

Developing a Framework for Historic Restoration Projects:  
A Case Study of the Catawba Farm Dairy Barn

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**ABSTRACT**

As the national building stock ages and society needs for public facilities evolve, communities undertake revitalization projects to restore or repurpose existing structures to suit current needs. Community-based restoration projects involve a variety of stakeholders: owners, community members, and visitors to the community. Because some restoration projects involve derelict or at-risk structures, communities need a framework for prioritizing construction tasks and undertaking short term rehabilitation procedures in order to save the building in the short term while the community negotiates its appropriate use. Several frameworks exist to help communities prioritize tasks in terms of the building's structure or the long term energy efficiency of the building, but communities need a framework that provides the additional construct of allowing project stakeholders to begin baseline restoration tasks to prolong the immediate life of the facility.

This research aims to develop a multi-step, straightforward framework for communities to approach restoration projects, conduct analyses, identify potential future use alternatives, and prioritize tasks for reconstruction. The paper first details the methodology used to develop the framework by presenting a case study of a historic dairy barn facility in Catawba, Virginia. The research uses the case study approach as a baseline for developing the framework, and then applies the framework back to the dairy barn restoration project in order to prioritize construction tasks and develop a path forward for the facility. In addition to the case study framework development, the research offers procedures and estimates specifically for the case study facility restoration. Finally, the paper offers recommendations for application and testing of the framework and offers areas for future examination.

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# **Chapter 1 : Introduction and Problem Statement**

## **Introduction**

This research covers several areas pertaining to restoration decision making, forensic and economic analysis of historic building projects, and assigning priority to particular tasks in community-based historic restoration projects. The research approaches these topics through a case study of the Catawba Hospital Farm, a 1920's cast-in-place dairy barn in rural Catawba, Virginia. The research aims to evaluate the Catawba Farm restoration project through interviews with community members and by conducting economic and forensic analysis of alternative uses for the barn. Using the case study as a model, the researcher endeavors to develop a framework for communities to evaluate and approach historic building restoration projects. The framework intends to consider the perspectives of all relevant stakeholders in community historic building restoration projects. Because restoration often involves rehabilitation of derelict buildings, the framework aims to provide a matrix for communities to prioritize restoration efforts in order to save the facility in the short term, while the community continues to consider future use alternatives for the building(s).

## **Problem Statement**

This research addresses several problems concerning the existing building stock in the United States. First, the existing building stock is aging. Second, as the building stock ages, public needs for built structures evolve. If communities choose to preserve their historic facilities, then they need a framework for integrating all stakeholder perspectives into planning for community historic restoration projects. Such a framework must provide a means for incorporating the overriding needs and desires of the community to preserve the structure and adapt it to suit modern day use. Because community-based restoration projects involve several perspectives and agendas, communities require a framework that allows for historic structures to be preserved in the short term while the community negotiates the appropriate long term use for the facility.

## **Research Questions**

In order to fully develop a framework for communities to approach historic restoration projects, the researcher aimed to address several important questions:

- 1) How do communities at large currently evaluate historic restoration projects?
- 2) What is the best process to evaluate historic restoration projects for their economic and intrinsic community value and benefit?
- 3) What factors currently motivate community historic restoration projects?
- 4) How do communities determine the most appropriate use for historic facilities?
- 5) How do communities assign priority to restoration projects?
- 6) Is there a better method for evaluating historic restoration projects to consider all stakeholder concerns?
- 7) How can communities plan restoration projects in order to immediately preserve the structural integrity of the facility while still negotiating its future use?

## **Scope**

The scope of the research includes developing a path forward for the case study facility, the Catawba Hospital Farm dairy barn community restoration project. This analysis includes:

- Forensic and economic analysis for a baseline restoration plan
- Conducting interviews with stakeholders in the restoration project
- Direct observation of the community's efforts to sustain the facility
- Evaluating future use alternatives

Using the case study as a baseline, the scope of the research extends to developing a general framework for communities at large to approach and prioritize tasks for historic restoration projects.

## **Scope Limitations**

As the research involves a case study as the baseline for developing the framework for community restoration projects, it follows that the scope limitation is the Catawba Hospital Farm dairy barn in Catawba, Virginia.

## Chapter 2 : Literature Review

### Prioritizing Construction Tasks

Community historic restoration projects present a number of challenges. The public nature of such projects invites the input of various stakeholders. In addition to the various perspectives involved, restoration projects involve challenges in the process of renovation. Project participants need methods for prioritizing construction tasks in restoration projects. Several approaches exist to facilitate prioritization of construction tasks for restoration projects. One such approach, Alanne's "knapsack" model provides a mathematical model to help communities prioritize restoration efforts in terms of their long term sustainable benefits (Alanne 2003). This model allows for the conflicting goals of various project stakeholders to have consideration. Additionally, it provides a way to better illustrate sustainable renovation practices and a fully automated, computer-model approach to prioritizing energy efficient improvements to existing structures.

Another model, Rosenfeld and Shohet's decision support model, offers a four step approach to restoration projects:

- 1) Preliminary survey of background conditions
- 2) Evaluation and ranking of the facility's physical condition
- 3) Generation of viable alternatives for renovation, rehabilitation, or reconstruction
- 4) Quantitative techno-economic comparison among the alternatives and systematic presentation of the recommendations

This model intends to provide project stakeholders with a means to renovate or reconstruct an existing facility to maintain its current use (Rosenfeld & Shohet 1999).

Each of the aforementioned models takes a case study approach to the development of methodologies for prioritizing construction tasks. The first involves the retrofit of an existing residential complex in Finland. The second involves a 25 year old "Construction Center" for the Israeli army. Neither of these models addresses an approach to renovation tasks that allows for immediate preservation

of the facility while the community negotiates an alternative use for the building. This research intends to use the case study approach to develop a framework that allows for immediate short term renovation projects while the community negotiates the facility's future use.

### **Case Studies**

The case study format allows the researcher to consider and develop an understanding of dynamics in a single setting and use that understanding to theorize about the broader context of the research findings. Some research indicates that theories developed from case studies have potential strengths like “novelty, testability, and empirical validity” (Eisenhardt 1989). The novel nature of single-setting case studies lends the case study approach to areas where the existing research is seemingly incomplete. Case studies allow the researcher to approach a problem to answer “how?” and “why?” questions without requiring control of behavioral events. Rather, the case study allows the researcher to make observations and gather input from those persons engaged in the problem the case study intends to examine (Yin 2008). Because the research intends to develop a framework utilizing the single-setting case study as a model, the case study approach emerges as the most appropriate vehicle for the research.

### **Laser Scanning Technology**

Laser scanning technology uses a device that analyzes real-world objects and environments to collect data on their shape and appearance. The collected data can then be used to construct digital, three dimensional models useful for many different applications. Laser scanners calculate object distances by measuring time of travel for wavelength pulses that reflect off objects and return to the sensor (Su et al. 2006). Using those calculations, laser scanning software can generate a “point cloud” of object points from scanned location.

In the construction and engineering industries, professionals use laser scanning to generate as-built drawings and renderings for construction projects (vertical and horizontal). Such renderings are useful for recording and restoring historical sites, creating digital site models and appropriate layouts, facilitating existing construction redesign, and maintaining quality control. Industry workers can scan a

construction project in progress and compare it to digital mock-ups to check for quality and accuracy (Booth 2002).

The AEC also uses laser scanning technology for Geographic Information Systems (GIS) to update existing maps. Surveyors also use the technology to provide an accurate depiction of terrain for a construction project. Laser scanning has also been used for urban excavations to test structural integrity of existing buildings in the virtual environment. In this scenario, industry workers take laser scans of existing buildings, import them to a computer model and perform virtual tests to see the effects of nearby excavations before conducting those excavations in the physical world (Oliviera et al. 2005).

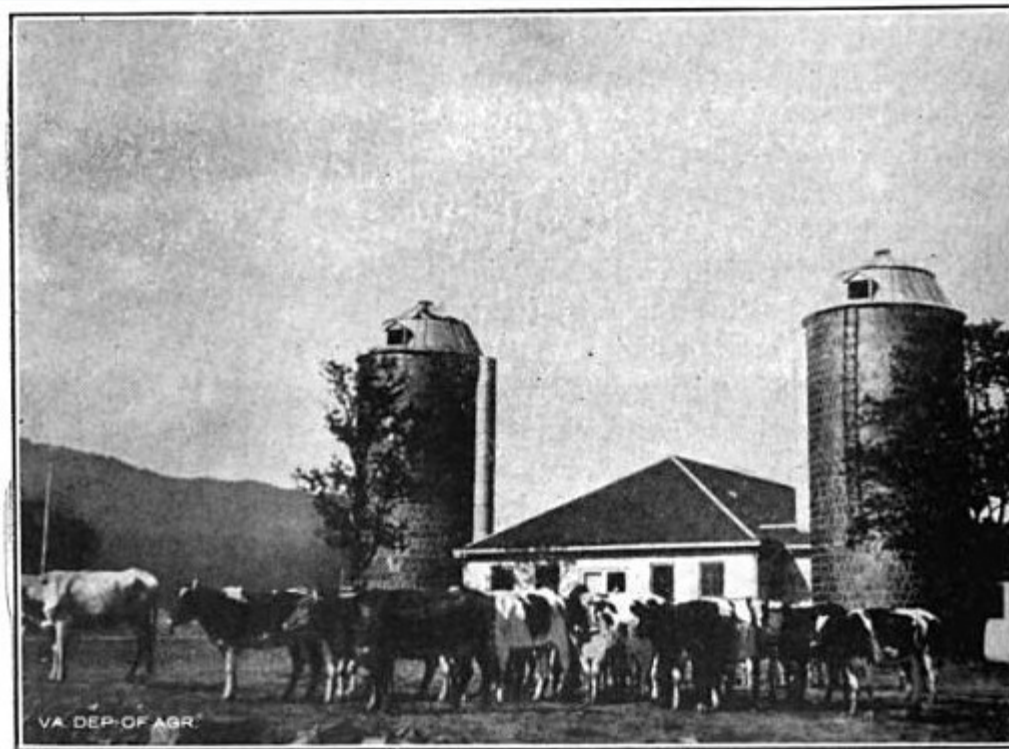
To process laser scanning data, professionals apply techniques like segmentation and the Butterfly method (an algorithm to compact all data points) to sort the data points. They also compress the 3-D image by selecting relevant data points and using displacement mapping techniques to mesh triangles of data together. Professionals also report laser scanning data directly to 3-D Building Information Models to monitor quality control of as-built construction versus 3-D design models. This allows for continuous monitoring of the system both during construction and during the operations phase (Oliviera et al. 2005). Historic restoration and heritage landmark specialists also use laser scanning data to produce 3-D images of heritage sites.

Laser Scanning presents several challenges for industry professionals. First, laser scanning data has compatibility issues with some forms of 3-dimensional software. Computer software engineers are still devising methods for transforming laser scan point clouds into relevant information. Additionally, laser scanning produces so many data points that it becomes difficult to sort through and limit the information gathered from laser scans. Laser scanning has some physical limitations as well. The scanning equipment cannot account for obstructions in front of the object being scanned, which can produce voids in the scan. Laser scans also do not offer specific data about building materials. The scanning equipment does not recognize some reflective materials, producing voids in point clouds (Su et al. 2005).

## **Barn History**

At the turn of the 20<sup>th</sup> century, the country faced an epidemic of tuberculosis. In order for communities to cope with the widespread development of tuberculosis, many states and localities established hospitals designed to help patients cope with and recover from the disease. In 1908, the Virginia legislature approved funding to develop a sanatorium for tuberculosis patients in Catawba, Virginia in rural Roanoke County (VDH 1912). The site of the sanatorium comprised 500+ acres for use by the hospital. The location originally housed a vacation destination, the Red Sulphur Springs resort. The resort catered to members of the elite class, attracting visitors to the mountains of western Virginia and the natural springs on site. Virginia provided terrain for several such resorts in the early 20<sup>th</sup> century, including Warm Springs and Hot Springs resorts in Bath County, Virginia. As public interest for natural springs resorts declined, the location of the Red Sulphur Springs resort emerged as a potential location for the state tuberculosis hospital. Medical experts believed that the combination of fresh air and the natural “healing” springs would provide an optimal location for patient recuperation.

The original site for the hospital consisted of “651 acres, of which 258 acres [were] on the mountain side and include[d] only the surface rights, being purchased to control the water shed. The remaining 393 acres consist[ed] of the Springs property, having much good woodland and many desirable sites for cottages and camps, and a farm of good blue grass pastures and arable land” (VDH 1912). The exact date of the construction of the dairy barn does not specifically exist in public record; however, Virginia state Agricultural Board publications indicate that the hospital constructed the barn between 1911 and 1918. A 1911 Virginia Department of Public Welfare report on the State Board of Charities and Corrections states: “We recommend that an appropriation be made to increase the capacity of [the sanatorium], to build an infirmary, new office building and dairy, and to improve the roads and grounds” (VSBCC 1911). Later, a 1918 Agricultural Board publication included a picture of the dairy barn (Koiner 1919).

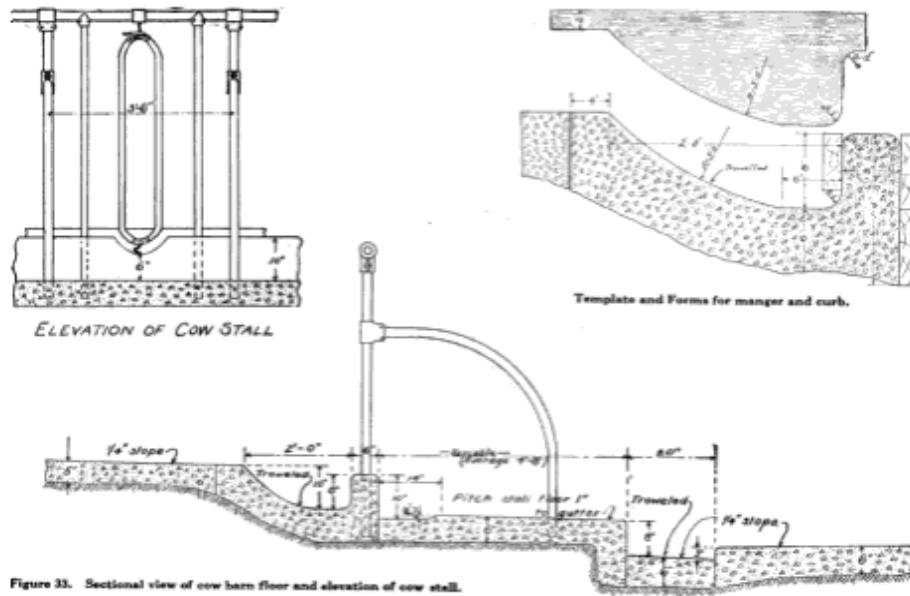


**Figure 2-1: Dairy Barn in 1919**

Several early 20<sup>th</sup> century publications concerning the tuberculosis epidemic include recommendations for hospitals and sanatoriums to construct and operate their own dairy facilities. At the time, the Department of Agriculture estimated that some 20% of dairy cattle had contracted the disease, and the recommendation was that in-house dairy operations might help contain the disease and prevent the spread of tuberculosis beyond the confines of the hospital (COSCONY 1903). Publications regarding suggestions for tuberculosis treatment facilities show several examples of tuberculosis hospitals that operated their own dairies, including the Gaylord Farm Sanatorium in Connecticut and the Iowa State Sanatorium (Carrington 1914). According to the current director of the Catawba Sanatorium, John White, the hospital ran the dairy operation by utilizing patient labor from those inhabitants that recuperated to the point where they could work in the farming operation.

The dairy barn's construction consists of cast in place concrete with a slate roof and two ceramic, metal-roofed silos. Several early 20<sup>th</sup> century documents indicate that concrete construction became the preferred method for constructing dairy barns in the early 20<sup>th</sup> century. Concrete construction allowed for

more sanitary facilities because dairy workers could conceivably “hose down” the facility to keep the areas clean (Carrington 1914). One 1914 publication entitled *Concrete for the Farmer* states “the ease with which concrete can be kept in a sanitary condition makes its use very desirable in dairy barns. It is especially advisable that the floor of such a building be constructed of concrete” (UPCC 1914). Below is a cross section from that same publication showing the ideal construction for the dairy barn floor and cow stall, followed by a picture showing this technique demonstrated in the Catawba Dairy barn.

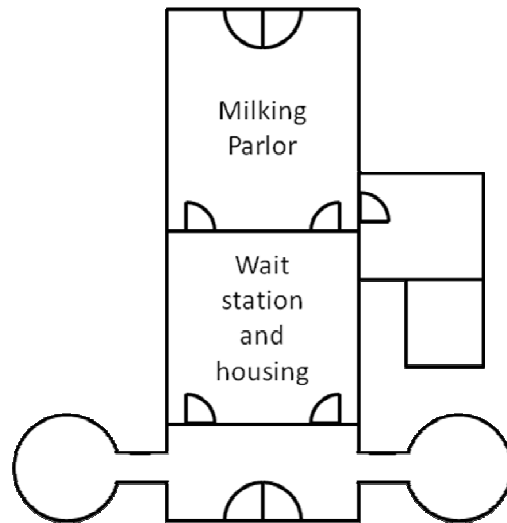


**Figure 2-2: Cross Section of Concrete Dairy Facility**



**Figure 2-3: Catawba Farm Dairy**

Many early 20<sup>th</sup> century dairy barns had facilities for housing the cattle, holding the grain, and milking and bottling stations for the barn's production (UPCC 1914). Conceivably, the front two rooms of the barn providing housing and feeding areas for dairy cattle, the rear room provided housed the milking parlor, and the silos stored the grain for the cattle (see figures below).



**Figure 2-4: Original Barn Layout**

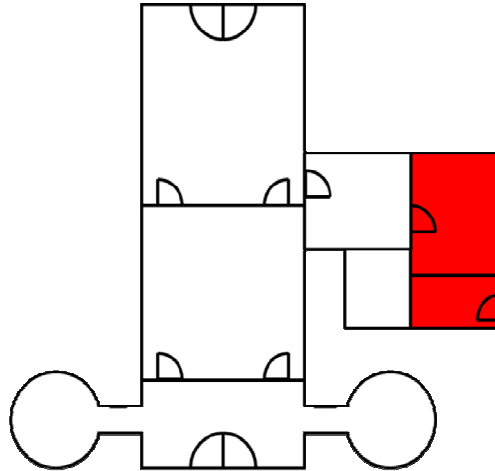


**Figure 2-5: Milking Parlor**



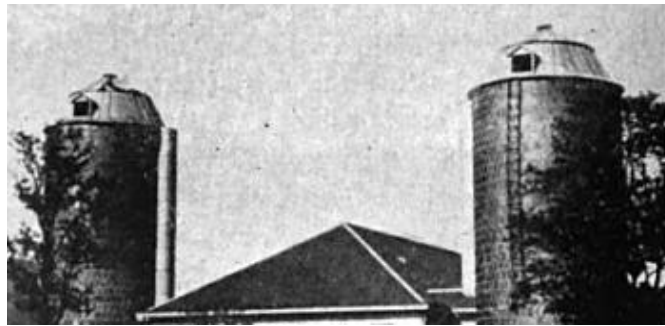
**Figure 2-6: Wait Station/Feeding Room**

A 1950's hospital insurance document indicates the then-recent construction of an addition to the dairy barn for a bottling and sanitation facility (Foulke 1950). The diagram below shows the likely location of that addition.



**Figure 2-7: Barn Addition**

Additionally, as the pictures below show, the silo roofs underwent a change at some point in the barn's life. The first picture shows the original, taller silo roofs, and the second shows the current remnants of shorter profile silo roofs.



**Figure 2-8: Original silo roofs**



**Figure 2-9: Current silo roofs**

In the latter 20<sup>th</sup> century, tuberculosis treatment evolved from fresh air recuperation to surgical remedies. Accordingly, the need for state tuberculosis treatment hospitals declined. In the late 1970's the state changed the mission of the Catawba Hospital from a tuberculosis treatment facility to a state mental institution. Currently, the hospital population consists of a combination of old-age dementia patients and patients deemed "insane" in criminal court. As a mental institution, the need for a quarantined dairy and the use of patient labor no longer seemed appropriate (White 2009). In the 1980's the hospital deeded 400 acres of farm property (separate from the grounds of the Catawba Sanatorium) to Virginia Polytechnic Institute and State University for use in its agricultural curriculum. From the 1980's to the early 1990's the university indeed used the facility for the education of Agricultural Sciences students, but the use of the facility declined in the 1990's. Since the 1990's the relative neglect of the buildings and the land prompted the Association for the Preservation of Virginia Antiquities (APVA) to declare the Catawba Farm site as one of the 10 most endangered historical properties in Virginia in 2005. The APVA makes annual declarations for endangered facilities in order to bring attention to the need for rehabilitation or restoration of significant historic places in the state. The state has put forth proposals to develop the land as a prison or sell it to land developers for housing or a golf course. All of those efforts have since failed, creating the need for Virginia Tech and the Catawba community to find a better use for the land and facilities.

Currently, the management of the Catawba Farm falls under the auspices of the College of Natural Resources. The College established the Catawba Landcare effort, a partnership program that intends to preserve the Catawba Farm as a working agricultural center. Founded two decades ago in Australia, Landcare organizations exist in more than 20 countries, helping to promote sustainable land use. The Catawba branch of the Landcare effort consists of representatives from Virginia Tech, the Catawba community, Western Virginia Land Trust, Western Virginia Water Authority, Virginia Cooperative Extension, Department of Forestry, and the Blue Ridge Forest. Through the community partnership, the College of Natural Resources aims to utilize the property as a sustainability center. The group outlines several goals for the center, including: "education and outreach opportunities, a landcare enterprise

incubator that includes training, and community engagement activities, all of which are consistent with the principles of landcare which Catawba Landcare has formed under (social, ecological, and economic vitality), and the principles of sustainability and engagement towards which Virginia Tech is increasingly moving” (Kimmel & Gabbard 2009).

As part of the effort to promote the reuse of the facility, the Landcare group hosted two clean-up days to bring community and university personnel to the farm to begin cleanup. The cleanup days each attracted more than 60 people from Catawba, the University, the greater Roanoke Valley, and even people from Australia and Mississippi interested in the effort. The College of Natural Resources solicited the aid of several university departments and the university at large to collaborate in the development of the sustainability center. Currently, ecology students are conducting testing on the watershed inside the property, a local agency has planted an extensive garden to provide produce to families in need, and the farm cultivates warm season grasses for use in the boilers at the Catawba Sanatorium. The College of Architecture and JAS energy are working on designs for a new sustainability center building to showcase sustainable building practices and energy production (Kimmel & Gabbard 2009).

As the Catawba community participates in the Landcare effort it becomes increasingly apparent how much importance the facility has to the community. During one of the clean-up days, one longtime Catawba resident, Louise Gorman, stated, “As long as we have that, see that view, we feel safe and secure, and we want future generations to see it, too” (Lowe 2008). As a result, one potential goal of the Landcare effort is to preserve some of the structures currently residing on the property. The preservation of the structures aligns with the landcare and sustainability center goals to showcase sustainable living practices by demonstrating renovation and restoration as sustainable building practices.

Building industry stakeholders have made strides to recognize the sustainable qualities of existing building stock. The National Trust for Historic Preservation’s Barn Again! Program, a program that advocates the restoration of historic barn structures, highlights the efforts made to recognize preservation as a sustainable building practice. Such movements emphasize the need to address the building stock that already exists in the United States. The United States “demolishes 200,000 buildings a year – generating

124 million tons of debris, enough to construct a wall 30 feet high and 30 feet thick around the entire coastline” (Hadley 2006). Encouraging new construction while demolishing older buildings seems contrary to the term “sustainable”, especially with such accumulated amounts of debris. Accordingly, the preservation of certain structures at the Catawba Farm facility aligns with the Landcare group’s efforts to promote sustainability.

### Chapter 3 : Approach

The approach to the research involved several phases. Figure 5-1 provides a graphical representation of the research approach followed by explanations of each phase of the approach.

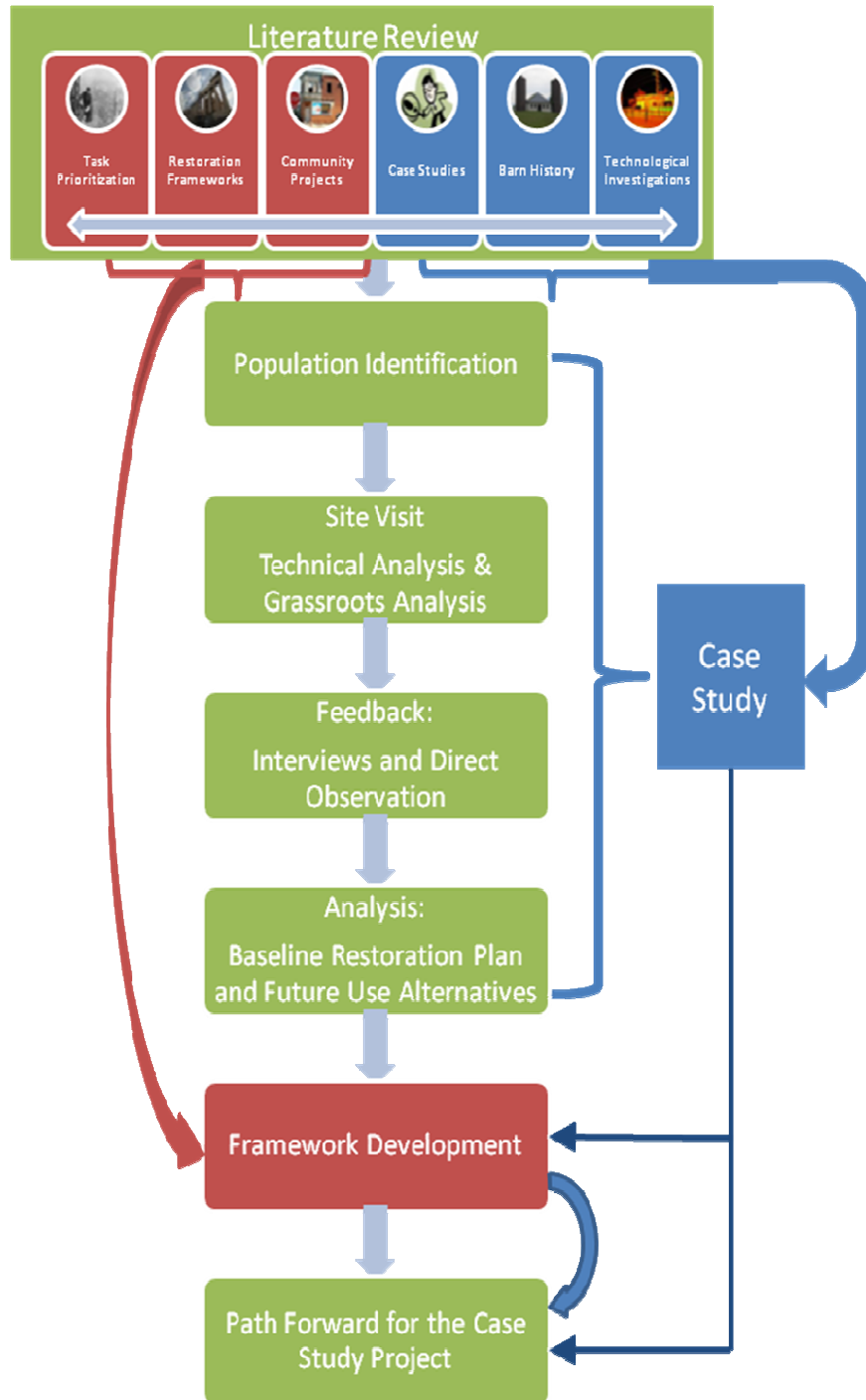


Figure 3-1: Research Approach

## Literature Review

The first phase of the research approach involved a literature review of various resources. Figure 3-1 shows the various topics covered in the literature review.



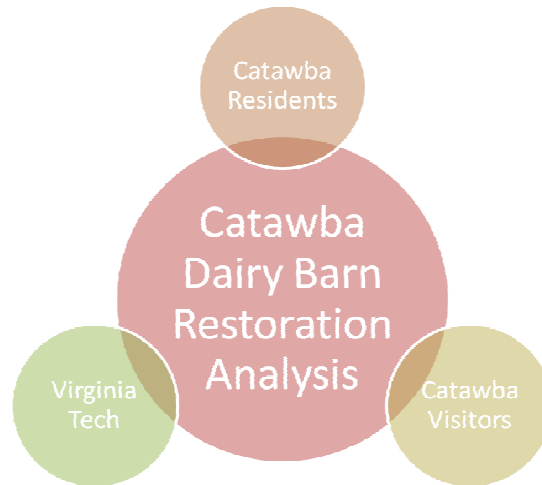
**Figure 3-2: Literature Review**

The task prioritization and restoration framework portions of the literature review allowed the researcher to determine the current methods for evaluating historic restoration projects and the ways in which constructors and communities prioritize tasks for a project. The research on community projects allowed the researcher to understand current movements and organizations devoted to community restoration projects. The researcher used the information gained about task prioritization, restoration frameworks, and community projects to help develop the framework for the thesis research.

The case study portion of the literature review helped the researcher verify the appropriateness of the case study medium for framework development. The barn history portion allowed the researcher to establish the facility's historical context. The technological investigations portion of the literature review helped the researcher identify instances where laser scanning technology is an appropriate system for evaluating historic buildings. The researcher used the information gained in the case study, barn history, and technological investigation portions of the literature review to aid in the case study approach to the dairy barn.

## Population Identification

The population for analysis in the project includes the Catawba Hospital Farm dairy barn facility and the relevant stakeholders in the project. Figure 3-1 shows the stakeholders for the project.



**Figure 3-3: Stakeholders in the Catawba Hospital Farm Dairy Barn Project**

The persons interviewed to establish the farm’s history and potential future use alternatives were: a representative from the owner organization, an administrator with the College of Natural Resources who spearheaded the Catawba Landcare initiative; a farm worker who has served as caretaker for the farm for 20+ years; the current president of the Catawba Sanatorium state hospital who has served in that post for 10 years; members of the Catawba community ranging from 5 years to 30+ years of residence; and visitors to the Catawba community who helped with the Landcare effort or frequented the Appalachian Trail.

## Site Visit

The researcher made an initial visit to the Catawba Hospital Farm site. The site consists of ~400 acres of farmland and several buildings used in the farm’s operation. The buildings include: concrete dairy barn with 2 ceramic silos, wood hay barn with metal roof, 2 residences, horse barn, sheep barn, equipment shed, and a granary facility with 2 concrete silos.

After a discussion with the VA Tech College of Natural Resources representative, the researcher chose to focus the study on the feasibility of restoring the dairy barn structure as it was the structure most likely to warrant renovation versus demolition and it is the structure that area residents most identify with the Catawba farm facility.

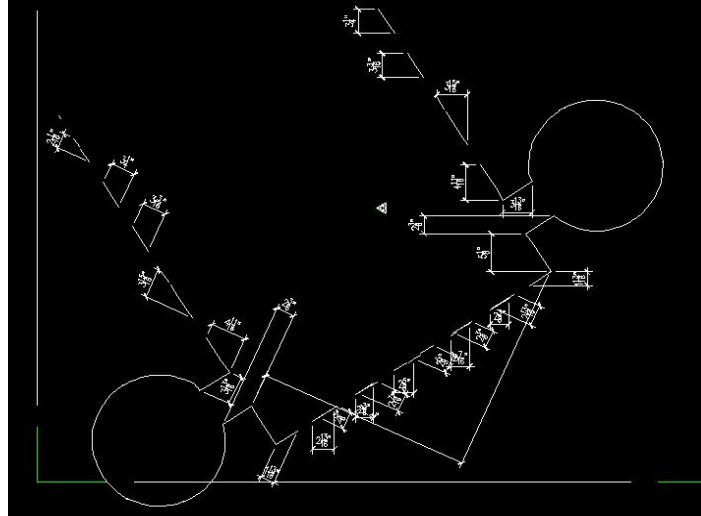
### 1) Technological Analysis

The researcher initially chose to approach the forensic examination of the farm structure by conducting laser scanning analyses of the building. The researcher used a Faro Scene laser scanner and Faro Scene software to take scans of the building in order to produce 3-dimensional point cloud pictures of the facility. Figure 3-2 shows a point cloud of the dairy barn facility generated on site.



**Figure 3-4: 3-D point cloud of dairy barn**

The researcher then exported those scans to AutoCad and used Point Cloud software to try and produce “as built” dimensional documentation of the building. Figure 3-3 shows a drawing of the silo layout as produced in AutoCad.



**Figure 3-5: AutoCad drawing of dairy barn**

After several visits to the Catawba Farm site using the laser scanning equipment, the researcher determined that laser scanning was not the most appropriate alternative for evaluating the building. The laser scanning equipment required a power source for the scanner and the lap top computer receiving images, and the farm facility has no permanent power source. Additionally, the software used to transfer the point cloud images into AutoCad to generate as built documentation did not produce accurate dimensions for the building. The Kubit Software webpage indicates the software's ability to produce accurate dimensions, so this drawback warrants further investigation. The software also required excessive virtual memory from the computer to transfer and manipulate the images, which caused the computer to crash continually in the analysis process. The somewhat derelict condition of portions of the dairy barn also raised concerns about the safety of the laser scanning equipment in this application and the plant growth on the facility prevented the scanner from producing accurate point cloud profiles of some surfaces of the facility.

## **2) Grassroots Analysis**

The researcher returned to the site equipped with a camera, tape measure, and ladder. Using those tools, the researcher gathered information about the buildings dimensions, visual data regarding the building's state, and ideas for approaching the building's rehabilitation. From these analyses the researcher

consulted texts that outlined processes for building renovations in order to develop a plan for the renovation.

## **Feedback**

### **1) Interviews**

The researcher conducted several informal interviews with visitors to the farm, representatives from Virginia Tech, representatives from the Catawba Hospital, former and current farm workers, and residents of Catawba. Those interviews allowed the researcher to develop ideas for potential future use alternatives for the building, gauge public interest in rehabilitating the facility, and understand the motivations for the preservation of the Catawba Hospital Farm.

Questions asked included:

How long have you lived in the Catawba area or how often do you visit the Catawba area?

What does the Catawba farm mean to you?

Why are you participating in the Landcare effort?

What do you see as the most appropriate use for the Catawba farm facility?

Which structures on the farm would you like to see preserved?

### **2) Direct Observation**

The researcher conducted several site visits to the Catawba Dairy barn. Most notably, the researcher participated in several “Catawba Cleanup Days” whereby the researcher interacted with the community and other citizens concerned with the sustainable use of the farm facility. From those observations the researcher determined appropriate uses for the facility and gauged the level of buy-in associated with the community members towards the project.

## **Analysis**

After gathering data through site visits and interviews, the researcher took a four phased approach to the case study and framework development.

### **1) Baseline Restoration Plan**

The researcher developed a baseline restoration plan to save the dairy barn structure in the short term. To develop the baseline plan, the researcher determined which tasks were imperative to the facilities immediate integrity by consulting established resources concerning renovations and applying those practices to the case study project.

### **2) Determine Future Use Alternatives**

From the interviews and site visits, the researcher determined three potential use alternatives that might be appropriate for the rehabilitated facility.

### **3) Compare and Contrast Future Use Alternatives**

The researcher compared and contrasted the future use alternatives to determine which construction tasks were important for each proposed iteration of the future facility. The researcher isolated those tasks that overlapped in order to offer a more comprehensive recommendation for short term rehabilitation projects for the dairy barn.

### **4) Develop Framework for Community Restoration Projects**

The researcher evaluated the methods used to approach the case study project in order to develop a general framework for community restoration projects.

### **5) Develop a Path Forward for the Project**

The researcher used the proposed framework and information gained from the baseline restoration plan and compare/contrast of the future use alternatives to develop an immediate plan for the restoration of the

dairy barn. The plan includes a list of tasks in order of importance, a rough estimate for the facility's restoration, and procedures for implementing the necessary construction tasks for the project.

### **Framework Development**

Using the information gained through the literature review and the case study project, the researcher developed a multistep framework and prioritization matrix for use in evaluating community restoration projects. The purpose of the framework and matrix is to provide communities a means to evaluate and prioritize restoration tasks in order to address immediate concerns while still determining the facility's future use. The proposed framework and prioritization matrix appear in the results section of this document.

### **Path Forward for the Restoration Project**

Using the proposed framework and the information gained from the site investigation and assembled community feedback, the researcher applied the framework and prioritization matrix back to the case study project in order to develop a path forward for the project. The application of the framework and prioritization matrix appears in the results section of this document.

## Chapter 4 Results

### Baseline Restoration Plan

After conducting several site visits, the researcher determined several areas that require attention for the rehabilitation of the dairy barn structure.

#### 1) Roof

The roof of the building consists of slate with a wood sheathing and wood rafters. The roof over the milking parlors (rear two thirds of the building) is in relatively decent shape. However, the front of the building has severe water damage. It appears that the roof began to deteriorate as slate shingles loosened, allowing water to penetrate the sheathing and the rafters. This enabled serious rot. Figures 4-1 and 4-2 show pictures of the damage to the ceiling of the front room and the damage to the roof.



**Figure 4-1: Front room roof**



**Figure 4-2: Front room ceiling**

The rafters, beams, and columns for the front of the building all need replacement. Because the state of the water damage allowed some sagging of the ceiling joists for the front room of the barn, the reconstruction will require jacking up the ceiling to successfully and levelly connect the front of the barn to the rear two thirds of the barn. Other than the front of the building, the rest of the roofing is in decent shape and will require cleaning and replacement of some broken shingles.

## 2) Gutters

The gutter system for the entire building needs replacement in order to prevent further deterioration to the roof due to water leakage and poor drainage. Figure 4-3 shows the current state of the gutter system.



**Figure 4-3: Gutter deterioration**

## 3) Silos

The foundation for the main section of the building is in good shape, but the silo foundations, should the silos be used as habitable spaces in the building's future, need further reinforcement. The floors inside the silos are earthen and need replacement with poured concrete. Additionally, the open-air hallways between the front room and silos need enclosure. As the original use for the silos was to store grain, portions of the sides of the silos are open and originally utilized wood enclosures depending upon the level of the grain. The contractors will need to enclose those openings to make the silos a habitable space. Lastly, the metal silo roofs and wooden roofing structures need replacement. The following figures show the damage and obstacles to rehabilitating and renovating the silos.



**Figure 4-4: Side openings**



**Figure 4-5: Earthen floor and foundation gaps**



**Figure 4-6: Opening between rooms**



**Figure 4-7: Silo roof damage**

#### **4) Windows and Doors**

Virtually all of the windows in the dairy barn structure are missing or broken. Several doors are missing as well, and the ones that are present in the structure need replacement due to age or water damage. The replacement of these building members is especially important for regulating the interior temperature and moisture.



**Figure 4-8: Missing and broken windows**



**Figure 4-9: Missing door**

### **5) Lead paint Remediation**

The ceilings in the building's interior have lead based paint peeling from them. This is an issue that the barn owners must address early in the restoration process.



**Figure 4-10: Peeling lead paint**

### **6) Updated Wiring and Plumbing**

In order to repurpose the building for any commercial or private use, the wiring and plumbing will need updating. The current wiring is somewhat updated, but will need inspection and work to meet current codes. The plumbing consists of spigots running to the milking parlor. Plumbing also exists in the addition to the original barn in the part that was used for sterilizing and bottling. In both cases, the plumbing will need inspection and updating to accommodate a more modern use.



**Figure 4-11: Bottling room plumbing**



**Figure 4-12: Existing fixture**



**Figure 4-13: Milking parlor spigot**

## Future Use Alternatives

After conducting interviews with the relevant stakeholders in the Catawba community at large, the researcher identified three future use alternatives for the Catawba Hospital Farm dairy barn.



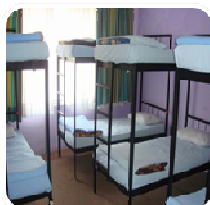
### Food distribution center for local farmers

- Co-op
- Sell goods to local grocery stores



### Museum

- Showcase dairy farm history
- Educational facility



### Hostel

- Proximity to Appalachian Trail
- Shower/Store facility

**Figure 4-14: Future use alternatives**

### **1) Food distribution center for local farmers**

The use of the dairy barn as a food distribution center aligns with the Catawba Landcare group's goal for showcasing sustainable agriculture and promoting local farming efforts. Currently, apart from farmer's markets in Roanoke, Salem, and Fincastle, local farmers have limited resources for selling their produce to local distributors. Having a food distribution center to assemble local agricultural products from various producers allows for one central location to facilitate delivery of produce and farm products to local grocery stores and distributors. One of the Landcare group's goals is to showcase sustainable farming practices on the farm's extensive acreage, so the distribution center could be a potential revenue source for both the Catawba community and the sustainability center. The facility could also offer retail space to sell agricultural products directly from the center. A retail space has the potential to attract more visitors to the sustainability center.

### **2) Museum**

The dairy barn facility, with its rich architectural and historical significance, could become a museum. The milking parlors could be living museum relics used to showcase historical dairy practices. Other portions of the barn could house exhibits for the Catawba hospital and the Catawba community at large. Currently, no historical society for the Catawba Valley exists, so the dairy barn could provide a space to showcase the history of the valley, the Catawba sanatorium, and historical farming practices.

### **3) Hostel**

The acreage for the Catawba farm abuts the Appalachian Trail just below McAfee's Knob in Roanoke County. Every year some 400+ people hike the length of the Appalachian Trail from Georgia to Maine. Additionally, McAfee's Knob and nearby Dragon's Tooth and Tinker Cliffs attract thousands of day trippers and short trip campers yearly. Because of its position in proximity to the Appalachian Trail, the Catawba dairy barn is an opportune place to house a hostel facility for through hikers and visitors to the area. The nearby Homeplace restaurant is a popular spot for hikers, drawing people off the trail. Should the dairy barn house a hostel facility, those through hikers could rest and take advantage of shower and

laundry facilities on site. The use of the dairy barn as a hostel could generate revenue for the sustainability center and attract area tourists to the facility.

#### **4) Combination**

The farm owners and the community could also consider a combination of the three proposed future use alternatives. A hostel or a food distribution center could also house a museum for the community. The size of the dairy barn lends it to multiple uses depending upon the ultimate goals of the owner and the community.

## **Compare and Contrast Future Use Alternatives**

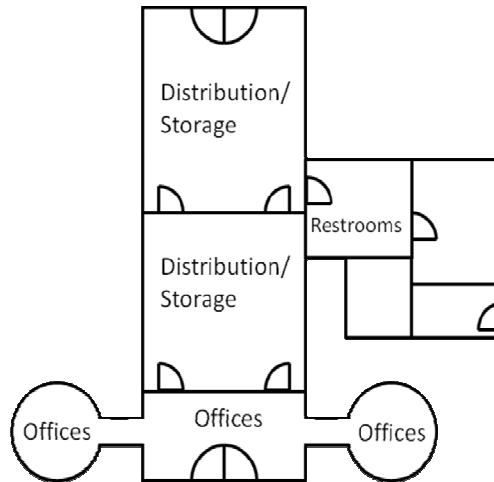
The researcher began with a list of baseline restoration and rehabilitation tasks needed to update the facility, regardless of the proposed future use. Those tasks include:

- Roof support restoration
- Re-support silo foundations
- Roof insulation
- Gutters
- Slate restoration
- Windows and doors
- Enclose access to silos
- Silo roof replacement
- Lead paint remediation
- Updated wiring and plumbing
- Concrete restoration

In order to evaluate the future use alternatives, the researcher considered the possible facility layout and additional construction tasks needed to accommodate each use. The facility layouts come from an examination of the existing building infrastructure and Virginia building codes. Taking those factors into consideration, the researcher proposed the following layouts for the facility. Actual layouts will be the determination of the owner organization and any designers and contractors hired by the owner organization.

### **1) Food distribution center**

Figure 4-15 shows a possible layout for the proposed use as a food distribution center.



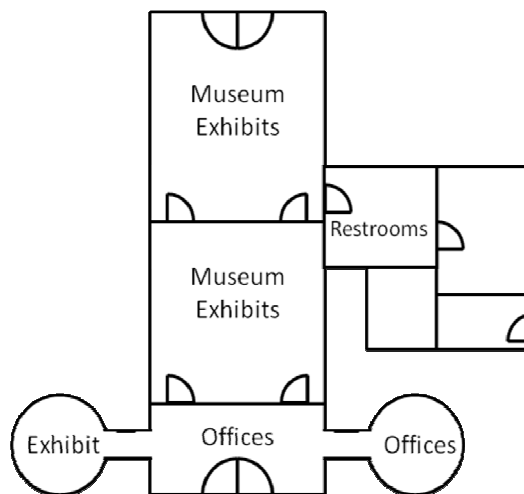
**Figure 4-15: Possible food distribution center layout**

In addition to the baseline restoration tasks, the installation of a food distribution center would require the following additional construction tasks:

- Insulate/heat/cool front office area
- Install plumbing and bathroom fixtures in restroom areas
- Pour slab in silos
- Install shelves/tables for distribution area

## 2) Museum

Figure 4-16 shows a possible layout for the proposed use as a museum.



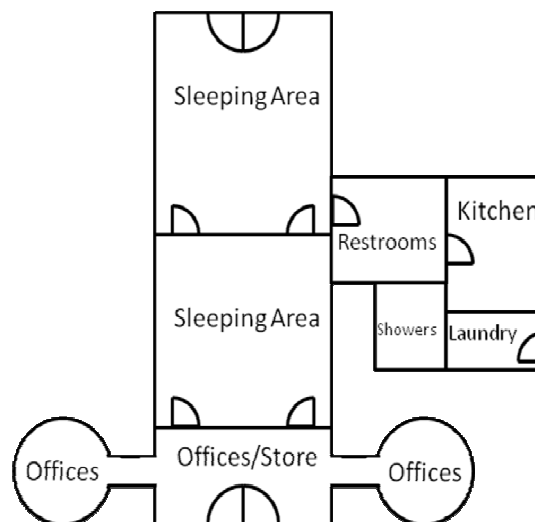
**Figure 4-16: Possible museum layout**

In addition to the baseline restoration tasks, the installation of a museum would require the following additional construction tasks:

- Insulate/heat/cool front office area
- Insulate/heat/cool exhibit areas
- Install plumbing and bathroom fixtures in restroom areas
- Pour slab in silos
- Install exhibit display areas

### 3) Hostel

Figure 4-17 shows a possible layout for the proposed use as a museum.



**Figure 4-17: Possible layout for hostel**

In addition to the baseline restoration tasks, the installation of a hostel would require the following additional construction tasks:

- Insulate/heat/cool front office area
- Insulate/heat/cool entire building
- Install plumbing and bathroom fixtures in restroom areas
- Install showers

- Install kitchen area
- Bring building to code for habitation
- Pour slab in silos

#### 4) Compare/Contrast

Once the researcher established the major additional tasks needed for each proposed future use alternatives, the researcher compared those tasks to find congruent needs in the three proposed future use alternatives. The following table highlights those congruent uses.

**Table 4-1: Compare/contrast future use alternatives**

Food Distribution Center	Museum	Hostel
<ul style="list-style-type: none"> <li>- <i>Insulate/heat/cool front office area</i></li> <li>- <i>Install plumbing and bathroom fixtures in restroom areas</i></li> <li>- <i>Pour slab in silos</i></li> <li>- Install shelves/tables for distribution area</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Insulate/heat/cool front office area</i></li> <li>- <i>Install plumbing and bathroom fixtures in restroom areas</i></li> <li>- <i>Pour slab in silos</i></li> <li>- Insulate/heat/cool exhibit areas</li> <li>- Install exhibit display areas</li> </ul>	<ul style="list-style-type: none"> <li>- <i>Insulate/heat/cool front office area</i></li> <li>- <i>Install plumbing and bathroom fixtures in restroom areas</i></li> <li>- <i>Pour slab in silos</i></li> <li>- Insulate/heat/cool entire building</li> <li>- Install showers</li> <li>- Install kitchen area</li> <li>- Bring building to code for habitation</li> </ul>

By establishing congruent uses, the researcher could propose additional tasks for the baseline that the owner organization will need to complete, regardless of the future use alternative.

### Framework for Community Restoration Projects

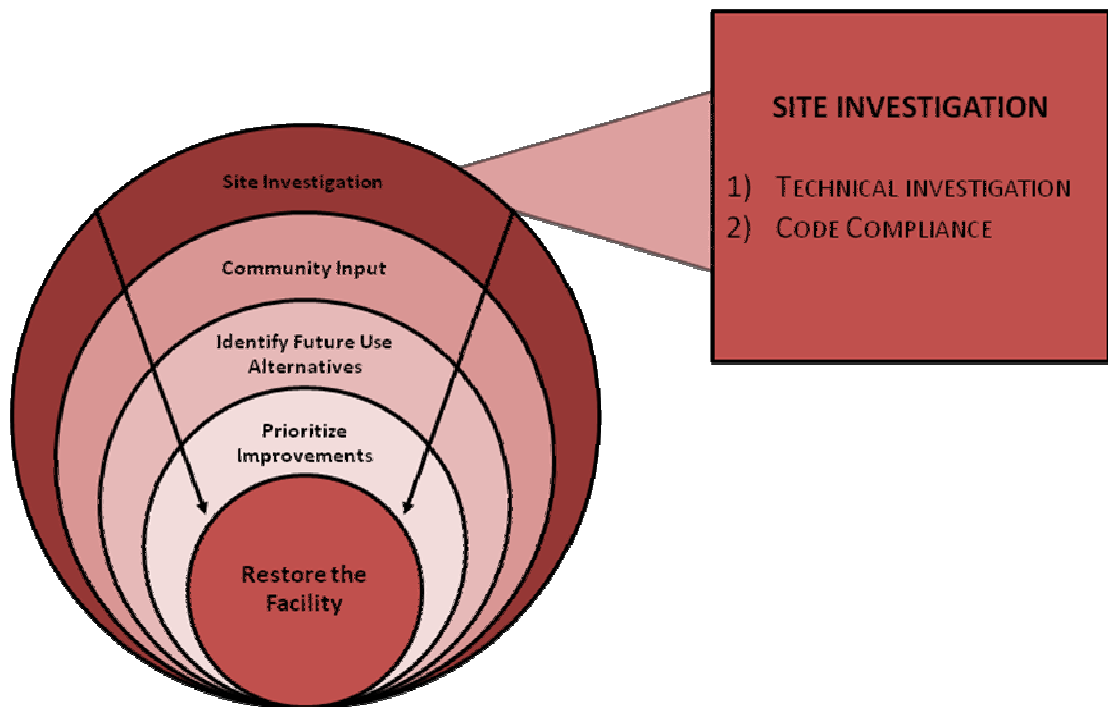
The method used to evaluate the Catawba dairy barn restoration led to the development of a framework for communities at large to consider and prioritize tasks for restoration projects. The following figure shows the proposed framework followed by sections explaining the various steps associated with the framework.



**Figure 4-18: Framework**

The framework includes four important steps in the approach to community historic restoration projects.

**Step One: Site Investigation**



**Figure 4-19: Site investigation**

The community must identify a person or persons to visit the site to develop a baseline restoration plan for the facility. That person or persons should use appropriate technological and grassroots techniques to

conduct a forensic investigation and evaluation of the facility. At this point, the investigator can make a determination as to the feasibility of the restoration project. If the scope of the damage or the deterioration of the building exceeds a level that the investigator deems appropriate, the investigator should notify the owner and community representatives to allow them to make a determination regarding the future of the facility. This step warrants a 2 step approach in the form of investigation and code compliance. Because historic status implies the age of the structure, the investigative party should consider modern code compliance for any iteration of the future use of the facility.

### Step Two: Community Input

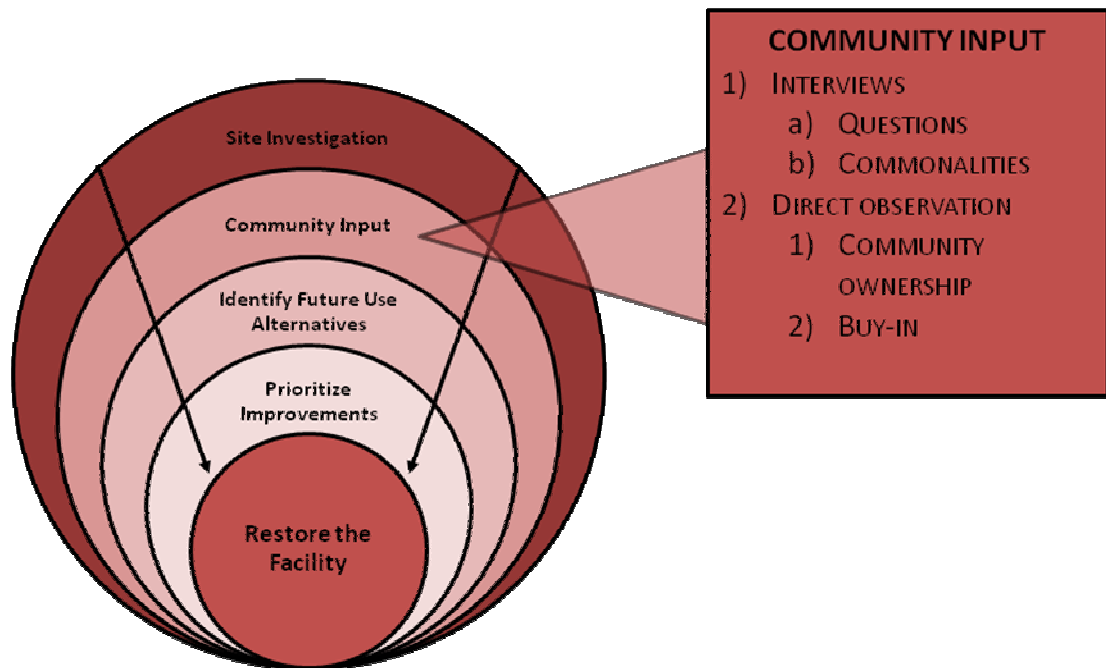


Figure 4-20: Community input

After the initial site investigation, the project leaders should solicit feedback and recommendations from the owners, community, and funding organizations to determine the possible future use alternatives for the facility. During this leg of the framework implementation, the project leaders can also ascertain the community sentiment for the building and gain knowledge concerning the facility's place and importance to the community. By recognizing the trends in the community input, the project leaders can investigate those future use alternatives that are most appropriate to meet the community and owner needs.

The community input phase takes a two step approach to information gathering. The first step involves interviews with relevant stakeholders and identifying commonalities in those interviews. The second step involves direct observation of the community's efforts in supporting the restoration or rehabilitation of the facility. In the case of the Catawba dairy barn, the researcher gathered input from conversations with community members, owner representatives, and visitors to the Catawba area. The researcher developed direct observations by participating in "clean-up" days for the farm.

### Step Three: Identify Future Use Alternatives

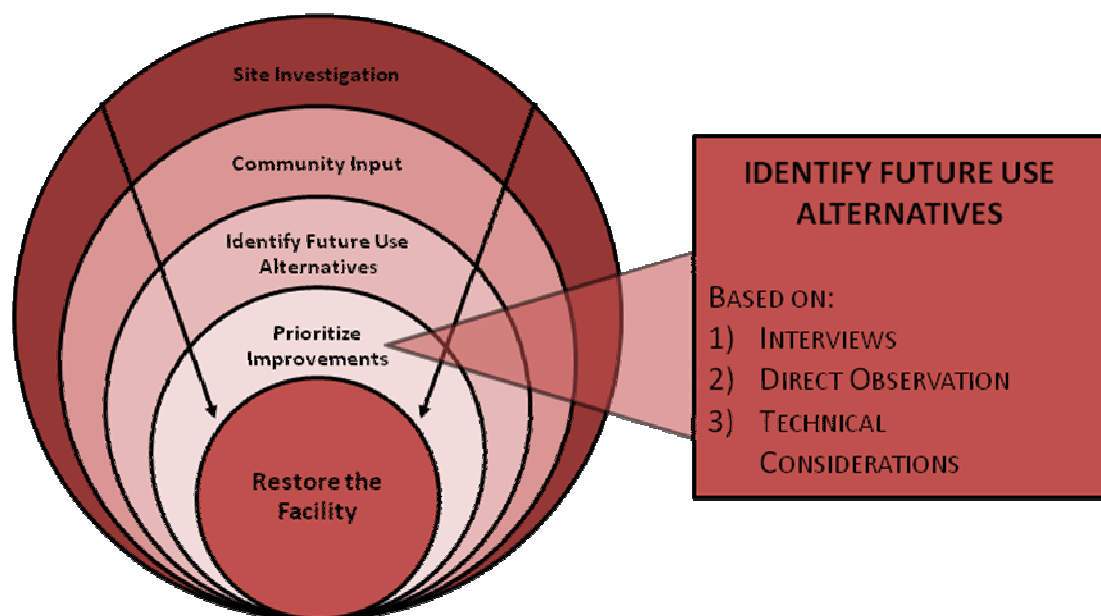
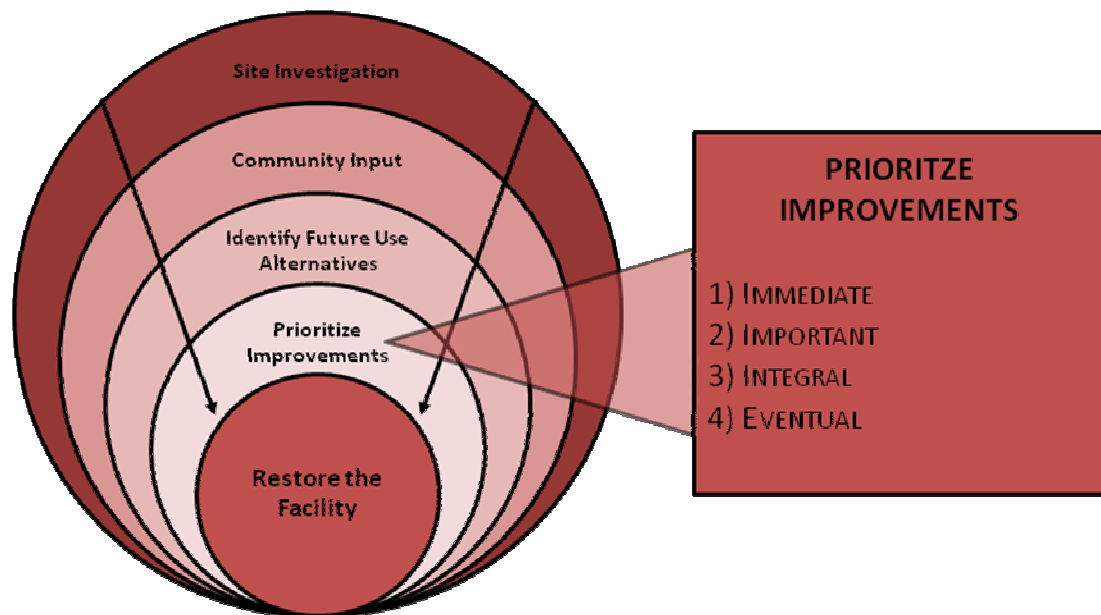


Figure 4-21: Identify future use alternatives

Once the project leaders collect and assimilate the community and owner organization input, results from direct observation of the community's efforts and sentiment towards the facility, and the technical consideration from the baseline restoration plan, those leaders can identify those future use alternatives that are most popular and appropriate for the facility. The site investigators can then take those plans and conduct a compare/contrast of the future use alternatives to identify those rehabilitation or restoration tasks that are congruent for each alternative and those tasks that are unique to a particular alternative. In the case study, for instance, the need to repair the barn roof is a congruent task for each of the future use alternatives, while adding kitchen facilities is a task unique to the hostel alternative.

## Step Four: Prioritize Improvements



**Figure 4-22: Prioritize improvements**

In step four, the project leaders must evaluate the associated tasks for each alternative and categorize them as immediate, important, integral, and eventual. This allows the project leaders to propose construction projects to save the facility in the short term while planning for additional tasks associated with each future use alternative. Through this step, project leaders can begin the facility restoration before the community and owners even decide on the facility's eventual use. This step also allows project leaders to show the community the construction tasks in order of importance and helps delineate between the tasks that are necessary for any use and those that are unique or extra for any future use alternative. For the purposes of the framework, the research dictates the following definitions for the various improvement categories (qualifying Merriam-Webster dictionary definitions to suit the framework):

- **IMMEDIATE:** Needing to occur without loss of time. In the case of the framework this means any tasks that the project leaders must address in the short term to save the structure.
- **IMPORTANT:** marked by or indicative of significant worth or consequence. In the case of the framework this means any task that is not required to immediately save the facility, but is a task that the project leaders must address regardless of the future use alternative.

- **INTEGRAL:** essential to completeness. In the case of the framework this means any task unique to the chosen future use alternative that project leaders must consider to implement that alternative.
- **EVENTUAL:** taking place at an unspecified later time. In the case of the framework this means any task that is not essential for implementing a future use alternative, but is a task that the project leaders consider worthwhile in the long term.

After establishing those definitions for the various improvement categories, the researcher consulted several resources to help develop a matrix to facilitate the implementation of the prioritizing of construction tasks. Those resources include: J. Kirk Irwin’s *Historic Preservation Handbook*, Swanke Hayden Connell Architect’s *Historic Preservation Project Planning and Estimating*, and J. Stanley Rabun’s *Structural Analysis of Historic Buildings*. The matrix consists of construction tasks on the x axis and prioritizing categories and criteria on the y axis. The researcher designed the matrix to allow project leaders to consider construction tasks in terms of criteria that match the category definitions given above. Should a task meet the criteria for more than one category, then the higher category prevails.

**Table 4-2: Priority Matrix**

		TASK ONE	TASK TWO	TASK THREE	TASK FOUR	TASK FIVE	TASK SIX
IMMEDIATE	It is imperative to the immediate integrity of the building for the team to complete the task and/or it is imperative to the immediate safety of the renovation workers and future occupants to complete the task						
IMPORTANT	It is a task required regardless of the facility’s future use and/or it is a task required for the building to meet code						
INTEGRAL	It is a task unique to, but required of the chosen future use						
EVENTUAL	It is a task that does not require immediate attention, but seems worthwhile in the long term						

## **Path Forward for the Project**

The path forward for the Catawba Dairy Barn includes implementing the proposed framework for restoration projects. As the researcher already conducted a site investigation, solicited community input, and identified future use alternatives, the path forward addresses the “prioritize tasks” portion of the framework in order to provide Virginia Tech and the Catawba community a plan for restoring the dairy barn facility. In order to facilitate the prioritization of the construction tasks for the project, the researcher implemented the matrix tool. Some of the tasks meet the criteria for more than one category, and as stated above, those tasks follow the higher category. For instance, roof support restoration is an activity that meets “immediate” and “important” criteria, but the “immediate” categorization prevails. The numbers under the X’s for eventual tasks denote the three proposed future use alternatives: 1) food distribution center, 2) museum, 3) hostel.

**Table 4-3: Priority matrix for the dairy barn**

		Roof and attic support restoration	Gutters	Slate Restoration	Lead Paint Remediation	Re-support Silo Foundations	Windows and Doors	Enclose Silo Access	Silo Roof Replacement	Update Wiring and Plumbing	Pour Silo Floors	Concrete Restoration around Doors	Insulate/Heat/Cool Front Office	Install Plumbing and Bathroom	Shelves	Insulate/Heat Cool Exhibit Areas	Install Exhibit Display Areas	Insulate/Heat/Cool Whole Building	Install Shower Facilities	Concrete Patching
<b>IMMEDIATE</b>	It is imperative to the immediate integrity of the building for the team to complete the task and/or it is imperative to the immediate safety of the renovation workers and future occupants to complete the task	X	X	X	X															
<b>IMPORTANT</b>	It is a task required regardless of the facility's future use and/or it is a task required for the building to meet code	X	X	X	X	X	X	X	X	X	X	X	X	X						
<b>INTEGRAL</b>	It is a task unique to, but required of the chosen future use														X 1	X 2	X 2	X 3	X 3	
<b>EVENTUAL</b>	It is a task that does not require immediate attention, but seems worthwhile																			X

## **Improvement Explanations and Procedures**

The following sections provide a more detailed path forward for the case study project by describing the various project tasks in detail and offering some rough cost estimates. For the sake of the case study project, at the request of the owner organization, the immediate improvements section includes a cost estimate for those tasks. The researcher compiled the cost estimates using RS Means 2009 Facilities Maintenance and Repair Cost data. The estimates are a rough indication of the material and labor costs and do not include costs associated with heavy equipment rental. The procedures for restoration come from barn restoration guides published by the Barn Again! program with the National Trust for Historic Preservation.

### **Immediate Improvements**

Immediate improvement classification implies that the project leaders must address the construction tasks as soon as possible. This classification means that the improvement is imperative to the immediate structural integrity of the building or the immediate safety of any person or persons working on the project.

- Roof and attic support restoration
  - This task is immediate because the front room roof requires attention to keep the front portion of the structure from collapsing in the near future. Should the roof collapse, there exists the possibility that the community and owner might question the validity of restoring the building and choose to forgo the restoration project.
    - Recommendations for roof support restoration: The roof in the front portion of the building requires immediate attention (see figure below)



**Figure 4-23: Barn roof**

1. Remove slate from the front of the building
2. Remove front roof structure
3. Utilize jacks to support the attic floor from underneath
4. Replace attic floor girders and beams in the front of the building
5. Remove slate from front room portion of the building
6. Replace attic flooring
7. Replace king posts, rafters, roofing boards and purlins

**Table 4-4: Roof support restoration estimate**

Description	Unit	Project Quantity	Bare Material	Bare Labor	Bare Total	Total O&P	Project Total
Plywood, underlayment grade, 3/8" thick	SF	1020	\$0.91	\$0.31	\$1.22	\$1.51	\$1540
Beam and Girder Framing, Triple 2" x 6"	LF	100	\$1.39	\$0.84	\$2.23	\$2.92	\$290
Posts and Columns, 6"x6"	LF	100	\$4.32	\$2.15	\$6.47	\$8.3	\$830
Rafters, to 4 in 12 pitch, 2" x 8", ordinary	LF	1000	\$.63	\$.48	\$1.11	\$1.49	\$1490
Ridge Board 2" x 10"	LF	25	\$.88	\$1.16	\$2.04	\$2.88	\$70
Ceiling Framing, Suspended, 2" x 3"	LF	500	\$0.28	\$0.46	\$0.74	\$1.08	\$540
<b>Total Estimated Task Cost</b>							<b>\$4760</b>

- Gutters

- Because much of the building’s deterioration occurred because of water damage over time, the gutter replacement emerges as an immediate task. This task is integral to maintaining the roof support restoration project.

- Recommendations for gutter repair and replacement:

1. Remove existing gutters and flashing from front of building
2. Install flashing on new roofing boards
3. Install new gutters – support with hangers every 3 feet and install downspouts every 30 to 40 feet
4. Test gutters and downspouts to ensure drainage away from the building
5. Patch existing gutters in the rear portions of the building by
  - Wire brushing the holes
  - Position patches larger than the holes over the holes
  - Paint with metal primer
  - Secure seams with self-tapping metal screws
  - Caulk screw heads with silicone

**Table 4-5: Gutter restoration estimate**

Description	Unit	Project Quantity	Bare Material	Bare Labor	Bare Total	Total O&P	Project Total
Gutters, Copper, Half Round, 6" Wide	LF	275	9	1.95	8.19	9.95	\$2700
Downspouts, 3" diameter	LF	100	8.69	1.18	9.87	11.42	\$1150
Downspout Elbows, 3" diameter	Ea	10	7.78	2.24	10.02	12.1	\$120
<b>Total Estimated Task Cost</b>							<b>\$4000</b>

- Slate restoration
  - Coupled with the roof support and gutter restoration, the slate on the front of the building needs some replacement and repair to preserve the structural integrity of the front portion of the building. Additionally, portions of the slate in the rear of the building need replacement without rebuilding the entire roof structure.
    - Recommendations for slate restoration
      1. Lay new underlayment on the front section of the building
      2. Lay felt underlayment overtop of the underlayment\*

(\*According to the *Slate Roof Bible*, damp-proofing materials are unnecessary and can actually damage the slate roof because the felt life expectancy is shorter than the slate roof)

3. Reuse unbroken slate tiles and replace those tiles that broke in the roof re-support process

**Table 4-6: Slate restoration estimate**

Description	Unit	Project Quantity	Bare Material	Bare Labor	Bare Total	Total O&P	Project Total
Slate roof repair, extensive replacement	Sq	11	n/a*	\$161.89	\$161.89	\$201.68	\$2220
Slate roof repair individual pieces, scattered	Ea	150	\$5.96	\$8.51	\$14.47	\$21.69	\$3250
<b>Total Estimated Task Cost</b>							<b>\$5470</b>

- Lead paint remediation
  - Lead paint presents an important safety consideration for any person or persons involved with the restoration of the building. Remediation and removal should be an urgent task.
    - Recommendations for lead paint remediation:
      1. Take care to have the proper safety equipment including a filtered respirator, eye protection, and full protection for all exposed skin
      2. Power wash the ceilings with low pressure water (no higher than 600 psi).

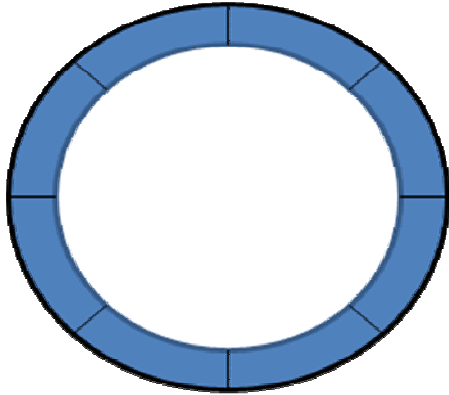
3. Hand scrape any loose paint after power-washing
4. Allow sufficient drying time before painting

**Table 4-7: Lead paint remediation estimate**

Description	Unit	Project Quantity	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P	Project Total
Lead Paint Remediation, Ceilings (wood)	SF	2500	\$0.64	\$0.20		\$0.84	\$1.03	\$2575
<b>Total Estimated Task Cost</b>								<b>\$2575</b>

### Important Improvements

- Re-support silo foundations
  - While the silos are somewhat structurally sound in their current stage, the erosion of the foundations due to the silage requires attention should the silos have a use in any of the alternatives. In interviews, the silos emerged as a favorite portion of the building to the community, so their restoration and use is integral to maintaining support for the restoration project.
    - Recommendations for Resupporting Silo Foundations
      1. The silos are 14 feet in diameter in the interior with 8” thick ceramic block walls. In order to ensure that the structure stays sound during the resupporting process, the team should approach the foundations in a staggered fashion (see figure below)



**Figure 4-24: Silo foundation restoration plan**

The team should re-support the foundation by addressing every other section of the silo foundation and allowing the foundation sections to cure between pours.

- Roof insulation
  - Regardless of the future use, the roof requires insulation to maintain its structural integrity and prevent future damage due to water and weather. The roof insulation will also aid in heating and cooling loads for the building.
    - Recommendations for Roof Insulation:
      1. Clear the attic space of any obstructions to the roof insulation
      2. Spray 3” polyurethane foam on the roofing boards
- Windows and doors
  - While not integral to the structural integrity of the building, each future use alternative requires the enclosure of the building. To maintain this enclosure, the project requires the replacement and/or repair of the windows and doors.
    - Recommendations for Window and Door Replacement
      1. Remove old windows
      2. Install new window and door casings
      3. Install new windows and doors

- Enclose access to silos
  - Each future use alternative indicates the use of the silos as offices or other uses. Accordingly, the open-air access to the silos requires enclosure and the vertical openings to the silos require enclosure. The project leaders might achieve this objective by installing glass in the vertical openings and extending the slate roof over the access from the front room to the silos.
- Silo roof replacement
  - As each future use alternative requires the use of the silos, the metal roofs require replacement. It up to the project leaders to determine whether to restore the roofs to their original profile or to replicate the existing roof structures.
- Updated wiring and plumbing
  - Each future use alternative requires updated plumbing and wiring for each of the rooms.
- Pour silo floors
  - Each future use alternative identifies the silo space as usable space, so the silos require a floor. Concrete emerges as the most appropriate alternative in terms of ease of installation and complementing the rest of the building. Before installing the concrete flooring, the project leaders should make sure to install the necessary plumbing and wiring for the silo structures.
- Concrete restoration
  - Portions of the building, especially those areas surrounding openings, require concrete restoration and patchwork.
- Insulate/Heat/Cool front office area
  - Each use requires the use of the front area as office and/or public space. Hence, the front room and the silo areas need heating, cooling, and insulation to operate according to their proposed use.

- Install plumbing and bathroom fixtures in restroom areas
  - As public buildings, each use requires the installation of men's and women's restroom facilities.

### **Integral Improvements**

The researcher categorized these improvements according to the future use alternative

- Food distribution center
  - Install shelves/tables for distribution area
    - This use requires the installation of equipment and areas for local farmers to assemble and distribute their agricultural products
- Museum
  - Insulate/heat/cool exhibit areas
    - Because exhibition areas require specific heating and cooling environments, the project leaders would have to implement the installation of HVAC controls for the exhibition areas
  - Install exhibit display areas
    - A museum requires display areas and shelves for any installations.
- Hostel
  - Insulate/heat/cool entire building
    - Because a hostel must accommodate year-round residential use of the facility, this requires the installation of HVAC systems for the entire building.
  - Install showers
    - In addition to toilets and sinks in the bathroom facilities, a hostel requires the installation of men's and women's shower facilities
  - Install kitchen area
    - A hostel must also include kitchen facilities for use by the visitors to the hostel

- Bring building to code for habitation
  - Because a hostel necessitates the use of the facility in a residential capacity, the project planners must renovate the facility to comply with standards for habitation

### **Eventual Improvements**

In the case of the Catawba Dairy barn, no eventual improvements emerge at this stage. Presumably, as the project planners get closer to choosing a future use alternative, eventual projects will emerge.

### **Potential Funding Sources**

#### *National Trust for Historic Preservation*

The National Trust for Historic Preservation offers several grant programs for community development and rural communities. The Barn Again! program offers grants and scholarships for research and rehabilitation of historic barn structures. Additionally, the National Trust website offers several links to funding sources for historic restoration projects and provides information on Federal and State tax credits for historic restoration and rehabilitation.

#### *United States Department of Agriculture*

The United States Department of Agriculture offers several funding programs for research and rehabilitation of agricultural facilities. Additionally, the USDA website features funding sources targeted specifically for rural areas. The website also features a database of private funding sources for rural community development projects.

#### *Grants.gov*

The grants.gov website offers a variety of federal funding opportunities for community development projects, rural rehabilitation, and historic restoration. Additionally, the grants.gov site features information on tax credits available to communities, non-profits, and state and federal agencies for sustainable redevelopment projects.

## **Chapter 5 : Summary and Conclusions**

### **Summary and Conclusion**

The purpose of the thesis research was to conduct a case study of a community historic restoration project in order to develop a framework for communities at large to prioritize construction tasks. The secondary purpose of the framework was to provide an avenue for communities to identify and prioritize construction tasks even before determining the future use for the facility. The thesis research fulfilled the research purpose by providing a straightforward framework and prioritization matrix for communities to employ when approaching restoration projects.

The case study approach to the research provided an avenue for examining a community restoration project first hand and afforded the opportunity to apply the proposed framework back to the case study project. The stakeholders associated with the Catawba dairy barn restoration project now have a viable path forward to consider as they approach the actual restoration. Preserving the facility in any of the proposed future use alternatives has the additional benefit of aligning the dairy barn structure with the Landcare effort's larger goals to showcase sustainability. Preserving the barn's integrity not only fulfills the community's desire to save the structure, but also highlights historic renovation and repurposing existing structures as sustainable building practices.

The proposed framework offers communities a methodology for approaching restoration projects, incorporating stakeholder concerns, conducting technical analyses, and identifying potential future use alternatives. It has the additional benefit of offering a matrix for prioritizing construction tasks in terms of 4 categories: immediate, important, integral, and eventual. Prioritizing renovation tasks in such a way allows the community to begin the restoration process even before finalizing the facility's future use. The framework and matrix provide a straightforward, organized, and simple approach for communities to prioritize construction tasks.

## Areas for Future Research

Follow-up considerations include revisiting the case study facility to determine the effectiveness of the proposed framework and matrix. The researcher can solicit feedback from stakeholder groups to determine whether the framework provided a useful means for approaching restoration tasks. Additional follow-up considerations include enhancing the criteria for the prioritization matrix. In its current form, the matrix assumes the structural integrity and safety of the building to be the primary drivers for prioritizing rehabilitation tasks. However, those constraints preclude other significant considerations, including community schedule considerations, economic considerations, and deadlines for funding or grant programs, and deadlines for rehabilitation tax credits. For example, if a the community considers restoring a facility and finds grant funding for some specific part of the restoration, then the deadline for that funding makes that task a priority, regardless of whether it meets the proposed criteria for an “immediate” concern.

One of the major concerns that arose from the case study project was the use of laser scanning technology to produce as-built documentation for the dairy barn facility. As described in the approach section, the scanning technology had several drawbacks in this case study examination. The lack of power at the facility and the derelict structure created a poor environment to conduct the laser scans. Additionally, the laptop used to generate and manipulate the scanned images did not have enough power to easily facilitate the as-built documentation process. The researcher intends to further explore the software in more appropriate environments (i.e. locations with electricity and locations that do not present a potential danger for the equipment) to develop a better understanding and grasp of the technological equipment. The researcher can also explore alternative technological solutions for producing as-built documentation existing structures.

## Chapter 6 : References and Bibliography

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