Appendix J
Amphibian Study

Date: December 5, 2005

Subject: Technical Memo on the Interpretation of the Frog Call Survey Conducted at the Elizabeth Mine Site April 2005

From: Mark D. Sprenger, Ph.D.
OSRTI - ERT

To: Edward Hathaway, RPM
Region I

This memo serves as a technical summation of the results from the frog call survey conducted at the Elizabeth Mine Site in April of 2005. It is anticipated that a more extensive interpretation of the results will be presented within the ecological risk assessment (ERA), as within the ERA chemistry data on the vernal pools will be available.

The Elizabeth Mine is an abandoned copper mine located on Mine Road in the Village of South Strafford within the Town of Strafford, Orange County, VT. The mine operated from the early 1800s until its closure in 1958. Past operations at the property included mining, copper smelting, and ore processing. As a result of these activities, three mine tailings piles and two open-cut mines were generated. At the close of the mining operation in 1958, the mine property encompassed approximately 1,400 acres (EPA 2001).

Several generalized conclusions can be made from the observations made during the frog call survey:

Within the Furnace Flats area, on either side of the Ompompanoosuc River, no vernal pools were found. In addition, the observed habitat present was considered not to be breeding habitat for the species of frogs included within the survey.

In the cluster of pools (5-6) in the immediate area of the South Mine including the South Mine had pools which contained frogs and two which did not. The two pools which did not contain frogs were observed to have the bottom covered with an orange precipitate.

Elevation did not appear to be a causative factor in the presence or absence of frogs as pools with frogs occurred at the top of the ridge as well as near TP4.

A review of the pool pH data does not indicate that pH is a major factor in the presence or absence of frogs; as at least one pool with a pH of below 5 had frogs in it. A potential indicater of the absence of frogs is the presence of orange precipitate, although lack of utilization of any vernal pool is undoubtedly a function of several factors. I review of the pool water chemistry may suggest a causative association with particular metals. The

presence of the precipitate may be an indication of high metals loading in addition to pH suppression.

In summary, the results of the frog call survey indicate that the area in and around the Elizabeth Mine Site is used as breeding habitat for frogs (specifically but not limited to wood frogs). Absence of frogs in any particular pool could not be accounted for by elevation differences or general location. The presence of orange precipitate within a pool appears to be indicative of the pool not functioning as breeding habitat. The results of this survey can not definitively answer whether or not pools without precipitate have functional loss as breeding habitat. As indicated above, it can be concluded that pools with precipitate have lost amphibian breeding habitat function.

DATE: June, 2005

TO: Mark Sprenger, EPA/ERT Work Assignment Manager

THROUGH: Parry Bhambra, REAC Operations Section Leader

FROM: George Molnar, REAC Biology Group, Elizabeth Mine Site Task Leader

SUBJECT: Frog Call Survey at the Elizabeth Mine Site.
WORK ASSIGNMENT EAC00110 ELIZABETH MINE _ TRIP REPORT

BACKGROUND

At the request of the United States Environmental Protection Agency (EPA) Region I and the EPA/ Environmental Response Team (ERT), personnel from the Response, Engineering, and Analytical Contract (REAC) performed a frog call survey in areas of interest. The objective of this field effort was to generate site-specific ecological data for the Elizabeth Mine Site, located in South Strafford, Vermont (VT).

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OBSERVATIONS AND ACTIVITIES

A qualitative frog call survey was conducted at the Elizabeth Mine Site in concurrence with the breeding season of the wood frog (*Rana sylvatica*). The objective of the survey was to assess terrestrial amphibian breeding/reproductive potential within the terrestrial portions of the study area. Frogs breeding/calling within survey areas support the assumption that the area is an appropriate, viable breeding habitat.

> Sunday April 17, 2005: Two members of the REAC field team (George Molnar and Dan Cooke) and Fish and Wildlife Service (FWS) personnel (Rich Henry [liaison to ERT] and Mike Horne) traveled to White River Junction, VT and met with FWS (Ken Munney) and ERT representatives (Barbara Williams). The field crew then departed White River Junction to locate call survey reference areas. It was anticipated that two reference areas would be located; one at an elevation of approximately 1,400 feet (ft) above sea level, similar to the elevation of South Mine and the South and North Cut portions of the site, and another at approximately 900 ft, similar to the elevation at the Furnace Flats area (Figure 1).
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> The team arrived at an entrance to the Charles Downes State Forest identified as "The Site of Camp William James". Based on a United States Geological Survey (USGS) topographical (topo) map the area was at an elevation of approximately 1,400 ft. Adjacent to the road near the entrance was a vernal pool. Hundreds of wood frogs were observed and heard calling in full chorus. Several pairs were observed in amplexus. Field team members scouted out the surrounding areas while Molnar took Global Positioning System (GPS) readings using a Trimble Pro XRS GPS unit; Cooke collected

water quality data using a Yellow Springs Instruments (YSI) multiparameter water quality meter. The location was selected as the high elevation reference area. Field team members then departed the area and scouted out a nearby pond slightly at a lower elevation. No frogs were heard calling.

Team members traveled south of the town of Sharon and across the White River to look for an area that would be an appropriate low elevation reference. Wood frogs were observed in two pools located in eroded depressions on boulders along the river bank The habitat present was not comparable to that of the Furnace Flats portions of the site and it was decided to search for another reference area. The team departed and drove to another area located on a flood plain of the White River. No frogs were heard or observed, and like the former area, the habitat was not comparable to Furnace Flats. Field team members departed the area and drove to the Furnace Flats area.

Upon arrival at Furnace Flats, team members separated and searched areas upstream and downstream of the confluence of Copperas Brook and the West Branch of the Ompompanoosuc River. Team members limited their search between the north bank of the Ompompanoosuc and the south side of Route 132. No frogs were heard calling. The area was primarily wooded flood plain and no pools were present with the exception of a small marsh approximately one half acre in size downstream of the confluence. No appropriate wood frog breeding habitat was present throughout the area, but the marsh appeared suitable for breeding spring peepers (*Hyla crucifer*). However, given evidence observed such as drift lines, alluvial deposits and debris the area appeared suceptible to flooding that most likely limited its function as spring peeper breeding habitat. Field team members then departed the Furnace Flats area and drove to Tailings Pile 1 (TP-1).

Upon arriving at TP-1, team members scouted out the area near Copperas Brook. Henry and Horne separated from the group to scout the area near Mine Road while Molnar, Cooke, Williams and Munney walked around the east portion of the pile to Mine Road to meet with Henry and Horne. No frogs were heard calling, and no suitable wood frog breeding habitat was found. The field team then drove up to the South Mine/South Cut area.

A cluster of approximately seven pools were found in the vicinity of the South Mine. The largest of the pools appeared to be originating from the South Mine cut. Frogs were observed in all but two of the pools, though few were calling as it was later in the day. Field team members briefly scouted areas immediately surrounding the south end of the South Cut. Since it was late in the day, the team drove back to Furnace Flats to listen for spring peepers in the marsh area, but no calls were heard. However, spring peepers were heard calling in full chorus on the north side of Route 132 across from Furnace Flats on private property some distance from the river. The team left the site and discussed field activities for the following day.

Monday April 18, 2005: The team drove to the site and separated into two groups. Cooke, Horne and Munney walked along Copperas Brook and an unnamed drainage down to the West Branch of the Ompompanoosuc River. Molnar, Henry and Williams went to scout out the areas surrounding the North and South Cut.

Cooke, Horne and Munney scouted the area down to the West Branch of the Ompompanoosuc River and downstream of the confluence with Copperas Brook. In general, the topography of the area was very steep or showed evidence of disturbance via

high water in the Ompompanoosuc. No suitable frog breeding habitat was found. The team then scouted out the areas surrounding the North Cut.

Molnar, Henry and Williams began scouting for pools on the eastern side of the south end of the South Cut moving towards the North Cut. The topography of the area was steep; no frogs were heard calling, and no suitable pools were located. The search continued on the western side of the north end of the North Cut moving towards the South Cut. Henry searched on the west side of the ridge top, while Williams searched the ridge top and Molnar stayed to the east of the ridge top. Several pools were located along a snowmobile trail that ran adjacent to the west side of the cuts. The pools were located near the north end of the south cut and another was found on the southern end. No frogs were observed or heard calling in these pools. The search ended at the South Mine where wood frogs were calling in full chorus. Several pairs were observed in amplexus, and egg masses were present in one of the larger pools adjacent to the access road leading to South Mine. Wood frogs were observed in all pools except one which was receiving drainage from the South Cut area and another located in full shade. Orange precipitate was present along the bottom of the pool receiving the drainage. Molnar, Henry and Williams left the area to meet with the other team at Tailings Pile 4 (TP-4). As the team approached TP-4, wood frogs were heard calling. The area was searched and two pools were found in the immediate area just south of TP-4 off the access road to South Mine. Only a few frogs were observed and heard calling.

After discussing the morning's findings the team separated again. Cooke, Horne and Munney scouted out the areas surrounding Sargent Brook; Molnar and Henry went to take GPS and water quality readings in the pools observed at South Mine and along the cuts while Williams stayed behind. No suitable breeding habitat/pools were found in the areas surrounding Sargent Brook.

Molnar and Henry took GPS and water quality readings at the South Mine pool cluster and moved up to the South Cut along the snowmobile trail leading to the other pools. Other than at the South Mine, no frogs were heard or seen; however when taking readings near the group of pools near the north end of the South Cut, wood frogs were heard calling in the distance along the ridge top. Approximately 100 meters (m) off the trail a large pool was located with hundreds of frogs observed and calling in full chorus. In addition, a large tadpole most likely of a species other than wood frog was observed. Given the size of the pool and the size of the tadpole it was most likely a permanent pool. Molnar and Henry completed taking the GPS and water quality readings and met the rest of the crew at TP-4. Locations of all the pools can be found on Figure 1; water quality readings of all the pools can be found in Table 1.

The crew discussed the day's findings and Munney departed from the site. Molnar, Henry and Horne then scouted out the area below TP-4 for pools/frogs while Cooke and Williams returned to the vehicle to meet with the group. No pools or suitable breeding habitat were found and no frogs were heard calling. After meeting up with Cooke and Williams the field crew returned to the hotel and organized equipment.

Tuesday April 19, 2005: Field crew members departed White River Junction and returned to NJ.

Table 1. Water Quality Readings Taken in Pools
Elizabeth Mine Site
South Strafford, VT

Location	Temperature °C	Conductivity µS/cm	pH std. Units	Dissolved Oxygen mg/L	Frogs Present
1	10	0.19	6.4	7.2	Yes
2	12	0.03	6.2	6.2	Yes
3	11	0.03	6.7	5.9	No
4	6	0.27	4.1	12.5	No
5	NM	NM	NM	NM	NM
6	10	0.05	5.6	NA	No
7	4	0.06	4.8	NA	Yes
8	9	0.11	4.5	NA	Yes
9	13	0.08	6.4	NA	Yes
10	8	0.135	4.6	NA	No
11	12	0.23	4.1	NA	No
12	3	0.41	3.4	NA	No
13	13	0.095	6.6	NA	Yes
14	11	0.49	6.6	NA	Yes
15	NM	NM	NM	NM	NM

1 - Reference pool
2 - Large pool found on ridge top
3 - Pool found along trail 150 m from ridge top pool
4 - Pool found near ridge top pool
5 - Pool found near ridge top pool (shallow pool; no water quality measured)
6 - Pool found near southern end of the South Cut
7 - Pool draining South Mine (shade)
8 - Pool draining South Mine (sun)
9 - Pool in South Mine complex with eggs present
10 - Drainage flowing into orange stained pool
11 - Pool with orange staining at the South Mine cluster
12 - Pool near orange stained pool at the South Mine cluster
13 - Pool near TP-4
14 - Additional pool near TP-4
15 - Misc. pool located between North and South Cuts (shallow pool; no water quality measured)

NA - Not applicable due to instrument malfunction
NM - Water quality not measured pool too shallow.
µS/cm - microsiemens per centimeter
mg/L - milligrams per liter
std units - standard units
°C - degrees Centigrade