

CAVE OWNERS' NEWSLETTER



A publication of the Virginia Cave Board, Department of Conservation and Recreation No. 23, December 2010

Letter From the Chairman

by Thomas Lera

Another year has passed and the origin of White-Nose Syndrome (WNS) is still unknown, nor have we found a way to eliminate it and save the bats. The white powdery substance found on the bat's wings and muzzle, *Geomyces destructans*, is a devastating, newly described fungus associated with the death of hundreds of thousands of bats in Virginia and the northeastern United States. Read more about WNS later in this issue and what you can do to help save the bats on the Virginia Cave Board (VCB) Web site (http://www.dcr.virginia.gov/natural_heritage/cavehome.shtml).

Also in this issue are articles about Marcellus Shale and karst and the many presentations and panel discussions several Cave Board members and Department of Conservation and Recreation (DCR) staff gave when they participated in Karst Management Strategy meetings with federal and international governmental agencies.

If you have not already heard, the majority of funding for DCR's Virginia Karst Program was redirected as part of former Governor Kaine's budget reductions. This is a great loss to our continuing programs and activities. We will miss their expertise, their cheer, and we wish them well. On the good side, the DCR Natural Heritage Program maintains a very limited Virginia Karst Program that continues to work on karst problems and WNS issues.

The Cave Board is also facing a crisis in that Governor McDonnell's efforts to downsize Virginia's government includes the possibility of combining the Cave Board, the Virginia Land Conservation Foundation, and the Chippokes Plantation Farm Foundation into the Board of Conservation and Recreation. To me it doesn't make sense, since the Cave Board requires no state funding and does not draw on state resources other than holding a meeting in Richmond. If you would like to leave a comment about this consolidation, write your Delegate or Senator and ask them not to support the recommendation of the Simplification & Operations Committee on Government Reform & Restructuring regarding the Virginia Cave Board.

We continue to keep your best interest in mind and, should you need any help with managing your cave, would like more information on what is discussed in the newsletter, or would like to have a presentation on WNS, please feel free to write or call.

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To All Who Care About Virginia Karstlands

by Judy Molnar, Virginia Cave Board

As part of Governor McDonnell's Commission on Government Reform & Restructuring Reform, the Subcommittee on Government Simplification & Operations has recommended that the Commission eliminate or consolidate various boards and commissions. The complete recommendations can be found at this link:

<http://www.reform.virginia.gov/docs/BoardsCommissions11222010.pdf>

These recommendations include the merger of the Virginia Cave Board (VCB) and two other state boards - the Chippokes Plantation Farm Foundation and the Virginia Land Conservation Foundation - within the Board of Conservation and Recreation. Because boards are limited in size, this merger would greatly dilute the knowledge and expertise about karst issues that can be represented on a State board. This consolidation would essentially eliminate the Virginia Cave Board, and severely weaken the Virginia Cave Protection Act under which the Board was established. Most importantly, the Virginia Cave Board is the only state entity dedicated to helping Virginians manage the extensive karst landscapes of Western Virginia. Its dissolution would be a disservice both to Virginia's karst resources and the citizens that rely on them.



From *Cave About* on page 1

Background: The VCB is composed of **appointed volunteers** with expertise in a wide variety of areas. Presently, Board members include university professors, a former commercial cave manager, private citizens, a geologist with the United States Geological Survey, industry consultants, and educators. Board members attend and present papers at regional, national, and international conferences and discuss Virginia's cave and karst resources. Board members help developers and city and county governments in providing best management solutions for development in karst areas. Board members keep all cave owners aware of karst issues through the *Virginia Cave Owners' Newsletter* and serve as a resource for all teachers who teach about karst, which is part of the state's Standards of Learning.

When writing in support of all that the VCB does, please focus on any or all of the following talking points:

- 1) The VCB raises its own funds, so this Board presents **no cost** to the Commonwealth.
- 2) Water resources are a key component of Virginia's economic development. Fully one-fourth of all Virginia counties and cities are underlain by karst terrain and contain caves. An understanding of karst water resources for wise use by multiple stakeholders in Virginia karst requires Virginia karst expertise. The VCB brings this specialized expertise not found in any other Board or Commission to the Commonwealth.
- 3) Water quality is an important issue for Virginia, especially in environmentally sensitive karst areas. All the rivers that flow into the Chesapeake Bay have their headwaters in karst, so anything that impacts the water quality in karst will be felt all the way downstream statewide to the Bay.
- 4) For many people, the only caves they will ever step into are tourist caves; hence it is vital that cave visitors understand the importance of protecting karst. A significant part of Virginia's tourism includes caverns, several of which are renowned worldwide. VCB members work with commercial cave managers and help them provide their visitors with information that accurately reflects the wonders and importance of the karst landscape. A new concept that extends this education, the Virginia Cave and Karst Trail is just getting started and will not get far if the VCB is eliminated.
- 5) State budget cuts have already reduced the Department of Conservation and Recreation Karst Program. The VCB's expertise is needed more than ever to help support the State employees who are left for all the karst issues they have to deal with.

6) This is the third winter that White-Nose Syndrome is affecting Virginia's bats, and if what's happened up north is any indication, this winter and the ones to follow will be critical for the survival of several bat species. The impact on agriculture and local ecology may be huge. It seems a bit short-sighted to eliminate the VCB's expertise now.

To sum up: The consolidation of the VCB with other boards neither simplifies nor reduces costs to the Commonwealth but leaves a huge dent in the expertise available in dealing with issues in Virginia karst. It's in the best interest of the State to keep the VCB a separate standing Board as currently legislated.

Please support the Virginia Cave Board by **writing** [this packs the most punch] **to your local state representatives about this issue** and to the following members of the subcommittee:
Delegates Glen G. Oder (DelGOder@house.state.va.us) and R. Lee Ware, Jr. (DelLWare@house.virginia.gov);
Speaker William J. Howell (DelAHowell@house.virginia.gov);
Senators Mary Whipple (district31@senate.virginia.gov), L. Louise Lucas (district18@senate.virginia.gov), Ryan T. McDougle (district04@senate.virginia.gov), and Mark D. Obenshain (district26@senate.virginia.gov).
The following link will help you locate addresses for the representatives: <http://conview.state.va.us/whosmy.nsf/main?openform>.

If you wish to make additional online comments, make sure you **mention the Virginia Cave Board specifically** [there is no place online it is actually mentioned] at this link: <http://www.reform.virginia.gov/Comments/CommentOnAction.cfm?id=146&sec=Natural%20Resources>, or call the Virginia General Assembly's Constituent Viewpoint Comment line toll-free at 1-800-889-0229 (804-698-1990 in Richmond). Many thanks!

Update on the Virginia Cave and Karst Trail

by Babs Bodin, Virginia Cave Board

The Virginia Cave and Karst Trail (VCKT), which was recommended by the Virginia Outdoors Plan, is becoming a reality! The Virginia Cave Board (VCB) is spearheading the development of the statewide trail system to educate the public about, and for preservation of, Virginia's fragile karstic resources. The VCB wants people to physically visit Virginia's cave and karst sites rather than just download tons of geological information from a Web site!

Having decided to develop the VCKT system, practicality then dictated that the most feasible course of

From *Cave & Karst* on page 2

action would be to build the VCKT in manageable segments that are linked together by driving directions contained on the VCB Web site. Important first steps have been made by establishing the first trail segment at Crystal Caverns, and the project at Skyline Caverns is well underway.

Crystal Caverns at Hupp's Hill erected 12 permanent markers during the spring of 2010. These interpretive signs, which form the 1/3-mile-long "**How Strata Shaped Strategy Walking Trail**", clearly show that the hillock's rich Civil War history happened because of its geology. Each marker interprets how soldiers utilized karstic features for tactical application of their armies' strategic goals during the 1862 and 1864 Valley Campaigns. Besides Civil War infantry trenches and gun emplacements, visitors can view a sinkhole used as a gun emplacement and two wild caves, as well as the surface "footprint" of Crystal Caverns. Many visitors to Hupp's Hill found that traversing this walking trail, which is also part of the Civil War Trails network, has been an extremely worthwhile educational and recreational pursuit.

A second trail segment at Skyline Caverns is an Eagle Scout project constructed under the direction of the Front Royal Grotto of the National Speleological Society. The existing trail has several karst features posted and one cave is partially fenced. Much more is planned, however. A kiosk will contain a topographical map with a trail overlay that will direct visitors to the actual trail signs, which will interpret selected karst features. A rough draft of signage text, which will be further refined for sign production, defines karst and sinkholes, explains cave ecosystems, connects sinkholes to groundwater supplies, and discusses the effect development has on karst.

By establishing these trail segments, we have now made the very important first steps towards building the statewide trail system—after all, the hardest part of beginning a big project is actually getting started! With one trail segment finished and another in progress we now have models that can serve as templates for building additional trail segments in other localities. VCB envisions a network of such segments that can be built by individual cave owners, grottos, and heritage sites.

A rather important consideration in these times of budget deficits is the cost factor involved in erecting permanent markers. What may be very surprising is the fact that the Crystal Caverns trail segment was constructed on a shoestring. For example, while the camera-ready sign text for each marker at Crystal Caverns took several hours to research, write, and import visual images, the signs themselves were very inexpensive to produce, costing approximately \$60 per marker. While not state-of-the-art, these markers have a rustic appeal and will last for at least 10 years, at which time more funding may finally be available for upgrades. But until these upgrades can be made, it is expected that many, many people will learn about

the Commonwealth's cave and karst resources by reading them. In other words, finding major funding in an unhealthy economy does not have to deter teaching valuable educational lessons NOW.

The Virginia Cave Board, in conjunction with local grottos, needs your help to inventory cave and karst resources that can be included on the Virginia Cave and Karst Trail. Please e-mail me at babsbodin@gmail.com if you would like to help educate visitors about the Commonwealth's rich karst resource.



White-Nose Syndrome in Virginia: Hope for Bats Amidst the Devastation?

by Wil Orndorff, Virginia Natural Heritage Program

The winter of 2010–11 will be the third year that bats hibernating in Virginia's caves have been under attack from White-Nose Syndrome (WNS), a disease characterized by a white fungus on wings and/or muzzles of many affected bats and resulting in death rates of up to 90 percent in some affected bat species. The last issue of the *Virginia Cave Owners' Newsletter* (Summer 2009) was dedicated to WNS and what actions cavers and cave owners might be able to take in order to slow its spread or lessen its effects. At that time bats from only five Virginia caves were known to be affected. Eighteen months later, that number has grown to at least 21 caves. Except for the Powell River basin, at least one cave in every major Virginia watershed is home to bats affected by WNS. Also during this time, *Geomyces destructans*, the fungus associated with WNS, was discovered to have spread to bats in Tennessee, Missouri, and Oklahoma and to three additional species of bat. While scientists are sure that infection by this fungus plays a leading role in WNS, the possibility that as yet unrecognized pathogens or environmental factors contribute has not been ruled out.

Eight bat species hibernate in Virginia's caves:

From *White-Nose* on page 3

Little Brown bats, Big Brown bats, Northern long-eared bats, Eastern small-footed bats, Tri-colored bats (formerly called pipistrelles), Indiana bats, Gray bats, and, our official State bat, the Virginia Big-eared bat. The last three species were already considered endangered before the arrival of WNS. More on Virginia's bats can be found online at www.dcr.virginia.gov/natural_heritage/karst_bats.shtml. Of the eight cave bat species, only the Virginia Big-eared bat has yet to show signs of susceptibility to infection by *Geomyces destructans*. The response of the other seven species to the fungus is highly variable. Little Brown and Tri-colored bats appear most affected, with 75 percent or more individuals dying in less than two years from the fungus' first detection in a particular cave. Cave owners reported bats turning up dead on the landscape in the middle of winter snowstorms near known summer roost sites. Decomposing bat carcasses were common last winter in WNS-positive caves (see photo). In some affected caves that started with only a few hundred bats, these two species have all but disappeared.



Indiana, Gray, Northern long-eared, and Eastern small-footed bats are all members of the same genus, *Myotis*, as Little Brown bats. Although all are known to develop *Geomyces* infections, the degree to which the fungus affects these species varies. In the northeastern United States, where WNS was first recognized in 2007, the number of Indiana bats has greatly diminished, but not to the same degree as Little Browns. The susceptibility of more southern and western bat species first found to be affected by WNS during early 2010 remains to be seen.

The caving community's initial response to WNS was to adopt practices to discourage the possible transport of fungal spores by cavers on their clothing and equipment. These practices included the chemical decontamination of gear and the confinement of each caver's activities to small geographic areas. Unfortunately, these practices appear to have made little difference as WNS continued to increase its range and spread rapidly between caves within its range, including to caves literally under lock and key that had not been visited for years. Clearly, *Geomyces* and WNS are being spread in ways that don't directly involve people. Bat-to-bat transmission of WNS has been shown in the laboratory, and many scientists suspect this to be the primary mode of transmission in the wild.

In light of these developments, the Virginia Cave Board met with representatives from the Virginia caving

community in May 2010 to agree on modified protocols for caving activity as WNS becomes widespread. These protocols can be view online at www.dcr.virginia.gov/natural_heritage/documents/wns_recommendations_va_jul_12_10.pdf. Under these modified protocols, decontamination of gear is no longer advocated when moving from one cave to another within the known range of WNS. In Virginia this means all cave counties except Lee and Wise in the Powell River basin. The Board recommends that for those counties, clean gear be dedicated for use only in those counties. Unfortunately, it is likely that WNS will make its way there soon regardless of human activity. The most crucial element of the revised protocols is that gear used within the range of WNS is not to be taken into areas where WNS is not known. The idea here is to avoid the transport of spores by cavers more quickly to areas than they would spread naturally, if at all. Human transport between caves is probably irrelevant within the WNS-positive areas.

Cavers are playing a critical role in monitoring the response of our bat populations to White-Nose Syndrome. Dozens of cavers have volunteered hundreds of hours helping to weigh, count, measure, photograph, and band thousands of bats so that the progress of the disease can be tracked and hopefully some resistant animals identified. The current management strategy state wildlife agencies are implementing in Virginia is one of monitoring and avoidance of disturbance to remaining bat populations. As part of this process, a list of caves to avoid during hibernation season, October 1 through April 15, is being maintained jointly by the Virginia Department of Game and Inland Fisheries and the Virginia DCR Natural Heritage Program. Equally important to the protection of caves bats hibernate in is the protection of their summer roost sites. For Little Brown bats, this can be trying because they commonly will roost in sites where they are unwanted, such as attics of houses and under the eaves of outbuildings. If you or someone you know is aware of a summer roost site, please notify me at

Wil.Orndorff@dcr.virginia.gov (540-553-1235). If these bats are a nuisance, there are ways to exclude them without harm. The hope is that, in the future, perhaps decades or even centuries from now, the offspring of bats resistant to WNS will help bat numbers return to what they were just a few years ago.

Amidst the devastation, there are a few hopeful signs. In the early spring of 2010 in some caves with high mortality among Little Browns, Indiana bats had yet to suffer much of an effect. During the summer, Gray bats from Tennessee that use caves in southwestern Virginia for summer roosts were as healthy and numerous as ever, despite WNS being confirmed in some Gray bat caves the previous winter. And this fall, numbers of Little Brown bats at some of Virginia's third year WNS-positive hibernacula sites were higher than anticipated. The weights and wing condition of many of these presumed survivors were much better than expected, both for Little Browns and Tri-colored bats, especially among females. And no one has yet observed a Virginia Big-eared bat with WNS. Keep your fingers crossed. Nature is nothing if not resilient.



Local Conference Addresses Issues With Development In Karst Areas

by Dr. Dan Doctor, Virginia Cave Board

Two local conferences aimed at providing a forum of discussion between developing communities, resource managers, and scientists regarding development in karst areas of Virginia and West Virginia were combined in 2010. The annual *Growing Communities on Karst* conference, organized by the West Virginia Department of Environmental Protection (DEP), was held in conjunction with the *Great Valley Water Resources Science Forum*, organized by the U.S. Geological Survey (USGS). The joint conference took place at the National Conservation Training Center in Shepherdstown, West Virginia, on September 16–17, 2010. The combined meeting attracted nearly 200 participants from municipalities, state government, federal government, private industry, and private citizens.

A list of presenters and presentation topics is provided below. The keynote presentation was given by Dr. William B. White, professor emeritus of Pennsylvania State University and a world-renowned expert on the hydrology and geomorphology of karst terrains, who spoke on the elevated sensitivity to pollution of groundwater in karst areas. A summary of water quality in carbonate aquifers of the United States was presented by Bruce Lindsey of the USGS, who demonstrated a link between areas of high sinkhole density and degraded water quality in several regions of the nation.

Two speakers highlighted the growing population pressures placed on karst areas in the Shenandoah Valley. Scott Phillips of the USGS Chesapeake Bay Program indicated that the Great Valley of Virginia and West Virginia is projected to experience the greatest impacts of future population growth in the Chesapeake Bay Watershed, and that this region is targeted for nutrient and sediment reductions strategies. William Stubblefield of the Berkeley County Commission also spoke of trends in population growth and associated development in the Great Valley portion of West Virginia; he presented a projected population density of 400+ persons per square mile by the year 2025 in Berkeley County.

Another highlight was the presentation of issues surrounding the exploration for natural gas resources by hydraulic fracturing (fracking) of the Marcellus Shale in western Virginia and in West Virginia, given by Dr. James Coleman of the USGS. He reported on the estimated extent of the resource, the processes involved with extracting the gas, problems associated with water use and disposal, and that a proposed drilling operation in Rockingham County,

Virginia, was abandoned due to strong local opposition. A later presentation given by Jill Keihn of the Northern Shenandoah Valley Regional Commission (NSRVC) addressed a similar concern related to exploration for natural gas: the availability of water supplies for the fracking process. Ms. Keihn explained that a mandate for county and city water supply plans in Virginia was put in place after the drought of 2002. The NSRVC is charged with drafting the regional plan, which must be approved by the State Water Control Board. The plan is updated every 5 years, and re-submitted for approval every 10 years. She discussed concerns about projected demands on water resources resulting from population growth and natural gas exploration, for which a water pipeline from the Shenandoah Valley to points farther west has been suggested.

Finally, two presentations focused on the utility of geologic mapping to identify areas susceptible to sinkhole occurrence in the Great Valley. David Brezinski of the Maryland Geological Survey presented his study of sinkholes and related geologic features in Frederick County, Maryland. The information was used by the Department of Transportation to raise awareness of areas prone to sinkhole hazards that may be encountered during road construction and repair. Dr. Dan Doctor of the USGS presented on the use of Google Earth imagery to identify sinkholes and other hydrologic features in karst areas; the presentation continued to demonstrate using a Geographic Information System (GIS) for conducting sinkhole susceptibility analysis. He demonstrated a method of Geographically Weighted Regression (GWR) that compares geologic map data with sinkhole occurrence to provide a more quantitative assessment of sinkhole susceptibility in Jefferson County, West Virginia.

Presenters

- Dye tracing in karst (Bill Jones, Karst Waters Institute)
- Groundwater Contamination and Karst (William B. White, Pennsylvania State University, retired)
- Groundwater Quality in Carbonate Aquifers of the USA (Bruce Lindsey, USGS–Pennsylvania Water Science Center)
- Ecological Flows in the Shenandoah River (Carlton Haywood, Interstate Commission on the Potomac River Basin)
- Chesapeake Bay Activities and Future Directions (Scott Phillips, USGS–Chief, Chesapeake Bay Program)
- Marcellus Shale Issues (James Coleman, USGS Energy Resources Program)
- Geologic Controls on Sinkhole Occurrence, Frederick Valley Maryland (David Brezinski, Maryland Geological Survey)
- Field Trip–Recognizing and Understanding Local Geological Features (David Weary, USGS National Cooperative Geologic Mapping Program)
- Land Remediation in Karst (Twila Carr and Don Martin, WVDEP)

From *Conference* on page 5

- Karst Considerations at the Local level (William Stubblefield, Berkeley County Commission)
- Clarke County's Proactive Approach (Allison Teeter, Clarke County GIS and John Staelin, Clarke County Commission)
- Early Warning Detection Systems for Source Water Protection (Adrienne Buka, River Alert Information Network (RAIN))
- Water: Planning for the Future (Jill Keihn, Northern Shenandoah Valley Regional Commission)
- Assessing geologic controls on sinkhole occurrence using Geographic Information Science (Dan Doctor, USGS National Cooperative Geologic Mapping Program)



Marcellus Shale in Virginia

by Drew Harrison, Virginia Cave Board

The Marcellus Shale is a sedimentary rock formation predominantly consisting of shale with some inter-bedded limestone. The sediments that created the Marcellus Shale were deposited in a relatively deep water marine environment during the middle Devonian period approximately 350 to 400 million years ago. The deposition of the sediment created a large basin that extended from New York south to Tennessee and from Ohio east into Virginia. The depth of the formation varies but generally is closest to the surface (< 1,000 feet) in the west (Ohio) and dips to depths of up to 9,000 feet below the surface in western Virginia. The thickness of the formation also varies from several feet to several hundred feet.

The commercially significant part of the Marcellus is the black marine shale component that is high in organic content. The organic matter within the shale was transformed over time into hydrocarbon gas, predominantly methane, and occurs within the pore spaces of the shale. The majority of the drilling in the Marcellus Shale has been in Pennsylvania where more than 650 producing wells have been drilled and over 4,000 drilling permits issued to date.¹ Drilling permits in Virginia are issued by the Department of Mines, Minerals and Energy and to date no permits have been issued for drilling into the Marcellus Shale in Virginia.² Currently, gas exploration and production in Virginia only occurs in seven southwest Virginia counties (Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, and Wise). The gas-producing wells in these counties have been drilled into either shallower known gas-producing formations or are associated with coal bed methane.

The Marcellus Shale exists under parts of 24 western Virginia counties located from the Blue Ridge Mountains to the

West Virginia border. Twenty-two of the 24 counties where the Marcellus Shale exists also contain karst. Since any construction or land-disturbing activity within a karst area can potentially impact water quality and quantity, landowners in these areas should be aware of the potential impact of drilling in to the Marcellus Shale. While a significant amount of news coverage has been dedicated to issues concerning drilling and hydro-fracturing of wells, a comprehensive study of the issues needs to be completed. Therefore, at this time, it is not the intention of the Cave Board to offer an opinion either in support of or against drilling, but rather to highlight issues that may impact landowners within karst areas of Virginia.

Basically, any given gas well requires the drilling of a horizontal bore hole into the target formation. This bore hole is cased with steel and grouted in place with concrete. A properly cased well is unlikely to cause any negative impact to the surrounding area. Some wells are then drilled horizontally through the formation and fractured with high pressure from fluid pumped down the well to increase gas production. The fracturing is conducted several thousand feet below ground and as long as the well casing is properly installed, it is unlikely that fluids will impact any areas outside of the target formation. The fracturing process may require in excess of 1,000,000 gallons of water that generally will come from the closest available source. Once the fracturing process has been completed, the fluids are generally pumped into an onsite storage pit along with other drilling fluids. The drilling fluids are either sent for disposal, treated onsite, or recycled.

Therefore, landowners should seek answers to the following questions if a gas well is planned nearby:

1. Where will the fracturing fluid water be obtained, how much will be required, and over what time frame will the withdrawal take place for gas wells near or on their property? Karst water systems are not always well understood and any significant withdrawal of water within a short period of time from a localized source could cause disruption of supply and impact water quality. Drought conditions could exacerbate any water shortage issues.
2. How will the drilling fluids be stored onsite? Improper construction or location of storage facilities could impact the groundwater as a release occurred. Properly constructed storage should include an impermeable liner that is routinely inspected.
3. What is the planned method for disposal of drilling fluids? The quicker fluids are removed from site, the less likely a release could occur. Also, any residual sediment should be properly disposed of to prevent any contaminants from leaching to groundwater.

From *Marcellus Shale* on page 6

To learn more about drilling and production of natural gas from the Marcellus Shale in Virginia, you can log on to the Virginia Department of Mines, Minerals, and Energy Division of Gas and Oil Web site at: <http://www.dmme.virginia.gov/divisiongasoil.shtml>

1. Pennsylvania Department of Environmental Protection Bureau of Oil and Gas Management
2. Virginia Department of Mines, Minerals, and Energy Division of Gas and Oil



Cave Owners' Newsletter Will Be Available Online

In 2011, the Virginia Cave Board's *Virginia Cave Owners' Newsletter* plans to move into the age of technology by moving to an online distribution method.

Early next year, all subscribers will receive a postcard describing this new method of distribution. The cave owner will enter his or her name, address, and e-mail address on a Web form at the Web site. Now when a *Virginia Cave Owners' Newsletter* is published, each person who signed up will receive an e-mail and a link where they can download or read the newsletter on their computer.



For additional information please contact the **Virginia Department of Conservation and Recreation, Division of Natural Heritage**, 217 Governor Street, 3rd Floor, Richmond, VA 23219 or one of the following members of the Virginia Cave Board:

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We're on the Web! Visit us at:

<http://www.dcr.virginia.gov/dnh/cavehome1>

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