

2024 ANNUAL REPORT REVIEW

CAYUGA MINE, CARGILL, INC.

Seneca and Tompkins Counties, New York

Prepared For

**NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION**

By

John T. Boyd Company

Mining and Geological Consultants

Pittsburgh, Pennsylvania, USA



Report No. 2499.008

JUNE 2025



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June 11, 2025
File: 2499.008

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Attention: Mr. Matthew Podniesinski
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Subject: 2024 Annual Report Review
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Seneca and Tompkins Counties, New York

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At the request of the New York State Department of Environmental Conservation (NYSDEC), Dr. Keith A. Heasley, Executive Consultant – Geotechnical, of John T. Boyd Company (BOYD) reviewed the Annual Report for the Cayuga Mine signed by Zoe Scopa. The signed report¹ file, was received by Thomas Rigley, NYSDEC via email on January 30, 2025. Supporting data were received by BOYD in January 2025 via a secured shared internet drive.

On February 15, 2006, Mr. Steven M. Potter, then the Director, Bureau of Resource Management & Development, NYSDEC, requested that BOYD review all documents, digital data, and annual reports received by BOYD starting with the 2006 Annual Report.

¹ Scopa, Zoe, 2025, Annual Report for Mine File #709-3-29-0052; Cayuga Salt Mine, Permit ID#0-9999-00075-00001, Towns of Lansing and Ulysses, County of Tompkins, Town of Covert, County of Seneca, File: Cargill MLRP annual report Jan - Dec 2024 Permit ID#0-9999-00075-00001.pdf.docx, Cargill Salt

The received documents were reviewed for their adherence to conditions of the revised Permit². Condition 16 of the permit notes, "Consultant Services - Cargill is responsible for retaining and funding Consultant Services to be provided by a qualified, independent mining engineering geotechnical consultant." BOYD is providing the Consulting Services for this annual review.

Discussion of Annual Report

The Permit has several conditions that affect the Annual Report and its review including:

Condition 9

Condition 9 of the Permit notes, "Frontenac Point Anomaly - No mining shall occur under the Frontenac Point Anomaly. No mining or mining activities shall be conducted within 1000 feet of the Frontenac Point Anomaly."

Condition 10

Condition 10 of the Permit notes, "Further Investigations - Cargill shall conduct further investigations and report on the adequacy of the thin rock overburden at the northern extent of the mineral lease area where the solid rock overburden becomes thinner where the glacial till and lake sediments thicken and lake depth increases. Additionally, further investigation and reporting shall be conducted for areas identified as anomalies A and B (and any other anomalous areas identified through additional investigations) if Cargill proposes to mine under these areas, or up to these areas without an established standoff. The aforementioned conditions must be thoroughly analyzed for stability by Cargill and reviewed by the Department before mining proceeds in these areas."

Past and current discussion points regarding Conditions 9 and 10 follow:

- Based upon the additional seismic survey and consultant reports, Cargill will maintain the planned 1,000 ft setback around the Frontenac Point Anomaly.
- The required additional investigations and reports have been performed for Anomaly C. Further, undermining of Anomaly C was completed from June, 2018 through July 2019 using a large pillar configuration rather than the more yielding production pillar previously used at the Cayuga Mine³. The undermining of the C Anomaly "did not present any indications of geologic or geotechnical concerns

² New York State Department of Environmental Conservation, 2021, Permit, Under the Environmental Conservation Law," permit Issued to: Cargill Incorporated, for facility: Cayuga Salt Mine, DEC ID 0-9999-00075, effective date with modifications February 12, 2021, expiration date April 23, 2024, Permit Administrator Elizabeth A. Tracy, February 12.

³ Scopa, Zoe, 2023, Cayuga Mine – Further Investigation of Reserves under A and B Scour Zones. Memorandum to Keith Heasley, John T. Boyd Company, August 25.

associated with potential scouring of overlying rock mass,” and the C Anomaly exploration borehole “has shown no evidence of water or gas or dissolution since it was completed in 2017.”

- Cargill has agreed that no additional mining will occur under Anomaly E and no mining will occur under Anomaly D and the Frontenac Point Anomaly. Additional investigations and reports will need to be undertaken for Anomalies A and B.
- in 2023, a report was prepared⁴ and presented⁵ on the reprocessing and associated reinterpretation of the seismic data from 14 historic, 2-D seismic lines above the Cayuga Mine. After reviewing the seismic reprocessing and reinterpretation, BOYD agreed⁶: “(1) with Cargill’s acceptance of the 4C Exploration, Ltd reprocessing and reinterpretation of the historic seismic data as the most extensive, accurate (and realistic) representation of the Cayuga Lake-bottom glacial scours, (2) that the Onondaga carbonate beam is only slightly scoured (less than 20 ft) and retains a substantial thickness (more than 400 ft) for mining to occur 1,000 ft below, and (3) that Cargill has provided sufficient affirmative “further investigation” to comply with Permit Special Conditions 10 (formerly 9B) and that mining can proceed under the B and A scours.”

Condition 17.a

Condition 17.a requires “For each year the mine is in operation, Cargill shall submit to the Department an Annual Report. The report shall be due on or before each anniversary date of the issuance of the permit.”

Condition 17.a.(1)

Condition 17.a.(1) requires “Certification signed by the Cargill Lansing Mine Manager that all mining related activities, to the best of his knowledge, conducted during the reporting year were in conformance with this permit and the approved plans, or that variances have been reported and managed.”

- A certification was included on Page 2 and the certification was signed by Mr. Shawn G. Wilczynski, Mine Manager, on January 30, 2025. This certification notes “that all mining activities, to the best of my knowledge, conducted during the reporting period from January 1st of 2024 through December 31st of 2024 were in conformance with the DEC Permit # 0-9999-00075/00001 and the approved plans. No variances occurred and none were reported.”

⁴ 4C Exploration Ltd, 2023b, 2D Seismic Depth Imaging Results Lansing Salt Mine, Cayuga County, NY, March 2023.

⁵ 4C Exploration Ltd, 2023a, The Use of Depth Migration to Improve Seismic Imaging at Lansing Salt Mine, Cayuga County, NY, PowerPoint presentation, Cargill Salt, July 11.

⁶ BOYD, 2023, Seismic Reprocessing of Anomalies A and B Cayuga Mine, Cargill, Inc., October 20.

Condition 17.a.(2)

Condition 17.a.(2) requires “A summary of non-routine mining incidents as defined in Special Condition 19 of this permit and any action taken by Cargill in response thereto or resolution thereof.” And Special Condition 19 states regarding Non-Routine Incidents - “Cargill shall immediately notify the Department's Region 7 Mined Land Reclamation Specialist of any non-routine mining incidents both surface and subsurface associated with activities related to this permit. Non-routine mining incidents shall mean incidents during mining, processing, or other mine related activities that may adversely affect mine stability, ground and surface water and other natural resources, or the health, safety, welfare or property of the general public. The Department shall require Cargill to record any data the Department believes may be of future value for adequate evaluation of a non-routine mining incident.”

On Page 2 of the Annual Report, it is noted “The Cayuga Mine is not aware of any non-routine incidents associated with the mining, processing, or other mine related activities that would have adversely affected any of the following:

- Mine stability
- Ground and surface water
- Natural resources
- Health, safety, welfare or property of the general public.”

Condition 17.a.(3)

Condition 17.a.(3) requires: “An updated Mining Plan Map depicting the current extent of mining activities, and the proposed advancement of the working faces for the subsequent three years.”

Included with the Annual Report on the last page was a map depicting the recent northern workings of the Cargill Mine, the planned mining for the next three fiscal years, the shorelines of Cayuga Lake, and the Frontenac Point, A and B anomalies.

The Annual Report notes “The Cayuga Mine is currently operating in the northern region of the mine. Active mining is located in panels U-78S1, U78S2, U-84, and U-88.”

The following maps were included in the data available to BOYD and support this report:

- “Basemap.dwg”, Last modified 01/23/25, contains the latest pillar plan for the mine.
- “2024 Royalty Map.dwg”, Last Modified 01/23/25, Contains the monthly face advances from 1987 through 2024.

- “Cayuga Mine 6 Level Map Dec 2024.dwg”, Last modified 01/23/25, contains the routes of the primary and secondary escapeways along with the primary ventilation routes and controls.
- “Convergence Stations and YieldPoint Map.pdf”, Last Modified 01/24/25, contains the convergence and extensometer stations’ locations.
- UG with subsidence stations.dwg”, Last Modified 05/22/25, contains the locations of the surface subsidence stations in relation to the underground mine.

Condition 17.a.(4)

Condition 17.a.(4) requires “The summary of in situ measurements of rock mechanics required by Special Condition 18.b. of this permit.” Special Condition 18.b. states: “In situ measurements of rock mechanics shall be collected in accordance with the approved Mined Land Use Plan. A summary of the data collected shall be submitted to the Department as part of the Annual Report. Exceptions to anticipated trends in rock behavior shall be noted and explained to the Department after these data are collected and exceptions to the anticipated behavior are identified. If closure rates are higher than anticipated, Cargill shall increase the frequency of measurement in the affected area and submit for review and approved by the Department a plan and implementation schedule for corrective action.”

Closure Measurements

On Page 2 of the Annual Report, Cargill noted, “Currently, there are over 300 convergence stations being monitored.” And “Evaluations of the convergence data indicate that overall, no unusual trends have been identified and the mine is behaving as expected, and there are no local or global stability concerns.”

Cargill provided closure data, including raw and processed data, graphs, and, on occasion, explanations of any inconsistencies and anomalous readings, including reasons for abandonment, along with observations in the vicinity of the instrument, in Excel spreadsheets. The location of closure stations and extensometers was shown on the following map:

- “Convergence Stations and YieldPoint Map.dwg”, Last Modified 01/24/25, contains the convergence and extensometer stations’ locations.

Closure measurements can be evaluated to indicate possible instability in three ways:

1. By studying the graphs of the rate of closure over time. The shape of these graphs indicates areas of instability, areas of concern, and areas of stability. Mr. Petersen of Rocktec Solutions (Cargill geotechnical consultant) has evaluated the closure in this manner in the past.

2. By establishing trigger values for total closure. This method is applicable in harder, less viscous rock, but is not applicable for the Cayuga Mine, as stable closure in salt will continue until the openings are closed.
3. By establishing trigger values for long-term closure rates. Since this is not being completed by the other investigators, BOYD applied such trigger rates in its evaluation of the closure readings.

All of the 350+ convergence stations (both manual and the electronically-read YieldPoint system) that were monitored within the last few years were scrutinized for total convergence, convergence rate, and trends; and the 23 stations with the highest convergence rates for the most recent reading are listed in Table 1. After analyzing the location, time since installation, total measured closure, closure rate and closure trends, BOYD determined that the closure stations listed in Table 1 (as in the previous annual report review) could be divided into 5 groups of stations with similar locations, characteristics and explanations.

Table 1: Stations with the highest closure rates

Station	Closure Rate (in./year)	Time Since Installation (days)	Total Measured Closure (in)	Group	Notes
U40B Pin #14	0.765	8,532	32.203	2	Steady Decreasing, but Last 2 Reading Rising
U12 Pin #32	0.757	12,727	26.829	3	Highly Variable, Short Interval, Rising Over year
U12 Pin #107	0.730	8,229	13.211	3	Highly Variable, Short Interval, Rising Over year
W1 Pin #04	0.682	14,910	24.610	4	High, but Steady Convergence
U40B Pin #08	0.680	8,672	33.528	2	Steady to Decreasing
NW3 Pin #71	0.635	1,870	7.864	1	Installed 3/19, High Initial Rate, Rapidly Decreasing
U40B Pin #08-YP	0.583			2	
U86 Pin #02	0.567	325	1.139	1	Installed 3/23, High Initial Rate, Rapidly Decreasing
U40B Pin #14-YP	0.538			2	
U12 Pin #108E-YP	0.535			3	
U12 Pin #28E-YP	0.507			3	
U12 Pin #107E-YP	0.501			3	
U12 Pin #40	0.429	12,607	18.228	3	Highly Variable, Short Interval, Rising Over year
U40B Pin #20	0.418	8,357	18.591	2	Steady Decreasing, but Last 2 Reading Rising
NW2 Pin #50	0.416	6,960	19.862	5	Steady Decreasing
U40B Pin #02-YP	0.399			2	
U12 Pin #106E-YP	0.390			3	
NW2 Pin #44-YP	0.386			5	
U40B Pin #02	0.365	8,783	25.071	2	Steady Decreasing
W1 Pin #27	0.356	14,707	21.807	4	Steady to Decreasing
U12 Pin #90E-YP	0.337			3	
U40 Pin #08	0.335	9,098	25.253	2	Steady to Decreasing
U56 Pin #02-YP	0.330			5	

Note: the stations numbers followed by the “YP” were read electronically by the YieldPoint system. Total measured closure was not readily available from these stations, and the closure rates are averaged over the year.

1. Group 1 are the convergence stations that are located near the recent active mining which has occurred in panels U78, U80, U82, U84, U86, and U88. This group of stations are located in the outby end of the sections or in the Northwest 3 (NW3) mains from which the active sections were driven. The areas surrounding all of these convergence stations were recently mined and are still undergoing the relatively quick initial closure after initial mining. Further, all of these stations are still being affected by additional yielding and stresses from the nearby active sections. Since the locations of these convergence stations were recently mined, the total measured closures are small (1 to 9 in.), and since active mining has moved more distant, the closure rates are all decreasing.
2. The Group 2 convergence stations are all located in or around panel U40B. It appears that panel U40B was originally driven as a yield-pillar production panel around 400–500 ft wide. Then, non-typically, other 400–500 ft wide yield-pillar production panels (U42, U44E, and U46E) were driven directly from U40B. This is in contrast to a sub-main such as E1, NW1, NW2, and NW3, which are typically 270–350 ft wide, from which the typical 400–500 ft wide yield-pillar production panel has traditionally been driven. This development scenario has caused a number of relatively wide yield-pillar extraction areas where the production panels intersect along U40B, and these wide panel intersections are monitored by convergence stations U40B #2, U40B #8, U40B #14, and U40B #20, all of which show significant total closure (18 to 33 in.) and relatively high closure rates. However, the closure rates for the U40B stations have been fairly steady and generally decreasing for the last 20 years and are consistent with a stable viscous closure of the area as would be expected.
3. The Group 3 convergence stations are all located in a zone of concentrated high closure rate in panel U12, which has experienced anomalous mine closure rates since 2018. The U12 panel was originally driven in 1998, and it is slightly wider (475 to 575 ft) than most of the more recent (400-500 ft wide) yield-pillar panels. Because of their age and elevated closure rate, all of the Group 3 convergence stations have significant total closure (13–26 in.) and relatively high closure rates. However, similar to panel U40B, the closure rates for the U12 stations have been fairly steady and generally decreasing (with a noted seasonal variation) for the last 20 years. A number of the convergence stations with higher closure rates have slightly increased in the last year. This may be seasonal or noise in the system, but should be re-examined in the future.
4. The Group 4 convergence stations are five stations in two groups with elevated convergence readings. Station W1 #4 and W1 #27 are located in the first entries of the mine. W1 #4 is located in the original bottom area of the mine and was installed 40 years ago. It does have a relatively high rate of closure 0.67–0.70 in./year and has closed a considerable amount (26.8 in.) since the original installation. However, the closure rate has been fairly constant for the last 20–30 years and the entry appears to be in a stable closure mode as would be expected for a viscous salt mine entry. Similarly, W1 #27 has a high rate of closure, 0.35 in./year; however, the closure rate has been fairly constant to decreasing for the last 20–30 years.

5. The Group 5 convergence stations, NW2 #44, NW2 #50, and U56 #2, are all located in the same general area near the western end of NW2. Analysis of the closure and closure rates for these three stations and other surrounding stations, shows a trend of generally steady or decreasing closure rate (with some variation) for many years. The slightly higher closure rate in this location is not alarming, but should be studied to be verified as natural variation with succeeding closure rate measurements.

Closure rate data are significant because they offer insight into the collapses and the inundation of the Retsof Mine. Sustained closure rates of 15 in./year or less were measured in stable areas of the Retsof Mine, while in the failure areas, closure was regularly measured with sustained rates over 230 in./year, with onset of failure around 600 in./year. Although Retsof and Cayuga mines have different overburden and material properties, in the general sense, a comparison seems warranted for a relative indicator of stability. In comparison, the highest closure rate reported in this annual report was 0.765 in./year for the closure station U40B #14. This rate is 5.1% of the Retsof Mine stable area sustained rate and 0.13% for Retsof Mine's onset of failure rate.

Extensometer Measurements

Cargill, in addressing their extensometer program, included a statement in the Annual Report on Page 2, Section 17.a.(4) that "Roof sag and wall expansion, measured with extensometers, is also monitored as conditions warrant, and is reviewed internally and externally as well. This data indicates the mine is behaving as expected."

BOYD was provided with data from 41 extensometers, all of which were multiple-point extensometers, and all of them were electronically read on the YieldPoint system. This year, the extensometer data were more complete, with the dilation rate for all of the anchors and the total gage length being reported. The location of the extensometers can be divided into 10 areas, 5 old and 5 new. The old areas include (26 total extensometers): the Surge Bin in 4-level, the belt area near the bottom of No. 1 Slope, the belt area near the bottom of No. 2 Slope, the neck of Panel U12, and the shop in U81. The new instrumented areas include (15 total extensometers): the Z3 intersection area in U62, the Screening Plant, 4 Shaft, 4-Level Lake, and U80.

- The Surge Bin area of 4-level has 11 electronically-read extensometers on the YieldPoint system. The largest dilation rate reading reported in this area was in the first 4 ft. of the roof at extensometer #3 in the center of the entry directly over the surge bin with a dilation rate of 0.191 in./yr (a strain rate of 3.8×10^{-3} -/yr).
- In the belt entry near the bottom of the No. 1 Slope, there are 3 triple-point extensometers with anchors at 5, 10, and 15 ft that are electronically read by the YieldPoint system. The largest strain reading in this area for the year was at

extensometer #2 between the roof and the 5 ft anchor with a dilation rate of 0.172 in./yr (a strain rate of 2.9×10^{-3} -/yr).

- In the belt entry near the bottom of the No. 2 Slope, there are 7 triple-point extensometers: 5 with anchors at 5, 10, and 15 ft and 2 with anchors at 4.25, 9.5, and 19.3 ft. All 7 extensometers are electronically read by the YieldPoint system. The largest strain rate reading in this area for the year was at extensometer #2 (in the intersection) with a dilation rate of 0.144 in./yr (a strain rate of 2.4×10^{-3} -/yr).
- There is one extensometer in the center of intersection A-7 in Panel U12. This extensometer shows a very low dilation rate of 0.009 in./yr (a strain rate of 0.251×10^{-3} -/yr) between 6 and 9 ft into the roof.
- In the shop area in panel U81 near the active panels, there are 3 triple-point extensometers with anchors at 5, 10, and 15 ft that are electronically read by the YieldPoint system. The largest dilation reading in this area for the year was between the 5 and 10 ft anchor at extensometer #2 with a peak dilation rate of 0.010 in./yr. (a strain rate of 0.016×10^{-3} -/yr).
- In 2024, there are 3 new triple-point extensometers in U62 around the Z3 intersection with anchors at 5, 10, and 15 ft. The largest dilation reading in this area for the year was between the 10 and 15 ft anchor at extensometer #2 with a peak dilation rate of 0.017 in./yr (a strain rate of 0.028×10^{-3} -/yr).
- There are 4 new triple-point extensometers with anchors at 3, 8, and 13 ft in the area of the screening plant. The largest dilation reading in this area for the year was between the roof and the 3 ft anchor at extensometer #4, with a peak dilation rate of 0.036 in./yr (a strain rate of 1.00×10^{-3} -/yr).
- There are 2 new triple-point extensometers with anchors at 4, 9, and 18 ft in the 4-Shaft area. These extensometers only have a few readings, which are small and highly variable.
- There are 2 new triple-point extensometers with anchors at 3, 8, and 13 ft at the 4-Level Lake area. The largest dilation reading in this area for the year was between the 3 and 8 ft anchor at extensometer #2 with a peak dilation rate of 0.128 in./yr (a strain rate of 2.13×10^{-3} -/yr).
- Finally, there are 4 new triple-point extensometers with anchors at 3, 5, and 9 ft and installed along the length of the U80 Panel. The largest dilation reading in this area for the year was between the 3 and 5 ft anchor at extensometer #3 with a dilation rate of 0.065 in./yr (a strain rate of 2.70×10^{-3} -/yr).

Like previous reviews, BOYD evaluated the rate measured as strain per year. Using RESPEC's 1995 Cargill salts values:

Dilation Limit	$J_2^{0.5}/I_1 = 0.36$
Creep Rate	$\dot{\epsilon}^c = 8.3 \times 10^{-30}(\Delta\sigma)^{5.9}$

BOYD assessed the stress state to estimate that a strain rate greater than 8×10^{-3} (-/yr) is needed for destructive dilation. The highest calculated strain rate from the 31 extensometers reported by Cargill was 3.8×10^{-3} -/yr which is less than half of the limit of destructive dilation at Retsof. Also, this year, with all of the bays in the extensometers being measured, there is greater chance for a high strain rate in a given “short” bay, but all of the measured strain rates are within sustainable dilation rates.

Micro-seismic Measurements

The 2024 Annual Report Data included seismic reports by ESG Solutions.

Cargill notes in the annual report that “The Cayuga Mine operates a micro-seismic monitoring network which now has over 120 geophones and covers over 6 square miles of mine workings. Microseismic monitoring is continuous and the data from this system is reviewed internally by the engineering department and externally by Engineering Seismology Group (ESG) and RESPEC. This data indicates the mine is behaving as expected and global stability continues to be maintained.”

ESG Solutions prepared eight reports that cover the micro-seismicity from 2024⁷. The first five reports were monthly for January through May, then the final three reports were for three-month periods, June-August, September-November, and December-February, 2025. The reports were titled, “Seismic Data Processing Results and Health Analysis Report for Cayuga Monitoring System,” and covered the eight reporting periods listed above.

The micro-seismic system allows examining inside the rock mass around the mine for strata cracking, movement, and associated stress redistribution. With the steady convergence of the entries in the salt mine, one would expect to see continuous micro-seismic activity around the mine. The higher the convergence rate, a corresponding higher level of micro-seismic activity would be expected.

All eight of the seismic data processing reports from 2024 were reviewed. As expected, the previously extracted areas of the mine show steady micro-seismic activity. In particular, clustering of micro-seismic events is seen over:

- The main NW1 between panels U30 to U38
- U40B and the middle of southern panels U32 to U38
- The middle of the southern panels U46 to U62
- The southern end of panels U72 to U76

⁷ ESG Solutions, 2024, Seismic Data Processing Results and Health Analysis Report for Cayuga Monitoring System, 8 reporting periods, ESG Solutions, Kingston, ON, CA.

- The outby half of panel U12
- The eastern ends of panels E3 to E9

Areas where the mine demonstrated higher rates of convergence (such as U40B and U12) exhibit clustering of events. Also, it is important to note that there are fewer seismic events over the newer, larger pillar panels. Large localized increases in event activity or magnitude, which might indicate unstable convergence or potential failure, were not observed at any location.

Condition 17.a.(5)

Condition 17.a.(5) requires “The summary of subsidence monitoring data required by Special Condition 18.a. of this permit.” Special Condition 18.a. states, “Subsidence monitoring shall be conducted in accordance with the approved subsidence monitoring plan contained in the approved Mined Land Use Plan. Summaries of data collected shall be submitted to the Department as part of the Annual Report. Exceptions to anticipated trends shall be noted and explained to the Department after the data are collected and exceptions to anticipated behavior are established.”

Discussions at a June 16, 2022, meeting among Cargill, BOYD, and the NYSDEC addressed the LiDAR reporting. LiDAR represents an advance over land surveys as the LiDAR extensive coverage is over an area as opposed to just at limited points along established survey lines. The data points tend to be at a greater density. Such an advance in subsidence monitoring was embraced by the meeting attendees, who agreed on the following suggested changes to Condition 17.a.(5):

- A LiDAR survey will be completed every two years of mine affected land, including land survey of control points. Suggested reporting requirements are:
 - An AutoCAD map contoured (color coded) for total movement since the initial LiDAR survey.
 - An AutoCAD map contoured (color coded) for rate movement over the last two-year period.
 - A spreadsheet showing control point survey results, and
 - Text discussing the results.
- The agreed upon survey interval will be revisited at the next annual meeting.

Cargill included a statement in the Annual Report, Page 2, that “Surface subsidence measurements continue to be performed in accordance with the Mined Land Use Plan. A baseline LiDAR survey of (subsidence) was completed in November 2021 and a repeat survey was completed in December 2023 to monitor global ground subsidence

changes. The results of this survey were reviewed internally and by third-party consultants, including BOYD, and while there were no abnormal findings, it was determined that the two-year period between surveys was too short for the historically low subsidence rates associated with the Cayuga Mine to detect trends of significant movement. Cargill has engaged a third-party firm to perform a traditional ground survey measuring elevation changes throughout the surface area of influence for higher precision measurement. This survey is in progress and results will be made available to BOYD upon receipt.”

BOYD received the Cargill LiDAR Subsidence report on March 20, 2024⁸, and reviewed and commented on the report in the 2023 Annual Report Review⁹. BOYD reported that: “With the small amount of potential subsidence expected within 2 years ($<<1.0$ in.), and the accuracy of the LiDAR survey (± 2 in.), it is not expected to be able to discern any subsidence from the 2-year LiDAR subsidence difference, and indeed there is no strong areal trend evident in the final report figures.”

It was discussed that: “Any surface subsidence derived from the closure in the mine would be expected to produce a very broad (hundreds of feet) subsidence trough. Given the scatter in the LiDAR point data..., it is difficult to see any broad-area trends.” BOYD has been in on-going discussions with Cargill engineers regarding how best to display any future LiDAR subsidence data in order to highlight broad-area trends as would be expected with any potential subsidence at Cayuga Mine.

In March, 2025, BOYD received a table of the most recent land subsidence survey data (“2025 CTM Surface Subsidence Survey.pdf”). This base data was further supported by an AutoCAD drawing of the survey stations (“UG with subsidence stations.dwg”) and a spreadsheet of the survey data (“Subsidence Data – 2025.xlsx”) received in May, 2025.

⁸ Wingfield Scale and Measure Company, 2024, “Cargill – Cayuga Mine Aerial Lidar Subsidence Survey 2 – 2023”, Dec2023-Cargill-Cayuga-SubsidenceSurvey-U3.pdf, March 20.

⁹ Heasley, Keith A. and Ronald L. Lewis, 2024, “2023 Annual Report Review Cayuga Mine, Cargill, Inc., Seneca and Tompkins Counties, New York, Report 2499.008, July.

In this subsidence data, over 250 stations were surveyed in 2024/2025. All of the data from these stations was reviewed, and two plots were made to better visualize the nature of the measured subsidence. These plots are presented below as Figures 1 and 2.

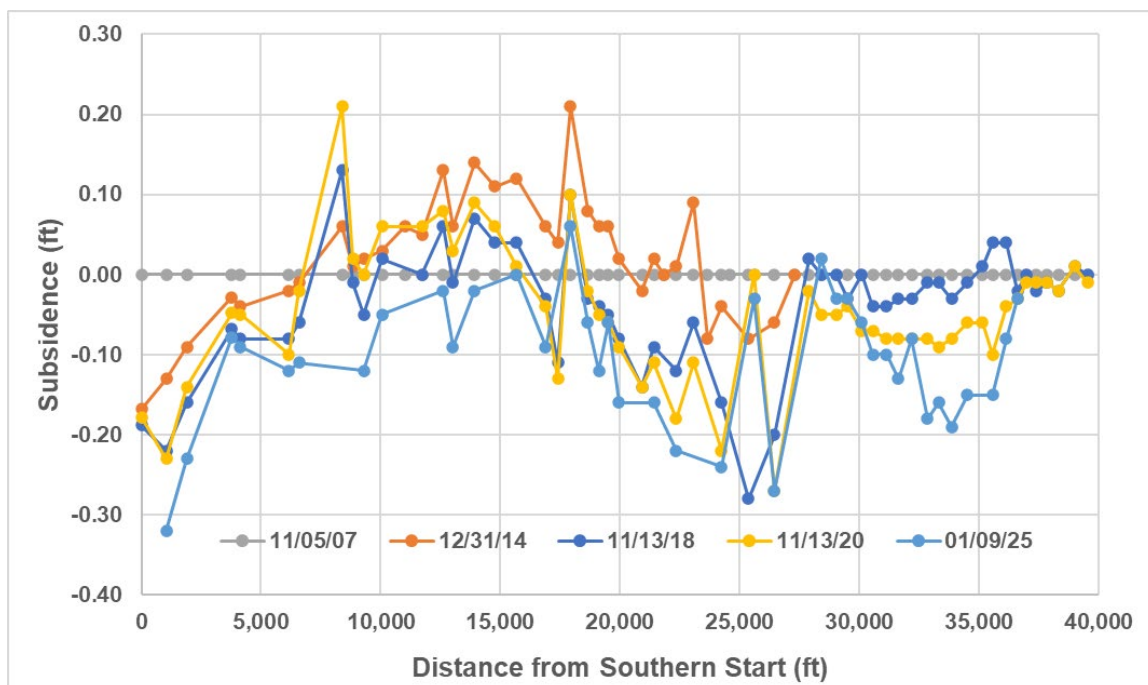


Figure 1. Cayuga Lake - East Shore Subsidence, Stations N175 - E-Ext272.

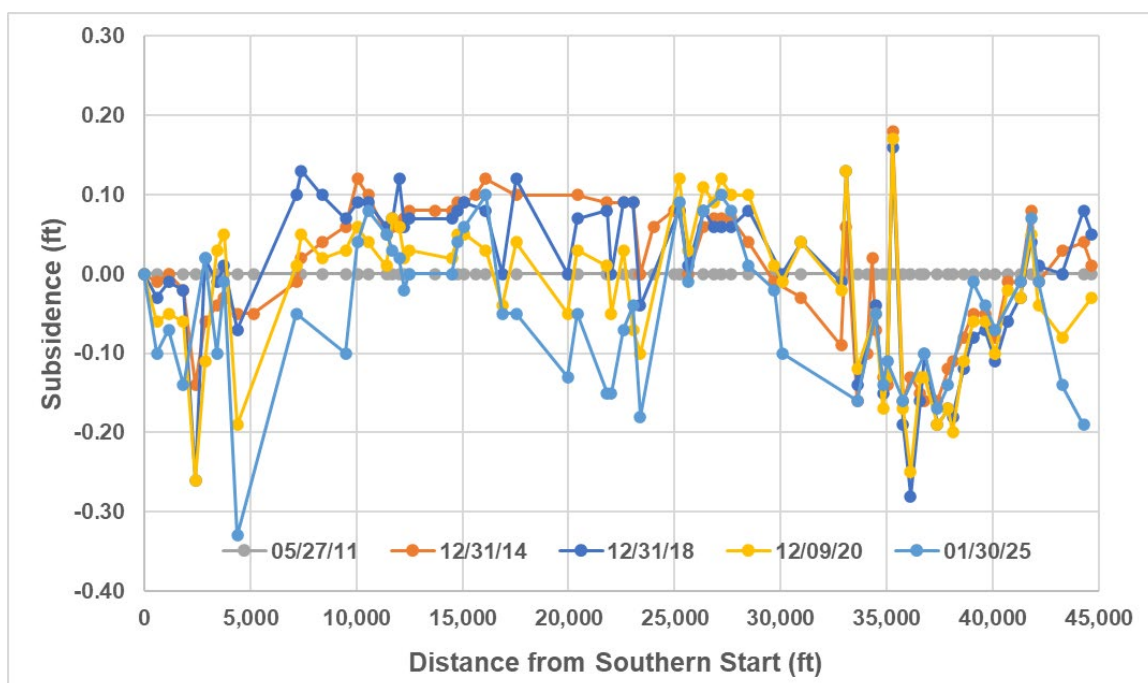


Figure 2. Cayuga Lake - West Shore Subsidence, Stations W132-77 & W380-411.

These Figures show the subsidence along a line of monitoring stations that extend south to north along each side of the lake, adjacent to the mine. These subsidence measurements were made over the 19-year period between May, 2007 and January, 2025

For Figure 1 on the east side of the lake:

- The main entries of W1 cross under the subsidence line at 170 ft along the line.
- The inby end of panels U25 to U45 run from 8,400 ft to 17,000 ft along the line. This area was mined between January 1991 and January 2002.
- The inby end of panels U49 to U65A run from 18,000 ft to 25,400 ft along the line. This area was mined between January 2004 and January 2012.
- The main entries NW3 and panels U71 to U94 run from 26,500 ft to 36,600 ft along the line. This area was mined between January 2013 and January 2019.

For Figure 2 on the west side of the lake:

- The main entries S3 and panels E3 to E9 run from 1,500 ft to 10,500 ft along the line. This area was mined before 1987.
- The U12 panel crosses under the subsidence line at 12,250 ft along the line.
- The inby end of panels U24 to U42 run from 20,000 ft to 28,500 ft along the line, but are somewhat distant from the lines. This area was mined between January 1992 and January 2002.
- The inby end of panels U54 to U62 run from 31,000 ft to 37,000 ft along the line. This area was mined between January 2008 and January 2013.
- The inby end of panels U78 to U80 run from 42,500 ft to 45,000 ft along the line, and the end of these panels were mined in 2024 and 2025.

Both Figures 1 and 2 show that the ground movements are relatively small, with the maximum subsidence slightly over 0.3 ft or about 4 in. Many of the measurements are less than 0.1 ft or about 1 in. Also, there is scatter in the measurements. Many of the measurements show uplift rather than subsidence, although many of the points that initially moved up, subsequently moved down over time. Also, very few of the subsidence measurements were actually over the mining, which is predominantly under the lake, and the subsidence monitoring points are adjacent to the lake (and mining) along the eastern and western shore.

However, even with all of the confounding aspects of the subsidence measurements, there does appear to be some observable subsidence movements that were reasonably

documented in the measurements. In Figure 1, between the distances of 18,000 ft to 25,400 ft, the mining of panels U49 to U65A appears to show a subsidence trough of about 0.30 ft. Similarly, just past the U49 to U65A panels between the distances of 26,500 ft to 36,600 ft, the main NW3 entries and panels U71 to U94 (mined from 1/13 to 1/19) have created a well-defined subsidence trough down to -0.20 ft.

In Figure 2, the U24 to U42 panels mined in the 90s appear to produce some subsidence (up to 0.18 ft) between the distances of 20,000 ft to 28,500 ft. This subsidence is especially noticeable toward the higher distances (to the north) where the subsidence stations get closer to the end of the panels. The next block of panels, U54 to U62, that were mined between 2008 and 2013 and running from distances of 31,000 ft to 37,000 ft show a developing trough with up to 0.20 ft to 0.30 ft of subsidence. The final block of panels that is presently being mined, U78 to U80, extends from distances of 42,500 to 45,000 and appears to show the beginning a subsidence trough in the most recent measurements.

The magnitude and location of the subsidence measurements presented in Figures 1 and 2, are consistent with points at the edge of subsidence troughs centered over the production panels which are under the lake. Further, the slow steady increase in the subsidence is consistent with stable closure of the underlying panels.

Condition 17.a.(6)

Condition 17.a.(6) requires “Information regarding the source and volume of any water inflow into the mine, and the disposition of such water.”

Page 3 of the Annual Report notes that: “The Cayuga Mine does not have any uncontrolled inflows or leaks.” The report notes that “all inflows are near or fully saturated, sodium chloride dominant salt brine.” “These inflows are directed to a settling pond located on the 4-level of the mine. The brine is then pumped from the settling pond to abandoned areas of the mine as well as active areas of the mine for dust control. A Mining Permit Modification Application was submitted to the DEC on June 30th, 2023 for the purpose of transitioning the brine storage to the abandoned S3 mains and adjacent panels.” This permit modification application is still being evaluated by the NYSDEC.

Cargill lists the following water flows in the Annual Report:

- #1 Production Shaft – 33 gallons per minute (gpm)
- #2 Ventilation Shaft – Less than 1 gpm
- #3 and #4 Service Shafts – Seasonal flow 1-2 gpm
- ED Plant Concentrate discharge – Less than 1 gpm

- Unit 12 cased boreholes – 2-3 gpm
- Total Water Inflow = 38 gpm

Cargill also states that: “The Cayuga Mine maintains cased boreholes in Unit 12. Brine chemistry, isotopic characterization, and low hydrostatic pressures of the fully saturated brine from these boreholes support the conclusion that this fluid was trapped at the time of salt deposition. Helium isotope age dates of the fluid put it at >3 million years old, which is consistent with the likelihood that it is Silurian aged (~400 million years old). The details of this characterization have been provided to BOYD.”

The letter¹⁰ from Alpha (Alpha) Geoscience that analyzed the brine inflow in U12 was reviewed. In the letter, Alpha concluded that geochemical evidence shows:

- “The fluid is a fully saturated multi-chloride brine and has remained fully saturated over time during depressurization flow from the boreholes.
- The ionic chemistry has been stable and consistent over time during depressurization flow.
- Isotopic geochemistry of the fluid is inconsistent with water from Cayuga Lake:
 - ¹⁸O and ²H isotopic data indicate that the fluid is a “basinal brine” that was trapped in the formation during the deposition of the evaporite sequence during the Silurian (~400 million years ago).
 - Carbon isotope data is consistent with a deep, thermogenic origin of the trace amounts of dissolved methane. The significance of this is that there is no recent biogenic signature.
 - Helium isotope age dates of the fluid put it at >3 million years old, which is consistent with the likelihood that it is Silurian aged (~400 million years old).”

And that hydrogeologic evidence shows that:

- “The hydrostatic pressure of Cayuga lake level at the mine level would be ~958 psi, assuming a fresh water head.
- The fluid pressure range in the horizons above the mine is less than half of the hydrostatic pressure that would be exerted by Cayuga Lake if the lake was the source.
- Successful depressurization of the fluid horizons by pressure relief wells shows that there is a hydrologic limit to the pressure source.
 - During depressurization flow from the relief wells, the fluid pressure as well as the fluid flow rate drops off rapidly. This is indicative of a hydraulically limited source.
 - Localized areas have been completely depressurized with no subsequent recharge.”

¹⁰ Alpha Geosciences, 2024, “U12 Panel Fluid Source,” December, 2 p.

Essentially, all aspects of the geochemical and hydrogeological evidence indicate that the brine inflows in U12 are from water that was trapped within the formations since deposition and that there is no hydraulic connection to the surface. BOYD agrees with Alpha's interpretation of the geochemical and hydrogeologic evidence from the boreholes in panel U12.

Condition 17.a.(7)

Condition 17.a.(7) requires "A summary of all other monitoring data required under the terms of this permit or Department SPDES permit issued to Cargill."

Discussions on December 2, 2021, limited SPDES data given to BOYD to a summary type.

Page 3 of the Annual Report notes that "During Calendar year 2024 Cargill experienced one exceedance. For the month of September outfall 012 chloride results from a sample were 7,120 mg/l vs a permit limit of 5,000 mg/l. NYSDEC was verbally notified of the exceedance on 10/21/24. A Non-compliance event form was submitted with the discharge monitoring reports to the NYSDEC via NetDMR in October. Follow-up sampling on 10/15/24 showed chlorides were well-under the SPDES permit limit as of 11/15/24 (4,250 mg/L). Also, sampling on 10/30/24 showed chlorides were well-under the SPDES permit limit as well (151 mg/L)."

Condition 17.b

Condition 17.b requires "Upon transmittal or receipt, Cargill shall submit to the Department copies of all correspondence with the Mine Safety and Health Administration involving non-routine mining incidents as described below."

Cargill notes on Page 3 of the Annual Report, "The Cayuga Mine has not received any citations or correspondence from MSHA regarding non-routine mining incidents as identified in section 19 of the mine's MLRP."

Condition 17.c

Condition 17.c requires "Prior to undertaking any material change in the approved mining methods or techniques described in the documents listed in Special Conditions #3 & 4, Cargill shall submit to the Department a description of such modification in accordance with all applicable laws including the Uniform Procedures Act and State Environmental Quality Review Act."

Cargill notes on Page 3 of the Annual Report, "The mining methods used at the Cayuga Mine have not been changed in the last year."

Condition 17.d

Condition 17.d requires “Cargill must maintain a written record, and make it available to the Department upon request, of all written citizen complaints received by Cargill and any responses by Cargill thereto.”

Cargill notes on Page 3 of the Annual Report, “Cargill maintains a written record of citizen complaints that is available to the Department upon request.”

During 2024, Cargill’s application to modify the Mined Land Reclamation Permit (MLRP) dated June 30, 2023¹¹, to allow disposal in salt brine in Panel S3 was still actively in the review process, and in particular, numerous public comments had been received on the permit modification application during 2024. In response to the public comments, Cargill submitted a letter to NYSDEC dated April 3, 2025, containing a summary of the company’s responses¹². The comments and associated responses are numerous and extensive, and cover 36 pages of the letter. To best address these comments and not overload the annual report review with the discussion on the S3 sump, BOYD has decided to include the discussion of the comments and responses in a separate report to be finalized after submittal of this annual report review.

Condition 18.a

Condition 18.a requires “Subsidence monitoring shall be conducted in accordance with the approved subsidence monitoring plan contained in the approved Mined Land Use Plan. Summaries of data collected shall be submitted to the Department as part of the Annual Report. Exceptions to anticipated trends shall be noted and explained to the Department after the data are collected and exceptions to anticipated behavior are established.”

Condition 18.b

And Condition 18.b requires “In situ measurements of rock mechanics shall be collected in accordance with the approved Mined Land Use Plan. A summary of the data collected shall be submitted to the Department as part of the Annual Report. Exceptions to anticipated trends in rock behavior shall be noted and explained to the Department after these data are collected and exceptions to the anticipated behavior are identified. If closure rates are higher than anticipated, Cargill shall increase the frequency of measurement in the affected area and submit for review and approved by the Department a plan and implementation schedule for corrective action.”

¹¹ JMT of New York, Inc., 2023, Modification Application for Permit to Mine, Cargill, Inc., Cayuga Salt Mine, MLF # 70052, Prepared for: Cargill, Inc., Project No. 20-01312N-003, June.

¹² Scopa, Zoe, 2025, S3 Storage Public Comment Responses 4-3-25, Cargill Incorporated – Road Safety, April, 37 p.

Cargill notes on Page 3 of the Annual Report, "All monitoring of subsidence and in situ measurements of rock mechanics have continued as outlined in 17.a.(4) and 17.a.(5)".

Site Visit

BOYD recommends the following topics be addressed during the next site visit:

- Continued discussions of best presentation of YieldPoint data.
- The results of the latest land survey of subsidence.
- Extending subsidence stations up the west side of the lake.
- The report from Alpha Geosciences on the brine from the U12 boreholes.
- The public comments on the permit modification for the S-3 Sump.

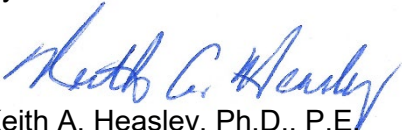
BOYD suggests that in-mine observations be completed for portions of the S-3 Sump and/or the 4-Shaft.

Please contact us if you require additional information or if we may be of further service.

Respectfully submitted,

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