A Bat Conservation Evaluation for White Grass Ranch, Grand Teton National Park, Wyoming

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for
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CONTENTS

SUMMARY

The buildings of White Grass Ranch are scheduled for renovation beginning in the summer of 2006. Unless these activities actively include mitigation efforts, virtually the entire population of bats at the ranch will be eliminated.

In this report I evaluated the level of bat use of the structures at White Grass Ranch based on field studies of ranch buildings and the surrounding area. This information was used in combination with expert advice and published conservation literature to design a strategy to mitigate impact to the bat community in the vicinity of White Grass Ranch. In short, this plan suggests staggered exclusion and development of ranch buildings combined with the strategic placement of alternative roost structures (i.e., bat houses) in advance of such activities.

If employed correctly, these strategies could retain virtually the entire bat population at the ranch without substantially hindering development plans. Further, they are relatively inexpensive in terms of materials and labor and they are fairly simple to implement using the instructions in this report and that of Tuttle et al. (2004). However, to be effective, it is imperative that guidelines for bat houses and exclusion from buildings be followed carefully. Even small alterations in the timing of tasks or the construction of roost structures could result in the failure of mitigation efforts. The staff of Bat Conservation International (www.batcon.org) and/or myself may be contacted for advice and assistance with implementation efforts.

FINDINGS AND RECOMMENDATIONS

The abandoned structures comprising White Grass Ranch exhibit substantial and long-term use by bats of multiple species (Table 1, Figure 1, Appendix 1, and Keinath 2005). These bats use buildings as day roosts, night roosts, and maternity colonies, as well as more exposed locations for shelter, feeding and rest during the night (Keinath 2005, Kunz 1982). Structures housing maternity colonies are very important to local bat population, but other roost types are also important and often overlooked. Males and females of most species of Wyoming bats are segregated during the pup-rearing season, use of structures is usually sex-biased, with males selecting different structures, or sites within the same structure, than females and offspring. These smaller, predominantly male, roosts often go unnoticed by property-owners, which can lead to unintentional destruction bats (Tartarian 2001).

About 8 species of bats are regularly found in Grand Teton National Park (Keinath 2005). Of these, we identified 5 species roosting in White Grass structures (*Corynorhinus townsendii, Eptesicus fuscus, Myotis evotis, Myotis lucifugus*, and *Myotis volans*) and via visual roost inspections and/or nocturnal recording if bat echolocation calls via the Anabat® system (http://users.lmi.net/corben/anabat.htm) (Table 1). Of these, *M. lucifugus* (little brown bat) was by far the most common. *Myotis volans* (long-legged myotis) and *E. fuscus* (big brown bat) were common, but not readily seen in the roosts, as they were more "shy than the little brown bats. *C.townsendii* (Townsend's big-eared bat) was rare, but regularly present. *M. evotis* (big-eared myotis) was only recorded on Anabat®.

Renovation of the White Grass Ranch buildings will necessitate exclusion of the bats therein, thus eliminating large amounts of available roost space. Without extensive and time-consuming

study, there is no way to know how many of these bats can find new roosts. Given the high use of park structures by bats, it is likely that natural structures are limiting in the environment. Thus, even if excluded bats could find a new roost, it would likely be in another building, which only moves the problem to elsewhere in the park. Further, structures suitable for large maternity colonies (like that in building 1156) and Townsend's big-eared bats (e.g., buildings 1162 and 1168) are definitely limiting (e.g., Kunz 1982) and their removal would likely be detrimental to the bat community. Finally, given the beneficial nature of bats (a single little brown bat can catch 1,200 mosquito-sized insects in *an hour* (French et al. 2001), it may be highly desirable to maintain a sizeable population around the newly renovated White Grass Ranch..

To minimize displacement and mortality of bats, renovation of buildings at White Grass Ranch should employ the following three guidelines.

1. Selected Exclusion
2. Staggered and/or Partial Development
3. Placement of Alternative Roost Structures

These guidelines are elaborated below and should be applied in a building-by-building basis using the framework outlined in Table 1, Figure 1, and Appendix 1.

Selected Exclusion

Building-specific recommendations are presented in Table 1 and Appendix 1.

Bats should be excluded from a building prior to the commencement of construction on that building. Eviction of bats, or any activity that directly affects their roosting area, should occur only prior to or after the maternity season, when young will not be trapped inside, creating additional problems (French et al. 2001)..Thus, exclusions at White Grass Ranch should occur during their hibernation period; *no earlier than October 31 in the fall and no later than April in the spring*. Even during this period, buildings should be checked for the presence of "stragglers."

Bats should only be excluded from those buildings to be worked on in the following summer, with the remaining buildings left undisturbed until the following winter. To be effective, exclusion must seal all possible entrances to a building, not just the obvious ones noted in this document. Since most buildings at White Grass Ranch are deteriorating, they have many holes. Therefore, effective exclusion will likely entail covering entire roofs with plastic sheeting and covering all walls, joints, and eaves with fine metal screen. Particular attention should be given to places where roofs meet the top of log walls and support beams.

If working on a building that currently contains bats (e.g., due to ineffective exclusion), it is not appropriate simply to wait for bats to fly out at night and then seal openings. Not all of the bats leave at the same time, and some bats may remain inside all night. Take weather conditions into consideration when deciding how long to leave the netting or tubes in place; there may be evenings (such as during storms), when no bats exit. (French et al. 2001). Also, bats may move from one house to another throughout the year to find more favorable microclimates or to deter predators, so even though a house was not used earlier, it may be currently occupied. *Remember, all buildings at White Grass Ranch had evidence of some bat use.*

Staggered and/or Partial Development

Building-specific recommendations are presented in Table 1 and Appendix 1.

It is best not to exclude and renovate all buildings at once, as this would entail a large disturbance the bat population at White Grass Ranch and not afford sufficient "cushion" for them to adjust to new roost structures. It would be best to renovate a few buildings per year, leaving remaining, un-renovated buildings *undisturbed* until the following year.

NOTE: In particular, development of buildings 1156, 1162, and 1164 (see Figure 1) should be delayed as long as possible, and bat houses should be erected near them well before bats are excluded. Building 1162 will entail erecting a special Townsend's big-eared bat roost at least one year before it is renovated.

Building 1156 is a large, well established maternity colony, the southern wing if which seems to be an optimal nursery (see Appendix 1). If possible, the local bat community would benefit by leaving this building undisturbed except for minimal renovations conducted in the late fall and winter for the purpose of stabilizing the structure. Even leaving just the southern wing (Rooms 5612, 5613, and 5615) undisturbed would be beneficial, because they contain the largest concentration if bats. If it is not possible to leave this building or a portion thereof un-renovated, exclusion should at least be planned as noted in the preceding paragraphs.

Placement of Alternative Roost Structures

Specific recommendations for alternative roost structures are presented in Tables 1 and 2, Figure 1, and the Appendices.

Use of bat houses to provide alternative roosting space for bats excluded from buildings is an accepted management strategy by many state and regional agencies (e.g., Ellison et al 2003, Hinman and Snow 2003, SDBWG 2004, Tartarian 2001, WYBWG *In Prep*). According to studies by Bat Conservation International and the Bat House Research Project (BCI 2005) odds of attracting bats are good for well-designed, well-built bat houses mounted according to recommendations; 50 – 90 percent of such houses being used in the first two years depending on the project site. In general, successful bat houses meet the criteria in Table 2 and discussed in Tuttle et al (2004). Small, poorly-made houses commonly sold in stores and houses improperly installed are likely to fail. Bat houses for White Grass Ranch should only be purchased from a BCI certified dealer (current list at http://batcon.org; projects>bat house>certified models), or built from an approved blue print (Tuttle et al. 2004). Both purchased and custom-built houses should be mounted according to guidelines in this report (Table1, Table 2, Appendix 1) and provided by Tuttle et al. (2004).

Based on this study, it seems that adequate roosting area would be provided by erecting 7 bat houses (1 large, maternity house, 2 medium houses, and 4 smaller houses) and one structure for Townsend's big eared bat. Suggested placement of these structures is noted coarsely in Figure 1 and more precisely in Appendix 1.

1. Large Maternity House : The use of bat houses for maternity colonies is closely correlated with the size of the structure as measured in linear roost space (i.e., total length of all roost chambers). Large houses (linear roost space > 15 feet) are more than 3 times as likely to be used as a maternity colony than small houses (Tuttle et al. 2004). The four-chamber nursery house presented by Tuttle et al. (2004) is a moderately sized

and priced house that contains roughly 5 feet of linear roost space. The large house at White Grass Ranch should consist of two units similar in design to the four-chambered nursery (e.g. Figure 2), each of which is about 50% wider than the house presented by Tuttle et al. (2004) to afford more roosting space. The two can either be mounted against the wall of building 1156, or back-to-back on poles immediately next to the building. Those mounted on poles can later be moved a short distance from their original position (see below). When mounted back-to-back. a slot should be cut in the back of each house allowing bats to move between the two. If this design is followed, this house will provide about 15 linear feet of roost space.

2. Medium Houses: There are a couple buildings with high concentrations of bats and possible maternity roosts, but that do not have enough bats to merit a large maternity house. In these two locations a smaller version of the above house should be constructed consisting of two units exactly matching the dimensions presented in Tuttle et al (2004). They should be mounted just like the large maternity house (Figure 2). If this design is followed, the medium houses will each provide about 10 linear feet of roost space.
3. Small Houses: To accommodate the moderate number of bats roosting in virtually all buildings at White Grass, 4 smaller bat houses should be erected. These houses can be mounted on poles very close to the buildings in question. They consist of two single-chamber houses mounted back-to-back to form a three chamber house (Tuttle et al. 2004, p.10). Each of these houses will provide 5-6 linear feet of roost space.
4. *Corynorhinus* "Bat Cave": Townsend's big eared bats (*Corynorhinus townsendii*), like those roosting in buildings 1162 and 1168, will not occupy standard bat houses. They require large, open roost structures that simulate chambers of caves. Both buildings 1162 and 1168 contain large rooms with open ceilings that have this characteristic. Thus, they require special structures such as those described in Appendix 2. Although two buildings have roosting *C. townsendii*, only one such roost should be built due to its size and expense. Since building 1168 is scheduled to be the first building renovated, and it is the most visible building on site, I suggest that the "bat cave" be erected near building 1162. If desired the exterior of the "bat cave" can be cosmetically enhanced to blend with the rest of the ranch (e.g., to appear like a grain silo).

Moving bat houses: Unless noted, bat houses should be mounted on, or very near, the buildings in question. This has been shown to be more effective than placing houses at a distance from the buildings, presumably because the bats are used to roosting in buildings and once excluded they search for new roosts in the vicinity of those buildings. If more distance between bats and renovated buildings is desired, houses should initially be placed on poles and may be gradually moved further from buildings over the course of several years, as suggested in Appendix 1. Houses should be moved only once per year, after the bats have vacated them for winter hibernacula (i.e., between roughly November 1 and March 31, as noted above). If bats were occupying the bat house, the distance moved in any one year should not exceed roughly 20 meters. Further to preserve the access characteristics and thermal regime if the bat house, the height, shading, and orientation of the house should not be altered. In other words, except for its distance from the former roost building nothing should change.

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TABLES AND FIGURES

Table 1: Building-specific bat use and recommendations for mitigating impact to bats at White Grass Ranch. Recommendations are *in addition* to general guidelines presented in the text.

Building	Roost Status	Species Findings	Special Recommendations
1154 (B)	Moderate bat use.	Total Anabat®: Calls: 9. Anabat® ID: 40k Myotis; MYLU?, MYVO?. Visual ID: MYLU.	Exclude bats as noted in text. No mitigation necessary.
1155 (D)	Low to moderate bat use.	Total Calls: 206. Anabat® ID: MYLU. Visual ID: none .	Exclude bats as noted in text. No mitigation necessary.
1156 (C)	Very high bat use. Large, long-term maternity colony.	Total Anabat®: Calls: 761. Anabat® ID: EPFU, MYLU, MYVO; MYEV?. Visual ID: EPFU, MYLU, MYVO.	**Option 1**: Leave building undisturbed (i.e., un-renovated). **Option 2**: Leave south wing undisturbed, but renovate remainder of building taking care to minimize construction disturbance to that wing. Place large bat houses as noted in Option 3. **Option 3**: Place bat houses as shown in building diagram (Appendix 1) and leave them in place at least one year before exclusion begins. Exclude bats as noted in text and take care not to disturb bat houses with renovation activity.
1157 (E)	Low to moderate bat use.	Total Anabat®: Calls: 294. Anabat® ID: MYLU; MYEV?. Visual ID: MYLU.	Exclude bats as noted in text. No mitigation necessary.
1158 (G)	Low bat use.	Total Anabat®: Calls: 148. Anabat® ID: EPFU, MYLU. Visual ID: none.	Exclude bats as noted in text. No mitigation necessary.
1159 (I)	Moderate bat use. Possible maternity colony.	Total Anabat®: Calls: 14. Anabat® ID: 40k Myotis; MYLU?, MYVO?. Visual ID: MYLU, MYVO.	Coordinate exclusion and mitigation of this structure with building 1160.
1160 (J)	Moderate bat use.	Total Anabat®: Calls: 75. Anabat® ID: EPFU, MYLU; MYEV?, MYVO?. Visual ID: none.	Place bat house as shown in building diagrams (Appendix 1) and leave in place at least one year before exclusion begins. Exclude bats as noted in text and do not disturb bat houses with renovation activity.
1161 (F)	Low bat use.	Total Anabat®: Calls: 51. Anabat® ID: MYLU, MYVO. Visual ID: MYLU.	Exclude bats as noted in text. No mitigation necessary.
1162 (H)	Moderate bat use. *C. townsendii* present.	Total Anabat®: Calls: 399. Anabat® ID: COTO, EPFU, MYLU. Visual ID: COTO, MYLU.	Exclude bats as noted in text. At least one year prior to exclusion, consider erecting a "bat cave" for roosting *C. townsendii* (placement shown in Appendix I, described in Appendix II).
1163 (K)	Low to moderate bat use.	Total Anabat®: Calls: 5. Anabat® ID: EPFU, MYVO; MYLU?. Visual ID: MYLU.	Place bat house as shown in building diagram (Appendix 1) and leave in place at least one year before exclusion begins. Exclude bats as noted in text and do not disturb bat houses with renovation activity.
1164 (M)	High bat use. *M. evotis* present.	Total Anabat®: Calls: 125. Anabat® ID: EPFU, MYEV, MYLU, MYVO. Visual ID: MYLU.	Coordinate exclusion and mitigation of this structure with building 1165. Place bat houses as shown in building diagrams (Appendix 1) and leave in place at least one year before exclusion begins. Exclude bats as noted in text and do not disturb bat houses with renovation activity.
1165 (L)	Moderate bat use.	Total Anabat®: Calls: 214. Anabat® ID: MYLU, MYVO; MYEV?. Visual ID: MYLU.	Coordinate exclusion and mitigation of this structure with building 1164.
1168 (A)	Low to moderate bat use. *C. townsendii* present.	Total Calls: 0**. Anabat® ID: none. Visual ID: COTO, MYLU, MYVO.	Construction is scheduled to begin in 2006. Exclude bats in the winter of 2005-06 as noted in text. Place a bat house by the middle of March, as shown in building diagram (Appendix 1). Do not disturb the bat house with renovation activity.

Table 2: Criteria for successful bat houses excerpted from BCI (1993; http://batcon.org) and edited for relevance to White Grass Ranch. Refer to Tuttle et al. (2004) for more extensive information.

1. ***Design*** - . Tall designs like the multi-chamber (nursery) and rocket-style houses (with chambers at least 25 inches ntall) have generally performed best. All bat houses should be at least 2 feet tall, have chambers at least 20 inches tall and 14 inches wide, and have a landing area extending below the entrance at least 3 to 6 inches (some houses feature recessed partitions that offer landing space inside). Taller and wider houses are even better. Rocket boxes should be at least 3 feet tall and have at least 12 inches of linear roost space. Most bat houses have one to four roosting chambers-the more the better. Roost partitions should be carefully spaced 3/4 to 1 inch apart. All partitions and landing areas should be roughened. Wood surfaces can be scratched or grooved horizontally, at roughly 1/4- to 1/2-inch intervals, or covered with durable square, plastic mesh (1/8 or 1/4 inch mesh, available from companies such as Internet, Inc. at 1-800-328-8456 or Aquamasters at 410-252-2079). Include vents approximately 6 inches from the bottom of all houses 24 to 32 inches tall where average July high temperatures are 85º F or above. Front vents are as long as a house is wide, side vents 6 inches tall by 1/2 inch wide. Houses 36 inches tall or taller should have vents approximately 10 to 12 inches from the bottom.
2. ***Construction*** - For wooden houses, a combination of exterior plywood (ACX, BCX, or T1-11 grade) and cedar is best. Plywood for bat house exteriors should be ½-inch thick or greater and have at least four plies. Do not use pressure-treated wood. Any screws, hardware or staples used must be exterior grade (galvanized, coated, stainless, etc). To increase longevity, use screws rather than nails. Caulk all seams, especially around the roof. Alternative materials, such as plastic or fiber-cement board, may last longer and require less maintenance.
3. ***Wood Treatment*** - For the exterior, apply three coats of exterior grade, water-based paint or stain. Available observations suggest that color should be black where average high temperatures in July are less than 85º F, (which includes Grand Teton National Park), dark colors (such as dark brown) where they are 85 to 95° F. Much depends upon amount of sun exposure; adjust to darker colors for less sun. For the interior, use two coats dark, exterior grade, water-based stain. Apply stain after creating scratches or grooves or prior to stapling plastic mesh. Paint fills grooves, making them unusable.
4. ***Sun Exposure*** - Houses where high temperatures in July average 80º F or less, should receive at least 10 hours of sun; more is better. At least six hours of direct daily sun are recommended for all bat houses where daily high temperatures in July average less than 100º F. Full, all-day sun is often successful in all but the hottest climates. To create favorable conditions for maternity colonies in summer, internal bat house temperatures should stay between 80º F and 100º F as long as possible.
5. ***Mounting*** - Bat houses should be mounted on buildings or poles. Houses mounted on trees or metal siding are seldom used. Wooden, brick, or stone buildings with proper solar exposure are excellent choices, and locations under the eaves often are successful. Single-chamber houses work best when mounted on buildings. Mounting two bat houses back to back on poles is ideal (face one house north, the other south). Place houses 3/4 inch apart and cover both with a galvanized metal roof to protect the center roosting space from rain. All bat houses should be mounted at least 12 feet above ground; 15 to 20 feet is better. Bat houses should not be lit at night.
6. ***Protection from Predators*** - Houses mounted on sides of buildings or on metal poles provide the best protection from predators. Metal predator guards may be helpful, especially on wooden poles. Bat houses may be found more quickly if located along forest or water edges where bats tend to fly; however, they should be placed at least 20 to 25 feet from the nearest tree branches, wires or other potential perches for aerial predators.
7. ***Avoiding Uninvited Guests*** - Wasps can be a problem before bats fully occupy a house. Use of 3/4-inch roosting spaces reduces wasp use. If nests accumulate, they should be removed in late winter or early spring before either wasps or bats return. Open-bottom houses greatly reduce problems with birds, mice, squirrels or parasites, and guano does not accumulate inside.
8. ***Timing*** - Bat houses can be installed at any time of the year, but are more likely to be used during their first summer if installed before the bats return in spring. When using bat houses in conjunction with excluding a colony from a building, install the bat houses at least two to six weeks before the actual eviction.

Figure 1: White Grass Ranch site diagram and summary bat findings, with suggested placement of bat mitigation structures.

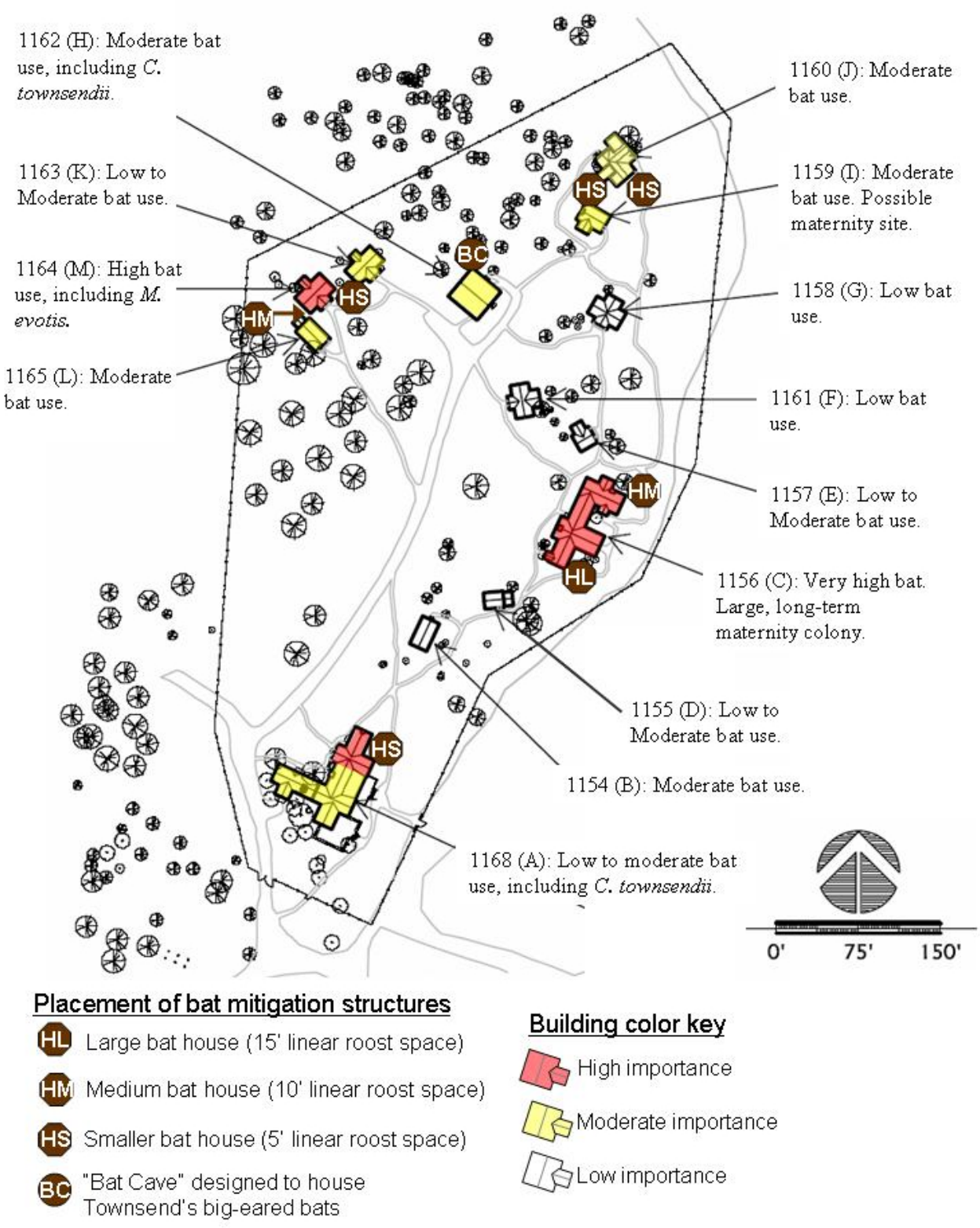
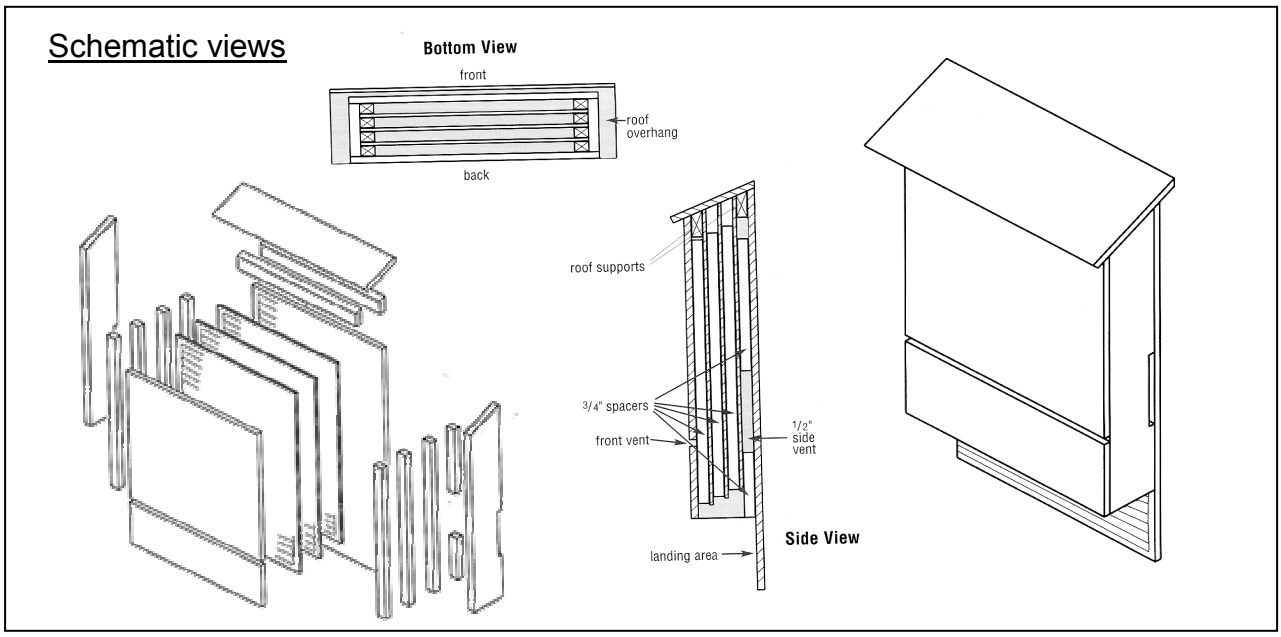
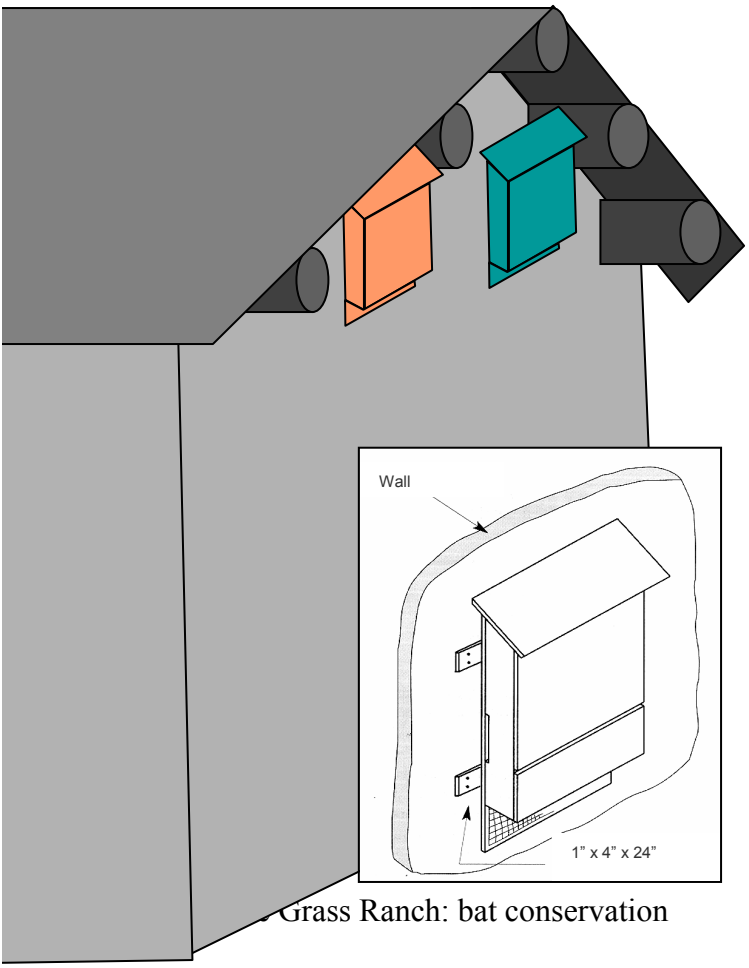


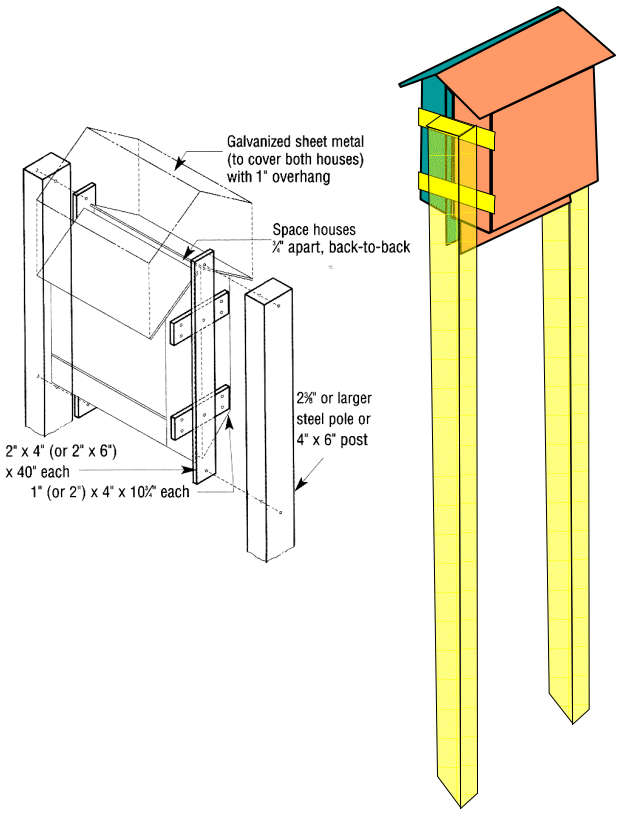
Figure 2: Schematic of four-chambered bat houses and suggestions for mounting. House drawings excerpted from Tuttle et al. (2004), which has complete instructions.



Mounting two units on a building



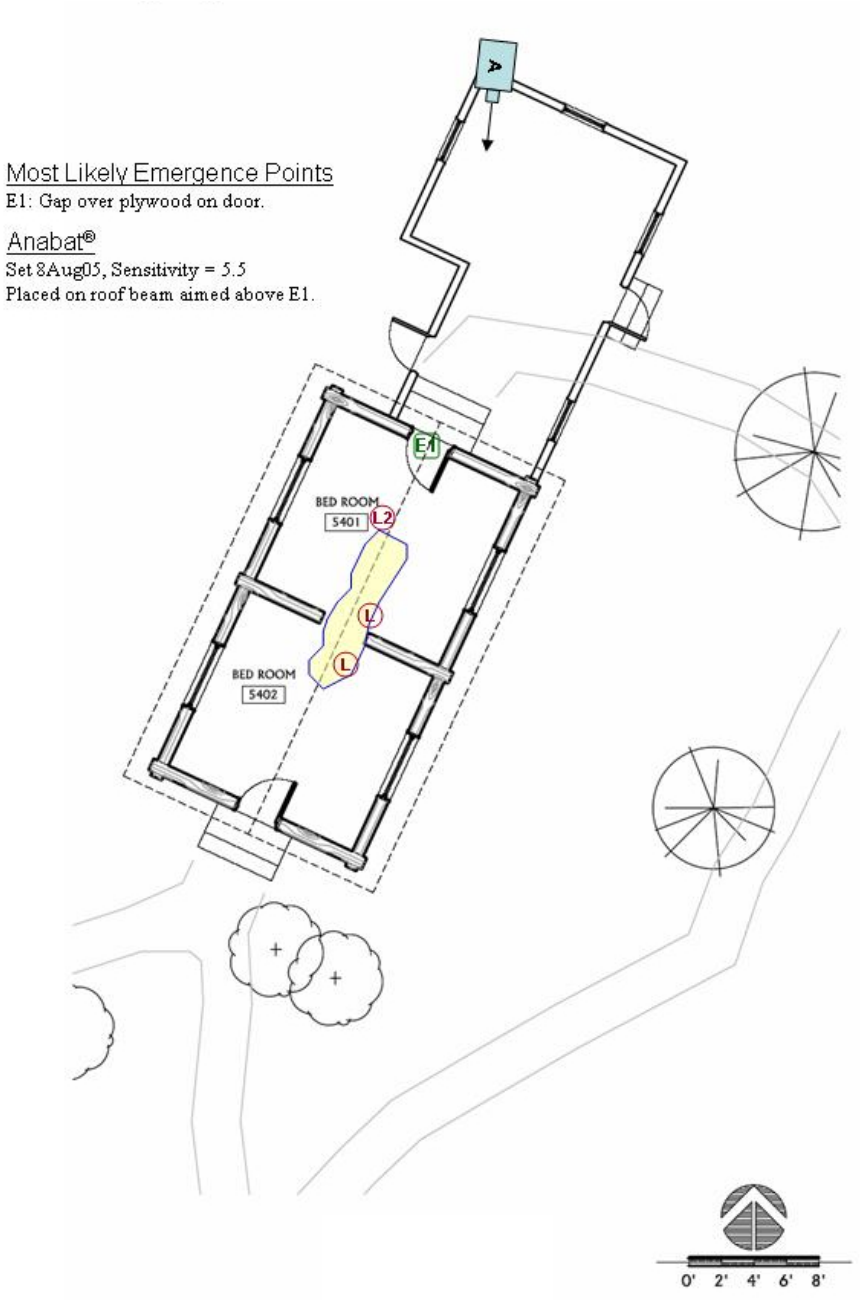
Mounting two units on poles



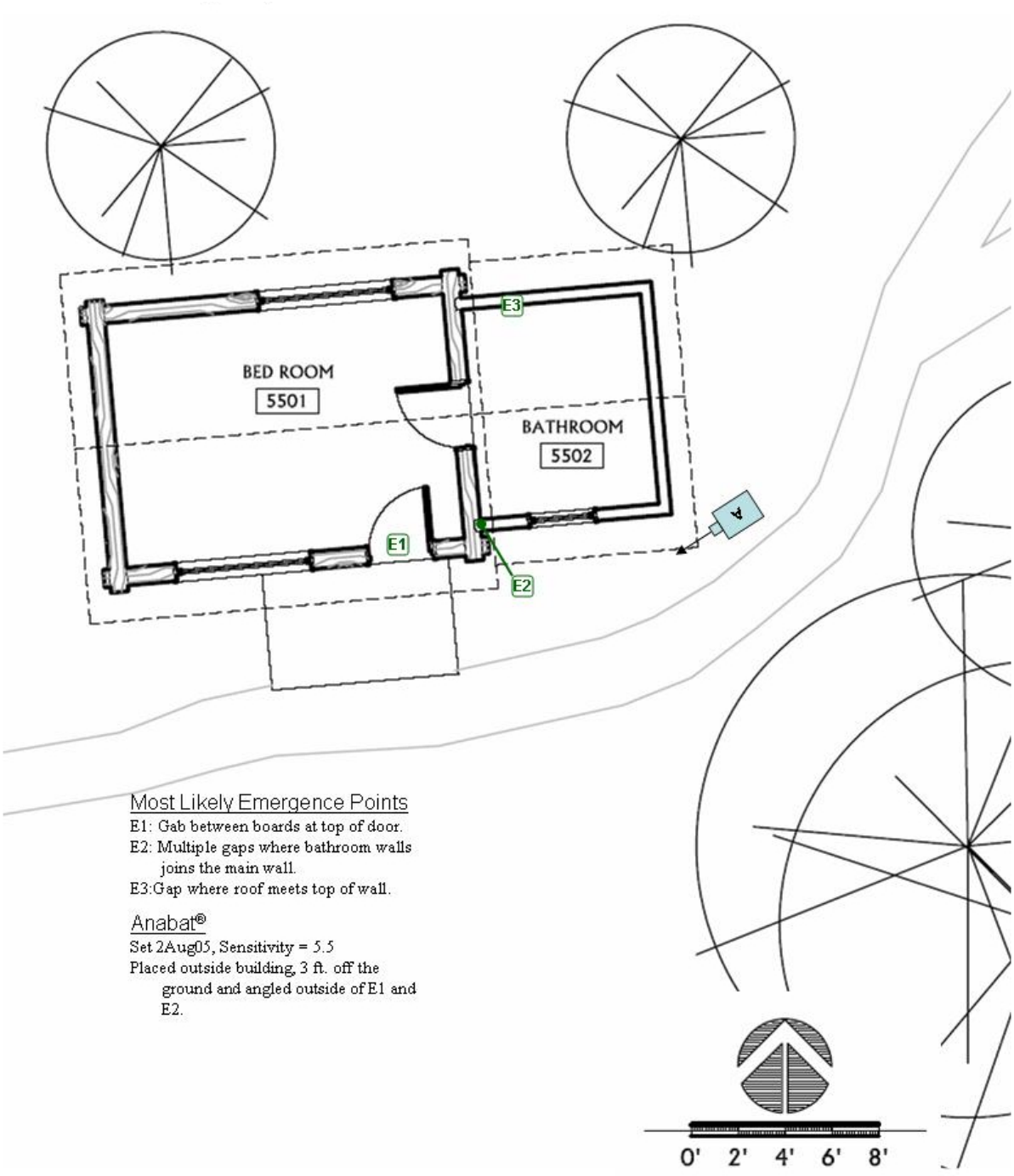
APPENDIX I: BUILDING DIAGRAMS AND BAT HOUSE PLACEMENT

Key to building diagrams

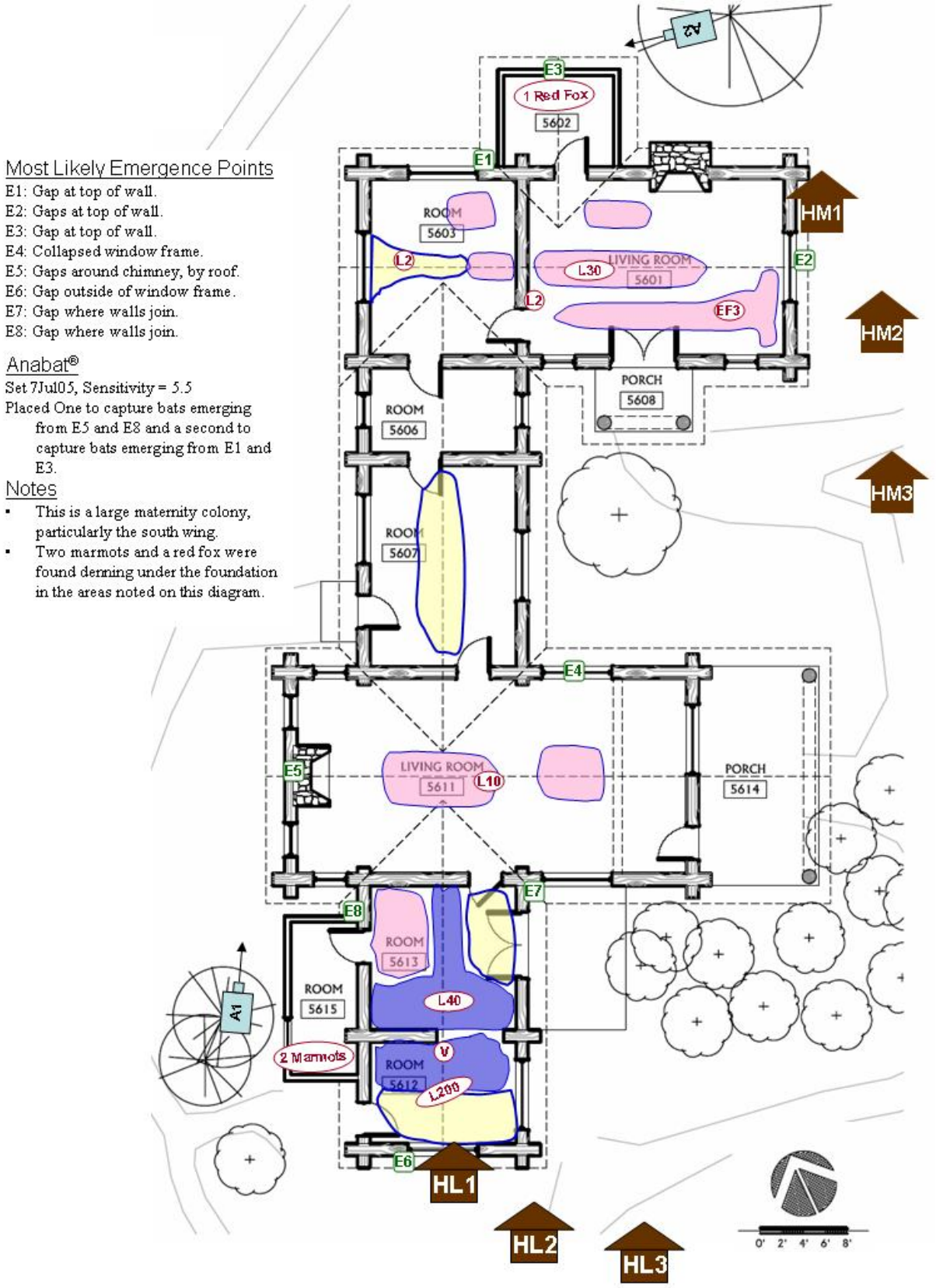
Building 1154 (WG-B in 2004 survey)



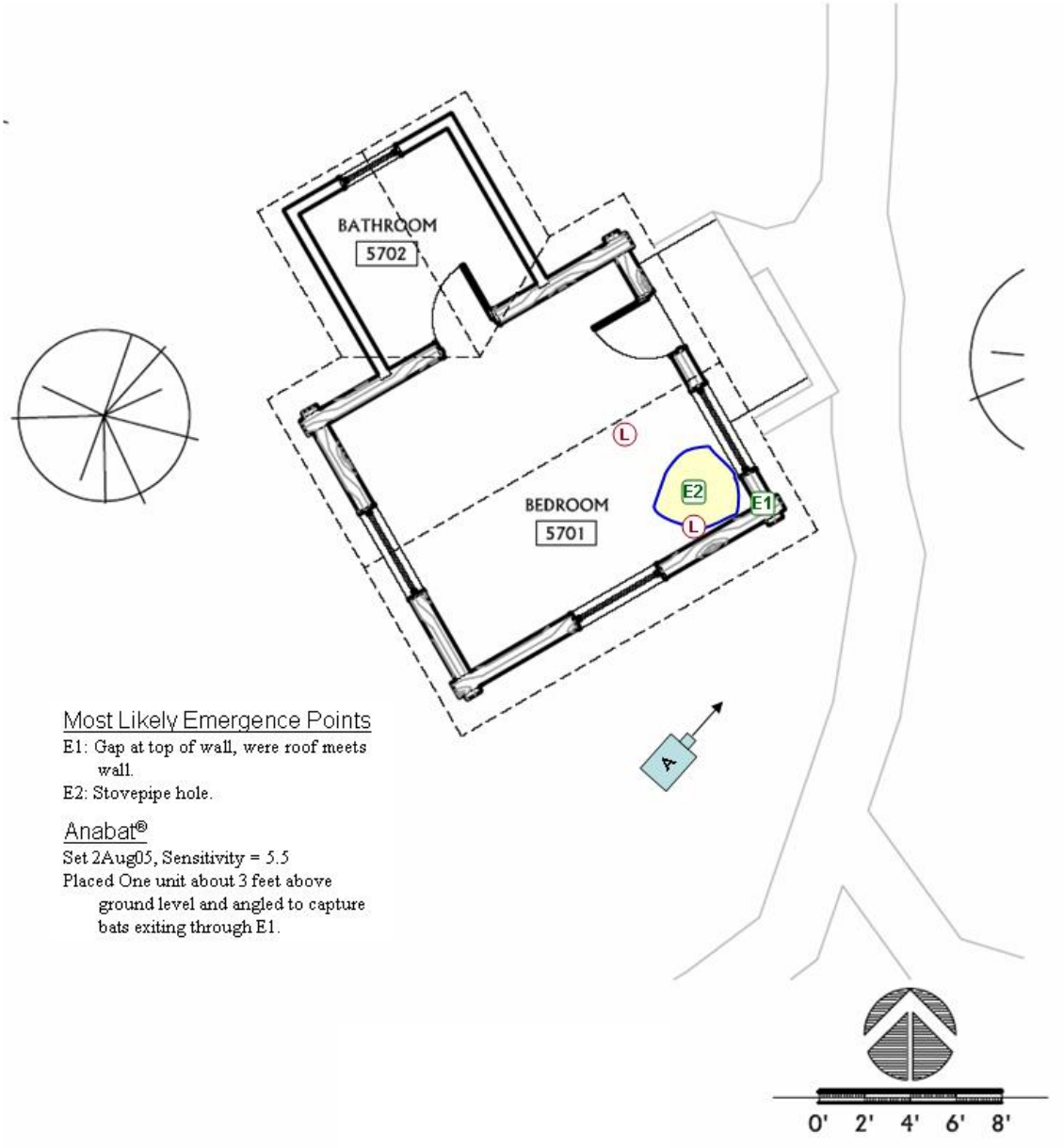
Building 1155 (WG-D in 2004 survey)



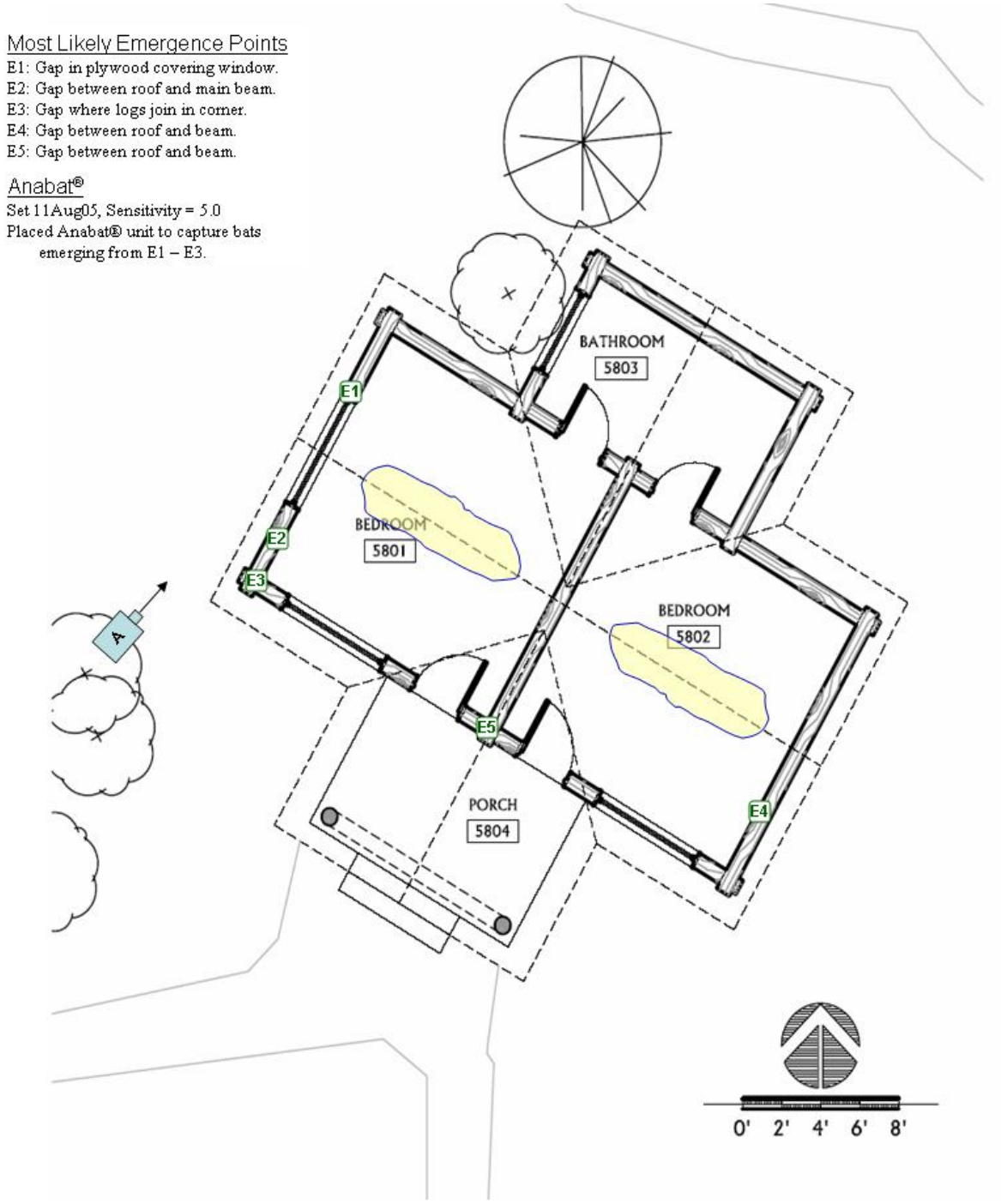
Building 1156 (WG-C in 2004 survey)



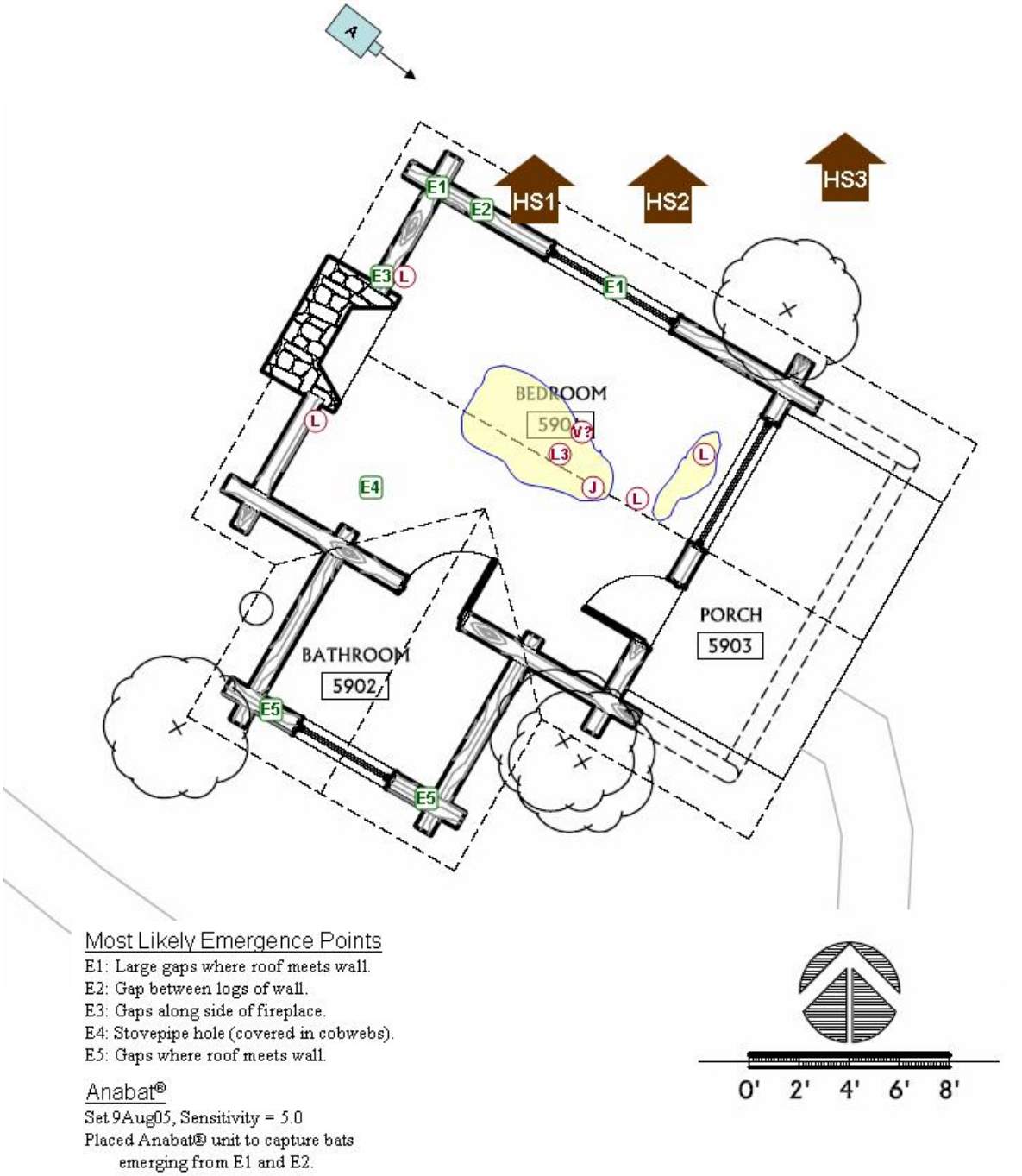
Building 1157 (WG-E in 2004 survey)



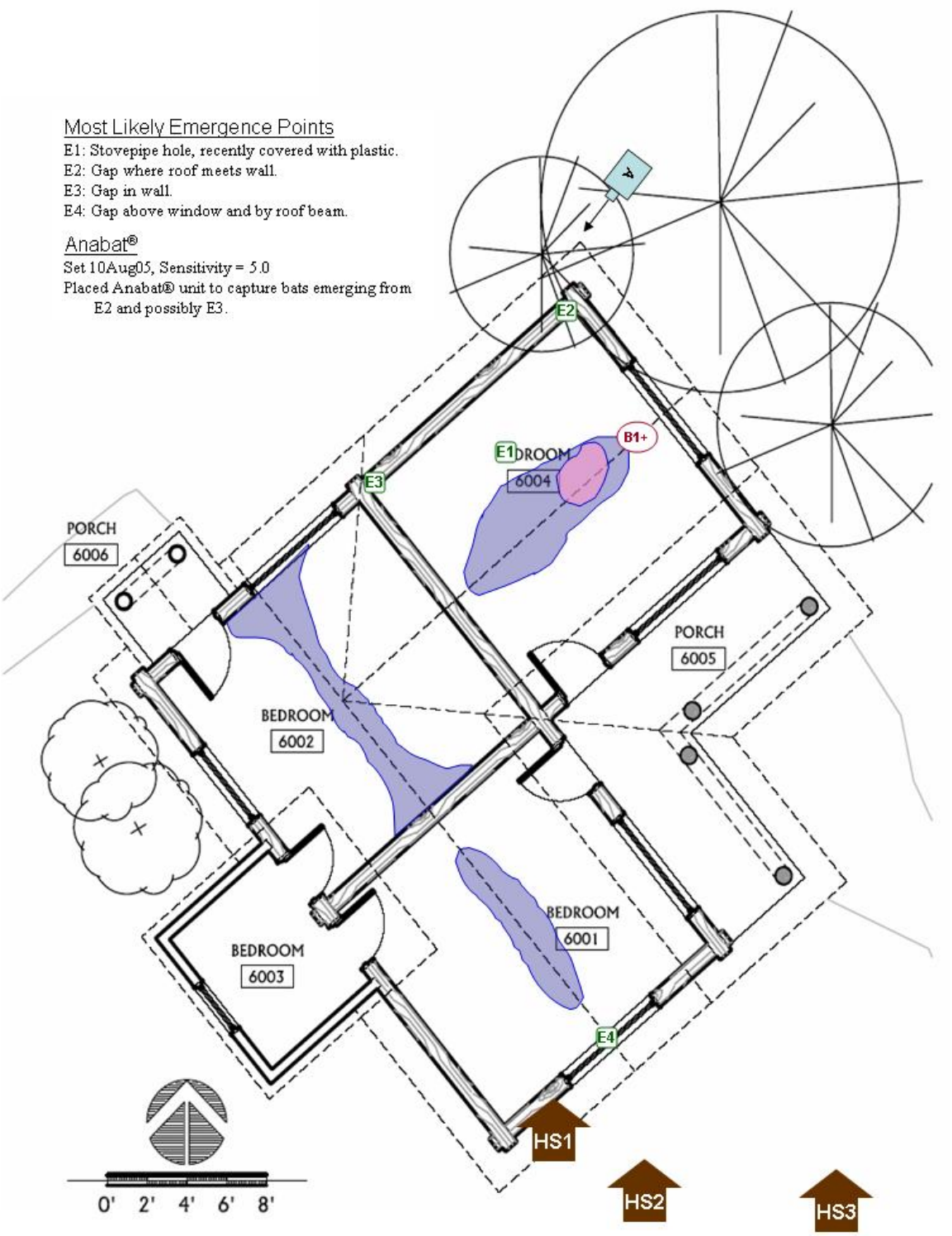
Building 1158 (WG-G in 2004 survey)



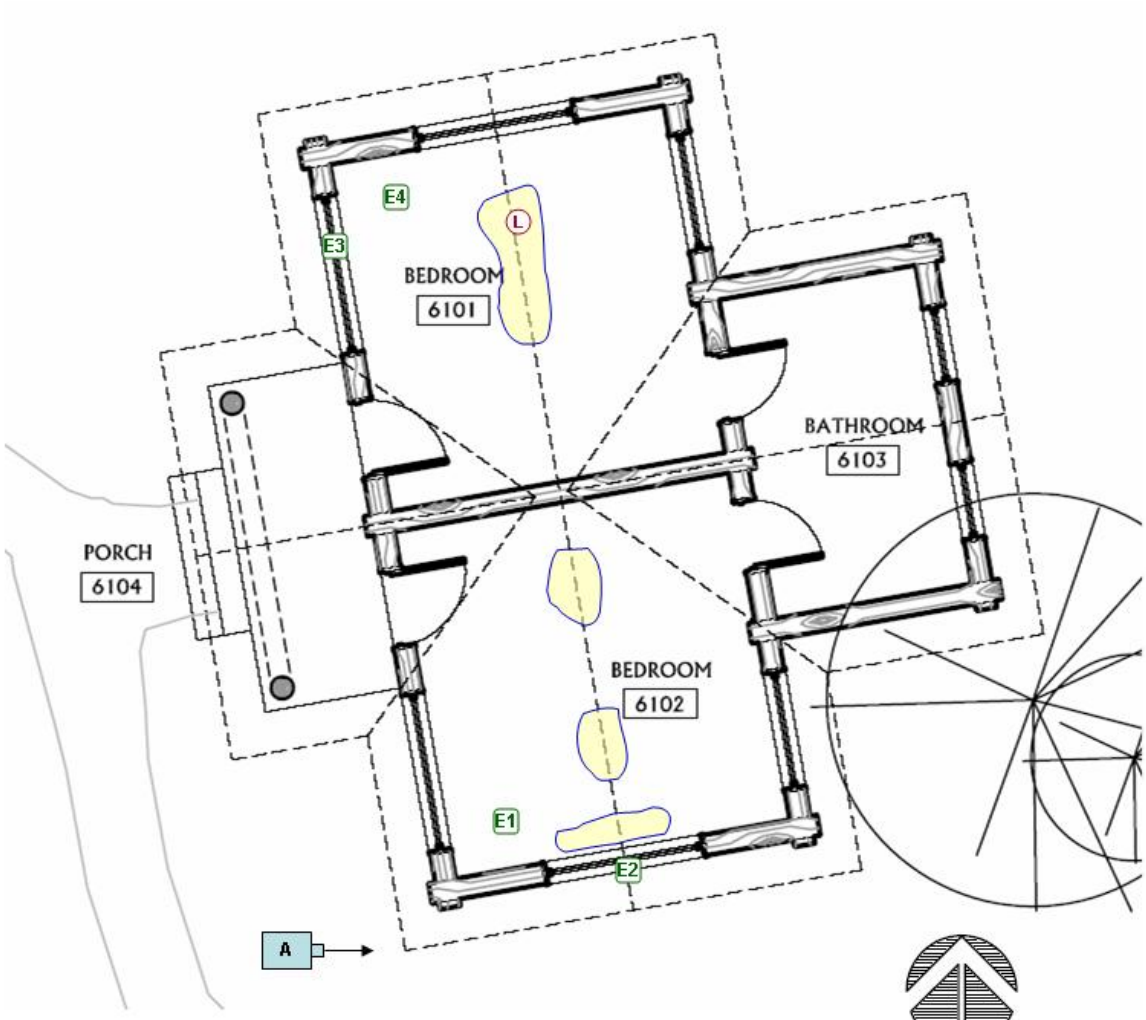
Building 1159 (WG-I in 2004 survey)



Building 1160 (WG-J in 2004 survey)



Building 1161 (WG-F in 2004 survey)



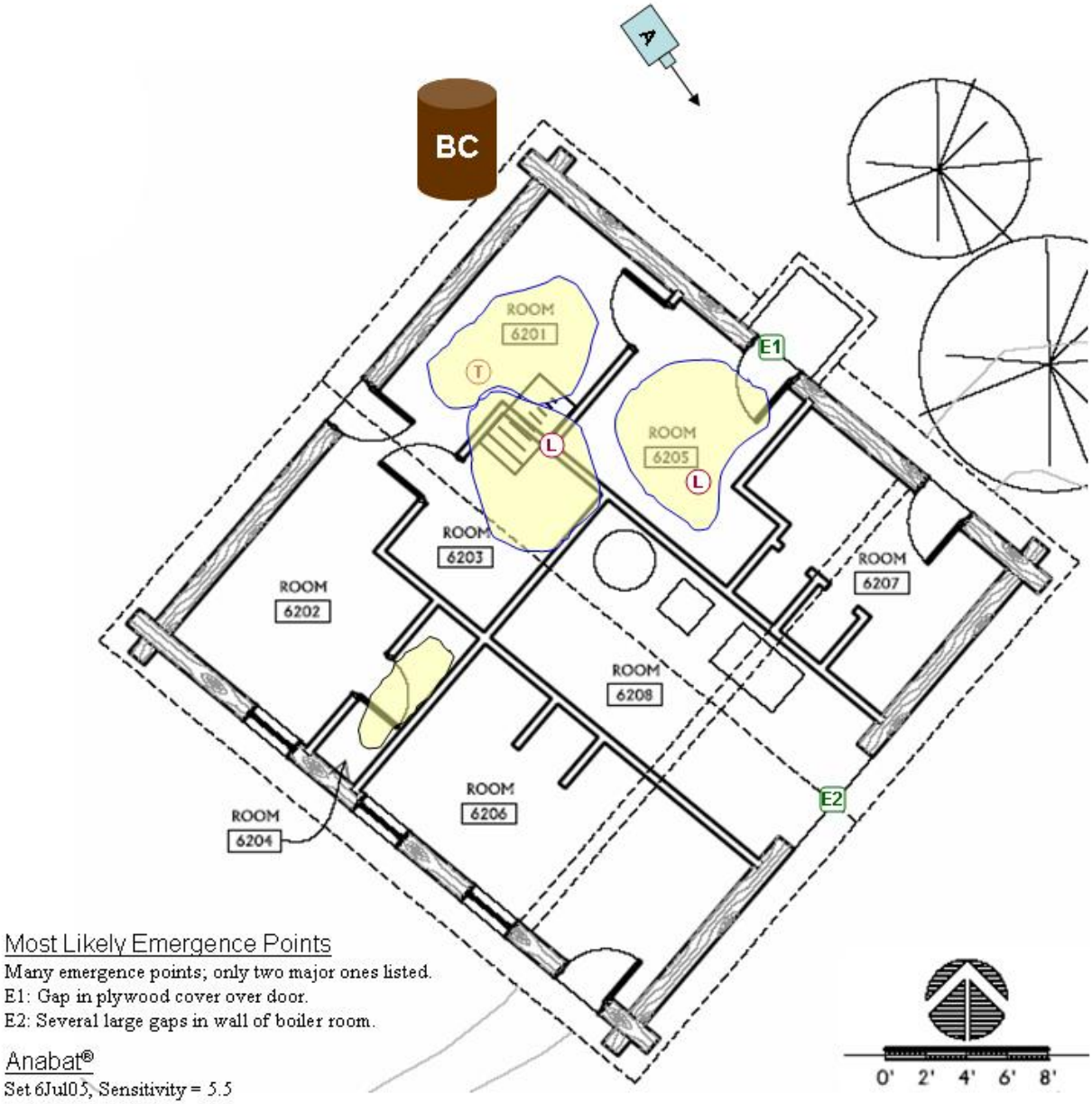
Most Likely Emergence Points

E1: Stovepipe hole.
E2: Gap by roof peak.
E3: Gap in logs over window.
E4: Small stovepipe.

Anabat®

Set 4Aug05, Sensitivity = 5.5
Placed Anabat® unit on log 2feet off the ground and angled to capture bats emerging from E2.

Building 1162 (WG-H in 2004 survey)



Most Likely Emergence Points

Many emergence points; only two major ones listed.
E1: Gap in plywood cover over door.
E2: Several large gaps in wall of boiler room.

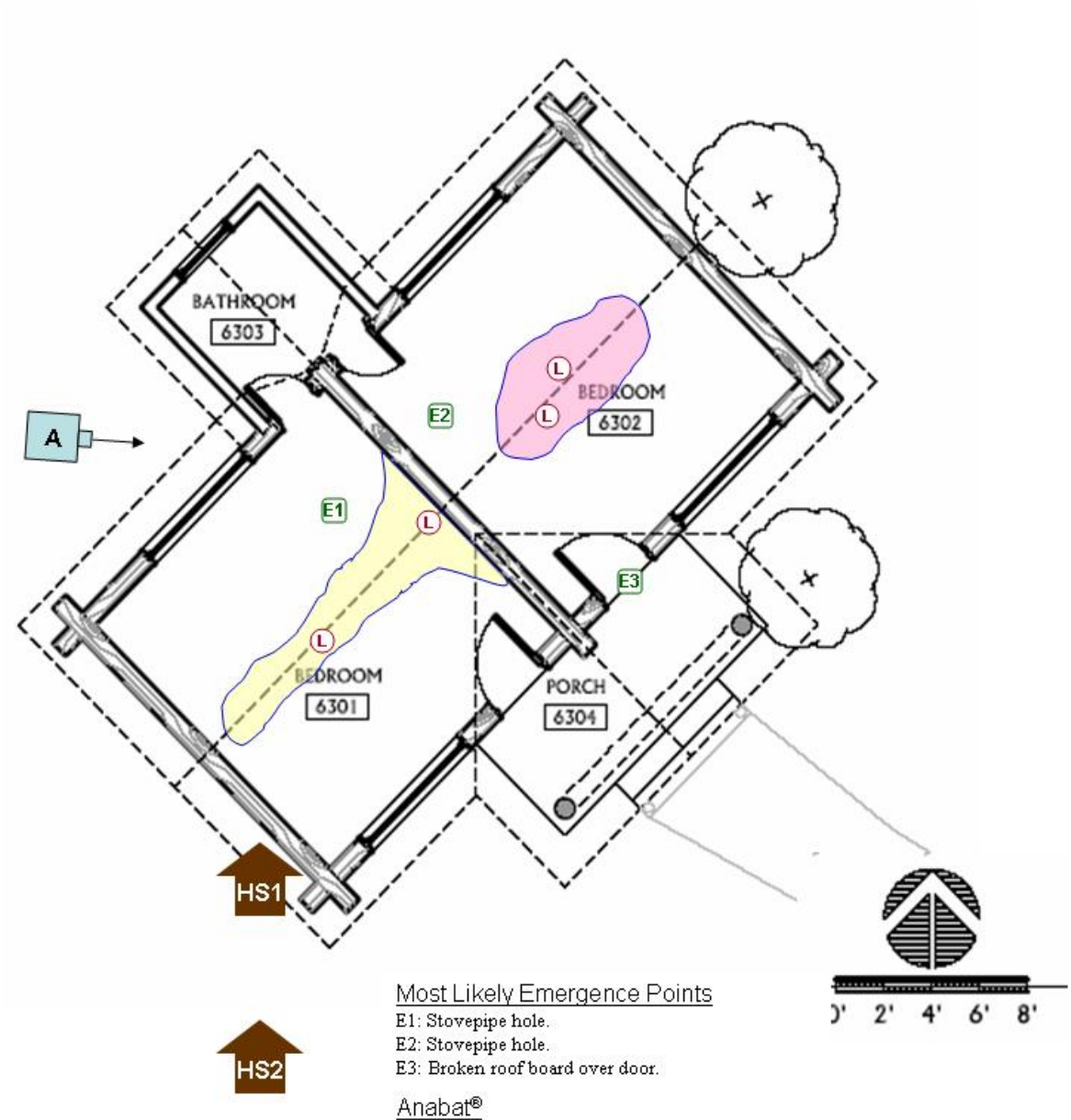
Anabat®

Set 6Jul05, Sensitivity = 5.5
Placed Anabat® unit on log 1feet off the ground and angled to capture bats emerging from E1.

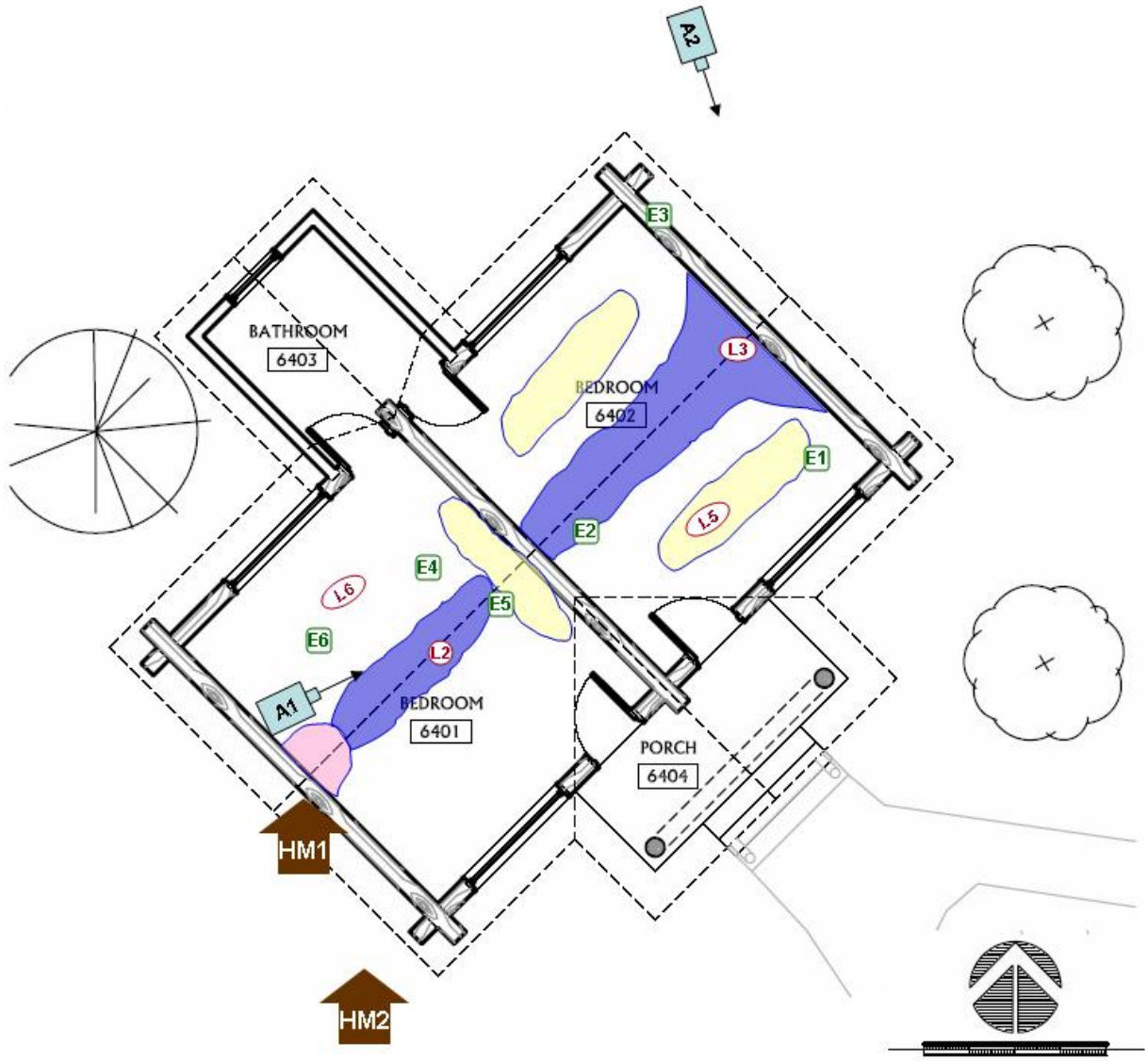
Note

C. townsendii and one *M. lucifugus* found in attic, not in main level.

Building 1163 (WG-K in 2004 survey)



Building 1164 (WG-M in 2004 survey)



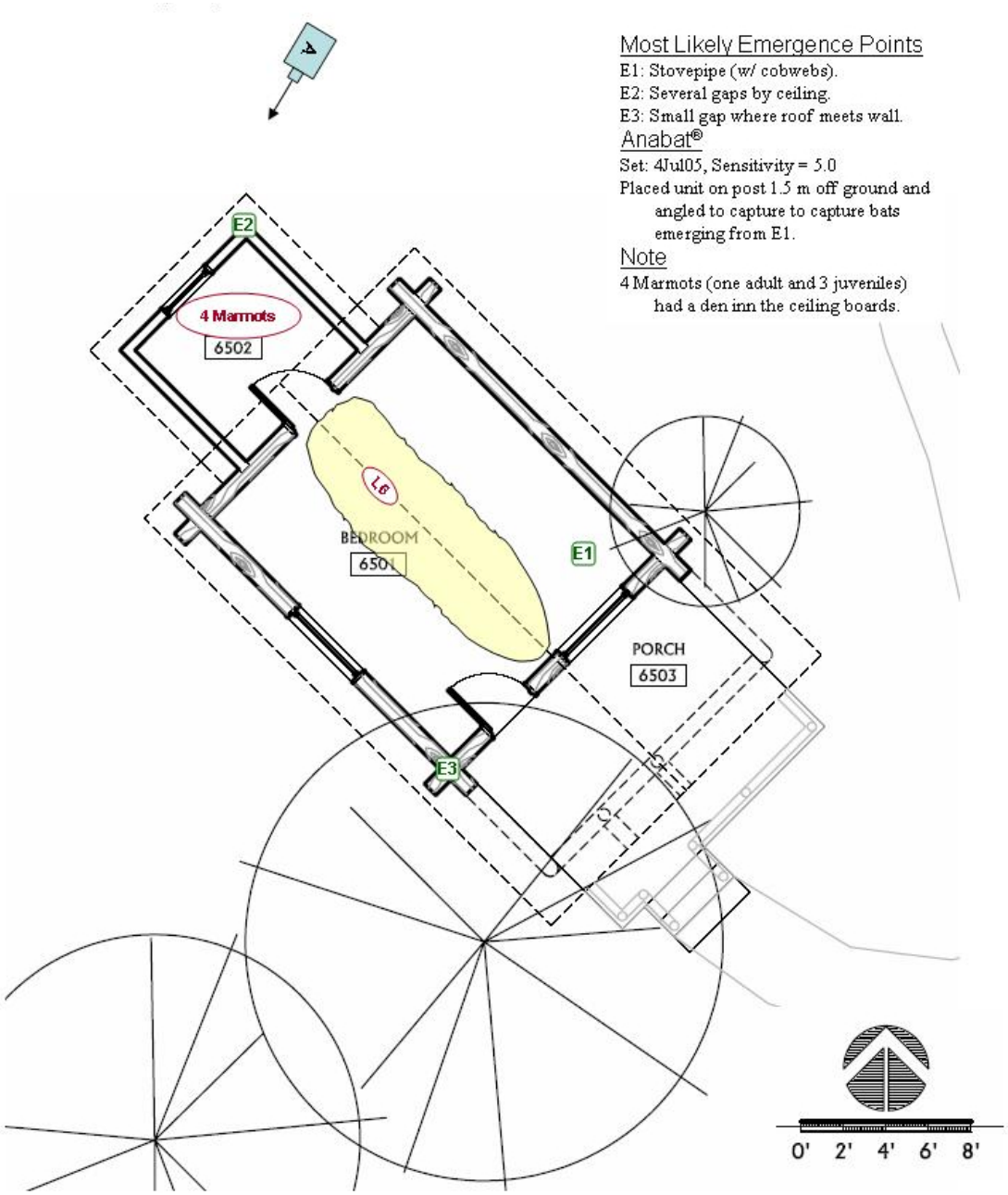
Most Likely Emergence Points

E1: Stovepipe (w/ cobwebs).
E2: Partially covered stovepipe.
E3: Gap where roof meets wall.
E4: Stovepipe hole.
E5: Large stovepipe hole.
E6: Gaps in roof boards.

Anabat®

Set: 8Jul05, Sensitivity = 5.5
Placed two units. One on roof to capture to capture bats emerging from E4 and E5. Second on log and angled to to capture bats emerging E3.

Building 1165 (WG-L in 2004 survey)



Building 1168 (WG-A in 2004 survey)

Most Likely Emergence Points

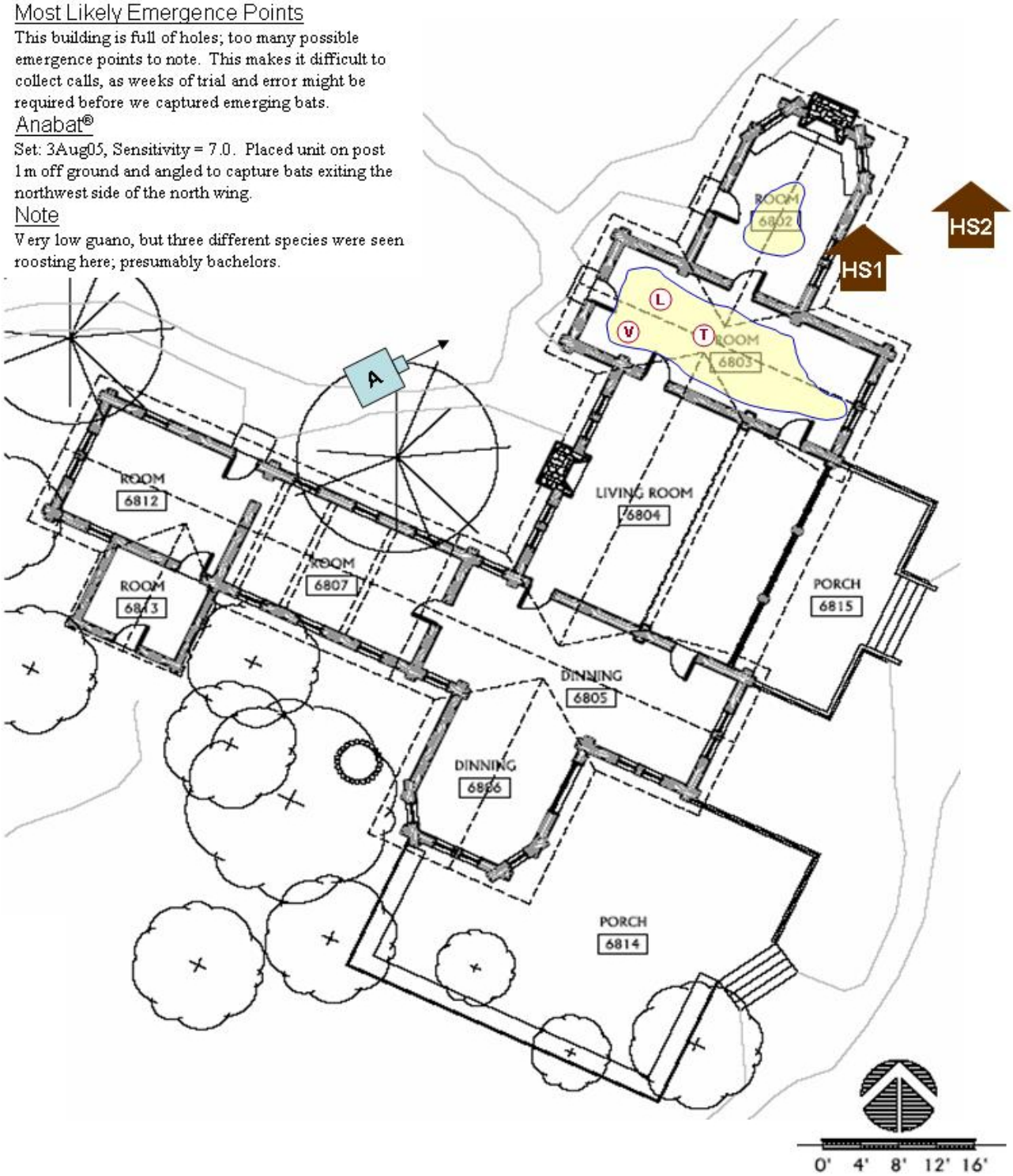
This building is full of holes; too many possible emergence points to note. This makes it difficult to collect calls, as weeks of trial and error might be required before we captured emerging bats.

Anabat®

Set: 3Aug05, Sensitivity = 7.0. Placed unit on post 1m off ground and angled to capture bats exiting the northwest side of the north wing.

Note

Very low guano, but three different species were seen roosting here; presumably bachelors.



APPENDIX II: SUGGESTIONS FOR BUILDING ARTIFICIAL ROOST STRUCTURES FOR TOWNSEND'S BIG-EARED BATS

As noted in the report Townsend's big-eared bat (*Corynorhinus townsendii*) will not occupy standard bat houses, because they require large, open roost structures that simulate chambers of caves. BCI has been testing some artificial structures for *C. rafinesquii*, a close relative of C. townsendii that lives in the southeastern United States (Mark Kiser,, BCI, Pers. Comm.). There is no concrete recommendation fir designing, building, and using such structures at White Grass Ranch, because so few have been tried and all of those were in the southeast. Developers at the ranch should read the information below and then contact Mark Kiser (Conservation Specialist and Coordinator of the Bat House Project, Bat Conservation International, PO Box 162603, Austin, TX 78716, mkiser@batcon.org, bathouses@batcon.org, Phone: 512-327-9721 ext. 45, Fax: 512-327-9724) for project-specific guidance.

All 18 artificial roosts described in the article included below ("Innovative Homes for Bats that Shun Bat Houses") have attracted day-roosting bats. Although most have 1 to 4 bats, one has 15 to 20 *C. rafinesquii*. In short, these structures are made from cinder blocks, concrete-fiber pipe, concrete highway culvert and concrete manhole shaft pieces stacked to form 14 to 16 foot tall x 3 to 4 foot diameter hollow structures, with a sealed cap or roof that contains suitable interior surfaces on which bats can cling. These roosts sit atop a concrete slab or footer for stability. Other possible materials include concrete septic tanks (although several openings would need to be cut into the walls), a small grain silo (which would require some extensive modification), or a storage tank of similar size. It is possible that waste material currently in Grand Teton National Park or nearby municipal efforts could be salvaged for use in constructing such roosts, thereby reducing the associated cost.

Another successful roost type built for *Corynorhinus* species is a small wooden shed or cabin, which is discussed in the below article entitled "Bat House on a Truck". This also seems appropriate at white grass, since the existing big-eared bats roost in the buildings. However, it would likely be more expensive than a culvert-based structure.

Innovative Homes for Bats that Shun Bat Houses

by Mark and Selena Kiser

Discussion

Until recently, the North American Bat House Research Project focused exclusively on crevice-roosting species. But other species that don't use conventional bat houses also need homes to replace lost habitat. With support from Walter Sedgwick of the Island Foundation, Bat Conservation International is developing and testing unique, long-lived roosts to help forest-dwelling bats in the southeastern United States. Initial results are highly encouraging.

Rafinesque's big-eared bat (Corynorhinus rafinesquii) traditionally relied on extra-large tree cavities in old-growth forests and heat-trapping cavities in cave entrances. As old forests were cut and caves disturbed, however, this species has declined alarmingly. Remaining big-eared bats now live mostly in human-made structures such as abandoned buildings, as well as in bridges, culverts, wells, cisterns, and bunkers. They rarely share buildings with humans, and since they do not roost in crevices, they are not attracted to traditional bat houses. These bats prefer roosts

10 to 20 feet (3.1 to 6.1 meters) tall with openings that are several feet in diameter. Males are often solitary, and maternity colonies usually include fewer than 50 bats but sometimes as many as 300.

With the loss of mature forests, some big-eared bats survived by moving into abandoned buildings and cabins – a temporary solution at best. Most of these roosts are now falling down or being replaced by buildings that are inaccessible to big-eared bats, placing remaining colonies in further jeopardy. Longer-lasting roost options are needed.

Three years ago, Bat Conservation International began testing a new generation of bat roosts designed specifically to meet the needs of big-eared bats and southeastern myotis (Myotis austroriparius), another forest-dwelling species that relies heavily on large tree cavities. The first three artificial tree hollows were built of vertically stacked concrete culverts and manhole shaft sections in August 2000 at BCI-member Walter Sedgwick's Bar-M plantation in southern Georgia. These species favor mature gum trees (Nyssa sp.) in bottomland hardwood and swamp forests, but much of the habitat at Walter's test site is young gum forest that produces no large cavities. Southeastern myotis had been captured there, but big-eared bats had not been found. Just six months after the "stack roosts" went up, BCI's local collaborator Laura Finn found a southeastern myotis using one of the roosts; a big-eared bat moved into another 15 months later.

Meanwhile, Mary Kay Clark, Curator of Mammals at the North Carolina State Museum of Natural Sciences, alerted BCI to the impending loss of big-eared bat roosts in old buildings at two North Carolina state parks. Walter Sedgwick agreed to fund additional testing, and BCI, working with the museum and the North Carolina Division of Parks and Recreation, built two stack roosts at South Mountains State Park in 2001 and two others at Lumber River State Park in 2002.

Six of the seven roosts now in place have already been occupied by Rafinesque's big-eared bats. Laura Finn observed a pregnant bat using the Georgia roosts in May 2002. She captured, banded, and radio-tracked this bat as it moved among the three roosts with no apparent preference. Three months later, the bat and her presumed pup were reported in the largest roost. In July 2002, both stack roosts at Lumber River State Park were occupied by one big-eared bat each. A big brown bat (Eptesicus fuscus) used one roost at South Mountains State Park in 2001 and 2002, and a big-eared bat was confirmed in the other roost in April 2003.

While the experimental roosts have not yet attracted large numbers of bats, we expect usage to grow. Now we're testing use of cinder blocks instead of culverts for such roosts; this would lower costs significantly since cranes and heavy trucks would not be needed for installation. Stay tuned for updates.

Acknowledgements: BCI especially thanks Walter Sedgwick for his invaluable leadership and support, as well as Roger Croft, Laura and Tom Finn, the Florida Department of Transportation, Seth Lambiase, Jeremy Harrill, James Sessoms, Alan Rogers, the North Carolina Division of Parks and Recreation, Mary Kay Clark, Lisa Gatens, the North Carolina State Museum of Natural Sciences, Mid-Atlantic Drainage, Ronnie Harrill, Mark Bloschock, and the Texas Department of Transportation, without whose additional help this project would not have been possible. Thanks to essential financial help from Paxson Offield, we are expanding the project to help two of the most important remaining colonies, one at Mammoth Cave National Park, Kentucky and another at Saint Catherine Creek National Wildlife Refuge in Mississippi. BCI is seeking additional sponsors for continued testing of these roosts for big-eared bats and

southeastern myotis. To help with these projects, please contact Mark Kiser or BCI Executive Director Robb Hankins at (512) 327-9721.

Construction

Georgia roosts

Finished height: 16 feet (4.9 meters)
Inside diameter: Roosts 1 & 2: were 3 feet (0.9 meter). Roost 3 was 4 feet (1.2 meter).
Materials: Roosts 1 & 2 used two 8-foot (2.4-meter) highway culverts Roost 3 used one 8-foot highway culvert base and two 4-foot (1.2- meter) manhole shaft sections

North Carolina roosts

Finished height: 14.5 feet (4.4 meters)
Inside diameter: 4 feet (1.2 meters)
Materials: Four to five manhole shaft sections Inside diameter:

For each roost, the top five feet of soil was excavated, replaced with clay, and leveled. A concrete pad, six feet (1.8 meters) on a side and eight inches (20.3 centimeters) thick, was installed. Roost sections were stacked on the pads and topped with a concrete cap. An entrance hole was precut in each base section. These varied in size and shape, although most were about 2 x 2 feet (61 x 61 centimeters). One or two 1 x 3-inch (2.5 x 7.6-centimeter) vertical slots were cut 4 to 5 feet (1.2 to 1.5 meters) from the top to provide additional access and escape routes. Floors and lower interior walls were painted dark to reduce interior light. Upper walls and ceilings were roughened by adding lumps of concrete mix, attaching plastic mesh, or cutting grooves to provide footholds for bats.

Ronnie Harrill sets the cap on an experimental roost for Rafinesque's big-eared bats at South Mountains State Park in North Carolina. These bats need artificial roosts to survive after losing traditional roosts in large tree hollows and cave entrance cavities. © Elaine Acker, BCI \ 9165402

Bat House on a Truck

by Ann McCreary

For years, a run-down cabin in Washington, known locally as the Rattlesnake House, was just another scenic remnant of Methow Valley history. Built in 1906 and abandoned more than 50 years ago, the cabin looked empty. In fact, it was home to a thriving colony of Townsend's big-eared bats (*Corynorhinus townsendii*), which used it as a nursery roost.

Kent Woodruff, a U.S. Forest Service wildlife biologist, discovered the colony about six years ago. Townsend's big-eared bats are an uncommon species. Found in low numbers from British Columbia to Mexico, they are a species of special concern. The existence of the nursery colony, with 100 to 200 females and their young, was an exciting discovery.

The future of the Rattlesnake House was uncertain due to a change in ownership, but the new owner graciously agreed to donate the building if it could be relocated. Kent developed a plan to move the 24 x 30-foot (7.3 x 9.1-meter) structure to a location about half a mile (0.8 kilometers) away.

Because he didn't know if the 87-year-old house would survive the move, Kent's plan called for first building a new house near the future site of Rattlesnake House. The new site was acquired by the Trust for Public Land and subsequently sold to a private owner. "TPL was generous in dedicating part of the land as non-developable, and the new owner is excited about working with us," Kent said. The new house resembles the old roost in size and appearance. "We salvaged old barn boards and materials to put on the new house to make it smell and appear old," Kent said.

With a volunteer crew and financial backing from conservation groups and government agencies, work on the bat project began in spring 2001. The goal was to complete the new structure first, before the onset of hibernation. This would give the bats an opportunity to discover the new house before the old roost was relocated.

The new house, completed in September 2001, was designed to be more cave-like and less accessible to other animals to make it more attractive to the bats. The old house was loaded onto a flatbed truck and moved in October 2001. After some major reconstruction, the roof was nailed back on in December. Then it was a matter of waiting to see whether the bats would adopt the houses the following summer.

Kent started checking both houses the next spring, but no bats appeared. Throughout the summer, he would look inside only to find them empty. "I was pretty discouraged. I watched all summer long, and for some reason they didn't show up. I'd pretty much given up and thought, 'Maybe next summer.'"

One day in August, not feeling very hopeful, Kent peered into the Rattlesnake House. To his surprise and delight, "it was full of bats." He left quickly so that he wouldn't disturb them. He continued to monitor the houses, and the bats remained until September. He also found two or three bats in the new house, and speculated that they were bachelors. By the end of the summer, however, a female and her young had also moved into the new bat house.

Kent is hopeful the bats will return again. If they do, the many volunteers who helped with this project will have accomplished something new. "I am not aware of anyone who has successfully

moved a Townsend's big-eared bat colony," Kent says. "We will watch carefully to see what happens this year."

This project was supported by several agencies and organizations, including Bat Conservation International, the Trust for Public Land, Washington Department of Fish and Wildlife, the *Methow* Institute Foundation, the Washington Bat Working Group, the U.S. Fish and Wildlife Service, the Washington Conservation Corps, Bats Northwest, and *Wastman* Construction.

A dilapidated cabin (above left) in Washington was moved to a new location to protect it for Townsend's big-eared bats that had used it for years. To help the bats relocate, a second cabin (above right) was built at the new site. Some bats used both cabins in the first year. Photos © kent woodruff