



Fairfax County
Department of Public Works and Environmental Services
Capital Facilities/Land Development Services



Meadowood Special Recreation Management Area
Bureau of Land Management
10406 Gunston Road, Lorton, VA 22079
Parcel Identification. no.: 11430 01 0040

Barn/Arena Assessment

December 2010



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INTRODUCTION

Fairfax County staff from Department of Public Works and Environmental Services (DPWES) was requested by Supervisor Gerry Hyland, Mount Vernon District, Fairfax County to assist in the review of proposed plans for the modifications and/or replacement of the horse barn/arena facility in the Meadowood Special Recreation Area in Lorton, Virginia. DPWES staff invited staff from Fairfax County Park Authority to assist with the evaluation from an equestrian facility programming perspective.

The purpose of this report is to evaluate the findings of the Horse Barn Assessment Report dated December 3, 2010 by POZ Environmental, LLC (POZ) and the Arena/Stable Rehabilitation study report dated April 2008 by Division of Architecture and Engineering Services, National Operations Center for the Bureau of Land Management (BLM). In addition, issues specific to Fairfax County or Virginia regulations as well as a number of programming items relative to some facility type are included herein. The report represents a basic assessment based on observations by County staff during the site visit on December 8 and 13, 2010 and the two study reports noted herein. This report addresses site/civil, architectural and building program, structural, electrical and plumbing issues and provides applicable recommendations. An evaluation of the preliminary cost comparison contained in the 2008 BLM Report is also included. One of the goals for the facility identified by BLM is to provide better public access to the facility to allow for equestrian events, as well as public riding classes. As such a few recommendations are also included to address deficiencies related to the programming needs for better public access and use of the facility. The County inspection team included the following staff:

DPWES- Capital Facilities

Kim Callahan, P.E., Civil/site
Teresa Lepe, P.E., Structural
Katayoon Shaya, R.A., Architectural
John Sanford, P.E., Cost Estimating
Gary Bolt, Inspections- Building

DPWES- Land Development Services

Brian Foley, P.E., Structural
Wayne Brooks, Inspections- Electrical
Gary Williams, Inspections- Plumbing

Park Authority- Resource Management

Todd Brown- Equestrian programming

1. SITE ASSESSMENT

The site assessment focuses on Stormwater Management and Wastewater issues observed on the site area immediately surrounding the existing Barn/Arena.

A. STORMWATER MANAGEMENT

Existing Conditions:

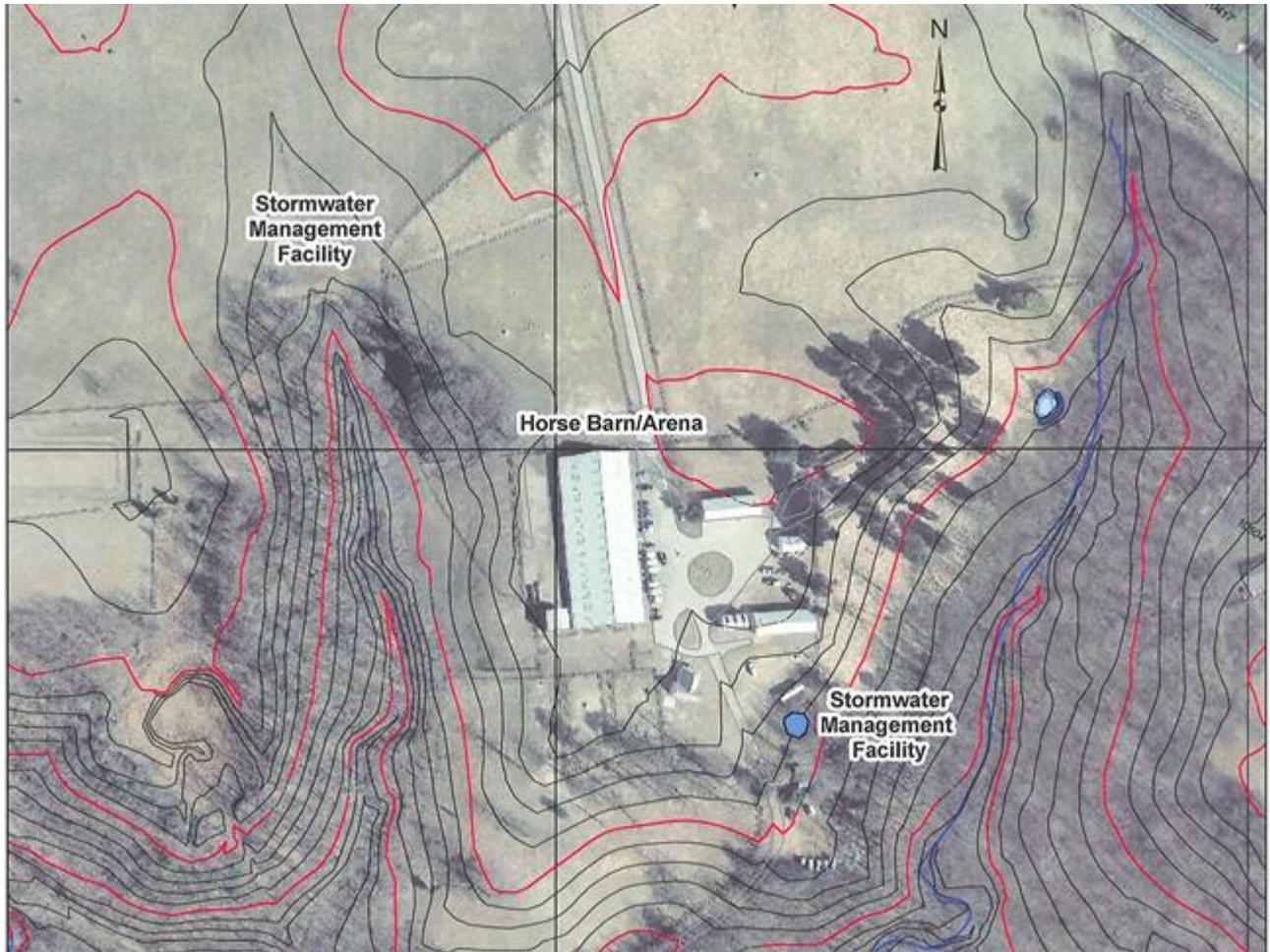
The property is located in the Kane Creek Watershed of Fairfax County. The site immediately surrounding the barn/arena drains east and west into two on-site streams that run south and converge before outfalling into Belmont Bay. The existing site appears to have inadequate Stormwater Management (SWM) measures. The only structural SWM measures observed on-site were two small dry ponds; one south-east of the arena and another to the north-west.

To the east of the arena, stormwater runoff from the roof of the barn/arena is collected in a series of roof drains that outfall at ground level. Runoff from the east half of the roof discharges from the roof drains into a small swale running south, parallel to the barn/arena, sheet flows across the parking lot into two asphalt channels, and is then piped into a small dry pond south-east of the building. A PVC pipe is used as an outlet structure, which outfalls into a small stream, where signs of erosion are visible at the outfall point. BLM staff indicated that during large storm events, water appears to be infiltrating the foundation along the south eastern side of the barn/arena. They believe this infiltration is caused by the runoff from the roof drains.

To the west and north of the arena, high runoff rates during storm events, causes sediment to be deposited into the stream. In an attempt to address this issue, BLM staff has implemented the following measures:

- On the west side of the arena, runoff from the roof drains sheet flow downhill into the stream. A large portion of this hillside was once a pasture area for horses. This use caused the soil to be well compacted, and did not allow for the vegetative growth necessary to reduce the runoff rate. In order to reduce the runoff velocity and promote infiltration, BLM staff fenced off the hillside to restrict horse access, and planted the area with native grasses and trees.
- To the northwest of the arena, a small stormwater management facility was recently installed to collect runoff from the fields and pastures south of Gunston Rd. The facility consists of an embankment with emergency spillway, and a concrete culvert that outfalls into a riprap ditch lined with filter fabric that flows into the stream. At the time of the site visit, it appeared that some of the riprap had rolled down the steep embankment leaving the filter fabric liner exposed. A portion of the field upstream of the stormwater management facility has been fenced off from horses, and planted with native trees and grasses.

At the north end of the arena, the runoff from the roof drains sheet flow around the building to the west. BLM staff noted that the stalls at the north end of the site often get flooded during large storm events. See image below:



Aerial view of Meadowood Barn/Arena

A metal dumpster located on-site at the south-west corner of the arena, uphill from the stream is currently being used to store horse manure. The dumpster is located directly on grade; therefore, during a storm event it is possible for polluted runoff to seep out of openings in the dumpster and continue downhill into the stream.

Recommendations:

The velocity of the stormwater runoff from the arena roof, parking lot, and horse pastures should be reduced to allow for infiltration. BLM staff has started taking measures to address this issue by restricting horse access from various hillsides, and planting them with native grasses and trees.

Low impact development (LID) and Best Management Practices (BMPs) should continue to be researched and implemented in order to reduce pollution from runoff, flooding of the arena, and erosion of the adjacent streams. Examples of LID and BMPs include, but are not limited to: rain gardens, porous pavement, and cisterns. Cisterns can be used to collect stormwater runoff from the roof drains, which may then be reused for other purposes. Installing rain gardens and replacing some of the existing asphalt with porous pavement can

help promote infiltration and aid in phosphorus removal. In addition, an evaluation of the existing stormwater management facilities should be done to determine if any improvements are needed in order to adequately address requirements for stormwater detention and quality control.

The U.S. Environmental Protection Agency is in the process of establishing a strict “pollution diet” to restore the Chesapeake Bay and its network of local rivers, streams and creeks. The agency is working with its state partners to set binding limits on nutrient and sediment pollution through a Total Maximum Daily Load, or TMDL, a tool of the federal Clean Water Act that will be backed by accountability measures to ensure cleanup commitments are met. A TMDL is the calculation of the maximum amount of pollution a body of water can receive and still meet state water quality standards designed to ensure waterways are safe, swimmable and fishable. EPA recently issued draft the Chesapeake Bay TMDLs. Horse facilities are currently exempt in Virginia, however, as a federal facility, BLM may be required to upgrade the manure dumpster system to include a concrete or impermeable base with edges, runoff containment, and a roof in order to prevent rainfall from entering and percolating through the dumpster and running off or into the subsurface. BLM staff is currently researching alternative methods for containing the horse manure.

B. WASTERWATER MANAGEMNT- Septic System

Existing Conditions:

A wash bay for the horses is located at the south end of the arena. Wastewater generated from this station drains into a septic tank immediately adjacent to this end of the arena. According to BLM staff, the septic tank has been recently serviced, and the septic system professional believed that the drain fields were either no longer working, or had never actually been installed. If no operational drain field exists, than once the effluent leaves the septic tank, it will runoff downhill directly into the stream, which causes concern since there is generally horse waste in the wash down water.

Recommendations:

A verification of the state of the current drainfields must be performed to determine if installation of new drainfields are required. Soil borings should be done in the vicinity of the proposed drain field to determine suitability of the existing soil.

2. ARCHITECTURAL AND GENERAL BUILDING PROGRAM ASSESSMENT

The general building program assessment focuses on the barn, arena, and storage facilities. The recommendations are based on improvements needed to provide for better public access to the facility to allow for equestrian events, lessons and others.

Existing Conditions:

In general, the grounds are well kept. The facilities appear in fair to good condition, but they show deterioration resulting from heavy use for over 30 years. The paragraphs below, address the specific conditions for the major areas of the barn/arena building:

Barn/Arena- The arena and barn are combined in one structure with stalls surrounding the arena. Based on observations, a number of issues arise from this co-location that appears to limit flexibility on the independent use of each area. While the aisle ways serve as the general circulation for public and trainers, they also accommodate multiple activities such as food storage, tack storage, saddling, building maintenance use and access, horse stall cleaning and removal of manure, and horse watering. It was observed during our visit that several activities were taking place at the same time causing obstruction for one or all groups needing to use the different areas. BLM staff noted that the arena is about six feet too narrow for the turn movement of horses and several horses have slipped and fallen when going around the corners at a canter or faster, which poses a problem for jumping or speed work. The barn doors need continued repair and maintenance due to age and are hard to open/close even though top tracks were recently changed. The roof has constant leaks and frequent maintenance is required to protect the spaces below.

Ventilation- Indoor ventilation is poor and the air is unhealthy for both the public and the horses because of high levels of dust. Although there is a dust suppression system that is operated on a daily basis, the level of combined activities in the stalls, aisle ways, and arena as well as the opening and closing of main barn doors at each end contribute to high levels of dust generated at the ground level and entering from the immediate site when the doors are open. Sweeping dust entering the buildings due to mild winds was observed during our visit. The dust suppression system is in deteriorating conditions requiring continual maintenance as the parts and pieces fail. Mist from the system also covers surfaces beyond the arena and contributes to corrosion of wiring and electrical components, pipes and fittings and other accessories and components within the space.

Accessibility- Accessibility to the site and facilities in the complex is a challenge to individuals with disabilities. The main access doors and passageways are narrow and the arena and aisleways surfaces are not accessible to wheelchair, as they are not hard or firm surfaces. The public toilet room is a small, single fixture room with a narrow door. Toilet fixtures are not accessible. An exterior portable accessible toilet unit (porta-potty) is provided outside across the equipment storage to accommodate individuals with disabilities. The room housing the hot water heater is thru the small toilet room inside the barn.

Horse Stalls- Stalls are about 10 feet by 10 feet each. Every other stall has a very small sliding window that provides for a smaller opening for ventilation. Most windows open and close with difficulty due to dust accumulation over time. This window arrangement would generally be fine if adequate summer time ventilation is provided. This appears to be an issue in the facility as evident by the use of portable fans with manual

operation mounted on the back wall of each stall. Lighting above stalls seems inadequate as well. The automatic horse watering system serving each stall is turned off due to continued maintenance needs. To keep from freezing, the pipes are wrapped in heat tape and insulation which creates a risk of fire if damaged or displaced. Each stall is provided with a tack storage unit located in the main aisleway across from the stall. Not only the contents collect dust in this location, but the use of the storage unit by the boarders, impedes the open circulation that the aisleway must provide for other functions.

Storage - Storage space for the arena equipment is inadequate. Hay storage and equipment storage are separate from the main barn/arena building which is appropriate, however access is not very convenient according to BLM staff. Equipment storage shed is an open structure on one side and is not a secure facility.

Recommendations:

One of the stated goals for the facility as indicated by BLM staff is to provide better public access to the facility to allow for a variety of equestrian activities. In order to operate the Meadowood Barn/Arena facility as a public stable that offers shows and clinics, indoor riding for riders originating off site, boarding horses, and riding lessons, a number of improvements in the facilities and its infrastructure must be made. The effort must first focus on improvements required to ensure that a safe environment is provided for the public as well as the horses boarding in the facility as noted in the structural and electrical assessment portion of this report. Included below are a few recommendations based on the assumption that the existing facility can be upgraded, improved and re-programmed to accommodate the desired functions. A detailed planning effort must be undertaken to determine if this approach is feasible or a new, replacement structure would be more cost effective and better provide for the facility's operational and programming needs.

- **Roads and parking-** Vehicular access and traffic flow would require a comprehensive review. In order to provide for a safe and functional access and circulation, a roadway around the building should be provided that would allow the truck and trailers to load and unload at a designated area and travel to the separate parking area. This arrangement would also allow trailers to stop at each end of the building accommodating the relevant activities and for the equestrian patrons to bring their horses in the building at any of the three sliding doors on either end of the building. The path of circulation for horses must be separate from where the non-riding public enters and exits the building as a significant number of visitors have fears and concerns about walking beside or around horses and should have the ability to enter the facility and watch a show without interacting directly with the horse. Overflow parking will be needed to park the trailers when facility is well attended. The shoulders of the entrance road could possibly serve as trailer parking when temporarily parked for a shorter visit but this could be determined thru a planning effort for the site features.
- **Preparation and warm up area-** An outside warm-up ring for shows would be necessary and can be placed close to the building on either or both ends. The new roadway around the building would be placed between the new warm up rings and the turn out pastures, although this could potentially reduce the turn out pasture and "sick pens" areas for the horses.
- **Spectator access and seating-** To accommodate spectators attending shows and exhibitions, an area of spectator seating in the form of bleachers will be needed. Bleachers can be placed near the office located to the right of the current main entrance to the barn/arena facility and would sit in the current aisleway near the

office, with the public walkway relocated to where the stalls are currently located. The required circulation would be provided by eliminating a few stalls in the area.

- **Aisleways and barn/arena circulation-** The flooring in the aisleways should be concrete in order to make them more accessible for people with disabilities. Concrete surface will also greatly reduce the amount of dust in the building. The board riding fencing at the arena perimeter should be removed and replaced with a portable metal tubing gate system. This will allow the arena set up to be more flexible, and it will be less of an obstruction to the viewers.
- **Accessibility-** The current facilities are not accessible for individuals with disabilities nor do they meet the current accessibility codes and requirements. With any upgrade and improvements, accessibility must be provided not only to equestrian activities and programs but for the use of the facility. The accessible features would include a path of travel to function and activity areas, toilet rooms, spectator seating, and other program areas as planned.
- **Stalls-** The current stall size of 10 foot by 10 foot although functional, may be on the small side. BLM staff noted that a more desirable size is 12 foot by 12 foot. The rubber mats used as the surface material is good; however the use of sawdust is contributing to the amount of dust in the space. Additional lighting above the stalls is needed for better overall light conditions. The electrical wiring should be upgraded to a concealed system to provide a safer environment. A few stalls should be upgraded with a top door to accommodate stallions if brought in for a show that would help prevent the horse from jumping out.
- **Arena/ring-** The current arena is narrower than a dressage ring. BLM staff noted that the show ring must be wider than a dressage ring. As such, the current dimensions are inadequate and more structural changes may be necessary to accommodate the desired ring size for shows as well as preventing horses from falling during turns as noted earlier. A sand, blue dust mixture should replace the current rubber gravel mixture for arena surface material which would allow for a more accurate preparation of the arena surface for the different types of shows. A drag with the tractor would also be needed to assist with the arena preparation. The ring will need additional storage
- **Storage-** There is a separate hay storage outside the barn/arena facility however, access is not very convenient. Easy access to hay storage from the stalls provides for better/more efficient operations. Equipment storage shed is an open structure on one side and not secure. The equipment must be in a secure storage and be protected from the elements. The arena itself needs additional storage for equipment.
- **Water use-** The water access for horse watering is adequate but with the change in the ring fencing, it may need to be relocated. Wash stalls at the end of the barn are located appropriately and while function well, equipment upgrade will improve the usability. The current dust suppression system could potentially be removed and replaced with a portable system to accommodate the watering needs that vary with each show. Portable water wagon, powered by a tractor, may be used to spread water from the tank as a dust control measure.

- **General-** Additional number of other elements in the facility will help in providing a better public service and a higher quality experience to facility users and operators when providing shows and exhibitions. These include: a show office for show officials to manage their event, internet capability and a place to serve food and beverages during an event.

Conclusion:

Notwithstanding the building's structural and infrastructure issues, overall, the facility and grounds are in a functional condition. While the goal of public access to the facility can be met with some improvements, the decision to renovate or replace the facility would be driven by the extent of improvements to the structure required to ensure safety of the building and the people using the facilities.

3. STRUCTURAL ASSESSMENT

Building Component Description:

Beginning on page 1 of the POZ report, a thorough description of the structure is provided. County staff worked to verify the elements noted in the report during the investigation. The following is an additional description:

- **Roof Diaphragm-** The roofing is 4'-0" wide corrugated metal panels with interspersed translucent panels for light. The panels bear on purlins spaced at 2'-0" oc. The short span is anticipated to allow the panels to carry the load to the purlins. The metal panels as a whole act as the main diaphragm of the structure delivering the horizontal load to the main wind force resisting system (MWFRS).
- **Arena Purlins-** The purlins are placed on the roof trusses and span the 8'-0" truss spacing. The purlins are oriented in the strong direction (heel-up) to allow a better capacity for the span. The POZ report indicates the stringers are 2x4's. See image below:



Arena Purlins

- **Arena Trusses-** The POZ report indicates that the trusses are 2 x 10 double trusses spaced at 8'-0" oc. The trusses appear to be braced on the bottom chord at third points, but it was unclear if the bracing was consistent and how the connection was made. As indicated in the POZ report, there are a number of trusses at the south end of the barn that exhibit bowing in the bottom chord, an indication that the load has been exceeded. The trusses are made up of various sections and fastened with metal gusset plates.
- **Columns-** The arena and stable columns are 6x6 posts at 8'-0" spacing. The arena trusses bear on the 2x12 beams (see below) which carries the roof live and dead load into the columns. It should also be noted that the arena columns have no bracing and have an unsupported height from grade up to the beam connection elevation.
- **Stable Purlins-** The purlins in the stable/walkway areas are 2 x 4's per the POZ report and are placed in the weak (flat) direction. However, their span length is 4'-0" oc as opposed to the 8'-0" span placed in the strong direction (heel-up) in the arena area.

- **Stable Rafters-** The rafters in the stable/walkway area per the POZ report are 2x10 at 4'-0" oc.
- **Beams-** The rafters and trusses bear on 2x12 beams nailed to each side of the column as described in the POZ report. While the beams are made up of two 2x12s, they do not act as a two-ply beam as commonly seen in modern construction. The beams are also notched at the very location where they experience their highest concentrated loads. See image below:



Location of concentrated loads: truss, rafter, beam, post.

- **Main Wind Force Resisting System (MWFRS)-** Through the field visit it was observed that the MWFRS consisted of the metal roof diaphragm delivering load to horizontal boards and 2x wood kickers between the 6x6 columns of exterior and first interior column-line. A clear and consistent load path to deliver horizontal load to the ground was not apparent.

Existing Conditions:

The inspection conducted by County staff was limited to visual observations from ground level; destructive testing, excavation and high elevation inspections were not performed. However, a more detailed investigation was conducted by POZ staff which did include excavation to observe conditions below grade and access to structural members at high elevations. The existing conditions described in the POZ report were verified including, but not limited to the following:

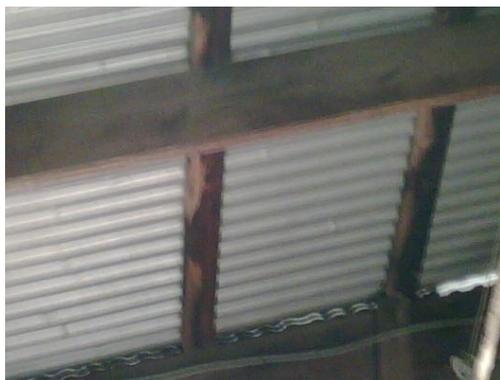
- The wood in the trusses at the north end of the barn are experiencing severe wood rot due to water infiltration. It is not prominent throughout, but is serious in multiple locations and should be addressed. See image below:



Daylight can be seen through rotten areas of truss chord members

- The trusses at the south end also appear to be tilting and the bottom chord appears to be bowing.

- Evidence of water infiltration along the south side can be seen in the discoloration on the roof purlins. See image below:



Evidence of water infiltration

Additional Items not included in the POZ report, but found during the Fairfax County team inspection:

- Movement of arena purlins between trusses: it was observed that in many locations along the north end of the structure, arena purlins were no longer in contact with their associated steel connectors at the roof trusses.
- Holes in roof sheathing where fasteners have pulled through.
- There is significant wood rot to the horizontal boards of the MWFRS along the exterior wall at ground level around the perimeter of the barn.
- At the north end of the building, it appears that a column height was short and a 2x4 element was used to extend the column to the required height.
- Door headers have evidence of rotting wood.
- The temporary truss bracing elements used in the erection of the trusses from the 1970s were left in place throughout the structure. These elements in conjunction with permanent bracing make it difficult to determine bracing adequacy.

Recommendations:

Recommendations by County staff will closely resemble those made by POZ Environmental. The Bureau of Land Management has many options for the future use of the Meadowood horse barn/arena. The POZ report and the recommendations herein in conjunction with associated costs will help drive the decision making on all options.

If the BLM wishes to preserve the horse barn, a rigorous investigation backed up by a complete analysis of all elements of the vertical and horizontal load resisting systems must be conducted. It must be conducted as soon as possible. Some assumptions may be required for the analysis, but conservative assumptions could be used to obtain a better understanding of the deficiencies. The original barn did not include the fire suppression system and may not have included the extent of lighting and dust control. The entire additional load should be included in the calculation.

Listed below is specific for structural members:

- **Roof Diaphragm-** It is important that the metal roof panels are securely fastened to the all purlins. The POZ report indicates that they are attached and were tested by trying to lift the panels. The connections

from the sheathing to the trusses as well as from the truss to the columns should be analyzed to make sure they have the capacity to transfer the lateral load. The panels must be fastened to the roof structure and any fasteners that have pulled through the panels must be replaced and reinforced.

- **Purlins-** A simple calculation should be performed to determine if the purlins are adequate to carry the load for 8'-0" span in the strong direction and the 4'-0" span in the weak direction. All clips connecting the purlins to the trusses must be maintained to ensure a full load path. Purlins subject to moisture infiltration should be checked for rot and mold growth.
- **Arena Trusses-** An analysis must be conducted to ensure the trusses have a capacity to resist the current loads (snow, dust control water pipes, various wood supports, etc.) and future loads, such as a sprinkler system. The bracing should also be checked to ensure truss stability is maintained. **The north end trusses experiencing wood rot must be replaced or repaired immediately.**
- **Columns-** A calculation should be performed to determine the adequacy of the 6x6 columns. The POZ report does indicate that some rotting has occurred in the columns in the areas below ground. It was not possible to observe this during the site visit, but further investigation should be performed to determine the extent of the rotting.
- **Beams-** The connection of the 2x12 beams to the 6x6 columns must be strengthened after a complete investigation and analysis of the current conditions. If notching has compromised the beams' shear capacity, then the beams must be strengthened accordingly.
- **MWFRS and other wind related systems-** A complete analysis of the MWFRS, component and cladding and uplift must be conducted. The current systems appear inadequate and may need to be strengthened based on the results of the analysis. Horizontal boards rotting at the exterior wall near grade, must be replaced at a minimum. The structure's ability to resist out of plane wind loading must also be maintained by ensuring a complete load path of members with sufficient capacity to pass the load from the point of application to the ground.

One of the main forces reducing the structural integrity of the horse barn/arena is the water infiltration from the walls and roof. To reduce the threat of structural collapse, leaks in the roof and walls must be abated. A structural analysis, the reinforcement of structural members and the adequate fastening of cladding to structure will not be worthwhile if water infiltration were allowed to continue.

A comparison of the costs associated with analysis and remediation with a full replacement of the barn/arena must be made. The outcome of such a comparison will provide the BLM staff with a list of options to move forward and address the issues with the Meadowood Horse Barn/Arena. However, doing nothing cannot be an option when considering the safety of the people and animals that could be affected by inaction.

Conclusions:

Structures that fail under normal conditions and design loads usually do so as a result of three factors: inadequate design, poor construction and limited or no maintenance. There is evidence of all three factors in the Meadowood horse barn/arena.

- **Inadequate Design:** Evidence of this can be seen in two areas, the connection of the beam to the columns and the design of the systems associated with wind load. Connections of wood members with large reactions (in this case 2x12 beams) should not be side fastened to another wood member (in this case the 6x6 column) with merely face nailing. In most cases today, large through bolts or lag screws would be specified in such conditions.

The MWFRS, uplift considerations and components and cladding appear to have been inadequately addressed in the design. This can be seen in the shifting of the arena purlins, and the limited horizontal load resisting elements. A metal panel roof with openings for translucent panels can leave the diaphragm weakened and unable to transfer load to the vertical resisting elements.

- **Poor construction:** The conclusions in the POZ report states, “that safety was not a consideration with the construction of this structure. Although the structure has withstood the test of time (34 years), it was built with 'shortcuts' and no consideration of safety.” Through the field investigation, County staff did see construction methods that are not consistent with commercial permitted projects through the truss bracing and column extensions noted herein.
- **Limited maintenance:** Water infiltration is the bane of any structure composed of wood. Failure to properly maintain a structure can be seen in the extensive rot of the wood trusses and the staining of the arena purlins. In addition, metal roof panels left without the full array of fasteners to the structure below can further inhibit the diaphragm's ability to span between vertical bracing elements and can affect uplift resistance. Evidence of uplift issues could be the seen by the shifted purlins atop the roof trusses.

The County investigation also concluded that at the time of the initial construction of the facility, the land was considered agricultural. During the 1970s and even today, building permits for agricultural structures are not required in any Virginia jurisdiction. Therefore, the design of this structure did not have the benefit of minimum design standards referenced in the Virginia Uniform Statewide Building Code. The design also did not benefit from thorough plan review by County engineers for the structural, electrical and plumbing disciplines prior to permit issuance. Once under construction, the project lacked formal scrutiny by County inspectors certified in their areas of expertise and able to question any shortcut made by the contractor. Finally, when the structure was transferred to the U.S. Government, it was not under the jurisdiction of the County with regards to minimum maintenance standards as set forth by the Virginia Maintenance Code.

The structural adequacy of the horse barn/arena is without question compromised based on all of the factors listed above. Its ability to resist imposed loads without a partial failure is limited. Immediate action is necessary to ensure the safety of the human and non-human occupants of the structure.

4. ELECTRICAL ASSESSMENT

The electrical assessment focuses on the current conditions of the electrical system at the barn/arena to determine safety and code compliance for the electrical elements.

Existing Conditions:

The existing electrical system is a 200 amp service that would potentially be sufficient if it only fed the barn/arena, although electrical load calculation is required to be certain about the adequacy. The electrical service originates from the 400 amp service at the old house on the east side of the Storage Shed. The house has a 400 amp service which consists of a 200 amp panel that provides power for the house and a 200 amp disconnect which provides power to the Storage Shed, the Workshop, the Storage Building, the Ferrier Building and the Barn/Arena.

The National Electrical Code (NEC) requires the lighting fixtures (luminaires), equipment enclosures, boxes, conduit bodies and fittings to be protected from physical damage and installed to minimize the entrance of dust, foreign matter, moisture and corrosive particles. Currently, most electrical components are not protected from any physical damage, dust, and corrosion. NEC also prohibits the use of Armored Cable (AC cable) where subject to physical damage, in damp or wet locations, and where exposed to corrosive fumes or vapors.

Generally a building's interior is not considered to be a damp or wet location. However, the barn/arena tends to be subject to moisture for a few reasons:

- There is an existing dust suppression system (mister system) that is used daily to spray water in the arena to control dust. Mist is deposited on the surfaces in the facility including all electrical components.
- The building is not climate controlled. As such, the temperature variations in the changing season and spring/summer humidity contribute to condensation and humidity within the space, making it a damp environment.
- Water infiltration thru the roof leaks and structural components in rain/snow conditions, also contributes to the moisture in the surfaces of the building interior.

The facility includes the following electrical components:

Light Fixtures (luminaires)- The light fixtures appear to be high enough to be protected from physical damage but are not approved to keep out dust nor are designed for wet or damp locations. In addition: there are approximately forty-one open tube fluorescent light fixtures. None have protective lamp covers that would keep broken glass, in case of a lamp burst, from falling on people, animals or the ground to be stepped on. A good number of light fixtures show signs of rust and/or corrosion. Several light fixtures were not illuminated at the time of our assessment.

Armored Cable (AC cable)- The AC cables show signs of rust and/or corrosion. Cable is loose and hanging without support in several places. It must be secured/supported throughout.

Outlet (device) Boxes- The outlet boxes are not the approved type to keep out dust nor are they designed for wet or damp locations. Many outlet boxes show signs of rust and/or corrosion. The outlet boxes that are installed next to the stalls are not protected from physical damage. An extension ring has been welded to the face plate in

an attempt to provide some level of protection from physical damage to the devices but does not provide sufficient protection.

Outlets (switches and receptacles)- The switches, receptacles and cover plates are not approved to keep out dust and are not designed for wet or damp locations. A number of cover plates show signs of rust and/or corrosion. There are portable fans installed in all the stalls that are powered by receptacles mounted on the beam just above the fans. The receptacles are mounted face up where dust and debris accumulate in the devices. There is a risk that if any of the devices overheat, it would cause the dust and debris to ignite. At the time of the barn/arena construction in 1976, the electrical code did not require Ground-Fault Circuit Interrupters (GFCI's) protection on the receptacles in the barn. Today's code will require the receptacles to be GFCI protected.

The heat-tape in the barn was removed by the time of our assessment. Heat tapes are acceptable for protection from freezing however they have potential for electrical malfunctions and risk of fire. This is a concern due to the combustible contents of the barn/arena.

There is a ground electrode system for the total building grounding.

Recommendations:

A number of corrections need to be made in the facility to prevent further damage to the electrical components as well as prevent potential hazardous situations involving electrical service. A few recommendations are outlined below:

- Installing GFCI receptacles for personal protection in the barn is highly recommended as required by current codes.
- The grounding electrode system should be verified to be sufficient for the service and feeders that have been installed and added to over the years.
- With safety being the highest priority for the protection of personnel, public, and the animals, grounding throughout the entire system should be verified to make sure that the potential of shock is eliminated. The locations of many of the electrical devices are places where the horses can come in contact with and the potential of hazard increases with the moisture and dust content in the building.
- The electrical panel in the barn has gaps where circuit breakers were removed. These locations need knock-out blanks installed in the cover to fill the gaps.
- The directory in the panel needs to be updated to show what each of the circuit breakers control.

5. PLUMBING ASSESSMENT

The plumbing assessment focuses on the current conditions of the water supply distribution system at the facility to determine adequacy for the application.

Existing Conditions:

The water supply to the barn is connected to the public water system and has a reduced pressure backflow preventer installed to protect the public system from possible cross connections on the site. The water distribution system supplies water to automatic horse watering troughs, horse washes, a dust suppression system, hose bibbs, yard hydrants and the toilet room. Some of the hose bibbs do not have backflow protection and there is a mix of approved and unapproved yard hydrants on the site. The water distribution piping is not marked to identify non-potable water and water to the bathroom is supplied by the same water system.

Water piping in the barn is above ground and is protected from freezing by the use of heat tapes.

The toilet room not does meet the requirements for access, usability, fixture types, fixture sizes and clearances. The fixtures are non-compliant for usability or the accessibility standards.

Recommendations:

A code evaluation must be conducted to determine if a fire suppression system is required. If a wet fire suppression system is installed in the barn, the public water supply will need a double check valve assembly for backflow protection. If antifreeze is added to the system, a reduced pressure backflow preventer shall be installed.

The use of heat tape to protect the pipes in the facility from freezing is acceptable; however they have potential for electrical malfunctions and risk of fire. This risk must be reduced or abated thru alternate means of freeze protection including the replacement of the piping system.

The water distribution system outlets need backflow protection and water piping needs to be marked to identify the non-potable and potable water.

6. COST ASSESSMENT

To provide an estimated cost of recommendations provided in this report, further study and scoping of the required modifications and improvements is needed which was outside the scope of our review and inspection. Therefore, the cost assessment portion of this report focuses on the review of preliminary estimated cost comparison for the alternative schemes for facility overhaul or replacement presented in the 2008 BLM report. The 2008 BLM report proposed four alternatives:

- Alternate 1 - Overhaul existing Barn/Arena complex keeping existing footprint.
- Alternate 1A - Alternate 1 plus replacing metal roofing & siding and adding windows.
- Alternative 2 - Overhaul existing Barn/Arena complex, delete arena and reduce the footprint by almost half (42%). The arena function would be accomplished by constructing a separate new metal arena.
- Alternative 3 - Construct New Metal Building Stables (2) with new stalls at a different location than the existing barn. Upon completion, demolish the existing barn/arena and construct a new arena.

A preliminary cost breakdown is provided in the 2008 report. The scope of work for each alternative seems appropriate, and line item prices seem reasonable based on available market cost data. Given the level of detail in the investigation of the existing structure in the 2008 report, the contingency costs at 25% for renovation and 15% for new work appear to be higher than industry standards. The contingency of 25% for the renovation portion of Alt 4, seems especially high considering it includes only demolition of the existing building. Our experience has shown that a contingency of 15% for renovations and 10% for new construction seems more reasonable. It must also be noted that the preliminary estimate was completed in June 2007 and we suggest updating to current cost index. The adjustment of contingency to the more common industry practice levels, results in the revised costs noted below:

MEADOWOOD PRELIMINARY COST ESTIMATE COMPARISONS (from BLM 2008 Report)		ALT-1	ALT-1A	ALT-3	ALT-4
ITEM	DESCRIPTION				
	SUBTOTAL FOR ALL RENOVATION WORK (June 2007 estimate)	439,099	754,553	467,566	99,781
	Contingency @ 15%	65,860	113,180	70,130	14,970
	SUBTOTAL FOR ALL NEW WORK (from June 2007 estimate)			283,788	965,686
	Contingency @ 10%	-	-	28,380	96,570
	TOTAL FOR REHAB & NEW WORK (2007 cost)	504,959	867,733	849,864	1,177,007
	Inflated to 2010 Cost*	557,980	958,840	939,100	1,300,590

* Using ENR Construction Cost Index, 2010 was 1.105 compared to 2007 rates.

7. Conclusion

As noted at the start of this report, our review was limited to a site visit of the Meadowood facilities, the review of the 2008 BLM report, and the 2010 POZ study. Based upon this review, we have noted the existing conditions and recommendations in each section of the report. In general, in order to determine the facility's functionality to provide the desired programs and better public accessibility, the integrity of the building systems, the cost effectiveness and the lifecycle usability and expense of renovating the existing building or replacing with a new facility, a rigorous investigation and a complete analysis of all elements of the buildings structural, electrical, and plumbing components as well as the site conditions must be conducted. The investigation of the structural members as noted in the Structural Assessment portion of this report must be conducted as soon as possible to obtain a better understanding of the current deficiencies and the building's structural integrity in order to address the safety concerns.



Fairfax County
Department of Public Works and Environmental Services
Capital Facilities/Land Development Services



Meadowood Special Recreation Management Area
Bureau of Land Management

Barn/Arena Existing Conditions

