



February 5, 2024  
Ms. Dereth Glance  
Region Administrator  
NYS Dept of Environmental Conservation, Region 7  
By e-mail to [dereth.glance@dec.ny.gov](mailto:dereth.glance@dec.ny.gov)

Dear Dereth,

My apologies for not introducing you to Stephanie Redmond who also attended the FLI Conference and who with Raymond Vaughan PG, Andrew Michalski PG, and me co-authored our poster on [Open Issues and Bounding Factors for Mining-Induced Salinization of Cayuga Lake](#).

Thanks so much for DEC's invaluable contributions to the January 31st FLI Conference. Lewis McCaffrey really got the conference off to a great start with his presentation, [Historic and contemporary perspectives of Finger Lakes Water Quality](#). The CSLAP monitoring program has been a huge assist to our understanding of lake water quality over time. Our only suggestions there would be to try to find budget to keep sampling at 8 times per year and to add sodium as an important analyte going forward given its public health connection to pervasive hypertension amongst adult Americans.

Thank you also for sending on February 1 the DEC replies to the CLEAN questions sent after our Webex conversation on December 10<sup>th</sup> with you and seven other DEC officials.

We will be mulling over your replies, but I'll just mention in this note that the DEC response to our question No. 4 didn't really answer our question. The DEC response correctly understands that our question about "Profile A" refers to Profile A in the Expanded Environmental Assessment, and there's no dispute that the carbonate beam is about 400 feet thick where it hasn't been deeply scoured. Our question, however, asked about the carbonate beam where it has been deeply scoured, particularly as shown by Profile A. For the purpose of discussion, see our question No. 4 and the DEC response (both shown here in blue), below: (I then break down our question into two parts)

**CLEAN question 4. RESPEC and others have used the term "carbonate beam" to refer to the sequence of relatively strong carbonate beds above the mine. Does DEC agree, based on the cross-section known as Profile A, that the carbonate beam is missing (thickness has been reduced to zero by erosion) at the center of Profile A at a location that's within or immediately adjacent to Anomaly B?**

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DEC's response: Since CLEAN has not specified where Profile A appears in Cargill's documentation, this response is based on Profile A in the Expanded Environmental Assessment. The cross-section does depict scour of the carbonate beds of at least 75 feet between the beds and Syracuse Salt Formation. The early seismic data and the profiles depicting the scours were the basis for DEC's permit conditions requiring Cargill to assess the adequacy of the thinner rock over the mine and the anomalies in the northern reserves. As noted above, Cargill has continued to perform additional seismic studies and processing of the seismic data to further define the thickness of the carbonate beam at these anomaly locations. The additional analyses have shown that the carbonate beam is more than 400 ft thick.

**Our Question 4.1: Does Profile A show zero thickness (complete absence) of the carbonate beam at the center of the lake where it's most deeply scoured?**

According to RESPEC's definition of the carbonate beam (see [their November 2013 report](#) on Corehole 18, pdf pages 15, 20-22), the bottom of the carbonate beam is at the base of the Bertie which is equivalent to the top of the Camillus. Depending on whether the labels in Profile A represent formation bases or tops, the carbonate beam is either completely absent or reduced to a thickness of about 10 feet at the center of the lake where it's most deeply scoured. Thus, at best, only about 10 feet of the 400-foot-thick carbonate beam remain in place at the center of the lake, according to Profile A. Stated otherwise, about 390 feet of a 400-foot-thick carbonate beam have been lost due to glacial scouring at the center of the lake, according to Profile A. The reference to "scour of the carbonate beds of at least 75 feet" in DEC's response appears to be either a substantial understatement or a reference to something different from what we asked about. The severe thinning of the strong carbonate beam at the center of the lake is concerning, given the comparative weakness of the underlying beds. We invite you or your staff to respond on this point.

**Our Question 4.2: Do newer seismic lines or other geological evidence show less severe thinning of the carbonate beam than Profile A shows?**

This question is not easily answered because Cargill and DEC withhold most of the relevant evidence. We rely here on work done on behalf of CLEAN by experts John K. Warren (of [Saltwork Consultants Pty Ltd.](#) and the author of *Evaporites: a geological compendium*, Springer, 1813 pages) and his colleague Angus Ferguson, particularly their interpretations of the public-domain seismic data acquired by Scholz. As a general observation, we also note that newer seismic studies are more capable of improving *absolute* vertical distances than *relative* vertical distances.

At our [website library](#), under Saltwork Consultants Pty Ltd documents, the first report and the last report listed are by geophysicist Ferguson and evaporite geologist Warren. The first sentence of the executive summary for the first report reads "There is now multiple public-domain evidence, seismic and geological, that the Onondaga Formation has been downcut by the valley floor in the area of the Cayuga mine." The Onondaga Formation is of course only one of the intermediate beds within the carbonate beam, so this statement does not directly address the absence or near-absence of the carbonate beam at the center of the lake.

Slide 12 of their second report in 2017 shows the carbonate beam as “eroded out.” This conclusion, based on Profile A, simply adds to what I say above in Question 4.1; it doesn’t directly apply to newer seismic evidence. The same slide shows the center of the bedrock valley coming to within 80 feet of the comparatively weak Syracuse Formation in which the various salt beds are found. It should be noted that the intervening 80 feet of Camillus Shale doesn’t add substantial strength; it’s also comparatively weak.

Perhaps the most useful purpose of Slide 12 is the comparison it offers to the Retsof Mine that collapsed in 1994. While I don’t have a full stratigraphic column at hand for Retsof, a comparison can be made to Fig. 2 of [the report by R.M. Yager et al., \*Brine migration from a flooded salt mine in the Genesee Valley, Livingston County, New York\*, USGS Professional Paper 1767 \(2009\)](#), which shows that about 150 feet of carbonate beam remained in place above the Retsof mine prior to its collapse. This comparison is not reassuring for the Cayuga Mine. If collapse occurred at Retsof with 150 feet of carbonate beam remaining, what is the likelihood of collapse at Cayuga if only zero to 10 feet of carbonate beam remain?

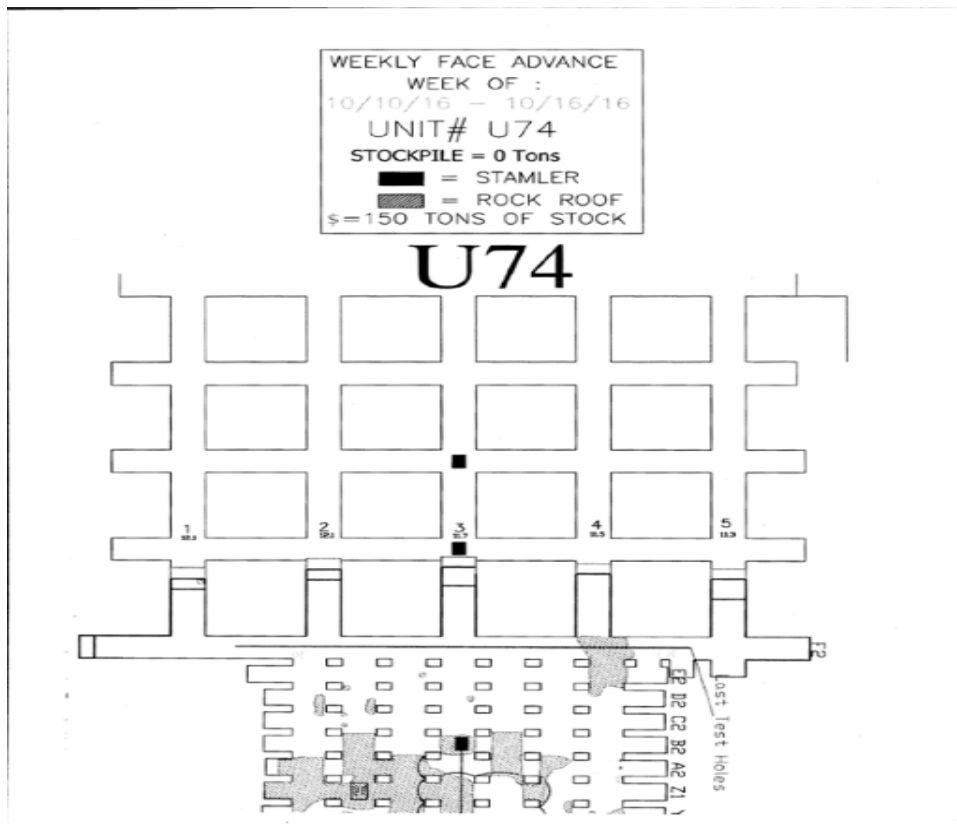
**Slide 20 of Ferguson and Warren’s report has these recommendations:**

- The NYS Department of Environmental Conservation should consider immediately halting any further exploitation of this thinning bedrock zone until the following have been completed:
- 1) A 3-D seismic survey, or detailed 2-D survey, with acquisition parameters focused on mapping the glacial valley floor and the degree of downcutting in the Carbonate Beam, the Camillus Shale, and the underlying Evaporite Section.
- 2) The same survey should be used to construct a salt anomaly map that defines the position of known and future mine workings with respect to the glacial valley thalweg.
- 3) The salt core at Corehole 18 is re-logged using current understandings of the significance of textures and vein structures in salt core, with a view to defining the degree, if any, of ice-flexure driven penetration by undersaturated groundwaters.

If these studies have been done already, it’s time for them to be released so that third-party experts can assess their accuracy and findings.

And apropos of the application to modify the mine permit to allow flooding of the S3 portion of the mine, the last bullet point on Slide 19 appears relevant: [Currently the influence of roof-rock degradation on mine stability and safety in the region north and west of the current workings is underestimated.](#)

This mine map of the eastern portion of U74 provided by then senior mine engineer Dave Plumeau in a 2016 letter to DEC’s Steve Army is indicative of this sort of exposed roof rock problem. Our consultant John K. Warren’s manta for safe salt mining is to “stay in the salt.” [please see [para 2 on page 74 of this Warren document.](#)] The U74 map shows that Cargill has been unable to do this in the thinning bedrock northern reserves.



Source: Sept 9, 2016, letter from Dave Plumeau to DEC's Steve Army at DEC Region 8.

### 2011 letter to Boyd by Plumeau, who at that time was Cargill's senior mine manager

Please see [this 2011 letter](#) by at-the-time Cargill's senior mine manager, Dave Plumeau, in which he seeks to rebut various points that had been raised by DEC's external mine expert, John T. Boyd Company. In this letter, we learn from Mr. Plumeau on p. 2 of the letter that:

On page 3 paragraph 5, Dr. Scovazzo states "The conclusion that the shale below the 4A Salt will fail..." This failure is indicated for the two models which represent the mining done 10 years ago and the mining under way at present, but the future mining—under the thinnest bedrock—should not see this failure. Note that to date, there is no evidence that the shale in question is failing: no microseismic events (indicative of rock fracturing) are being detected from that horizon. Dr. Scovazzo rightly concludes that the modeling was very conservative in its assumptions.

Dr. Scovazzo also quotes (same sentence as above) "...and that the Bertie Formation potential for failure will increase as mining progresses north." This is true, but it is also true that the factors of safety indicated by the modeling remain above 1 (no failure) for the Bertie formation in all modeling scenarios and for all predicted time frames (and by extrapolation for the foreseeable future---at least to 100 years). The model is conservative (over-predicting of failure) but still shows that the strong layers above the mine will maintain integrity for a time well beyond the life of the mine.

I'd like to draw your attention to several worrisome points made by Cargill's Senior Mining Engineer in this [2011 letter to DEC](#):

- 1) There is the assumption implicit in the last sentence above that (my informal wording) "As long as the mine doesn't collapse during the life of the mine, we're good." In other words, whatever happens after Cargill has gone back to Minnesota is not Cargill's concern. To our knowledge no Cargill consultant has ever been hired to study whether the integrity of the water in Cayuga Lake will be better protected by keeping the mine voids dry indefinitely, including after the mine is closed.
- 2) In the first Plumeau paragraph inserted above, we see a ready and unexpected admission by Cargill's senior mine engineer at Cayuga Salt Mine that, yes, "the shale below the 4A salt will fail," even if not immediately or at all locations. After subtracting out 10 feet for the thickness of the 5-salt seam, we know that at Corehole 17 there is about 147' ( $2730-2573-10 = 147$ ) of non-halite rock separating the bottom of the 4A Formation from the top of the 6-level salt seam.

A few further comments from CLEAN:

- a. Oddly, Mr. Plumeau did not see fit to spell out what failure of the shale below the 4A salt seam would mean for global mine stability, for the 6-level mine operations beneath, or for the safety of Cargill's miners in the area mined in the previous ten years or in the area then being mined in 2011. What risks would this "yes, it will fail" admission pose? He does not say.
- b. And, in a further oddity, Mr. Plumeau makes the assertion that this sort of failure will not be a problem for future mining under the thin bedrock zone because "[no microseismic events \(indicative of rock fracturing\) are being detected from that horizon.](#)" It's thought that most microseismic events above the mine are being triggered by subsidence related to mining underneath, or nearly under, a given microseismic event. It's not clear to us if Plumeau is reasoning that the absence of microseismic events above an area not yet mined is indicative of future safety once mining is done in that area.
- c. In the second Plumeau paragraph inserted above as blue text, Plumeau accepts the finding of the model that the potential for Bertie Formation failure (which as noted above is the lowest formation within the carbonate beam) "will increase as mining progresses north."

We understand him to dismiss this increasing risk of Bertie Formation failure "as mining progresses north" by saying that such a failure is unlikely to occur during the life of the mine. But, taking him at his word, he is writing that the risk increases "as mining progresses north" and so clearly the increasing risk *is* occurring during the life of the mine.

We will continue to ask the DEC, why is mining being permitted to continue north into the thin bedrock zone of the permitted reserves without as of yet any setbacks from the several of the scour anomalies that exist in this portion of the reserves? And, given the material change in mining technology in the northern reserves from small-yielding technology to large pillar technology, why has no EIS been mandated? If approvals have been given for mining up to Anomaly B without any setback, for example, where are they? Is there accessible documentation that Boyd has concluded that such setbacks are not needed?

Dave Plumeau has accepted in 2011 that the risk of Bertie Formation failure increases “as mining progresses north.” We point out that either mine failure or intentional flooding after the mine is closed may pose an unacceptable risk to the water quality of Cayuga Lake. The recently revealed proposal to allow brine disposal in level 6 of the mine adds to this unacceptable risk, and we urge DEC – in conjunction with Office of General Services – not to stumble into an irreversible flooding of the mine without full evaluation of the consequences. While we look forward to the review process(es) outlined in DEC’s recent Notice of Incomplete Application (NOIA), the adequacy of such review remains to be seen.

A “good hard look” is clearly needed. The renewal of Cargill’s mining permit cannot be treated as an automatic administrative procedure due to Cargill’s stated need to flood the south end of the mine.

Best regards,

*John*

John V. Dennis  
President, CLEAN

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