Statement of Work
Call #2

Meadowood Arena/Horse Barn Structural Assessment

Department of the Interior
Bureau of Land Management
Eastern States
Meadowood SRMA
Lower Potomac Field Station

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By
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STATEMENT OF WORK

A. SCOPE: For the existing 26,000 square foot barn at the Meadowood Recreation Area, the work will consist of: investigation of the wood support columns to determine if rotting has taken place; gauging of trusses to determine if any movement has occurred; assessing condition of the roof in arena area; a structural analysis and a report with recommendations to: extend the useful life of the building 25 years; upgrade the building structural members to meet the International Building Code (2006) for both Class A and B occupancy loads; and estimate associated construction cost for repair/life extension for both a Class A and B structure.

B. INTRODUCTION & BACKGROUND:

1. A rapid assessment was made by POZ Environmental, LLC for the structural and electrical components of the barn. POZ is an engineering firm located in northeastern Pennsylvania, practicing principles of engineering for solutions to environmental, civil, structural, and geotechnical challenges. The principal investigator for this task was Emanuel T Posluszny, P.E. and Charles Petras as an associate. Emanuel holds a BS degree in Environmental Engineering and is licensed professional engineer with 32 years of engineering experience in environmental, civil, structural, and geotechnical disciplines. Emanuel has designed and inspected numerous structural facilities for the DOI using principles of engineering. Charles Petras, who holds a BS degree from Temple University in the school of Landscape Architecture, has working experience in the construction industry for over 25 years. Both Emanuel and Charles have designed, managed, and inspected both steel and wood frame structures.
2. The barn is owned and managed by the Department of the Interior, Bureau of Land Management, Eastern States, who acquired 800 acres of the Meadowood SRMA in 2001 with the primary purpose of managing the open space for recreation, environmental education, and wild horse and burro interpretation. The barn is one of many structures that makes up the original riding complex/farm, which was initially a private facility. The barn is 104 feet wide by 248 feet long, and constructed in 1976. It consists of a light gage metal (aluminum) siding applied to wood framing with horse stalls located along the perimeter of the two long sides with adjacent aisles for access which are each about 13 feet wide. The complex has stalls for about 48 horses, with an office area, toilet room, mechanical room for pumps, two horse washing bays and an overhead misting system for dust suppression. The arena, located in the center of the building, has double trusses at eight foot centers with a span of 59 feet 7 inches (approximately 60 feet). The arena is approximately 190 feet long, with a platform area at one end. Behind the platform is a set-up area which takes up the remainder of the barn at approximately 40 feet in length.
3. **Structural Component** – The structural component of the barn consists of the roof trusses, columns, beams, purlins, and sheeting.
   a. **Roof Trusses** –The weight of each truss is estimated at 346.7 pounds (pine) or 476.5 pounds (fir). An eight-foot distance between doubled-up trusses was

used to deliver concentrated truss loads adjacent to the columns. I. . Although the trusses are still in position and carrying the roof loads, suspected movement has taken place over time. This movement has been identified in the tilting of one truss at the south end of the barn in the arena area. It was also noted that the Lower Chord span is exceptionally long (60 feet). Some trusses, also in the southern end of the arena area, are bowing horizontally in the lower chord member. The performance of the trusses is in question due to the lack of lower chord bracing and required x-bracing required on a regulated spacing. Since no supports are located between each truss, it can be hypothesized that horizontal bending is taken place. This is probably do to the suspected movement of the trusses at its apex. If the barn is repaired, there would be a need for a sprinkler system to be installed, which will add additional weight to the roof support system. The lower chord members are butted together and fastened with metal plates and grommets at 16-foot intervals for the 60-foot span. No web members are arranged vertically, and only consist of 2 by 4 lumber intersecting the Upper with the Lower Chord members (2 by 10 lumber). Although the web members are attached to the Upper and Lower Chord members, the configuration and dimensions of the metal plating is inconsistent in size and application.

b. Columns – The columns which were inspected had a thin coating of preservative and are placed in soil. It would have been more structurally sound to place each column on top of concrete. Each column consists of a 6" by 6" post that extends upward to support a truss. The soil around three posts (one arena and two exterior posts) was excavated to a depth of 12 to 18 inches. The sampling showed that each of the buried portion of the beam had a tar-like coating on the surface of the wood. Soil around the arena post consisted of a sandy-silt with minor clay component with easy excavation and apparent voids. One exterior column showed rotting at the surface of the wood in the soil. The arena columns were placed on 8-foot centers along the perimeter of the Arena, and 10-foot centers along the exterior perimeter of the barn with the exception of the large doorways, which were 20 feet wide. Since the posts are the limiting factor for the structural integrity of the barn, more sampling below the ground surface is needed.

c. Beams – The beams consisted of 2 by 12 lumber 8 feet in length which were nailed to the face of the column with 16d common nails in three vertically sets. The beam had two components: an inner beam with the facing position toward the arena, and an outer beam positioned toward the horse stalls. The beams were not nailed together and not equal in elevation but had a 2.5-inch offset. The trusses were positioned on the top of the inner beam (higher in elevation), and the rafters between the inner column and the exterior wall of the barn on the outside beam (lower in elevation). At one inspection point, the inside beam has a compression of 3/8 of an inch under the position of the truss. The truss was not placed on the top of the column but rather on the inside beam at a point where it off-set the column. The beams have held the weight of the trusses and roof components, which was calculated to be 5500 pounds at each truss intersection. However, the weight of the roof relies on

the shearing strength of the nail set and the absence of horizontal movement of the beam from the column; for example, this structure would not be appropriate for active tectonic zones. Periodic inspection of this loading point should be maintained because there appears to be minimal safety factors used in the construction of this structure.

d. Purlins – Nailer setting on the Upper Chord for securing the metal sheeting. These consist of 2 by 4 lumber 8 feet long which were presumably nailed to the Upper Chord at 18 to 24 inches on center. The lumber was position with the heal-up and spanned the Upper Chords unsupported. The 8-foot span for 2 by 4 lumber appears insufficient especially for live loads (repair by man). . Again, there appears to be minimal safety factors used for this structural component.

e. Sheeting – The roof covering of the building was 4-foot wide metal sheeting, presumable steel. The sheeting was screwed or nailed in the ridges and valleys to the purlins. Sampling of the nailing soundness consisted of gently pushing up the exposed metal sheeting at various places in random stalls, which resulted in the observation that the sheeting is secure to the purlins.

C. <u>PROVIDED BY GOVERNMENT</u>:

1. Barn layout map/CAD files.
2. 24 ft ladder
3. Mechanical auger and operator
4. Aggregate stone for backfilling and equipment and labor for backfilling

D. <u>ASSESSMENT PROCEDURE:</u> To identify structural elements in the buildings to include, but not limited to, load bearing walls/elements, post and beam structures, if any, tension members, etc. Identify any other unique characteristics that may impact or be needed for future design and/or corrective measures. The structural engineer shall verify:

- Structural load bearing system and lateral stability
- Load capacity of roof(s) and all supporting members including bracing and wood species identification and estimate of grade
- Condition assessment of buried wood posts & estimated bearing capacity
- Evaluation of exterior metal walls and roofs, including openings and ventilation
- All electrical, plumbing and mechanical components
- ADA requirements

1. **Columns** – The work will consist of inspecting the columns below ground surface. The proposed plan is to sample columns along the perimeter of the arena area.

a. An inventory of each column will be made with respect to the BLM drawing, and annotated in the field book as CExA (Column (C) - east (E) – sequential number (x) from the south to north– arena area (A)) or CWxA. Columns in the front (north) and back (south) of the barn are labeled CNx (north – sequential number from the west (x)) or CSx. This may be replaced with an existing building coordinate system.

b. The soil will be measured by a POZ engineer with a moisture meter at every column and will be visibly inspected with an auger at 32-foot intervals (32 total), which includes the large doorways to the north and south areas within the Arena and exterior portions of the barn. The soil profiles will be photographed using a folding rule as a legend. This data will be annotated in the field book.

c. Excavation of the inspection holes generally equal to the bottom of the column shall be made along one face of columns selected by the POZ engineer, and inspection of the column at that face made by a POZ engineer. To expedite this procedure, BLM has agreed to supply and operate a mechanical auger to facilitate the excavation for this inspection, and also backfill & compact the excavations. The mechanical auger shall not drill beyond the bottom of the column. The results will be logged by a POZ engineer in the field book and include:

1) Depth of excavation.
2) Base of material at bottom of column.
3) Preservative coating, if any.
4) Presence or Absence of wood rot and thickness of rotting, if any.
5) If conditions warrant further investigation of the column, wood analysis with the use of a wood auger may be done. Any auger holes in wood shall be sealed with a silicone sealant.

2. Trusses – This inspection will provide information of past movement of the trusses.

a. An inventory of each truss (33) shall be made with respect to the BLM CAD drawing and annotated in the field book as TxA (truss (T) – sequential number from the south (x) – arena area (A).{see D.1.a - above}

b. The positioning (vertical and horizontal displacement) of each double truss shall be made and annotated.

c. Rapid static and static survey of control points in arena area, will tie into boundary controls with the robotic surveyor and traverse to truss points at:

1) Apex of truss
2) Upper-Lower Chord intersections
3) Beam-Lower Chord intersections
4) All web intersections with Upper and Lower Chords.
5) Opus solution will be used for control network. Points will be checked with OPUS and RTK, angle of convergence checks will be to a tolerance of 0.25 inches.
6) Baseline – Values will be based off of the most southerly truss to the ground surface. Measurements to the nearest 1/4" and designed as +/- will be recorded:
7) The values of displacement from the baseline between subsequent trusses, which are “8-foot on center” will be in inches to the nearest ¼-inch increment and designated +/- from the previous sequential truss.
8) Additional data for doubled-up trusses are: separation at apex and/or lower chord.

9) Data shall be downloaded into a CAD file and mapped in 3-D image.

3. Purlins - The stability of the purlins (nailers) and roof shall be inspected..

a. The inspection shall be done with the aid of a man-lift that will be rented from a local vender and operated by an insured contractor (see Section I) to aid in the inspection process.

b. The data collected will be annotated in the field book and include:

1) Rot or water staining

2) Lack of nailing

3) Unsecured sections

c. Annotation of problem areas will be identified as between trusses (TaA & TbA – see Section D.2.a).

E. REPORTING PROCEDURES - The analysis will be accomplished by a professional structural engineer with knowledge/theory and experience in wood frame structures in accordance with IBC 2006 and ASCE 7-05. The engineer will also prepare a report that shall include the results/findings of the investigation study with a table of contents, executive summary, signature sheet of evaluator, project manager and reviewer with a PE Seal, introduction, general remarks, site investigation, recommendation/s for extending the barn life to a 25-year span with associated cost estimates for both a Class A and B structure, annotated photos showing location taken, and appendices (references, all calculations, evaluation checklists, summary data sheet, deficiencies, construction cost estimate (unit costs with Overhead and Profit, drawings, and any other data, etc.). BLM shall provide: Copy of the Existing CAD Drawings, and Copy of Alternatives for Arena/Stable Rehabilitation, a proposal developed by a citizen's group for use of the facility, and a copy of the Meadowood Integrated Activity Management Plan.

F. DELIVERABLES:

A/E shall submit/provide:

1) Evaluation Report:

a. Draft Report Submittal: Electronic format on compact disk in PDF and MSWORD format.

Final Submittal: Electronic format on compact disk in PDF format and two (2) signed hard copies

G. MEASUREMENT AND PAYMENT:

1. The columns shall be measured by an engineer on an hourly basis to include instrumentation and is estimated at roughly 30 minutes per column and a total of 38 man hours (general engineering rate).

2. Trusses shall be measured by using an engineer/surveyor with survey equipment, and will be on an hourly basis for the location of the 33 trusses/sections to be loading in AutoCAD and shown in a 3-D image file. The time is estimated at 32.84 hours. (general engineering rate)

3. Purlins will be measured by using an engineer on an hourly basis. The time is estimated at 8 hours (general engineering rate).
4. Analysis and report will be on an hourly basis of 100 total hours (professional engineering rate).

Cost Summary

Item	Classification	Applicable Rate	Hours	Item Total
Inspecting columns, surveying trusses, inspecting purlins	General Engineering	106.85	78.84	8424.05
Analysis of Data, Preparation of Report	Professional Engineering	121.15	100	12115.00
Total				$20,539.05

H SCHEDULE

Notice to Proceed (NTP)	**Target Date ***	**Duration From NTP (Days) ****
On Site Inspection of Columns		10
On Site inspection of Trusses		10
On Site Inspection of Purlins		10
Analysis of Data and Draft Report ***		30
Final Report Delivered		40

* All dates tentative subject to NTP
** Days are calendar days
***The draft submittal will be reviewed by appropriate BLM personnel. BLM will return review comments within 7 calendar days of submittal. The A/E shall respond to all review comments in writing. In the event a re-submittal is required, it shall show the date of revision on the cover sheet

I. INSURANCE - Contractor shall provide proof of insurance with minimum liability coverage of $1,000,000 for each occurrence and workers compensation as required by law.