

**LEWIS MILL**

**2012 Stabilization Project**

**San Miguel County, Colorado**

For San Miguel County

**Open Space and Recreation Program**



**FINAL REPORT**

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## **LEWIS MILL**

### **2012 Stabilization Project**

#### **San Miguel County, Colorado**

#### **Summary**

The Lewis Mill was constructed circa 1907 at a remote location near the head of Bridal Veil Basin at an altitude of approximately 12,500 feet. The building is a timber frame structure that was largely pre-fabricated off site, transported and assembled on a combined stonework and excavated rock foundation. Based on available information, the building received little structural maintenance until after the year 2000. In the summer of 2000 a comprehensive building assessment was conducted by AE Design Associates, P.C., and areas of significant deterioration of the structure were documented.

The structural needs for the Lewis Mill Building were evaluated in 2003 by KL&A Inc., Structural Engineers and Builders. Subsequently, many improvements were incorporated into the Lewis Mill Building structure based on recommendations contained in the report.

A follow-up examination of the structure was conducted in 2011 by KL&A Inc. to determine additional needs of the building structure that may have developed from either normal deterioration or from the effects of the high winds and deep snowfall normal in this harsh environment. In 2012, San Miguel County initiated a project to address many of the recommendations contained in this report as well as repair/replacement of a roof section damaged by high winds that occurred during the winter of 2011-2012.

During the spring of 2012 San Miguel County developed an initial list of priority items that needed immediate attention. Pre-qualified contractors attended a Pre-Bid site meeting on June 25, 2012, and proposals were submitted to San Miguel County. The bids were evaluated and an award made to Leopard Creek Timberframe Co. of Placerville, Colorado.

Work on the list of necessary items as well as the roof repair/replacement was initiated in early August 2012 and completed in approximately 3 weeks. During that time, all targeted tasks (except item 13) were completed as well as select additional authorized work items.

Stephen C. Fearn, P.E., Silverton, Colorado was engaged by San Miguel County to provide Engineering Consultation during the project phases.

#### **Stabilization Work Plan**

Priority items identified for work are listed on the following page. Work completed in each area is summarized in the following descriptions and photographs.

High Priority Stabilization:

1. Stabilize lateral resisting frame along Grid 4
2. Create new foundation for northern most column on Grid 4
3. East Strong Back Wall – Column Lines A – G, Grid 6

Additional High Priority Item:

4. Repair damaged roof on south east gable

Medium Priority Stabilization:

5. Missing knee braces
6. Repair floor framing of level 3 above thickener Column Lines e & G, Grids 4 – 6
7. Repair/replace rotten beams level 1 and at Columns 5E and 6C
8. Replace collapsed floor of level 2 Column lines B & C, Grid 6
9. Add additional connections at repaired roof beams on Grid 6
10. Remove thickener debris from level 2 floor including lumber and equipment
11. Repair stair between levels 1 and 2

Low Priority Stabilization:

12. Inspect level 2 floor at thickener and repair/replace as required
13. Repair rotten beam and post elements of northeast dormer
14. Repair south wall framing on level 2

Additional Items:

15. Additional floor support posts underneath Level 2 floor between Column Lines A and G and Grid Lines 4 and 5.
16. Temporary stabilizing tension rod between Column Lines E and G along Grid Line 5.
17. Bucket elevator shaft housing support for bucket elevators No. 5 and 6.

**Recommendations for Future Work**

1. Support bottom of bucket elevator 6 housing.
2. Support top and bottom of bucket elevator 7 housing.
3. Repair deteriorated structural timbers of the crushed ore bin located at Column Line C and Grid Line 2.
4. Provide additional stabilization of the north wall (Column Line G) at Grid Line 5. This is a high priority item.
5. Monitor stability of lateral resisting frame along Column Line 4.
6. Complete window closures to prevent accumulation of snow inside of building.
7. Repair rotten beam and post elements of northeast dormer

### Work Completed

#### 1. Stabilize lateral Resisting Frame along Grid 4.

Cross bracing was installed between level 2 and 3 along Grid line 4 – between Column Lines F & G; and between E & F. 1 inch diameter steel rod w/turnbuckles and welded attachment brackets were installed for tension members. 6 x 6 timber was installed for compression members. The bottom of the timber braces were secured to the existing wood sill by fabricated metal ‘buckets.’ The sill along Grid line 4 below level 1 is mounted on the rock foundation and was determined to have minimal deterioration.

Column 4E required extensive reinforcement due to deformation. Columns 4C and 4b were reinforced as shown. Columns 4C and 4B were reinforced by installing helper columns from the base part way up the column. These were secured with through bolts.

Figure 1



Stabilizing Bracing between Column Lines F & G along Grid 4

Figure 2



Stabilizing Bracing between Column Lines E & F along Grid 4

Figure 3



Supporting 'Bucket' on Sill (typical)

Figure 4



Top Compression Brace Connection (typical)

Figure 5



Tension Member Connection (typical)

Figure 6



Reinforcement of Column 4C Base

Figure 7



Reinforcement of Column 4B Base

2. Create new foundation for northern most column on Grid 4 (Column 4G)

The bottom of the column was rotten and had shifted slightly to the north. It was determined that the sill timber on top of the rock foundation was sound. Sister columns (3x8) were bolted on both sides of the column for support, and the rotten section of column 4G removed. This was replaced with a sound section to carry the load in compression, and the assembly secured with through bolts. The outer metal covering was replaced to help protect the column from future deterioration.

Figure 8



Outside Column 4G Sister Timber Setting on Timber Sill and Rock Foundation

Figure 9



New Compression Section for Column 4G and Sister Reinforcements on Each Side

Figure 10



Metal Covering Replaced at Column 4G

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3. East Strong Back Wall – Column Lines A – G, Grid 6

This wall was the westerly wall (Grid 6) of the Concentrate Storage Bin. Repairs were completed at Column 6F (new post and brace); Column 6E (new braces); and, Column 6C (pony sets and support of Level 2 Floor Beam). In addition, Column 5E and 5C were reinforced and a floor beam support post installed along Grid 5 between Column Lines E and F.

Figure 11



Pony Set installed to support Column 6C and Floor Beam between Grid 5 and 6

Figure 12



Repair of Column 5C Supporting Level 2

In addition to the reinforcement of Column 5E and the post installed along Grid 6 between Column Lines E and F, the Stairway between Levels 1 and 2 was repaired (Item 11).

Figure 13



Extensive Reinforcement/Repairs of Column 5E and Repaired Stairway between Levels 1 and 2  
Intermediate Post between Column Lines E and F in Background at Photo Right

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4. Repair damaged roof on south east gable.

The southern half of the roof section (between Column Lines C and D and Grid Lines 5 and 6) had been lifted off by high winter winds and folded over the northern half of the section, and was minimally suspended by remnants of metal roofing. The suspended section of roof was removed and replaced. Existing materials were utilized as much as possible and new materials were installed where required. The entire section was secured with metal brackets to prevent a future incident of wind lift damage.

Figure 14



Repaired/Replaced Roof Section from Inside Mill between Column Lines C and D

Roof Section is secured to Roof and Wall Framing Timbers by Metal Brackets

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5. Missing knee braces.

Missing knee braces were replaced as they were identified. These apparently had been removed during mill equipment modifications.

6. Repair floor framing of Level 3 above thickener and at Columns 5E and 6C.

Part of the floor framing supporting Level 3 was repaired and safety rails installed around the remaining openings. The unsafe/unsupported sections of floor were removed.

Figure 15



Level 3 Repaired/Removed Floor Sections and Safety Railings Above Thickener.

7. Repair/replace rotten beams Level 1 and at Columns 5E and 6C.

See Figure 11 and Figure 13.

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8. Replace collapsed floor of Level 2, Column Lines B and C, Grid 6.

Collapsed floor was removed; new support beams installed as needed. Part of the floor was left open to provide light and viewing of Tube Mill on Level 1. Safety railings were installed around the open area.

Figure 16



Repaired Floor Area, New Floor Beams and Safety Railing with Viewing Area between Column Lines B and C and Grid 4 and 5.

9. Add additional connections at repaired roof beams on Grid 6.

This item was addressed as part of the roof repair.

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10. Remove Thickener debris from Level 2 floor including lumber and equipment.

All thickener debris was removed from Level 2 floor and placed in the Concentrate Bin (Figure 18). Equipment items were placed in the concentrate bin for future restoration.

Figure 17



Cleaned Thickener Base and Surrounding Floor on Level 2

Figure 18



Equipment and Thickener Floor Material in the Concentrate Bin

11. Repair Stair between levels 1 and 2.

See Figure 13 for repaired Stairway.

12. Inspect level 2 floor at thickener and repair/replace as required.

A short post was placed between the floor beam and the underlying unexcavated rock surface to provide extra support for the floor.

13. Repair rotten beam and post elements of northeast dormer.

Reserved for future work.

14. Repair south wall framing on level 2.

Column 5A was reinforced as shown in Figure 19.

Figure 19



Stabilization of South Wall framing on Level 2

Additional Items:

15. Additional floor support posts were placed underneath Level 2 floor between Column Lines A and G and Grid Lines 4 and 5 as shown in Figure 20.

Figure 20



Support Posts underneath Floor Beams between Column Lines A and G and Grid Lines 4 and 5

16. A temporary stabilizing tension rod was installed between Column Lines E and G along Grid Line 5 to help stabilize a bulge in the north wall (Column Line G). This is part of the structural problem created when the thickener was installed and column F5 was removed between Level 2 and Level 3. This continues to be an area of structural weakness in the building framing. The Rod is shown in Figure 21.

Figure 21



Location of Tension Stabilizing Rod along Grid Line 5

17. Elevator Shaft Housing Support. The Lewis Mill has three bucket elevator shafts (denominated as Items No. 5, 6 and 7 on Drawing LM-2 from the Historic Structural Assessment). The housings were partially supported on the building timber frame and were partially free-standing. All three are beginning to show partial collapse primarily from the free-standing portions. Helper support was installed at the top and bottom of No. 5 and at the top of No. 6 as shown in Figures ----

Figure 22



Additional Support at Top of Bucket Elevator Shaft No. 5

Figure 23



Additional Support at Top of Bucket Elevator Shaft No. 6

Figure 24



Additional Support at the Bottom of Bucket Elevator Shaft No. 5

**Future Work - Photo**

Crushed Ore Bin Bottom – South Side Column Line C, Grid Line 2.

Figure 25



