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# Whiting Farm Cold Storage Assessment

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# **FINAL REPORT: WHITING FARM COLD STORAGE ASSESSMENT**

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## Executive Summary

This report is an analysis of the potential development of cool, cold, and frozen storage facilities as part of a larger food hub development at Whiting Farm in Auburn, Maine. Whiting Farm is a small farm with its focus split between growing a variety of vegetables for local food banks and farm stand sales, providing educational opportunities for the developmentally disabled clients of John F. Murphy homes and for students in Lewiston and Auburn, as well as creating other community partnerships to bring as many organizations and individuals on site to gain agricultural experience as possible.

The goal of developing a food hub at Whiting Farm centered around cool, cold, and frozen storage is to give local farmers who don't have the financial means to install their own storage facility the ability to store their produce in a reliable way. This can substantially increase their profits and would allow them to potentially expand their farm's production. Our research began with a literature review and online research, but we primarily focused on connecting with as many relevant people and organizations as possible through personal communications. We spoke to local farmers, food hubs throughout Maine and New England, and food systems consultants who work in Maine and across the country.

From this research, we've determined that creating a food hub focused on storage, while possible, is very difficult and more food hubs have failed than succeeded in becoming viable businesses in Maine. We intend this report to serve as an aggregation of all of the information needed for Whiting Farm to make decisions about what types of storage to build and the best practices for doing so. This report includes analyses of several case studies of failed food hubs, recommendations for the layout and facility specifics for the refrigerated section of the food hub, a contact list of local farmers and other possible partners, an analysis of the potential profitability of the storage rental space, a guide to the storage of specific fruits and vegetables, and summary accounts of each conversation we had along the way.

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# Introduction

For this community engaged Environmental Studies capstone project, we partnered with Whiting Farm in Auburn, Maine. Kim Finnerty, who operates Whiting Farm on behalf of John F. Murphy Homes, the nonprofit that owns the farm, was our primary contact and the driving force behind this project as a whole. Initially, her vision was to build a simple cool, cold and frozen storage facility at Whiting Farm in which area farmers could rent out storage space, as needed. Having access to temperature controlled storage allows farmers to store their produce, mainly vegetables, for extended periods of time, enabling farmers to be able to sell their produce when it is most profitable, instead of having to try to get it to market as soon as it is picked, which often is inopportune financially. Additionally it allows farmers to sell their produce far past the end of the growing season, so that communities like Lewiston/Auburn can have access to locally grown fruits and vegetables throughout the entire year, not just in harvest season. The greater Lewiston/Auburn area is home to many farms, only some of which have adequate storage facilities. Some farming groups, like the Somali Bantu Community Association, struggle to find any storage access. The aim of our project was to provide these farmers with the infrastructure necessary for greater financial success in the future.

As the semester wore on, however, Kim's vision evolved and expanded to include the development of an entire food hub facility with a commercial kitchen, loading dock, and classroom in addition to the cool cold and frozen storage facility. The purpose of such a food hub at Whiting Farm is multi-faceted. Firstly, it will aim to provide farmers with the infrastructure necessary to expand production, reach new markets, and sell their produce more effectively. Secondly, it will serve as an agricultural community center, with an apprenticeship program that teaches students about every step of the farming process, from planting to harvesting and from budgeting to marketing.

We focused our efforts on researching and developing plans for the cool, cold and frozen storage component of the food hub at large. We surveyed area farmers to determine the demand for such a storage facility, we spoke to food hubs and farms with existing storage facilities, and we conducted extensive literature-based research about communal agricultural storage and

refrigeration technologies. Throughout the project, we framed all of our thinking about storage in the context of a larger food hub system, not as a standalone operation. Our recommendations reflect this system-oriented approach as we believe that it is impossible to decouple the direction of the food hub at large from the details of the storage facility's development in particular.

## Methodology

Initially, our research was focused around determining the demand for a cold storage facility located at Whiting Farm. To do this, we needed to survey farmers that we identified as being the most likely to use such a facility. These included farmers that were within a 20 mile radius of Whiting Farm and did not already have a storage facility on-site. To attain information on potential demand, we contacted farmers and asked if they would be interested in renting storage space in our facility and how much they would be willing to pay for such a service. Other questions asked, such as what types of produce they would be looking to store and what type of storage (cool, cold, or frozen) they could use more of, were to get an idea of what consumer preferences would be like for our facility. For example, if we had a lot of interest from farmers looking to mainly use freezer storage space, we would then be able to adjust the dimensions of the freezer space to accommodate demand.

After we had contacted farmers in the area, we shifted our focus to the accessibility, functionality and food safety considerations that would need to be incorporated into the layout and design of the facility. To better envision how we would create an accessible, functional, and clean facility, we looked to similar facilities in Maine that we could base our recommendations off of. While touring a number of facilities, we were able to analyze how the layout and management structure of the facility led to higher levels of accessibility and functionality than others. During these tours, we asked the cold storage managers what exactly they would change in their facility had they the opportunity to redesign it. This information was compiled and then analyzed for any potential design recommendations that we could provide for facility layout best practices.

To review the storage equipment options that are available and appropriate for this type of facility, we turned to a local refrigeration company. Because we want to design a new building

specifically around cold storage, we asked them about “best case scenarios” for cold storage construction. These questions were aimed to detail requirements for a facility that would be best suited to house a cold storage unit.

To identify the optimal storage conditions needed for commonly grown fruits and vegetables we conducted a review of farming handbooks and other food storage guides. This list will help the storage manager adjust the temperature and humidity of the facility so as to maintain an optimal storage environment.

To project the installation costs, we provided the dimensions of our facility to a local refrigeration company. The quote we received back from them details equipment and installation costs. To identify potential operating costs, we compared similar facilities energy costs as well as similar refrigeration units’ energy costs.

Finally, grants were identified and included based on applicability to the project and to the specific applicant. Some of these grants were geared specifically towards New England and Maine farms while others were for farm systems that included educational goals.

## Results and Discussion

The importance of supporting the local food system within and around Lewiston/Auburn, Maine is crucial to understand when considering the construction of a food hub at Whiting Farm. As populations grow, the reliance on distant food sources and international trade also intensifies.<sup>1</sup> The benefits of a long-distance food system includes the increased availability of food options that cater to a variety of cultural cuisines present world-wide.<sup>2</sup> The international food chain might be efficient given established markets and technology that allows for long-distance processing and transport, however it will not sustain itself long term due to the increasing negative environmental impacts of transportation emissions, water and air pollution from mass production, and a desire to rebuild local, economies and bring profit to rural agricultural producers.<sup>3</sup> This is especially true in Maine, particularly within the region of Lewiston/Auburn

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<sup>1</sup> Halweil 2002: 6

<sup>2</sup> Ibid.

<sup>3</sup> Halweil 2002: 7

that has over 1,200 farms in total (~15% of Maine farms), and 400 of those engage in direct retail.<sup>4</sup> In 2015, Karp resources and Crossroads Resource Center were hired by Grow L+A, which created a Food Hub Task Force in order to establish the feasibility of constructing a food hub in Bates Mill No.5, located in downtown Lewiston. Despite the large amount of vegetable production in the area, and a desire for more access to local markets, the hub was found not feasible because of costs associated with refurbishing the mill, and the lack of dependability that farmers could have on the food hub to expand production without proof of profits.<sup>5</sup> The recommendations that Karp Resources and Crossroads Resource Center provided Grow L+A as a conclusion to their report were to integrate with the area's local food initiatives and activities, build momentum and success through collaboration, and to continue their involvement with Mill No.5, should development continue.<sup>6</sup> Lewiston/Auburn has a high population of refugees from many countries, especially Somalia. This provides an opportunity for Kim and Whiting Farm to partner with organizations of Somali Bantu farmers to increase the production and profitability of their farms but also produce goods that are culturally appropriate for various types of cuisine. This will limit the reliance on the international food chain and promote local sustainability of the Lewiston/Auburn food system.

Our assessment of a cold storage facility at Whiting Farm is part of a larger project that Kim Finnerty wants to implement, including the construction of a food hub on the premises that will include three types of storage, a washing/packing station, as well as a commercial kitchen. Through our research, and the guidelines provided us by Kim, we have created criteria and guidelines that we suggest Kim should follow in order to build and operate a facility that is efficient, cost-effective, and accessible for all users. The specific constraints and guidelines of the facility given to us by Kim include:

- 2700 square foot building; 300 square feet allocated for cool and frozen storage, 540 square feet for cold storage, and 1200 for a commercial kitchen, classroom, and washing/packing space.
- Humidity and temperature controlled storage chambers (cool, cold, and frozen)

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<sup>4</sup> Karp Resources 2012: 16

<sup>5</sup> Karp Resources 2012: 18

<sup>6</sup> Karp Resources 2012: 22

- 3 year payback period (it will need to be profitable at least 3 years after its construction)
- Low wattage energy requirements
- Space to operate a forklift

Through the methodology mentioned earlier (conversation, literature review, facility visits, and case studies) we have identified the steps that Kim can take in constructing a successful storage facility and food hub in general. The five major steps include: identifying a vision; identifying and fulfilling demand; creating a design that will facilitate the operations; applying for and securing funding; and constructing the facility in the most desirable location.

### ***Vision***

Kim's vision has already been established based upon her desire to construct a food hub that will allow her to create a farmer apprenticeship program as well as continue her current education and job-training programs that occur at Whiting Farm in association with John F. Murphy Homes' mission to serve those with developmental disabilities. Kim also hopes that this will be a hub for agricultural and other food-related business ventures. For this, it will be crucial for Kim to continue outreach and establish potential partners who she can count on to utilize the facility.

### ***Demand***

In order for farmers and other food businesses to utilize a food hub facility, it has to be accessible and profitable for them. In order for Kim to ensure that this facility will meet the needs of her potential partners, it would be helpful to conduct market research in the area to ensure that once the products are stored at the facility, they can be adequately distributed to markets in the L/A and surrounding area that will accommodate them. In conjunction with that, Kim will need to purchase a refrigerated van, estimated at around \$50,000 that users of the space can also use to distribute their goods. Another option would be to partner with a distribution organization like Crown of Maine or Farm Fresh Connection that could potentially pick up produce from the facility and distribute around Maine to consumers who have a demand for local produce and value-added goods.

## *Design*

For design and facility specifics, our recommendations focus mainly on the cool, cold, and frozen storage components of the facility but we have included some considerations into how the entire facility should be structured. We recommend that the dimensions of frozen and cool storage be 20 feet by 15 feet, and the cold storage be 20 feet by 27 feet. Each storage facility also accounts for a 12 foot path to accommodate a forklift for moving heavy pallets around the space (Fig. 3). The capacity of the cool and frozen chambers will be 16 pallets and the capacity of the cold storage chamber will be 22 pallets (Fig. 5). To ensure efficient operation of the facility that meets environmental and economic standards, we have identified humidity control, temperature monitoring, economizer systems, and upfront investment as crucial components of design. In order to maintain produce sufficient for sale in markets, the humidity and temperature will need to remain at certain levels to ensure the integrity of the product. These controls can be monitored through a security system offered by Seacoast Security in Freeport, ME. Even though different products require different environmental conditions, it is possible to create three environments that complement one another to maintain freshness of a variety of things (see Appendix B for complete storage recommendations). It is recommended that cool storage be kept between 45-55 degrees fahrenheit, cold storage between 35-40 degrees fahrenheit, and frozen storage below zero degrees fahrenheit. The humidity levels also depends upon what is being stored in the space and for how long, but that is something that can be adjusted utilizing humidifiers and dehumidifiers. To keep cost and emissions of refrigeration low during the winter, an economizer system can be implemented to draw in cool air during the cooler months. In addition, upfront investment in proper insulation and compressor units will ensure a facility that operates at peak performance. In addition to mechanics of the facility, having someone in the manager position is recommended to facilitate the business and technical operations.

## ***Funding***

The estimated cost of installation for the cool, cold, and frozen storage chambers is \$90,000, which includes assembly and equipment. This quote was provided to us by Pro-Tech Refrigeration in Auburn, ME. Kim also provided us with a quote from her contractor for accessory costs including shelving and doors, which is estimated to be \$43,000. According to the case studies of other food hubs located within New England, the average estimated operating costs for a facility this size would be \$700-800 a month for just the refrigerated storage. However, a separate walk-in cooler refrigeration company identified that a 10x12 freezer alone would cost over \$400 dollars a month for energy usage (Table 2). As Kim's freezer layout is almost 3 times that size, it would be important to attain a clearer idea of the importance of this larger freezer space to ensure long-term financial viability. According to data given us to by Crossroads Resource Center, the average rental rates for a facility this size is \$25/pallet/month for both cool and cold storage, and \$45/pallet/month for frozen storage. Based on these numbers, the average total monthly revenue for the facility at Whiting Farm would be \$1,670 (Fig. 4). It will be important for Kim to apply for and secure grants for upfront construction costs related to the facility (see Appendix B for a complete list of grant opportunities that this project would qualify for).

## ***Construction***

There are some major constraints in terms of construction, especially when deciding on where the facility itself will be built. Whiting Farm is around 120 acres, and has plenty of space to build the facility with adequate access for pick up and drop off. However, without potable water, a well will need to be dug on site, but Kim is currently unsure of where the best place will be to do so (Fig. 6). Since she is on the boundary of two watersheds (Taylor Pond and Lake Auburn), there will need to be careful planning for washing station drainage. Once a site is identified, there are other construction details that should be kept in mind. Because this is a new facility, things like insulation and concrete slab flooring can be planned out exactly as to align with our goals of energy-efficiency and cost-effectiveness. Insulation is measured in terms of r-values. When purchasing insulation, the higher r-value the better. Because the amount of

insulation a facility has directly affects its energy efficiency, it is better to spend more on a one-time cost to save more on electricity usage in the future. The amount of floor or foundation insulation there is will also have an effect on energy-efficiency and cost-effectiveness. Because the units identified in the Pro-Tech proposal have an insulated floor, insulating the concrete slab beneath cold and cool units is not worth the investment.<sup>7</sup> However, that is not the same for the freezer unit. Because concrete slabs can absorb radiant heat, a two to four inch layer of rigid foam insulation can make a positive difference.

Based upon this model for developing facility, it is essential to be realistic in the planning stages when designing a food hub. Perhaps the easiest trap for developers to fall into is to be over-optimistic and overly excited about the dream of a food hub, thereby making it difficult to confront what the realistic demand and chances of success are. This can lead to creating a facility and business structure that is too large, needing far more business to survive than can realistically be available right away (see Appendix AI). It is essential that a new food hub start by defining its actions by moderation, build a firm base of partnerships and clients, and establish itself as a viable option for farmers to utilize before scaling up. Farmers, when contacted about their possible usage of a food hub and cold storage facility at Whiting Farm, routinely reply that if such an operation were to come into existence they would consider planting more crops to make use of it, but until they're confident in such a facility's durability and viability, they would not take the risk of expanding production (see Appendix AIII). Farmers in the area, at present, currently only plant what they know they can effectively store and bring to market. It is inherently risky for them to plant more on the expectation that a new food hub will exist at the end of the growing season. A new food hub has to display to farmers that they are reliable and financially secure before they will commit to expanding their production to populate the food hub. In Maine, the odds are somewhat against a new food hub's success, causing farmers to be increasingly hesitant (see Appendix AII). For Whiting Farm to succeed in developing a food hub centered around a cool, cold, and frozen storage facility it is essential that the initial facility can have low enough initial operating costs to survive several years of relatively low usage. The fatal

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<sup>7</sup>Store it Cold. "How to Build a Standing Walk-In Cooler with a CoolBot". Accessed 12/14/2017

flaw that can be seen in the failed food hubs studied is routinely that they overcommit themselves by building to large, too soon, so that demand is far too low to meet the huge operating costs related to a large scale building and business.

## Recommendations for Next Steps

### ***Transportation***

From our discussions with farmers and food hubs alike, we learned that transportation to the potential food hub at Whiting Farm will be one of the largest barriers to overcome. Many farmers stated that they simply don't have the time nor the resources to drive their produce to and from Whiting Farm every day, or even multiple times a day in some cases. We recommend, based on our conversations with Justin Nadeau of Unity Food Hub, that Whiting Farm purchase an insulated, refrigerated van. A new van costs approximately \$30,000-\$50,000, and can be bought with refrigeration directly from a specializing company, or Whiting Farm could purchase any van, new or used, and then simply pay to have the refrigeration and insulation added to it. There are a multitude of dealerships specializing in refrigerated trucks and vans in Maine and the rest of New England, and it would be wise to shop around closer to the actual date of purchase to get a sense of which new and used models are available and cost effective at that time.

We envision that this refrigerated van could be the basis for an additional service that Whiting Farm could provide farmers, for a fee. Pricing for this service is difficult to determine this far in advance since one of the largest components of the operating cost for this service is the price of gasoline, which constantly changes and is impossible to accurately predict.

### ***Certification***

In order to provide assurance to both farmers using the Whiting food hub and customers wishing to purchase products there, we recommend that Whiting pursue Good Agricultural Practices and Good Handling Practices certifications. These are voluntary certifications provided by USDA, and serve to verify that the facility is adhering to the USDA standards for ensuring microbial food safety. To achieve these certifications, Whiting Farm should make sure, at every

stage of the design and construction, that the items being purchased and installed are up to USDA standards and that they are implemented in such a way as to make cleaning of the facility simple and easy, while also ensuring that there is a sufficient monitoring system in place to guarantee that the cool, cold, and frozen storage rooms are always kept at the correct temperatures and that produce is never removed from their designated temperature zones for more than four hours at a time. To achieve these certifications, Whiting Farm will submit an audit request form once the facility is built to the local USDA office, who will then perform the audit. Further details can be found here: <https://www.ams.usda.gov/services/auditing/gap-ghp>.

### ***Building Permits***

Based on a conversation with Eric Cousens, Deputy Director of Planning for Economic and Community Development for Auburn, the food hub at Whiting Farm would likely not face any major problems in securing building permits. The one major issue will be navigating the regulations of both the Lake Auburn and Taylor Pond Watersheds, especially given the need for a washing station. A soil analysis will be necessary to find a location that will be suitable, but Mr. Cousens had little doubt that Whiting Farm and the City of Auburn would be able to work out a solution. He is very excited about the prospect of promoting local agricultural through a food hub at Whiting Farm, and is willing and able to assist in the permitting process in conjunction with the architect or contractor who eventually plans and builds the facility. His contact information and further details about Auburn's permit process can be found at: <http://www.auburnmaine.gov/pages/government/planning-permitting-and-code>.

### ***Continued Outreach***

The most fundamental step necessary for the sustainable success of the food hub at Whiting Farm is to ensure that farmers and other organizations use it on a continued basis. Our best recommendation for how to ensure this happens is to continue to reach out to as many possible users as possible throughout the planning and construction stages to make sure that the food hub at Whiting stays in their minds, and that as many people as possible in the area are aware of its developing existence. One effective way to use the list of farms in the area that

we've compiled for this report is to start sending out a periodic newsletter to the contact list, and anyone else who may be interested. It would update everyone about the progress being made towards opening the food hub as well as to simply remind as many people as possible about the existence of such a project (see Appendix A).

## References

- Chase, Lisa and Grubinger, Vern. *Food, Farms, and Community: Exploring Food Systems*. 2014. University of New Hampshire. Print.
- Counsel, Auburn City. 2010. "Code of Ordinances City of Auburn, Maine." Tallahassee, FL: Municipal Code Corporation. Accessed Nov 2017.
- Growing Together, North Carolina: Connecting local foods to mainstream markets. 2017. Webinar Training: "Best Practices for On-Farm Cold Storage". *Center for Environmental Farming Systems funded by USDA*. Accessed 12/12/17.
- Halweil, Brian. 2002. "Home Grown: The Case for Local Food in a Global Market". Edited by Hendrickson, John and Sanford, Scott. 2015. "On-Farm Cold Storage of Fall-Harvested Fruit and Vegetable Crops." *Board of Regents of the University of Wisconsin System*. Accessed Nov 2017.
- Karp Resources and Crossroads Resource Center. 2015. "Lewiston-Auburn Regional Food Hub Feasibility Study". *Prepared for Grow L+A*. Accessed 12/14/17.
- Kutz, M. (Ed.). (2013). *Handbook of farm, dairy and food machinery engineering*. Retrieved from <http://ebookcentral.proquest.com>. Accessed Nov 2017.
- Ladner, Peter. *The Urban Food Revolution*. 2011. New Society Publishers. Print.
- Mad River Food Hub. "Rates". [Madrivierfoodhub.com](http://Madrivierfoodhub.com). Waitsfield, VT. Accessed 12/12/17.
- Maine Department of Agriculture and Forestry: "Agriculture Resource Development Division, in association with 'Get real. Get Maine'." 2013. *Maine Agri-Tourism Map*. Accessed 12/12/17.
- Örmeci Kart, M. C. 2015. "Analysis of Investment Cost of Apple Cold Storage Facilities." *Custos e Agronegocio* 11 (1):53-70. Accessed Nov 2017.
- Prugh, Thomas. *Worldwatch Paper 163*: Worldwatch Institute. Accessed 12/12/17.
- Ross, N. J. (2006). "How Civic is it? Success Stories in Locally Focused Agriculture in Maine." *Renewable Agriculture and Food Systems*, 21(2), 114-123. Accessed Nov 2017.

Schmidt, M., Kolodinsky, J., DeSisto, T., & Conte, F. (2016). "Increasing Farm Income and Local Food Access: A Case Study of a Collaborative Aggregation, Marketing, and Distribution Strategy That Links Farmers to Markets." *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 157-175. Accessed 12/12/17.

"Storage Conditions Fruits & Vegetables." University of Maine Cooperative Extension 2001. Web. 11/16/17. Accessed Nov 2017.

Store it Cold. "How to Build a Standing Walk-In Cooler with a CoolBot". Accessed 12/14/2017

Thompson, Antony Keith. 2016. "Fruit and Vegetable Storage Hypobaric, Hyperbaric and Controlled Atmosphere" *SpringerBriefs in Health, Food, and Nutrition*. Accessed Nov 2017.

United States Department of Agriculture. 2016. "The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks". Edited by Gross, Kenneth C., Wang, Chien Yi., and Saltveit, Mikal. *Agricultural Research Service*. Accessed Nov 2017.

U.S. Cooler. "Cooler Connection". Blog.uscooler.com. Accessed 12/12/17.

# Appendices

## Appendix A: Summary of Informants

### *I. Food Hubs*

**Name:** Unity Food Hub, Unity ME

**Contact:** Justin Nadeau

**Goal:** Aggregates markets and distributes Maine foods from mid-sized farms & food businesses throughout the state.

**Operation:** Maine Farmland Trust is a major partner, but they also have around 52 partners that help them increase the access that both farmers and consumers have to markets. Their facility is strictly used for storage/packing of wholesale produce for the Harvest Share program. Farmers drop off produce at the hub, and then the hub is responsible for the distribution. Their Harvest Share program allows consumers to sign up and receive shares of vegetables weekly, biweekly, or monthly that are delivered to specified pickup locations. The harvest shares are comprised of vegetables and meat from multiple producers. Through the Harvest Share program they also aim to educate consumers about the products they are receiving.

**Types of produce distributed:** Variety of vegetables and meats

**Certification:** GAP (Good Agricultural Practices) and HACCP Plan (Hazardous Analysis Critical Control Point)

**Notes:**

The Unity Food Hub incorporates three different types of storage at their facility, including two cold and moist coolers, one cool and dry cooler, and a freezer, in addition to a commercial kitchen. One cold storage space is used for receiving, while the other one is used for harvest share delivery. Without a growth plan, incorporating too many products can get out of control, which is why they only focus on the storage and distribution of vegetables and meat. That being said, a generator was installed during construction to account for future growth and

increased energy needs of either the cooler or kitchen space. To aid in transportation of produce, they own a refrigerated van and rent a refrigerated box truck.

Justin highly suggested implementing a security system for cooler control malfunctioning in order to make sure that storage standards are maintained at all times. Seacoast Security out of Freeport, ME offers security monitoring systems for commercial use. He also suggested incorporating temperature control units that check temperature and humidity every four hours and store the data on a USB drive to create a database of environmental conditions within the coolers. In addition to temperature and humidity controls, a sprinkler system is also necessary to prevent destruction in the instance of emergency.

The reason for incorporating a HACCP plan into their business structure is to address the critical control points within the operation that might introduce contaminants including processed foods (or lack thereof) and the pre-washing of produce by farmers before delivery. Another part of the HACCP plan is the incorporation of a pest management plan. Modern Pests, out of Brunswick, ME implemented rodent traps for the facility and helped them establish the plan for future pest management.

- I. Cold and Moist: 37 degrees F, 35% humidity
  - A. Organization: delivery cooler and receiving cooler
  - B. ~ 8ft tall, 15ft x 30ft
  - C. Bagged in larger quantities (easier to manage – than opening up a bunch of small bags)
  - D. Often run coolers all year round
- II. Cold and Dry: 55 degrees F + dehumidifier
  - A. ~ 8 ft tall, 20ft x 25ft
  - B. Plastic pallets
  - C. Plastic shelves/bins (vertical space)
  - D. Compressor: can't go below 50 degrees (made the unit cheaper because it's smaller)
- III. Freezer: -10 degrees F
  - A. Temperature control unit

- B. Separate from building (an afterthought to the original design)
- C. Door flaps to help with loss of cool air
- D. Shelving
- E. ~8ft x 8ft

**Name:** Northern Girl Food Hub (closed)

**Place:** Van Buren, ME

**Type of Location:** Food Hub

**Goal:** Facilitate distribution of Maine grown produce specifically for mid-sized farms

**Operation:** The facility was built in response to a need identified by Maine Food Strategy for processing and distribution infrastructure. The company partnered with Crown of Maine to distribute/ local products to food services, institutions, and direct retail. Had a contract with Whole Foods before their sales declined and they had to scale back on organic produce, especially for use in their prepared-foods kitchen. A major part of their business was also the foraging of fiddleheads to sell to out of state buyers, but this operation alone was unable to support the facility once whole foods (their major customer) left.

**Name:** Coastal Farms and Foods (Closed)

**Place:** Belfast, ME

**Type of Location:** Storage space and kitchen space for processing of value-added products.

**Operation:** 50,000 square foot facility utilized by 15 food entrepreneurs and 50 farmers using cooler storage. The facility was in an ideal location for a food hub, since one third of Maine's farms are located within a 50 mile radius of the building (access to producers and potential markets). The original business plan was dependent upon blueberry processing and freezing to fill the storage space, but eventually the blueberry business was not producing enough to fill the space, which led to its failure, in addition to a lack of upfront funds, as well as a weak facility design and business plan based upon customer base.

**Name:** Karp Report: Lewiston-Auburn Regional Food Hub Feasibility Study (proved not feasible)

**Place:** Bates Mill No. 5, Lewiston, ME

**Contact:** L/A Good Food Council

**Goal:** Proposed food hub to fill empty mill space

**Operation:** The key findings of the studied by Karp Resources include the needs of regional producers, commercial buyers, and the community. They also include an analysis of the region's assets including a summary inventory of the key food networks in the region. The food hub for the mill was found to not be feasible because there is still attention needed at creating a local food network that will facilitate and support a food hub in the future. <sup>8</sup>

**Name:** Farm Fresh Connection

**Place:** Freeport, ME

**Contact:** Hillary

**Type of Location:** Food Hub

**Goal:** Facilitate distribution of Maine grown produce specifically for mid-sized farms

**Operation:** Buys from 100+ farms across the state of Maine and distributes to other locations in Maine. Delivery routes change depending on the week but daily customers include the Bath/Scarborough area while weekly customers include St Joseph's College and Sysco. Farm Fresh Connection also delivers to other areas around Maine including Sugarloaf, Kingfield, Wells, Kennebunk, Lewiston, and Auburn.

**Types of Produce Distributed:** vegetables, fruit, eggs, cheese, meats, honey, syrup, grains, dry beans, and pickles/sauerkraut.

**Certification Yes/No, Type:** Yes, GAP/GHP certified (Good Agricultural/Handling Practices)

**Site:** Warehouse with walk-in cooler, loading dock, dry storage, 3 chest freezers. No washing/packing facility (rely on the farms to have the product "ready to handle") or commercial kitchen space.

**Notes:**

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<sup>8</sup> "Lewiston-Auburn Regional Food Hub Feasibility Study". 2015. Prepared for Grow L+A by Karp Resources and Crossroads Resource Center. Web. 11/12/17.

Although the business model of Farm Fresh Connection is different than what Whiting Farm envisions (distribution vs. aggregation/storage), Farm Fresh Connection is a successful example of a regional food hub that has gained the trust and business of over 100 farms around Maine. Some of these connections were made before the project got started but mainly included mid-sized farms with similar problems; they were too big for farmers markets but too small for commercial wholesale. Through the use of a refrigerated box truck, Farm Fresh began picking up and distributing produce to restaurants, markets, co-ops, schools, and other distributors. Their facility is comprised of a 30'x40' warehouse barn that houses a 12'x30' walk-in cooler and other storage space. Because they don't have a washing or packing facility, they buy products that are prepackaged/dated/labeled. These labels help them keep track of how long they have been in there and keep them in accordance with GAP/GHP standards. These food safety standards are a must if any farm/food hub wants to sell wholesale, which can be a limiting factor for some of their producers. When building a facility, the only GAP/GHP standards that can be built in are aspects of the facility that have to do with access to running water including vegetable washing, hand washing, bathroom facilities, etc. Other information and advice that was offered was the idea of renting refrigerated storage/commercial kitchen space (which Whiting Farm is pursuing already) and the idea of a visit to Boulanger and Sons farm to see an example of a clean, simple, and cost-effective facility. Boulanger and Sons sell to a variety of distributors but also have contracts with Hannaford's grocery stores.

## ***II. State and National Food System Experts***

**Name:** Crossroads Resource Center

**Contact:** Ken Meter and Megan Phillips Goldenberg

**Operation:** Consulting non-profit that analyzes and provides tools for food systems around the country to operate efficiently and effectively in ways that promote local agriculture.

**Notes:**

Ken and Megan stressed the importance of designing the facility to facilitate connections between producers and consumers within the L/A and surrounding community. A way to

accomplish this, as outlined in our plan for developing a facility, is to identify the key players and figure out what is needed within the community and how this facility can contribute to that. Megan also outlined the importance of demonstrating need of the facility in order to obtain grants. For example, opening up temporary storage or implementing programs in existing kitchens in L/A and demonstrating how they could expand with the new food hub facility.

**Name:** Chris Hallweaver

**Operation:** Northern Girl management

**Notes:**

After providing Chris with background on the Whiting Farm food hub, he suggested creating a strong partnership with SBCA, an organization that is definitely in need of facility. By creating this partnership, their profitability will grow because of the reliable storage and space to create value added products that can be sold in the market.

**Name:** Maine Farmland Trust

**Contact:** Alex Fouliard (Farming for Wholesale)

**Operation:** Provide in-person training and workshops for farms transitioning to production for wholesale, providing one-on-one technical assistance for farms based on financial logistics to connect them with customer networks. This includes getting local food into mainstream markets (retailers, food hubs, etc.) and preparing markets for local products.

**Notes:**

*I. Motivation*

- A. Making wholesale profitable for farmers
- B. Wholesale is next direction for local food to grow into, but it is important to maintain the quality and value of local food
- C. Observed that storage and transportation are the missing links in the chain that farmers need support around (specific financial support)
- D. Know the market: who is selling and who is buying

*II. Wholesale and food hubs*

- A. How do we make this facility more accessible for farmers or wholesale?

1. Wholesale buyers look for high quality, good aesthetic, and really consistent quantities
2. Regular communication and availability
3. Distribution plan
4. Strategic planning of the facility

**Name:** Maine Farmland Trust

**Place:** Based in Portland, ME

**Contact:** Elizabeth Sprague (Farm Business planning Project Manager)

**Organization goal:** Advocate for and support farmers and farmland

**Operation:** Market research and food hub feasibility

**Notes:**

- I. Conduct market and demographic research to optimize consumer base: likely only one third of those who expressed interest will actually end up using the space
- II. Constant funding and/or grants are favorable for operation

**Name:** Cooperative Development Institute

**Contact:** Jonah Fertig

**Goal of operation:** Help businesses establish economic control through worker, producer, harvester, consumer, and multi-stakeholder cooperatives

**Notes:**

- I. Scale of the facility impacts not only what will be stored and processed there but also how it will be distributed.
- II. A facility of this scale will need some sort of management position to facilitate the movement of produce into and out of the system.
- III. Most efficient to run the facility at capacity, which means establishing need beforehand is extremely important.

**Name:** Lewiston/Auburn Good Food Council

**Contact:** Julia Harper

**Goal of organization:** Ensure access to good food for the Lewiston-Auburn community through education, advocacy, and community-based decision-making. This includes coordination between sectors of the food system, as well as evaluating and influencing policy.

**Notes:**

*I. Karp Report: Lewiston-Auburn Regional Food Hub Feasibility Study*

- A. Limited scope: only focused in three counties
- B. Producers and consumers in the area are not necessarily ready for wholesale and prefer direct selling to consumers

*II. Good Food council Food Charter Goals*

- A. Food security for every member of the community
- B. Consider local and sustainable agriculture when making food decisions
- C. Enable leadership by all members of the community by sharing knowledge of “good food”
- D. Elevate good food policy
- E. Preservation of working landscapes and development of community infrastructure that enhances production of and access to “good food”

**Name:** River Rise Farm

**Place:** Turner, ME

**Contact:** Bonnie Lounsbury (Owner)

**Operation:** Diversified vegetable farm: wholesale and direct retail

**Notes:**

As a farmer who produces vegetables for both direct retail and wholesale, Bonnie had a lot of information regarding the usage of storage by different farmers and farming operations. Most farms doing sales through a farmer’s market or CSA have their own storage, while larger storage facilities align best with production for wholesale. She highlighted the insufficient price points offered by buyers for local producers as a downfall to both direct and wholesale markets.

### ***III. Potential Users and Partners***

**Name:** Somali Bantu Community Association (SBCA)

**Place:** Office in Lewiston, ME

**Contact:** Kristina Kalolo (Marketing/campaign manager)

**Operation:** Assist farmers in finding markets for their produce

**Types of produce distributed:** Diverse vegetable production

**Site:** Whiting Farm, Auburn ME (one of three farming locations)

**Notes:**

- I.* Currently farm on three different properties, only one of which has a washing station
- II.* Rent 1-2 pallets of storage space from Good Shepherd food bank
- III.* Currently 60 farmers growing on Whiting Farm land and greenhouses (mix of subsistence and market production)
- IV.* *SBCA Future relationship with Whiting Farm*
  - A.* Increased economic viability (potential to sell directly at Whiting's farm stand, and increase the amount of farmers who can grow commercially)
  - B.* One location/facility would facilitate their ability to scale up business to increase production, process produce, and store products on-site.
  - C.* Potential for value-added products to bring to farmer's markets (i.e. Somali tea, sambusas, mandazi, and other breads)
  - D.* Access to processing and storage facilities increases the shelf life of produce that a lot of the farmers depend upon for their food security
  - E.* Ability to create a strong in-community market with a consistent space to access culturally-appropriate produce

**Name:** Goss Berry Farm

**Place:** Mechanic Falls, ME

**Contact:** Walter Goss

**Operation:** Sell 40% of crops direct and 60% wholesale

**Types of produce distributed:** Strawberries, blueberries, raspberries

**Notes:**

Interested in utilizing off-site freezer storage for produce, specifically for raspberries. They are also interested in renting out space in the commercial kitchen. They have never rented storage space before, but they are planning on expanding production over the next five years and will need more storage, but constructing storage on-site is too expensive. They typically put berries into freezer storage during July and August and sell out by the end of the year. Currently their frozen berries are picked up at the farm and they own a passenger van for non-frozen deliveries.

**Name:** St. Mary's Nutrition Center

**Place:** Lewiston, ME

**Contact:** Kirsten Walter

**Operation:** Extension of the St. Mary's medical center - provide cooking and health and nutrition classes; maintain gardens around the city; gleaning; operate the Lewiston food pantry; and more.

**Notes:**

Because of the fast turn-over rate in the St. Mary's food pantry, it does not make sense for them to store food off-site, especially products that are stored in cold environments for short periods of time. However, there is potential for them to use cool off-site storage for products that they can store for longer periods of time throughout fall and winter. In addition, Kirsten sees potential for them to utilize this facility to expand their existing programming or create new programs. Kirsten also mentioned that they get requests from people in the community to utilize their commercial kitchen for value-added goods, but because they do not have the staffing or scheduling to make it work they defer people to other locations. This would be incentive for Kim

to open up a commercial kitchen and allow anyone to rent out space to produce value-added goods.

***IV. Other contacts (not committed partners)***

*\*Not all of these farms were contacted or are within a 20 mile radius of Whiting Farm, but could potentially be partners in the future when the food hub expands.*

- Food Joy - Auburn
- Jillson's Farm - Sabattus
- Valley View Farm - Auburn
- Little Ridge Farm - Lisbon
- Four Loves Farm - Auburn
- Whispering Winds Farm - Mechanic Falls
- Maine Gleaning Network
- Verrill's Vegetable Stand - Poland
- Apple Creek Farm - Bowdoinham
- Bubier Family Farm - Greene
- West Minot Sugarhouse - West Minot
- Spruce Bay Farm - Poland
- Crestholm Farm - Oxford
- Chipman Farm - Poland Spring
- Blue Ox Malthouse - Turner
- Burdock Farm - Greene
- East Branch Farm - Durham
- Levesque's Organic Farm - Leeds
- Maple Ridge Farm and Fishery - Sabattus
- New Leaf Farm - Durham
- Oscar's Farm - Mechanic Falls
- Derl Farm - North Yarmouth
- Frith Farm - Scarborough

- Andrews Farm - Gardiner
- Grace Pond Farm - Monmouth
- Ironwood Farm - Albion

#### NOT INTERESTED

\*These farms were contacted and did not express an immediate interest in the facility, but might be interested in the future depending on the construction and business structure.

- Cat and Fiddle Farm - Minot
- Willow Pond Farm - Sabattus
- River Rise Farm - Turner
- RE Hemond Farm - Minot

## Appendix B: List of Grant Opportunities

- Agricultural Development Grant
  - This is a grant for agricultural projects in the state of Maine from the state government. They are not currently accepting applications but will do so approximately once a year. Check back here to see when specifics are posted: [http://www.maine.gov/dacf/ard/grants/agricultural\\_development.shtml](http://www.maine.gov/dacf/ard/grants/agricultural_development.shtml).
- Harvard Pilgrim Agricultural Grants
  - Harvard Pilgrim is an organization that specializes in giving grants to healthy community food organizations throughout Maine and the rest of New England. Their website doesn't have much info about how to apply for a grant but they are worth reaching out to when the time comes. [https://www.harvardpilgrim.org/portal/page?\\_pageid=1438,6375992&\\_dad=portal&\\_schema=PORTALhttp://www.maine.gov/dacf/ard/grants/agricultural\\_development.shtml](https://www.harvardpilgrim.org/portal/page?_pageid=1438,6375992&_dad=portal&_schema=PORTALhttp://www.maine.gov/dacf/ard/grants/agricultural_development.shtml)
- Rural Cooperative Development Grant
  - This is a grant from USDA for up to \$200,000 for rural organizations working on developing infrastructure and cooperatives. The funding period for 2017 has closed but it will likely reopen in the Spring of 2018. <https://www.grants.gov/web/grants/view-opportunity.html?oppId=29279>.

- Farm to School Grants
  - This is a USDA grant for up to \$100,000 given to organizations providing schools with healthy food. If this is a direction Whiting Farm is interested in going and we can figure out how cold storage would help LA schools then this will be a good option.  
<https://www.grants.gov/web/grants/view-opportunity.html?oppId=292793>.
  
- Sustainable Agriculture Research and Education (SARE) Professional Development Grant.
  - This is a grant of up to \$150,000 from UVM for organizations educating farm service providers/cooperative extension personnel. If this project goes in the direction of establishing an agricultural apprenticeship program, then this grant would be highly relevant. The first application deadline is in July, 2018.  
<https://www.nesare.org/Grants/Get-a-Grant/Professional-Development-Grant>.
  
- SARE Research and Education Grant
  - This is a grant for organizations to develop educational and on-farm demonstration programs that advance the field of agriculture for up to \$200,000. The first application deadline is in July, 2018.  
<http://www.nesare.org/Grants/Get-a-Grant/Research-and-Education-Grant>.
  
- USDA Socially Disadvantaged Groups Grant
  - This is a grant from USDA for providing assistance to socially disadvantaged groups engaging in agriculture. Since Whiting Farm works closely with John F. Murphy Homes, SBCA, and New Roots this could be highly applicable applicable. Up to \$175,000. The full application is due July, 2018  
<https://www.rd.usda.gov/programs-services/socially-disadvantaged-groups-grant>.
  
- USDA Rural Renewable Energy Grant
  - This is a USDA grant for agricultural producers to develop renewable energy systems for up to \$500,000. The first application deadline is in March 2018.  
<https://www.rd.usda.gov/programs-services/rural-energy-america-program-renewable-energy-systems-energy-efficiency>.

## Appendix C: Produce Storage Guidelines

*Table 1.* List of fruits and vegetables grown in Maine, ideal temperature (Degrees F) and humidity (%) storage conditions, and approximate storage life provided these conditions. Chart provided by UMaine Cooperative Extension, 2001.

Fruit/Vegetable Type	Temperature (Degrees F)	Humidity (%)	Approximate Storage Life
<b>Fruits</b>			
Apples	30–40	90–95	1–12 months
Apricots	31–32	90–95	1–3 weeks
Blackberries	31–32	90–95	2–3 days
Currants	31–32	90–95	1–4 weeks
Elderberries	31–32	90–95	1–2 weeks
Gooseberries	31–32	90–95	3–4 weeks
Raspberries	31–32	90–95	2–3 days
Strawberries	32	90–95	3–7 days
Cherries, sour	32	90–95	3–7 days
Cherries, sweet	30–31	90–95	2–3 weeks
Grapes, American	31–32	85	2–8 weeks
Nectarines	31–32	90–95	2–4 weeks
Peaches	31–32	90–95	2–4 weeks
Pears	29–31	90–95	2–7 months
Plums and prunes	31–32	90–95	2–5 weeks

Quinces	31–32	90	2–3 months
<b>VEGETABLES</b>			
Artichokes, Jerusalem	31–32	90–95	4–5 months
Asparagus	32–35	95–100	2–3 weeks
Beans, dry	40–50	40–50	6–10 months
Beans green or snap	40–45	95	7–10 days
Beans, lima	37–41	95	5–7 days
Beans, sprouts	32	95–100	7–9 days
Beets, bunched	32	98–100	10–14 days
Beets, topped	32	98–100	4–6 months
Broccoli	32	95–100	10–14 days
Brussels, sprouts	32	95–100	3–5 weeks
Cabbage, early	32	98–100	3–6 weeks
Cabbage, late	32	98–100	5–6 months
Cabbage, Chinese	32	95–100	2–3 months
Carrots, bunched	32	95–100	2 weeks
Carrots, mature	32	98–100	7–9 months
Carrots, immature	32	98–100	4–6 weeks
Cauliflower	32	95–98	3–4 weeks
Celeriac	32	97–99	6–8 months
Celery	32	98–100	2–3 months
Chard	32	95–100	10–14 days

Chicory, witloof	32	95–100	2–4 weeks
Collards	32	95–100	10–14 days
Corn, sweet	32	95–98	5–8 days
Cucumbers	50–55	95	10–14 days
Eggplant	46–54	90–95	1 week
Endive and escarole	32	95–100	2–3 weeks
Garlic	32	65–70	6–7 months
Greens, leafy	32	95–100	10–14 days
Horseradish	30–32	98–100	10–12 months
Jicama	55–65	65–70	1–2 months
Kale	32	95–100	2–3 weeks
Kohlrabi	32	98–100	2–3 months
Leeks	32	95–100	2–3 months
Lettuce	32	98–100	2–3 weeks
Cantaloupe (3/4 slip)	36–41	95	15 days
Cantaloupe (full slip)	32–36	95	5–14 days
Casaba	50	90–95	3 weeks
Crenshaw	45	90–95	2 weeks
Honey Dew	45	90–95	3 weeks
Persian	45	90–95	2 weeks
Watermelon	50–60	90	2–3 weeks
Mushrooms	32	95	3–4 days

Okra	45–50	90–95	7–10 days
Onions, green	32	95–100	3–4 weeks
Onion, dry	32	65–70	1–8 months
Onion sets	32	65–70	6–8 months
Parsley	32	95–100	2–2.5 months
Parsnips	32	98–100	4–6 months
Peas, green	32	95–98	1–2 weeks
Peas, southern	40–41	95	6–8 days
Peppers, chili (dry)	32–50	60–70	6 months
Peppers, sweet	45–55	90–95	2–3 weeks
Potatoes, early crop	40	90–95	4–5 months
Potatoes, late crop	38–40	90–95	5–10 months
Pumpkins	50–55	50–70	2–3 months
Radishes, spring	32	95–100	3–4 weeks
Radishes, winter	32	95–100	2–4 months
Rhubarb	32	95–100	2–4 weeks
Rutabagas	32	98–100	4–6 months
Salsify	32	95–98	2–4 months
Spinach	32	95–100	10–14 days
Squashes, summer	41–50	95	1–2 weeks
Squashes, winter	50	50–70	1–6 months
Sweet potatoes	55–60	85–90	4–7 months

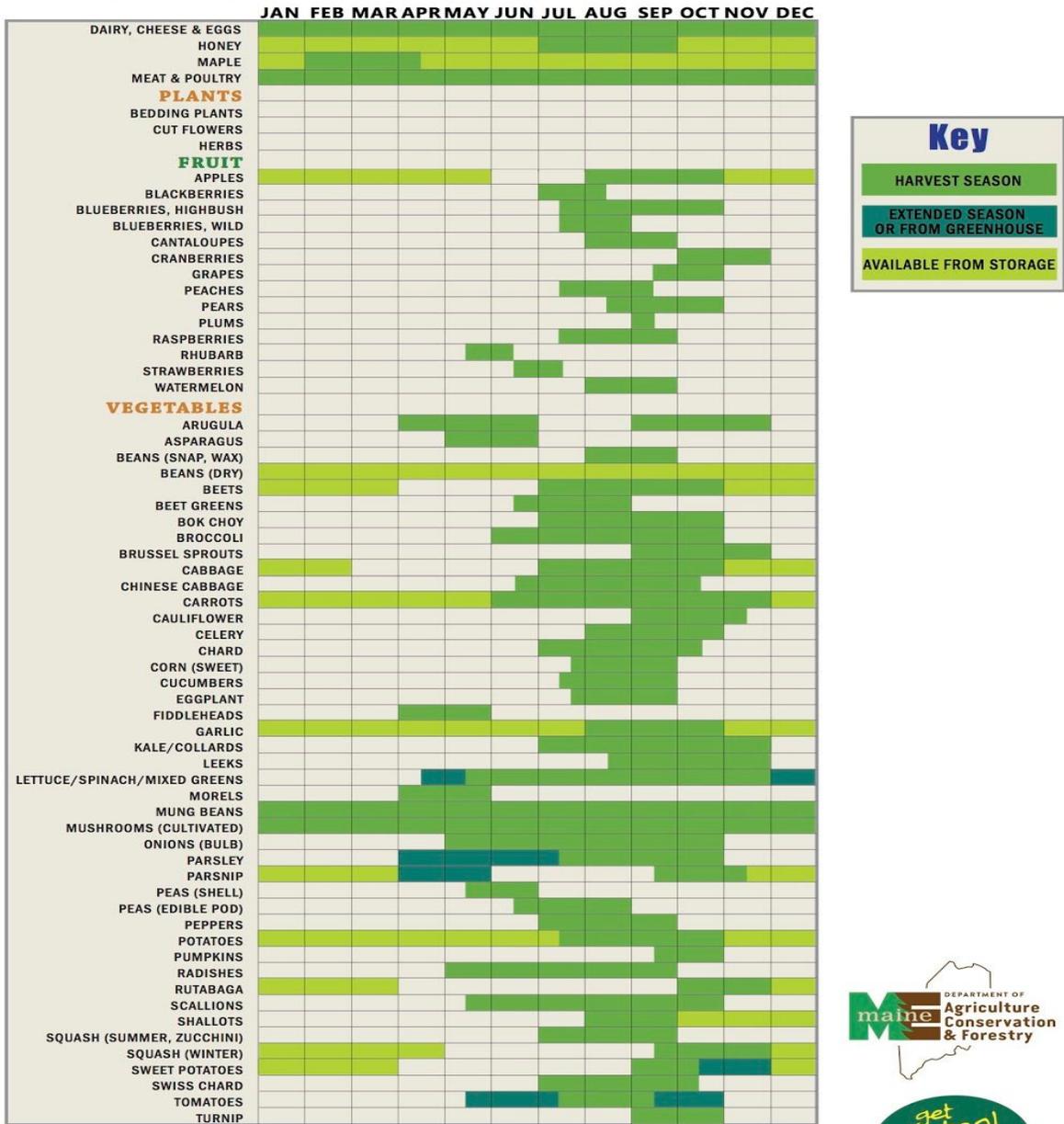
Tomatoes mature—green	55–70	90–95	1–3 weeks
Tomatoes firm—ripe	55–70	90–95	4–7 days
Turnips	32	95	4–5 months
Turnip greens	32	95–100	10–14 days
Watercress	32	95–100	2–3 weeks

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<sup>9</sup> "Storage Conditions Fruits & Vegetables." University of Maine Cooperative Extension 2001. Web. 11/16/17.

# Maine PRODUCT Seasonal Availability



Please note: the bars represent average dates for the state of Maine. Availability of products can vary widely based upon weather, locality, variety grown and other conditions such as pests or disease outbreak. This chart is meant to serve as a guideline for the purchase of fresh, wholesome Maine-grown products. Look for the Get Real. Get Maine! logo at your local grocery store, farmer's market or farm stand.



Figure 1. Seasonality chart for common vegetable crops grown in Maine. This will be important when considering what types of produce will be stored throughout various times in the year.

Provided by Maine Department of Agriculture, Conservation and Forestry.

# Appendix D: Layout and Design

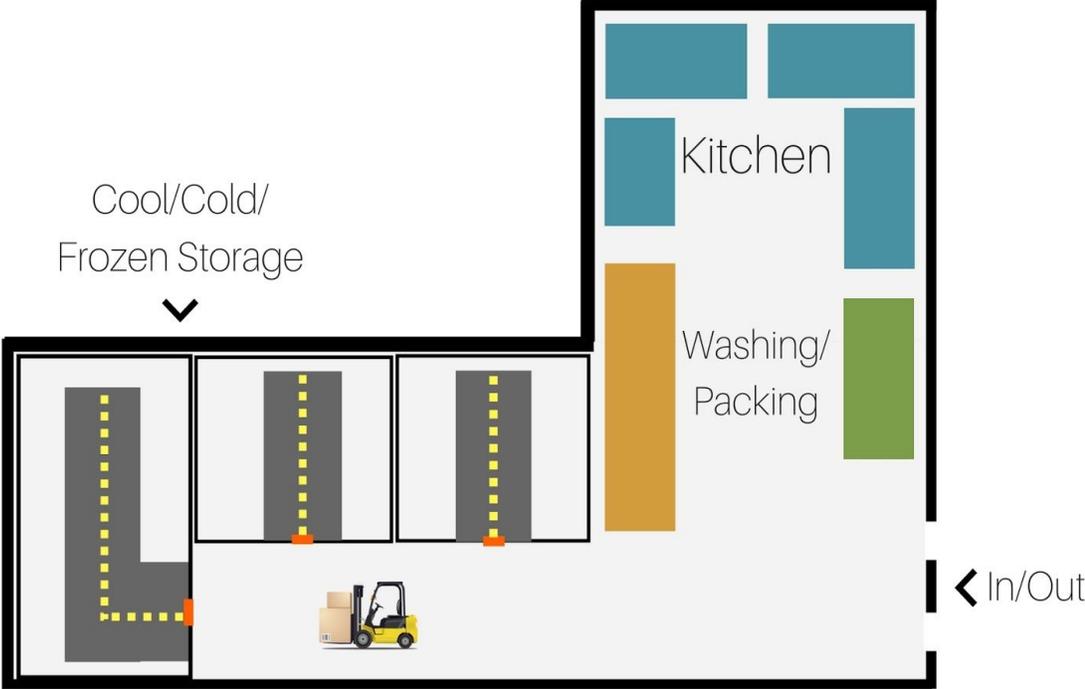


Figure 2. Food hub layout including cool, cold, frozen storage, kitchen, and washing/packing station. Represents loading dock accessibility as well as space needed for forklift usage. Produced by Ayden Eickhoff, 2017.

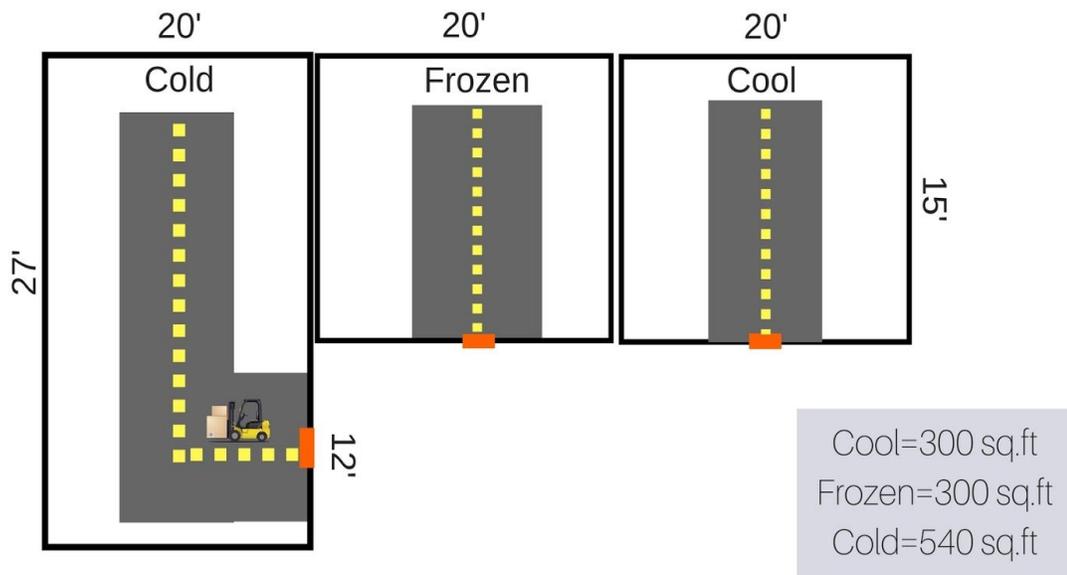


Figure 3. Cool, cold, and frozen storage layout. The 12 foot space in the middle of the chamber and the five foot wide doors at the end implemented to accommodate forklift usage. Produced by Ayden Eickhoff, 2017.

Type	Pallets	Cost per Pallet (monthly)	Revenue (monthly)
Cool	16	\$25	\$400
Cold	22	\$25	\$550
Frozen	16	\$45	\$720

Total Revenue=\$1,670/month

Figure 4. Potential revenue provided maximum capacity of the storage chamber and monthly rental rates. Produced by Ayden Eickhoff, 2017.

Freezer	Average Cost per month
6x6	\$227.72
6x8	\$227.72
8x8	\$227.72
8x10	\$347.24
8x12	\$347.24
10x10	\$347.24
10x12	\$406.38

Table 2. Estimated energy cost per month for freezer operation. Data provided by U.S. Cooler Connection.

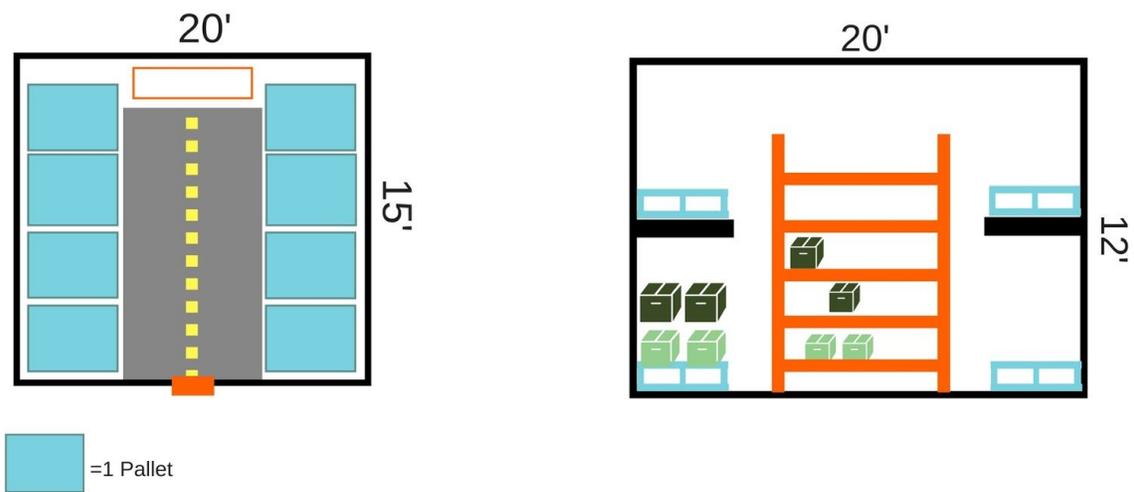


Figure 5. Layout and organization of the cool or frozen storage chambers. Each one will have the capacity to hold 16 pallets, with two rows of four, stacked two shelves high. There is additional shelving space at the back of the chamber where the forklift cannot reach. Produced by Ayden Eickhoff, 2017.



*Figure 6.* Potential locations for the food hub at Whiting Farm. Location is dependent upon well availability, easiest access for drop-off and pick-up, as well as best potential for renewable energy like solar panels. Image courtesy of Google Maps.