destructive closure. Due to the lack of bat sign or potential for future bat use, a "DCAT" recommendation is usually warranted on these features.

No Bat Habitat

Description

Assessing a feature as containing no bat habitat means no subterranean habitat is available. No underground workings are present at all, and the feature would present no option for bats to roost in subterranean environments. This scenario occurs for features that are totally collapsed, prospect scrapes, entirely and permanently flooded, or some other similar circumstance. This assessment is also appropriate for portals that are almost entirely sloughed closed and/or overgrown with vegetation such that bats would be unable to access the workings.

Closure Recommendation

With no subterranean component and thus no bat habitat, a "DCAT" recommendation is always warranted. For some features, though, especially those that contain no inherent hazard, a "Leave As Is" recommendation may be most appropriate. This recommendation is most applicable to prospect scrapes and pits that contain no headwall and may be largely overgrown.

Unknown Bat Habitat

Description

If an internal survey cannot be conducted, and underground workings are likely to exist based on observations from the surface, then bat habitat cannot be assessed. This usually occurs when the feature is not accessible due to safety concerns (e.g., wildlife hazards, rock or timber hazards) at the portal or collar. Often, looking into the feature from outside confirms that underground workings are present, though inaccessible. An unknown bat habitat assessment may also be appropriate for some partial internal surveys, when a survey is terminated underground due to safety concerns. In these instances, though, if extensive workings and/or bats and bat sign are observed prior to terminating the survey, then a higher bat habitat classification and feature protection are warranted.

Closure Recommendation

Closures of features with unknown bat habitat should follow conservative recommendations to minimize the possibility of destroying potentially important bat roosts. When possible, bat-friendly closures should be recommended for these features. In cases where destructive closures are more appropriate (e.g., collapse of feature is imminent), exclusion is required prior to closures occurring in the warm season when bats are active.

APPENDIX 3

Closure Recommendation Classifications

Closure recommendations are assigned to each opening of a distinct feature surveyed and prescribe the appropriate remediation strategy for the site. Bat use, other wildlife use, feature stability, and overall nature of the workings are considered when determining the closure recommendations. Survey of a feature usually results in recommendation of a bat-compatible closure or destructive closure for each opening, with a seasonal component to advise suitable timing of the closure. In some cases, openings may warrant other wildlife-friendly closures or recommendation of no action (leave as is). Each of these classifications are described below.

Bat-compatible Closures

Bat-compatible closures are recommended for openings to features that contain bats / bat sign and/or exhibit characteristics that indicate high potential for bat use. These features warrant protective closures to maintain the bat habitat within and allow for continued bat use. Bat-compatible closures include a variety of methods that fall on a spectrum of high to low compatibility. No closure method is perfect for all bat species, but generally, gates designed to comply with bat-compatible specifications are preferred to 1) minimize the potential of disrupting current use patterns and 2) promote long-term access for bats and other wildlife. For openings that are unstable or present access challenges, construction of a standard bat gate may not be possible. In these instances, use of alternative methods such as culverts or cable nets may be the most feasible method; while these closure types are not ideal for bats and other wildlife, they may still facilitate moderate levels of access and habitat use and therefore present a suitable alternative to total habitat loss.

Three seasonal designations are used to recommend appropriate timing of bat-friendly closures:

- **BCAT (Bat-compatible Closure, Any Time):** "Any time" bat closures are recommended for openings to features in which overall bat use is relatively minor or not confined to any single season.
- **BCCS (Bat-compatible Closure, Cold Season):** Cold season bat closures are recommended for openings to features that display significant warm season use, typically by a maternity colony of bats. Closure is recommended to occur during the cold season to avoid disturbance of bat colonies, which could potentially lead to abandonment of the site.
- **BCWS (Bat-compatible Closure, Warm Season):** Warm season bat closures are recommended for openings to features that are documented as hibernacula or exhibit characteristics that indicate high potential for significant cold season use by hibernating bats. Closure is recommended to occur during the warm season to avoid disturbance of hibernating bats, which could potentially lead to bats arousing and burning critical energy reserves.

Airflow Closures

Airflow closures may be recommended for secondary openings to features with multiple openings that access habitat warranting protection. Independent, secondary openings often contribute to the microclimate and habitat suitability of the underground workings via air exchange but may not serve as important access points for wildlife. In these cases, it is appropriate to close these secondary openings in a way to maintain air exchange without preserving access to wildlife.

Other Wildlife-compatible Closures

Protection may also be recommended for openings to features that display significant use by wildlife other than, or in addition to, bats. These closure recommendations are relatively rare, and closure methods are dependent on type of wildlife use. Protection of features may be warranted for use by wildlife including, but not limited to, birds (e.g., owls, vultures), mammals (e.g., cats, foxes, porcupines, ringtails), and reptiles/amphibians (e.g., salamanders).

Closure Modifications

Closure modifications are recommended for existing closures such as bat gates or backfills that do not adequately protect or maintain habitat provided by the feature. In these cases, a modification to the existing closure is recommended to improve wildlife access to habitat assessed at the time of survey. Closure modifications are recommended to provide access to previously inaccessible habitat or to facilitate increased use of existing habitat. Seasonality is also considered in closure modification recommendations to advise suitable timing of the modification.

Destructive Closures

Destructive closures are recommended for openings to features that either offer no bat habitat, contain no evidence of bat use, or exhibit only minor, insignificant bat use. In some cases, destructive closures may also be recommended for secondary openings to features that are protected through bat-compatible closure of primary openings used for wildlife access. Two destructive closure designations are used to recommend appropriate measures based on possible bat use:

- **DCAT (Destructive Closure, Any Time):** These openings access features that exhibit no signs of bat use or potential for bats to be present and can be destructively closed without conducting exclusion, during any season. This recommendation may also be applied to secondary openings to features protected for wildlife habitat, provided that these openings do not serve any critical function in maintaining wildlife access or suitable habitat conditions.
- **DCWS (Destructive Closure, Warm Season):** These openings access features that either exhibit signs of minor, insignificant bat use or have the potential for bats to be present

during destructive closure. In some cases, other wildlife such as birds may be present, and these animals should also be excluded; alternatively, closure with bat exclusion may be timed for after the nesting season when birds are no longer using the feature. Using appropriate exclusion techniques on the features prior to closure is critical. Exclusion needs to be done during the warm season when bats are active and will be able to escape. See Appendix 5 and refer to “Managing Abandoned Mines for Bats,” published by Bat Conservation International, for guidance on exclusion techniques.

No Action

"Leave as is" treatments are recommended for features that present no inherent safety concerns. A feature with this recommendation is generally either a prospect scrape/trench with no subterranean component, or the portal has completely collapsed, making the feature inaccessible.

APPENDIX 4

Exclusion Guidance as Excerpted from BCI's "Managing Abandoned Mines for Bats"

Timing of Exclusions

The exact timing of exclusions and site closures is best determined locally, given the variability in types of use by different species. As a general rule, bats must be active for exclusions to be effective, so all exclusions should be conducted outside of hibernation season. In general:

- The best time to implement exclusions and portal closures is during late summer or early fall, after cessation of maternity activities and before the onset of hibernation.
- Early-fall closures will best ensure a window for bats to find alternate hibernacula and will give females a full spring season to locate alternate maternity sites.

Exclusions for Destructive Closures

Regardless of the reason for a destructive closure of known or potential bat roosts, steps must be taken to ensure significant bat colonies are not destroyed as a direct result of closure activities. Managers should include adequate exclusions as a routine part of mine reclamation programs to minimize the risk of entombing bats in closed workings. Further, closures should be conducted immediately following exclusion to limit the chance of bats becoming reestablished in the mine. In general, these two guidelines can help determine whether exclusions should be conducted and how intense the exclusion effort should be.

Exclusions Not Required: Exclusions are generally not required if a mine does not offer potential bat habitat, as mutually agreed upon by all partners involved in the mine closure project.

Standard Exclusions: In general, exclusions are recommended at all mines that represent habitat for bats. Given the ephemeral and episodic use of some roosts, it is prudent to err on the side of caution and conduct standard exclusions efforts, especially if significant time has elapsed since biological assessments were conducted.

The use of one-inch mesh material (e.g., chicken wire, polypropylene or similar material) is most often used to exclude bats from a mine. Lighter-weight material may be used for remote mines that require physically transporting the material over long distances or rough terrain. Although this material is very effective for excluding bats, it may also entangle bats and other wildlife. Managers may need to develop a plan to periodically check exclusion materials at sites with large bat colonies or high use by other wildlife to prevent loss of entangled bats, amphibians, reptiles or birds.

Exclusion materials should be maintained for at least three nights prior to portal closure at mines that provide habitat and where little or no bat use has been detected. Simultaneously

covering all external openings with exclusion materials and leaving it in place for at least one week is an effective method for excluding most bat species from roosts. Difficulties in navigating through exclusion materials should cause bats to seek alternate roosts rather than continuing to access the mine through the wire.

For most species, simply spreading exclusion materials across portals will be sufficient to allow bats to exit a mine while effectively discouraging their return. However, not all bats in all roosts across all landscapes will respond in an identical manner. As a general rule, smaller colonies in areas where roosts are abundant tend to quickly abandon roosts after exclusion materials are installed. For example, exclusion materials left in place for three to five nights will usually cause small colonies of Townsend's big-eared bat roosting in small mines in Nevada to abandon the roosts.

END OF SURVEY REPORT