

**NOMINATION CATEGORY:**

**REMEDICATION OF PHYSICAL  
SAFETY HAZARDS**

**PROJECT:**

**CARISSA GOLD MINE**

**SOUTH PASS CITY, WYOMING**

**SUBMITTED BY**

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**PARTNERS & CONTRIBUTORS**

RESPEC Company, LLC  
Trihydro  
Lidstone & Associates  
Forsgren Associates  
Martin / Martin  
Wyoming State Parks  
Wyoming State Historic Preservation Office

**CONTRACTORS**

Fremont Development  
71 Construction  
Electrical Dynamics, Inc.  
G.M. Stewart  
J Wright  
S&T Excavating, Inc.  
Hayward Baker  
George Eppler, LLC

**PROJECT START TO COMPLETION**

November 8, 2004 – August 31, 2021

**TOTAL CONSTRUCTION COST**

\$5,826,133.56

# 1.0 PROJECT SUMMARY

In 2003, the Wyoming Legislature purchased property in Fremont County, Wyoming, which contained the Carissa Gold Mine, near the historic Wyoming mining town of South Pass City. The State planned to include the Carissa Gold Mine property as part of its South Pass City Historic Site (SPC) maintained by Wyoming State Parks (State Parks). After the purchase of the property, the State and the Wyoming Department of Environmental Quality, Abandoned Mine Land Division (WY AML) entered a contract with RESPEC Company, LLC (RESPEC). The project team performed an inventory and assessment of the physical and environmental hazards associated with the Carissa Gold Mine property. Over 18 years, 44 construction contracts have been completed at the Carissa Gold Mine to mitigate a wide range of hazardous conditions, including hazardous material cleanup, mine opening safeguarding, and structural stabilization for the Mill Building, as shown in Figure 1, and surrounding structures. Because of the successful completion of these projects, the Carissa Gold Mine is now a state park that provides educational opportunities for Wyoming students, a historic resource to thousands of tourists and visitors each year, and a time capsule for Wyoming’s rich mining history. Since 2013, more than 34,000 people have toured the Carissa Gold Mine, of which 8,200 were K-12 students from Wyoming schools.



Figure 1: Mill Building at the Carissa Gold Mine, 2003

# 2.0 MINING HISTORY

Gold was first discovered in 1842 by a placer miner along the Sweetwater River. For the next 20 years, prospecting and development was limited by, in part, by hostilities between miners and the Native American population. In 1863, placer gold was discovered near Oregon Buttes along the Overland Trail. Prospectors worked the placers for several months. This activity ceased because of Native American hostilities that also forced abandonment of the original Overland Trail and its relocation south to its present location. In 1866, prospectors entered the area again and lode gold was discovered the following year along Willow Creek, a tributary to the Sweetwater River, approximately 8 miles north of the original Oregon Buttes discovery. The lode was named Carissa.

Discovery of the Carissa Lode triggered the South Pass gold rush, Wyoming's largest 19th-century mining boom. The area surrounding the Carissa Lode was originally named the Sweetwater Mining District. Three gold camps with associated mines were established in the district and included South Pass City, Miners Delight, and Atlantic City. By 1872, 12 stamp mills with a total of 161 stamps were crushing ore. From 1872 to 1875, interest in the South Pass area declined, and the district was nearly deserted. Numerous smaller "mining booms" have occurred in the area since 1875; however, mining activities were minimal.

In 1929, the current Mill Building (previously known as the Dexter Mill) was purchased for the Carissa Gold Mine and moved from Atlantic City to its present location. While this "new mill" was being constructed, the 1898 John Spry Mill was torn down. Photographs of the new mill soon after being erected at the Carissa depict that it was sided and roofed with corrugated metal, as shown in Figure 2. All other mine-related buildings predate the construction of the new mill, but show improvements made by 1930 for the mine's re-opening. The new mill, or Dexter Mill, currently present on the Carissa Gold Mine property is visually, materially, and historically the most significant and dominant structural feature of the entire site.



**Figure 2: Original Mill Building at the Carissa lode in 1903.**



**Figure 3: Mill Building (newly reconstructed Dexter Mill) at the Carissa Lode in 1929.**

The Carissa Gold Mine was considered the flagship property of the Sweetwater Mining District throughout the mining booms. The mine has the largest extent of workings, mined the greatest tonnage, had the largest mill, and was the biggest producer of gold of all the mines in the district. Total gold production is estimated at between 50,000 and 180,000 ounces.

### **3.0 PROJECT DEVELOPMENT & INVESTIGATION**

After the site was purchased in 2003, in coordination with State Parks and Wyoming State Historic Preservation Office (SHPO), the Wyoming AML embarked on mitigating a wide range of hazards to make the site safe for the public. The initial project scope included the investigation of all hazards at the site,

ranging from mine openings, mine adits, shafts, and vertical openings, to mine waste and tailings associated with the Mill Building. The inventory and investigation phase of the project identified more than 75 mine-related features, seven debris and solid waste dump areas, one underground, and six surface fuel storage tanks. Of these features, 42 represented an Office of Surface Mining (OSM) Priority 1 or 2 safety hazards that were remediated and/or mitigated. The mine features a variety of mining techniques (e.g., open pit, glory hole, and underground mining). The extent of disturbance and overall dimension of each feature also vary widely.

## 4.0 REMEDIATION EFFORTS OF PHYSICAL AND ENVIRONMENTAL HAZARDS

### 4.1 CARISSA MILL BUILDING CLEANUP

One of the first projects on the site in 2003 by the WY AML and its consultant, RESPEC, was an inventory and assessment of the physical and environmental hazards associated with the Carissa Mill Building. A sampling plan was designed based on field screening results, using an x-ray fluorescence (XRF) analyzer. Sampling activities also included soil/tailings samples, wipe samples, mercury vapor samples, and asbestos samples. Analytical results from the samples located in the Carissa Mill Building indicated several metals (arsenic, lead, thallium) exceeded the U.S. Environmental Protection Agency Region IX Preliminary Remediation Goals and that mercury vapor was slightly above ambient air tolerances.

Subsequently, the WY AML conducted the following proactive remediation actions within the Mill Building, beginning in 2004, with the goal of mitigating human exposure to contaminants for future use scenarios:

- / Packaging and off-site disposal of inventoried wastes
- / Consolidation, packaging, and removal of all rock cores
- / Removal and exterior disposal of tailing and other bulk wastes from within tanks and limited areas outside of and adjacent to the tanks
- / Excavation and disposal of on-site bulk tailings from within and immediately exterior to the Mill Building into a designated open pit area adjacent to the site
- / Encapsulation of a large portion of the original concrete and earthen floors with new concrete flooring on Levels 4, 5, and 6, thereby reducing possible exposure to a considerable amount of remnant materials
- / Encapsulation of the original earthen floor that was not previously overlaid by new concrete, two layers of geotextile fabric, and capped with approximately 4 inches of crushed rock base, then encapsulated with rough-sawn lumber to match historical record of flooring
- / High-efficiency particulate absorption (HEPA) vacuum all surfaces located along the proposed pathway for pedestrians, as described in the South Pass City Master Plan
- / Cleaning all horizontal surfaces, tank sides, and the stovepipe from the assay furnace along the proposed pathway with a wet mop, rag wash, and scrub brush
- / Application of flat, clear urethane coats to encapsulate any remnant arsenic and lead particles to previously cleaned surfaces along the proposed pathway

After these mitigation efforts, additional testing was performed to assess the current conditions in the Mill Building and the previous mitigation efforts. The results of the testing indicated substantially reduced concentrations of arsenic and lead throughout the Mill Building and along the planned pathway. Risk to potential receptors (e.g., SPC employees, tour participants, future construction) was significantly reduced.

## 4.2 MINE SAFEGUARDING

A key safety aspect for the Carissa Gold Mine site included design for and closure of mine opening features. The following features presented falling and entrapment hazards and were designated Priority 1 and 2 safety hazards:

- |                         |                          |
|-------------------------|--------------------------|
| / Operating Shaft       | / Alpine Shaft           |
| / Glory Hole            | / Ben Hur Shaft          |
| / Antoine Shaft         | / BLM-Willow Creek Shaft |
| / Sherlock Shaft        | / Washington Shaft       |
| / Polly Perkins Shaft   | / Mill Pond Adit         |
| / Jeanette Shafts       | / Charlie's Folly        |
| / Charles Dickens Shaft |                          |

A variety of closure methods were used to mitigate and eliminate the hazards associated with these features. Polyurethane foam (PUF) plugs, buck and rail fencing, rock wedge plugs, accessible bulkhead closure, and riprap and concrete plugs were used as appropriate to the hazard.

The Operating Shaft was located within the Shaft House, and consisted of a 300-foot-vertical, double-compartment shaft sunk in the footwall of the Carissa Lode. It was the only accessible surface connection to the underground mine workings at the Carissa Gold Mine. The original headframe for the Shaft House was demolished in the 1980s. Initial mitigation work included the installation of a PUF plug, installation of 6-inch PVC perforated drain pipe into the PUF, and stabilization of the existing wood cribbing still present in the shaft. In later years, the WY AML and State Parks coordinated efforts to reconstruct a historically accurate headframe and Shaft House above the original Operating Shaft, as shown in Figure 2, and install a water pump through the PUF plug in the Operating Shaft to supply the Mill Building with water. Protective paneling and a floor system was installed in the Operating Shaft to protect SPC personnel from falling wood timbers and collapsing collar. The Ore Tram that connected the Shaft House to the Mill Building was also reconstructed. Figure 5 shows the completed Shaft House.



Figure 4: Construction and Placement of the Reconstructed Headframe Over the Operating Shaft.



Figure 5: Completed Shaft House Reconstruction.

### 4.3 STRUCTURAL STABILIZATION

Another component of the Carissa Gold Mine project included the investigation and characterization of the structures located on the project site. WY AML consultants performed thorough investigations to determine the characteristics of each structure, assess structural competencies, and make recommendations for stabilization if needed. The following structures on site were evaluated:

- |                 |                                       |
|-----------------|---------------------------------------|
| / Mill Building | / Hoist Building                      |
| / Mill Office   | / Reagent Shed                        |
| / Mine Office   | / Log Cabin                           |
| / Bunkhouse     | / Powder Keg                          |
| / Cookhouse     | / Seven storage tanks across the site |

Stabilizing structures at the Carissa Gold Mine were performed throughout multiple project phases. Initially, the majority of the structures had minor repairs, including replacement of rotting sill logs, replacement of failing rolled roofing, and roof repairs when needed. In 2017, State Parks and WY AML initiated work to ensure longevity of site structures, which included installing a French drain system around the perimeter of the Mill Building to prevent water infiltration through the original stacked rock foundations. From 2018 to 2021, new foundations were constructed for nearly all structures at the site. These foundations include foundation stem walls and concrete plinths for the Bunkhouse, Cookhouse, and Mill Office; thickened edge slabs for the Reagent Shed and Log Cabin; and a variety of concrete retaining walls to support the Reagent Shed, west Mill Building approaches, and the southern wall of the Mill Building. The most extensive of these projects was performed in the summer of 2019. The original stacked rock foundation wall on the southern side of the Mill Building began showing signs of failure. Rocks had dislodged from the wall in multiple locations and the wall was bowing outward in some sections. To mitigate this imminent failure, WY AML consultants performed a two-phase mitigation:

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1. Coring out sections of previously placed concrete that covered original tailings on Level 6 of the Mill Building interior

2. Performing permeation grouting into the tailings to solidify the mass, which would allow it to support increased loads and resist collapse when the stacked rock wall would be removed

After the permeation grouting process was completed, the stacked rock wall was temporarily stockpiled on site, and a shotcrete wall with soil nails was installed to stabilize the structure. The stacked rock wall was then reconstructed to reflect the historic accuracy of the structure. Also, agreements were made to share funding responsibilities on the project between the WY AML and State Parks—the WY AML was responsible for funding all hazard mitigation work and structural stabilization efforts, and State Parks was responsible for funding restoration or reconstruction portions of projects.

Each structural stabilization project required intensive care of the structures because the Carissa Gold Mine and its structures and features were placed on the National Register of Historic Places within the South Pass City Historic District. This required stabilizing construction and finishes while maintaining the structures in their original condition. With this requirement, many of the structural stabilization projects are not visible and ensure a historically accurate appearance.

## 5.0 SUMMARY

The success of the Carissa Gold Mine project demonstrates how AML projects can preserve important historic sites and contribute to the inventory of cultural assets in their respective states. The Carissa Gold Mine required coordination and collaboration between multiple entities, including the WY AML, State Parks, SHPO, engineering consultants, cultural consultants, and contractors to successfully mitigate the site's physical and environmental hazards. Leveraging multiple funding sources allowed the balance of hazard mitigation and restoration work to create a State Park that is visited by thousands of tourists every summer and has become an educational resource for the State of Wyoming. The Carissa Gold Mine is a time capsule of our nation's history of hardrock mining and the gold rush that so many states experienced at the turn of the last century. This project exemplifies the Wyoming Department of Environmental Quality's mission statement to protect, conserve, and enhance the quality of Wyoming's environment for the benefit of current and future generations.



Figure 6: Carissa Mill Building and surrounding structures.

# PHASE 1: MILL CLEANUP

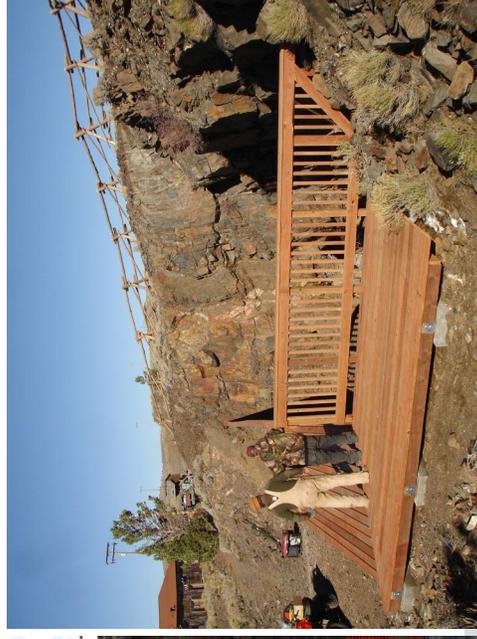


Cleanup of tanks within the Mill Building



Cleanup of the interior of the Mill Building and the preparation of disposal of hazardous materials

# MINE OPENING CLOSURES



Viewing platform for the glory hole

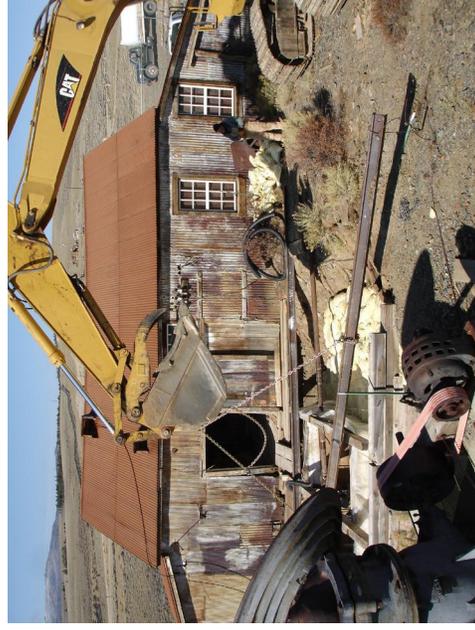


Mill Pond adit accessible closure

# MINE OPENING CLOSURES

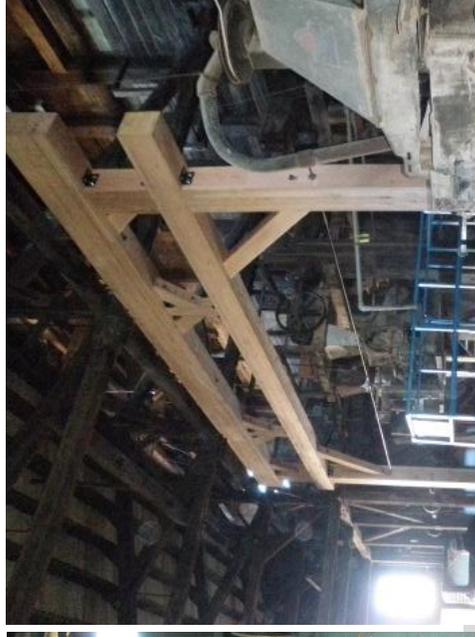


Concrete plug closure for Charlies Folly



PUF plug closure for Willow Creek Shaft

# MILL BUILDING STRUCTURAL STABILIZATION



Construction of the structural glulam and ball mill foundation



Retaining wall construction for the Mill Building approaches

# MILL BUILDING STRUCTURAL STABILIZATION



Permeation grouting of subfloor at Level 6 in the Mill Building



Construction of the shotcrete and soil nailed retaining wall on the south wall of the Mill Building; original stacked rock material used to recreate the original stacked rock foundation

# ADDITIONAL STRUCTURES STABILIZATION



Structural stabilization of the Cookhouse with concrete stem wall foundation



Structural stabilization of the Mill Office with concrete stem wall foundation



**Notes:**  
 All dimensions and elevations are indicated in feet based on the location of the finished rock. The Contractor and Engineer shall verify these elevations based on the finished rock elevation and shall be responsible for any adjustments to the drawings to reflect the actual construction.

**General Notes:**  
 1. All masonry and structural steel shall be fabricated and installed in accordance with the specifications and drawings. All masonry shall be constructed in accordance with the specifications and drawings. All steel shall be fabricated and installed in accordance with the specifications and drawings.

**Legend:**  
 - Masonry Wall  
 - Floor Joist

**South Wall Mill Building**  
 FORMED & COMPLETE

**FOUNDRY AND FABRICATION OF THE MILL BUILDING**

**REVISIONS**

NO.	DATE	DESCRIPTION
1	10/1/2023	ISSUED FOR PERMIT
2	10/1/2023	ISSUED FOR PERMIT
3	10/1/2023	ISSUED FOR PERMIT
4	10/1/2023	ISSUED FOR PERMIT
5	10/1/2023	ISSUED FOR PERMIT





