ROBERT W. MILES
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM

Date:	May 17, 2023
To:	Nate Gillespie, Operations Manager
From:	Robert W. Miles
Subject:	Scotts Valley Water District Bethany Reservoir Results of Condition Assessment
Engineering Analysis:	Robert W. Miles, Bob Riley, Ed Darrimon
Review:	Ed Darrimon, Bob Riley

PURPOSE

The purpose of this memo is to record and summarize the results of the field assessment of Bethany Reservoir.

FIELD ASSESSMENT

Prior to the field assessment, a Reservoir Assessment Plan (Reference 1) was submitted for review on February 14, 2023. The plan was used for review, planning, and schedule coordination for the field work.

The assessment was conducted on Thursday March 2, 2023. The assessment was originally scheduled for the following Monday, but was moved to March 2 due to anticipated inclement weather.

Present during the assessment were the following persons:

Person	Primary Role
Ed Darrimon, Bay Area Coating Consultants	Consultant for coatings assessment and paint testing
Austin Darrimon, Bay Area Coating Consultants	Coatings thickness measurements and observations
Bob Riley, Mesiti-Miller Engineering	Survey of site and foundation, and general structural observations
Robert Miles, Robert W. Miles Consulting Engineers (RWM)	Assessment manager, plate steel thickness measurements and reservoir observations
Ryan Richie, Operations Supervisor, Scotts Valley Water District (SVWD)	Coordination of SVWD operations staff and procedures
Nate Gillespie, Operations Manager	Manager of SVWD operations

BACKGROUND

There is one original set of reservoir fabrication shop drawings dated July 2, 1965 available from SCWD records (Reference 2). The reservoir dimensions are shown as a diameter of 46'-6" and a shell height of 32'-2", including the top angle. The overflow level is depicted as 32'-0" above the tank bottom. The drawing shows a 6-inch overflow, a 36-inch manway, and a 12-inch inlet/outlet connection. The drain size is not indicated. The drawing shows a concrete ringwall foundation "By Customer", and no details are indicated. An interior shell ladder and an exterior stairway are shown.

The reservoir was constructed in 1965 by the Pittsburgh-Des Moines Steel Company as recorded on the nameplate. The nameplate (Photo 2) shows a reservoir shell height of 32'-2", a diameter of 46'-6", and capacity of 400,000 gallons, but does not list the American Water Works Association (AWWA) reference standard.

The set of original design drawings includes two sheets that depict a design for a redwood beam and joist roof framing system supported by steel columns (Reference 3). The drawings were prepared by B. G. Spencer, Consulting Engineer, and are dated July 12, 1965. The metal roof panel system is called out as "Curoco Super Span" ribbed panels, with a specific pattern indicated.

In 1985 and 1986 the site was the subject of installation of a soil-supporting caisson system on the north side of the reservoir (Reference 5). The system was installed to prevent further sloughing of the steep slope, and potential development of a landslide area, on that side of the reservoir.

Following the Loma Prieta earthquake of 1989 an investigation was conducted, and a subsequent report was prepared by Kennedy/Jenks/Chilton (Reference 4) that indicates modifications and repairs to the wood roof that was damaged by the earthquake. The rehabilitation work on the roof was substantial in scope.

Diving survey observations in January 2021 (Reference 6) indicate that the interior shell and bottom need recoating "as soon as budgets allow". The report contains other recommendations as well.

RESERVOIR STRUCTURAL ELEMENTS

Since the existing wood roof will be removed during the rehabilitation process the roof was not assessed for structural condition.

The shell plate members were tested for thickness from the smooth exterior surfaces, due to the coating defects on the interior surfaces. The defects made it impossible to achieve precise field steel thickness measurements from the inside surfaces due to the surface roughness. Efforts to obtain thickness measurements from the smooth outside surfaces of the shell were successful. The thickness data is presented as ranges of the measurements in Table 1.

Thickness measurements of the bottom plates were obtained, but have questionable accuracy due to the surface roughness.

TABLE 1 - STEEL PLATE THICKNESSES

Member or Element	Measured Plate Element Thicknesses Ranges, inch
Shell Plates	
Ring 1	0.327-0.337
Ring 2	0.249-0.251
Ring 3	0.257-0.266
Ring 4	0.248-0.248
Bottom Plates	0.249-0.288

1. Thicknesses measured with Phase II ultrasonic thickness gauge, Model UTG-2700.
2. Shell thickness ranges as obtained from sets of three measurements. Bottom thickness range obtained from eight measurements.

RESERVOIR DIMENSIONS

The reservoir Ring 1 outside shell circumference was measured as 148.27 feet, which equates to an outside diameter of 47.20 feet.

The shell ring widths were measured as summarized in the following Table 2.

TABLE 2 - SHELL RING DIMENSIONS

Ring Number	Width, inches
1	96
2	96
3	96
4	96

Considering the measured shell thickness of Ring 1 the net inside diameter is 47.14 feet, greater than the 46'-6" listed on the nameplate. With the shell height of 32'-0" the nominal tank volume calculates as 417,754 gallons up to the shell height. This compares with a volume of 400,000 gallons on the nameplate. Using the dimensions on the shop drawings, the capacity calculates as 406,488 gallons up to the overflow height of 32'-0".

INTERIOR SURVEY

Shell, and Bottom Plate Coatings

1. Observations of the interior shell and bottom coatings indicate that the interior coating system is probably a thin-film vinyl chloride system that was used in the 1960's and 1970's. This type of coating material was widely used by the Bureau of Reclamation (USBR) on its hydraulic steel structures. It was produced by several manufacturers using the USBR formulation designated as VR-3. On steel reservoirs, it was used as an alternative system to the coal tar enamel system that was, during that era, used as a tank lining system on approximately 85 percent of water reservoirs in California. This vinyl

system had a track record of low adhesion to the steel substrates, and tended to form blisters during service. Due to the difficulty of application, low adhesion issues, and evolving air pollution regulations, the vinyl systems were discontinued for non-USBR facilities in the 1980's.

2. The shell plates have developed a uniform pattern of small blisters (Photos 3, 4). The surfaces have developed a white, light, powdery deposit, which is possibly calcium carbonate from the operation of the cathodic protection system protecting steel surfaces beneath fractures of the blisters, or a result of using a zinc orthophosphate sequestering agent in the water. There are only a few small spots that exhibit active corrosion below the operating high-water level. When the existing coating was removed at one location, a smooth, shiny steel surface is visible, indicating that the cathodic protection system is effective. The bottom plates exhibit the same surface condition as the shell plates, but the blister sizes are generally larger (Photo 5). Table 3 summaries dry film thickness measurements for the existing coatings.

3. At the high-water level, and in the level fluctuation zone near high-water level, the coating system has failed and bare, corroding steel is present (Photos 6, 7). This water level fluctuation zone cannot be protected by the cathodic protection system.

4. The conclusions for the interior coating system immersed surfaces are that the existing vinyl coating system has reached the end of its service life and corrosion protection is being provided only by the cathodic protection system (Reference 13).

TABLE 3 - COATING THICKNESSES

Locations	Measured Coating Thicknesses, mils		
	High	Low	Average
Interior bottom	11.5	8.0	9.6
Interior shell	21.5	10.5	13.5
Exterior shell	11.0	4.0	7.0

1. Data is reproduced from Reference 14

Interior Fittings

The major fittings include one 36-inch shell manway, one 12-inch inlet/outlet connection, a tank gauge device, a 6-inch drain connection, and a 6-inch overflow. The pipe connections are in good condition without any significant visible corrosion issues (Photos 9, 10, 11, 12, 13, 14).

The 12-inch inlet/outlet connection has a small location with some visible minor corrosion. The connection pipe appears to be coal tar enamel-lined pipe in good condition. The interior surfaces of the 6-inch drain connection have some internal corrosion. It does not appear to be mortar lined. All three of the bottom pipe connections need review to determine their relative risk of damage to the bottom plates and pipes during a damaging earthquake event. The calculations for this review will be performed during the next phase, the Planning Analysis.

The interior shell ladder (Photos 15, 16) has a width of 16 inches and a rung spacing of 12 inches, and does not have a climbing safety device.

The interior float for the tank gauge has a corroded and separated cable connection and is not operable (Photo 10).

Floor Plate Thickness Survey

Efforts to obtain a line of thickness measurements at the shell were not successful due to the presence of the blistered bottom coating system. As the footnote in Table 1 indicates, a total of 8 measurements were obtained at the available test locations.

Cathodic Protection System

Based upon the condition of the shell and bottom plates the existing cathodic protection system has been operational and is performing well on the immersed surfaces.

EXTERIOR SURVEY

General Observations

1. The exterior surfaces are characterized by an aged coating system that is still performing well in most areas but has significant areas that have developed a checking type of coating failure (Photo 18). The exterior system is suspected of having a significant lead content, based upon the era in which it was applied. Laboratory testing has been conducted to determine the specific chemical materials in the coating samples, and is attached to this memorandum. The roof top girder/drain gutter has significant corrosion (Photo 19)

2. An exterior projection plate thickness survey was not successful due to the roughness of the coating surfaces.

3. The workmanship and quality of fitting and welding of the original reservoir steel construction was not in compliance with the AWWA D100 standard of the time nor the shop drawings. For example, the bottom plate projections outside of the bottom of Ring 1 shell plates vary from nearly 2 inches to approximately 0.5 inch (Photo 20). There is excessive weld splatter along the weld joints, which should have been removed by grinding during the welding process (Photo 21). There are several post-construction weld repairs to the weld joining the Ring 1 shell plates to the bottom plates, generally on the south and south-east side (Photo 22). The measured tank diameter and the value shown on the shop drawings differs significantly. These types of issues indicate that a careless approach to tank layout, plate fitting, and welding was used.

Shell Fittings and Pipe Connections

The external surfaces of the manway are in serviceable condition. The buried 12-inch inlet/outlet pipe isolation valve is reported to not be capable of complete closure. The 6-inch overflow pipe is buried out to the cut slope, but where it emerges from the slope it consists of an open pipe without protection against entry of insects and animals. It also does not have provisions for de-chlorination of water if releases are necessary. There are no apparent sample taps in the reservoir shell.

Shell Stairway

The exterior stairway was constructed as part of the reservoir in 1965, prior to establishment of the Occupational Safety and Health Administration (OSHA) in 1970. As such, it does not comply with the detailed California regulations (CalOSHA) for fixed industrial stairs promulgated after 1970 (References 7, 8). Items such as the rise and run and tread depth dimensions are not compliant, as examples. However, more important than some of the mandated dimensions, there are several other items that cause the stairway to be an awkward means of accessing the roof area.

1. The treads are less than the required 10-inch depth, but a factor that magnifies this deficiency is that there is a toe board at the rear of each tread (Photos 23, 24) that prevents placement of the worker's boot securely onto the tread. If the worker has a boot size of about 12 or larger, there is no space for the heel on the tread. This forces the worker to traverse the stairway sideways, to obtain space for the heel of the boot.

2. Treads are placed so that there is no overlap of each tread face over the rear face of the tread immediately below (Photo 24). This is related to Item 1 above.

3. There are no intermediate platforms, as required by the CalOSHA regulations. While presence of intermediate platforms seems like an unimportant detail, platforms serve as resting areas when workers are carrying materials and equipment while on the stairway. As an example of their use, platforms can allow places to organize and collect water quality samples from shell sample ports.

Review of Bottom Ring Profile

The intention of this review is to determine if there is any apparent damage to the Ring 1 shell plates as a result of the Loma Prieta earthquake of 1989.

During the assessment, a "dent" was observed in the shell, at the entrance road side of the reservoir (Photo 25). The dent is where the shell crosses over a fillet-welded joint in the bottom plates. It is located at about azimuth 225 degrees, as measured by the phone compass application. Near the dent there are several weld repairs on the shell-to-bottom weld, and each of these is where the shell passes over a lap joint in the bottom (Photo 22). There is also a small shell "bulge" on the opposite side near the stairway, at about azimuth 32 degrees. It is also at the location of a bottom lap joint. Although relatively easy to feel by hand, efforts to obtain a clear photo of the bulge area were not successful due to the lighting conditions. These areas are about 180 to 190 degrees apart. It may be that these areas represent damage from rocking motion during the Loma Prieta earthquake.

My conclusion at the site was that I had never seen defects like the "bulge" and "dent" that were the results of poor fitting and welding processes. The locations of the dent and weld repairs are in the general azimuth location of the roof cripple wall damage sustained in the Loma Prieta earthquake (Reference 4). In view of the coincidental locations of the bulge, dent, and past damage to the roof, it is probable that the bulge and dent represent incipient shell buckling damage caused by the earthquake.

Review of Concrete Ringwall Foundation

A visual review of the concrete ringwall foundation indicated that the concrete appears to be in generally sound and undamaged condition. There are radial cracks that may have formed as the result of drying shrinkage of the concrete following placement in 1965 (Photos 27, 28). The ringwall was excavated at one location (Photos 29, 30), indicating that the ringwall is about 12 inches in depth.

EXISTING COATING MATERIALS ANALYSES

Submission of samples of interior and exterior existing coatings resulted in the report prepared by Geoanalytical Laboratories Inc., included as an attachment to this memorandum. The report (Reference 9) indicates several elements of concern in the exterior coating materials, as summarized in the following Table 4.

TABLE 4 – EXISTING EXTERIOR COATINGS, ELEMENTS OF CONCERN

Element	TTLC Test Result, mg/kg	California Regulatory Threshold, mg/kg
Barium	660	10,000
Chromium (III)	18,000	2,500
Lead	99,000	1,000
Vanadium	4,300	2,400

1. TTLC is the Total Threshold Limit Concentration, EPA Method 6020.
2. California regulatory levels are from Reference 10.
3. mg/kg – Milligrams per kilogram

Barium is a soft, silvery, alkaline earth metal that is very reactive and therefore always combined with other materials, producing materials such as barium sulfate, and barium chloride. Barium sulfate is used as a white pigment in paints, as a filler and consistency modifier. The most extensive use of barium sulfate is in drilling mud, as a density increasing component. It has wide application in various other industries. The test result of 660 mg/kg in Table 4 is below the California regulatory level,

Barium is considered toxic if released in sufficient quantity as a dust during abrasive blasting operations. California has a worker permissible exposure limit (PEL) for barium sulfate as airborne dust (Reference 10).

Chromium is a metal that has been of concern due to its tendency to contain Chromium (VI), a carcinogen. Chromium was used in the past as an anti-corrosion barrier pigment in paint primers, such as zinc chromate primer. However, Chromium (VI) may also appear as a trace element in coatings that contain lead. The test result for chromium in Table 4 is greater than the regulatory level, and its presence is a concern to worker safety during removal by abrasive blasting. California has a PEL for Chromium (VI) as airborne dust (Reference 10) that is extremely low. California also has a special regulation for Chromium (VI) that applies to protection of workers during construction (Reference 11).

In the past, lead was used in paints as an anti-corrosion barrier pigment, a function for which it is very effective. However, at sufficient levels, lead is a toxic and hazardous material. The test result in Table 4 of 99,000 mg/kg is extremely high and abrasive blasting operations become very expensive due to the regulations that govern worker safety, the use of specialized removal equipment, and disposal of hazardous materials (Reference 12). California has a PEL for lead as airborne dust (Reference 10) that is very low. In contrast to removal by abrasive blasting, removal of structures and steel reservoirs with intact lead paint is an operation that is relatively easily managed at minimal cost. Management of lead paint on reservoirs is usually by removal using abrasive blasting, removal by demolition of the structure, or encapsulation by use of topcoats of paint.

Vanadium is a metallic element that occurs naturally, but is also used as an ingredient in the making of steel and other materials. Vanadium pentoxide is regulated as an airborne dust that has a California PEL that is relatively low (Reference 10), and is a concern to worker safety during removal by abrasive blasting. The test result for vanadium in Table 4 indicates that it is above the California threshold limit in Reference 10.

For the interior coating materials, the elements of concern would be barium and lead. The test results indicate that barium was detected at a concentration of 13,000 mg/kg, which is above the regulatory threshold value of 10,000 mg/kg. Barium sulfate was used by the paint manufacturer as a white pigment and consistency modifier. Lead was detected in the sample at a relatively low value of 230 mg/kg. However, the presence of lead and barium sulfate must be respected by painting contractors during planning for abrasive blasting operations, to ensure that these materials in airborne dust do not become potential worker health or regulatory issues.

SITE REVIEW

Caisson Earth Retaining System

The grade beam associated with the existing caisson system was excavated and determined to be in the general location shown on the design drawings (Reference 5). A brief visual review of the north side of the reservoir indicated that there appears to be no active earth slide activity. This observation was made by engineers who are not engineering geologists nor geotechnical engineers, so a technical evaluation by a qualified professional would be more definitive and necessary for project planning purposes.

Asphalt Pavement Around the Reservoir

The pavement is deteriorated and is not serving to capture and direct rainwater drainage away from the reservoir and steep slope on the north side of the site.

Overflow and Drain Pipe

The combined overflow and drain pipe discharges at the slope and does not have a de-chlorination feature. The operating staff reported that there has never been a known overflow event and that reservoir drainage is not routinely discharged. The reservoir maximum operating water height is 28 feet, four feet lower than the overflow height of 32 feet.

Site Fencing

The existing site fencing consists of an array of portable fence panels. Security would be improved by a permanent fence installation. A permanent fence would provide a first barrier for entry to the reservoir and importantly, the roof. The second barrier would be the stairway gate. Almost all malicious reservoir site entries are for the purposes of general mischief and tagging by juveniles. A two-barrier system would discourage entry and reduce the possibility of damage and potential injury to the entrants.

Foundation Conditions

The facility has a quite extensive history of geotechnical evaluations. The following existing documents concerning the site foundation conditions have been reviewed, and we have the following brief summary of each.

1. Soil investigation report by M. Jacobs and Associates, 1985 (Reference 16). Prepared in response to reports of several cracks in pavement on north side of reservoir. Two borings completed, recommendations were to underpin the foundation ring or construct a soldier beam wall, with preference for the underpinning strategy.

2. Expansion of soil investigation and report by M. Jacobs & Associates, 1986, (Reference 17). Three additional borings completed. A system of anchor piers and tie rods were recommended, to be designed by others, to stabilize the slope on the north side of the reservoir. The configuration had a nebulous description, and the term "soldier beam wall" was not used.

3. Design drawing for caisson system and continuous cap beam by Urfer and Associates, 1986 (Reference 5). The drawing depicts the caisson system that was subsequently constructed in about the year 1986 on the north side in the area of the pavement cracks.

4. Geotechnical investigation and report by Bauldry Engineering, 2010 (Reference 19). Three borings were completed. This investigation was used in conjunction with the Jacobs report of 1986, consultation with Zinn Geology, and the 1986 design by Urfer and Associates (Reference 5) for construction of a "buried pier retaining wall (soldier piers)"

5. Geologic test pits and trenches by Zinn Geology, 2011 (Reference 20). This figure is a log of the geologic excavations at the Bethany site. It depicts the rock and soil types, and shows the identified fracture zones and displacements. This investigation was not authorized to be completed.

6. Narrative of findings and analysis of the test trenches by Zinn Geology, 2023 (Reference 21). A series of emails that describe the preliminary conclusions about the Bethany site by Erik Zinn. Mr. Zinn describes the ridge site as becoming fractured by seismic events due to amplification of accelerations by the topography. He summarizes with the statement that "The next seismic shaking event will likely reoccupy the existing cracks and fractures, because those are now existing

> weaknesses in the bedrock". Additionally, Mr. Zinn advises that the "tank foundation would need to either be placed somewhere where that process is not happening, or it would have to be designed to withstand the horizontal and vertical ground displacements observed from the past and future trenching programs".

In reviewing the past geotechnical work, it becomes apparent that the caisson retaining system installed in 1986 may only be a temporary measure. The real issue may be that the earth movement observed before the caisson construction may have been the result of movement of rock and soil due to fractures of the ridge bedrock, along a line parallel with the ridge top.

The geotechnical conditions at the site indicate that the future of the existing Bethany Reservoir may involve considerations beyond just rehabilitation of the steel structure itself. Continued operation of the reservoir into a long service life may require that the structure be retired from active operation and a new reservoir constructed at a more suitable site. A possibility is that the reservoir could be reconstructed at a location to the northeast, along the ridge top, and away from existing fractures in the bedrock. Such a strategy would require additional geologic test trenches to identify a suitable location. Another potential strategy would be to merely accept the risk of future foundation failure at the site and rehabilitate the existing structure. Other potential strategies exist, of course, such as constructing a new reservoir at a suitable site in the vicinity.

At this time, as we start on the Planning Analysis phase, we recommend that consideration be given to the potential site on the northeast side of the ridge. This potential site would be the subject of geological review and test trenching to either eliminate or confirm that it is a suitable site for a new reservoir.

REFERENCES

1. Reservoir Assessment Plan, Bethany Reservoir Rehabilitation, Robert W. Miles, Consulting Engineers, March 2, 2023.

2. Shop Drawings,1-46'-6" Dia x 32'-2" High 400 M Gal FB Tank, Scotts Valley California, Sheets 1-9, Pittsburgh-Des Moines Steel Company, 7-2-65.

3. 46'-6" Dia x 32'-0" High Steel Water Tank, Roof Plan, B. G. Spencer Consulting Engineer, 7-12-65, Sheets 1 of 4 and 3 of 4.

4. Report, Tank Seismic Damage, Scotts Valley Water District, Kennedy/Jenks/Chilton, November 1989.

5. Drawing, Bethany Tank Slide Repair, Scotts Valley Water District, Donald C. Sheet S1, Urfer and Associates, 4 Feb 86.

6. Inspection Report for Scotts Valley Water District, 400KG Steel On-Grade Bethany Tank, Inland Potable Services, Inc., January 5, 2021.

7. California Code of Regulations, Title 8, Section 3231, Stairways.

8. California Code of Regulations, Title 8, Section 3234, Fixed Industrial Stairs.

9. Certificate of Analysis, GeoAnalytical Laboratories, Inc., Lab ID J3C0605-01 and 02, 3/15/23.

10. California Code of Regulations, Title 8, Section 5155, Airborne Contaminants, Table AC-1.

11. California Code of Regulations, Title 8, Section 1532.2, Chromium (VI).

12. California Code of Regulations, Title 8, Section 1532.1, Lead.

13. California Code of Regulations, Title 22, Section 66261.24, Characteristic of Toxicity.

14. Bethany Reservoir Coating and Lining Assessment, Scotts Valley Water District, Bay Area Coating Consultants, March 2, 2023.

15. Bethany Tank Evaluation Task 2 – Physical Condition Assessment Memo, Mesiti-Miller Engineering, March 16, 2023.

16. Soil Investigation for Bethany Tank, M. Jacobs and Associates, November 4, 1985.

17. Expansion of Soil Investigation for Bethany Tank, M. Jacobs & Associates, January 2, 1986.

18. Not Used

19. Geotechnical Investigation for Bethany Water Tank Upgrade Project, Bauldry Engineering, July 30, 2010.

20. Bethany H_2O Tank, Log of Test Pits, Zinn Geology, 2 Sept. 2010.

21. Geology, Preliminary Findings and Email Correspondence, Zinn Geology, March 2023.

22. Topographic Survey, Bethany Tank Site, Atlas Land Surveys Inc., 4/16/10.

23. Topographic Map of SVWD – Bethany Tank, Alpha Land Surveys, 3/28/17.

Photo 1A – Bethany Reservoir, Southeast Side Facing Access Road

Photo 1B – Interior View. Showing the columns, roof, and cathodic protection anodes

Photo 2 - Nameplate

Photo 3 – Typical Surfaces of Shell

Photo 4 – Closeup of Shell Coating Blisters

Photo 5 – Typical Blisters on Bottom Plates

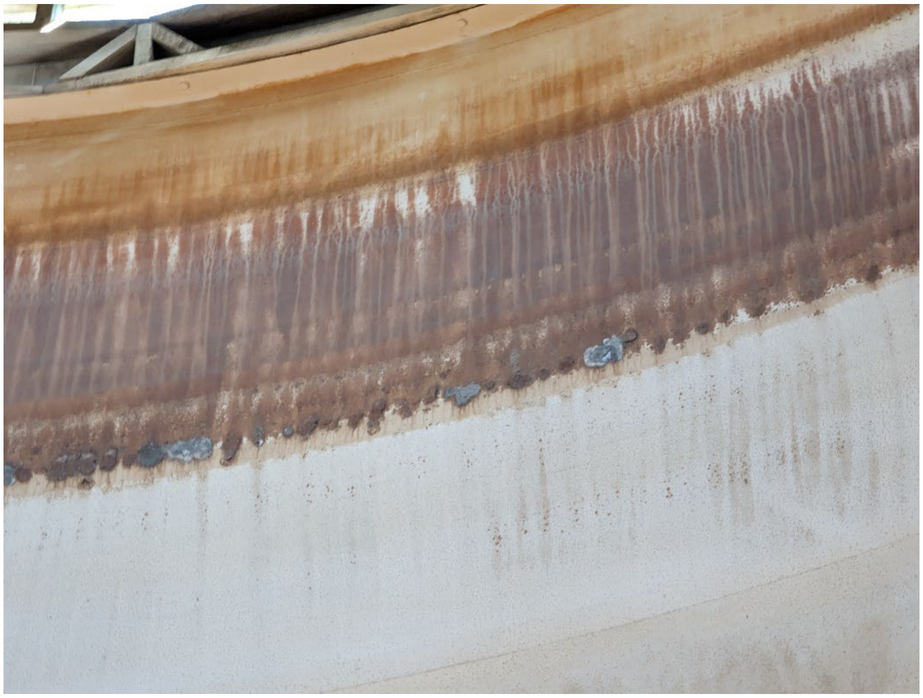

Photo 6 – Coating Failure and Corrosion Above the High-Water Level. Note the corrosion pitting and apparent grey coating patches at the water level.

Photo 7 – Coating Failure and Corrosion Above the Operating Water Level

Photo 8 – Corrosion at Spalled Coating at Base of Shell. Cathodic protection system is limiting the depth of corrosion pits.

Photo 9 – Shell Manway

Photo 10 – Gauge Float Inoperable

Photo 11 – Drain Connection, Overflow at Top of Photo

Photo 12 – Overflow at Bottom

Photo 13 – Overflow up the shell

Photo 14 – Overflow at Top

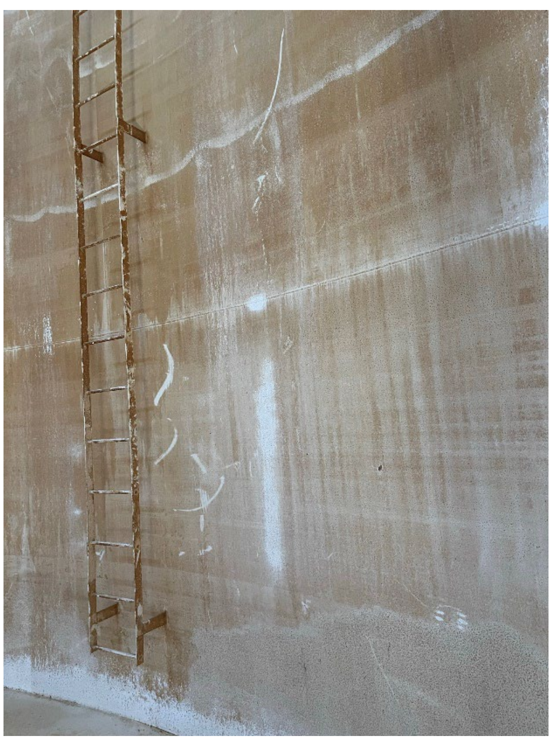

Photo 15 – Interior Ladder

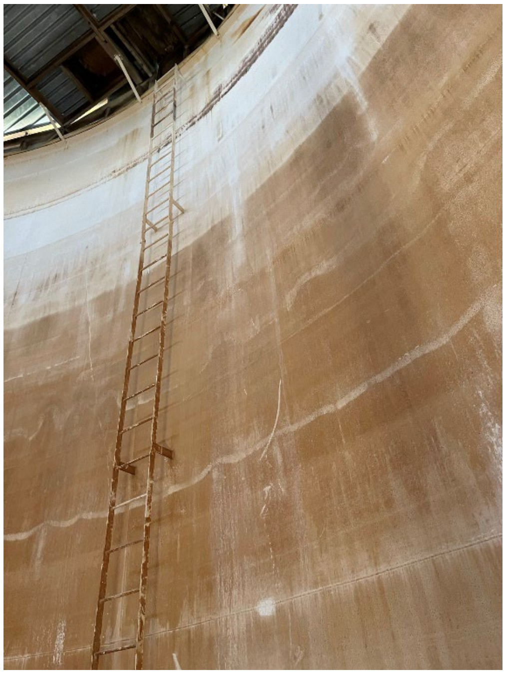

Photo 16 – Interior Ladder up the shell

Photo 17 – Column Base

Photo 18 – Closeup of Exterior Checked Coating Failure

Photo 19 – Corrosion in the Roof Top Girder/Gutter

Photo 20 – Bottom Plate Projection. In this photo, the bottom plate projection varies greatly from the bottom left to the top right. There appears to be three welding passes in some areas, where only one should have been used.

Photo 21 – Weld Splatter on Horizontal Joint, Ring 1 to Ring 2

Photo 22 – Weld Repair at Shell to Bottom Joint

Photo 23 – Stairway Tread. Note the toe board at the back of the treads.

Photo 24 – Rear View of Stairway. Note the lack of overlap between treads and presence of a toe board at rear of each tread.

Photo 25 – "Dent" at Shell to Bottom Joint

Reserved for photo of the bulge

Photo 26 – "Bulge" at Shell to Bottom Joint

Photo 27 – Radial Crack in Concrete Foundation

Photo 28 – Radial Cracks in Concrete Foundation. There are two cracks in this photo.

Photo 29 – Excavation for Depth of Concrete Foundation

Photo 30 – Foundation Appears to Be About 12 inches In Depth

GeoAnalytical Laboratories, Inc.

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Report # J3C0605

Report Date: 03/15/23

Date Rec'd: 03/06/23

Bay Area Coating Consultants
P.O. Box 867
Denair, CA 95316

Cover Letter for Certificate of Analysis

This analytical report must be reproduced in its entirety.

Dear Ed,

Enclosed are the results of analyses for samples received on 3/06/2023 with the Chain-of-Custody document. The samples were received at 21.8°C. All analyses met the method criteria except as noted in the Notes and Definitions page or in the report with data qualifiers.

Donna Keller
Laboratory Director

This analytical report must be reproduced in its entirety, including it's Cover Letter.

ELAP Certification # 2585

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Report # J3C0605

Bay Area Coating Consultants
P.O. Box 867
Denair, CA 95316

Report Date: 03/15/23

Date Rec'd: 03/06/23

CERTIFICATE OF ANALYSIS

Sampler: Ed Darrimon

Sample ID: Exterior Coating

Lab ID	Sample Date / Time	RL	Method	Analyte	Result	Units	Notes	Started
J3C0605-01	3/01/2023 10:30	0.5	6020	**Antimony**	**5.2**	mg/kg		3/14/23 14:56
		0.5		**Arsenic**	**2.0**	mg/kg		3/14/23 14:56
		0.5		**Barium**	**660**	mg/kg		3/14/23 14:56
		0.5		Beryllium	ND	mg/kg		3/14/23 14:56
		0.5		**Cadmium**	**0.7**	mg/kg		3/14/23 14:56
		0.5		**Chromium**	**18000**	mg/kg		3/14/23 14:56
		0.5		**Cobalt**	**280**	mg/kg		3/14/23 14:56
		0.5		**Copper**	**590**	mg/kg		3/14/23 14:56
		1.0		**Lead**	**99000**	mg/kg		3/14/23 14:56
		0.2		**Molybdenum**	**3.7**	mg/kg		3/14/23 14:56
		0.5		**Nickel**	**8.1**	mg/kg		3/14/23 14:56
		0.5		Selenium	ND	mg/kg		3/14/23 14:56
		1.0		Silver	ND	mg/kg		3/14/23 14:56
		0.5		Thallium	ND	mg/kg		3/14/23 14:56
		0.5		**Vanadium**	**4300**	mg/kg		3/14/23 14:56
		0.5		**Zinc**	**23000**	mg/kg		3/14/23 14:56
		0.5	6020A	Mercury	ND	mg/kg		3/14/23 14:56

Sample ID: Interior Lining

Lab ID	Sample Date / Time	RL	Method	Analyte	Result	Units	Notes	Started
J3C0605-02	3/01/2023 10:30	0.5	6020	Antimony	ND	mg/kg		3/14/23 14:56
		0.5		Arsenic	ND	mg/kg		3/14/23 14:56
		0.5		**Barium**	**13000**	mg/kg		3/14/23 14:56
		0.5		Beryllium	ND	mg/kg		3/14/23 14:56
		0.5		Cadmium	ND	mg/kg		3/14/23 14:56
		0.5		**Chromium**	**6.4**	mg/kg		3/14/23 14:56
		0.5		**Cobalt**	**3.3**	mg/kg		3/14/23 14:56
		0.5		**Copper**	**21**	mg/kg		3/14/23 14:56
		1.0		**Lead**	**230**	mg/kg		3/14/23 14:56
		0.2		**Molybdenum**	**0.2**	mg/kg		3/14/23 14:56
		0.5		**Nickel**	**16**	mg/kg		3/14/23 14:56
		0.5		Selenium	ND	mg/kg		3/14/23 14:56
		1.0		Silver	ND	mg/kg		3/14/23 14:56
		0.5		Thallium	ND	mg/kg		3/14/23 14:56
		0.5		**Vanadium**	**2.0**	mg/kg		3/14/23 14:56
		0.5		**Zinc**	**390**	mg/kg		3/14/23 14:56
		0.5	6020A	Mercury	ND	mg/kg		3/14/23 14:56

Joshua Martinez
Chemist

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ELAP Certification # 2585

Report # J3C0605

Report Date: 03/15/23

Date Rec'd: 03/06/23

Bay Area Coating Consultants
P.O. Box 867
Denair, CA 95316

GeoAnalytical Laboratories, Inc.
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email: info@geoanalyticallab.com

Report # J3C0605

Report Date: 03/15/23
Date Rec'd: 03/06/23

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Inorganic Chemistry - Quality Control
GeoAnalytical Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch J000619 - 6020 - 3050B			**Prepared & Analyzed: 03/14/23**							
Blank (J000619-BLK1)										
Antimony	ND	0.5	mg/kg							
Arsenic	ND	0.5	"							
Barium	ND	0.5	"							
Beryllium	ND	0.5	"							
Cadmium	ND	0.5	"							
Chromium	ND	0.5	"							
Cobalt	ND	0.5	"							
Copper	ND	0.5	"							
Lead	ND	1.0	"							
Molybdenum	ND	0.2	"							
Nickel	ND	0.5	"							
Selenium	ND	0.5	"							
Silver	ND	1.0	"							
Thallium	ND	0.5	"							
Vanadium	ND	0.5	"							
Zinc	ND	0.5	"							
Mercury	ND	0.5	"							
LCS (J000619-BS1)										
Antimony	2.94	0.5	mg/kg	3.125		94	80-120			
Arsenic	6.33	0.5	"	6.250		101	80-120			
Barium	12.0	0.5	"	12.50		96	80-120			
Beryllium	3.11	0.5	"	3.125		99	80-120			
Cadmium	6.23	0.5	"	6.250		100	80-120			
Chromium	12.6	0.5	"	12.50		101	80-120			
Cobalt	12.6	0.5	"	12.50		101	80-120			
Copper	12.8	0.5	"	12.50		102	80-120			
Lead	12.3	1.0	"	12.50		98	80-120			
Molybdenum	3.21	0.2	"	3.125		103	80-120			
Nickel	12.5	0.5	"	12.50		100	80-120			
Selenium	6.14	0.5	"	6.250		98	80-120			
Silver	5.96	1.0	"	6.250		95	80-120			
Thallium	3.01	0.5	"	3.125		96	80-120			
Vanadium	6.26	0.5	"	6.250		100	80-120			
Zinc	12.8	0.5	"	12.50		102	80-120			
Mercury	0.65	0.5	"	0.6250		104	80-120			

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch J000619 - 6020 - 3050B			**Prepared & Analyzed: 03/14/23**							
LCS Dup (J000619-BSD1)										
Antimony	2.99	0.5	mg/kg	3.125		96	80-120	2	20	
Arsenic	6.20	0.5	"	6.250		99	80-120	2	20	
Barium	12.0	0.5	"	12.50		96	80-120	0.6	20	
Beryllium	3.08	0.5	"	3.125		99	80-120	0.8	20	
Cadmium	6.16	0.5	"	6.250		99	80-120	1	20	
Chromium	12.4	0.5	"	12.50		99	80-120	1	20	
Cobalt	12.5	0.5	"	12.50		100	80-120	0.8	20	
Copper	12.8	0.5	"	12.50		102	80-120	0.2	20	
Lead	12.2	1.0	"	12.50		98	80-120	0.5	20	
Molybdenum	3.13	0.2	"	3.125		100	80-120	2	20	
Nickel	12.4	0.5	"	12.50		100	80-120	0.1	20	
Selenium	6.12	0.5	"	6.250		98	80-120	0.4	20	
Silver	5.93	1.0	"	6.250		95	80-120	0.4	20	
Thallium	2.98	0.5	"	3.125		95	80-120	0.8	20	
Vanadium	6.17	0.5	"	6.250		99	80-120	1	20	
Zinc	12.7	0.5	"	12.50		102	80-120	0.3	20	
Mercury	0.64	0.5	"	0.6250		103	80-120	0.8	20	
Duplicate (J000619-DUP1)		**Source: J3B1301-01**								
Antimony	72.4	0.5	mg/kg		71.5			1	20	
Arsenic	7.92	0.5	"		8.12			3	20	
Barium	366	0.5	"		363			0.8	20	
Beryllium	0.35	0.5	"		0.36			4	20	
Cadmium	31.9	0.5	"		31.9			0.1	20	
Chromium	51.4	0.5	"		51.0			0.9	20	
Cobalt	27.3	0.5	"		27.2			0.4	20	
Copper	2390	0.5	"		2390			0.2	20	
Lead	369	1.0	"		369			0.04	20	
Molybdenum	6.62	0.2	"		6.82			3	20	
Nickel	59.7	0.5	"		59.9			0.3	20	
Selenium	1.40	0.5	"		1.39			0.7	20	
Silver	3.70	1.0	"		3.72			0.5	20	
Thallium	ND	0.5	"		ND				20	
Vanadium	22.3	0.5	"		22.2			0.5	20	
Zinc	2840	0.5	"		2850			0.3	20	
Mercury	0.94	0.5	"		0.97			3	20	

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Inorganic Chemistry - Quality Control
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Batch J000619 - 6020 - 3050B **Prepared & Analyzed: 03/14/23**

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Matrix Spike (J000619-MS1)	**Source: J3B1301-01**									
Antimony	87.5	0.5	mg/kg	3.125	71.5	512	80-120			QM-07
Arsenic	12.9	0.5	"	6.250	8.12	77	80-120			QM-07
Barium	406	0.5	"	12.50	363	345	80-120			QM-07
Beryllium	0.77	0.5	"	3.125	0.36	13	80-120			QM-07
Cadmium	29.8	0.5	"	6.250	31.9	NR	80-120			QM-07
Chromium	141	0.5	"	12.50	51.0	716	80-120			QM-07
Cobalt	17.3	0.5	"	12.50	27.2	NR	80-120			QM-07
Copper	1080	0.5	"	12.50	2390	NR	80-120			QM-07
Lead	541	1.0	"	12.50	369	NR	80-120			QM-07
Molybdenum	11.0	0.2	"	3.125	6.82	132	80-120			QM-07
Nickel	179	0.5	"	12.50	59.9	951	80-120			QM-07
Selenium	1.73	0.5	"	6.250	1.39	5	80-120			QM-07
Silver	3.03	1.0	"	6.250	3.72	NR	80-120			QM-07
Thallium	0.40	0.5	"	3.125	ND	13	80-120			QM-07
Vanadium	46.4	0.5	"	6.250	22.2	386	80-120			QM-07
Zinc	3200	0.5	"	12.50	2850	NR	80-120			QM-07
Mercury	0.93	0.5	"	0.6250	0.97	NR	80-120			QM-07
Matrix Spike Dup (J000619-MSD1)	**Source: J3B1301-01**									
Antimony	89.4	0.5	mg/kg	3.125	71.5	574	80-120	2	20	QM-07
Arsenic	13.4	0.5	"	6.250	8.12	85	80-120	4	20	
Barium	413	0.5	"	12.50	363	405	80-120	2	20	QM-07
Beryllium	0.80	0.5	"	3.125	0.36	14	80-120	4	20	QM-07
Cadmium	31.6	0.5	"	6.250	31.9	NR	80-120	6	20	QM-07
Chromium	145	0.5	"	12.50	51.0	756	80-120	3	20	QM-07
Cobalt	17.9	0.5	"	12.50	27.2	NR	80-120	4	20	QM-07
Copper	1050	0.5	"	12.50	2390	NR	80-120	2	20	QM-07
Lead	549	1.0	"	12.50	369	NR	80-120	2	20	QM-07
Molybdenum	11.4	0.2	"	3.125	6.82	147	80-120	4	20	QM-07
Nickel	185	0.5	"	12.50	59.9	1000	80-120	4	20	QM-07
Selenium	1.56	0.5	"	6.250	1.39	3	80-120	10	20	QM-07
Silver	3.22	1.0	"	6.250	3.72	NR	80-120	6	20	QM-07
Thallium	0.39	0.5	"	3.125	ND	12	80-120	4	20	QM-07
Vanadium	42.6	0.5	"	6.250	22.2	326	80-120	8	20	QM-07
Zinc	2990	0.5	"	12.50	2850	NR	80-120	7	20	QM-07
Mercury	0.97	0.5	"	0.6250	0.97	0.07	80-120	5	20	QM-07

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Notes and Definitions

QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference
RL	Reporting Limit
NA	Not Applicable
>AL	Greater than establish Action Levels
>MCL	Greater than establish Maximum Contaminant Levels
†	Some analytes are no longer listed in ELAP accreditation for compliance purposes

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