Developing a Agile Method framework for Strategic Assessment of Adaptive Reuse and Sustainability of Buildings in Rock Hill, South Carolina: *A Case Study of the Old Cotton Mill*

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Developing an Agile Method Framework for Strategic Assessment of Adaptive Reuse and Sustainability of Buildings in Rock Hill, South Carolina: *A Case Study of the Cotton Mill Factory*

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A B S T R A C T

Does the Agile Method provide an advantage over traditional best practice for sustainable adaptive reuse projects? Adaptive reuse is the act of finding a new use for an existing building. This project and report bring about the difference between traditional methods of design verse the Agile Method and how their relationships influences financial feasible and social parameters associated with identifying of an old cotton mills in South Carolina as good candidate for adaptive reuse. In contrast to the traditional design and construction process, the agile method is an engineering tool that forces IT professionals to work together effectively on data aspects of software systems which seek the ability to put their stakeholders priorities first. The agile method can assist in the transformation of the traditional decision-making processes of property stakeholders towards more effective strategies and outcomes. Using the demonstration as a model, the researcher endeavors to develop a framework for developing a feasible use for an abandoned building that fits well with an adaptive reuse plan that employs sustainable building best practice. This, in turn, enhances Rock Hill's ability for sustainable use. The agile method proposed in this paper provides, illustrated by one case study, an important step in making a better use of the facilities we already have and the residual life embedded in them.

"We must learn to cherish history and to preserve worthy old buildings . . . we must learn how to preserve them, not as pathetic museum pieces, but by giving them new uses."

Ada Louise Huxtable
Lessons in Healing the City's Scars

Chapter 1

1. INTRODUCTION

This chapter covers several areas pertaining to adaptive reuse (the act of finding a new use for an existing building) decision making, environmental and economic analysis of historic cotton mills, and assigning best use of the buildings for stakeholders. The research approaches these topics through a demonstration of the South Carolina Old Cotton Factory, an 1881 (the first steam-powered mill) brick and wood structure in Rock Hill, South Carolina. Using the demonstration as a model, the researcher endeavors to develop a framework for developing a feasible use for an abandoned building that fits well with an adaptive reuse plan that employs sustainable building best practice. The framework intends to consider the perspectives of all relevant stakeholders in relation to adaptive reuse buildings. Because adaptive reuse often involves rehabilitation, the feasible framework will aim to provide different scenarios for stakeholders to prioritize adaptive efforts in order to save the facility while continuing to consider future use alternatives for the facility.

1.2 PROBLEM STATEMENT

For example, today's popular proposal for abandoned buildings is demolition. The demolition of structures produces enormous amounts of material that, in most countries, results in significant waste. In the United States, construction and demolition (C&D) waste is about 143 million metric tons annually that is, for the most part, land filled (Chini and Bruening 2003). The primary intent of adaptive reuse is to divert the maximum amount of building materials from the waste. In addition, top priority is placed on the direct reuse of materials in existing structures and immediate reuse allows the materials to retain their current economic value.

Equally important, recycling has become second nature to modern communities as we strive for environmental sustainability. Aiming to reduce, reuse and recycle waste, we find new life in everything from bottles and boxes to clothes, vehicles and buildings. Adaptive reuse is a process that changes a derelict or ineffective building into a new building that can be used for a different purpose. A growing number of cities are pioneering holistic and policy strategies to abate and rehabilitate their vacant or underutilized historic industrial buildings (Schilling 2002). There are a number of conversions taking place in the Northeast due to the large number of industrial buildings located there, but it is a common trend around the country. The opportunity to reuse obsolete facilities in the urban core can support sustainability initiative design. As an alternative to our ever-increasing throw-away society, adaptive reuse offers a sustainable building site with existing infrastructure and materials.

Globally, the construction industry is one of the main contributors to the depletion of natural resources and a major cause of unwanted side effects such as air and water pollution, solid waste, deforestation, toxic waste, health hazards, global warming, and other negative consequences (Augenbroe and Pearce 1998). This research addresses several problems concerning the existing building stock in the United States. First, the existing building stock can have an environmental impact and as the building stock ages, economic needs for the building must evolve. If stakeholders choose to reuse an existing building, they will need a feasible framework for integrating all stakeholders' perspectives into planning for adaptive reuse. Such a feasible framework must provide a means for incorporating the overriding needs and desires of the stakeholders in relation to preserving the structure of the existing building to adapt to modern day use.

1.3 THE ENVIRONMENTAL IMPACTS

For example, the environmental impacts on an existing building can represent a number of challenges. Adaptive reuse can positively impact the environment through the recycling of materials, reuse of structural elements, and reduction in landfill waste (Langston 2007). Normally, these translate into cost advantages to the owner, but have much wider environmental implications.

In the United States, existing buildings contribute 38.1% of the nation's total carbon dioxide emissions; in contrast, transportation only produces 20.5% of U.S. carbon dioxide pollution, as depicted in Figure 1.1 (Kaplow 2009). In addition, buildings are also tremendous consumers of electricity accounting for 72.0% of total U.S. electricity consumption which is 38.9% of the country's total overall energy consumption, as depicted in Figure 1.2 (Kaplow 2009). Based on trends, the numbers are likely to keep going up with the addition of new construction. Also, occupants of already constructed buildings use 13.6% of the total water consumed in the United States each day or 15 trillion gallons per year and 40% of raw materials goes into building construction.

One of the environmental arguments for adaptive reuse is that there is lower material usage in the projects. In addition, existing buildings have embodied energy in the existing materials used in construction and savings are realized because new materials do not have to be mined, manufactured, or transported to the site and therefore the overall energy consumption and greenhouse gas emissions are reduced (Bullen 2005). For that reason, adaptive reuse enhances the long term usefulness of a building and as a result is a more sustainable option.

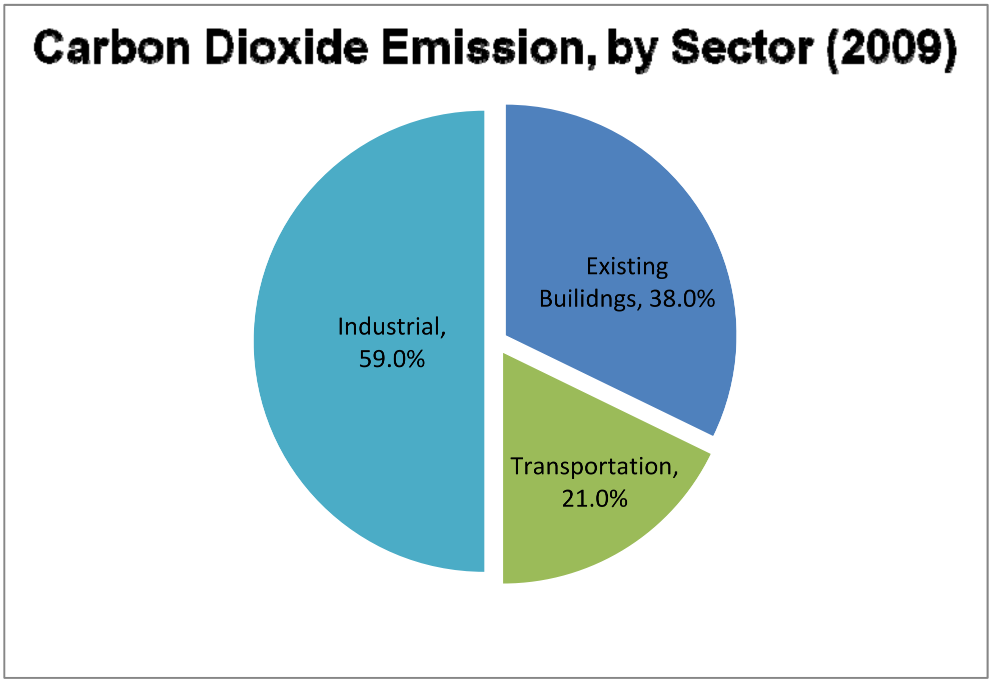


Figure 1.1 Carbon Dioxide Emissions - calculations provided by Stuart Kaplow

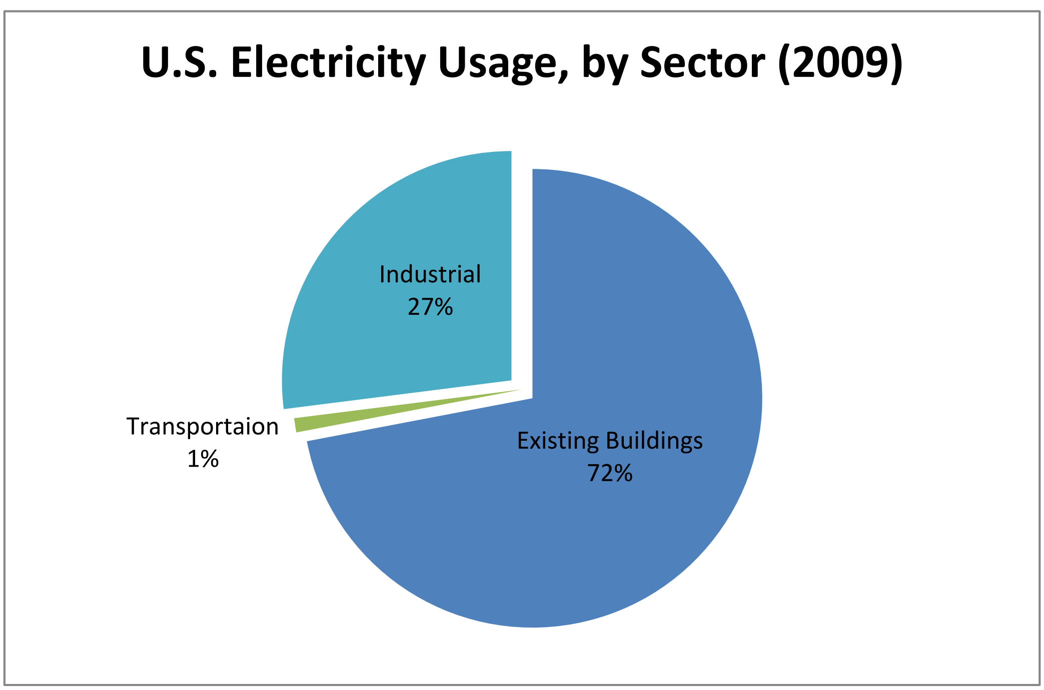


Figure 1.2 U.S. Electricity Usages - calculations provided by Stuart Kaplow

1.4 ECONOMICAL IMPACT

Furthermore, new construction intensively consumes many non-renewable resources. The only true renewable resource used in construction is sustainably grown and harvested timber (Binni and Carpeneter 2000).

The building's life cycle consists primarily of the construction phase, the renovation and maintenance phase, and the end-of life phase. According to the United States Environmental Protection Agency (EPA), the building construction industry uses large quantities of natural resources (Frisman 2004). In addition, deconstruction is a means to lessen these environmental and economic losses, throughout the recovery of existing building materials at the end of their life cycle and the reuse and recycling of these materials back into construction products. Deconstruction is the selective dismantling of building structures to recover the maximum amount of primarily reusable and secondarily recyclable materials in a safe and cost-effective manner (Guy 2005). Construction and demolition (C&D) debris is a waste stream generated by new construction, renovation, and demolition of existing buildings. Only 8% of the C&D debris is generated during the construction phase. However, 48% of C&D debris is generated during the building demolition at the end of its life cycle and 44% is generated during the renovation of the building structure.

The EPA has also estimated that C&D debris equals 25 to 30% of total waste produced in the United States each year. Construction activities consume 60% of raw materials and produce 160 million tons of C&D waste annually (Frisman 2004). The amount of C&D debris produced accounts for one third of the nation's non-hazardous solid waste generated each year. Also, roughly 60% of C&D waste generated, or an estimated 96 million tons, ends up in landfills every year, thus significantly contributing to the U.S. solid waste management challenge. Only 40% of C&D debris is being recycled every year.

The trend in the construction industry today is to partially or even completely demolish a building either when it is no longer serving its purpose, and thus modifications to the structure are needed, or when simply the building's useful life has expired and new construction must take place. Other examples for demolishing old buildings often argue that new construction of a building can bring prosperity to a town and provide employment for its people and improve living conditions (Nuta 2009). These arguments are true but somehow unconvincing. The demolition process is usually done using heavy mechanical equipment and can be accomplished in a matter of hours.

The fact that demolition takes place via heavy equipment such as cranes and wrecking balls, and its lack of intensive hand-labor makes the process a bit aggressive and violent. This means that most of the building materials might not be able to withstand the intensity of the process. As a result, the material will get destroyed and capacity for reuse will be diminished along the way. The most common end-of-use option for building materials that undergo the demolition process is down-cycling. Down-cycling is the process of converting waste materials or useless products into new materials or products of lesser quality and reduced functionality and typically degrades the materials quality and economic value (McDonough and Braungart 2002).

Table 1-A summarizes the estimates for construction and demolition materials generation from the construction, demolition, and renovation of residential and nonresidential buildings by the EPA in the United States in 2003. The estimated total is almost 170 million tons, with 39% coming from residential and 61% from nonresidential sources. Figure 1.3 provides a breakdown from the EPA, in percent of total, of the six building sectors that generate C&D materials. The largest sector is nonresidential demolition at 39%. Residential and nonresidential renovation materials make up 22% and 19%, respectively, followed by residential demolition at 11%. New construction represents 9% of total C&D materials, with residential construction at 6% and nonresidential construction at 3%.

Table 1 Estimated Amount of Related C&D Materials Generated during 2003 by the United States EPA

Estimated Amount of Building-Related C&D Materials Generated in the U. S. During 2003						
Source	**Residential**		**Nonresidential**		**Totals**	
	Million Ton	Percent	Million Ton	Percent	Million Ton	Percent
Construction	10	15%	5	5%	15	9%
Renovation	**38**	**57%**	**33**	**32%**	**71**	**42%**
Demolition	19	28%	65	63%	84	49%
Totals	67	100%	103	100%	170	100%
Percent	39%		61%		10%	

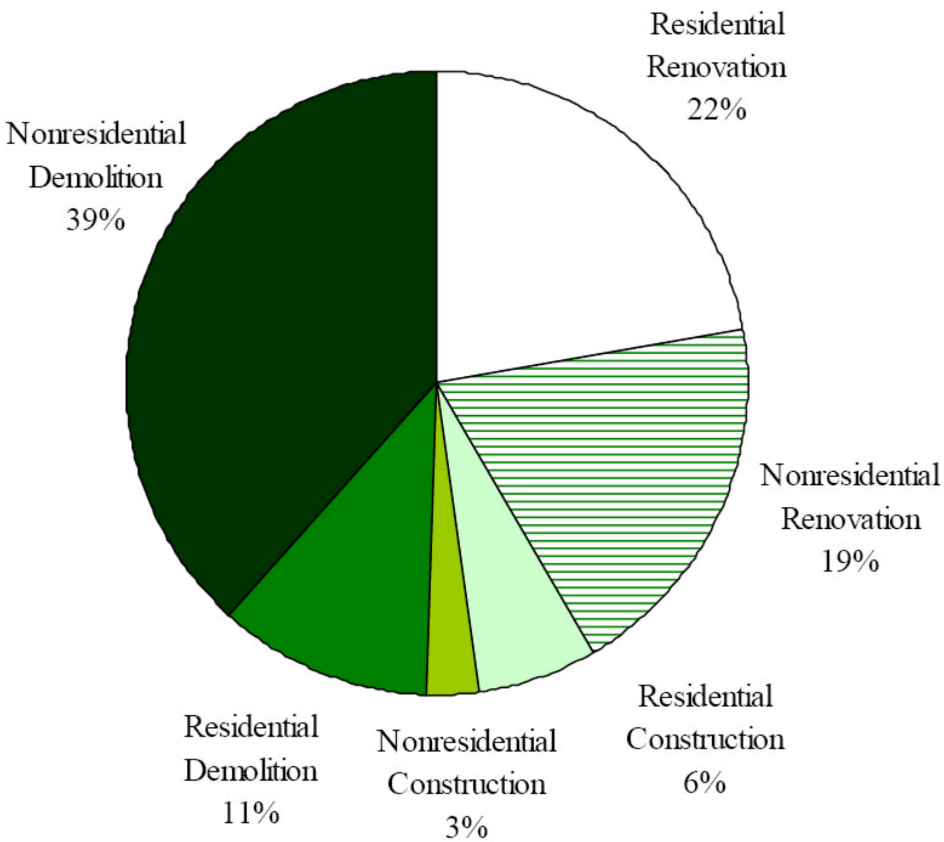


Figure 1.3 Breakdown of the total percent of the C&D materials in 2003 by the United States EPA

Vani Bahl (2005), an architect and column writer for Architecture Week, reported that “Construction costs are growing; we can’t afford to rebuild the environment every generation.” Based on figure 1.3, the manufacturing industry has increased greatly. The statistics reveal that building construction consumes roughly 40% of the raw materials entering the global economy every year and interestingly, about

85% of the total embodied energy in materials is used in their production and transportation (Bahl, 2005). If these numbers keep going up, raw materials will become scarce in the near future and that will be a major concern for the construction industry. For example, conventional oil production peaked in 2005-2006 and the flow to market of all hydrocarbon liquid taken together will start to diminish around 2010 (Heinberg 2007). However, adaptive re-use can provide an alternative method of construction and design that can help the construction industry in the future. Modern construction methods are incredibly wasteful of resources. Up to 20% of the total waste generated in the United States and other countries is directly attributed to building construction and demolition activities (Bahl 2005). Ultimately, re-using materials from existing buildings can save stakeholders money and time.

1.5 ABANDONED BUILDINGS

In addition, the problems created by abandoned lots and structures cannot be contained within property boundaries or city limits or stopped at county lines; they spillover to affect surrounding communities (Schilling 2002). As abandonment increases in a neighborhood, property values decline and owners become less willing, and perhaps less able, to maintain their real estate. In turn, more and more properties fall into disrepair and eventual abandonment.

Consequently, cotton mills of the late nineteenth century tell the story of how the Carolinas served as a trading post for cotton to be disbursed across the south and part of the reason for the banking industry developing in Charlotte. Between 1880 and 1920, the United States textile industry grew dramatically in the Southeast. In this area, labor was still cheap and growth was swift; in the Carolinas, more than 150 mills were built in the late 1800's. Mill production in the Southeast lasted about a century before cheaper labor elsewhere in the world led to decreased production and ultimately left empty mills scattered about the Southeast (Bergsman 2003). Vacant mills found in the

Southeast and obsolete mercantile buildings along the east coast are now architecturally significant and offer unique adaptive reuse opportunities.

Cotton mills, utilized for their textile factories, invoke images of America’s industrial strength and success (Kelso and Rabun 2009). As mills thrived, so did their surrounding communities. After the mills were no longer in use, developing towns and cities were left to search for stability and new opportunities outside their mill town identity (Kelso and Rabun 2009). Today, revitalized mills throughout the country serve as reminders of their historic roles and as demonstrations of reinvention.

The mill industry’s overall decline left an extensive legacy of vacant, often abandoned, and sometimes contaminated former mill sites. Susan Parker, the EPA Assistant Administrator for Solid Waste and Emergency Response, states “These properties now fall under the category of “brownfields”—defined by the U.S. Environmental Protection Agency (EPA) as “real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant (2006)”. Figure 1.4 depicts the EPA’s Brownfield Grant Program which has contributed to the revitalization of approximately 355 mill sites throughout the country (Parker 2006). Highlighted is the area of Charlotte, NC and Rock hill, SC.

The key is to remember that a building has a life; one wants to retain enough of the original to reflect that past (Campbell 1996).

Figure 1.4 Mill Properties Funded by EPAs Brownfields Program

Mill Properties Funded by EPAs Brownfields Program
Data pulled from Assessment Cleanup & Redevelopment Exchange System (ACRES)*

*Data do not include properties targeted by Section 128(a) State & Tribal Response Program Grants; geographic placement of dots may not be exact.

1.6 TAX INCENTIVES

Rehabilitating older buildings may also qualify owners for a tax deduction of a percentage of construction cost. The notion that local and state government agencies do not want to help is not true. Approximately 20% of the buildings on the National Register of Historic Places are in a designated Historic District and 10% of those buildings were built prior to 1936 (Rabu and Kelso 2009). In addition, renovations of old industrial buildings for a new industrial use qualify for 30% of tax incentives (Campbell 1996). Depending on the location or region of the country, the government is willing to help.

1.7 SUMMARY

In conclusion, this chapter provides a point of view on why abandoned buildings need to be preserved. For example, today's popular proposal for abandoned buildings is demolition. The demolition of structures produces enormous amounts of material that, in most countries, results in significant waste. The environmental impacts on an existing building can represent a number of challenges. Adaptive reuse can positively impact the environment through the recycling of materials, reuse of structural elements, and reduction in landfill waste. Deconstruction is a means to lessen these environmental and economic losses, throughout the recovery of existing building materials at the end of their life cycle and the reuse and recycling of these materials back into construction products.

Chapter 2: Background/Literature Review

2.1 LITERATURE REVIEW

In this chapter, the focus is on: how we presently deal with abandoned buildings. The research was conducted between providing insight into how adaptive buildings might accommodate sustainability while staying within the parameters of acceptable performance and standards within the building historic structure. Therefore, the research carried out preliminary investigation of stakeholders' views about adaptive reuse and strategies for improving the sustainability of existing buildings in South Carolina. The significance is examining how existing buildings can change their use which may identify the key factors needed to develop a best practice frame work and sustainable new buildings.

The first phase of the research involved a literature review of various resources. Figure 2.1 shows the various topics covered in the literature review.

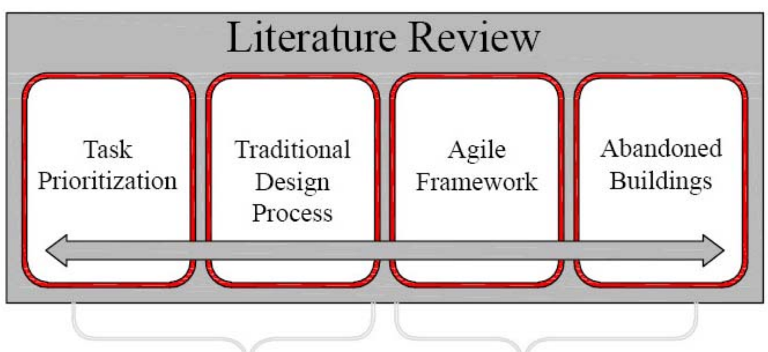


Figure 2.1 Literature Review

The task prioritization and agile framework portions of the literature review allowed the researcher a point of departure for an abandoned property that fit well with an adaptive reuse plan that employs sustainable building best practice. The research will use the information gained about task prioritization and agile framework to help develop the framework for this project and report.

The case study portions of the literature review allowed the researcher to verify the appropriateness of the case study medium for the framework development. The Old Cotton Factory portion allowed the researcher to establish the building context. The technological investigations portion of the literature review helped the researcher identify instances where the agile architecture method is an appropriate methodology for evaluating adaptive reuse buildings. The researcher used the information gained from the case study portion of the literature review and compared it to the agile method.

2.2 BACKGROUND

Traditionally, the research into assessing the adaptability of buildings has focused on new or proposed development projects and tends to concentrate on environmental criteria of sustainability. There has been little work to investigate new comprehensive strategies based upon better knowledge of the existing building stock, a need identified by Hassler et al. (2000). One approach that was investigated is Craig Langston's "adaptive reuse potential" model which uses mathematical equations to identify and rank existing buildings in Hong Kong that have high potential for adaptive reuse (Langston 2007). This model allows for traditional decision making processes of property stakeholders towards more sustainable practices, strategies, and outcomes. Use of multi-criteria assessment tools like SINDEX enables the full effects of buildings to be properly considered over their entire life cycle rather than their immediate period of ownership or function. SINDEX is a recent software tool that uses multiple criteria to calculate a sustainability index, and has the potential to completely replace conventional net present value methodologies for ranking and selecting projects (Langston 2007).

Another model that was explored is Peter Bullen's investigation in the adaptive reuse for commercial buildings in Western Australia. Bullen's main research is based around five questions that were built for a case study:

1. Is it economically more viable to extend the life of existing buildings through adaptation or demolish and rebuild?
2. What issues should be included in the decision process used to assess the suitability of a building for adaptation?
3. To what extent are heritage buildings in Western Australia exemplars of the economic, environmental, and social principles of sustainable development?
4. What examples of buildings in Western Australia illustrate the opportunities/barriers of adaptive reuse?
5. Should there be an assessment process in place in Western Australia that considers sustainable and reusable building construction and management methods?

This methodology is to have a survey of building owners in Western Australia and a review of literature concerning adaptive reuse of commercial buildings (Bullen 2007). The conclusions of the case study are that adaptive reuse enhances the long term usefulness of a building and is therefore a more sustainable option than demolition and rebuilding. The positive benefits for adaptive reuse identified during the research also support the tenets of sustainability and include: reducing resource consumptions, energy use and emissions, extending the useful life of buildings, being more cost effective than demolition and rebuilding (Bullen 2007).

Each of the aforementioned models takes a case study approach to the development of methodologies for prioritizing adaptive reuse. The first case study done by Langston, involves how you can find better uses for existing buildings in Hong Kong. The second case study by Bullen, involves an investigation of viable of adaptive reuse of commercial buildings and the impact it has on the existing built environment in Western Australia. However, neither of the case studies addresses an approach to find a better way for stakeholders to develop a best practice for adaptive reuse for sustainable buildings.

2.3 WHAT IS ADAPTIVE REUSE

Adaptive reuse is the act of finding a new use for an existing building. It is often described as a process by which structurally sound older buildings are developed for economically viable new uses (Austin 1988). Reuse can also mean rehabilitation, renovation or restoration works that do not necessarily involve changes of use (Holyoake and Watt 2002). Rehabilitation is the recycling of buildings involving restoration and new construction (Gregory 2004; Douglas 2002). The difference is that restoration returns a building to the condition it was when originally constructed, whereas renovation modifies a building, but does not involve a change in use (Douglas 2002).

Adaptive reuse has a major role to play in the sustainable development of communities, circumventing the wasteful processes of demolition and reconstruction. Reuse can create valuable community resources from unproductive property while substantially reducing land acquisition and construction cost, revitalizing existing neighborhoods, and helping to control sprawl (Department of Environment and Heritage 2004).

However, adaptive reuse has unique aspects and technical concerns. There are structural, infrastructures, and code-related issues that must be addressed before the building can become a functional complex and can include everything from historic preservation to hazardous materials assessments (Hickey 2005). Design is another concern for adaptive reuse. Unrestrained design concepts have to be balanced against the constraints inherent to a major renovation project (Hickey 2005).

2.4 CURRENT DESIGN PROCESS

In traditional design process, the architect is hired by the owner or stakeholder to develop schematic design before anything is finalized. After the schematic design is approve, the invested stakeholder can allow the architect to further invest time and energy on a complete set of drawings to give to the contractor, as depicted in figure 2.2.

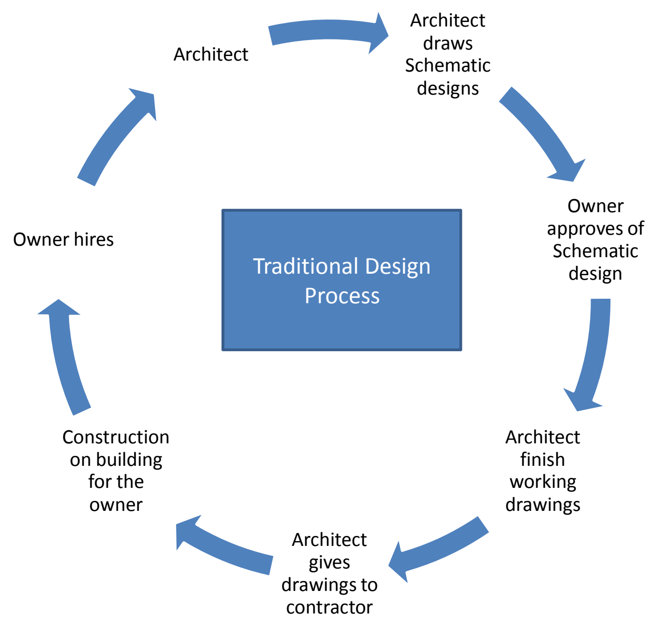


Figure 2.2 Traditional Design Process

Therefore, the traditional design process is similar to design-bid-build in construction. The owner secures the services of an architect to design a project. Once the design is 100% complete the project is then put out for bids from general contractors. There are many advantages to the traditional design-bid-build process; however, some owners have been persuaded that because you cannot commence construction until the design documents are 100% complete, that the design-bid -build process is not the right choice. Figure 2.3 depicts the traditional way of construction.

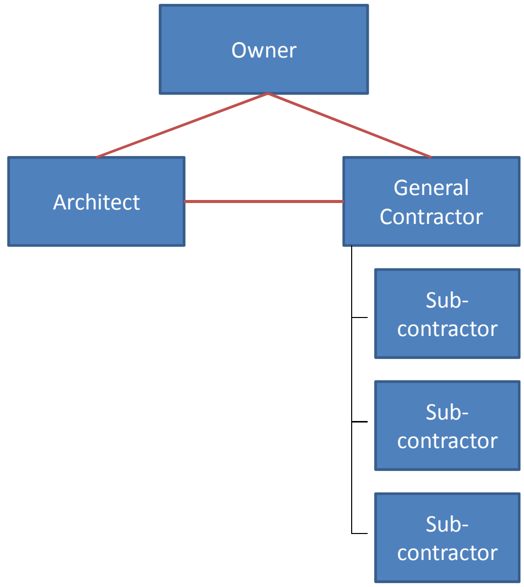


Figure 2.3 Traditional way of Design-bid-Build

2.5 AGILE METHOD

Methods used in other domains such as software suggest an alternate approach to this challenge that addresses the weakness of the traditional approach. In contrast to the traditional design and construction process, the agile method is an engineering tool that forces IT professionals to work together effectively on data aspects of software systems which seek the ability to put their stakeholders priorities first. Most engineering software development is chaotic activity, often characterized by the phrase "code and fix"(Amber 2004). However, these systems are usually written without an underlying plan, and the design of the system is cobbled together from many short term decisions. The software works pretty well with small systems but as the system grows it can become difficult to add new features to the system. Agile Modeling (AM) is a practice-based methodology for effective modeling and documentation of a software-based system, as depicted in figure 2.4 (Amber 2004). Also, for the stakeholder, agile modeling can give a collection of best practices which is also shown in the figure 2.4. The agile method imposes a disciplined process upon software development with the aim of making software development more predictable and more efficient which is called plan-driven methodology (Fowler 2005).

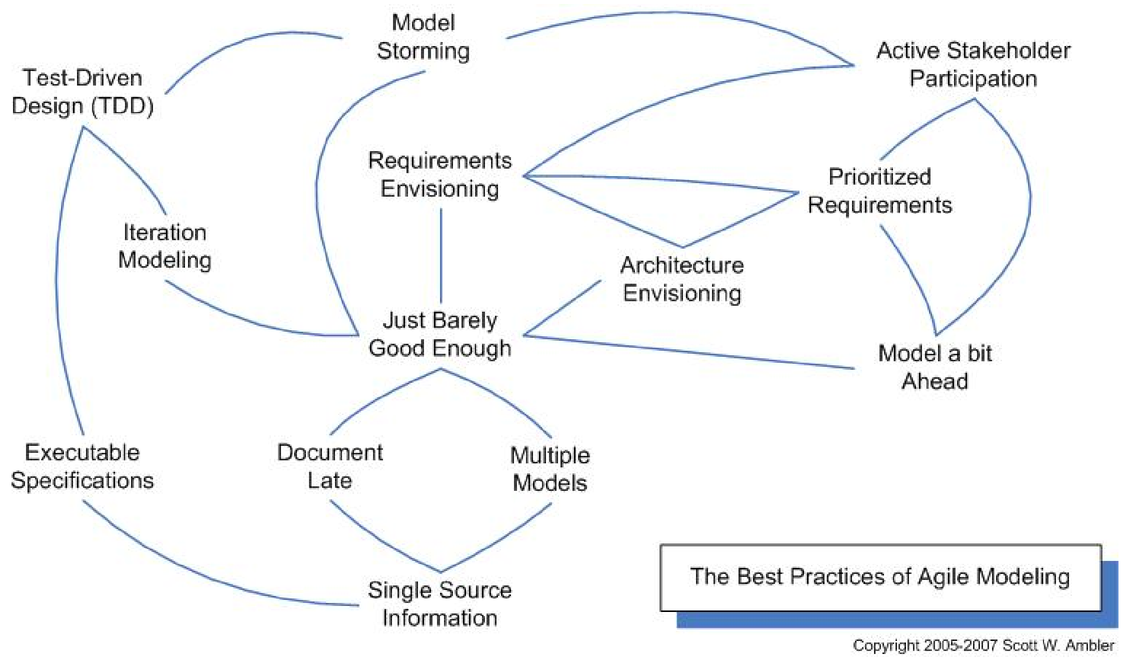


Figure 2.4 Agile Modeling (AM) is a practice-based methodology by Scott Ambler

Similar to design architects like Frank L Wright; an agile architect's primary goal is to provide the best solution for the stakeholder's investment (time, money, and effort) into the project. The Agile Architect's ambition is to deliver a solution which best meets the needs and aspiration of all the stakeholders, recognizing that this may mean a trade-off. The Agile Architect must work in a way that makes the best use for the various resources invested in the project. . Andrew Johnson of Questa Computing Ltd (2007) listed key objectives for an Agile Architect:

1. Deliver working solutions
2. Maximize stakeholder value
3. Find solutions which meet the goal of all stakeholder

The Architect's primary objective is to create a working solution for the stakeholder. This is a different focus to most other agile methods, which assume that the solution is to develop or change software. However, like other agile developers the Agile Architect focuses on the solution, not on documents and management deliverables which don't contribute to the solution.

In addition, Agile Architecture Model development explicitly includes an initial architectural modeling effort during Iteration 0 of an agile project, as depicted in figure 2.5 (Amber 2007). In the beginning, architecture modeling is particularly important for scaling agile software development techniques to large, complex, or globally distributed development efforts. A common agile practice is to perform some high level architectural modeling early in the project to help foster agreement regarding the technical strategy within the team and with critical stakeholders. The goal at this point is to identify an architectural strategy, not write mounds of documentation, enabling you to do this swiftly (Fowler 2005).

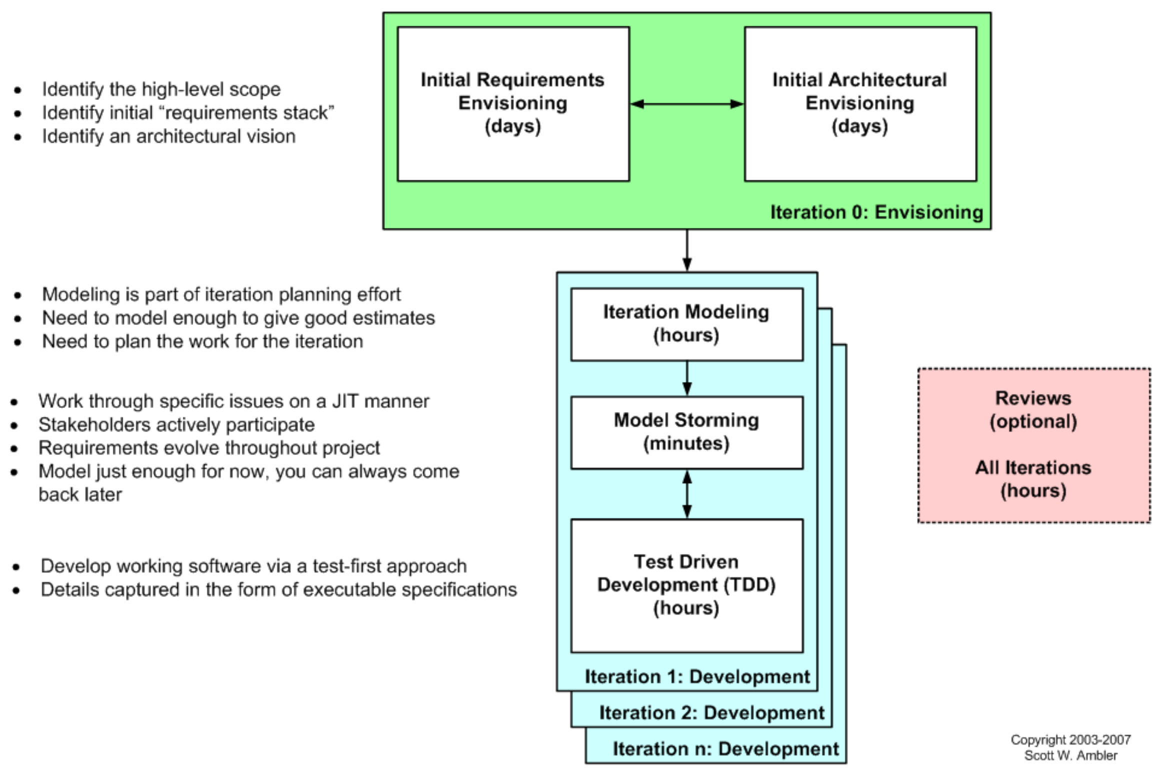


Figure 2.5 Agile Architecture Modeling (AAM) development by Scott Ambler

Although, the Agile Method is an IT methodology, the theories can be used in design and construction, as depicted in figure 2.6. There are two fundamentally

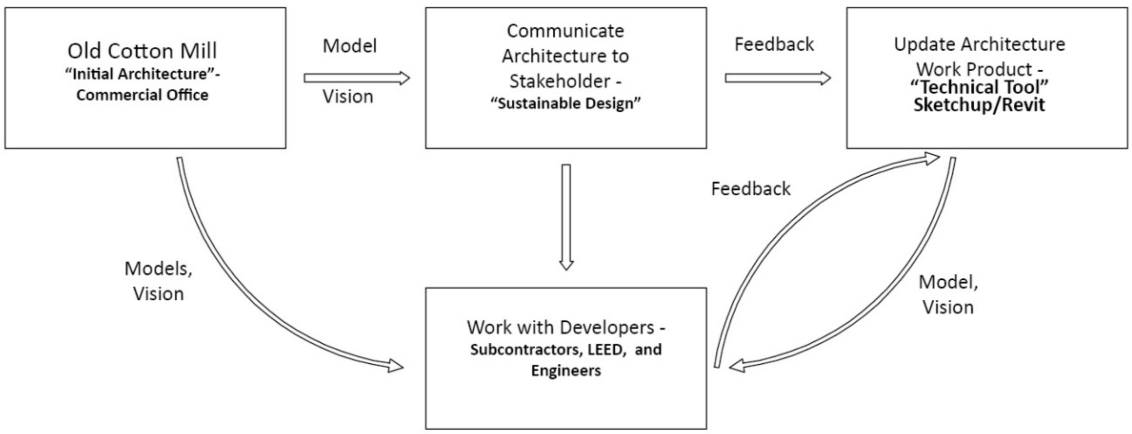


Figure 2.6 Bases for the Agile Method in Design

different activities. The first is design which is difficult to predict and requires valuable and creative people followed by construction. Once the stakeholder has the design, they can plan the construction. Once the stakeholder has the plan for construction, they can then deal with construction in a much more predictable way. In civil engineering, construction is much bigger in both cost and time than design and planning. In architecture, design and planning is bigger in cost and time.

From a design capacity, the agile method can provide the stakeholder with a faster feedback. The design team can identify a person(s) ons to visit the site to develop a baseline adaptive reuse plan for the facility. The individual should use appropriate techniques such as sketches and technical software to conduct a detailed investigation and evaluation of the building. At that point, the stakeholder can make a determination as to the feasibility of the adaptive reuse project. If the scope of damage or deterioration of the building exceeds a level that the designer deems appropriate, the designer should notify the owner/stakeholder to allow them to make a decision regarding the future of the facility.

Agile methodology presents several challenges for the industry stakeholders and professionals. First, if the initial design is not properly assessed, the contractor will not be able to give a an accurate estimate on the facility. Subcontractors are often bound to contracts that precisely stipulate what is required of them. Additionally, developing large, complex building can become difficult because the amount of money and time may be critical to the architectural aspects that are difficult to change because of the critical role they play in the core services offered by the stakeholder. In such cases, the cost of changing these aspects can be very high and, therefore, it will pay to make extra efforts to anticipate such changes early. In general, some aspects of the agile method can benefit stakeholders while other projects may benefit from a more traditional practice.

2.6 DRIVING PROBLEMS

In order to fully develop a feasible framework for stakeholders to approach adaptive reuse, the researcher aimed to address:

- Does the Agile Method provide an advantage over traditional best practice for sustainable adaptive reuse projects?

2.7 SCOPE

The scope of the research includes demonstrating how the Agile Method can develop a feasible framework for the Old Cotton Factory in South Carolina. This analysis includes:

- Evaluation of traditional practice verses the Agile Method alternatives through three scenarios. The scenarios are based on the researcher personal choice of programs which are:
  - Scenario #1 – Horticulture Operations

    - Scenario #2 – Art Gallery and Horticulture Operations (mixed-used)
    - Scenario #3 – Private Office and Rental Space (mixed-used)
- Comparison of the traditional practice to the Agile Method

Using the case study as a baseline of traditional practice, the scope of the research takes a first step forward in demonstrating how the Agile Method can contribute to adaptive reuse projects for a stakeholder.

2.8 SCOPE LIMITATION

Therefore, as the research involves around how adaptive reuse can be facilitated in more ways than the traditional process, previous research has focused mainly on new or proposed development projects and tends to concentrate on environmental criteria of sustainability in lieu of best practice. The Agile Methods that is used in other domains such as software suggest an alternate approach to this challenge that addresses the weakness of the traditional approach. In contrast to the traditional design and construction process, the agile method is an engineering tool that forces IT professionals to work together effectively on data aspects of software systems which seek the ability to put their stakeholders priorities first. One case study on an adaptive reuse project by McClure, Nicholson, and Montgomery Architects will be compared to in a demonstration. Consequently to the case study, the project will be the baseline for developing the Agile Method framework for best practice for adaptive reuse projects; however, the scope limitation is the Old Cotton Factory in South Carolina.

Chapter 3: Methodology

3.1 METHODOLOGY

In this chapter, the research intends to use a demonstration of the Agile Method and compare that approach to an existing building to determine which approach is feasible for the stakeholder to decide on the future of the existing building. The methodology to the research involved several phases. Figure 3.1 provides a graphical representation of the research approach followed by explanations of each phase of the methodology. The initial design of the Old Cotton Factory (completed by MNM Architects) will be the basis for case study. The researcher will take the information and break it down into different scenarios to see if the Agile Method is the best practice for adaptive reuse.

3.2 POPULATION IDENTIFICATION

After the literature review was conducted, identification of the building was the next step. For this purpose, Jim Montgomery from McClure, Nicholson, and Montgomery Architects (MNM) was contacted to identify a suitable building for the case study to be compared. McClure, Nicholson, and Montgomery Architects were contacted because the firm deals primary with adaptive reuse projects. They have just completed a renovation of an old cotton mill in Rock Hill, SC. This project is the base of the demonstration.

For more than 100 years, Rock Hill, South Carolina, was an important cotton market for county farmers. After the Civil War, local entrepreneurs recognized the potential for industry among the economic devastation that war and reconstruction had brought to the piedmont area of the Carolinas (Bodine 2005). What the surrounding counties near Rock Hill had were fields of cotton; what they lacked was the ability to convert raw cotton into fabric through local mass production. Investors within the Rock

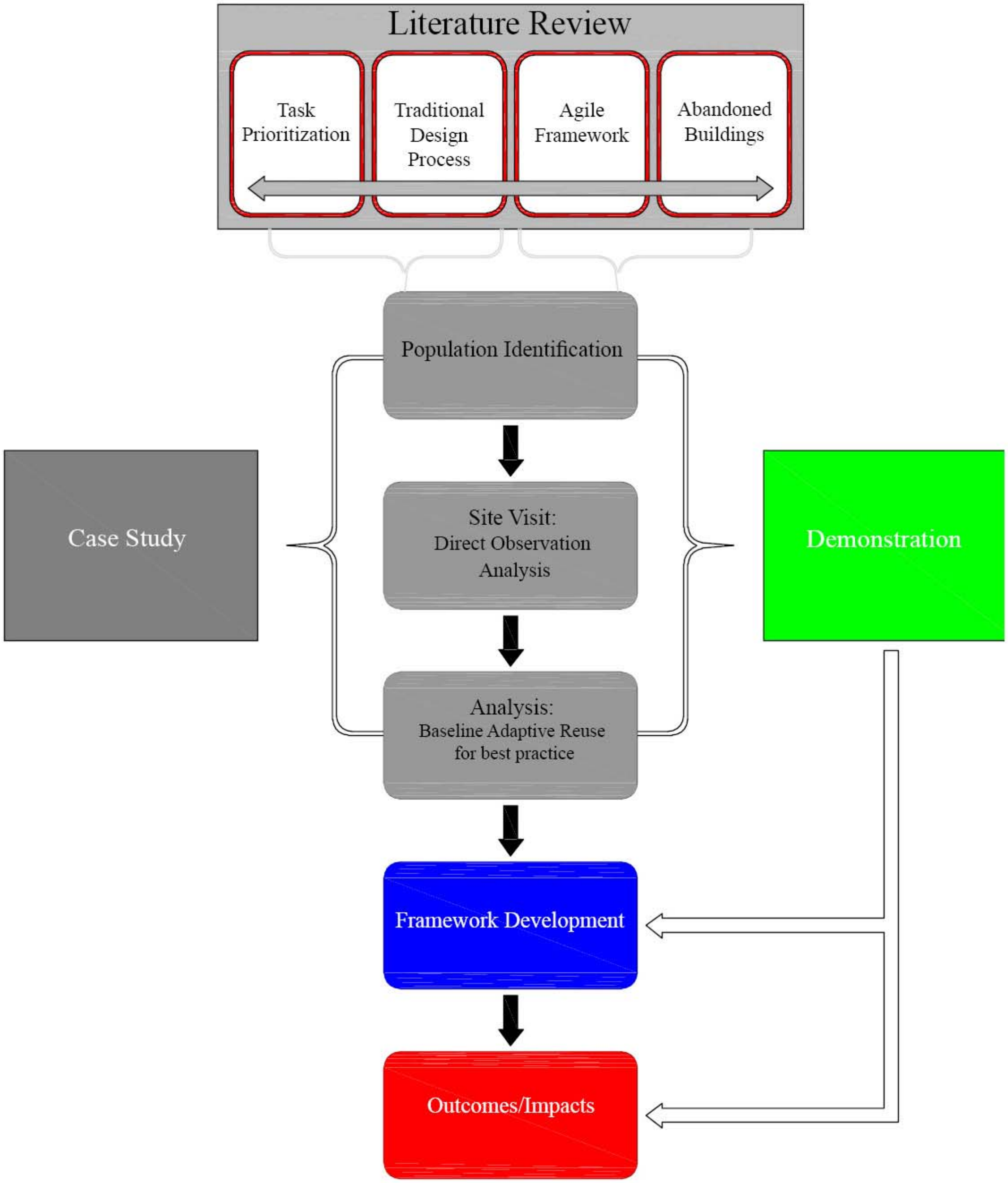


Figure 3.1 Methodology Approach

Hill business community recruited A.D. Holler to build a factory patterned after the Camper Down Mill on the Reedy River in Charlotte, NC. Steam powered by coal boilers initially, the Mill moved to electric power once the hydroelectric dams were developed along the Catawba River during the early part of the 20th century. The population of Rock Hill grew as well from 800 people in 1880 to over 5,500 by 1895 (Boline 2005).

3.3 SITE VISIT

After identifying the building with Jim Montgomery, reviewing the site pictures was conducted to determine which areas were most needed for repair and demolish. Image 3.1 and 3.2 depicts the elevations of the tower and windows of the factory in Rock Hill. The local textile industry fell on hard times as well throughout the next couple of decades, but rebounded following World War II. The arrival of the Boll Weevil and a lack of proper crop rotation contributed to the decline of cotton in the Carolina Piedmont (Bodine 2005). Throughout the 20th century, Rock Hill's Old Cotton Mill went through several owners, including Carhartt Inc., Belvedere Mills, Crescent Cotton Mill, Cutter Manufacturing Co., Goldtex Mills, and Edward Mills (Bodine 2005).

Image 3.1 Exterior façade of the Old Cotton factory – All images provided by MNM Architects

Globalization in the latter part of the century eventually ended the textile industry's reign as the largest employer in Rock Hill. A gradual decrease in cotton crop production and an increase in labor costs spurred the decline of the area's textile industry until it virtually ceased to exist in the early 1980s. As a result, Rock Hill lost its major economic driver and faced a citywide unemployment rate of 17% (Bodine 2005). In addition, the neighborhoods that existed as mill communities for generations suffered severe economic and community impacts including declining housing and infrastructure, rising crime and health concerns.

Image 3.2 Exterior of the Old Cotton Factory

The Old Cotton Mill operations ceased in 1967 and, in its later years, the space operated as Plej's Textile Mill Outlet until it closed in 2001. Image 3.3 through 3.8 depicts how over time the interior spaces has dilapidated after years of little investment in building improvement, the Rock Hill Economic Development Corp. purchased the building and, in 2006, sold the building to an investment group headed by Bryan Barwick, Gary Williams, and Bob Perrin who spent over $14 million renovating the 100,000 square foot building into mixed retail/business offices (Bodine 2005). It was at this time, the Old Cotton Mill received the South Carolina Historic Preservation Honor Award in recognition of the extensive restoration and interpretation of the building's architectural heritage.

Image 3.3 Interior space of the ground floor in the addition part of the Old Cotton Mill

Image 3.4 Interior space of the ground floor in the addition part of the Old Cotton Mill

Image 3.5: View of the interior of the Old Cotton Mill

Image 3.6: View of the window that needs to be replaced

Image 3.7: View of the tower

Image 3.8: Interior space of the Old Cotton Mill

3.4 ANALYSIS OF BUILDING

Based on the analysis of MNM Architects, the majority of the facility of the Old Cotton Mill can be renovated. Only a few areas will need to be removed. In addition, the research that was conducted by MNM Architects allowed the researcher to make some decisions. The researcher was able to identify the areas of interest in the building based on the site visit by MNM Architects and the researcher knowledge of design, the research was able to develop several scenarios for the client best interest.

3.5 FRAMEWORK DEVELOPEDMENT

For this purpose, MNM Architects decided that the best method of design for the client would be the traditional method. However, the demonstration that was used is the Agile Method. Based on the researcher opinion on what is best for the client and important stakeholders in the project, the agile method provided a faster solution for the owner/client. The idea to bring in important stakeholder (contractors, owner, consults) can benefit the projects effectiveness and efficiency, as shown earlier in figure 2.6.

Chapter 4: Case Study

4.1 CASE STUDY

The case study format allows the researcher to excel at bringing an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. Researcher Robert K. Yin defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real life context when the boundaries between phenomenon and context are not clearly evident (Yin 1984). Therefore, the research intends to follow the traditional design process framework for the Old Cotton Factory which will utilize the case study model.

4.2 POPULATION IDENTIFICATION

For this purpose, Jim Montgomery from MNM was interviewed to assist the research to identify the population identification for analysis in the project which includes the Old Cotton Factory and relevant stakeholders in the project and figure 4.1 show the stakeholders that are influential for the project. The figure illustrates an adaptive reuse framework that can integrate the three main bodies: Building (historic), Agencies (owner), and Activities (material). The framework expresses that the life cycle of a building begins with the different agents that are responsible for the use. The necessary activities that the owner must consider are issues that will affect the sustainability of the construction industry.

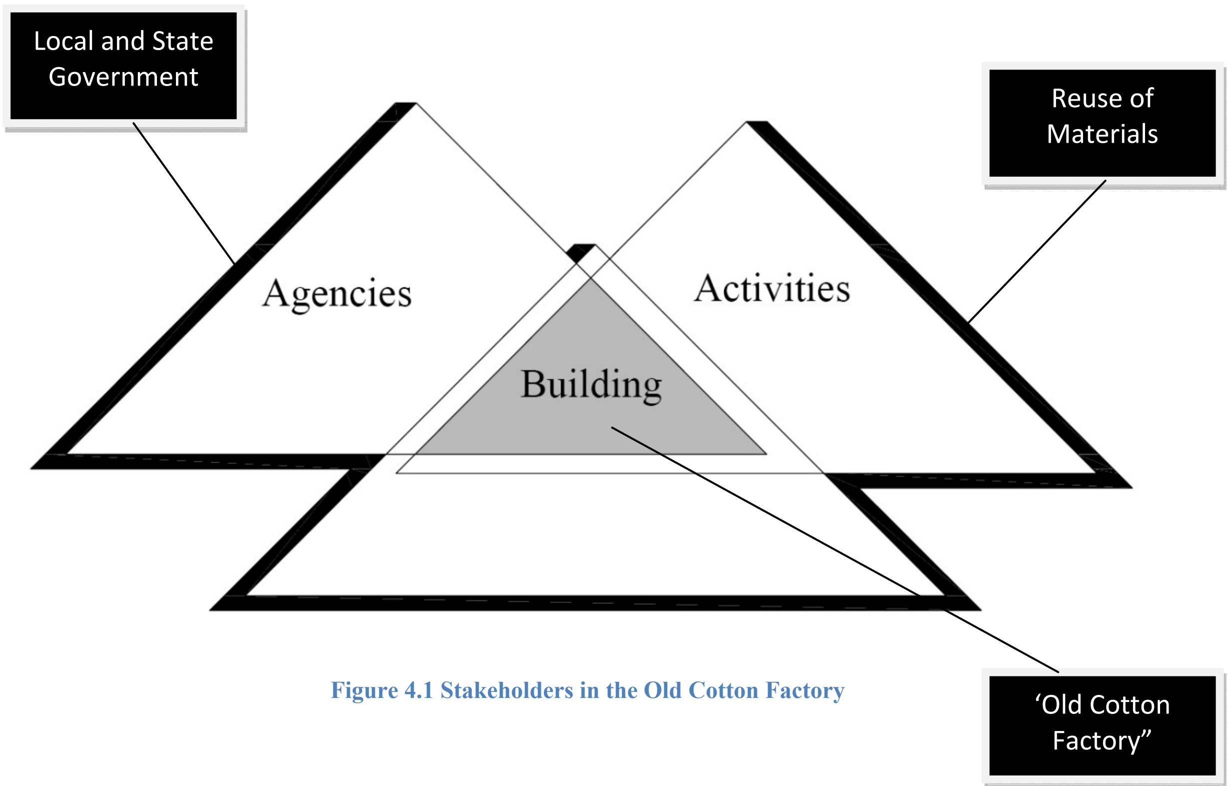


Figure 4.1 Stakeholders in the Old Cotton Factory

4.3 SITE VISIT

In addition, Mr. Montgomery conducted several site visits and interviewed major stakeholders. His research determined several areas that required attention for the reuse of the Old Cotton Mill. Originally, the Old Cotton Mill was a 45,000 square foot brick and wood structure. Throughout time, additions were added which increased the square footage to 90,000, depicted in image 4.1. Steel infrastructure replaced the majority of the wood from the previous design. The major building elements include: brick façade, with one brick chimney, and wood floors, wood beam and columns, and steel beams and columns.

After examining the structure, the researcher chose to focus on how to establish guidelines for assessing the initial condition of a potential building, and given that condition, run some scenarios for different types of uses that involve calculating sustainability variables for the Old Cotton Factory.

Image 4.1 The Old Cotton Mill with additions

4.4 COST ANALYSIS

Additionally, McClure, Nicholson, and Montgomery Architects was able to find financial records of major investors who wanted to help with the renovation of the Old Cotton Mill, depicted in figure 4.2. The Master Development Plan was financed by $1,540,000 pledged by the EPA and the United States Department of Housing and Urban Development. Additional federal grants were used to complete the assessment, cleanup, and redeveloped. The financial information was important because it allowed the stakeholder to know how much capital they had to work with and how that information could influence the use of the facility.

S.C. Department of Health and Environmental Control	
Funding Source	Amount
U.S. EPA Brownfields Revolving Loan Fund Loan	$425,000
U.S. EPA Brownfields Assessment Grant	$200,000
U.S. EPA Brownfields Cleanup Grant	$160,000
HUD Community Development Block Grant (CDBG)	$755,000
Total	$1,540,000

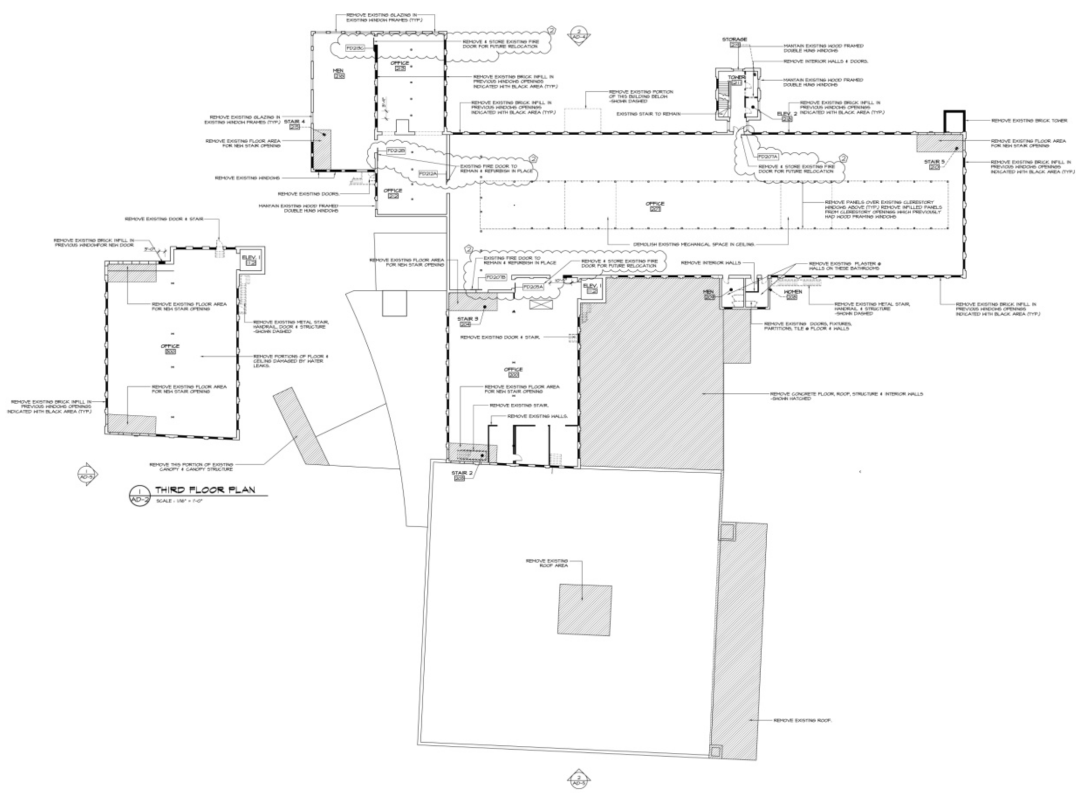
Figure 4.2 The Financed Master Development Plan Provided by EPA

4.5 OUTCOMES OF KEY STAKEHOLDER DICISION

Although, MNM Architects initially chose to approach the design by the traditional method. MNM Architects is responsible for envisioning the initial design and then bringing it to the rest of the project team for feedback and subsequent evolution. MNM Architects had to work with the key project stakeholders (owners/ contractors) in order to ensure that the best use for the building is achieved.

After the stakeholders approved the initial design, MNM Architects used AutoCAD to a produce a layout which is depicted in Figure 4.3. Based on the recommendation of the stakeholders, the AutoCAD layout was used to produce a three dimensional image depicted in Figure 4.5. The primary goal of architectural modeling should be to come to a common vision or understanding with respect to how the system can add value to the framework.

Figure 4.3: AutoCAD drawing of the Old Cotton Mill provided my MNM Architects



In the end, the total completion of design and construction process of the Old Cotton Factory was completed in two and a half years. When asked what was the major complaint or concern with the project, Mr. Montgomery responded by saying that the communication between the architect and contractor was not good in the beginning but slowly got better as the project went on. Images 4.2 and 4.3 show what the building looks like today.

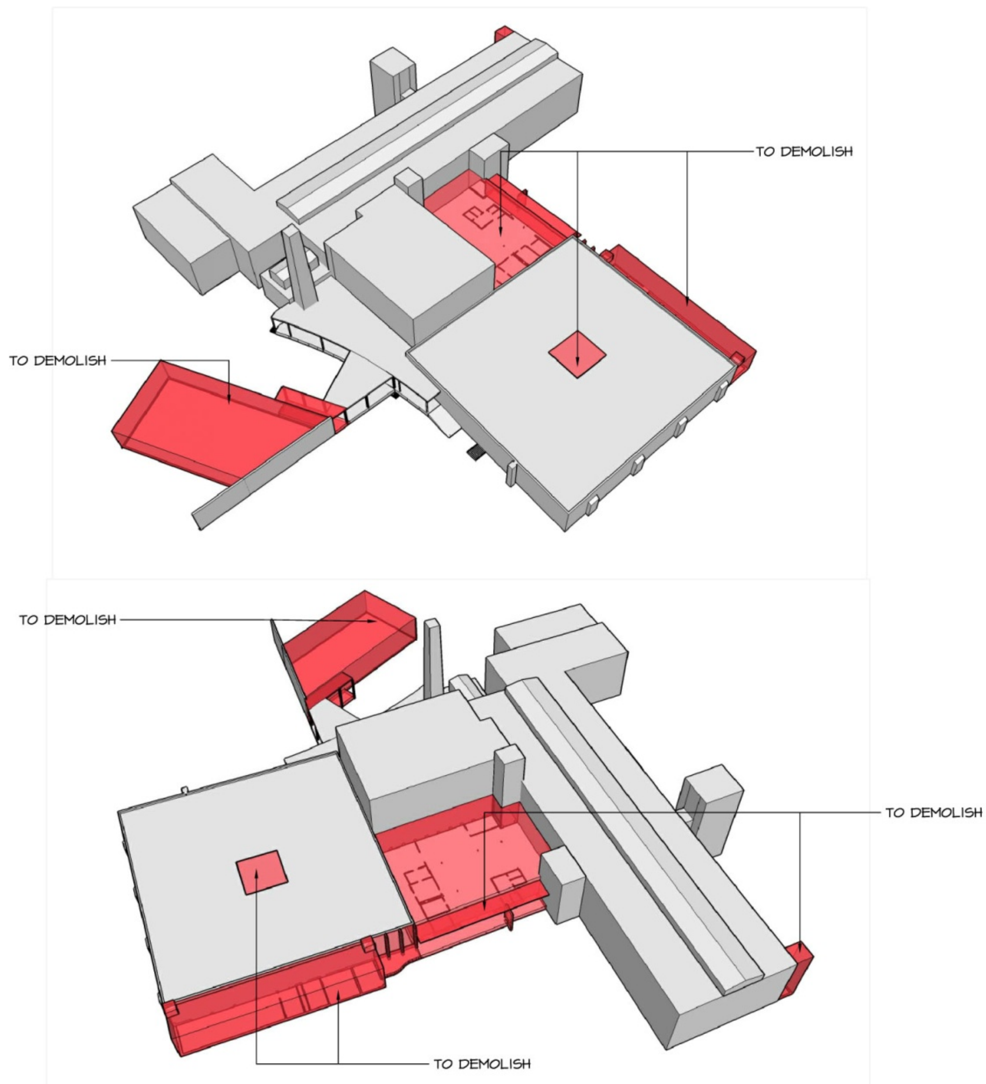


Figure 4.4 3-D of the Old Cotton Mill

Image 4.2 The renovation of the tower - image by MNM Architects

Image 4.3 The renovation of the interior space - image by MNM Architects

Chapter 5: Demonstration of the Agile Method

5.1 AGILE METHOD

In this chapter, a demonstration on how effective can the Agile Method can aid the client compared to the traditional method. In contrast to how MNM Architects initially chose to approach the design by the traditional method, the researcher conducted three scenarios using the Agile Method to conclude if the Agile Method is appropriate. Figure 5.1 depicts the framework for all three scenarios that will be used in the demonstration. The researcher is responsible for envisioning the initial design and then bringing it to the rest of the project team for feedback. The project team could consist of LEED accredited members, subcontractors, and engineers. In the demonstration, he researcher must work with the key project stakeholders in order to ensure that the best use for the building is achieved. After the stakeholders approved the initial design, the researcher used AutoCAD to a produce a layout.

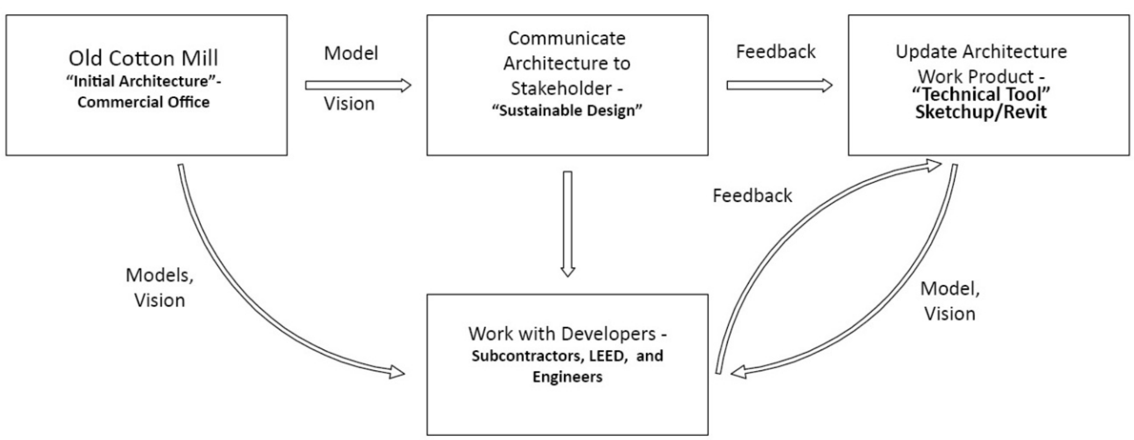


Figure 5.1 Old Cotton Mill Factory Process

During the demonstration, the researcher determined several areas that require attention for the adaptive reuse of the Old Cotton Mill based on the research from MNM Architects. An analysis of materials was also conducted for the demonstration to show how much materials will cost on a macro scale, which will be in the appendix. The first step in the adaptive reuse plan is to stabilize and rehabilitate the existing structure in a manner sensitive to the historic nature and importance of the building, and recognizing those elements that may or will be incorporated into the proposed new use of the building. The second step is to assess the impact of three different adaptive reuse scenarios established by the Old Cotton Mill. The scenarios are based on the researcher personal choice of programs which are:

- Scenario #1: Full utilization of the Old Cotton Mill for storage, maintenance and horticulture operations.

- Scenario #2: Partial utilization of the Old Cotton Mill for storage, maintenance and retail operations, and the remaining space dedicated to some "broadly defined public space" or as an arts incubator facility.

- Scenario #3: Full utilization for private office and retail and rental space at market rates.

5.2 BASIC ADAPTIVE REUSE PLAN

First, the principal initial focus of the rehabilitation plan is to identify the significant elements of the building and immediately stabilize those elements for future rehabilitation and incorporation into one of the three adaptive reuse scenarios.

It will become evident later in the description of the scenarios that the building area and volume is far in excess of the specific needs of the Old Cotton Mill; therefore, as a first step in the rehabilitation process it is recommended that, if permissible, partial existing basement located on the east corner of the two-story cotton mill building, and the two-story operation room which is located in the west corner of the building, be demolished. Although these structures appear in the Sanborn Map of 1942, and the operation building and the brick tower dates back to the period of significance established in the National Register Nomination form, they are not part of the original footprint of the building. The operation building in particular is significantly deteriorated and contains hazardous masonry conditions at the top of the north and south walls. The masonry from these structures should be salvaged and reused for repairing the exterior masonry of the remaining building.

Based on the literature review by MNM Architects, these materials are very important with the condition of the Old Cotton Mill. The highest priority of the rehabilitation plan is to provide a weather tight enclosure for the building interior. Mr. Montgomery wanted to utilize a “top down” approach, which starts from the top and work your way down, this entails the following steps:

1. ROOF REPLACEMENT AND PARAPET RECONSTRUCTION
    - a) Remove 100% of the existing roofing and related insulation materials.
    - b) Remove 100% of the existing roof deck material.
    - c) Repair and replace existing or missing roof framing members as required. (Our preliminary evaluation indicates that this work is limited to rafters and that the principal beams and purlins are structurally sound.)
    - d) Install new plywood roof deck material.
    - e) Dismantle and rebuild 100% of the existing parapets, maintaining the current corbelled profile of the masonry.
    - f) Reinstall original clay tile coping on top of the newly reconstructed parapets. Where sufficient clay tile coping material is not available, install a temporary aluminum coping.
    - g) Install a temporary single-ply roof membrane over the entire structure.
    - h) Provide temporary aluminum scuppers and downspouts for water relief and protection of the wall surfaces below.

2. WINDOW AND DOOR OPENING PROTECTION
    - a) Remove non-weather tight window and door closure assemblies and replace with new weather tight assemblies that will provide a minimum five years of useful life.

3. MASONRY

a) Grind out and repaint 100% of the exterior mortar joints (except as indicated in Item b) below).
b) Replace selected and limited areas of deteriorated masonry.
c) Grind out all cracks in the concrete string course below the second floor windows and install sealant.
d) Apply breathable masonry coating to the concrete string course below the second floor windows.
e) Thoroughly wash down all exterior masonry.

4. INTERIOR

a) Remove water from all pit areas. (Please note that the water should be tested prior to removal to determine if it is contaminated by pesticides or industrial waste, and properly removed and disposed of.)
b) Once the shell of the structure is weather tight, begin the process of slowly drying out the interior. (Please note that as the interior surfaces of the masonry begin to dry, moisture will be drawn from the interior of the wall assembly, and efflorescence may form on the interior surfaces. If this occurs, it should be a temporary condition.)

This work should be completed as soon as possible. The remaining tasks can be addressed as the planning process progresses, with the understanding that the conditions will continue to deteriorate and the related repair costs will continue to rise.

5.3 ADAPTIVE REUSE-SCENARIO #1

As mentioned previously, the square footage of the Old Cotton Mill is 90,000 square feet. The program established by the Old Cotton Mill for adaptive reuse under Scenario #1 requires significantly less area then the building provides. The maintenance storage and horticulture operations will cover 25,019 square feet that is being used by the Old Cotton Mill represents only 28% of the footprint of the building. The remaining areas proposed in the facility that are not assigned under this scenario will be emphasized as unassigned.

The researcher has provided two possible options for this scenario. In figure 5.2 and figure 5.3, Option “A” utilizes spaces #1a,#1b, #1c, #3, #6a, #6b, #8a, and #8b for

Old Cotton Mill activities. The remaining spaces #2, #4, #5, #7a, #7b, #9 and #10 remain unassigned. These may be considered for future expansion of Old Cotton Mill activities.

In figure 5.4 and figure 5.5, Option "B" utilizes spaces #1a, #1b, #1c, #2, #3, #6a, #6b, #7a, #7b, and #9 for Old Cotton Mill activities, and spaces #4, #5, #8a, #8b, and #10 remain unassigned. Both options would provide for paved employee parking.

The advantage of Option "A" is that it makes use of the large one story wing at the west end of the building. This space will be easily accessible to machinery and equipment, and will be much more cost effective for providing heat to those areas requiring it. The disadvantage is that the Old Cotton Mill activities are separated into two discrete clusters.

The advantage of Option "B" is that it consolidates the Old Cotton Mill activities; however, it necessitates the use of a large volume space, and the required related infrastructural improvements, with no significant benefit to the building or to the Old Cotton Mill.

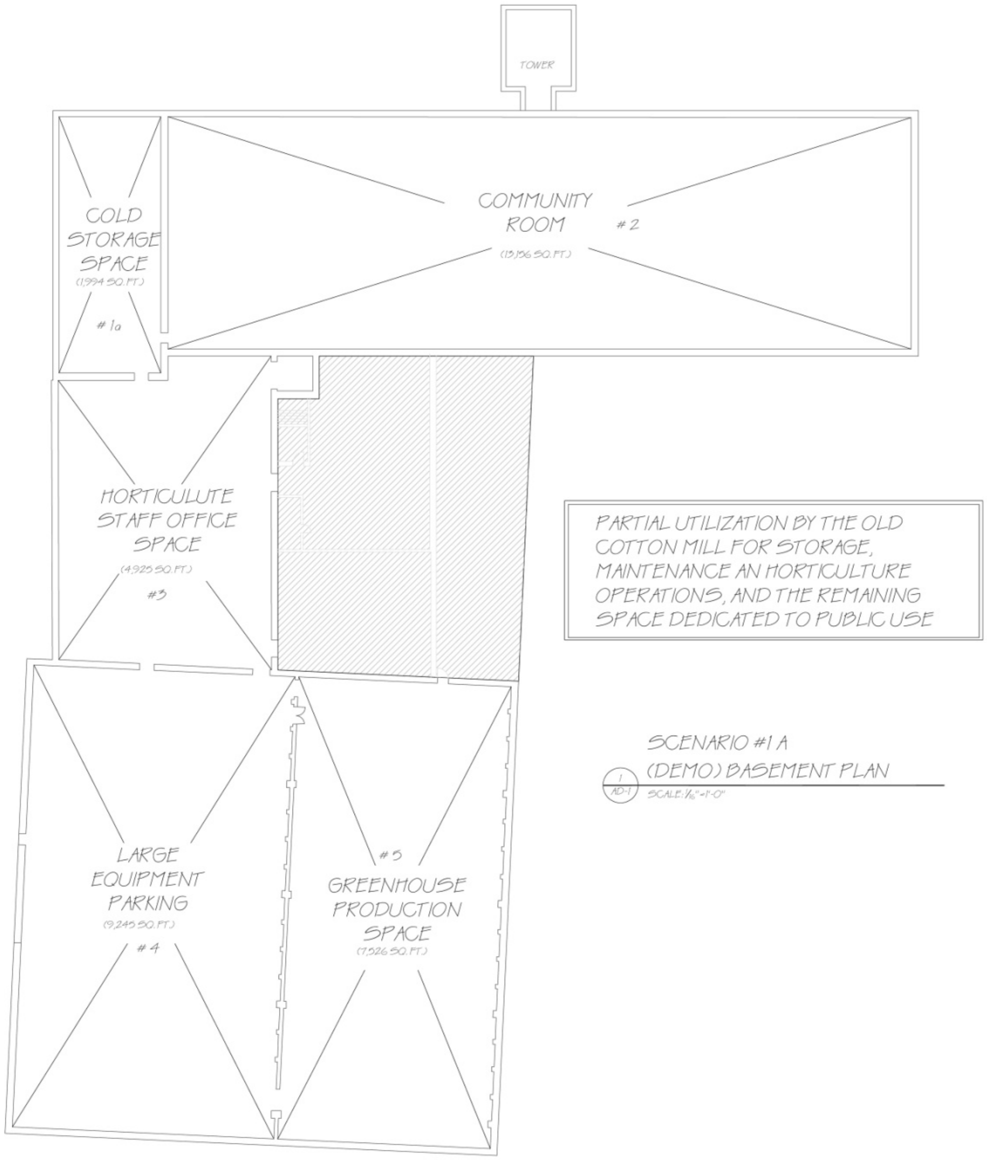


Figure 5.2 Horticulture operations - Option 1A Basement Plan

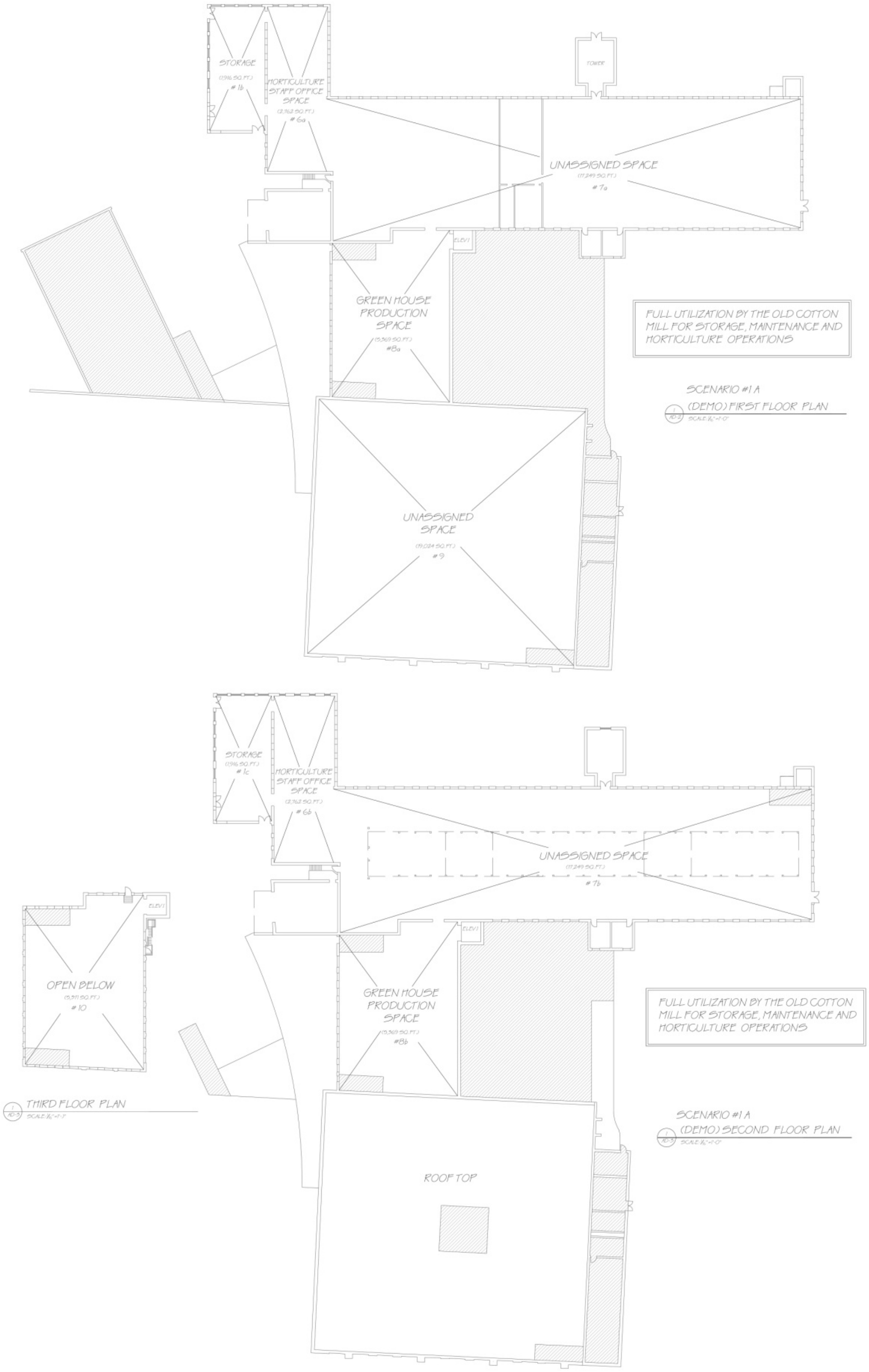


Figure 5.3 Horticulture operation - Option 1A Ground and Second Floor Plan

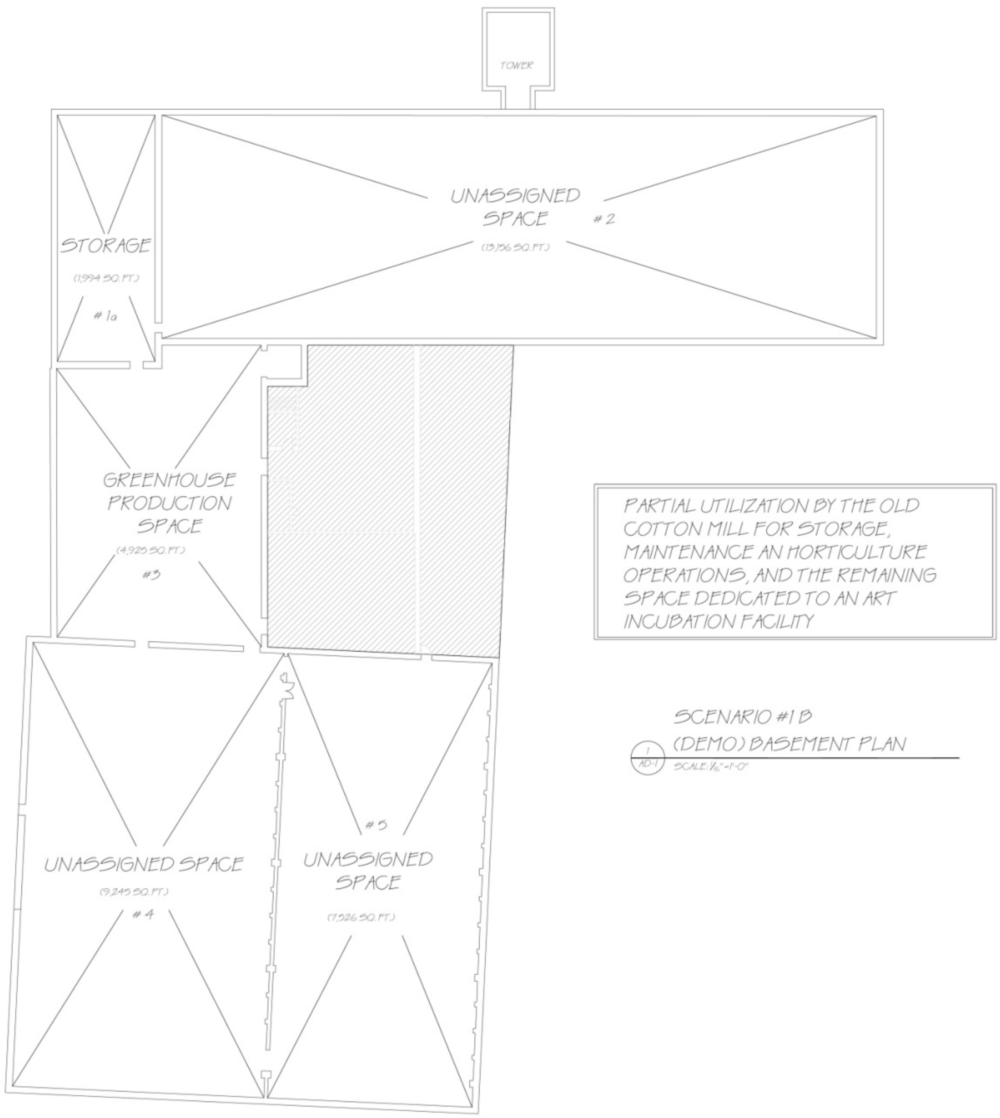
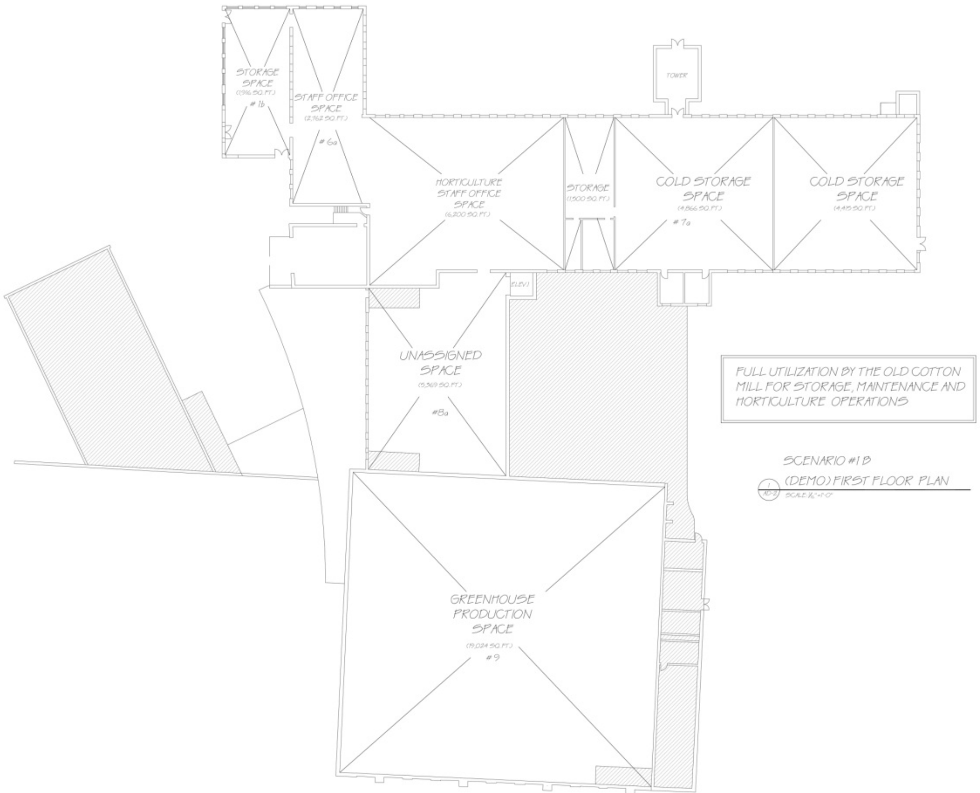


Figure 5.4 **Horticulture operation -** Option 1B Basement Plan



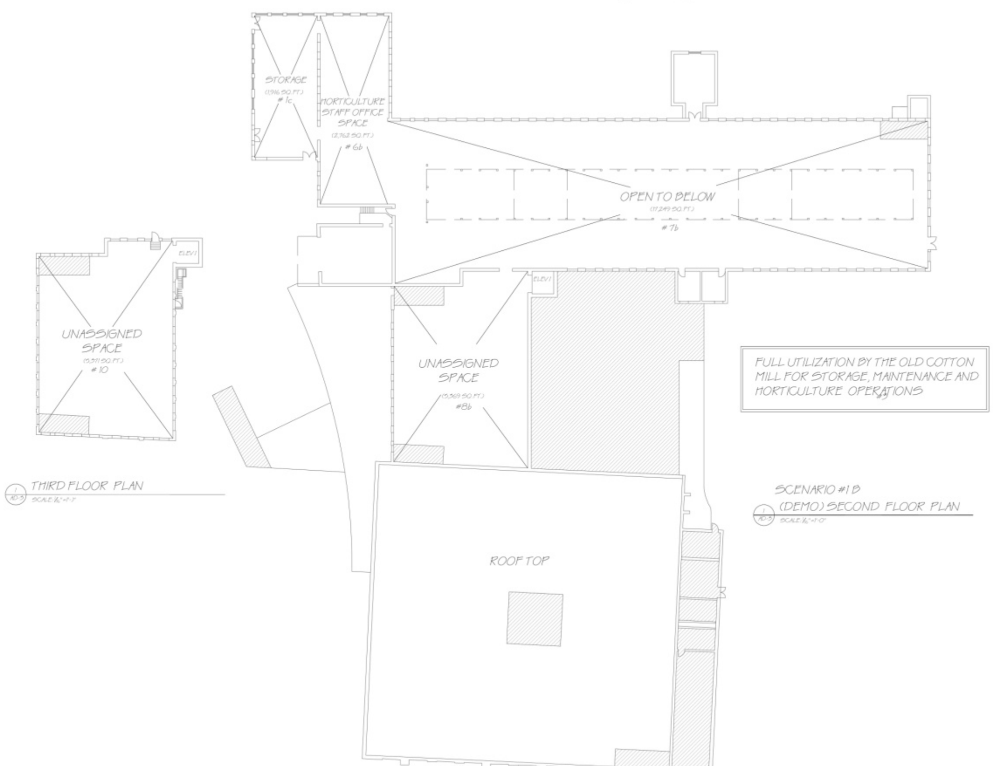


Figure 5.5 **Horticulture operation** - Option 1B Ground and Second Floor Plan

5.4 ADAPATIVE REUSE-SCENARIO #2

For scenario two which is retail and storage operation (mixed-used), two options have been recommended for Scenario #2, and both are an adaptation of Scenario #1A. In figure 5.6 and figure 5.7, Option “A”, the Tall 1 Story Warehouse space (#3) would be treated as a large community space capable of being subdivided into smaller rooms. Windows would be reinstalled on the south façade with a long east-west skylight on the roof to provide a naturally lit interior.

The 2 Story Artists’ Lofts (#7) would provide support for the community space, the lower level containing public restrooms and a serving kitchen for catering use, and the upper level utilized by the community room management offices, and perhaps a small conference room.

In figure 5.8 and , Option “B”, the warehouse space (#7) would be reconfigured to contain three levels of studio space in varying sizes for use and display by artists. Window opening in the south façade would remain closed, but would be finished with decorative panels that suggest the artistic functions within. A large north-south skylight atrium would be the entry centerpiece and contain vertical circulation.

The lower level of the Artists’ Lofts (#7) would contain public restrooms and the facility’s administrative offices. The upper level is ideal as a gallery and gift shop for the display and sale of items created by the artists.

In both options, the agricultural equipment that exists in Space #9 provides an opportunity to commemorate the history of the building and provide an educational resource. The lower level of this area could be turned into a small museum space for self-guided tours. In additional, investigation is required to determine whether the upper level should be made accessible to the public.

The required off-street parking for the community space, subject to the approval of the zoning administrator, could be as high as 200 spaces, requiring approximately 1.5 acres of landscaped parking. This does not include any parking required for Old cotton

Mill staff members utilizing this facility. The additional parking could be accommodated by off-peak parking demand that is different from the Old Cotton Mill use.

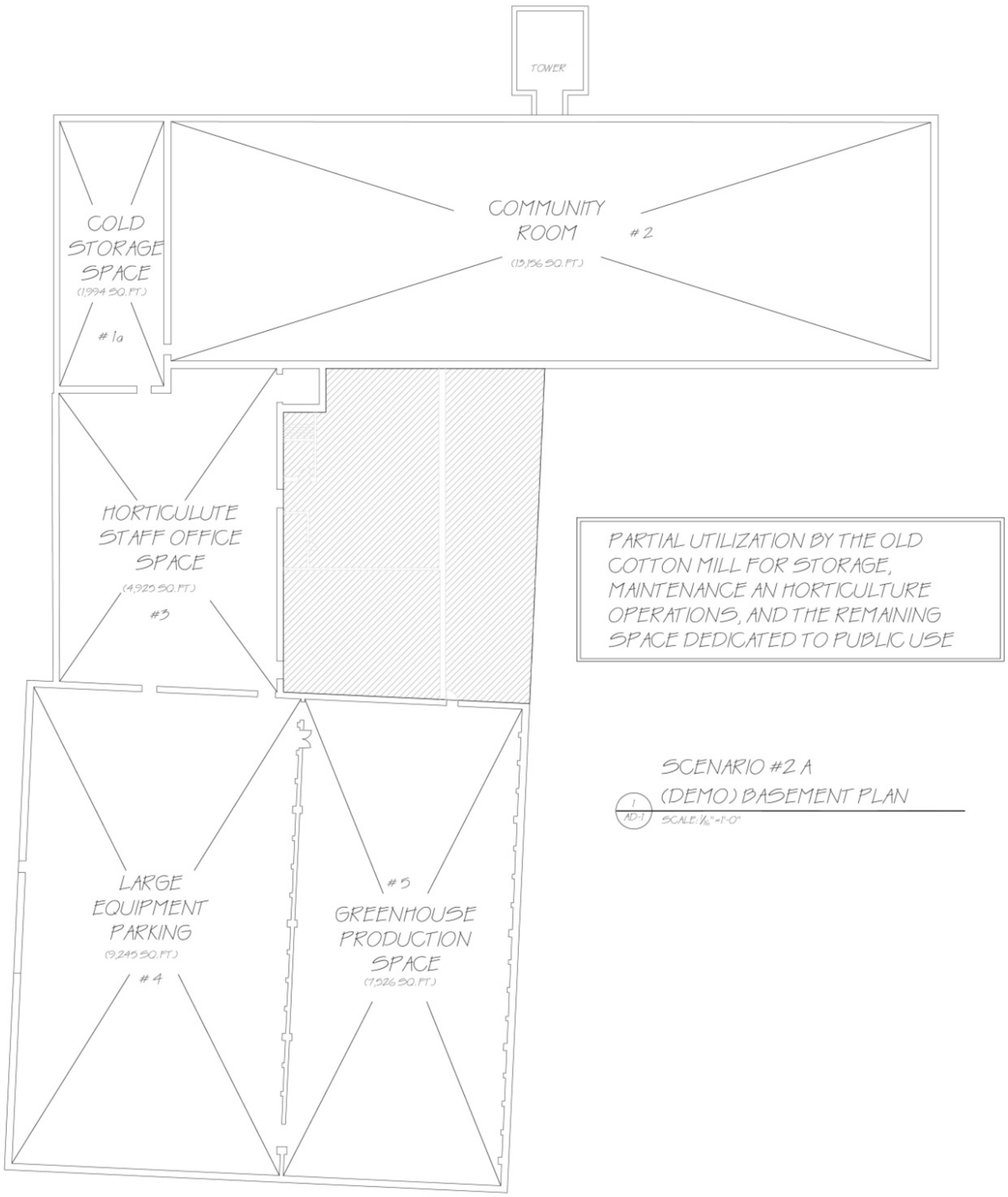


Figure 5.6 Retail and Storage operation - Option 2A Basement Plan

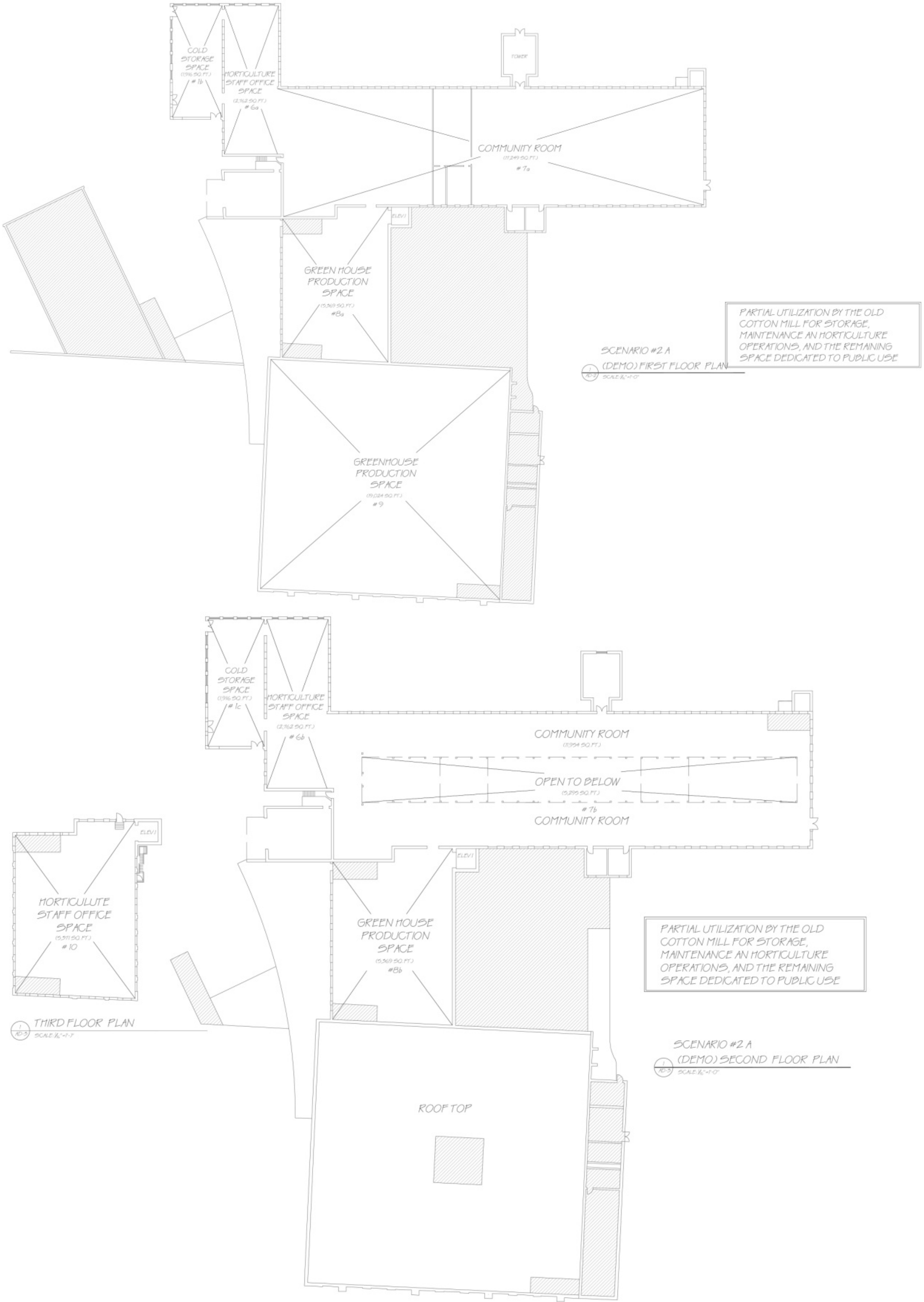


Figure 5.7 Retail and Storage operation - Option 2A Main and Second Floor Plan

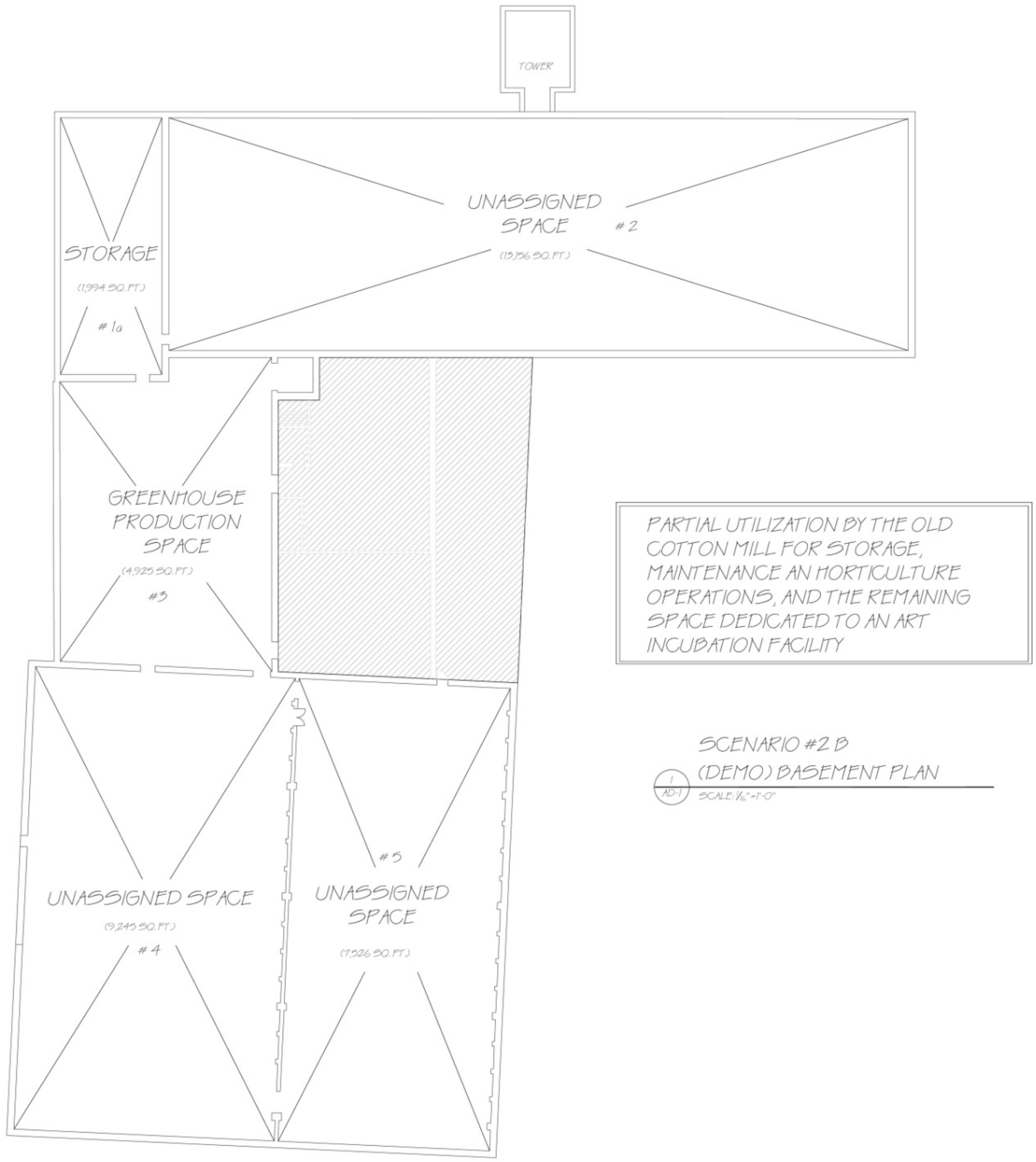


Figure 5.8 Retail and Storage operation - Option 2B Basement Plan

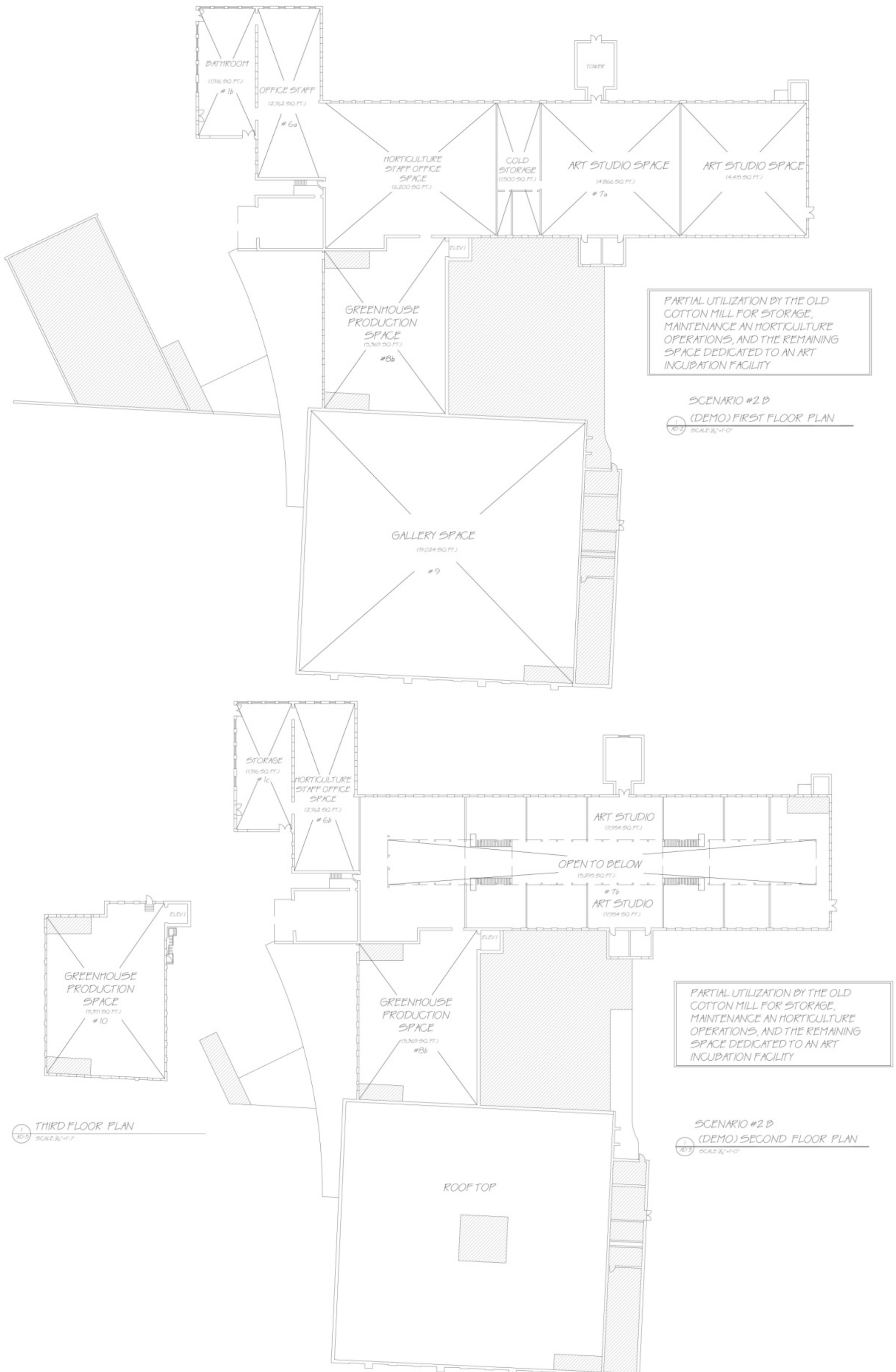


Figure 5.9 Retail and Storage operation - Option 2B Main and Second Floor Plan

5.5 ADAPTIVE REUSE – SCENARIO #3

In this scenario the building would be rehabilitated, restored and remodeled to accommodate a combined retail and office rental use. In figure 5.10 and 5.11, the original window openings would be restored and new windows installed at the perimeter walls. Existing wood beams would be replaced by steel beams.

Existing intermediate floor structures would be selectively removed and replaced. A contiguous second level inserted into Spaces #1, #3, #4, #5, #8 and #9 would provide additional retail/office space and the required circulation. This new circulation level is detached from the north wall of Space #7 to permit light from the roof mounted skylight to wash down the full height of the interior masonry and penetrate to the ground floor level.

Two principal entries have been implemented, one through the west facing main portal, and the other through a newly constructed entry vestibule at the east corner of Space #7. The former entry is related directly to the proposed botanical garden, proposed pedestrian crossing over the railroad tracks, and recreational path. The latter provides access from the parking area that will be located north of the building.

A loading dock is inserted on the west end of the building adjacent to Space #8, and an elevator is provided in the existing elevator shaft.

Two possible options for utilization of Space #7 are as a community space or as a food court, each with self-contained support facilities. A strategically placed skylight over a portion of this space could create an attractive “winter garden” effect. The estimated minimum parking requirement for this proposed use is substantially increased, requiring approximately 3 acres of landscaped and as high as 400 parking spaces.

Scenario 3 is better because the designer can design space to be leased, so the owner can recover some of the income that was lost in the design and construction process. The agile method provided a quicker responds for the stakeholder to determine which scenario is best.

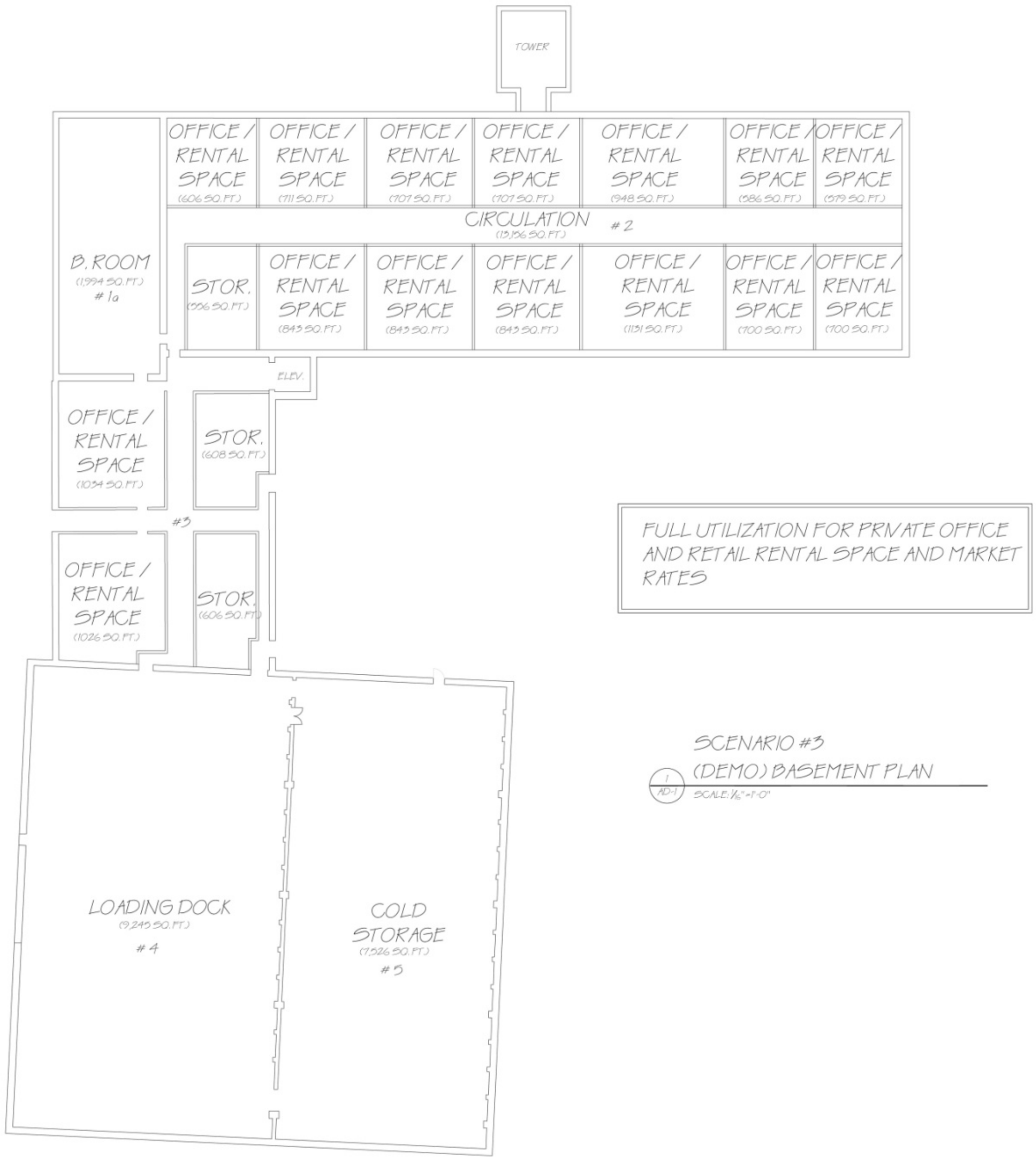


Figure 5.10 Retail and Office rental use - Option 3 Basement Plan

Figure 5.11 Retail and Office rental use - Option 3 Main and Second Floor Plan

5.6 FRAMEWORK FOR OLD COTTON MILL

The demonstration of the scenarios used to evaluate the Old Cotton Mill adaptive reuse project led to the development of the agile method for stakeholders at large to consider and prioritize tasks for restoration projects. The following figure 5.12 depicts the proposed Agile Method framework followed by sections explaining the various steps associated with the framework.

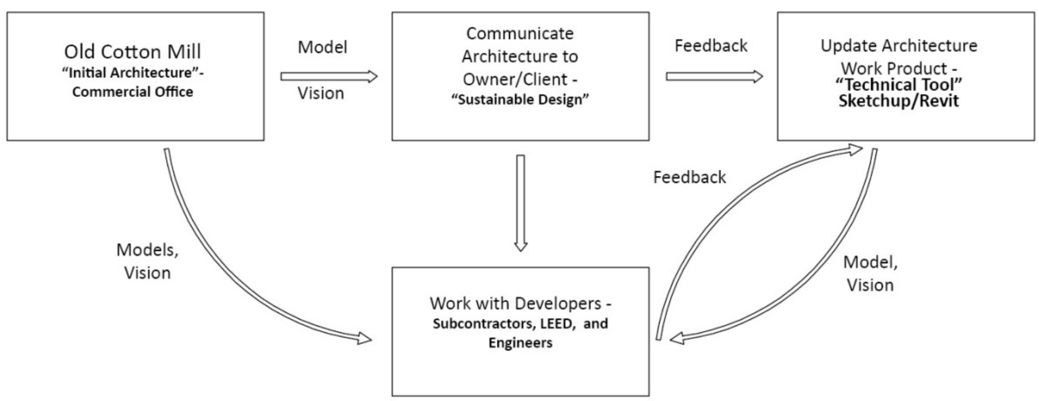


Figure 5.12 Framework

The framework includes four important steps in the approach to the stakeholder for the adaptive reuse projects.

Step One: Initial Design/Why

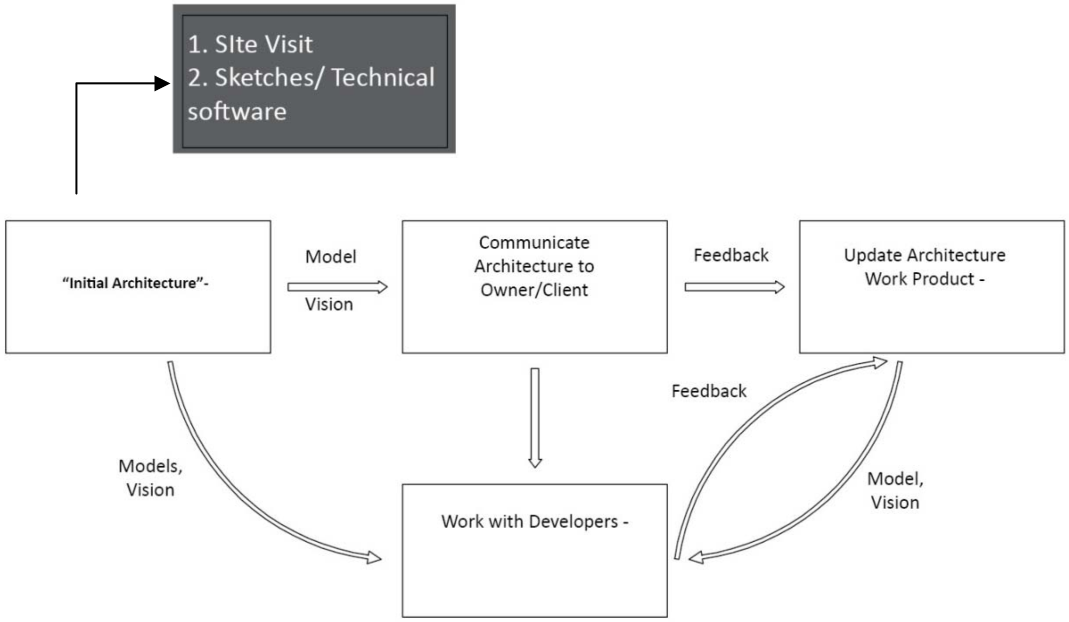


Figure 5.13 Initial Design

In addition, the stakeholder must identify a person or persons to visit the site to develop a baseline adaptive reuse plan for the facility, depicted in figure 5.13. The individual should use appropriate techniques such as sketches and technical software to conduct a detailed investigation and evaluation of the building. At that point, the stakeholder can make a determination as to the feasibility of the adaptive reuse project. If the scope of damage or deterioration of the building exceeds a level that the designer deems appropriate, the designer should notify the owner/stakeholder to allow them to make a decision regarding the future of the facility.

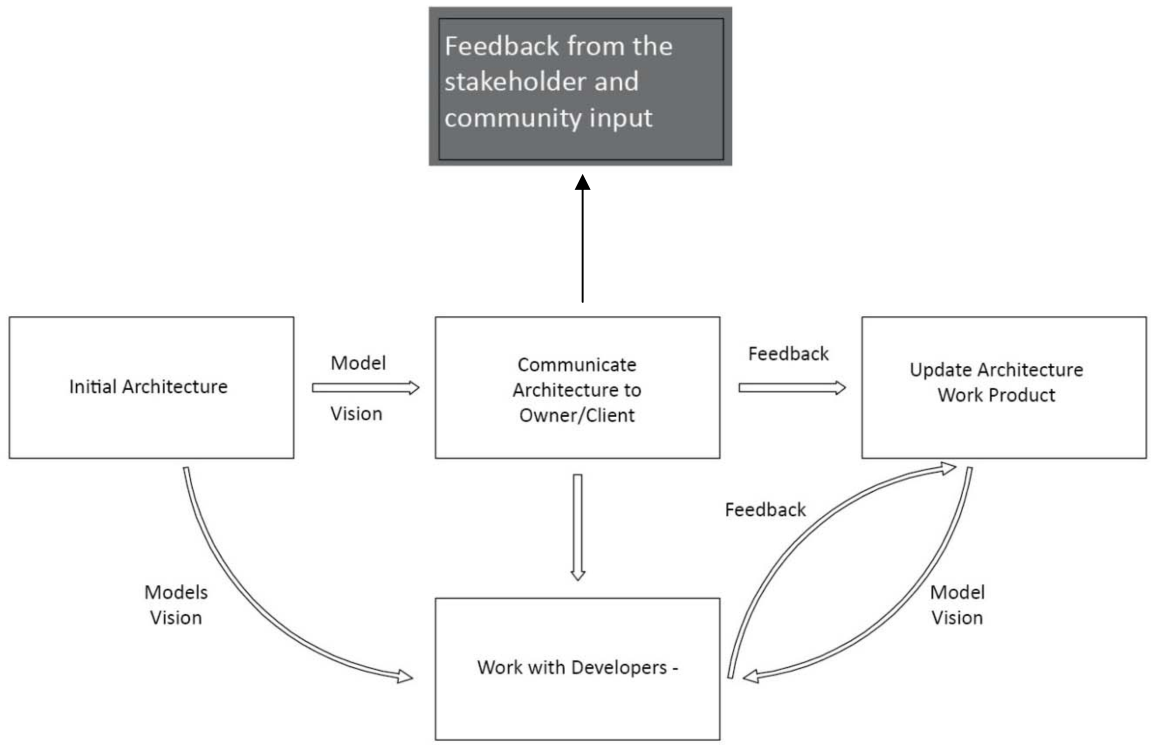


Figure 5.14 Communication

Step Two: Communicate/ What

After the initial site investigation, the project designer should solicit feedback and recommendations from the owner/stakeholder and funding organizations to determine possible future use alternatives for the facility, as depicted in figure 5.14. At this point of the framework, the project designer can also ascertain the stakeholders view on how the community will react to the facility. By recognizing the importance of community input, the project designer can investigate those ideas in future alternatives that are most appropriate to meet the stakeholder and community needs.

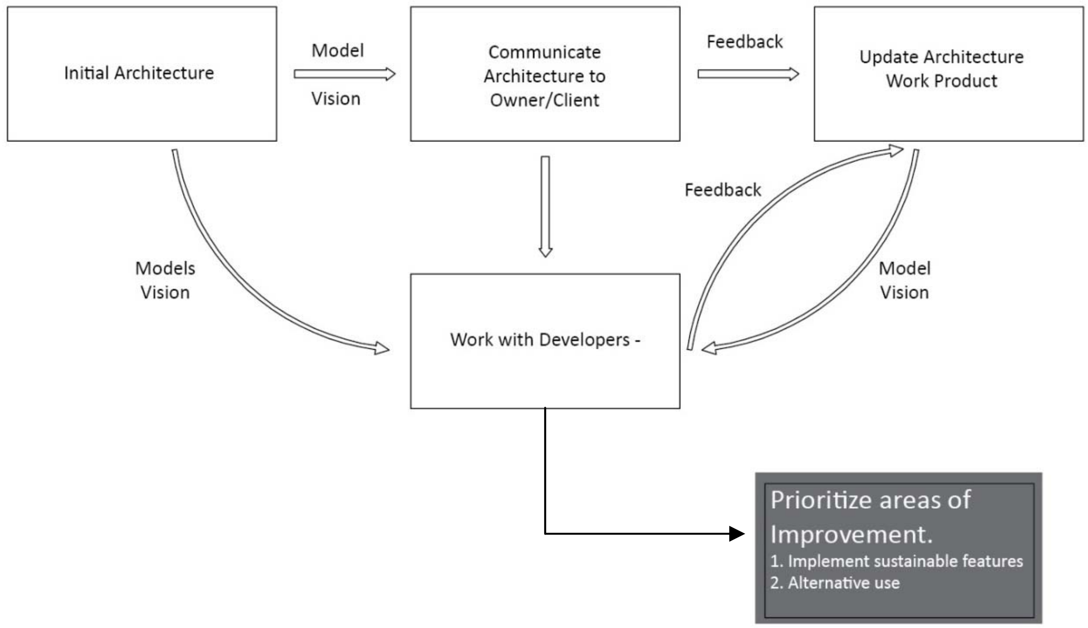


Figure 5.15 Works with Developers

Step Three: Work with Developers/How

In step three, the project designer must evaluate the associated responsibilities for each alternative, as depicted in figure 5.15. This allows the project designer to communicate and work with developers early in the design phase and get back to the initial design concept without losing valuable time and money for the owner.

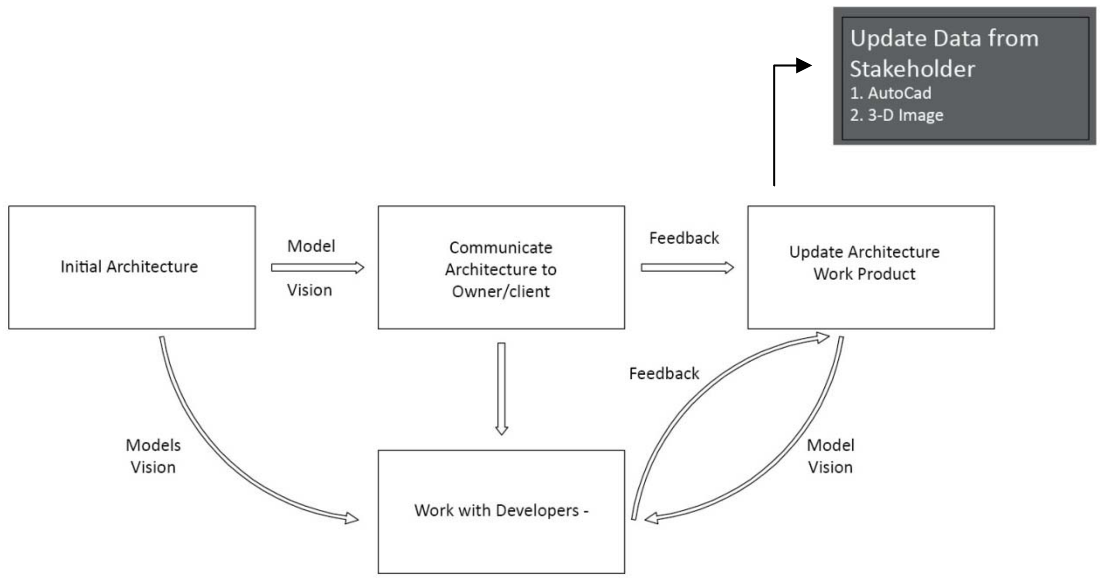


Figure 5.16 Update Product

Step Four: Update Product/When

In step four, once the project designer collects and assimilates the stakeholder's feedback, results from the direct observation of the site and the facility, and the technical consideration from the baseline restoration plan, the designer can identify and add those future use alternatives that are most popular and appropriate for the stakeholder's baseline adaptive reuse plan, as depicted in figure 5.16. The designer can then take those plans and conduct an updated product of the future use alternatives to identify those adaptive reuse responsibilities that are congruent for each alternative and those responsibilities that are unique to the particular alternative. In the case study, the need to repair the existing wood beams is a congruent undertaking for each of the future use alternatives, while adding a green roof is a task unique to the horticulture operation alternative.

Chapter 6: Summary and Conclusion

6.1 COMPARISON

In the case study, MNM Architects used a traditional method to design and construct the Old Cotton Factory. The traditional design process positions the contractor into the design phase late in the development, the outcome was confusion in the beginning and a longer construction time because the contractor was not able to be brought on-board early. However, the Agile Method allows the designer and contractor to engage early for the benefit of the stakeholder to make sure that the design and construction is handling in the beginning, depicted in Figure 6.1. Also, because the designer and contractor are evolved early, the stakeholder (owner/client) can receive many options during the schematic stages of design.

Figure 6.1 Agile Method Circle

6.2 SUMMARY AND CONCLUSION

The purpose of this project and report was to compare The Old Cotton Factory that was design by McClure, Nicholson, and Montgomery Architects using traditional design process to a demonstration using the Agile Method. The secondary purpose of the framework was to provide an avenue for owner/client to indentify and prioritize financial and construction responsibilities even before determining the future use for the facility. The project and report fulfilled the research purpose by providing a straightforward best practice for the owner/client to employ when approaching adaptive reuse projects.

The case study approach to the research provided a more traditional way of design which allows the client to have 100% completion of the drawings but not the early involvement of a contractor for the project. The Agile Method can give the owner/client associated with the Old Cotton Mill renovation project a framework to consider as they approach the actual restoration. Preserving the Old Cotton Mill integrity not only fulfills the community's desire to save the structure, but also highlights historic renovation.

The proposed Agile Method framework offers stakeholders a methodology for approaching restoration projects, incorporating stakeholders' concerns, conduction technical analyses, and identifying potential future use alternatives. The Agile Method has its benefits for offering a matrix for prioritizing design/construction responsibilities in terms of 4 categories: why, what, when, and how, as depicted in figure 6.2. The Agile Method can allow the designer to focus on the architecture, use scenarios to drive the design and evaluate potential solutions, and think through the choice of application type. Prioritizing adaptive reuse responsibilities in such a way allows the stakeholder to begin the restoration process even before finalizing the facility future use. The framework provides a straightforward, organized, and simple approach for communities to prioritize construction responsibilities.

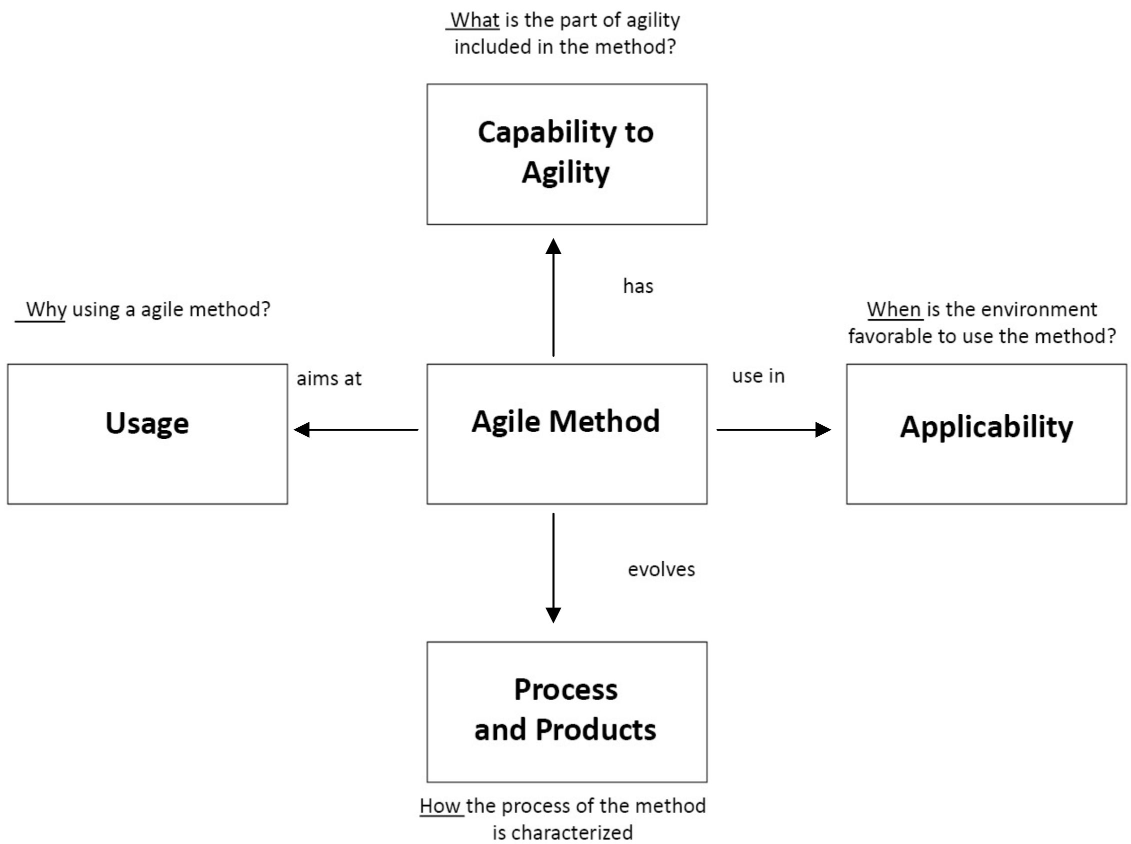


Figure 6.2 Applicability of the Agile Method

6.3 AREAS OF FUTURE RESEARCH

The areas of considerations include revisiting the case study facility to determine the effectiveness of the proposed framework. The researcher can request feedback from stakeholder groups to determine whether the framework provided a useful means for approaching adaptive reuse methods. In its current form, the framework assumes the structural integrity and safety of the building to be the primary drivers for prioritizing adaptive reuse. However, those constraints prohibit other significant considerations including the stakeholder schedule consideration, economic conditions, and deadlines for funding or grant programs, and deadlines for adaptive reuse tax credits. For example, if the stakeholder considers adaptive reuse for a facility and finds grant funding for some specific part of the renovation, then the deadline for that funding makes the responsibilities a priority, regardless of whether it meets the proposed criteria for an immediate use.

One of the major concerns that arose from the Agile Method is how early do you want the other parties involved in the design phase of the project. As described earlier in Chapter 2, the agile method has several drawbacks. The scope of the project can determine if the Agile Method is the proper process to use. Applying the Agile method as a framework may promote the idea of buildings being properly considered over their entire life cycle rather than their immediate period of ownership or function. One approach is to examine other textile factories in the United States for opportunities and barriers of adaptive reuse. The researcher can also explore alternative solutions for assessment process in the United States that consider sustainable and reusable building construction methods.

A P P E N D I X - A

SCENARIO 1A					
DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**	**SUMMARY**
DIVISION 1 - GENERAL REQUIREMENTS					
General conditions	1	ls	40,000.00	40,000	
Hazardous material abatement	1	al	10,000.00	10,000	
Selective demolition & disposal					
Misc. equipment	1	ls	15,000.00	15,000	
Misc. structure & decking	1	ls	20,000.00	20,000	85,000
DIVISION 2 - SITE CONSTRUCTION					
Site clearing	6000	sf	0.40	2,400	
Site drainage	6000	sf	5.00	30,000	
Asphalt paving	6000	sf	3.25	19,500	51,900
DIVISION 3 - CONCRETE					
Repair/replace existing concrete floors	2500	sf	14.00	35,000	
Repairs to structural concrete	1	ls	5,000.00	5,000	
Compacted fill in pit areas	2000	cy	17.50	35,000	75,000
DIVISION 4 - MASONRY					
Misc. openings & interior masonry repairs.	1	al	20,000.00	20,000	
Clean (wash) interior masonry	6000	sf	0.80	4,800	24,800
DIVISION 5 - METALS					
Repair/reconfiguration of existing steel structure	1	al	5,000.00	5,000	
Metal stairs	1	un	8,000.00	8,000	
Metal railings	200	lf	35.00	7,000	20,000
DIVISION 6 - WOOD & PLASTICS					
Interior trim (Hort. Staff Off.)	3600	sf	0.50	1,800	
ADA access ramp	1	un	7,000.00	7,000	8,800
DIVISION 7 - THERMAL & MOISTURE PROTECTION					
Roofing, flashing & insulation	25350	sf	7.00	177,450	
Sheet metal counterflashing	1600	lf	5.00	8,000	
Skylights	10	un	1,000.00	10,000	195,450
DIVISION 8 - DOORS & WINDOWS					
Exterior doors, frames & hardware	5	un	900.00	4,500	
Interior doors, frames & hardware	14	un	700.00	9,800	
Overhead doors	3	un	1,500.00	4,500	
Windows	9	un	900.00	8,100	26,900

DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**	**SUMMARY**
DIVISION 9 - FINISHES					
Metal stud & gypsum board partitions	600	lf	45.00	27,000	
Ceramic tile	300	sf	13.00	3,900	
Wood flooring	3200	sf	9.25	29,600	
Painting	7200	sf	0.75	5,400	65,900
DIVISION 10 - SPECIALITIES					
Signs	1	al	3,000.00	3,000	
Toilet compartments & accessories	4	un	900.00	3,600	6,600
DIVISION 11 - EQUIPMENT					
Appliances	1	al	1,500.00	1,500	1,500
DIVISION 12 - FURNISHINGS					
Kitchen casework & countertop	7	lf	425.00	2,975	2,975
DIVISION 15 - MECHANICAL SYSTEMS					
Plumbing waste & water distribution	20000	sf	2.00	40,000	
Plumbing fixtures					
Water closets	3	un	400.00	1,200	
Lavatories	2	un	350.00	700	
Urinals	1	un	800.00	800	
Sink	1	un	600.00	600	
Heating systems - greenhouse & shop spaces	14600	sf	4.00	58,400	
HVAC - office space	3700	sf	12.00	44,400	146,100
DIVISION 16 - ELECTRICAL SYSTEMS					
Power & lighting distribution - office space	3700	sf	14.00	51,800	
Power & lighting distribution - greenhouse & shop spac	36300	sf	4.00	145,200	
Power & lighting distribution - unassigned spaces	17300	sf	1.00	17,300	
Power & lighting distribution - site	6000	sf	2.50	15,000	229,300
DESIGN CONTINGENCY (10%)					94,023
CONSTRUCTION CONTINGENCY (10%)					94,023
TOTAL ESTIMATED COST					**1,128,270**

SCENARIO 1B					
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
DIVISION 1 - GENERAL REQUIREMENTS					
General conditions	1	ls	40,000.00	40,000	
Hazardous material abatement	1	al	10,000.00	10,000	
Selective demolition & disposal					
Misc. equipment	1	ls	15,000.00	15,000	
Misc. structure & decking	1	ls	20,000.00	20,000	85,000
DIVISION 2 - SITE CONSTRUCTION					
Site clearing	6000	sf	0.40	2,400	
Site drainage	6000	sf	5.00	30,000	
Asphalt paving	6000	sf	3.25	19,500	51,900
DIVISION 3 - CONCRETE					
Repair/replace existing concrete floors	2500	sf	14.00	35,000	
Repairs to structural concrete	1	ls	5,000.00	5,000	
Compacted fill in pit areas	2000	cy	17.50	35,000	75,000
DIVISION 4 - MASONRY					
Misc. openings & interior masonry repairs.	1	al	20,000.00	20,000	
Clean (wash) interior masonry	6000	sf	0.80	4,800	24,800
DIVISION 5 - METALS					
Repair/reconfiguration of existing steel structure	1	al	5,000.00	5,000	
Metal stairs	1	un	8,000.00	8,000	
Metal railings	200	lf	35.00	7,000	20,000
DIVISION 6 - WOOD & PLASTICS					
Interior trim (Hort. Staff Off.)	3200	sf	0.50	1,600	
ADA access ramp	1	un	7,000.00	7,000	8,600
DIVISION 7 - THERMAL & MOISTURE PROTECTION					
Roofing, flashing & insulation	22800	sf	7.00	159,600	
Sheet metal counterflashing	1900	lf	5.00	9,500	
Skylights	10	un	1,000.00	10,000	179,100
DIVISION 8 - DOORS & WINDOWS					
Exterior doors, frames & hardware	5	un	900.00	4,500	

Interior doors, frames & hardware	14	un	700.00	9,800	
Overhead doors	3	un	1,500.00	4,500	
Windows	18	un	900.00	16,200	35,000
DESCRIPTION	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**	**SUMMARY**
DIVISION 9 - FINISHES					
Metal stud & gypsum board partitions	600	lf	45.00	27,000	
Ceramic tile	300	sf	13.00	3,900	
Wood flooring	3000	sf	9.25	27,750	
Painting	7200	sf	0.75	5,400	64,050
DIVISION 10 - SPECIALITIES					
Signs	1	al	3,000.00	3,000	
Toilet compartments & accessories	4	un	900.00	3,600	6,600
DIVISION 11 - EQUIPMENT					
Appliances	1	al	1,500.00	1,500	1,500
DIVISION 12 - FURNISHINGS					
Kitchen casework & countertop	7	lf	425.00	2,975	2,975
DIVISION 15 - MECHANICAL SYSTEMS					
Plumbing waste & water distribution	20000	sf	2.00	40,000	
Plumbing fixtures					
Water closets	3	un	400.00	1,200	
Lavatories	2	un	350.00	700	
Urinals	1	un	800.00	800	
Sink	1	un	600.00	600	
Heating systems - greenhouse & shop spaces	17000	sf	4.50	76,500	
HVAC - office space	3300	sf	12.00	39,600	159,400
DIVISION 16 - ELECTRICAL SYSTEMS					
Power & lighting distribution - office space	3300	sf	14.00	46,200	
Power & lighting distribution - greenhouse & shop spaces	25000	sf	4.00	100,000	
Power & lighting distribution - unassigned spaces	18200	sf	1.00	18,200	
Power & lighting distribution - site	6000	sf	2.50	15,000	179,400
DESIGN CONTINGENCY (10%)					89,333
CONSTRUCTION CONTINGENCY (10%)					89,333
TOTAL ESTIMATED COST					**1,071,990**

SCENARIO 2A					
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
DIVISION 1 - GENERAL REQUIREMENTS					
General conditions	1	ls	70,000.00	70,000	
Hazardous material abatement	1	al	20,000.00	20,000	
Selective demolition & disposal					
Misc. equipment	1	ls	30,000.00	30,000	
Misc. structure & decking	1	ls	30,000.00	30,000	150,000
DIVISION 2 - SITE CONSTRUCTION					
Site clearing	66000	sf	0.40	26,400	
Site drainage	66000	sf	5.00	330,000	
Asphalt paving	66000	sf	3.25	214,500	
Landscaping	1	al	15,000.00	15,000	585,900
DIVISION 3 - CONCRETE					
Repair/replace existing concrete floors	4000	sf	14.00	56,000	
Repairs to structural concrete	1	ls	10,000.00	10,000	
Compacted fill in pit areas	2000	cy	17.50	35,000	101,000
DIVISION 4 - MASONRY					
Misc. openings & interior masonry repairs.	1	al	40,000.00	40,000	
Clean (wash) interior masonry	40000	sf	0.80	32,000	72,000
DIVISION 5 - METALS					
Repair/reconfiguration of existing steel structure	1	al	10,000.00	10,000	
Metal stairs	2	un	8,000.00	16,000	
Metal railings	300	lf	35.00	10,500	36,500
DIVISION 6 - WOOD & PLASTICS					
Interior trim	21000	sf	0.50	10,500	
ADA access ramps	2	un	7,000.00	14,000	
Misc. repairs to museum equipment	1	al	10,000.00	10,000	34,500
DIVISION 7 - THERMAL & MOISTURE PROTECTION					
Roofing, flashing & insulation	41000	sf	7.00	287,000	
Sheet metal counterflashing	3500	lf	5.00	17,500	
Skylights	20	un	1,000.00	20,000	324,500

DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
DIVISION 8 - DOORS & WINDOWS					
Exterior doors, frames & hardware	12	un	900.00	10,800	
Interior doors, frames & hardware	22	un	700.00	15,400	
Overhead doors	3	un	1,500.00	4,500	
Windows	57	un	1,100.00	62,700	93,400
DIVISION 9 - FINISHES					
Metal stud & gypsum board partitions	1000	lf	45.00	45,000	
Ceramic tile	2000	sf	13.00	26,000	
Wood flooring	5200	sf	9.25	48,100	
Painting	10000	sf	0.75	7,500	126,600
DIVISION 10 - SPECIALITIES					
Signs	1	al	7,000.00	7,000	
Museum interperative display panels	1	al	5,000.00	5,000	
Toilet compartments & accessories	12	un	900.00	10,800	22,800
DIVISION 11 - EQUIPMENT					
Appliances	1	al	1,500.00	1,500	
Commercial appliances	1	al	20,000.00	20,000	21,500
DIVISION 12 - FURNISHINGS					
Kitchen casework & countertop	7	lf	425.00	2,975	
Commercial kitchen casework & countertops	20	lf	650.00	13,000	
Demountable partitions	120	lf	150.00	18,000	33,975
DIVISION 14 - CONVEYING SYSTEMS					
Hydraulic elevator - 2 stops	1	ls	65,000.00	65,000	65,000
DIVISION 15 - MECHANICAL SYSTEMS					
Plumbing waste & water distribution	41000	sf	2.00	82,000	
Plumbing fixtures					
Water closets	9	un	400.00	3,600	
Lavatories	7	un	350.00	2,450	
Urinals	3	un	800.00	2,400	
Sinks	2	un	600.00	1,200	
Commercial sink	1	un	900.00	900	

DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
Heating systems - greenhouse & shop spaces	14600	sf	4.00	58,400	
HVAC - finished spaces	22300	sf	14.00	312,200	463,150
DIVISION 16 - ELECTRICAL SYSTEMS					
Power & lighting distribution - finished spaces	22300	sf	15.00	334,500	
Power & lighting distribution - greenhouse & shop spaces	20450	sf	4.00	81,800	
Power & lighting distribution - site	66000	sf	2.50	165,000	581,300
DESIGN CONTINGENCY (12%)					325,455
CONSTRUCTION CONTINGENCY (10%)					271,213
TOTAL ESTIMATED COST					**3,308,793**

SCENARIO 2B					
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
This scenario assumes that the tenants for the Art studio will be responsible for the cost of the building, finishes and infrasturcture o					
respective spaces.					
DIVISION 1 - GENERAL REQUIREMENTS					
General conditions	1	ls	70,000.00	70,000	
Hazardous material abatement	1	al	20,000.00	20,000	
Selective demolition & disposal					
Misc. equipment	1	ls	30,000.00	30,000	
Misc. structure & decking	1	ls	40,000.00	40,000	160,000
DIVISION 2 - SITE CONSTRUCTION					
Site clearing	66000	sf	0.40	26,400	
Site drainage	66000	sf	5.00	330,000	
Asphalt paving	66000	sf	3.25	214,500	
Landscaping	1	al	15,000.00	15,000	585,900
DIVISION 3 - CONCRETE					
Repair/replace existing concrete floors	4000	sf	14.00	56,000	
Repairs to structural concrete	1	ls	10,000.00	10,000	
Compacted fill in pit areas	2000	cy	17.50	35,000	101,000
DIVISION 4 - MASONRY					
Misc. openings & interior masonry repairs.	1	al	40,000.00	40,000	
Clean (wash) interior masonry	40000	sf	0.80	32,000	72,000
DIVISION 5 - METALS					
Repair/reconfiguration of existing steel structure	1	al	10,000.00	10,000	
Metal stairs	6	un	8,000.00	48,000	
Metal railings	1500	lf	35.00	52,500	
Two levels of steel framing & conc.	23000	sf	10.00	230,000	340,500
deck in Tall 1 Story Warehouse space (#3)					
DIVISION 6 - WOOD & PLASTICS					
Interior trim	21000	sf	0.50	10,500	
ADA access ramps	2	un	7,000.00	14,000	
Misc. repairs to museum equipment	1	al	10,000.00	10,000	34,500
DIVISION 7 - THERMAL & MOISTURE PROTECTION					

DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
Roofing, flashing & insulation	41000	sf	7.00	287,000	
Sheet metal counterflashing	3500	lf	5.00	17,500	
Skylights	16	un	1,000.00	16,000	
Atrium skylight	1800	sf	45.00	81,000	401,500
DIVISION 8 - DOORS & WINDOWS					
Exterior doors, frames & hardware	14	un	900.00	12,600	
Interior doors, frames & hardware	18	un	700.00	12,600	
Overhead doors	4	un	1,500.00	6,000	
Windows	27	un	900.00	24,300	55,500
DIVISION 9 - FINISHES					
Metal stud & gypsum board partitions	800	lf	45.00	36,000	
Ceramic tile	1000	sf	13.00	13,000	
Wood flooring	6200	sf	9.25	57,350	
Painting	10000	sf	0.75	7,500	113,850
DIVISION 10 - SPECIALITIES					
Signs	1	al	10,000.00	10,000	
Museum interperative display panels	1	al	5,000.00	5,000	
Toilet compartments & accessories	12	un	900.00	10,800	25,800
DIVISION 11 - EQUIPMENT					
Appliances	1	al	1,500.00	1,500	1,500
DIVISION 12 - FURNISHINGS					
Kitchen casework & countertop	7	lf	425.00	2,975	2,975
DIVISION 14 - CONVEYING SYSTEMS					
Hydraulic elevator - 3 stops	1	ls	90,000.00	90,000	90,000
DIVISION 15 - MECHANICAL SYSTEMS					
Plumbing waste & water distribution	64000	sf	1.80	115,200	
Plumbing fixtures					
Water closets	9	un	400.00	3,600	
Lavatories	6	un	350.00	2,100	
Urinals	3	un	800.00	2,400	
Sinks	1	un	600.00	600	
Heating systems - greenhouse & shop spaces	14600	sf	4.00	58,400	
HVAC - finished spaces	45000	sf	13.00	585,000	767,300

DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
DIVISION 16 - ELECTRICAL SYSTEMS					
Power & lighting distribution - finished spaces	45000	sf	13.00	585,000	
Power & lighting distribution - greenhouse & shop spaces	20450	sf	4.00	81,800	
Power & lighting distribution - site	66000	sf	2.50	165,000	831,800
DESIGN CONTINGENCY (15%)					537,619
CONSTRUCTION CONTINGENCY (10%)					358,413
TOTAL ESTIMATED COST					**4,480,156**

SCENARIO 3					
DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
This scenario assumes that the tenants for the retail/office space will be responsible for the cost of					
the buildout, finishes and infrastructure of their respective spaces.					
DIVISION 1 - GENERAL REQUIREMENTS					
General conditions	1	ls	70,000.00	70,000	
Hazardous material abatement	1	al	20,000.00	20,000	
Selective demolition & disposal					
Misc. equipment	1	ls	30,000.00	30,000	
Misc. structure & decking	1	ls	45,000.00	45,000	165,000
DIVISION 2 - SITE CONSTRUCTION					
Site clearing	135000	sf	0.40	54,000	
Site drainage	135000	sf	4.00	540,000	
Asphalt paving	135000	sf	3.25	438,750	
Landscaping	1	al	45,000.00	45,000	1,077,750
DIVISION 3 - CONCRETE					
Repair/replace existing concrete floors	4000	sf	14.00	56,000	
Repairs to structural concrete	1	ls	10,000.00	10,000	
Footings & foundations	80	lf	325.00	26,000	
ADA access ramps	2	un	12,000.00	24,000	
Compacted fill in pit areas	2000	cy	17.50	35,000	151,000
DIVISION 4 - MASONRY					
Misc. openings & interior masonry repairs.	1	al	60,000.00	60,000	
Clean (wash) interior masonry	100000	sf	0.80	80,000	140,000
DIVISION 5 - METALS					
Repair/reconfiguration of existing steel structure	1	al	10,000.00	10,000	
Metal stairs	4	un	8,000.00	32,000	
Metal railings	250	lf	35.00	8,750	
One level of steel framing & conc.	40940	sf	10.00	300,000	400,750
deck in spaces #1, #3, #4, #8 & #9					
DIVISION 6 - WOOD & PLASTICS					
Interior trim	60000	sf	0.50	30,000	30,000
DIVISION 7 - THERMAL & MOISTURE PROTECTION					

DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST	SUMMARY
Roofing, flashing & insulation	38500	sf	7.00	269,500	
Sheet metal counterflashing	3600	lf	5.00	18,000	
Skylights	12	un	1,000.00	12,000	
Atrium skylights	3500	sf	45.00	157,500	457,000
DIVISION 8 - DOORS & WINDOWS					
Exterior doors, frames & hardware	12	un	900.00	10,800	
Interior doors, frames & hardware	12	un	750.00	9,000	
Overhead doors	4	un	1,500.00	6,000	
Aluminum storefront	800	sf	34.00	27,200	
Windows	27	un	900.00	24,300	77,300
DIVISION 9 - FINISHES					
Metal stud & gypsum board partitions	500	lf	45.00	22,500	
Ceramic tile	4000	sf	13.00	52,000	
Painting	5000	sf	0.75	3,750	78,250
DIVISION 10 - SPECIALITIES					
Signs	1	al	5,000.00	5,000	
Toilet compartments & accessories	18	un	900.00	16,200	21,200
DIVISION 11 - EQUIPMENT					
Commercial appliances	1	al	20,000.00	20,000	20,000
DIVISION 12 - FURNISHINGS					
Commercial kitchen casework & countertops	20	lf	650.00	13,000	13,000
DIVISION 14 - CONVEYING SYSTEMS					
Hydraulic elevator - 2 stops	1	ls	65,000.00	65,000	65,000
DIVISION 15 - MECHANICAL SYSTEMS					
Plumbing waste & water distribution	60000	sf	1.80	108,000	
Plumbing fixtures					
Water closets	14	un	400.00	5,600	
Lavatories	9	un	350.00	3,150	
Urinals	4	un	800.00	3,200	
Sinks	1	un	600.00	600	
Commercial sink	1	un	900.00	900	
HVAC - finished spaces	60000	sf	11.00	660,000	781,450
DIVISION 16 - ELECTRICAL SYSTEMS					

Chapter 6: ANNOTATED BIBLIOGRAPHY and REFERENCES

6.1 ANNOTATED BIBLIOGRAPHY

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