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REPORT OF STRUCTURAL EVALUATION

AET Project No. 19-20035

ACME POWER PLANT – STRUCTURAL EVALUATION
ACME, WYOMING

OCTOBER 11, 2020

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EXECUTIVE SUMMARY

This study was commissioned by WWC Engineering in Sheridan, Wyoming to evaluate the current condition of the historic ACME Power Plant in Acme, Wyoming. The plant was constructed in three phases: 1910, 1947 and the early 1950s, to supply electrical power to the local coal mine, the village of Acme and the town of Sheridan. The power plant was decommissioned in 1976. The site has been utilized by several owners since the power plant shut-down and has been vacant for the last several years.

The power plant was constructed to support heavy industrial loads. This analysis shows that it retains sufficient capacity to support all but the highest potential live occupancy loads. It has sufficient capacity to resist all wind loads; deterioration to the roof of the 1910 building and 1947 addition require reconstruction to resist modern snow and rain loads. The 1950s addition roof has sufficient capacity to support modern snow and rain loads. It lies within a Zone A of a Special Flood Hazard Area, which places restrictions on the height of the lowest habitable level. This may hinder the power plant reuse.

The plant is in good condition, with notable exceptions addressed in the recommendations below:

RECOMMENDATIONS

Recommendation 1: Overall, the ACME power plant is in good structural condition, and does not exhibit conditions that put the building in jeopardy in the short term. The repairs described below likely fall within the $150,000 to $225,000 range. Modifications to support new uses would exceed these costs.be above this.

Recommendation 2: The basement and first floor structures were originally constructed to support heavy industrial loads, and will support most new loads without reinforcing. Modifications to infill the openings and topping to level the floors will be relatively straightforward, requiring no reinforcing.

Recommendation 3: The roofing membrane for the entire building is in poor condition and requires replacement.

Recommendation 4: The structural roof in the 1910 building is in poor condition and requires repair and/or replacement across the majority of its area – we estimate 80% of the roof requires attention, including 40% that requires replacement. It may be cost-effective to replace the roof in its entirety. The structural roof in the 1947 addition requires additional evaluation to determine its structural capacity. The 1950s building roof is in good condition and does not require attention.

Recommendation 5: The north/south spanning brick center wall of the 1910 building is cracked between the roof truss top and bottom chords - at four roof trusses. This requires a structural evaluation to determine if the bricks are overstressed in compression; it may require some brick reconstruction within this small area.

Recommendation 6: The exterior brick walls of the 1910 building and 1947 addition require repair and some reconstruction. The top five feet require 100% repointing and approximately 40% reconstruction. The decorative corbelling and dentils at the top of the walls require complete reconstruction, with 50% brick replacement. The walls below the large window heads require spot repointing – approximately 50% requires attention, with 10% requiring resetting or replacement.

Recommendation 7: The exterior brick walls of the 1950s addition are in good condition and require only spot repointing, with approximately 20% of wall area needing attention.

Recommendation 8: The small ancillary building that lies 50-ft. off the southwest corner of the building has settled in its southwest corner, causing extensive cracking of the south and west walls and the interior concrete slab-on-grade within the area. The recommended repair includes soil investigation and stabilization to prevent future settlement, and reconstruction of the walls and interior slab. The brick parapet at the top of the north wall requires reconstruction, and the remainder of the exterior brick walls require spot repointing – approximately 20%.

INTRODUCTION

The ACME Power Plant was originally built in 1910 on the south bank of the Tongue River, north of Sheridan, Wyoming, to provide electricity to the local coal mine, the small company town of ACME, and the town of Sheridan. A 3,000 kilowatt generator, boilers, coal bins, and office were added to the north façade of the building in 1947; a 5,000 kilowatt generator, supporting boilers and tall coal bins were added in the early 1950s. The power plant produced electricity until 1976 when it was sold to a private entity. The plant and site were subsequently used for hazardous waste storage, battery recycling and other uses. This report evaluates the current condition of the existing structure, based on its original construction and environmental forces that have weakened the structure. See photographs 1-5.

Purpose of Assessment

American Engineering Testing (AET) has been engaged by WWC Engineering, as part of their environmental and conditions assessment, to evaluate the current condition of the building. A small one-story building just to the west of the power plant is also reported on. The purpose of this study is to identify the original structural systems, to estimate their original capacities (as required for future planning), to evaluate their current state of deterioration and retained capacities, and to make recommendations for repair or replacement of damaged elements.

Scope of Assessment

The investigation has included a two-day site visit to observe, measure and photo-document the power plant and a small one-story ancillary building. Field sketches were created to record existing structures and locate deterioration within the interior structures and the exterior brick facades and concrete roof structures. The interior survey included the basement and first floor levels and the catwalks within the 1947 and1950s additions to the building. The roofs of the original building and the 1947 addition were observed from above and below; the roof of the 1952 addition was observed from below. The rooftop conveyors up to the 1952 addition were observed and photo-documented. The below-grade tunnels connected to the building were observed from within the building but were not surveyed through their length. A measured survey is included in this report that documents the building extents and major structural elements within the building - see attachment 1.

Methods and Techniques

AET staff spent Monday and Tuesday, September 14 & 15 on-site conducting a measured survey and photo-documenting the building, using a laser range-finder and laser-plumb-and-level tool to determine the building dimensions and past movement. Observations were recorded using a digital 35mm SLR camera with telephoto lens. Field measurements were recorded on building plans provided by WWC Engineering.

DESCRIPTION OF STRUCTURE

1910 Original Power Plant

The original power plant, constructed in 1910 and 1911, measures approximately 102-ft. wide (east-west dimension) by 69-ft. long (north-south dimension) by 33-ft. 8-in. tall. It consists of two main areas: the western half of the building houses four coal boilers with fireboxes below, coal bins hung from the roof that feed the boilers, and a waste-ash tunnel running north-south beneath the fireboxes. The east half housed the electric generators/turbines, switch-gears and controls. These have been removed. See photos 6-10.

The 1910 basement supports a concrete first floor, a multi-wythe brick center bearing wall, and multi-wythe brick exterior walls. The basement construction includes both concrete piers and walls, and steel columns. The supporting footings were not exposed but are likely to be large spread footings just beneath the basement slab, bearing on competent river sand. Concrete exterior basement walls enclose the space and connect to the 1947 basement to the north and the 1952 basement to the south. A concrete tunnel beneath the boilers on the west side of the basement transported ash from the boilers to an exterior exit at the north of the building. This tunnel is approximately seven feet wide by eight feet tall and is located beneath the four boiler fireboxes. It is covered with shallow arches supported on steel beams that span transverse to the tunnel. These arches follow the geometry of archaic masonry shallow-arch floors, which were common in this era; however, exposed aggregate on the underside of one arch indicates that these arches are cast-in-place concrete. The aggregate is rounded and appears to be river rock that may have been taken from the nearby Tongue River. The boilers above are supported by the east and west tunnel walls down to footings; concrete beams span transverse to the walls at approximately 11-ft. on-center and support the boiler side walls. The basement beneath the generator room is filled with large concrete pillars and walls that supported the turbines. These structures are oversized to support the weight and to dampen the cyclical vibration of the turbines. There are also steel columns that support first floor steel beams that frame openings within the first floor slab. See photos 11-13.

The first floor of the 1910 building consists of two systems: a slab-on-grade beneath the boiler room, and a structural cast-in-place concrete floor beneath the generator room. The thickness and reinforcing of the boiler room slab-on-grade was not investigated; therefore, it is not known if the slab-on-grade was designed as a structural slab containing sufficient reinforcing steel to span between supporting walls, or if it is supported by the soils below, relying on the soils to provide strength and stiffness. The location and geometry of the basement ash tunnel indicates that the boilers and fireboxes are supported by the tunnels. The first floor of the generator room is cast-in-place construction supported by steel I-beams. An "expanded metal, diamond mesh1" provides the steel reinforcing for the first floor slab, as seen from below. See photo 14.

The above-grade superstructure consists of 13-in. thick three-wythe brick exterior walls, a 13-in. thick three-wythe brick center wall, steel columns, beams and trusses supporting the roof and catwalks. The exterior brick walls include large industrial windows, topped with segmental brick arches, set within inset panels that have corbelled decorative top edges and pilasters between the panels. The top of the walls are decorated with brick dentils and corbelling just below the parapet cap. The exterior and interior walls are bearing walls that support the weight of the structure above, and shear walls that resist lateral wind and seismic loads. See photo 15.

The roof deck consists of a cast-in-place concrete slab, with the same expanded metal diamond mesh used in the first floor slab; this slab bears on steel channels. The channels over the generator room are supported by large steel trusses that span east/west. A 1910 construction photo shows these trusses bearing on the east and west exterior walls and the center wall, spanning over the generator room and the boiler room. A second truss bears atop these and supports the clerestory roof above. The center wall also supports a heavy industrial crane through corbelled brick pilasters that extend into the generator room. A mezzanine extends across the east wall of the generator room, with a concrete floor supported on steel beams and columns. All structural steel pieces are early shapes built up from rolled plates and angles, connected with rivets. This is typical steel construction for this era. See photos 16-18.

[1] Frank Kidder and Harry Parker. 1931. *Kidder Parker Architects' and Builders' Handbook*, New York; John Wiley & Sons, Inc.; pages 1002-1003.

Historic photos include four large chimneys set on the clerestory roof; these no longer exist on the building, and evidence of their structural support was not seen. There are areas within the roof that have precast ribbed roof panels, typical to the mid-20th century, that may indicate where the chimneys were removed.

A large conveyor was added onto the west roof to load coal into the 1950s coal bin. This conveyor remains on the roof. See photo 2 for conveyor.

1947 Addition

A “TIMELINE FOR ACME POWER PLANT” (attachment 2) indicates that the addition attached to the north face of the original power plant was constructed in 1947. It added new boilers and fire boxes, a 3,000 kilowatt generator, a staff office, and locker-room space. This addition extended the western roof and the western half of the clerestory section to the north by approximately 30-ft.; this housed the boilers, fireboxes, and coal bins that feed the boilers hung from the roof. Catwalks fill the southern portion of the space. A one-story office space extends northward approximately 15-ft. from the 1910 generator room, leaving the top portion of the 1910 north wall as an exterior wall. The basement ash tunnel was extended to the north, beneath the new boilers, and a full basement was built east of the ash tunnel. This basement extends eastward beneath the office space and steps up to a small locker-room at the east end of the basement. It appears that the generator was installed in the northern part of the 1910 generator room, although this is not confirmed.

The basement and first floor construction of the addition used similar systems to the 1910 construction: concrete basement walls and floors. Visual evidence indicates that the first floor is modern cast-in-place concrete construction, likely using deformed steel reinforcing bars rather than the steel mesh used in the 1910 slab. This floor is supported on steel I-beams that span to concrete basement walls. Unlike the 1910 construction, the exterior concrete walls extend approximately three feet above the exterior soil. Construction of the above-grade superstructure includes three-wythe thick brick exterior walls, similar in construction and detailing to the 1910 walls. The roof deck is cast-in-place concrete, supported on steel channels, similar to the 1910 roof. This addition does not include steel trusses; instead, the steel channels supporting the roof span north/south and bear on the 1910 north exterior wall and a new brick north wall. Steel connections are welded, rather than the riveted connections in the 1910 construction; steel shapes appear to be circa 1940s. See photos 19-20.

1950s Addition

Historic documents describe this addition as being constructed between 1950 and 1953, adding a “5,000 kilowatt steam turbine” to the southern face of the 1910 building, and extending the power plant by approximately 42-ft. to the south. The precise construction timeline was not discovered. The addition included a five-story tall boiler and firebox that step up from the 1910 west roof and clerestory roof to approximately 62-ft. above the exterior grade; the east edge of this tower approximately aligns with the east edge of the clerestory room. A 38-ft 2-in. tall generator room (4-ft. 6-in. taller than the 1910 structure) extends east from the tall tower to align with the east wall of the original building. The generator room housed the generator and all electrical switch gears and controls. The basement opens to a below-grade tunnel that supplied the plant with coal from a railroad hopper located approximately 50-ft. west of the plant. See photos 21-22.

The 1950s structure has a few similarities with the earlier phases: it includes a cast-in-place concrete basement, a modern cast-in-place concrete first floor, and it is clad in three-wythe thick brick walls. The other structural elements differ from the 1910 and 1947 construction in significant ways: whereas the others were brick masonry buildings with some steel included to support the roof and catwalks, the 1950s structure is a steel building that is clad in brick. The superstructure consists of steel columns that extend from the basement up to the first floor, which is standard steel floor construction: heavy steel I-beams that support the cast-in-place concrete floor. The generator, electrical equipment, and the boilers sat on this floor, with steps and voids in the floor to support the equipment, as needed. Steel columns extend above the generator room to support a large industrial crane and rails; columns within the boiler room extend 31-ft. above the first floor, supporting catwalks and framing the large boilers and mechanical fans, etc. Exterior columns support the steel roof framing and brace the exterior masonry walls around the perimeter of the building and in the building corners. The roof deck is a precast concrete ribbed panel that was common in at the time[2]. See photos 23-25.

Lateral wind and seismic loads are resisted by steel cross-bracing – in walls between columns, and in the roof between roof beams. Lateral stability for the industrial crane is provided by vertical trusses between crane support columns.

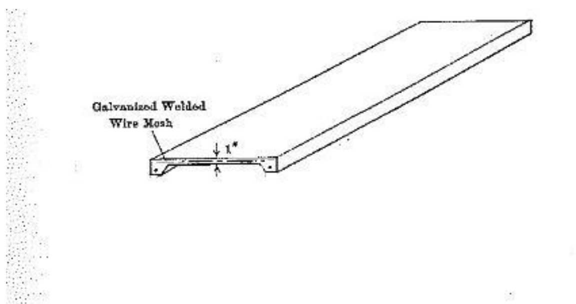

Fig. 101. Federal Channel Slabs

Precast roof panels above the 1950s addition

Ancillary Building

A small one-story brick-clad building that lies approximately 50-ft. off the southwest corner of the power plant is assessed. This building is a small two-room building, with a mezzanine above the southernmost room. The building does not have a basement and is presumed to be supported on shallow spread footings. The superstructure consists of 8 ½-in. thick brick and hollow clay-tile walls – one wythe of brick, one wythe of tile – that supports a sloped wood-framed roof. The walls support gravity loads and resist lateral wind and seismic loads. See photos 26-27.

STRUCTURAL ANALYSIS

The code-mandated forces to be analyzed for this building are gravity: self-weight (dead loads) and occupants (live load); environmental loads: flood and wind (lateral load), snow and rain (vertical); and seismic (lateral). Wyoming recognizes the 2018 editions of the International Building Code (IBC) and the International Existing Building Code (IEBC); this analysis references these.

Loading requirements have changed since the three phases of the building were constructed; the IBC specifies the modern loading requirements and the IEBC determines when modern versus original loading should be used. The future use of the power plant, as we understand it, would cause a change of occupancy from industrial to a different, unspecified use. This analysis uses the "Change of Occupancy" requirements in the IEBC (Chapter 10).

[2] Ibid, page 1009.

Gravity Loading

The building self-weight (dead loads) are basically the same from original to now; therefore, a new loading case is not required to be analyzed. Occupant (live) loading: the IEBC requires the existing structure be checked for modern loading requirements that are higher than the original loading, as defined by IBC Table 1607.1. While it is not known with certainty what the building designers used for design loads, it is likely that these were considered Light Manufacturing, with design loads of 125 pounds/sq.ft. (psf), or heavier. This is higher than most expected future loads such as assembly areas (100 psf), office lobbies (100 psf), dance halls or gymnasiums (100 psf), residential public rooms (100 psf). If future programming were any of these uses, the existing structure would not require reanalysis, due to the reduced loads. Alternatively, if the programming includes the following uses, the floors would require reanalysis: heavy manufacturing (250 psf), library stack rooms (150 psf), armory floors (150 psf), stage floors (150 psf) and heavy storage (250 psf). It should be noted that the structure is no longer carrying the very heavy turbines, which will lighten the load on the piers, walls and foundations directly supporting them, and possibly the floors adjacent to the turbines. Using this logic, the floors do not require reanalysis at this time to confirm they will support most likely future loadings. There was no evidence observed of deterioration that would reduce the basement, first floor or mezzanines significantly below their original capacities.

Environmental Loading - Horizontal (flood, wind)

Flood loading analysis is required for structures that reside in a Flood Hazard Area, as designated by the governing authority for the building. The Sheridan County Engineer, Ken Muller, and his staff stated that the ACME power plant lies within a Zone A of a Special Flood Hazard Area. They also provided the Rules and Regulations Governing Flood Plain Management, Sheridan County, Wyoming, dated 12/17/2013, that states:

> **H. Standards for Zones Without Base Flood Elevations and/or Floodway (A Zones)**
> These standards apply in Special Flood Hazard Areas where streams exist but no base flood elevation data have been provided (A Zones), or where base flood data have been provided but a floodway has not been delineated.
>
> (1) When base flood elevation or floodway data have not been identified by FEMA in a Flood Insurance Study and /or Flood Insurance Rate Maps, then the Floodplain Administrator shall obtain, review, and reasonably utilize scientific or historic base flood elevation and floodway data available from a federal, state, or other source, in order to administer these Rules and Regulations. If data are not available from any source, **only** then provisions 2 and 3 shall apply.
>
> (a) Where the floodplain administrator has obtained base flood elevation data, applicants of proposed projects that increase the base flood elevation more than one foot shall obtain a Conditional Letter of Map Revision preconstruction and a Letter of Map Revision post construction.
>
> (2) No encroachments, including structures or fill, shall be located within an area equal to the width of the stream or fifty feet, whichever is greater, measured from the ordinary high water mark, unless certification by a licensed professional engineer documents that the encroachment will not result in any increase in flood levels during the base flood.
>
> (3) In special flood hazard areas without base flood elevation data, new construction and substantial improvements of existing structures shall have the lowest floor of the lowest enclosed area (including basement or crawlspace) elevated no less than two feet above the highest adjacent grade (HAG) at the building site. Openings sufficient to facilitate the
>
> unimpeded movement of flood waters shall be provided in accordance with the construction standards in Sections 6 (B) and (C).

This regulation requires a lowest floor elevation above the base flood elevation, for any future change to occupancy for the power plant. Hydrologic information sufficient to analyze the water forces and scouring effects was not discovered; therefore, additional information is required to perform this analysis.

In the absence of this information, it is our professional opinion that this large industrial structure has sufficient strength to withstand all be the most prolonged and powerful flood.

Wind analysis is performed per the IBC section 1609 and the American Society of Civil Engineers (ASCE) 7 document. Based on these documents, the design wind load (unfactored) is 23 psf. The 1910 and 1947 structures resist this through shear of the 13-in. thick masonry exterior and the center north/south wall (1910 building). The worst case design loading is east/west winds pushing on the 139-ft. wide x 33-ft. 8-in. tall face of the building, resulting in 109,000 pounds of wind force on these combined structures. Each side wall resists ½ of the load, or 54,500 pounds. A presumed brick masonry wall compressive strength, fm, of 1,000 psi (industry standard) and a code-mandated allowable shear stress of 25%, gives a 250 psi shear strength of these walls. For a 13-in. thick wall, this would be 3,250 pounds shear capacity per inch of wall length, or 39,000 pound capacity per foot of wall length; this means the wall would have to be somewhat less than 18-in. long to resist the wind load. These walls are significantly longer than this. The 1950s structure resists lateral loads through braced frames; the analysis of these is beyond the scope of this study, however, given the size of these braces, it is our professional opinion that these braces can support the wind lateral loads.

Environment Loading – Vertical (snow and rain)

The 1910 building codes only considered flat roof snow loads, without the extra weight of snow drifts against an adjacent taller structure, such as the middle clerestory section of the building. This generally means that older roofs often don’t meet current snow loading requirements. There is a provision in the IEBC that states if the new loading does not increase stresses by more than 5%, the original loading can be used. Effectively, this means that new loads, such as new roofing membrane or rooftop mechanical units, are not added to the roof, then the existing roof is not required to meet the modern building codes. There are three points to note:

1. The existing roof membranes on the various roofs are in poor condition and require repair. It should be straightforward to install a new roof that is lighter than the asphalt built-up roofs that were likely installed originally.
2. The 1950s building uses precast roof panels that have a published capacity of 60 psf, including snow and roofing. Assuming 15 psf roofing membrane, this would leave 45 psf capacity for snow and rain loading. The IBC indicates a 28 psf ground snow load, which would equate to a 19.6 psf roof snow load (70% of ground snow load). Therefore, the 1950s building has sufficient capacity to support modern snow and rain requirements, including the expected snow drift loads and some light mechanical units.
3. The 1910 and 1947 structural roof decks are in poor condition in many places, and require repair or replacement as part of any renovation project. It would not be difficult to reinforce these during their repair to meet modern snow loads.

Seismic Loading

Seismic loads for this building are calculated using IBC Section 1613, and is based on several variables:

4. Seismicity of the area. Two variables represent this: a 0.2 second acceleration, Ss; and a 1 second acceleration, S1. These are 20% and 6% of gravity, respectively.
5. Soil classification. Based on the soil borings, this is estimated to be Classification D (stiff soil).
6. Occupant Risk Category. This building has the potential to house more than 300 people; therefore, a Risk Category of III is used.

Using these parameters, a Seismic Design Category of B is determined, which means that seismic forces would be low, generally lower than wind forces. Given the strength of the masonry walls described above, damage due to seismic forces is not a concern. It should be noted that the masonry boilers are very large and would create high lateral internal forces during an earthquake. This should be considered during the code review of any new proposed use.

The conclusion of this structural analysis is that the three sections of the building – 1910, 1947 and 1950s – are sufficiently strong to resist code-mandated modern loads. One exception is the roof slabs above the 1910 and 1947 buildings, which require repair or replacement. The existing boilers should be analyzed separately from the building structures to ensure they can resist internal forces.

EVALUATION OF EXISTING CONDITIONS

1910 Original Power Plant

The basement of the 1910 power plant was designed to carry heavy turbine and boiler loads, some of which have been removed. No visible deterioration was observed that would reduce the retained capacity of this basement. There is one exception: the steel beams that span across the ash tunnel are moderately deteriorated. These should be wire-brushed down to solid steel and evaluated for their retained capacity. See photo 28.

The first floor of this structure shows no visible signs of deterioration or reduced capacity. It would be relatively simple to infill the many holes in the floor, to create a level and strong floor for future use. Based on its previous design loads, it should be able to support all but the highest design loads (see Structural Analysis above).

The catwalks in the boiler room and the generator room were not analyzed for strength; if the decision is made to reuse them in the future, their retained capacity should be calculated.

The roofs of this structure are in fair to poor condition: daylight is visible through the roof above the generator room, and the edges of the clerestory roof are severely worn. These roofs will require a combination of repair and replacement. See photos 29 & 30.

The center brick wall is in generally good condition. There are cracks in the brick where the large roof trusses intersect it; these will require repair. Otherwise, the wall, including the pilasters against its east face, should not require significant repairs. See photos 31 & 32.

There are significant cracks and evidence of building movement in the original north and south walls of the 1910 building, where window openings were expanded to doorways; these areas require repair and some resetting of bricks. See photos 33 – 35.

The exterior brick walls are fairly good condition, with several notable exceptions (see photos 36-38):

- The decorative dentils and corbelling at the top of the walls are in poor condition and require reconstruction, using the existing bricks and approximately 50% new brick. The stone lintels over windows require replacement.
- The flat wall above the inset window panels (approximately 5-ft. tall) are in fair condition; they require a 100% repointing and resetting of approximately 40% of the bricks. This area is stained with surface salts due to water passing through the wall over the years; this should be treated to remove the salts for durability and aesthetic reasons.
- Below these areas, the brick is in reasonably good condition, with some notable exceptions: there are several areas along these walls that have spalled brick faces, missing mortar and loose bricks.

These walls should be spot repointed, with approximately 50% of the mortar joints needing attention and 10% of the bricks requiring resetting or replacement.

The roofing membrane on this building has failed and requires a complete replacement. The structural roof is in poor condition and needs repair or replacement. We estimate that up to 80% requires attention, with as much as 40% replacement required. It may be more cost effective to remove and replace this roof with a modern structural roof slab. See photo 39.

The coal conveyor on the west roof appears to be in good structural condition. There is no indication of instability or significantly reduced capacity that might cause collapse.

1947 Addition

This addition has many of the similar conditions as the 1910 building (see photos 40 - 42):

- The basement is in very good condition, with no signs of deterioration that would reduce its structural capacity; this includes the tunnel, the locker room, and the area between.
- The first floor appears to be in good condition, when viewed from below. The top surface is covered with debris in the office space and with ash and waste products in the boiler room, which makes it difficult to evaluate for cracking. There are no indications of deterioration within this area.
- The roofing membrane requires replacement over the office and over the boiler room.
- The structural roof decks above the office and the boiler room require additional evaluation to determine their retained capacity. There is a fibrous material with wire mesh attached to the underside of the clerestory roof that may be an asbestos layer, or it could possibly be an early proprietary deck that is part of the structural system. The clerestory roof slab edge is deteriorating and needs to be cut back and replaced. The percentages of repair and replacement of the clerestory roof are expected to be similar to the 1910 roof.
- The exterior brick walls have the same level of damage as the 1910 exterior walls, especially at the top five feet and the top decorative courses. The percentages of estimated repair, repointing and brick replacement are also the same.
- The brick piers that support the clerestory require reconstruction, including approximately 50% brick replacement.

1950s Addition

This addition is in good condition (see photos 42 & 44):

- There is little visible deterioration of the concrete basement or steel and concrete first floor. The steel columns in the basement have surface rust that should be removed and recoated; the current deterioration has not reduced its strength.
- The steel is in good condition that support the catwalks, the crane, the upper level boiler components, and the roof show little signs of deterioration.
- The exterior brick cladding has a simpler design than the decorative designs of the earlier buildings. This makes the brick less vulnerable to erosion from weather. In general, these walls are in good to very good condition (see photos 45-47):
    - There is evidence of past repairs to the top six feet of the wall, damage that was likely caused by failed roof flashing, allowing water infiltration. This repair remains watertight, with no signs of subsequent water damage or brick deterioration.
    - The bricks above the window openings are supported by steel lintels, rather than brick arches used in the earlier buildings. This design is vulnerable to lintel damage due to water collecting on the lintel. However, the lintels are in good condition: there are no

visible signs of rusting and no brick damage or movement caused by the expansion of rusting steel (rust-jacking).
  - The bottom six feet of bricks on the east end of the south wall and the east face of the building are weathered and discolored. It appears that this has been caused by foliage trapping water against the brick, causing surface deterioration.
  - Concrete exterior stairs are badly spalled and require selective demolition of the treads and landing, and replacement concrete.
- The exterior brick cladding will require selective repointing to address the east face deterioration, and localized damage in other areas. The percentage of wall area that requires repointing is less than 20%.
- The structural roof is made of precast ribbed roof panels supported on steel beams. This system is in good condition, with no visible signs of damage or deterioration. We expect there to be little repair or replacement to the roof structure.
- The roofing membrane requires replacement.

Ancillary Building

This small brick building with a wood roof is in relatively good condition, with one large exception (see photos 48 & 49):

- The majority of the brick walls are sound, with tight mortar joints and very little brick deterioration or damage. The parapet at the north wall requires rebuilding; this damage does not extend below the roof deck. The walls around the building require spot repointing, with approximately 20% requiring attention.
- The timber roof joists and underside of the roof deck are in good condition, with no excessive bowing or visible damage. This leads us to believe that the roofing membrane continues to protect the structure from water infiltration.
- The roofing membrane was not observed from above, although a Google satellite image shows a patchwork of colors on the roof, and the roof edge indicates a steel standing seam roof; therefore, this roof may be a patchwork of steel roof pieces. Further investigation is required to determine the roofing membrane condition.
- The structural concern involves the southwest corner of the building that has settled downward, causing large cracks in the west and south walls, and the concrete floor slab in this corner. This settlement is likely related to the railroad spur and below-grade coal hopper that lies just south of the building. A repair would involve stabilizing the soil support to prevent future settlement, reconstruction of the southwest corner of the masonry walls and floor slab.
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RECOMMENDATIONS

Recommendation 1: Overall, the ACME power plant is in good structural condition, and does not exhibit conditions that put the building in jeopardy in the short term. The repairs described below likely fall within the $150,000 to $225,000 range. Modifications to new uses would exceed these costs..

Recommendation 2: The basement and first floor structures were originally constructed to support heavy industrial loads, and will support most new loads without reinforcing. Modifications to infill the openings and topping to level the floors are relatively straightforward, requiring no reinforcing.

Recommendation 3: The roofing membrane for the entire building is in poor condition and requires replacement.

Recommendation 4: The structural roof in the 1910 building is in poor condition and requires repair and/or replacement across the majority of its area – we estimate 80% of the roof requires attention, and 40% requires replacement. It may be cost-effective to replace the roof in its entirety. The structural roof in the 1947 addition requires additional evaluation to determine its structural capacity. The 1950s building roof is in good condition and does not require attention.

Recommendation 5: The north/south spanning brick center wall of the 1910 building is cracked between the roof truss top and bottom chords - at four roof trusses. This requires a structural evaluation to determine if the bricks are overstressed in compression; it may require some brick reconstruction within this small area.

Recommendation 6: The exterior brick walls of the 1910 building and 1947 addition require repair and some reconstruction. The top five feet require 100% repointing and approximately 40% reconstruction. The decorative corbelling and dentils at the top of the walls, and stone lintels over windows, require complete reconstruction, with 50% brick replacement. The walls below the large window heads require spot repointing – approximately 50% requires attention, with 10% requiring resetting or replacement.

Recommendation 7: The exterior brick walls of the 1950s addition are in good condition and require only spot repointing, with approximately 20% of wall area needing attention.

Recommendation 8: The small ancillary building that lies 50 feet off the southwest corner of the building has settled in its southwest corner, causing extensive cracking of the south and west walls and the interior concrete slab-on-grade within the area. The recommended repair includes soil investigation and stabilization to prevent future settlement, and reconstruction of the walls and interior slab. The brick parapet at the top of the north wall requires reconstruction, and the remainder of the exterior brick walls require spot repointing – approximately 20%.

LIMITATIONS

The authorized scope of services did not include a complete review of the code compliance of the power plant. This analysis was limited to items that are visible for observation. As such, our conclusions and recommendations are based on a visual review of the structure and should not be construed as a final assessment of the property.

Should conditions be found in the future that differ from those documented by AET at the time our service, AET reserves the right to review our conclusions and recommendations and modify them accordingly.

STANDARD OF CARE

The work performed by American Engineering Testing, Inc., has been conducted in a manner consistent with that level of skill and care ordinarily exercised by other members of the profession currently practicing in this area.

We appreciate the opportunity to assist you with the historic ACME power plant and we hope that this report will help save the building for future exciting uses. Should you have any questions regarding this report or our services, don't hesitate to call or e-mail to discuss this.

Report Prepared By:

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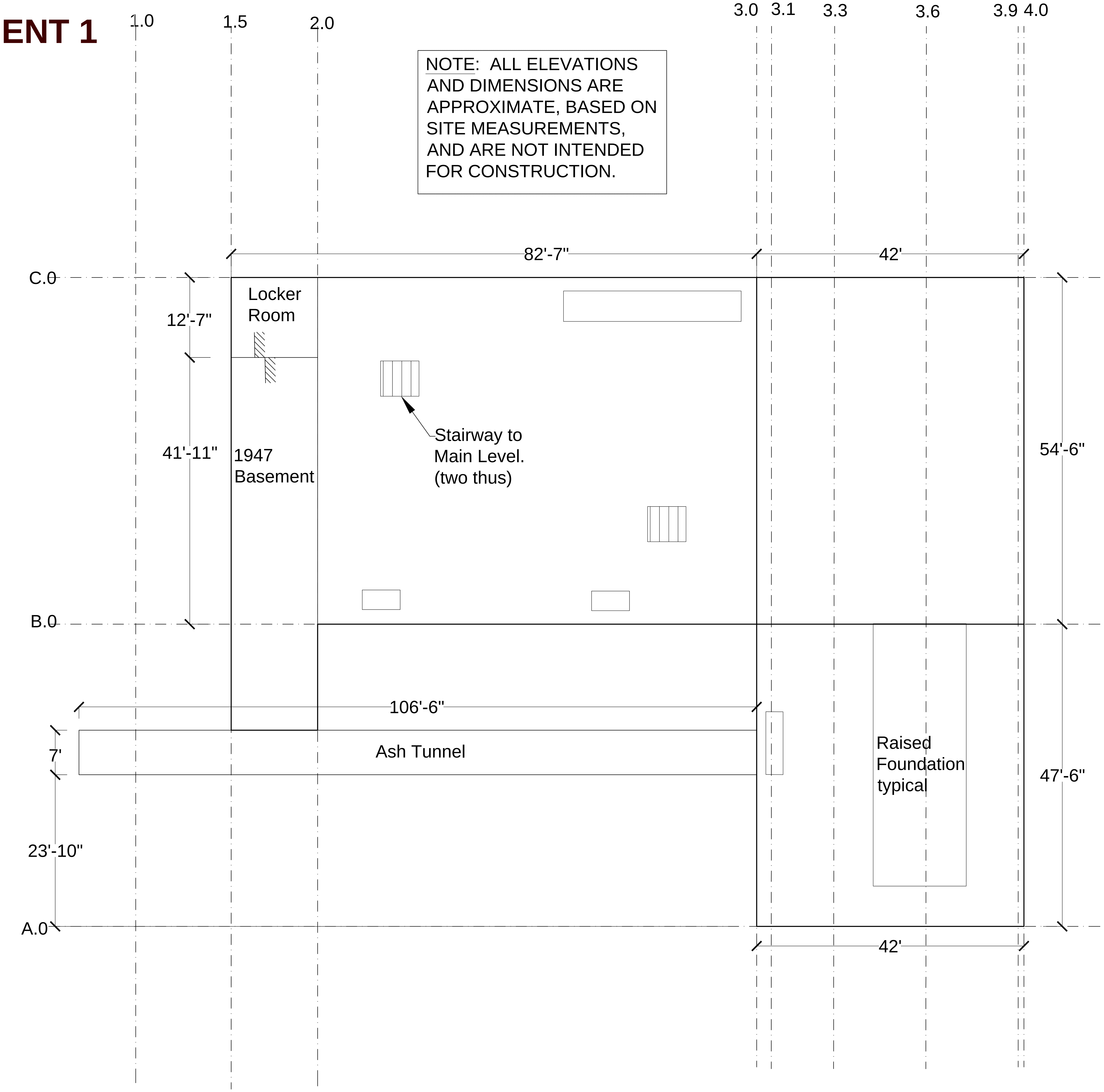
Attachments:

1. Measured Survey – four pages.
2. A TIMELINE FOR ACME POWER PLANT.
3. Photographs – 25 pages.

ATTACHMENT 1



AMERICAN ENGINEERING TESTING, INC.

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CLIENT:
WWC Engineering

PROJECT:
ACME POWER PLANT
Sheridan, WY

DRAWING TITLE:
BASEMENT

Consultants Project No.: 19-20035

Drawn: JHH

Checked: CH

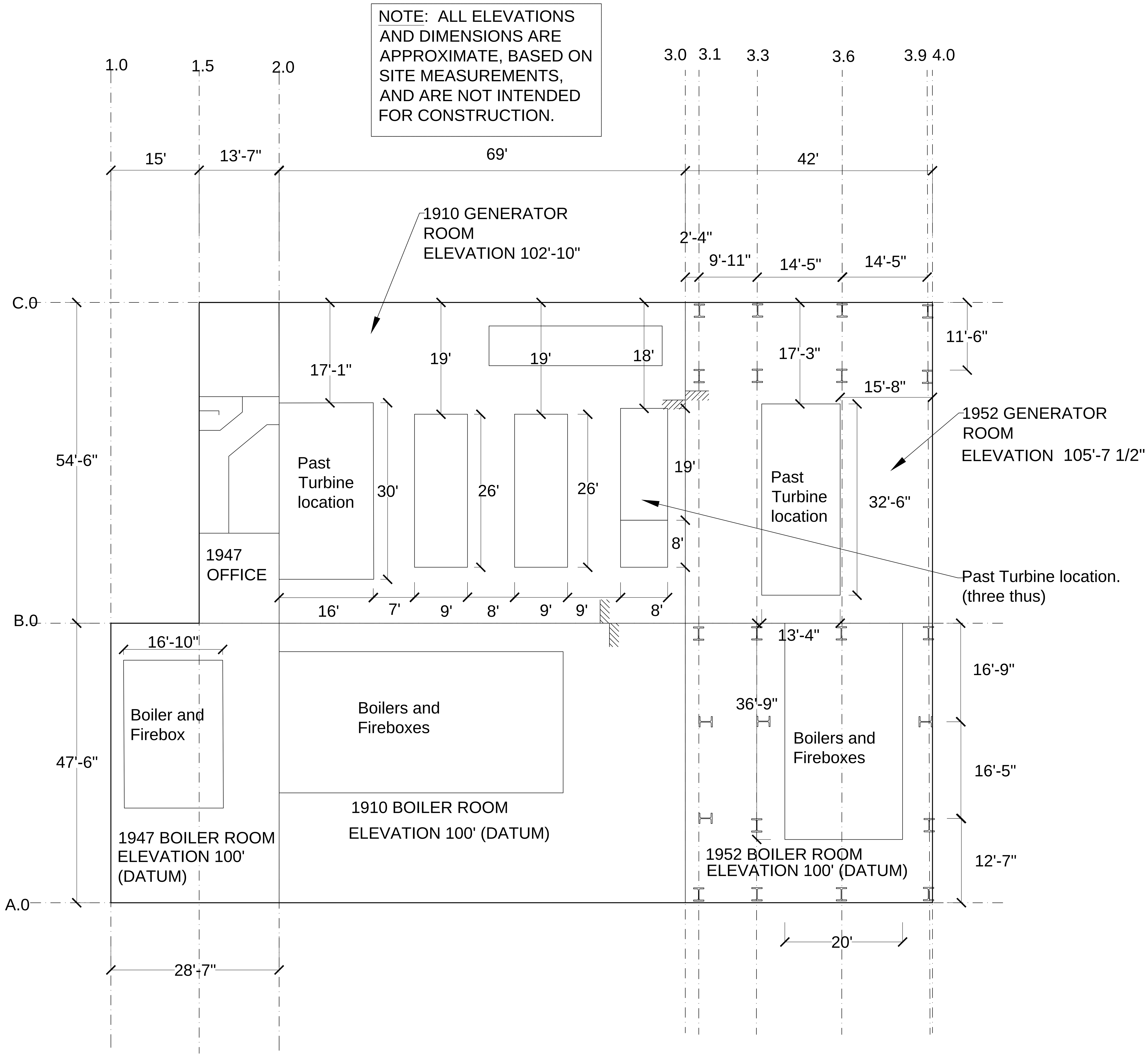
Scale: 1/8"=1'-0"

DRAWING NO:

Date: 09/30/2020

Sheet S1

NORTH



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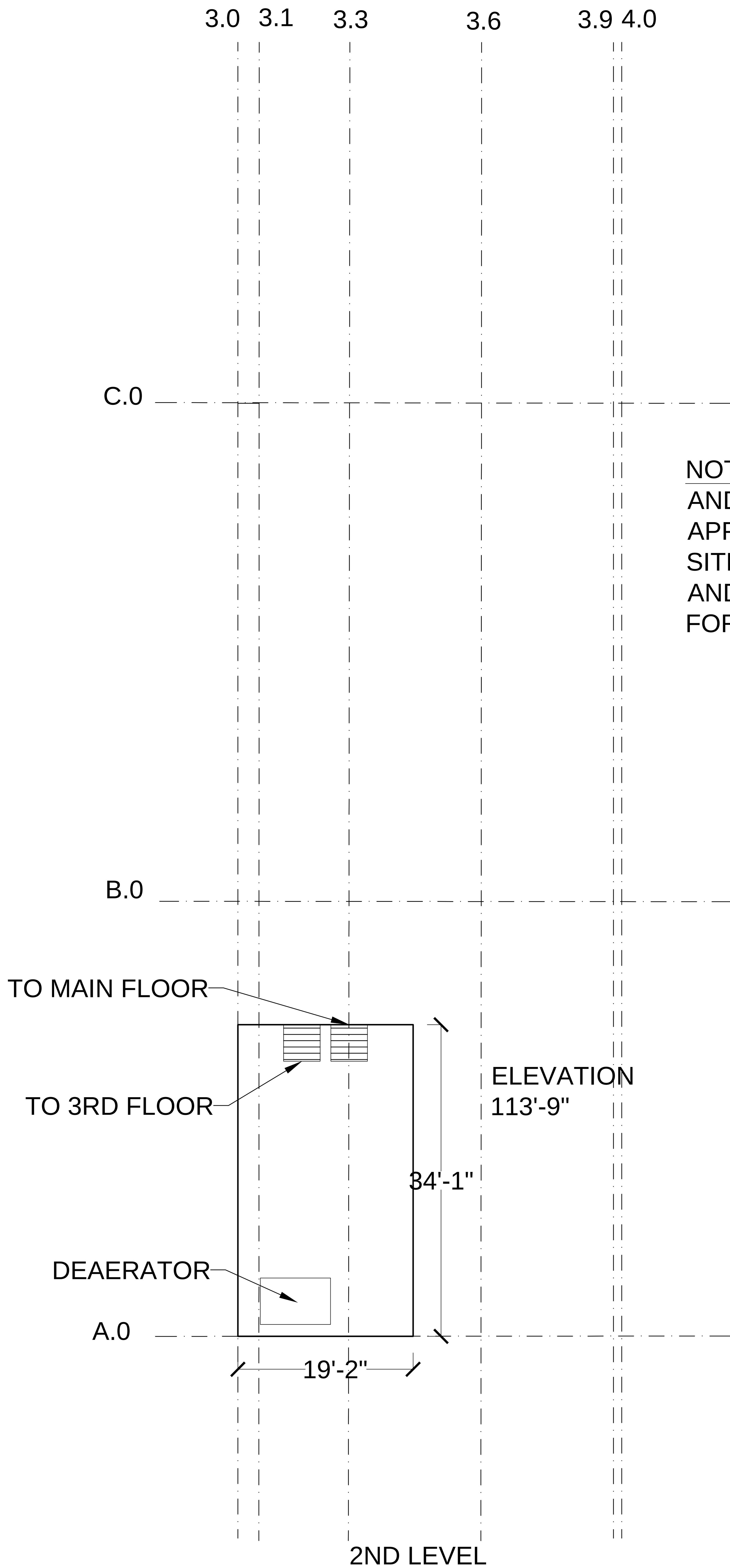
CLIENT:
WWC Engineering

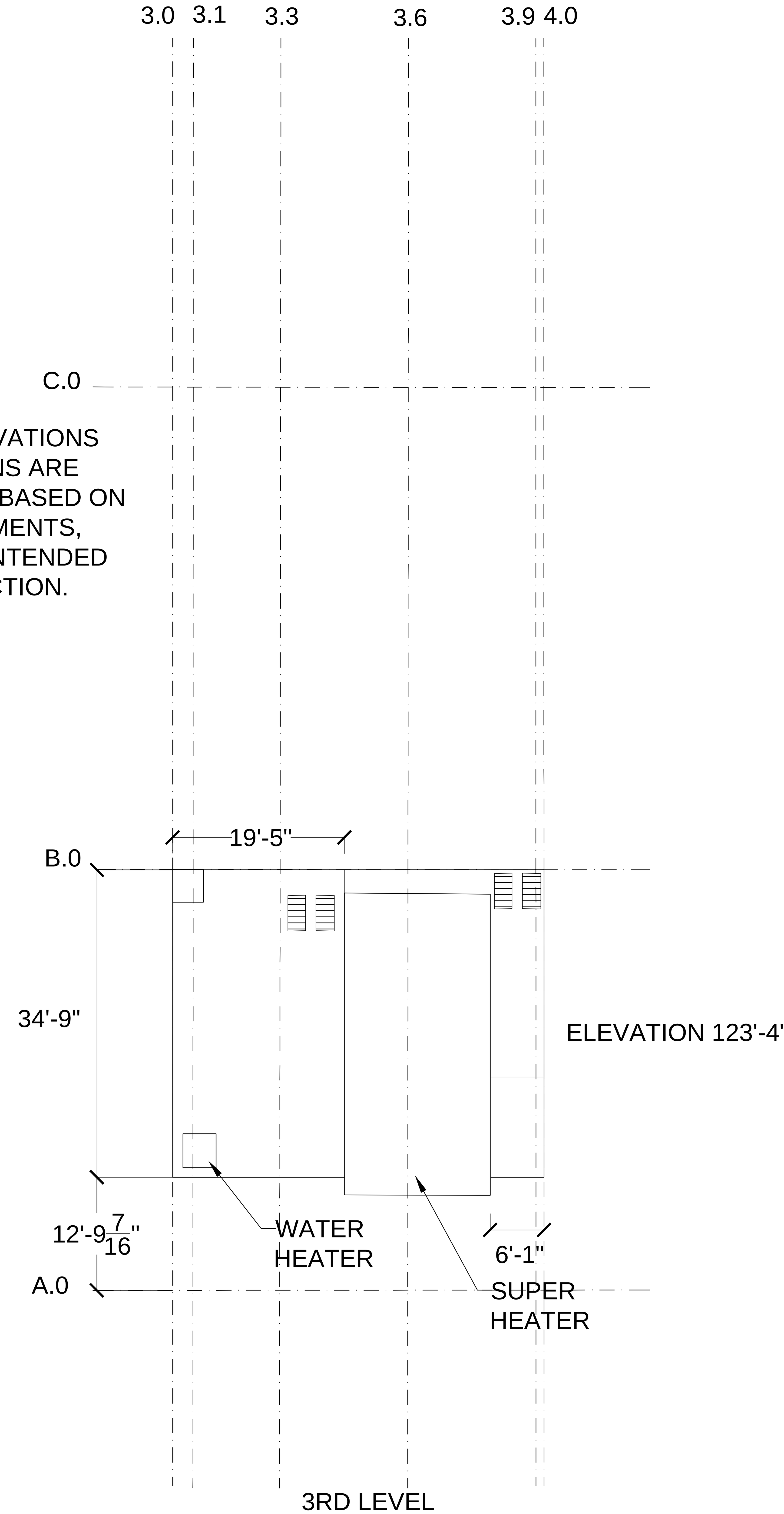
PROJECT:
ACME POWER PLANT
Sheridan, WY

DRAWING TITLE:
LEVEL ONE FLOOR PLAN

Consultants Project No.: 19-20035
Drawn: JHH
Checked: CH
Scale: 1/8"=1'-0"
DRAWING NO:
Date: 09/30/2020
Sheet S2
NORTH



NOTE: ALL ELEVATIONS AND DIMENSIONS ARE APPROXIMATE, BASED ON SITE MEASUREMENTS, AND ARE NOT INTENDED FOR CONSTRUCTION.



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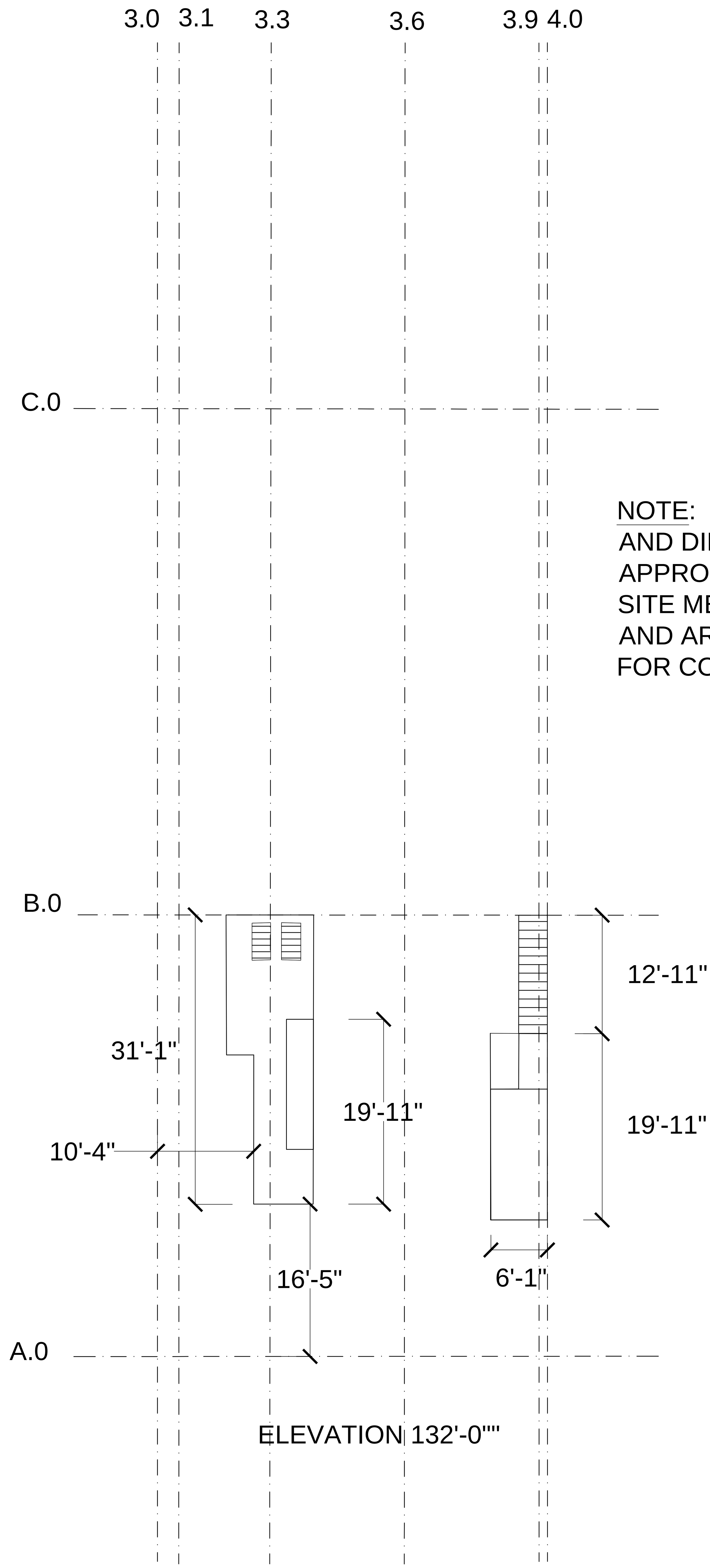
CLIENT:
WWC Engineering

PROJECT:
ACME POWER PLANT
Sheridan, WY

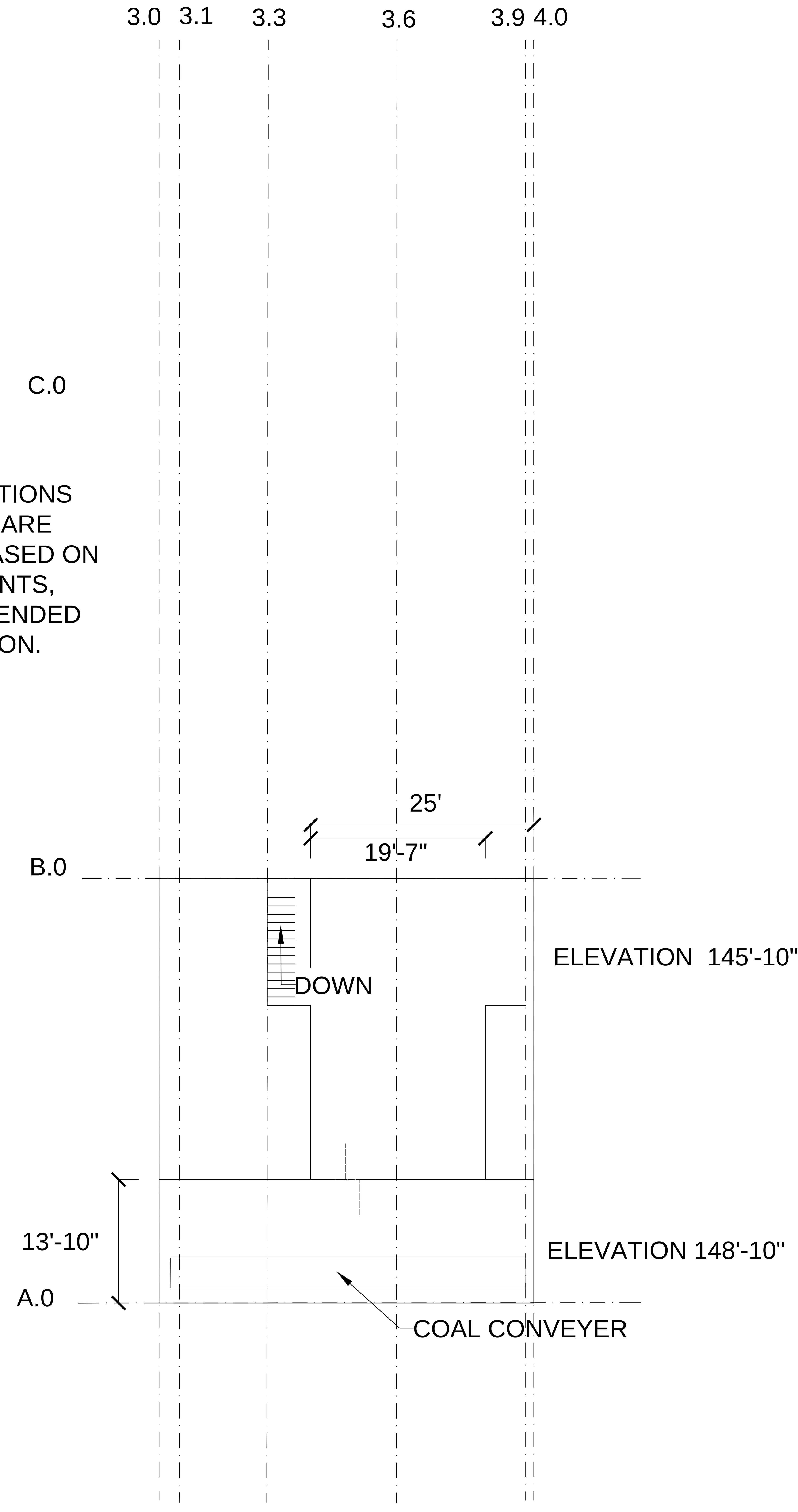
DRAWING TITLE:
CATWALKS
2ND & 3RD LEVEL

Consultants Project No.: 19-20035
Drawn: JHH
Checked: CH
Scale: 1/8"=1'-0"
DRAWING NO:
Date: 09/30/2020
Sheet S3
NORTH



4TH LEVEL

NOTE: ALL ELEVATIONS AND DIMENSIONS ARE APPROXIMATE, BASED ON SITE MEASUREMENTS, AND ARE NOT INTENDED FOR CONSTRUCTION.



5TH LEVEL

AMERICAN ENGINEERING TESTING, INC.
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CLIENT:
WWC Engineering

PROJECT:
ACME POWER PLANT
Sheridan, WY

DRAWING TITLE:
4TH & 5th LEVEL

Consultants Project No.: 19-20035
Drawn: JHH
Checked: CH
Scale: 1/8"=1'-0"
DRAWING NO:
Date: 09/30/2020
Sheet S4

NORTH

ATTACHMENT 2

TIMELINE FOR ACME POWER PLANT

1905 Federal Light and Traction Company (later known as the Sheridan County Electric Company) introduced round-the-clock electricity to Sheridan

1910 Power lines extended to Acme. Direct Current generator moved from Sheridan to Acme for newly established Acme Power Plant which was part of the Sheridan County Electric Company.

1947 Sheridan County Electric Company purchased by MDU. Same year installed a 3,000 kilowatt steam turbine at Acme.

1948 Welch Coal Company established to provide coal for the Acme plant.

1950 A 5,000 kilowatt steam turbine added at Acme plant.

1976 Acme plant closed. Air quality controls to bring the Acme plant into compliance with EPA Act would have cost $1million. MDU advertised for bids to sell the plant on August 31, 1976. Stated that if plant not sold it would be torn down. It was purchased by Carl Weissman and Sons (3W's) and used as a warehouse.

1983 After several meetings and a public hearing, the Sheridan BOCC passed a resolution in November, authorizing the issuance of not more than $9 million in industrial revenue bonds to Rosemary Perkins of Perkins Power, Cody, Wyoming for the purpose of purchasing, modernizing and operating the Acme Power plant and a greenhouse.

1989 Report that Petro Oil and Gas of Beverly Hills, CA, agreed to a joint venture with Rosemary Perkins to build a $50 million polyurethane manufacturing plant at Acme. This was a joint venture and somehow APAC was involved. Could have been one and the same company.

1991 Perkins Power into bankruptcy. Acme Power plant purchased from bankruptcy court by Hitexonics for $80,000. Joint venture planned with APAC. APAC didn't pay their share so contract was voided. Hitexonics was a principal stockholder of Black Diamond Resources owned by John Culhane which apparently became the default owner of the Acme Power Plant.

1993 Culhane announced that Black Diamond Resources planned to invest $12 million to make the Acme Power Plant a coal gasification plant by 1996. Months later the power plant and land was transferred to Golden Eagle Resources and then to Fort Acme. Directors for Fort Acme were Culhane and a Ray Young of Irvine, CA. The transfer was declared illegal by the president of Golden Eagle Resources but apparently nothing came of it? Zoning was changed from agricultural to industrial by Sheridan BOCC.

2000 Fort Acme assigned salvage rights to Robert Marron

ATTACHMENT 3

PHOTOGRAPHS
AET PROJECT NO. 19-20035 – ACME POWER PLANT STRUCTURAL ASSESSMENT – ACME, WYOMING

Photo 1: South elevation.

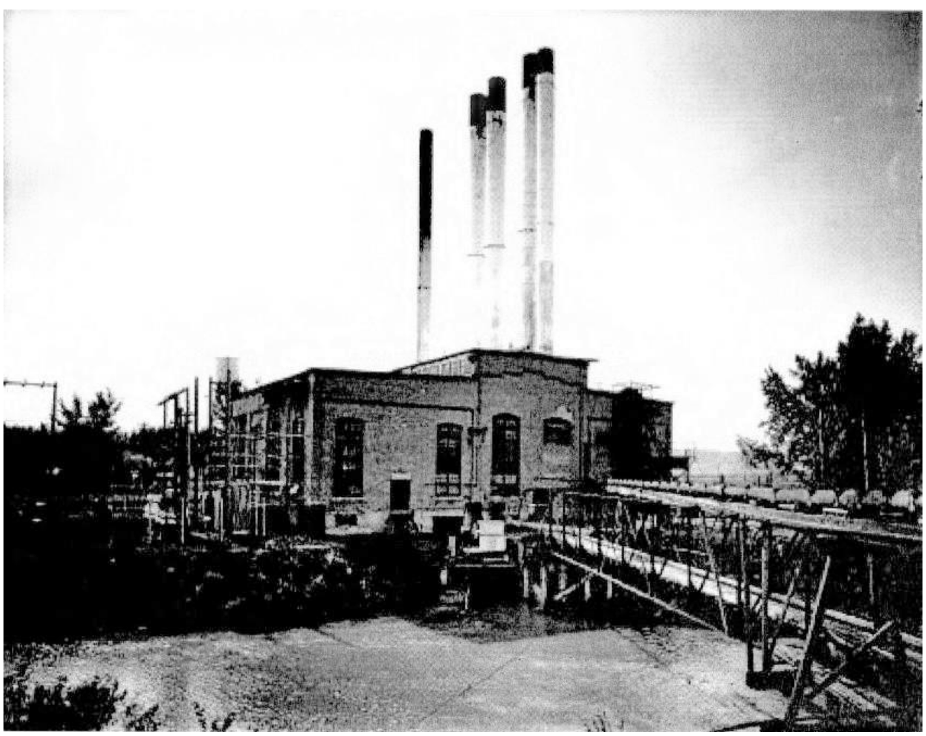
Photo 2: West elevation.

Photo 3: West half of north elevation.

Photo 4: South end of the east elevation.

Photo 5: Google imagery of power plant showing three phases of building (north to the left), and small ancillary building (with patchwork roof).

Photo 6: 1911 photograph of the building, showing north elevation and the Tongue River.



PHOTOGRAPHS
AET PROJECT NO. 19-20035 – ACME POWER PLANT STRUCTURAL ASSESSMENT – ACME, WYOMING

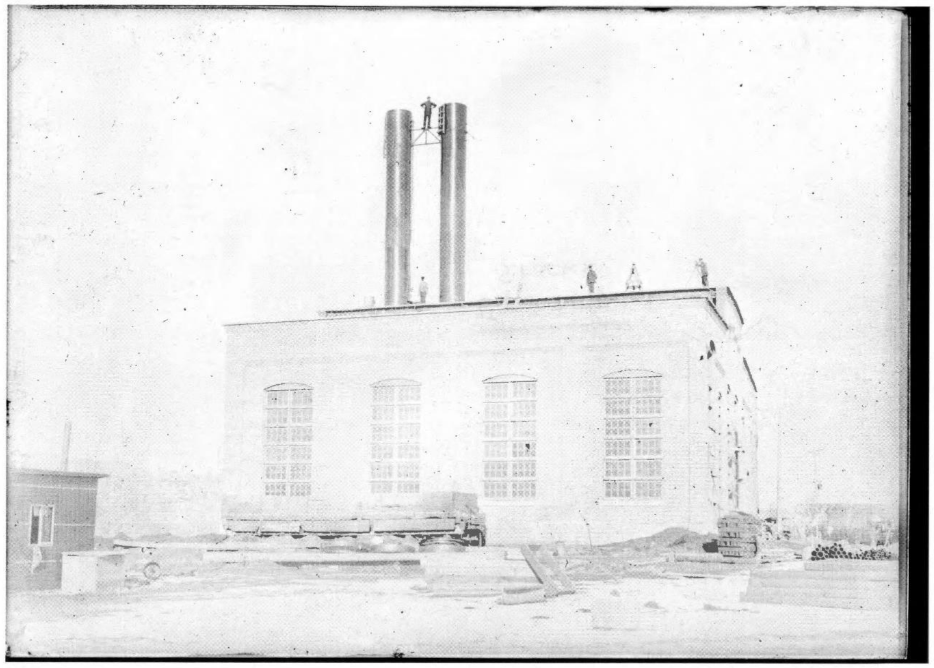
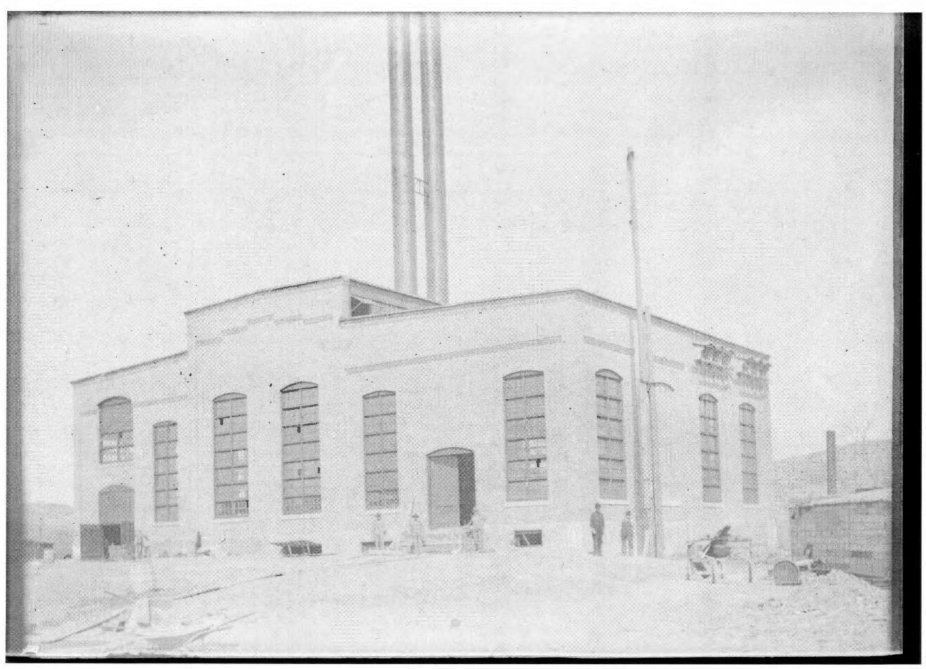


Photo 7: 1911 photograph of building, showing west elevation.

Photo 8: 1911 photograph showing south and east elevations.



PHOTOGRAPHS
AET PROJECT NO. 19-20035 – ACME POWER PLANT STRUCTURAL ASSESSMENT – ACME, WYOMING

Photo 9: 1910 boiler room.

Photo 10: 1910 generator room.

PHOTOGRAPHS
AET PROJECT NO. 19-20035 – ACME POWER PLANT STRUCTURAL ASSESSMENT – ACME, WYOMING

Photo 11: **Ash tunnel.**

Photo 12: **Ash tunnel roof showing river rock aggregate and shallow arched slab.**

Photo 13: Basement of 1910 building, showing large concrete pillars supporting generators, and steel column.

Photo 14: Underside of 1st floor slab of 1910 building, showing "expanded metal diamond mesh" reinforcing.

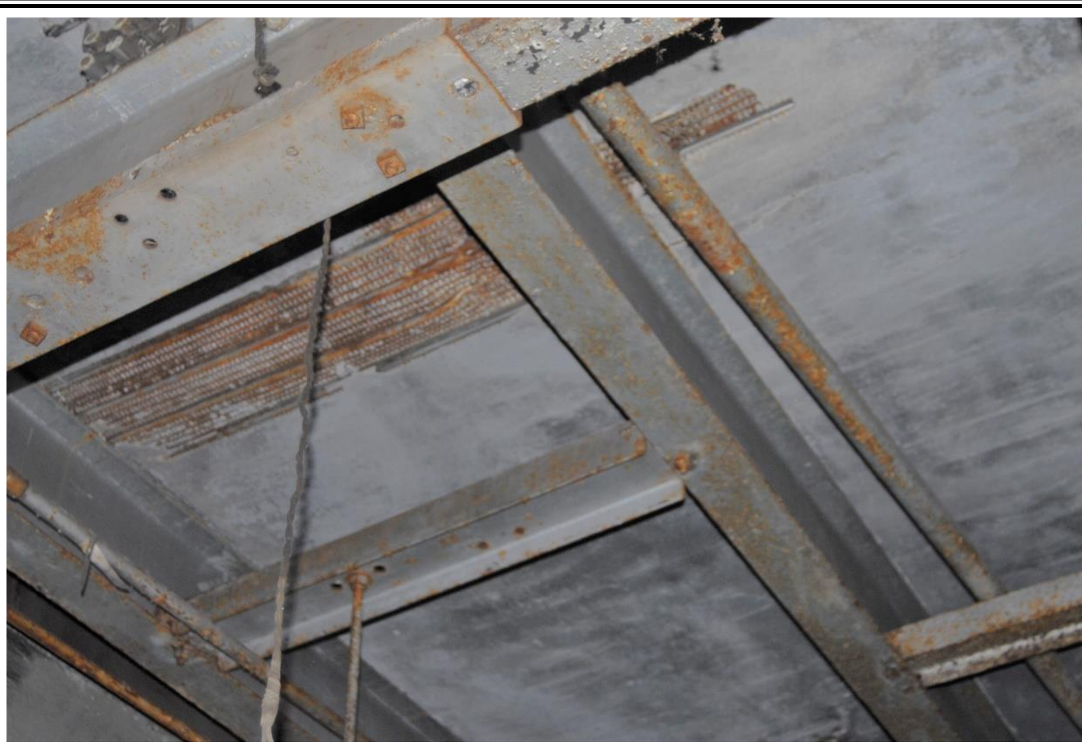


Photo 15: Decorative brick above windows and at top of wall of 1910 building.

Photo 16: Trusses in 1910 generator room, supporting roof and supported on center wall.

Photo 17: Crane rail supported on brick pilaster at center wall.

Photo 18: Steel column and trusses supporting roof and catwalk in 1910 building.

Photo 19: 1947 Basement.

Photo 20: 1947 First floor framing, taken from the basement.

Photo 21: 1950s generator room, looking northeast, showing crane support structure.

Photo 22: 1950s generator room, looking west.

Photo 23: 1950s roof over generator room, showing diagonal cross-bracing and precast roof panels.

Photo 24: 1950s boiler room showing fireboxes and diagonal steel wall bracing beyond.

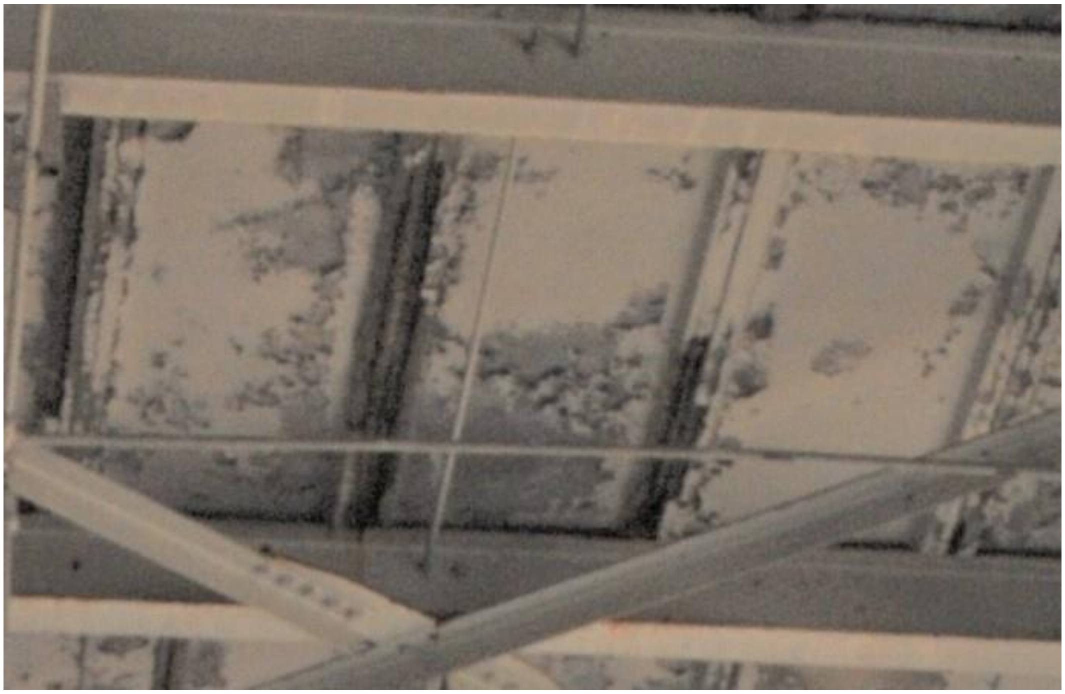


Photo 25: 1950s roof – precast ribbed roof panels.

Photo 26: Ancillary building – southeast corner.

Photo 27: **Ancillary building interior, showing mezzanine and wood roof joists.**

Photo 28: **Deteriorated bottom flange of steel beam that spans across ash tunnel and supports tunnel roof.**

Photo 29: Deteriorated west edge of 1910 clerestory roof.

Photo 30: Deteriorated roof edge of 1910 clerestory roof – concrete has fallen away, leaving only reinforcing bars.

Photo 31: 1910 roof truss diving into center wall, with crack between top and bottom chords of truss.

Photo 32: Close-up of wall crack at truss.

Photo 33: Crack in wall between 1910 & 1947 boiler rooms, above 1st floor doorway.

Photo 34: Crack in wall between 1950s and 1910 generator room, above doorway at east end of wall.

Photo 35: Crack in north wall of 1910 building, at east end, above mezzanine.

Photo 36: Damage to decorative brick at top of 1910 exterior wall.

PHOTOGRAPHS
AET PROJECT NO. 19-20035 – ACME POWER PLANT STRUCTURAL ASSESSMENT – ACME, WYOMING

Photo 37: Damage to top five feet of 1910 building.

Photo 38: Brick condition at lower half of 1910 building exterior wall.

PHOTOGRAPHS
AET PROJECT NO. 19-20035 – ACME POWER PLANT STRUCTURAL ASSESSMENT – ACME, WYOMING

Photo 39: Worn, patched and damaged roof over generator room in 1910 building.

Photo 40: Worn, patched and damaged roof over office of 1947 addition.

Photo 41: Fibrous material and wire mesh hanging from clerestory roof ion 1947 addition.

Photo 42: Damaged brick pier at clerestory of the 1947 addition.

Photo 43: 1950s addition basement.

Photo 44: Column in 1950s basement, showing surface rust.

Photo 45: Past brick repairs at top of exterior brick in the 1950s addition.

Photo 46: Spalled brick and damaged concrete stairs at south face of 1950s addition.

Photo 47: Close-up of damaged stair treads at south face of 1950s addition.

Photo 48: Damaged north parapet at small ancillary building

Photo 49: Crack in west wall of ancillary building, resulting from settlement of the southwest corner of the building.