ABSTRACT

Title of Document: HISTORIC PRESERVATION AND SUSTAINABILITY IN AN EQUESTRIAN CENTER REVITALIZATION

Shira Rosenthal, M.ARHP, 2015

Directed By: James W. Tilghman, Lecturer

This thesis examines the history and types of American Horse Farms and Equestrian Centers. The design strategy will employ the best practices to create a proposal for revitalization of an historic horse farm, enhanced by the utilization of technology, sustainability practices, and preservation, all of which can be applied to any equestrian farm. By studying successful precedents and the current and projected best practices, the best practices can be applied to a proposed preservation and enhancement of the forty-four acre Reddemeade Equestrian Center in Silver Spring, Maryland.

HISTORIC PRESERVATION AND SUSTAINABILITY IN AN EQUESTRIAN CENTER REVITALIZATION

By

Shira Faye Rosenthal

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Masters of Architecture and
Historic Preservation
2015

Advisory Committee:
James W. Tilghman, Chair
Jana Vandergoot
Donald Linebaugh
Steve Hurtt

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Preface

I have a personal connection and investment in this topic, which has made my thesis research and final product that much more enriching and engaging. I have been riding horses for close to ten years. My horse farm and riding experience began when I started working at a therapy barn, the Therapeutic Recreational Riding Center, located in Glenwood, Maryland, which specialized in using horseback riding to help people with mental and physical disabilities gain confidence, independence, and improve posture and motor control. I volunteered there for five years while taking beginner horseback riding lessons in exchange for some of my work. I loved the atmosphere of the farm because everyone was so caring and considerate of each other, especially bearing in mind the delicate nature of the work they did.

When I began my undergraduate education at the University of Maryland, I joined the equestrian club naturally because I felt it would be a great place for me to meet new people while doing something that I love. I became an active member of the club throughout my four years of undergraduate study. Not only did the club allow me to continue my riding, but since it is run as an extension of the Animal Sciences Department, we were taught how to self sufficiently care for the horses as well. I learned health and maintenance care skills that most people would only learn in a veterinary science program. It was extremely rewarding to understand and practice how to administer medications, treat wounds, correctly feed, and properly groom a horse. That experience benefited my horse knowledge in more ways than I knew at the time.

During this time, I was studying architecture at University of Maryland as well. I decided to pursue a career in architecture when I was in the 9th grade. I built my first model of a house out of chipboard and fell in love with the idea of designing spaces that could impact people's lives. With my love of art and math, a career in architecture seemed like a natural choice. My passion for historic preservation began while I was an undergraduate student, and grew even

more when I participated in a study abroad program in England with the Historic Preservation program. Naturally, when I later applied to the graduate school at University of Maryland, I applied for the dual degree in Architecture and Historic Preservation.

After graduating from the University of Maryland with my Bachelors of Science degree in Architecture, I wanted to continue riding while I pursued my architecture goals and prepared for graduate school. I was lucky enough to find Reddemeade Farm. The knowledge I had gained during my years at TRRC and University of Maryland's Equestrian Club put me miles ahead of the other people just starting out in terms of experience and expertise.

I found a family community at Reddemeade, something I find integral to the world of horseback riding. When you are participating in a sport where fifty percent of your team is a 1400-pound animal with a mind of its own, confidence building and trust in your mount and your instructor is paramount to staying safe and enjoying yourself. Even when you fall, you have to be able to pick yourself back up and try again, as all equestrians have done before.

Many people fail to realize that horseback riding is a centuries old activity with histories all over the world and with many different types of engagement. Historically, horses were most commonly used as work aids, for farming, ranching, transporting goods, and carrying workers. Eventually, the use of horses as sport became more popular. Horse racing and fox hunting are two of the oldest sports that are still practiced today.

The care for horses has improved with the inventions of better technologies and higher knowledge of the needs of the horse. Horses are essentially helpless creatures with very limited self-defense capabilities. They sleep standing up due to the fact that in the wild, if they were to sleep lying down and a predator were to approach, they cannot get back to a standing position quickly enough to run away. Their eyes only allow them to see primarily on the sides of their heads, not in front or back. A horse's limbs are extremely fragile because of the way their bones are shaped and attached to the rest of their body. This is why so many horses are retired from racing and competing so young and why horses don't have

particularly long life spans, typically between twenty and thirty years. These circumstances call for people to step in and care for these gentle giants.

Horse care is not as simple as just having a box for a horse to live in with access to grass. Having been a part of numerous different barns and seen the various types of operations and procedures they use, I've learned first hand that the type of care, the level of dedication, and the amount of money spent, all influence a horse's standard of living and longevity.

While the rich history and culture of horseback riding needs to be celebrated and, in many ways, imitated in the equestrian world, if horses are to live long and healthy lives for the benefit of their owners, their environments need to be drastically improved. As John Blackburn, a practicing architect who specializes in the design and construction of equestrian centers says in his book *Healthy Stables By Design*, "The health of the horse can be affected by every aspect of the farm from the layout of the roads and paddocks down to the selection and placement of the buckets in the stall."[1]

As a rider and horse owner, I am intrigued by the idea of preserving and celebrating the history of horses, both in the wild and with people, in conjunction with using architecture and the technology that has been developed to improve the quality of life for horses and the people who care for them. There are countless modifications that could theoretically be made to a farm like Reddemeade to make it a safer and more enjoyable atmosphere for everyone while educating riders and the public on the importance and history of horses.

[1] John Blackburn, *Healthy Stables By Design* (Victoria, Australia: Images Group), 126.

Dedication

I dedicate this thesis to the Reddemeade Equestrian Center, a place that allowed me to continue fostering my love of horses, gave me the knowledge and experience to be a successful equestrian, and showed me how supportive and special the horse community can be.

I also would like to dedicate this thesis to my beloved aunt, Andrea Malek, who I wish were still here to see this milestone in my life. She always encouraged me to do what would make me the happiest and to follow my heart. I'm reminded every day of her love and am incredibly grateful and blessed that I had her in my life.

Acknowledgements

I would like to thank my thesis committee for their constant support and inspiration during this process. Your input has been invaluable to me, and working with you on this project has been an incredibly enriching learning experience.

Chair:

James W. Tilghman

Committee:

Jana Vandergoot
Donald Linebaugh
Steve Hurtt

I would also like to thank my parents and brother for their continuing motivation over the years as I have worked to pursue my education in architecture. You always believed in me and offered me words of wisdom in difficult times, and for that, I am extremely grateful.

Rae Rosenthal
Jay Rosenthal
Evan Rosenthal

Table of Contents

Preface ii
Dedication v
Acknowledgements vi
Table of Contents vii
List of Figures ix
Chapter 1: Introduction 1
Chapter 2: Thesis Research Data and Analysis 2
Section 1: Site and Context: Reddemeade Farm 2
Subsection 1: History 2
Subsection 2: Landscape 3
Subsection 3: Survey Maps 3
Subsection 4: Problems and Opportunities 6
Section 2: Precedent Analysis 8
Subsection 1: Shelburne Farms, Shelburne, Vermont 9
Subsection 2: Sagamore Farm, Reistertown, Maryland 13
Subsection 3: Spanish Riding School, Vienna, Austria: 15
Subsection 4: Calumet Farms, Lexington, Kentucky 17
Subsection 5: Montpelier Farm, Montpelier Station, Virginia 19
Subsection 6: Heronwood Farm, Upperville, Virginia 21
Subsection 7: Oakhaven Farm, Austin, Texas 24
Subsection 8: Analysis of Best Practices 26
Section 3: Research Themes 30
Subsection 1: Progression of Equestrian Culture in the United States 30
Subsection 2: Educational Opportunities 31
Subsection 3: Sustainable Practices 32
Subsection 4: Culture 33
Chapter 3: Design Approach 34
Section 1: Literature Review 34
Subsection 1: Ventilation 34

Subsection 2: Hay Storage 35
Subsection 3: Fire Safety 36
Subsection 4: Stall Design 37
Subsection 5: Arena 39
Subsection 6: ADA Considerations 39
Subsection 7: Sustainable Methods 40
Section 2: Technical Considerations and Program 40
Subsection 1: Pragmatic Design Objectives and Approach 40
Subsection 2: Space Allocations 43
Subsection 3: Form, Structure, and Materials of the Barn 44
Subsection 4: Sustainability Goals 45
Subsection 6: Applicable Building Codes 46
Subsection 7: Program 46
Section 3: Design Strategies 47
Subsection 1: Impact of Research on Design Strategies 47
Subsection 2: Design Process 48
Subsection 3: Update to Design 56
Subsection 4: Final Design 57
Subsection 5: Reflections to Commentary 63
Chapter 4: Conclusion 65
Bibliography 66

List of Figures

Figure 1: The original main house built in 1867, which still exists on the property; Source: Photo taken by Shira Rosenthal

Figure 2: The current upper barn which was originally the dairy farm in 1938 for the Lethbridge family; Source: Photo taken by Shira Rosenthal

Figure 3: Property Line Map; Source: Map from http://www6.montgomerycountymd.gov/gistmpl.asp

Figure 4: Five-Foot Contour Lines with direction of rainwater runoff towards stream on the south end of the property; Map from http://www6.montgomerycountymd.gov/gistmpl.asp

Figure 5: Circulation paths; Red = Vehicular, Dark Blue = Pedestrian, Light Blue = Horse, Yellow = Trails; Map from http://www6.montgomerycountymd.gov/gistmpl.asp

Figure 6: Distance from Reddemeade Farm (North) to College Park (South); Source: Map from Googlemaps.com

Figure 7: Deed from 1984 that transferred the property to Reddemeade Farm; Source: Deed found on Mdlandrec.net

Figure 8: Image of current field pastures with steep topography on site; Source: Photo taken by Shira Rosenthal

Figure 9: Image of the current indoor riding arena; Source: Photo taken by Shira Rosenthal

Figure 10: Lila Vanderbilt and her four children riding on their estate; Source: Joe Sherman, *The House at Shelburne Farms,* page 54

Figure 11: A groom holding a hackney horse inside the breeding barn at Shelburne Farms; Source: Joe Sherman, *The House at Shelburne Farms,* page 21

Figure 12: Dr. Webb ad James Watson prepare to leave driving horses four-in-hand; Source: Joe Sherman, *The House at Shelburne Farms,* page 49

Figure 13: Image of Native Dancer, the prize winning Thoroughbred; Source: Sagamoreracing.com

Figure 14: Image of Native Dancer, the prize winning Thoroughbred, going down the track; Source: Sagamoreracing.com

Figure 15: The yearling barn at Sagamore Farm; Source: John Blackburn, *Healthy Stables by Design,* page 36

Figure 16: Site plan of Sagamore Farm; Racing farm typology includes racetrack (yellow), multiple paddocks (green), stalls and gathering spaces (red)

Figure 17: Two Lipizzan horses with a groom inside the Spanish Riding School; Source: The Spanish Riding School website http://www.srs.at/en/tradition/the-spanish-riding-school/

Figure 18: The main riding arena in the Spanish Riding School of Vienna; Source: The Spanish Riding School website http://www.srs.at/en/tradition/the-spanish-riding-school/

Figure 19: One of the tracks and barns at Calumet Farm; Source: Image from Calumetfarm.com

Figure 20: 1941 Triple Crown winner, Whirlaway with tour group at Calumet Farm, May 1947; Source: Image from Calumetfarm.com

Figure 21: A monument on Calumet Farm's property with names of their top winning Thoroughbred race horses; Source: Image from Calumetfarm.com

Figure 22: One of the barns at Calumet; Source: Image from Calumetfarm.com

Figure 23: The rolling fields at Montpelier Farm for retired Thoroughbred horses; Source: Image from TRFMontpelier.org

Figure 24: One of the barns at Montpelier Farm; Source: Image from TRFMontpelier.org

Figure 25: The broodmare barn at Heronwood Farm; Source: John Blackburn, *Healthy Stables by Design,* page 17

Figure 26: Picture and Section of Exterior Wall of a Horse Stall; John Blackburn, *Healthy Stables by Design,* page 29

Figure 27: A staff member working with a horse inside Heronwood; Source: John Blackburn, *Healthy Stables by Design,* page 18

Figure 28: A row of stalls with open roof ventilation in one of the barns; Source: John Blackburn, *Healthy Stables by Design,* page 24

Figure 29: Oakhaven Farm Main barn and other buildings; Source: Image from Oakhavenpartners.com

Figure 30: Oakhaven Farm Site and Floor Plan of one of the main barns; Source: John Blackburn, *Healthy Stables by Design,* page 44

Figure 31: Use of collected stone on the exterior of one of the barns at Oakhaven; Source: John Blackburn, *Healthy Stables by Design,* page 47

Figure 32: Exterior view of one of the barns at Oakhaven; Source: John Blackburn, *Healthy Stables by Design,* page 41

Figure 33: Barn typology study; drawn by Shira Rosenthal

Figure 34: Site plan of Periwinkle Farm in Spencerville, Maryland; a typical dressage farm typology with large horse stalls (purple), a separate indoor riding arena (red), and various sized turnout paddocks (green); drawn by Shira Rosenthal

Figure 35: Plan of Reddemeade Farm; fits into the dressage typology; drawn by Shira Rosenthal

Figure 36: Prototypical horse stable building section; Source: Richard Diedrich, *Building Type Basics for Recreational Facilities*, page 213

Figure 37: Detail of framing for a hay barn; Source: Alfred Hopkins, *Modern Farm Buildings,* page 111

Figure 38: Detail of "Burnett" stall – The best type of rigid stall partition; Source: Alfred Hopkins, *Modern Farm Buildings,* page 119

Figure 39: Detail of "Burnett" windows for horse stalls – The best type of window design for horse stalls; Source: Alfred Hopkins, *Modern Farm Buildings,* page 116

Figure 40: Prototypical Stable Site Plan; Source: Richard Diedrich, *Building Type Basics for Recreational Facilities*, page 102

Figure 41: Image of current portable fans attached to stalls at Reddemeade and nonfunctioning overhead watering system; Source: Photo taken by Shira Rosenthal

Figure 42: Image of multiple stalls in the lower boarding barn with ineffective portable fans and watering systems; Source: Photo taken by Shira Rosenthal

Figure 43: The current lower boarding barn with office space above; Source: Photo taken by Shira Rosenthal

Figure 44: The truss system and metal roofing material of the indoor riding arena; Source: Photo taken by Shira Rosenthal

Figure 45: The aisle facing south in the main barn, with barn owned lesson horses housed on each side; Source: Photo taken by Shira Rosenthal

Figure 46: The current manure/waste area on the south side of the main barn at Reddemeade; Source: Photo taken by Shira Rosenthal

Figure 47: Existing site plan with programmatic labels; drawn by Shira Rosenthal

Figure 48: Proposed site plan; Green signifies buildings and areas to be preserved. Red indicates areas that can be altered; drawn by Shira Rosenthal

Figure 49: Plan of first schematic design option; drawn by Shira Rosenthal

Figure 50: Section of first schematic design option; drawn by Shira Rosenthal

Figure 51: Plan of second schematic design option; drawn by Shira Rosenthal

Figure 52: Section of second schematic design option; drawn by Shira Rosenthal

Figure 53: Plan of third schematic design option; drawn by Shira Rosenthal

Figure 54: Section of third schematic design option; drawn by Shira Rosenthal

Figure 55: Current pasture outlines with the entrance gates to each field highlighted; Source: Map from Googlemaps.com, Illustration done by Shira Rosenthal

Figure 56: Proposed field design with all entrances to various fields in one central location; Source: Map from Googlemaps.com, Illustration done by Shira Rosenthal

Figure 57: Roof study models designed in Sketchup; modeled by Shira Rosenthal

Figure 58: Plan of the barn at the mid semester review; drawn by Shira Rosenthal

Figure 59: Section of the barn at the mid semester review; drawn by Shira Rosenthal

Figure 60: Final illustrative site plan at 1" = 50' scale; drawn by Shira Rosenthal

Figure 61: New plan placed over the existing building plan; drawn by Shira Rosenthal

Figure 62: Final plan- First floor at 1" = 8' scale; drawn by Shira Rosenthal

Figure 63: Final plan- Second floor at 1" = 8' scale; drawn by Shira Rosenthal

Figure 64: Final section- North south longitudinal at 1" = 4' scale; drawn by Shira Rosenthal

Figure 65: Final section- East west section perspective at 1" = 4' scale; drawn by Shira Rosenthal

Figure 66: Exterior perspective view of the entrance to the building; modeled and rendered by Shira Rosenthal

Figure 67: Interior perspective of one of the stall wings; modeled and rendered by Shira Rosenthal

Figure 68: Perspective view on the ground floor looking up into the cupola; modeled and rendered by Shira Rosenthal

Figure 69: Perspective view looking from the balcony of the cupola down to the stalls and the ground floor; modeled and rendered by Shira Rosenthal

Figure 70: Perspective view of the riding arena; modeled and rendered by Shira Rosenthal

Figure 71: Diagram of proposed driveway path suggested at the final presentation; drawn by Shira Rosenthal

Chapter 1: Introduction

The problem I will be exploring for my thesis project is this: how is it possible to preserve the history and culture of an historic horse farm while revitalizing and renovating it to meet the needs of the horses and humans for the present and future. I will do a comprehensive analysis of horse barns to understand how different methods can encourage broader practices in the community. Considering the typology of horse farms in a broader context will assist in understanding how best practices from different horse related uses might converge in the contemporary understanding of a modern horse farm.

I will go about solving this problem by looking at historic precedents to determine what methodology was successful and what could be changed, and then apply those findings to a modern farm operation. Through my research, I will establish relevant best practices from previous horse farms, and other types of farms, to establish a plan of action for a case study farm. This investigation will lead to examining sustainability and efficiency methods that can be integrated into a modern horse farm.

I will be looking broadly at the evolution of the use of horses in the United States and how they have developed. Looking at equestrian centers, I will consider the demand of the services that horse farms provide and issues that must be taken into consideration during design, such as topography, climate, and materials.

My hypothesis for this thesis is that designing an equestrian center with historic precedents and best practices taken into consideration will make a modern day horse farm operation more efficient and successful.

Chapter 2: Thesis Research Data and Analysis

Section 1: Site and Context: Reddemeade Farm

Subsection 1: History

Benjamin and Andrew Thompson bought the parcel of land that Reddemeade Farm sits on in 1867. For years, it passed between owners, being used for various unknown purposes. Charles and Doris Lethbridge bought the property in 1938 and used it as a dairy farm for the next twenty years. The original dairy barn the Lethbridges used, as well as the original main house from 1867, still exist and are actively used on the property today.





Figures 1 and 2: The original Main House built in 1867 and the dairy barn from 1938, to be preserved

In 1984, Paul and Jane Siegler purchased the property from the estate of Doris Lethbridge and turned it into Reddemeade Equestrian Center. Reddemeade is located in Silver Spring, Maryland, conveniently close to Ashton, Sandy Spring, Olney, Rockville, and Laurel. It sits on approximately 44 acres of rolling land. Currently, there is a main building, which houses 50+ stalls for the Reddemeade owned lesson horses, as well as the main office, indoor riding arena, bathroom, and observation decks. Directly adjacent to that structure is the main outdoor riding arena, which backs up to some of the field pastures for the horses. There are also two boarding barns, which house between thirteen and seventeen privately owned horses each. There is also a two-stall quarantine barn, a small structure with an office, bathroom, and

porch used for summer camp, a loft office located above the lower boarding barn, along with multiple hay and feed rooms on the premises. The property includes various grass fields for horse turnout, separated by electric fencing in some places and wooden fencing in other places.

My rationale for choosing this site as a test case for my thesis is that I have a personal connection to this farm. I ride and board my horse at Reddemeade, so I am incredibly invested in the farm and its future. I know what is needed at the farm and what horse farms need in general, so it is the perfect site for me to implement my thesis ideas.

Subsection 2: Landscape

The property of Reddemeade Farm has considerable topographic change. There are parts of the land that have very steep hills, with the main buildings sitting at the middle level of the topography. The way the land is contoured, rainwater flows from the north side of the property, including the entrance street, Ednor Road, to the north-west, down past the main building and through the horse pastures. The water is carried all the way through the property to the creek that lies on the South end of the property, which leads to the Patuxent River.

Subsection 3: Survey Maps

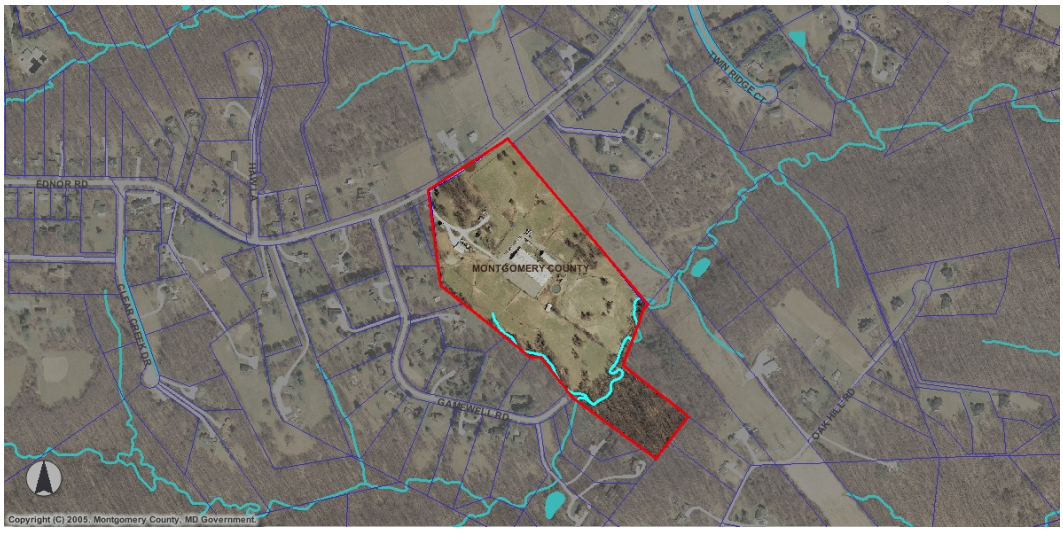


Figure 3: Property Line Map

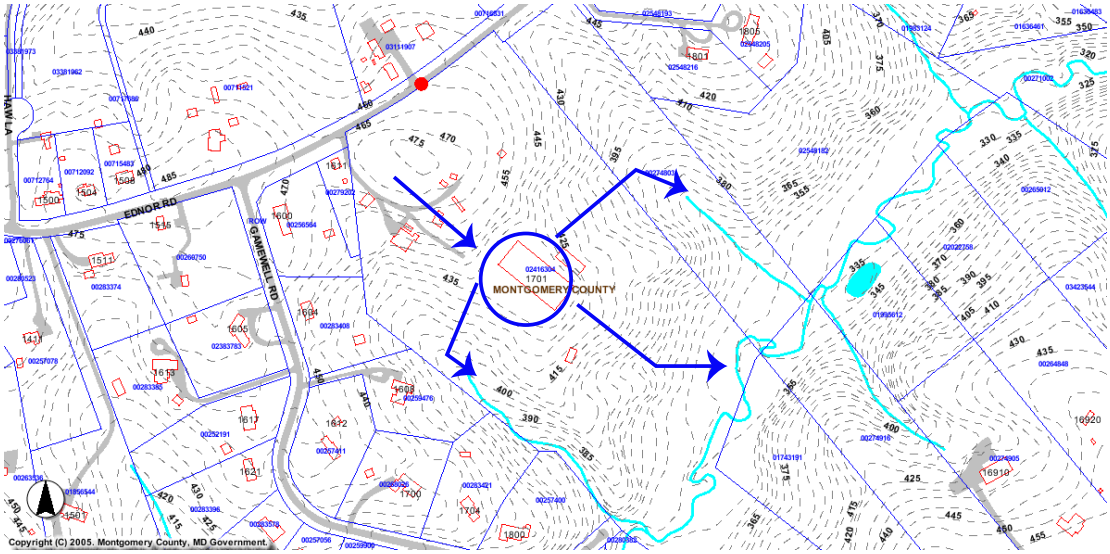


Figure 4: Five-Foot Contour Lines with direction of rainwater runoff towards stream on the south end of the property

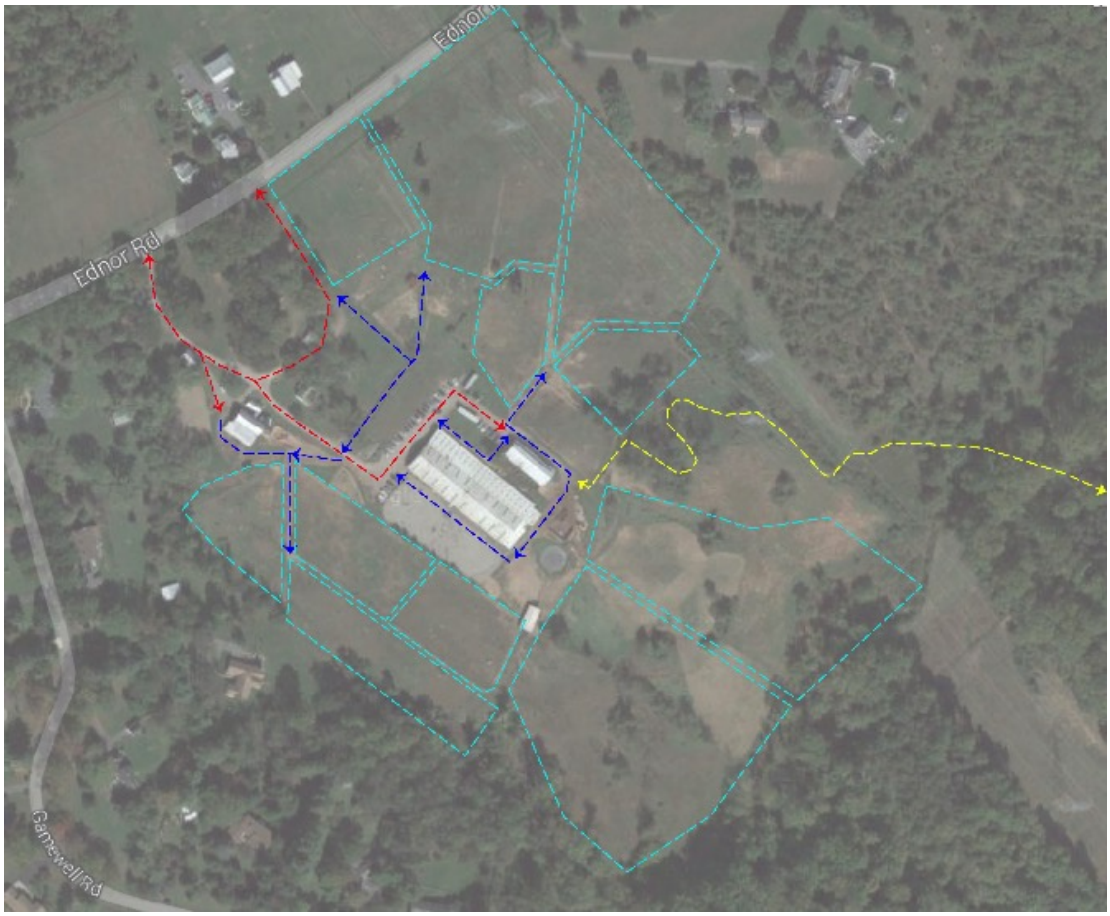


Figure 5: Circulation paths; Red = Vehicular, Dark Blue = Pedestrian, Light Blue = Horse, Yellow = Trails

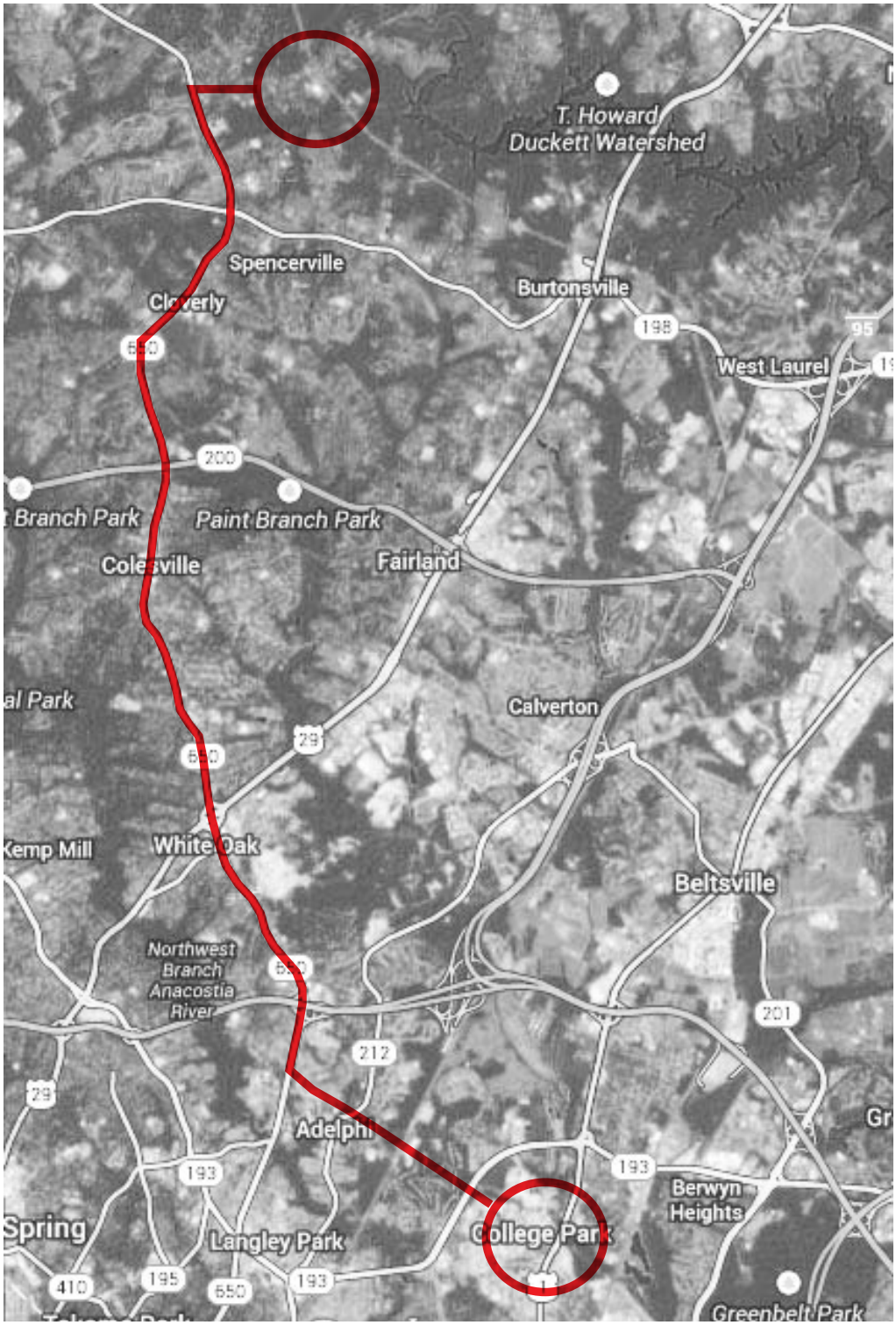
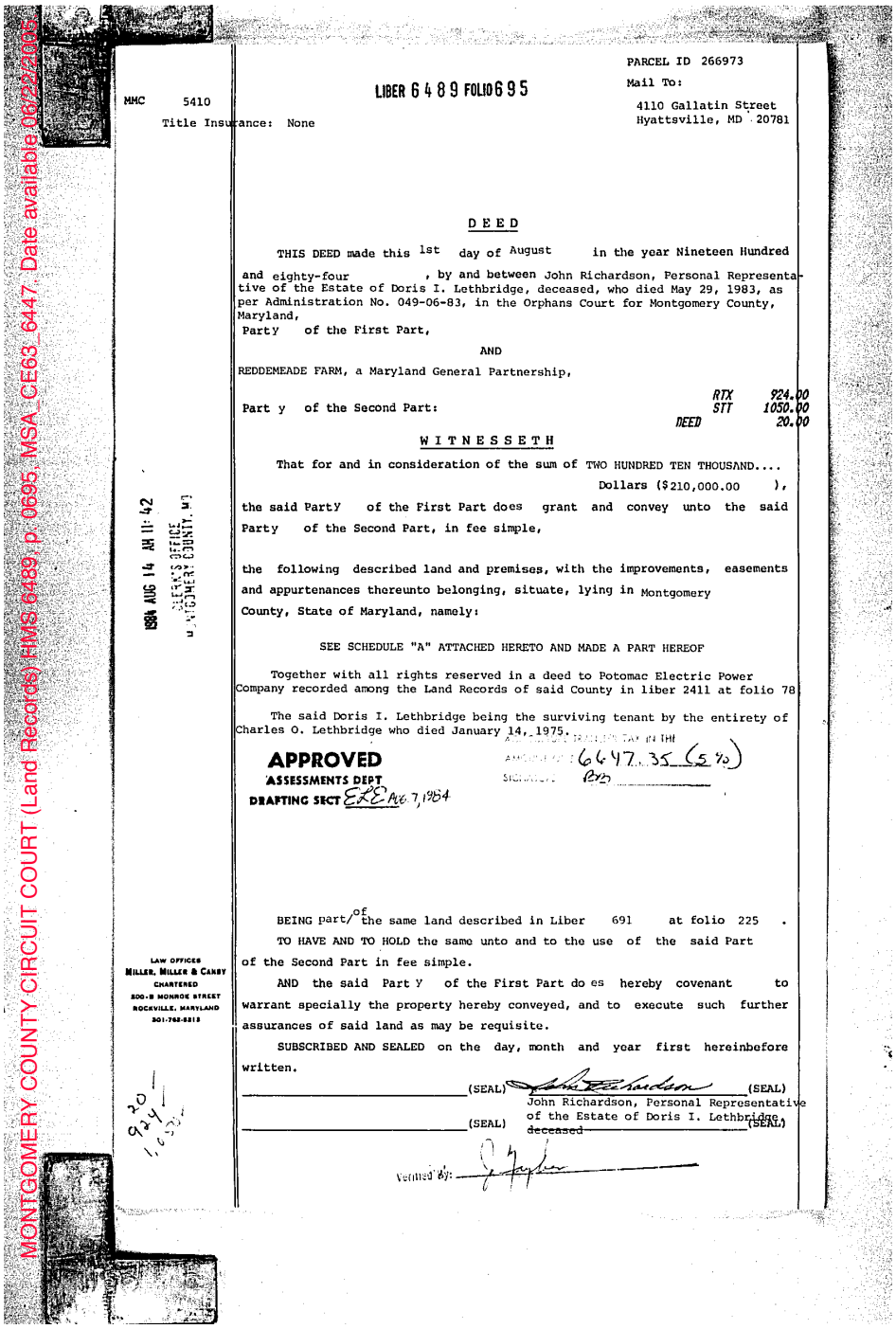


Figure 6: Distance from Reddemeade Farm (North) to College Park (South)



PARCEL ID 266973
Mail To:
4110 Gallatin Street
Hyattsville, MD 20781

MMC 5410
Title Insurance: None

LIBER 6489 FOLIO 695

DEED

THIS DEED made this 1st day of August in the year Nineteen Hundred and eighty-four, by and between John Richardson, Personal Representative of the Estate of Doris I. Lethbridge, deceased, who died May 29, 1983, as per Administration No. 049-06-83, in the Orphans Court for Montgomery County, Maryland,
Party of the First Part,

AND

REDDEMEADE FARM, a Maryland General Partnership,

Party of the Second Part:

RTX 924.00
STT 1050.00
DEED 20.00

WITNESSETH

That for and in consideration of the sum of TWO HUNDRED TEN THOUSAND.... Dollars ($210,000.00), the said Party of the First Part does grant and convey unto the said Party of the Second Part, in fee simple,

the following described land and premises, with the improvements, easements and appurtenances thereunto belonging, situate, lying in Montgomery County, State of Maryland, namely:

SEE SCHEDULE "A" ATTACHED HERETO AND MADE A PART HEREOF

Together with all rights reserved in a deed to Potomac Electric Power Company recorded among the Land Records of said County in liber 2411 at folio 78

The said Doris I. Lethbridge being the surviving tenant by the entirety of Charles O. Lethbridge who died January 14, 1975.

APPROVED
ASSESSMENTS DEPT
DRAFTING SECT EEE Aug 7, 1984

6447.35 (5%)

1984 AUG 14 AM 11:42
CLERK'S OFFICE
MONTGOMERY COUNTY, MD

LAW OFFICES
MILLER, MILLER & CANBY
CHARTERED
200-B MONROE STREET
ROCKVILLE, MARYLAND
301-762-5212

BEING part of the same land described in Liber 691 at folio 225 .

TO HAVE AND TO HOLD the same unto and to the use of the said Part of the Second Part in fee simple.

AND the said Party of the First Part does hereby covenant to warrant specially the property hereby conveyed, and to execute such further assurances of said land as may be requisite.

SUBSCRIBED AND SEALED on the day, month and year first hereinbefore written.

(SEAL) John Richardson (SEAL)
John Richardson, Personal Representative of the Estate of Doris I. Lethbridge, deceased
(SEAL) (SEAL)

Verified by:

MONTGOMERY COUNTY CIRCUIT COURT (Land Records) MWS 6489, p. 0695, MSA_CE63_6447. Date available 06/22/2016.

Figure 7: Deed from 1984 that transferred the property to Reddemeade Farm

Subsection 4: Problems and Opportunities

There are many issues with the site that cause significant problems for the horses, people, and buildings. The topography on the site is very steep at certain points. This causes

rainwater to gather at some of the low points in the horse pastures. This causes dangerous footing and can result in the formation of deep gullies that horses can get caught in.



Figure 8: Image of current field pastures with steep topography on site

There is an opportunity, however, to use the steep topography to create a gravity fed water filtration system, which can gather the runoff to be used for watering the horses and vegetation. This could be beneficial as well in filtering the water that runs through the property, possibly containing agricultural runoff, sediment, and dangerous pollutants from the streets and paddocks, before it reaches the creek on the south end of the property.

Fencing can also be an excellent opportunity to create something that is both beautiful and functional. It can be an integral part of the gravity fed water filtration system, allowing water to pass through the property down to the creek, but halting any harmful sediment and trash that might be carried along with it.

The main riding arena building is centered on the site with exposure to daylight all day. This gives a great opportunity to use natural daylight to light the indoor riding ring, provide heat in the winter, and harness the light for solar energy.



Figure 9: Image of the current indoor riding arena

The proximity of the site to the woods means wildlife is plentiful. This includes deer, foxes, rabbits, and other small mammals, all of which have access to the horse pastures. These animals can scare the horses, cause injury, or spread diseases. Reinforced wooden fencing with electric wire, only on top, can help to prevent the outside animals from gaining entry to the fields. At the same time, however, strategic fencing can help to keep animals out while integrating the pastures into the woodlands beyond so that the natural features look like an extension of the site and capitalize on the proximity to the woods and the streams leading off of the Patuxent River. The landscape of the farm could help to make the property become a nature preserve and a place of passive recreation, not just a horse farm.

Section 2: Precedent Analysis

Studying both historic and modern barn precedents launched the research to help create a barn typology and a system of best practices that could be used in the design. All of the

precedents that were researched helped to determine the features of a horse barn that are required and the features that I desire for my barn design.

Subsection 1: Shelburne Farms, Shelburne, Vermont

Lila Vanderbilt married William Seward Webb in 1881, and immediately they began a life together of privilege, status, and entertainment. In 1886, the couple decided that they wished to create a model agricultural estate on the shores of Lake Champlain, Vermont. They enlisted the expertise of Frederick Law Olmsted, who Lila's father, William Henry Vanderbilt, had made acquaintance with prior. Olmsted, known as the father-to-be of American landscape architecture, shared his thoughts on agricultural improvements with William Vanderbilt in 1848.[2] The fortuitous relationship was beneficial when it came to the design of Shelburne Farms forty years later.

Dr. Webb had a vision to combine thirty small farms, including his grandfather's post-Revolutionary War holdings on Lone Tree Hill and the Edward Saxton Farm, into one grand estate on Lake Champlain. Olmsted was instrumental in advising on a plan to knit all these pieces of property into one harmonious whole.[3] The size and scope of the emerging estate, and the fact that Olmsted, the heralded landscape visionary, played an influential role in the overall design gave the project immense prestige and enticed the public to take notice of the grand property that was forthcoming. Olmsted's simple yet profound overall design principle for all of his precedent setting projects, including Central Park in New York City, Jackson Park in Chicago, and the Boston Park Systems, was that "an exposure to nature [is] fundamental for man's physical and spiritual wellbeing."[4]

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[2] Joe Sherman, *The House at Shelburne Farms: The Story of One of America's Great Country Estates* (Middlebury, VT: P.S. Eriksson), 14.
[3] Sherman, *The House at Shelburne Farms,* 16.
[4] Ibid.,18.



Figure 10: Lila Vanderbilt and her four children riding on their estate

In addition to Olmsted's expertise, Dr. Webb enlisted prominent architect Robert H. Robertson to design the four main buildings on the estate: the actual Shelburne House, the Farm Barn, Coach Barn, and Breeding Barn. A passion for horses had a strong effect on the overall design of Shelburne Estate. The breeding barn that was built within the estate was the largest in America at the time, stabling over three hundred animals and large enough for games of indoor polo to be played. Webb had a goal of breeding "a refined all-purpose hackney, a strong, stocky horse that could both pull the plow and take the farmer to town in style."[5] The immensity of the farm was a factor that could not easily be overlooked. The Farm Barn, "a five-storied stone and timber structure with two wings enclosing a two acre courtyard, had shops for blacksmiths, carpenters, painters and management staff, as well as stalls for eighty teams of mules and horses."[6] Even compared to modern day commercial farms, this is a very large establishment.

[5] Sherman, *The House at Shelburne Farms,* 20.
[6] Ibid., 23.



Inside the Breeding Barn, a groom holds the reins of a hackney, the all-purpose horse Dr. Webb had great expectations for. The barn, which had stables for three hundred animals, was large enough for games of indoor polo to be played.

Figure 11: A groom holding a hackney horse inside the breeding barn at Shelburne Farms

The Coach Barn built by Robertson was located south about a quarter of a mile from the main house, near the lake. The building measured a hundred and sixty feet by a hundred and ninety feet. It consisted of a courtyard, which measured seventy-five feet by a hundred feet, a clock tower, carriage wash room, harness-cleaning room, along with thirty-two closed horse stalls and sixteen more open ones. In addition, there were thirteen sleeping rooms on the upper level for the Grooms, the Coach Barn supervisor, and other employees.[7]

[7] Sherman, *The House at Shelburne Farms, 23.*



Figure 12: Dr. Webb ad James Watson prepare to leave driving horses four-in-hand

The 3,800-acre Shelburne Farm was distinguished and admired for its innovative and progressive practices, its hackney horse breeding activities, and the grand family residence. After Dr. and Lila Webb passed away, Shelburne Farms was inherited by the next generations of the family. Around 1969, the family faced economic problems that threatened the existence of the estate. In 1972, the descendants, to promote conservation education, founded a non-profit corporation, Shelburne Farms Resources. Eventually, the house was deeded over entirely to the organization for public use. In 1983, the board of directors approved a plan to restore and transform the house into an inn. The majority of the land has been placed under conservation easements to be preserved and rehabilitated for new uses.[8] In 2001, the property officially became a National Historic Landmark.

[8] Shelburne Farms. "History of the Property." Last updated 2014. http://www.shelburnefarms.org/about/history.

Subsection 2: Sagamore Farm, Reistertown, Maryland

Sagamore Farm, located in Glyndon, Maryland in Baltimore County, is one of the most famous farms in Maryland. It is associated with Thoroughbred horse racing. Issac Emerson established Sagamore Farm in 1925. Emerson's daughter, Margaret Emerson Vanderbilt, who played an integral role in the operation of the farm as well, passed the farm to her son, Alfred G. Vanderbilt II, in 1933. Alfred left Yale during his junior year, at age twenty-one, to run Sagamore Farm. Vanderbilt turned the farm into an internationally recognized premier training and breeding facility for Thoroughbred horses, and the farm maintained that prestige for the next half century. During its prime, even the Queen of England boarded a broodmare at Sagamore.[9]

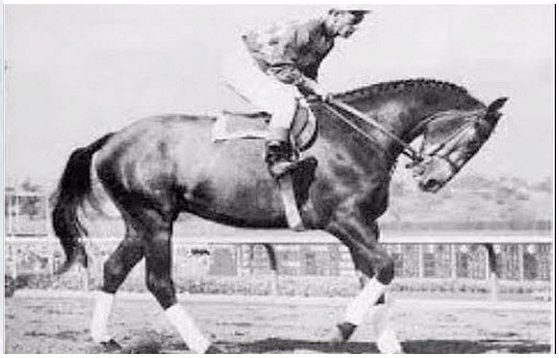
As part of one of New York's wealthiest families, Alfred Vanderbilt became extremely well known in the world of horse racing, eventually becoming the owner and president of Baltimore's Pimlico Race Course.[10] In 1941, Vanderbilt began a quest with Walter P. Chrysler, Jr. to acquire the 1935 English Triple Crown winner Bahram from the Aga Khan III, to be used for breeding purposes. He also acquired Kentucky Derby and Preakness Stakes winner Kauai King to stand at stud at Sagamore.[11]

The most notable horse to come out of Sagamore Farm, however, was, without question, the grey thoroughbred, Native Dancer. Known as the "Galloping Grey Ghost," he was housed at Sagamore during his racing career from 1952 to 1954. He won both the Preakness and Belmont Stakes in 1953 and finished his career winning twenty-one out of twenty two races. In 1963, Native Dancer was inducted into the National Museum of Racing and Hall of Fame.[12] In addition, the famous farm also was home to fellow inductees

[9] Sagamore Racing, "About Sagamore Farm," Last updated December 2014, http://sagamoreracing.com/about/.
[10] "About Sagamore Farm," http://sagamoreracing.com/about/.
[11] Ibid.
[12] Ibid.

Discovery and Bed o' Roses. In 2010, Sagamore's own horse, Shared Account, won the Breeders' Cup Fillies and Mares race for a prize of $2 million.[13]





Figures 13 and 14: Images of Native Dancer, the prize winning Thoroughbred

In 1986, Vanderbilt sold the farm to a developer, James Ward, and then in 2007, Kevin Plank, a Maryland native, graduate of University of Maryland, and founder and CEO of Under Armour, purchased Sagamore Farm. There is currently a plan for restoration by Blackburn Architects. Already, Blackburn has done restoration work on two of the existing barns, including a sixteen stall foaling barn and a twenty-stall broodmare barn. The entire planned project incorporates a wide array of LEED elements to make the farm more sustainable. These include reusing the original building materials for new construction and utilizing passive design techniques to create natural lighting and ventilation.[14]



Figure 15: The yearling barn at Sagamore Farm

[13] "About Sagamore Farm," http://sagamoreracing.com/about/.
[14] Blackburn Architects, "Sagamore Farm," Last updated 2014. http://blackburnarch.com/projects/sagamore-farm/.



Figure 16: Site plan of Sagamore Farm; Racing farm typology includes racetrack (yellow), multiple paddocks (green), stalls and gathering spaces (red)

Subsection 3: Spanish Riding School, Vienna, Austria:

The Spanish Riding School of Vienna, founded in 1565, is a traditional riding school for Lipizzan horses and classical dressage. It is the oldest of its kind in the world. The grand white riding hall was built in 1729 and has become a unique tourist attraction by offering performances by the stallions for the public in addition to opening up training sessions for public viewing. The leading horses and riders at the school perform worldwide.[15]



Figure 17: Two Lipizzan horses with a groom inside the Spanish Riding School

[15] Spanische Hofreitschule: Bundesgestut Piber (The Spanish Riding School). "The History." http://www.srs.at/en/tradition/the-spanish-riding-school/.

The school is located between Michaelerplatz and Josefsplatz near the Hofburg in central Vienna. The performances mostly take place in the Winter Riding School, which is an architecturally elaborate, sunlight-flooded hall, painted mainly white, with a portrait of Emperor Charles VI above the royal box. The riders always salute the portrait before they ride. The school also has a summer stable located in Heldenberg-Wetzdorf-Lower Austria, where the sixty-eight resident stallions go during July and August for a break from training.[16]



Figure 18: The main riding arena in the Spanish Riding School of Vienna

The riding school, which is the oldest of its kind in the world, dates back to the Habsburg Monarchy in 1572, but it was not until 1729 that Emperor Charles VI commissioned architect Joseph Emanuel Fischer von Erlach to build the riding hall that is still in use today.[17] The school was named for the Spanish horses that form one of the bases of the Lipizzan breed. This breed of horse is used exclusively at the Spanish Riding School. Traditionally, only men have trained and ridden the Lipizzan horses at the school, although there is not an official ban on women.[18] In 2008, two women, one from the United Kingdom and one from Austria,

[16] "The History," http://www.srs.at/en/tradition/the-spanish-riding-school/.
[17] "The History," http://www.srs.at/en/tradition/the-spanish-riding-school/.
[18] Ibid.

passed the entrance exam to train as riders at the school, and were the first to do so in 436 years.[19] The art of classical dressage was essentially established and furthered at this school.

Subsection 4: Calumet Farms, Lexington, Kentucky

William Monroe Wright, the owner of the Calumet Baking Powder Company, established Calumet Farms in 1924. He created the small farm in Lexington, Kentucky to be a breeding and racing farm for Standardbred Horses. His son, Warren Wright, took over the farm in 1932 after his father passed away. Warren decided to turn the barn's focus more towards the art and business of Thoroughbred racing. In 1933, the 762 acre operation began bloodstock investments with the intention to breed and raise their own horses to be racing champions. The first champion that Calumet raced in their signature "devil" red and blue racing silks was Nellie Morse, who they purchased in foal to the stallion American Flag.[20]



Figure 19: One of the tracks and barns at Calumet Farm

In 1939, the famous horse trainer, Ben A. Jones, came to Calumet to be the head trainer. His son, Jimmy, joined him later and together they trained Calumet's horses for the

[19] Ibid.
[20] Calumet Farm, "Our History," Last updated 2014, http://calumetfarm.com/history.

next twenty years. In 1941, one of Calumet's horses, Whirlaway, brought home the farm's first Triple Crown win. The next big success for Calumet came in 1947, when they became the first farm to exceed one million dollars in purse earnings from races. [21]



Figure 20: 1941 Triple Crown winner, Whirlaway with tour group at Calumet Farm, May 1947



Figure 21: A monument on Calumet Farm's property with names of their top winning Thoroughbred racehorses

[21] "Our History," http://calumetfarm.com/history.

Calumet went through a serious decline in the 1980's after the original owners and trainers had passed away. When their world class sire, Alydar, passed away in 1990, the farm soon went into bankruptcy. The horses were dispersed across the country, and the land was put up for auction in 1992. When businessman Henryk de Kwiatkowski learned that the farm was to be auctioned, he immediately went to Lexington to place a bid on the farm. He won ownership with a final bid of seventeen million dollars.[22] In 1991, Calumet Farm was added to the National Register of Historic Places.



Figure 22: One of the barns at Calumet Farm

Subsection 5: Montpelier Farm, Montpelier Station, Virginia

Montpelier Farm is the historic home of James and Dolly Madison, but now has a very different purpose. Founded in 1983, the Thoroughbred Retirement Foundation (TRF) was created to offer a home to retired off the track thoroughbreds in need of a new home after their racing careers were over. A 200-acre portion of the estate was dedicated to this new venture, run by Kim Wilkins.[23] This new attraction has kept the successful farm a staple in the equestrian community and is now the largest equine sanctuary in the world devoted to the

[22] "Our History," http://calumetfarm.com/history.
[23] Montpelier Farm: A Thoroughbred Retirement Foundation Facility. "About." Last updated 2010. http://www.trfmontpelier.org/about/.

"rescue, retirement, rehabilitation and retraining of Thoroughbred horses no longer able to compete on the racetrack."[24]



Figure 23: The rolling fields at Montpelier Farm for retired Thoroughbred horses

> "For much of the 20th century, under the stewardship of Marion DuPont Scott, Montpelier's last private owner, Montpelier was one of the nation's premier equestrian centers . . . In partnership with the TRF, we are proud that Montpelier will continue to be a showcase for America's race horses." Michael C. Quinn, President of the Montpelier Foundation[25]



Figure 24: One of the barns at Montpelier Farm

[24] Anne. "TRF at Montpelier Farm – Great Resources for OTTBs." Blue Ridge Equine Clinic. September 27, 2013. http://www.blueridgeequine.com/trf-at-montpelier-farm-great-resource-for-ottbs/.
[25] "About," http://www.trfmontpelier.org/about/.

Subsection 6: Heronwood Farm, Upperville, Virginia

Part of the bucolic Middleburg Region, Heronwood Farm occupies over 400 acres of land. Prior to the construction of the farm, the Redskins team owner, Jack Kent Cooke, owned the land. In 1983, John Blackburn was hired by the new owner to create eight of the initial buildings on the site. The two major barns on the site are the broodmare and yearling barns, completed in 1986. There are additionally three small isolation barns, a service building with a bunkhouse, a large storage building for hay and bedding, and a manager's house.[26] The Grafton Estate Meadow on the property was also completed in 1986, and the estate barn went through a renovation completed in 2000, and a covered riding arena was added in 2009. This project was the first specialized barn design for John Blackburn.



Figure 25: The broodmare barn at Heronwood Farm

Being primarily a foaling barn, Blackburn designed a 9,400 square foot broodmare barn with twenty stalls and a 7,900 square foot yearling barn with sixteen stalls. The most important design concepts at this farm were natural light and ventilation. Morgan Wheelock, a landscape architect from Cambridge, Massachusetts, who was hired to design the site, was an influence for many of the design decisions. He had theories and practices on natural light and ventilation that improved the health and safety of horses all over the United States, as

[26] Blackburn, *Healthy Stables By Design, 17.*

well as in Canada and France.[27] His ideas that were used in farms helped to make it easier for broodmares to carry their foals to full term safely. He eliminated the need for continuous, overburdened artificial lighting, which is a fire hazard and an expensive extra cost.[28]



Figure 26: Picture and Section of Exterior Wall of a Horse Stall

Wheelock had design practices for ventilation that were very beneficial in helping to ensure that the horses do not spread or receive any airborne illnesses. This happens most often when the barn uses conventional ventilation methods, which involve simply opening the front and back doors and letting the air pass through. This directly causes the horses to catch whatever airborne bacteria, pathogens, allergens and diseases might be spreading through the air from the other horses. Wheelock suggested orienting barns on properties so that they are perpendicular to the prevailing summer breeze instead.[29]

[27] Blackburn, *Healthy Stables By Design,* 19.
[28] Ibid., 25.
[29] Ibid., 26.




Figures 27 and 28: A staff member working with a horse inside Heronwood; A row of stalls with open roof ventilation in one of the barns

Heronwood was Blackburn's first use of low vents and vented skylights in a barn design. Heated (by the sun) roofs and eaves to encourage upward ventilation were also utilized.[30] There was a prevalence of stonewalls and fences originally at Heronwood. These fence lines unfortunately did not work with the new paddock design. As a result, they were dismantled so more practical fences could be built. The stones were preserved, however, and used in the new buildings.

Blackburn's goal for Heronwood's design was to "emulate the characteristic Federal style architecture that defined the Middleburg countryside."[31] These stylistic components are seen in the gabled end structures, dormers, along with other design details in the buildings. It was difficult though to make the Federal style scale and context work for a much smaller scale project. One way of achieving this goal was to use the original stone from the dismantled fences to create a different "shape at the end of the broodmare barn, which was meant to imitate the Federal form, shape, and proportion."[32]

An essential design element for a broodmare barn is surprisingly psychological. There must be a way for the customers to approach the barn from the center through a meeting

[30] Blackburn, *Healthy Stables By Design,* 19.
[31] Ibid., 21.
[32] Ibid., 25.

place, which gives them a space to relax and learn about the horse's bloodlines. At Heronwood, the reception room is located in the center of the barn's linear axis so that there are stalls on each side. People coming to the farm are immediately impressed with the interiors, as the owners believed that "the value in the interior translates to the value in the quality of the product being sold."[33]

It was important to consider the natural elements in the broodmare barn, as creating the more natural environment to encourage efficient cycling of the broodmare and foal is elemental. The goal is not only to simulate but invite the natural conditions indoors, as this will facilitate the horse cycling (developing of the baby) and foal dropping as close to January 1st as possible. This is ideal because a horse is classified as a yearling on the following January 1st, regardless of when he was born the previous year. So a horse that has been living and training as long as possible when designated as a yearling is considered a much stronger horse.[34] Heronwood's main goal is to provide as natural and efficient an environment as possible for the birth of the horses.

According to Blackburn, Heronwood Farm stands as "a testament to [the firm's] first application of design principles that promote the health and safety of horses."[35] The farm is still in operation today, but primarily as an alpaca breeding farm, in response to the farm ownership's desire to diversify their livestock holdings.

Subsection 7: Oakhaven Farm, Austin, Texas

Debbie and Willy Graves founded Oakhaven Farms in 1998. They established the operation as a premier breeding barn of Holsteiner and Oldenburg horses to be used for competition and pleasure. Their goal was to take their "highest quality sport horse mares,

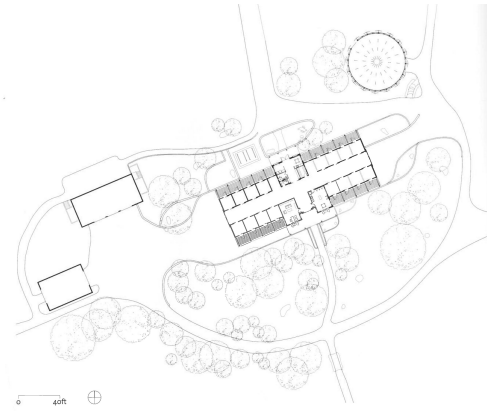
[33] Blackburn, *Healthy Stables By Design,* 25.
[34] Ibid., 25.
[35] Ibid., 28.

with proven athletic ability and wonderful temperaments, and match them to the best international and national stallions."[36] They wanted to be known nationally for their breeding.

John Blackburn designed the main barn at Oakhaven Farm in 2003. The specific design elements were focused on keeping the barn well ventilated and comfortable for both horses and humans in the extreme Texas heat. This was done by placing the main barn on top of a small hill, with the front of the barn facing south into the prevailing breezes. There is a skylight on the north side of the building so as not to let in the direct hot sunlight but still allow natural light and air to enter. The doors of the twelve by twelve foot stalls have mesh material, which is beneficial as it allows horses to see out and lets air in to cool them down.[37]

The farm also features a 200 by 80 foot covered riding arena, a 200 by 125 foot outdoor arena, a covered exerciser and hot walker with a round pen, and numerous large turnout paddocks for the horses. A unique quality of the farm's design was done by Goerge Salinas,





Figures 29 and 30: Oakhaven Farm Main barn and other buildings; Oakhaven Farm Site and Floor Plan of one of the main barns

who used collected stones from the land to ornament the exterior of the main barn. He additionally created retaining walls, fences, curbs, and many other features throughout the landscape that incorporate native materials.[38]

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[36] Oakhaven Partners, "About Oakhaven," Last updated December 2014, http://oakhavenpartners.com/about.html.

[37]

[38] "About Oakhaven," http://oakhavenpartners.com/about.html.




Figures 31 and 32: Use of collected stone on the exterior of one of the barns at Oakhaven; Exterior view of one of the barns at Oakhaven

Subsection 8: Analysis of Best Practices

After looking in-depth at multiple precedents of equestrian centers and horse farms, each one gives a unique view as to how an equestrian facility should be designed to best benefit the horses, humans, and purpose of the farm.

Shelburne Farm was not built solely as an equestrian operation but also as a private residence that had horses on the property. Even so, the size and function of their farm is equivalent to many breeding and training farms that would be seen today. Both Shelburne and Sagamore Farms had the purpose of breeding high quality horses for owners to use for sport and recreation. Operating multiple specialty barns within the property, such as broodmare, yearling, and coach barns, is a practice that can be emulated today and is useful for organization and overall management of large-scale properties. To translate to more modern uses, farms could have separate structures for jumping equipment and have different barns for mares and geldings. Since both these farms had prestigious owners, as well as valuable horses, the level of commitment to the care of the horses and stables is apparent in the level of detail and amount of work put into the farms. Both farms, for instance, had living quarters right on the property for farm workers so that if a problem arises, there is always somebody

there. While these farms showcase the rich history of horse usage in the United States and how the farms seen today essentially came to be, many of their practices could be extremely useful to modern equestrian centers.

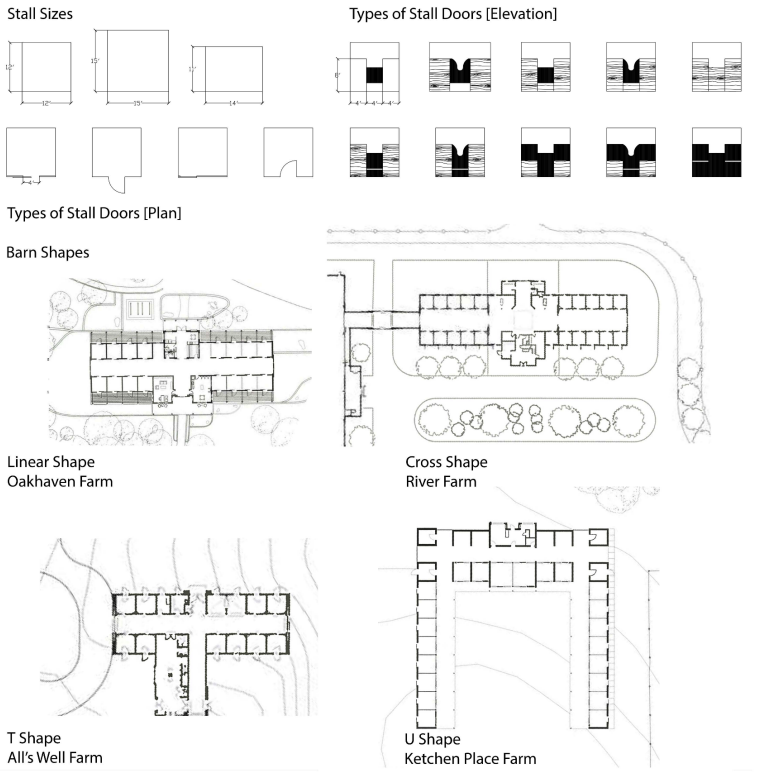


Figure 33: Barn typology study

The Spanish Riding School in Vienna is a somewhat eccentric version of what dressage riding schools could be in the United States. While most farms dedicated to dressage do not use only one breed of horse, are not somehow government affiliated, and are not used as a tourist attraction, as the Spanish Riding School is, their practice of exceptional treatment of their horses and sole dedication to the art of riding is a practice that could be successfully emulated.



Figure 34: Site plan of Periwinkle Farm in Spencerville, Maryland; a typical dressage farm typology with large horse stalls (purple), a separate indoor riding arena (red), and various sized turnout paddocks (green)

As the uses of horses has evolved away from work to sport, especially Thoroughbred horse racing in the United States, barns have had to adapt to the different needs of their equine clients. Calumet and Montpelier Farms are breed and sport specific farms dedicated to the sport of horse racing and exclusively Thoroughbred horses. These farms have to cater specifically to the unique needs of these special animals, such as proper ventilation as Thoroughbred horses have particularly sensitive respiratory systems. The land also needs to have enough space for practice race tracks and large pastures for these powerful animals to run around, especially Montpelier as it is dedicated to retired racehorses. The idea of designing for the specific needs of a certain breed of horse and particular activities is a practice that horse farms today should employ. Farms need to have the proper space, land, and equipment to work with dressage, hunter, cross-country, quarter horses, and even ponies. Not all of these horses have the same needs and all of these disciplines of riding require

different skills and teaching. By looking at farms such as Calumet and Montpelier, ways of running a horse farm for specific purposes can be learned effectively.

Heronwood Farm and Oakhaven Farm are both current equestrian centers designed to be the most efficient establishments, in terms of caring for horses and riding. Both farms were designed by Blackburn Architects, who showcase unique and efficient designs for horse farms while maintaining unique features to each property. The most important design aspects, according to Blackburn, are natural ventilation and daylight, in order to keep the horses in the healthiest state.[39] The use of low vents, vented skylights, roofs heated by the sun, and eaves to encourage upward ventilation are all elements that were used in these designs that can be easily utilized in farms across the country. Depending on the climate in the location of a farm, orienting the front of the barn to face south into the prevailing breezes can greatly help to cool the building down. Having a skylight on the north side of the building so as not to let in the direct hot sunlight but still allow natural light and air to enter is another useful tactic. These methods are all employed, in various ways, at Heronwood and Oakhaven Farms. Investigating these practices can help to build the most comfortable and pleasing farm possible, no matter the location or type of riding being done.

Looking at these various precedent studies of different horse farms, the more historic farms showcase the history of horse usage and some practices that could be adopted and be extremely beneficial in modern barns. Farms such as Calumet and Montpelier display the evolution of horse usage and racing in the United States and how designing for a specific breed and purpose can be essential to the overall wellbeing of the horses. Looking at farms like Heronwood and Oakhaven, which employ certain extraordinary practices by an architecture firm dedicated solely to equestrian farms, demonstrates modern day best practices for horse barns that could theoretically be applied to any horse operation.

39



Figure 35: Plan of Reddemeade Farm; fits into the dressage typology

Section 3: Research Themes

Subsection 1: Progression of Equestrian Culture in the United States

The history of horse usage in the United States dates back many centuries. The earliest use for horses was as modes of transportation. Farmers, ranchers, and armies depended on their horses to travel between locations. Throughout the early twentieth century, the U.S. Department of Agriculture (USDA) was maintaining breeding herds of horses to be used as mounts for the military.[40] These programs were also an attempt to preserve certain breeds of American horses, such as the Standardbred, Morgan, and American Saddle horses, all of which are still in use today. Farmers utilized horses to pull ploughs and work the land. Different horse breeds were used for different purposes, depending on size and strength ability.

[40] Kristina Adams, "Horses in History: A Bibliography," *United States Department of Agriculture National Agriculture Library*, http://www.nal.usda.gov/awic/pubs/HorseHistory/intro.shtml.

The Department of Agriculture reported the total number of horses in the United States in 1911 to be over twenty-three million. The aggregated value of horses and mules in 1927 was "more than one-fourth the estimated value of all livestock and in seven states, the value of horses and mules exceeded that of all other livestock combined."[41] The use of horses for transportation and their value decreased with the invention of the automobile, but by the late 1960s, horses became more popular again, this time as status symbols. This new popularity with owning horses again led to the development of the breeding industry of sport horses. A study from 2005 by the American Horse Council estimates that there are 9.2 million horses currently in the United States.[42] Racing was the first dominant activity among recreational uses for sport horses, but today people still use horses for racing, showing, different types of competition, breeding, recreation, and work.

Subsection 2: Educational Opportunities

By looking at the history of horse usage and how it has changed in this country, a series of relevant best practices begin to develop that can be used in all horse farms to maintain the most successful operations possible. The progression of the equestrian culture shows what methods have been successful and beneficial to horses and what practices could be changed. Teaching the broader community, especially when horse farms are located within heavily urbanized areas, about these practices can help to integrate the equestrian community with the general public and interest people in learning about the history of horses, what they can be used for, and the current opportunities available.

When people come to a horse farm for the first time, they should be able to experience a myriad of elements involving horses, not just the physical aspect of riding. People new to horses need to learn about safety while interacting with horses, the care the horses require, the

[41] Adams, "Horses in History: A Bibliography," http://www.nal.usda.gov/awic/pubs/HorseHistory/intro.shtml.
[42] Ibid.

responsibilities of working with horses, the different disciplines of riding, and the impact that horse farms have on the environment. Educating the community on sustainable practices that can be employed at farms, and how they can use similar practices in their homes, is an excellent way to establish a strong connection for new riders to the horses and the farm. This knowledge and understanding of the relationship that humans and horses have is all a part of being an equestrian and designing an equestrian center.

Subsection 3: Sustainable Practices

There are many practices that could be introduced in a horse farm to increase the level of sustainability, and improve the production and efficiency of the farm. Water is an essential element at a horse farm, not only used as drinking water for horses, but also used to water vegetation and pastures and to control dust levels inside the barn that could cause respiratory problems for horses and humans. If a farm is situated on a site with varying topography, as Reddemeade and many rural farmlands are, the water flow could be concentrated and reused using a gravity fed filtration system. Rather than let all the rainwater runoff flow through the property and create unwanted gullies and pools that are dangerous for horses and humans, the water could be caught and filtered and reused for many purposes.

Agriculture could be an extremely beneficial practice on a horse farm to increase efficiency and sustainability and lower spending. Horses eat, on average, approximately fourteen pounds of hay per day, along with approximately six to eight quarts of grain and alfalfa, depending on the horse. By growing and producing these products that are used so frequently by horses on the property, farms could save a lot of money, time, and resources. The cost of land in an urban area, such as Montgomery County, is very high. Land conservation utilized in open spaces could be extremely helpful.

Subsection 4: Culture

A horse farm generally has a very rich and lively community of people with a common interest. Taking the opportunity to turn a simple horse farm into a multi-layered operation where horses, agriculture, architecture, sustainability, and human entertainment and leisure all function together as one system is a great way to preserve the culture of horse farms in America that has been created over the centuries. The experience of going to a horse form does not have to be only about physical riding but can be expanded to include other aspects, such as sustainability, agriculture, and education, so everyone coming to a farm, not just those actually riding, has something to gain from it.

The sustainable practices that can be created on horse farms can be shared with the public as well. People could come visit horse farms not only to learn about horses and to ride, but also to learn about the process of caring for horses and everything that is involved. Demonstrating good environmental and sustainable practices can show people how a farm can be self-sustaining and prove the importance of sustainable practices within the culture of the equestrian community. Due to the expensive nature of the sport and the care animals, those who participate in equestrian culture most often belong to a higher income bracket. Reinforcing the concept that horse farms can be managed in a sustainable fashion to save money and resources can help to reshape the common misconception of horseback riding as only being for the wealthier class of people and can help to broaden the accessibility of horses to anyone who might be interested.

Chapter 3: Design Approach

Section 1: Literature Review

Subsection 1: Ventilation

When designing a horse farm, it is important to remember that creating an environment for a human is not the same as creating one for a horse, but it needs to be comfortable for both. There are many important aspects regarding stable design that must be considered. The two most important elements to consider are always strategic ventilation and natural lighting. The average 1,000-pound horse passes 2.4 gallons of urine and 31 pounds of feces daily.[43] A horse's head is naturally hanging down during daily activities; therefore, the stable and stall itself should be as clean as possible and well ventilated to maintain proper health.

Different methods of ventilation and lighting are often based on the equation of vertical lift created by the Dutch-Swiss mathematician Daniel Bernoulli; the principle was created by the speed of airflow over an airplane wing.[44] In addition, many designs are facilitated by the "rise of hot air known as the chimney effect, where air is pulled in low and vented out high."[45] Since horses, especially thoroughbreds, have very sensitive respiratory systems, proper airflow is paramount. To keep horses healthy, airborne bacteria pathogens and allergens need to be encouraged to travel through the barn rather than resting in one place. The most effective approach to ventilating a horse stable is utilizing a combination of eave vents and open volume under roof area exhausted by a ridge vent. The ridge vents can be continuous prefabricated, clerestory, or cupolas.[46] Putting vents along the floor and utilizing

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[43] Richard J. Diedrich, *Building Type Basics for Recreational Facilities* (Hoboken, NJ: John Wiley & Sons, 2005), 101.
[44] Blackburn, *Healthy Stables By Design,* 20.
[45] Ibid., 21.
[46] Ibid., 213.

vented skylights heated by the sun causes the heat within the barn to rise and exit. This is attained by employing Bernoulli's principle and the chimney effect.

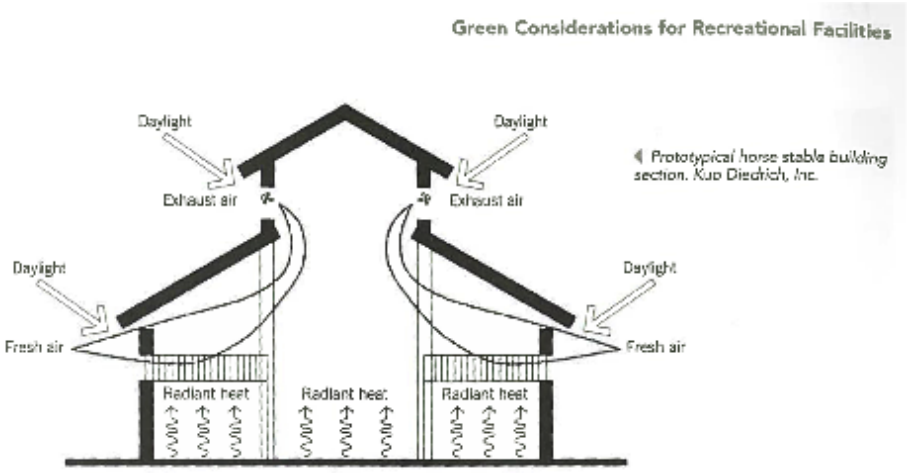


Figure 36: Prototypical horse stable building section

There are further design methods that can be employed to help achieve proper ventilation. Having a roof that has a pitch of 7:12 discourages heated air from circulating back down towards the stalls. Instead, heat will travel upwards towards the pitched roof with vented skylights and exit. The vented ridge skylight on the roof of the barn should ideally span the entire length of the barn.

Horses additionally need less warmth in the winter months than other animals, such as cows, so a good practice is to "let the ceiling of the horse stable run up the rafters, raising the collar beams, and giving the horse stable a cubage or volume of from 1000 to 1500 cubic feet of air per animal."[47] Horses are very temperature sensitive so these features need to be taken into consideration very seriously

Subsection 2: Hay Storage

Hay storage is a very controversial issue in barn design. A horse generally eats around fourteen pounds of hay per day, which equates to around two tons of hay per annum. Hay stored overhead of the horse stalls contributes to widespread allergens and other equine

[47] Hopkins, *Modern Farm Buildings*, 116.

respiratory ailments because the horse is constantly inhaling particles from above. Overhead haylofts can, however, help to keep the horses warm by retaining their body heat inside the barn during harsh winters. If overhead hay storage is used, leaving the hayloft open to avoid impeding natural light and ventilation is very important. Every ton of loose hay takes up about 500 cubic feet of space, while baled hay takes up approximately one-third of that amount, approximately 150 cubic feet per ton.[48] Baled hay has many benefits over loose hay, including being more manageable to move and distribute, and it greatly reduces fire risk as well; baled hay will not burn.

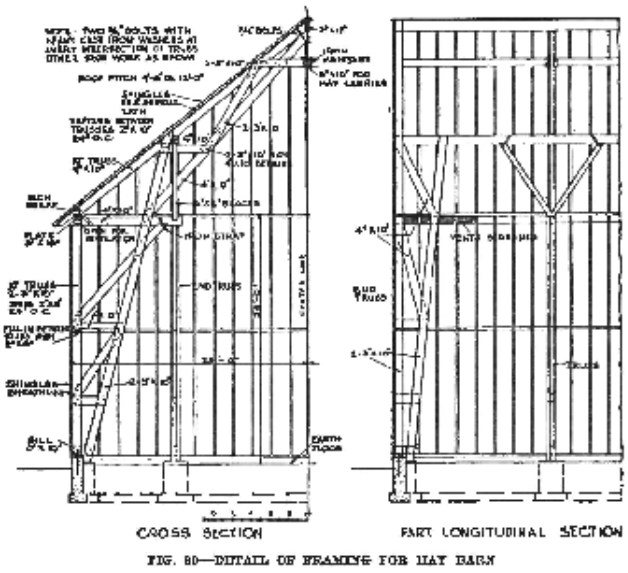


Figure 37: Detail of framing for a hay barn

Subsection 3: Fire Safety

Fire safety is also a very important consideration for barn design. Picking the right material for construction is key. Masonry material with heavy timber construction is a durable and fire resistant option, and as such, makes an ideal choice for barns. Having an adequate sprinkler system is essential as well. Since many fatal barn accidents occur due to improper placement of hay, grain, bedding, and other flammable elements, having a dividing

[48] Hopkins, *Modern Farm Buildings*, 113.

wall separate the rest of the barn from the storage areas for daily use, with the bulk hay and bedding confined to a separate facility, is the safest option.

Subsection 4: Stall Design

Other design guidelines to consider when constructing a horse barn include the general size of a horse stall, which is between twelve by twelve and fourteen by fifteen feet. The general formula for a horse stall is that the wall should be one and a half times the horse's length but not less than ten feet. This size allows the horse to turn around and be led out without kicking out the bedding. This size is also the best width to prevent a horse from casting itself, that is, when a horse rolls over in the stall, gets their hooves stuck against the wall, and cannot roll back over to get up. Having more stalls of a reasonable size, however, is more beneficial than having fewer excessively large stalls, as it allows for more horses to live in the barn.

For any type of barred opening, the bars should be one inch in diameter and three inches apart. Partitions in general are made of two-inch thick tongue-and-grove plank or three-quarter of inch minimum plywood and should be at least eight feet high.[49] Stall doors on interior aisles are typically seven feet high and between forty-two and forty-five inches wide.

[49] Diedrich, *Building Type Basics for Recreational Facilities,* 104.

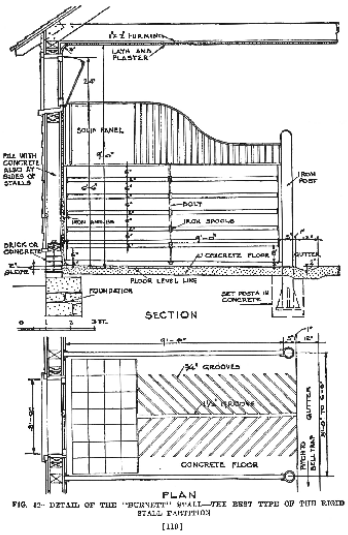


Figure 38: Detail of "Burnett" stall – The best type of rigid stall partition

A window in a horse stall should be no lower than six feet six inches from the floor. Painting the glass or overhanging eaves are also good methods to protect the horse's eyes from harsh direct sunlight. [50]

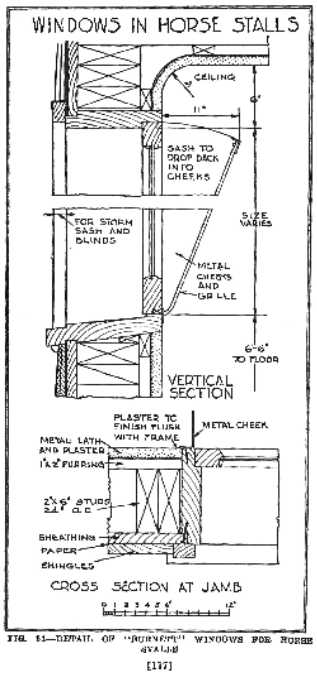


Figure 39: Detail of "Burnett" windows for horse stalls – The best type of window design for horse stalls

[50] Ibid., 115.

A great opportunity for direct and indirect ventilation at the stall level is the exterior walls of the stable. A shuttered window can be opened for plentiful ventilation during warmer weather but closed during extreme cold. In addition, the wall itself can promote ventilation between the wood board sheathing.

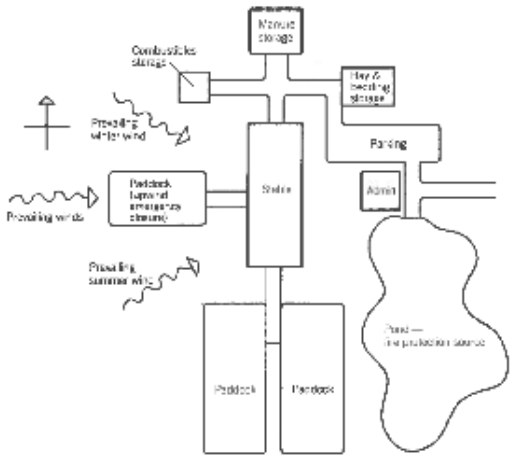


Figure 40: Prototypical Stable Site Plan

Subsection 5: Arena

The indoor arena should be at least 100 by 200 feet in area to accommodate a regulation size dressage ring. An aisle with a width of twenty feet, which is slightly wider than the average aisle, gives the animals and people more room to work and move around comfortably.

Subsection 6: ADA Considerations

ADA requirements and codes should always be considered in design, but for a horse barn, they are not always the safest option. For example, having an electric button operated release on the doors in the aisle to allow for wheelchairs to enter and exit would actually be dangerous because a horse could learn how to open their door and get loose. Similar to egress regulations for buildings, stable gates should swing easily out or slide so a horse can be

quickly led to safety. Exits as well should lead directly to a paddock upwind from the stable where the horse may be contained but distanced from the fire.[51]

Subsection 7: Sustainable Methods

Horseback riding is an exceedingly expensive hobby in itself. By using sustainable principles in ways such as material selection, resources are greatly conserved in addition to protecting the very costly investment of owning a horse. If paints and stains are needed on any of the materials, those materials should be kept out of reach of horses as some horses like to nibble on the wood which could be potentially toxic. Low-VOC materials allow the horses to breathe healthier and cleaner air. These simple yet effective measures can greatly increase the chances of the horses living a much healthier and longer life.

Section 2: Technical Considerations and Program

Subsection 1: Pragmatic Design Objectives and Approach

When designing any horse farm, whether it is for a private residence or a large-scale business, there are major pragmatic design objectives that need to be met. The two main design objectives for a horse barn are always ventilation and daylight. These are the two elements that can have the greatest effect on a horse's overall health. In the main barn where the horse stalls and riding arena are located, the main design objectives need to focus on implementing ventilation and heating methods, incorporating natural daylight, utilizing a sturdier roof material that produces less noise from wind and rain, and constructing a regulation arena space for sufficient practice riding.

Watering Systems:

More specifically for the horse stalls, there are elements that must be taken in to account to make the environment more comfortable for the horses and more manageable for humans

[51] Diedrich, *Building Type Basics for Recreational Facilities,* 103.

to care for them. Adding overhead watering systems for all stalls that allow workers to turn the water on from a central location and have it flow to all stalls, especially in a large scale barn where there twenty or more stalls to water, will cut down on the amount of time it takes to water every horse stall, decrease water spillage in the aisles, and always ensure that each horse has enough water in their buckets.

Fans:

Built in fans for each stall is an especially important element in warmer months and is much safer than stringing up portable fans outside a stall and running electric cords along the ceiling to the closest electrical outlet. This can cause serious problems and poses many hazards for the horses and people.



Figure 41 and 42: Image of current portable fans attached to stalls at Reddemeade and nonfunctioning overhead watering system

Feed Rooms:

Allocating space for a designated feed room for each separate barn, or for various sections of a large barn, will make it easier to bring the feed to every horse. A barn with seventy or more horses and only one feed room at the end of the aisle means the feeder has to transport each horse's grain all the way through the barn. This is not at all efficient and is

extremely cumbersome. A separate feed room also gives the opportunity to incorporate airtight food containers and a closed door so that rodents and other animals getting into the feed and unexpected water leakages will not be a problem.

In addition, if the room is made of concrete walls, that will serve the dual purpose of keeping the food from going bad and also providing the purpose of a safe shelter in case of extreme weather conditions, such as tornados.

Tack Rooms:

At barns where there are boarders who keep their horses and all of their equipment on the property, it is beneficial to have a tack room or some kind of storage be a part of the structure. This will allow people to store their expensive equipment securely, away from the areas where people are congregating frequently, and it will keep the barn more organized. Aisles that are full of saddles, grooming equipment, helmets, and other tack equipment are safety hazards for horses and people, will be obstacles in case of emergencies, and it does not look very tidy for prospective customers.



Figure 43: The current lower boarding barn with office space above

Fields:

Horses are intended to spend the majority of their time outside, as that is their natural habitat, and allowing them ample time to graze in a pasture will keep them the most happy and healthy. The fields where horses are turned out, however, need to be safe and secure. Proper fencing around the pastures, paddocks, and fields is an integral part of a horse pasture, but can also be a great opportunity to create a unique enclosure that welcomes the outlying nature but maintains a boundary. Reinforced wooden fencing allows a blended look with the natural landscape so that it is not as intrusive on the natural beauty the land offers. Electric fencing is a useful method to keep the horses within the pasture and deter outside animals from crossing in, without severely hurting any of them. Using solar panels to charge the electric fence is a sustainable opportunity that could be greatly utilized.

Ensuring that the fields have as even terrain as possible will also help protect the horses from tripping or getting their fragile legs stuck in an unseen hole. Horses are not able to bring themselves upright from the lying down position as easily as other animals, so if they fall over on an uneven hill, they could potentially become stuck if they cannot roll themselves back over. Having field lighting is important as well so that at night, if a horse does become stuck or injured, they are still visible in the dark and can be helped.

Subsection 2: Space Allocations

While having adequate facilities for the people who board their horses at an equestrian center is a priority, often times a barn's primary business is offering riding lessons on school horses. So there needs to be sufficient space for the public part of the business as well. In most cases, there needs to be at least seventy horse stalls for barn owned horses. There should be a main office, an observation deck for parents to watch their children riding, and a public bathroom. Ideally, every barn should be equipped with an indoor riding arena, outdoor riding

arena, enough horse pastures to accommodate all the horses, at least one tack room, feed room, and a separate hay room.

Subsection 3: Form, Structure, and Materials of the Barn

A horse barn has specific structural and mechanical needs to accommodate the specific activities that occur there. A riding ring needs to have a trussed roof that allows for air to rise up and exit so that circulation can continue and horses and people riding do not get overheated. The material that the roof over an indoor riding ring is made of is a surprisingly important detail that many people would not consider. If the roof is made of a metal material that produces a lot of noise when it rains or the wind is heavy, those sounds can scare the horses, and if the horses run off or misbehave because they are frightened, they could potentially hurt their riders. The acoustics within the indoor ring need to be considered to ensure the safety of everyone inside.



Figure 44: The truss system and metal roofing material of the indoor riding arena



Figure 45: The aisle facing south in the main barn, with barn owned lesson horses housed on each side

Subsection 4: Sustainability Goals

The best way to keep horses happy and healthy is to have them in an environment that mimics their natural habitat as much as possible. Horses were originally wild creatures and are meant to be outdoors as much as possible. Providing them with care and protection will help elongate their lives considerably, but it is also important to make them feel comfortable. There are many sustainable practices that could be employed to achieve that goal and make the entire farm more efficient and environmentally friendly. Using as much natural daylight as possible is good for the horse's and human's health and well-being, and will save on costly electricity. Solar panels can be employed to provide energy and heat during the winter months. Similarly, during the warmer months, allowing natural ventilation to cool the barn and the indoor riding ring rather than using fans or air conditioning can be very beneficial.

Topography:

Throughout the site of a farm, especially when there are steep topographic changes, collecting and reusing rainwater can be extremely useful. Rainwater could be collected and treated and then reused to provide water for the horses. It can also be useful in watering vegetation on the property and watering the footing of the riding rings, which is usually a sand type material and can create clouds of dust when many horses are riding at once.

Another common reuse method at a horse farm is a manure pit. Using horse waste as fertilizer and an energy generator is an excellent sustainable method to save money while using natural materials that will actually improve the land.



Figure 46: The current manure/waste area on the south side of the main barn at Reddemeade

Subsection 6: Applicable Building Codes

Indoor Arena:

There are certain technical aspects that need to be taken into consideration when designing a horse barn. The indoor riding arena should be at least 100 feet by 200 feet in area. This is not only to comfortably fit a regulation size dressage ring, but it is also a big enough size for multiple groups of riding lessons, with three to four horses each, to be riding in the ring at the same time if the weather forces everyone inside. If the ring is too small, it can be dangerous to have too many group lessons with that many horses going on simultaneously.

Subsection 7: Program

The main programmatic element to consider at an equestrian center is, of course, horseback riding. That is what people come to a horse farm for: to learn about horses and to learn to ride. There are other programmatic elements, however, that can be applied to a farm

to make the experience more diverse and expand the purpose of going to a horse farm. Incorporating the landscape into the program of an equestrian center can open up opportunities to blend the farm with the surrounding landscape, rather than just having it invade the natural environment surrounding it. Creating a nature preserve to fuse with the horse pastures can show how the horses are part of the ecosystem and that horse farms have no intention of harming these natural resources. Combining an agricultural sustainability program aspect can not only help to improve the efficiency and effectiveness of a farm, but can expand community outreach to show the people how operations like horse farms can be sustainable and not harm the environment. By utilizing a landscape watering system into the program of the site, the farm is not just the actual barn itself and the riding arenas, but it is expanded into the landscape beyond and creates an entirely different experience. Horses are natural creatures, so being around them and learning to work with them should not only be about the actual physical act of riding but about learning how horses fit into the human world and vice versa. Humans are a part of nature and a site like an equestrian center needs to emphasize that relationship by accentuating the natural environment that a horse lives in.

Section 3: Design Strategies

Subsection 1: Impact of Research on Design Strategies

Thinking about all the information collected from different resources and the best practices learned from precedent studies, there are many options to consider when designing a new equestrian center. A new barn structure will incorporate all the best practices learned from previous successful barns, outlined above. Elements such as ventilation, daylight access, materiality, topography, and of course safety measures will all effect design strategies and decisions. Utilizing the abundant natural sunlight, ventilation, rainwater collection, and other sustainable practices will make for a more efficient and successful operation.

Surveying a group of riders from Reddemeade Equestrian Center provided information about what the people who spend the majority of their time there believe to be the most important issues. Many people feel that the size and condition of the stalls is an issue that needs to be addressed. Some of the stalls are too small and in almost all of the stalls, the footing is very uneven, which can be dangerous for the horses and make it very difficult to clean the floors.

Many of those surveyed felt that the footing in the riding arenas is insufficient. The indoor ring has ground coverage that is very dusty, and when there are a lot of horses riding at once, the dust begins to rise, and can cause vision problems and respiratory problems for horses and people. The outdoor arena needs to have footing that has fewer small rocks. These rocks are hard to remove and if a horse steps on one in a specific way, it can get caught in the shoe and cause an abscess.

The final issue that most people felt needs to be addressed is the drainage on the property. There are certain areas, specifically near the upper barn on the north side of the property and the lower pastures on the east side of the property, that have very poor drainage. During heavy rainfall, these areas collect copious amounts of water and create deep ponds that are difficult for horses and people to maneuver around. In the fields especially, these collections of water can be dangerous if horses get themselves stuck.

Overall, the design objective for a new equestrian center is to continue the aesthetics and feel of the traditional American horse farm in the new structures while maintaining and preserving the historic components throughout the farm's landscape. This will help to make the horse farm site into one cohesive experience.

Subsection 2: Design Process

Moving forward with design possibilities, the historic buildings on the property and the existing footprint of the barn were taken into consideration. Keeping the new barn on the

existing space that was flattened out when Reddemeade was created in 1984 and not expanding it further into the surrounding landscape will help to lesson the environmental impact by decreasing the overall footprint.

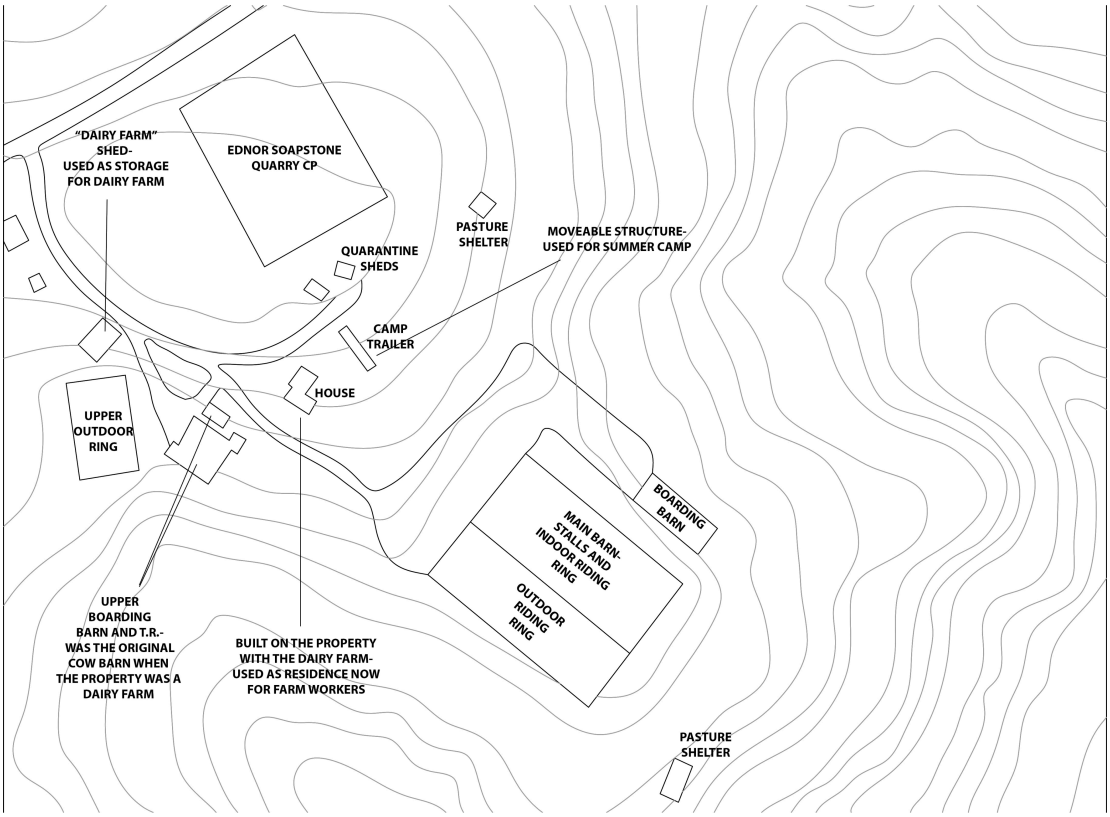


Figure 47: Existing Site Plan

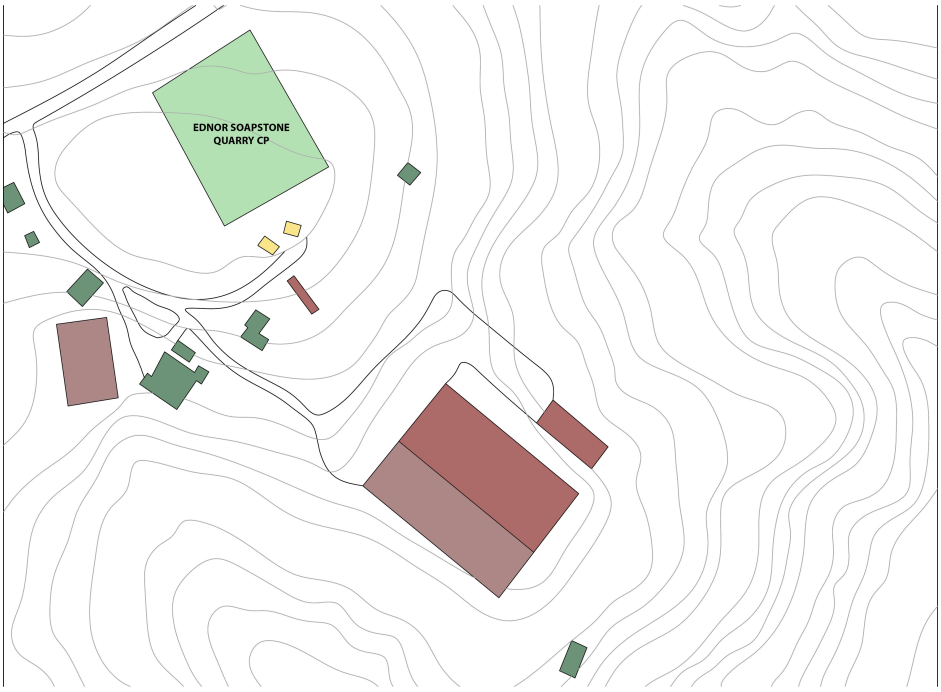


Figure 48: Proposed site plan; Green signifies buildings and areas to be preserved. Red indicates areas that can be altered

Below are possible design solutions to the location, orientation, and size of the different structural elements of Reddemeade Equestrian Center. These options are based on best practices learned from precedent studies and professional design strategies.

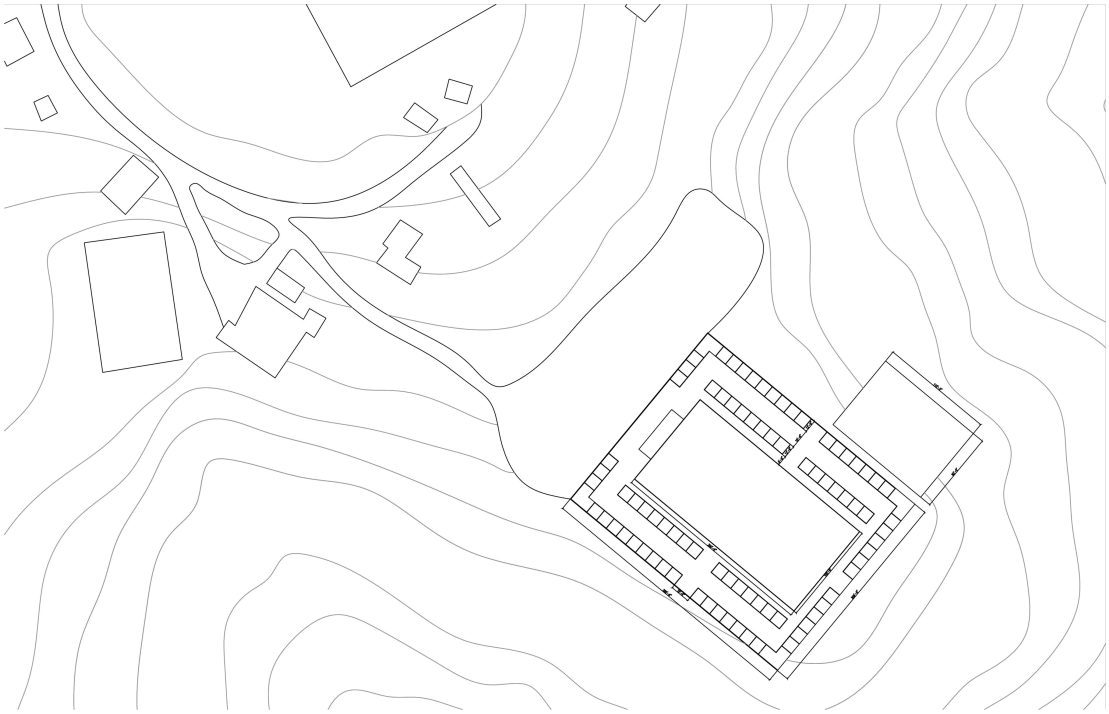


Figure 49: Schematic design option 1- Plan

The first option combines the stalls and arena together within one big structure, placing the arena at the center of the building so it is only accessibly by going inside first. This design would be more of a renovation of the existing building rather than a reconstruction. The major changes would be the relocation of the riding ring and opening the walls up between the ring and the stalls. However, in this form, there is no way to minimize sound between the stalls and the riding arena, which would be cause for much distraction for the horses and riders in the arena. Ideally, the arena would have some degree of separation from the stalls so the sound will not carry. It also would be difficult to get any type of natural ventilation, as walls surround all four sides of the arena. The air would have to be vented artificially, which will increase the overall energy usage.

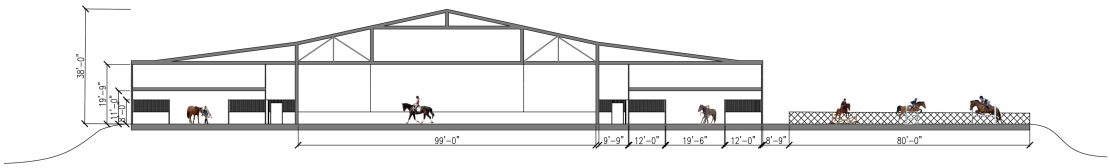


Figure 50: Schematic design option 1: Section

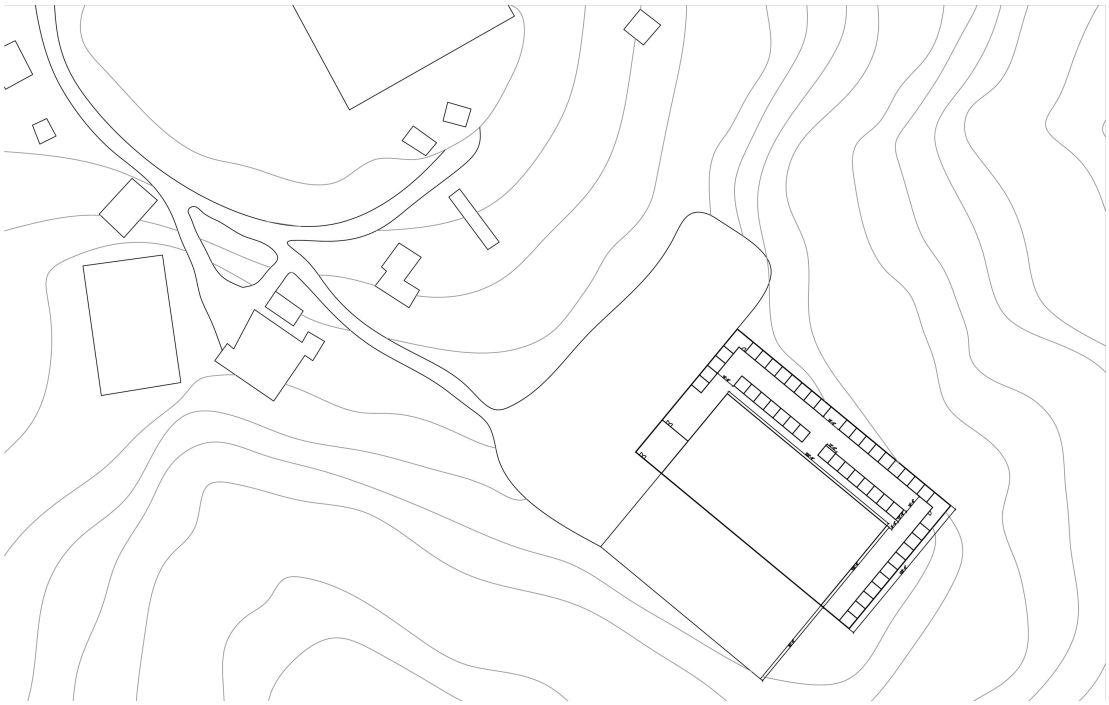


Figure 51: Schematic design option 2: Plan

This organization of the structure in this orientation is the closest design to the existing barn. There would be the least amount of construction cost as it would be more of a renovation rather than a whole new construction. The biggest change in this option is wrapping the stalls around the arena to form a U-shape, rather than having them only in one long line. This provides more stalls than before, which allows the barn to keep a larger number of horses. Utilizing the space at the south end of the arena with stalls rather than just having the building terminate there encloses the arena into a more private space as well. Having direct access from the indoor arena to the outdoor arena can be very convenient, especially if a competition is being held. This design, however, also does not address the sound issues and or the ventilation concerns. With only one side available for natural ventilation to the riding arena, that will not be enough moving air to keep the horses and humans at a comfortable temperature while they're riding in the warmer months.

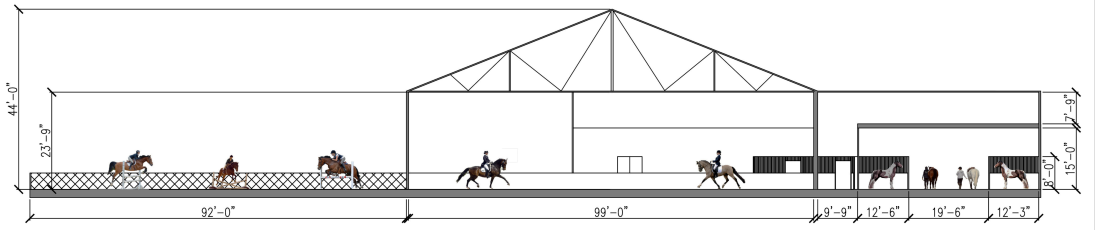


Figure 52: Design option 2: Section

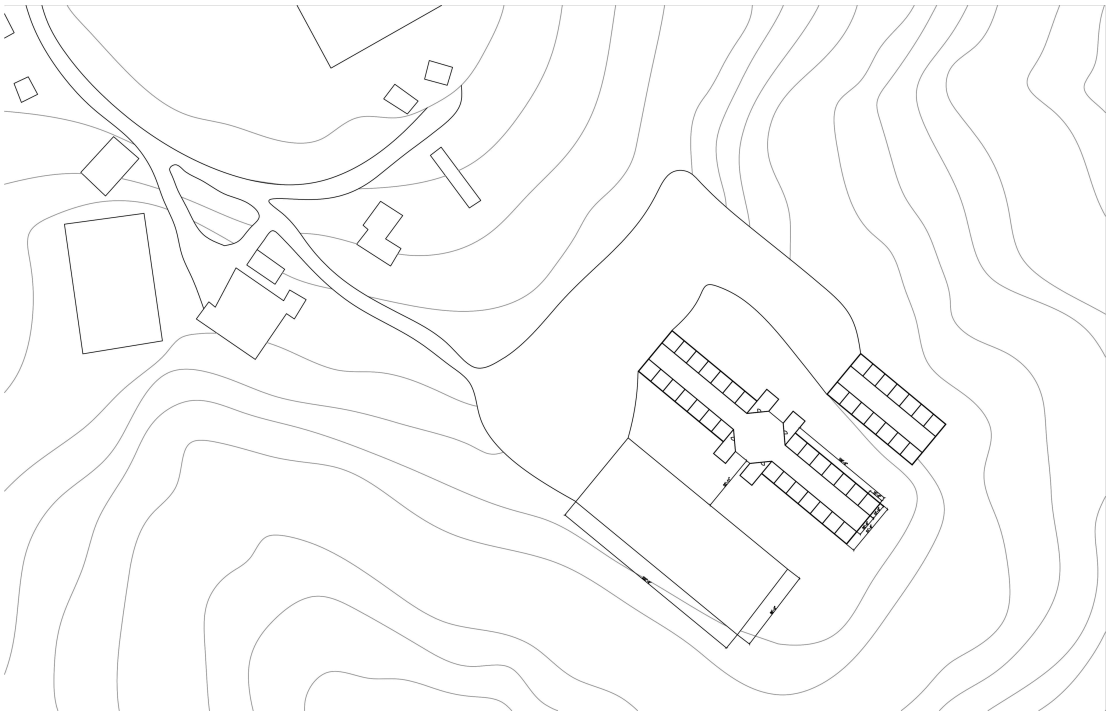


Figure 53: Design option 3: Plan

The shape and orientation of this design option is based on the barn typology study done for a dressage farm. Having the stalls in a completely separate structure than the riding arena ensures that there is no sound disruption from activities going on in the main part of the barn to disturb those riding. This is a very typical dressage farm layout, with a linear shaped barn, tack stalls and gathering spaces in the center, with a regulation size riding ring adjacent but detached. In inclement weather, however, walking a horse from the stalls to the riding

arena, without a covered connection, can be uncomfortable or not actually possible in very bad weather.

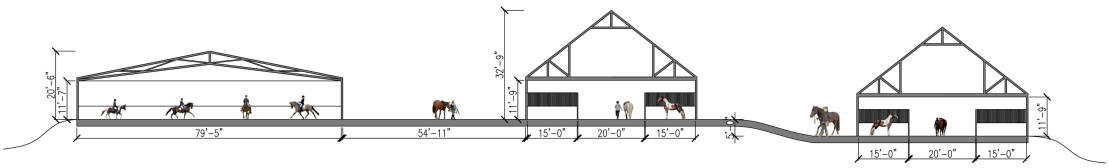


Figure 54: Design option 3: Section

The large scale of the land within the property offers many possible solutions to landscape issues. One of the issues is the location and access to the fields where the horses are turned out. Currently, the entrance gates for each field are located very unsystematically around the property, each a fair distance from the entrance to another field. This means that when someone needs to bring in or turn out all of the horses, they are walking sizable distances to do so. Having all the entrances to the various fields in one central location will make it easier and quicker to access the horses, especially in bad weather or an emergency.

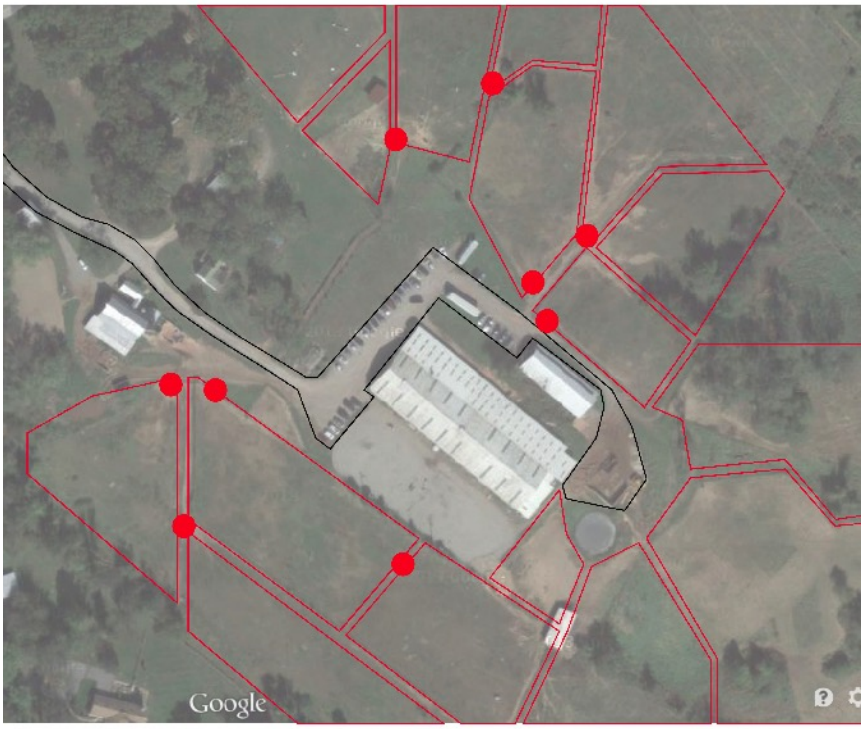


Figure 55: Current pasture outlines with the entrance gates to each field highlighted



Figure 56: Proposed field design with all entrances to various fields in one central location

Subsection 3: Update to Design

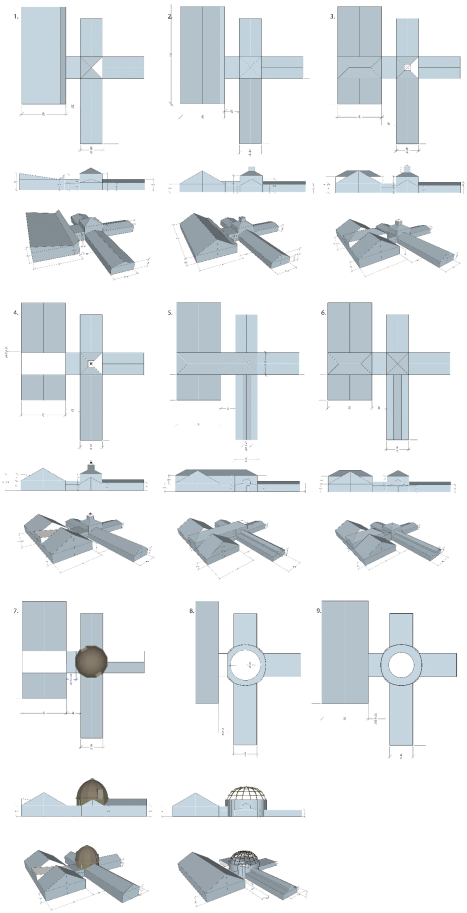


Figure 57: Roof study models

As the design process continued, many studies were done to determine which layout and orientation on the site was most beneficial in all aspects. An integral decision was the structure of the roof, as it would affect the sun paths on the site, how the interior spaces would feel, and the overall aesthetics of the building.

A later iteration of the design illustrated a sloped roofline over the riding arena, which encouraged rainwater collection off of the roof and opened up the opportunity for a scenic view over the riding arena and out the second story windows. The profile of this roof, however, did not seamlessly blend with the rest of the building. Additionally, with this orientation of the riding arena located on the south and the stall wings to the north, when visitors come down the driveway over the hill, they would see the arena first, rather than the

entrance to the barn. This was not an ideal situation and called for a 180 degree rotation of the building.

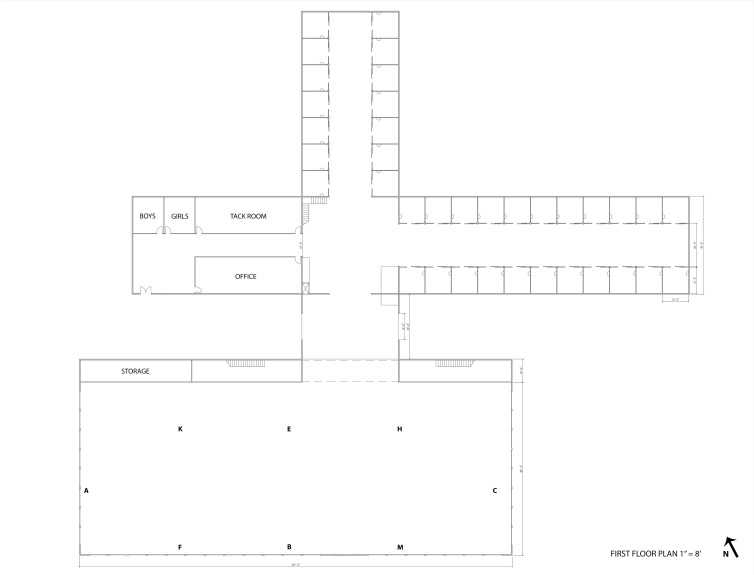


Figure 58: Mid semester design update- Plan

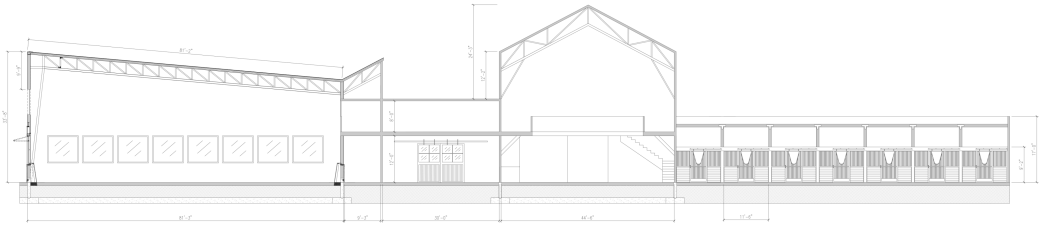


Figure 59: Mid semester design update- Section

Subsection 4: Final Design

Moving into the final design phase, many critiques and comments received during the design phase played a role in the final product. Switching the orientation of the structure so the arena is on the north side results in the portion of the barn with the stalls and social spaces, which is where visitors should want to go first, being the first feature that people see as they come down the driveway.

This orientation also allows the strongest summer breezes to come to the stalls first, which is where the horses spend the most of their time when they are inside. Since the stalls are on the southern part of the site, they have direct access to the pastures as well, which makes it easier for workers to take the horses to their respective fields without going through the barn.

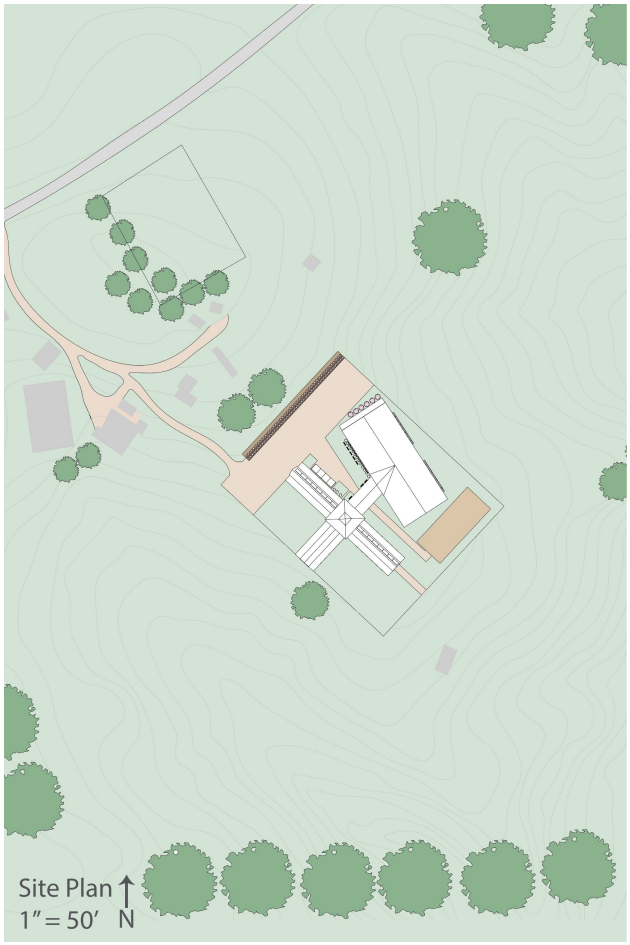


Figure 60: Final site plan

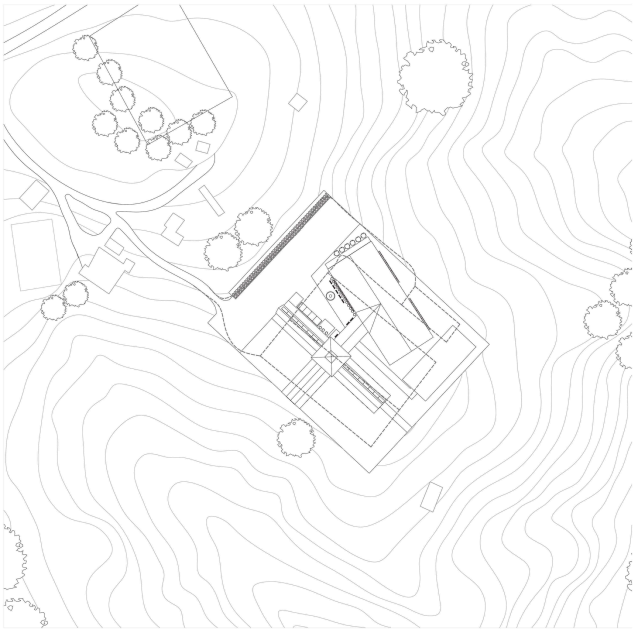


Figure 61: New plan over existing plan

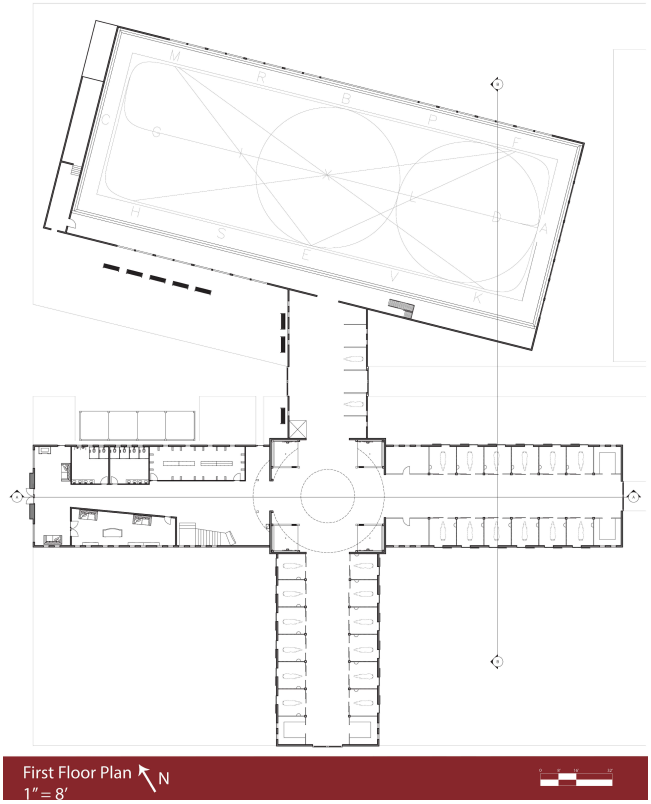


Figure 62: First floor plan

The final design for the barn has twenty-four horse stalls, an office, both gender bathrooms, a full tack room, four interior and four exterior wash stalls, cross ties, a circular

balcony overlooking the horse areas, a lounge, a fully enclosed, temperature controlled observation deck, a judge booth, and a regulation size (20m x 60m) riding arena. There are secondary entrances to the barn from the courtyard in between the administrative wing of the building and the arena and another one opposite that entrance on the south side of the connecting corridor between the barn and the arena. There is an elevator leading from the first floor entrance off of the courtyard to the second floor lounge, which allows for people who cannot use the stairs to enjoy the social space as well.

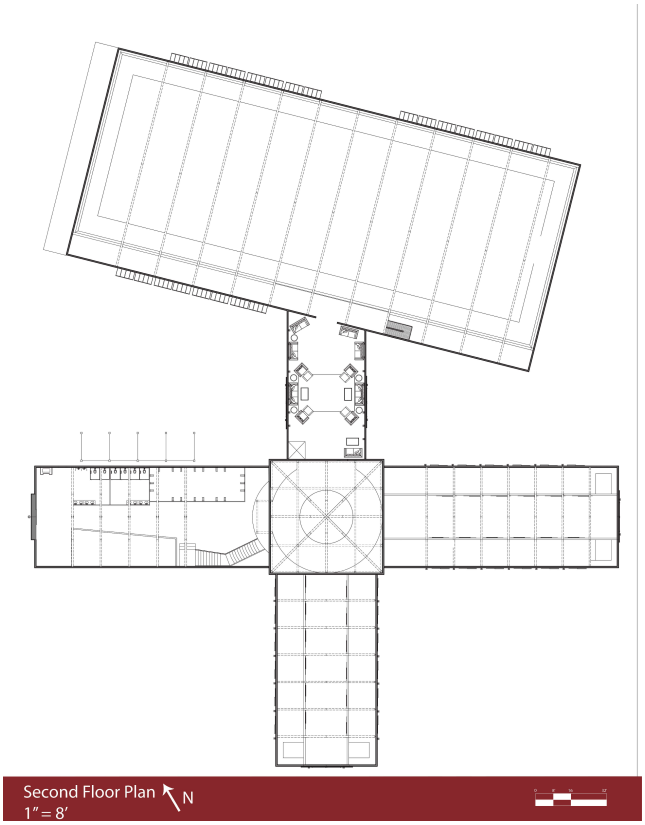


Figure 63: Second floor plan

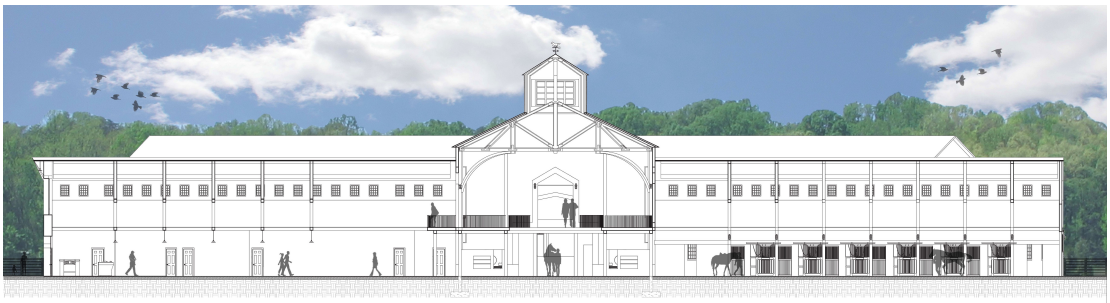


Figure 64: North south section

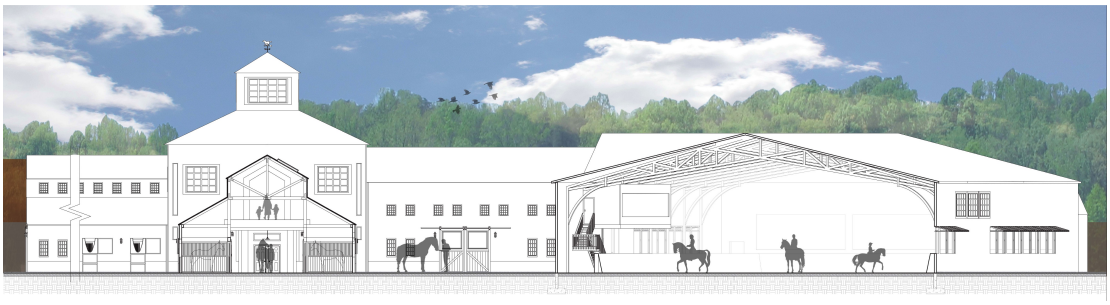


Figure 65: East west section perspective



Figure 66: Exterior perspective view of the entrance



Figure 67: Perspective of the stall wing



Figure 68: Perspective of the ground floor looking up into the cupola



Figure 69: Looking from the balcony down to the stalls and the ground floor



Figure 70: Arena perspective

Subsection 5: Reflections to Commentary

The comments given at the final presentation of my thesis project offered interesting insights into further phases that could be done on this project and how the work that I've done could have been improved. The idea of developing the landscape further is something that was initially anticipated as being part of the final design. There are great opportunities to redevelop the landscape in a way to address the water drainage issues on the site. Additionally, redesigning the fencing around the pastures to match the level of technology and sustainable practices within the building could be very interesting.

The idea was brought up that the entrance driveway could follow the same circular patterns that parts of the building do, which simulate movements within dressage tests. The driveway could extend out to the southwest direction and turn back up towards the building, making the entrance on the long edge of the barn, rather than the short edge.

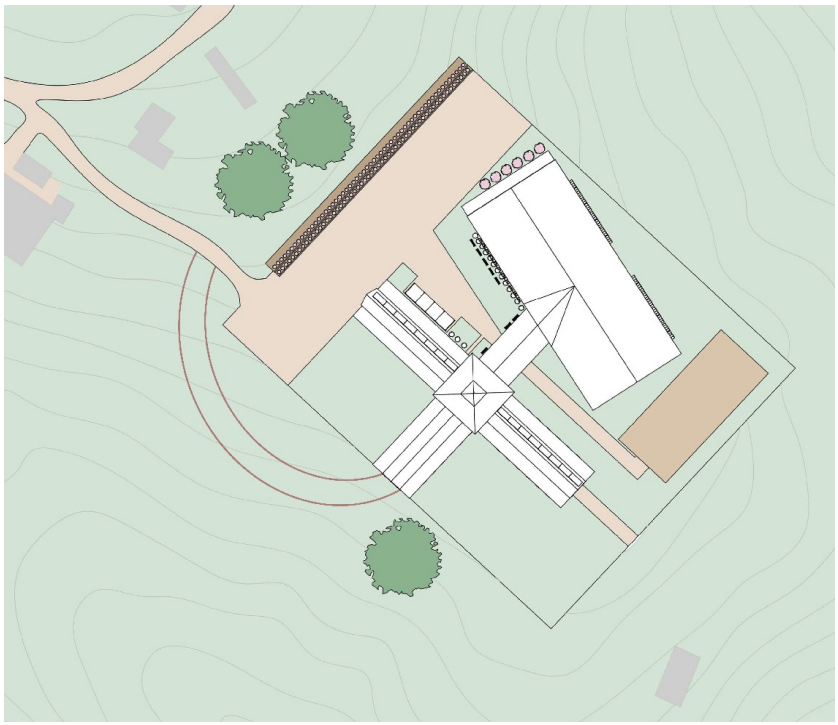


Figure 71: Proposed driveway path suggested at final presentation

The problem with making the entrance sequence follow this path is that the topography on the site has very steep inclines going outwards from the square outline, which was flattened when Reddemeade was created in 1984. Making the driveway going southwest would bring it downhill and then it would need to come back uphill to go to the barn. The only way that this driveway design could be plausible would be to add landfill to the site under where the new driveway would go. That approach would disrupt the existing landscape by extending the site footprint, and one of the main goals was to preserve as much of the existing site as possible.

One comment that was very useful and worth considering was that the connection corridor between the stalls and the arena could have been further designed to have the entrance to the arena be more celebratory. Functionally, the corridor is only meant to allow access for the horses from the stalls to the arena. Its smaller size is supposed to decrease sound transfer from the stall and social areas to the ring. However, this comment made a valid point that there is a way to make this connection more interesting without sacrificing the programmatic requirements.

All of the comments made during the final presentation were insightful and useful. Everyone seemed to understand the goals and decisions made for the barn design, yet offered interesting suggestions of where the design could be taken further with more time.

Chapter 4: Conclusion

The problem under consideration is how to preserve the history and culture of an historic horse farm while revitalizing and renovating it to meet the needs of the horses and humans for the present and future. After completing a comprehensive analysis of historic horse farms along with modern day equestrian operations, a collection of best practices to be utilized in any horse farm has been created. By considering the typology of horse farms in a much broader context, I was able to determine how the various best practices from different disciplines might converge in the contemporary understanding of a modern horse farm.

Through my research and discovery of the best practices to be utilized in an equestrian center, I have been able to establish a plan of action for a case study at Reddemeade Farm. Guided by five research themes, history of equestrian culture in the United States, educational opportunities, sustainable practices, landscape utilization, and culture, the proposed plan for Reddemeade, which theoretically could be applied to any equestrian center, incorporates all aspects of an equestrian farm into a cohesively designed site.

I conclude that my hypothesis, designing an equestrian center with historic precedents and best practices taken into consideration will make a modern day horse farm operation more efficient and successful, is correct and extremely plausible. By applying these methods, horse farms all over the country could maintain the historic character that makes them unique while improving the overall well-being and experience for the horses and people. Hopefully by doing this, love of horses and love of equestrian sports will continue to expand and flourish.

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