big enough

Pioneering the Small Home Revolution in Western Mass

Pioneer Valley Habitat for Humanity®

This project was supported by an Innovation Implementation Grant provided by the

COMMUNITY FOUNDATION OF WESTERN MASSACHUSETTS

Addendum to the March 2020 report: January 2021

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Addendum Summary

In our second Big Enough report (published in March of 2020), we wanted to look back at our original Big Enough Project report, reflect on our goals, and determine both our successes and challenges. In the process, Habitat came away with some important lessons learned that we wanted to share with future small home advocates, builders, and policy makers. You can find this report in full at pvhabitat.org/big-enough.

This addendum hopes to fill gaps in the original 2020 report, which was published prior to the completion of the third house on the shared Glendale Road land. Some information is duplicated to provide enough context for the addendum to stand alone. Habitat's goal was to compare the modular construction process of the first two houses to the third site-built house.

However, many processes were interrupted in 2020. Habitat adapted our work to ensure our volunteers were safe as we continued to build safe, durable, and affordable housing during the Covid-19 pandemic. This report includes an analysis of how those changes impacted our construction costs and timeline. Ultimately, Habitat was determined to complete the construction of Glendale Lot 2 in as timely a manner as possible (even if that meant incurring extra costs) in order to provide the partner family with the safety and stability of homeownership in an unstable year.

Big Enough pilot homes review

Since the launch of the project, Habitat has completed five small home projects: a single-family home in Greenfield, a one-bedroom small home on Garfield Avenue in Florence, and three single-family homes on Glendale Road in Northampton. Two of these projects, the 1 Garfield Ave home and the two modular homes at the Glendale Road development, are covered in more depth in the 2020 Big Enough Report. The comparison of the two modular homes and the third site-built home at Glendale Road is the main focus of this report addendum. These projects all combine various aspects of our research, prioritize different parts of the four areas of inquiry, and collectively address most of the seven areas of innovation.

There were experimental aspects to these projects for Habitat that pushed the boundaries of our traditional model of single-family stick-built homes. We have learned different lessons and discovered new challenges with each home. The cluster model implemented on Glendale Road proved to be a community and publicity builder. Use of prefabricated structures revealed financial and logistical difficulties, but with some adjustments, could be a viable option for future builds.

This report will cover primarily our successes and challenges as an affordable home construction organization around these pilot projects. Lived experience is a valuable part of assessing any new homes, and videos describing the homeowner experience, as well as a homeowner survey completed in spring 2020 are available at www.pvhabitat.org/homeowner-stories.

Glendale Road Phase 1

Phase 1 of this project consists of three zero-net energy possible homes built on a shared driveway off Glendale Road. While each home has a nearly identical floorplan, two were built with modular construction techniques through an innovative partnership with the Vermont Energy Investment Corporation (VEIC), the Massachusetts Department of Energy Resources, and a modular home builder called Vermod, while the third was built from the ground up on-site. All three homes utilized innovative financing options that will be described in detail later in this report. More details on the first two modular homes can be found in the 2020 Big Enough Report.

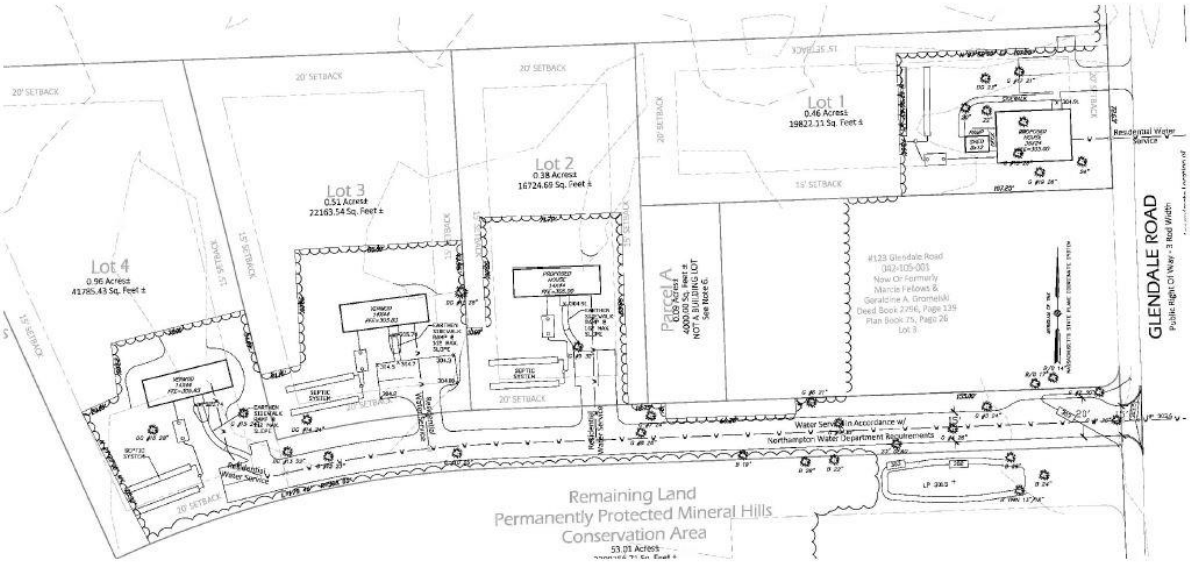
The third home on this common driveway was built entirely on-site. For an accurate comparison of labor, cost, and efficiency, the design and floor plan were devised to be as similar to the modular homes as possible; the only major differences were the addition of an accessible first floor full bath and a difference in foundations and roof structure. This addendum is primarily concerned with the cost, time, and engagement differences around the third site-built home in comparison to the two modular builds.

Of the seven areas of innovation, the Glendale Road cluster development targeted five: small footprint, lower sales price, innovative financing, zero net energy construction, and modular construction techniques.

These homes were supported with grant funding from the City of Northampton, the Federal Home Loan Bank of Boston, the Massachusetts Department of Energy Resources, and the Community Foundation of Western Massachusetts. Homeowner purchase financing was provided by Easthampton Savings Bank and Greenfield Cooperative Bank.

Glendale site-build home, completed in August 2020

Zoning and building codes



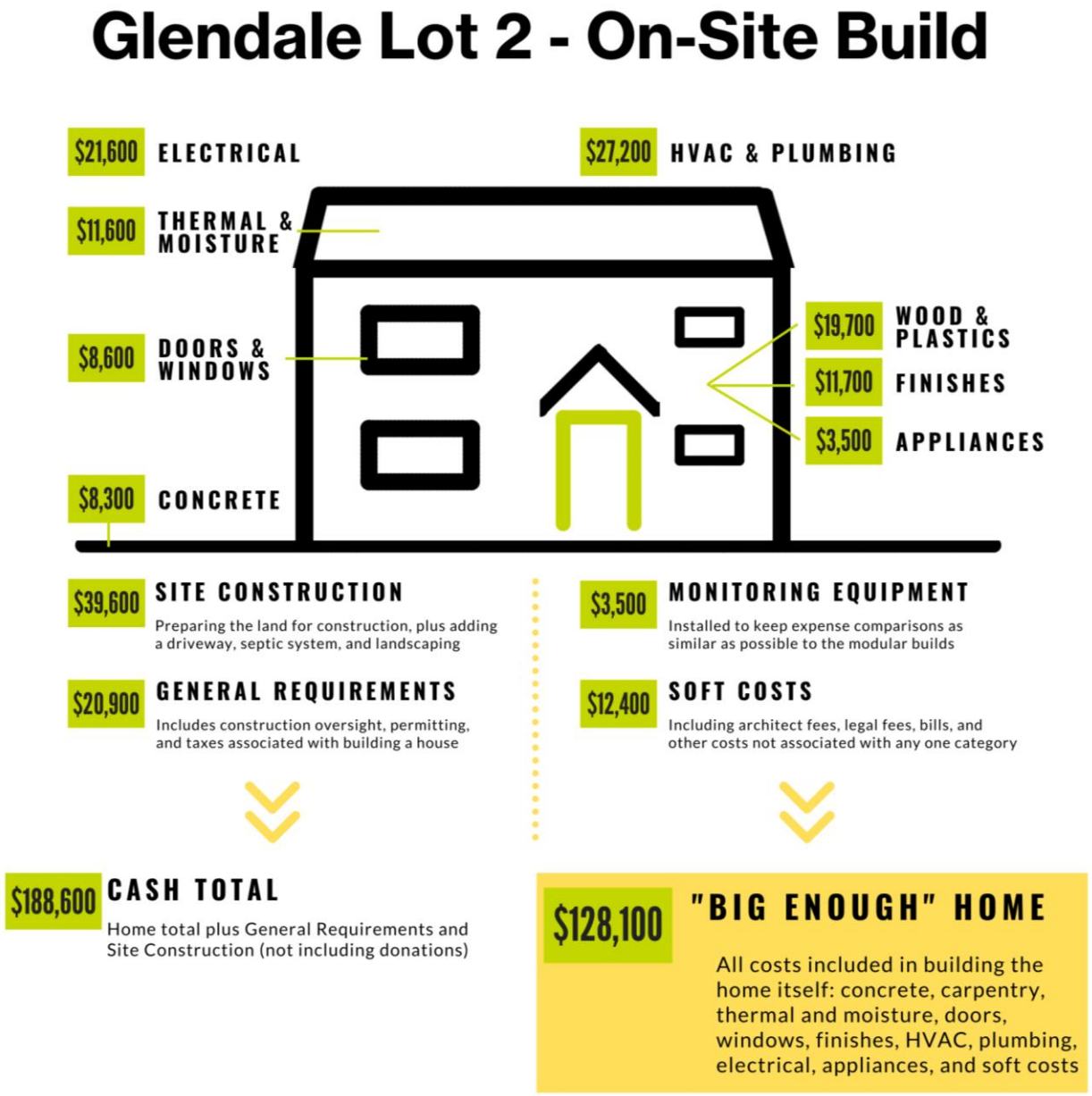
Modular homes are on Lots 3 and 4, the site-built home is on Lot 2, and an additional site-built small Habitat home will be built on Lot 1

Small lot zoning: The three homes off Glendale Road are part of a conservation limited development by the City of Northampton, built as a cluster development. The City applied to the Planning Board for a special permit, under which Habitat could build on smaller lot sizes (each lot is under one acre) while preserving over 50 acres of conservation land. Northampton zoning is written so that lot size and frontage space minimums may be waived if the development protects a majority of the property.

As a cluster development, the Glendale homes make use of a shared driveway. Shared driveways with small or no frontage can reduce the infrastructure cost of developing multiple lots that otherwise would need individual driveways or a subdivision road. They also enable owners to split maintenance costs through a shared management contract, and present less of an up-front logistical and financial difficulty as extending a road. This shared driveway allowed Habitat to orient the three homes in such a way that saves space and money while creating a natural small community of Habitat homes. However, Habitat's 2020 survey of other Habitat homeowners suggests that shared driveways with shared costs can present a challenge for homeowners to maintain and settle disputes around, and were not very popular.

Ownership and finance

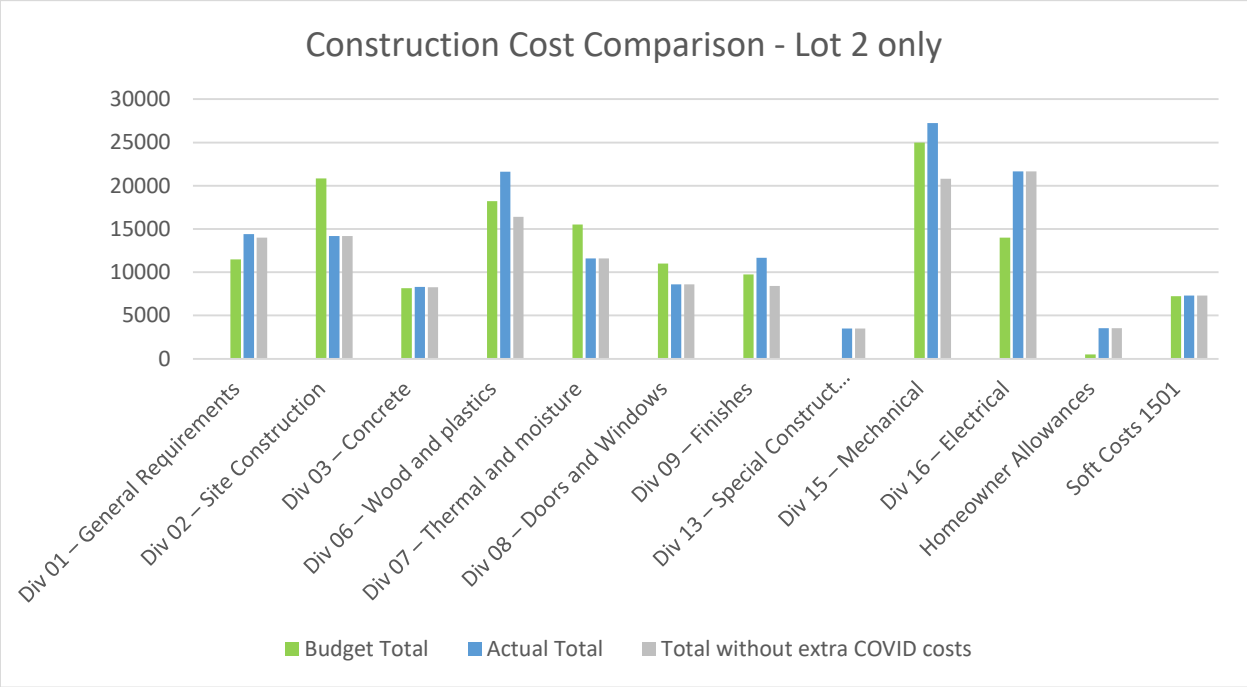
Modular home construction offers an opportunity for Habitat to potentially increase the speed of construction, but does not provide much opportunity for the cost savings associated with volunteer-driven construction. The budget for the site-built project was adjusted multiple times to account for previously unforeseen costs, but much of the standard building costs remained the same as expected for a standard Habitat build.



The graphic above details the final costs for each area of construction. Common costs on this build were significant, as more was spent on the site work than originally planned. Any common costs applicable to the whole site rather than one build, such as equipment rental, site work, and some general soft costs, were split among the three houses. Some individual totals, like the slightly differing land costs between the three lots, were also averaged across the three houses. Ensuring the builds were as identical as possible did add extra costs in the form of equipment and supplies that would not typically have been included in a standard PV Habitat build; this can be seen in the “monitoring equipment” cost and some soft costs.

The COVID-19 pandemic also added expenses that are not typically found in a Habitat build. Volunteers were barred from site beginning in late March and continuing through May, and outside contractors who were able to come in small groups were hired to ensure that progress was still being made. In this situation, getting the partner family into their new home on a

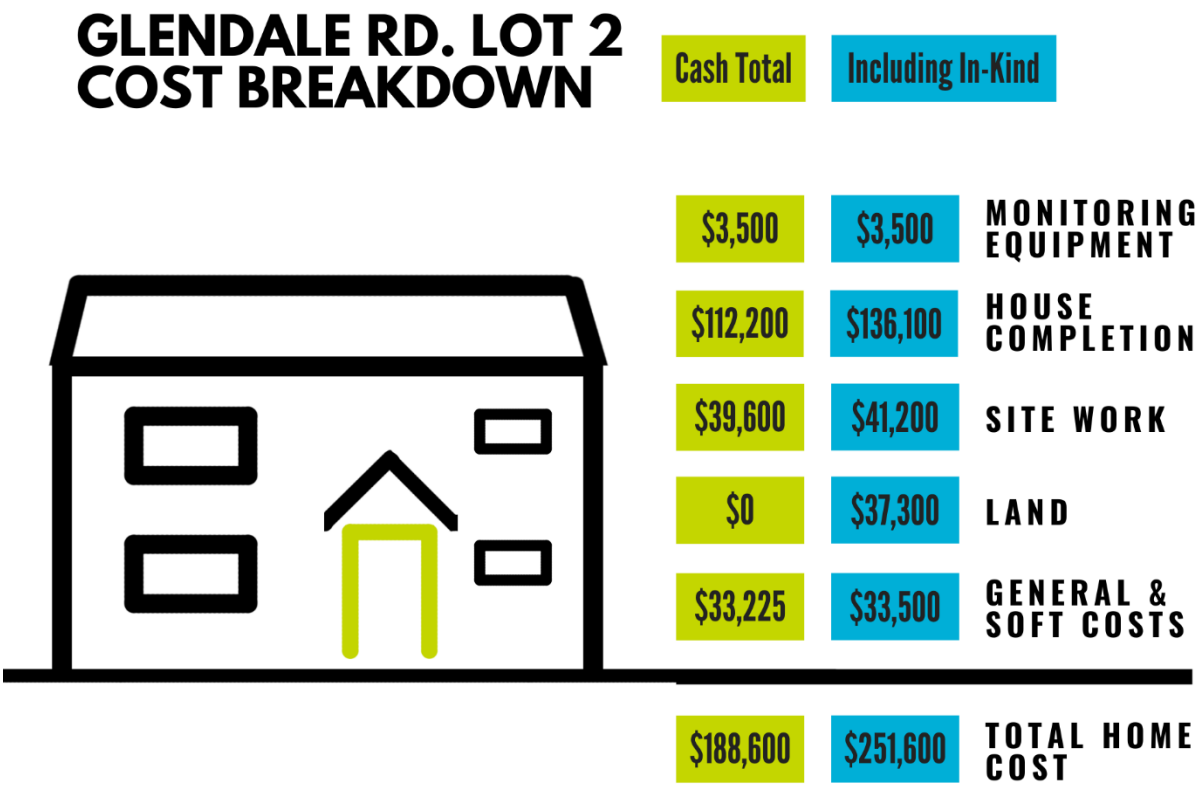
reasonable timeline was prioritized over the cost of hiring out labor that would typically be done by volunteers. In the graph below, the theoretical costs without additional COVID-19 expenses are listed alongside the actual numbers; additional expenses include paid labor that would have been done by volunteers, as well as recurring rental costs that were extended a few months as the build timeline was extended.



When split common costs are removed and the budget is only focused on Lot 2, some numbers show a dramatic decrease. The site construction was lowest for this lot, as it was the smallest acreage and closest to the road. A few columns also demonstrate that keeping this build as close as possible to the modular builds did add some cost. The Div 13 column indicates the cost for environmental monitoring equipment that was installed on the modular homes, which Pioneer Valley Habitat chose to also install in the Lot 2 home as well. “Homeowner Allowances” also increased dramatically as Pioneer Valley Habitat chose to install identical appliances in Lot 2 as in Lots 3 and 4, including a more expensive ventless washer/dryer unit, the purpose of which was to maintain a tight building envelope.

Numbers for several areas show significant increase in actuals over the budgeted numbers; these were all finish work areas that Pioneer Valley Habitat contracted out due to the COVID-19 pandemic, and all come in at or under budget with COVID costs subtracted.

In-kind: Pioneer Valley Habitat receives a significant amount of donated materials, before even considering the countless hours of donated volunteer labor. Occasionally, contractors and suppliers will also provide discounts or extra hours without necessarily disclosing that information, so other unidentifiable discounts or lenience could be included in the cash amounts. In total, in-kind donations amounted to around $27,000 in materials, labor, and items, which would have put the final totals significantly above budget if included.



The most significant donation (in terms of net value) received for this build was the land itself, which was donated as part of a conservation limited development arrangement with the City of Northampton. Solar panels valued at $10,000 from Pioneer Valley Photovoltaics were also donated. Massachusetts offers a number of rebate and tax-contingent discounts for solar installation that private builders and homebuyers can take advantage of to lower costs.

COVID-19 may have increased our contractor costs, but we did receive some donated contractor labor during that time as well. This means that our in-kind also may be slightly higher than typical with the addition of more labor as well as physical donations.

Financing: While these pilot homes were more expensive than typical PV Habitat builds, a significant portion of expenses was covered by grants awarded for innovative design and modular construction. The homes will maintain month-to-month affordability for homeowners through some creative financing on the part of local partner banks and an affordable mortgage through Habitat.

These houses were also all rated better than net-zero in terms of energy usage thanks to the tight building envelopes, high levels of insulation, efficient heating and appliances and solar panels, and we anticipate that homeowners will be able to pay for all of their utilities year-round with credits from surplus solar energy generated during the summer. The site-built home had a slightly higher HERS rating than the modular homes, likely due to being built from the ground up by volunteers rather than in a factory setting, but still rated better than all past site-built Habitat homes in terms of building envelope tightness and predicted energy usage.

Design and construction

For this Habitat affiliate, using factory prefabrication was a first from a design and construction standpoint. The main project goals were to gain knowledge about using modular building technologies and to analyze and revisit pre-construction assumptions post completion, specifically around:

1. The speed of a modular home construction process (the intent being to house more people faster than with site-built homes)
2. The cost of a modular home, including base and finish work
3. The feasibility of finishing a modular base with volunteer work

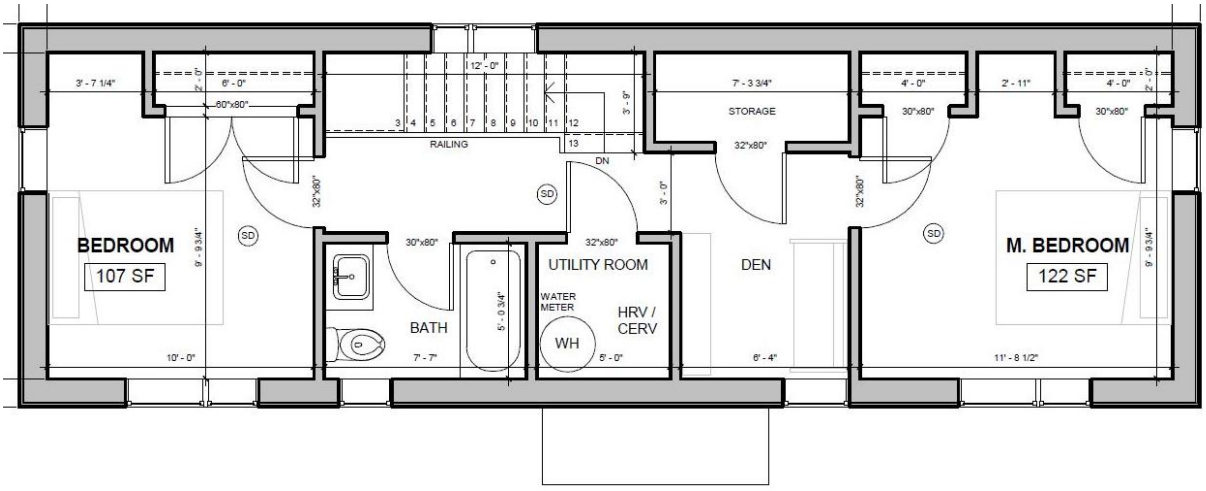
We opted for this particular modular home design for its simplicity, small footprint, and ability to still house a family comfortably in three bedrooms. While modular manufacturers generally have set floorplans, adjusting them is possible to suit the needs of the end user.

House layout and design for Lot 2 was limited by the design of the modular homes, which in turn was limited by the need to transport sections on flatbed trucks. Feedback on the actual design has been mixed; while the small, two-story design has allowed these to be three-bedroom homes on a small footprint, some have pointed out that it does make them look exceptionally narrow. Architects for Lot 2 have also indicated that they would have designed a different house had they not been limited by the modular footprint, but the basis of the pilot meant this was not possible.

The site-built house at Glendale does deviate in design from the others to prioritize accessibility. The modular homes were intended to be, at minimum, visitable by someone using a wheelchair, but the necessity of a raised foundation meant adding stairs to both the front and back entrances. A future design goal is to make all Habitat homes accessible for visitation by someone in a wheelchair.

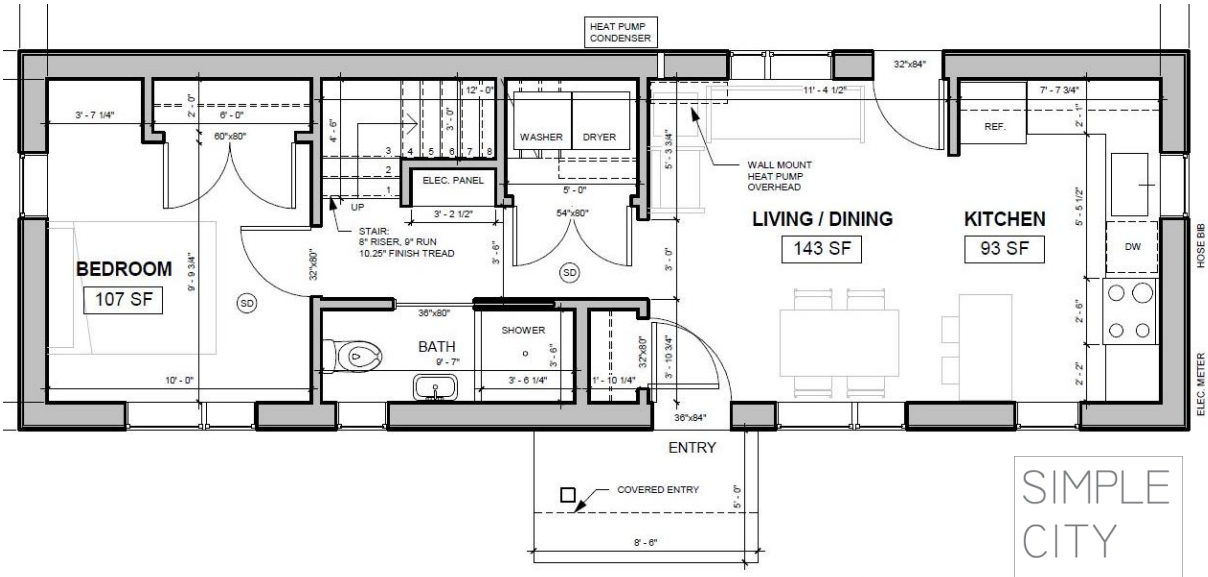
The site-built house at Glendale also deviates from the modular homes in its utilization of construction techniques that make more sense on-site than in a factory. For example, the modular homes have an insulated floor system built in the factory for installation over a sealed crawlspace. For the on-site home it would be more difficult to build a well-sealed insulated floor system, so an insulated slab was used instead. The factory-built homes used SIPs panels for the roof, but the site built home used insulated trusses because we did not have a crane to lift the SIPs on site.

Unique additions and customizations help give all three homes a distinctive and homey feel, which is essential when the canvas of a small house does not present much space to work with. Homeowners were allowed some level of customization with flooring, kitchen backsplash and light fixtures, all of which were adjustments that were still kept equivalent in costs to that of their neighbors. However, this degree of surface-level customization does help the houses to feel not entirely cookie-cutter and identical to one another.



1 Lot 2 Conventional Unit Level 2
1/4" = 1'-0"

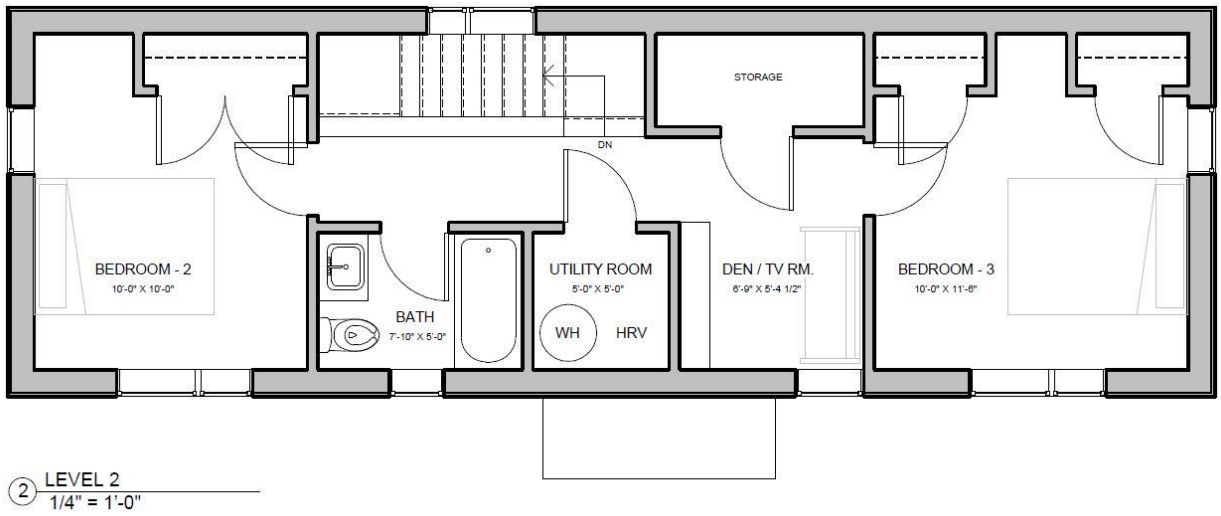
NOTE:
ALL DIMENSIONS ARE TO FINISH FACE OF DRYWALL OR SIDING

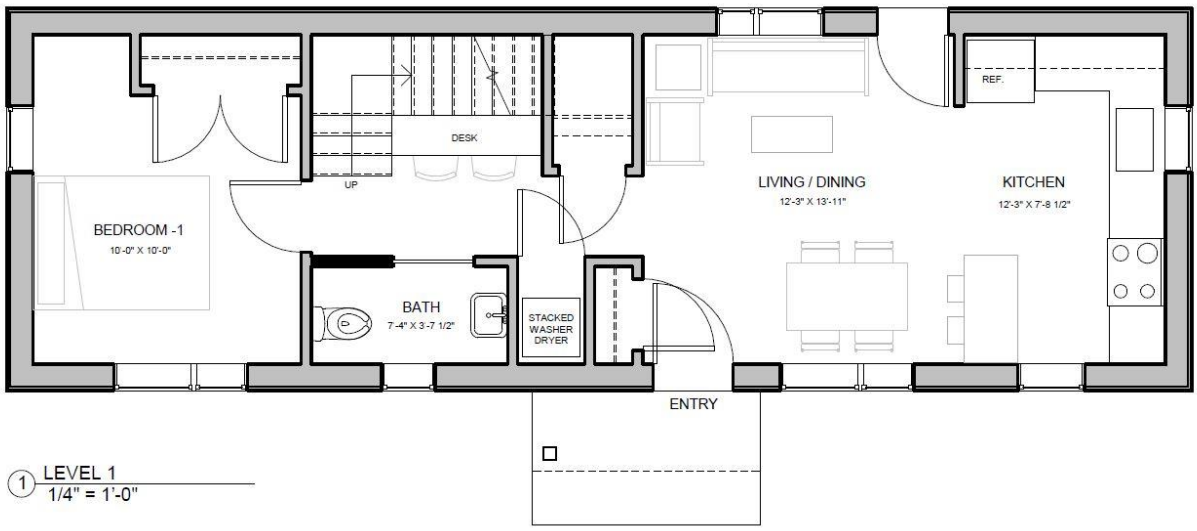


1 Lot 2 Conventional Unit Level 1
1/4" = 1'-0"

SIMPLE CITY STUDIO

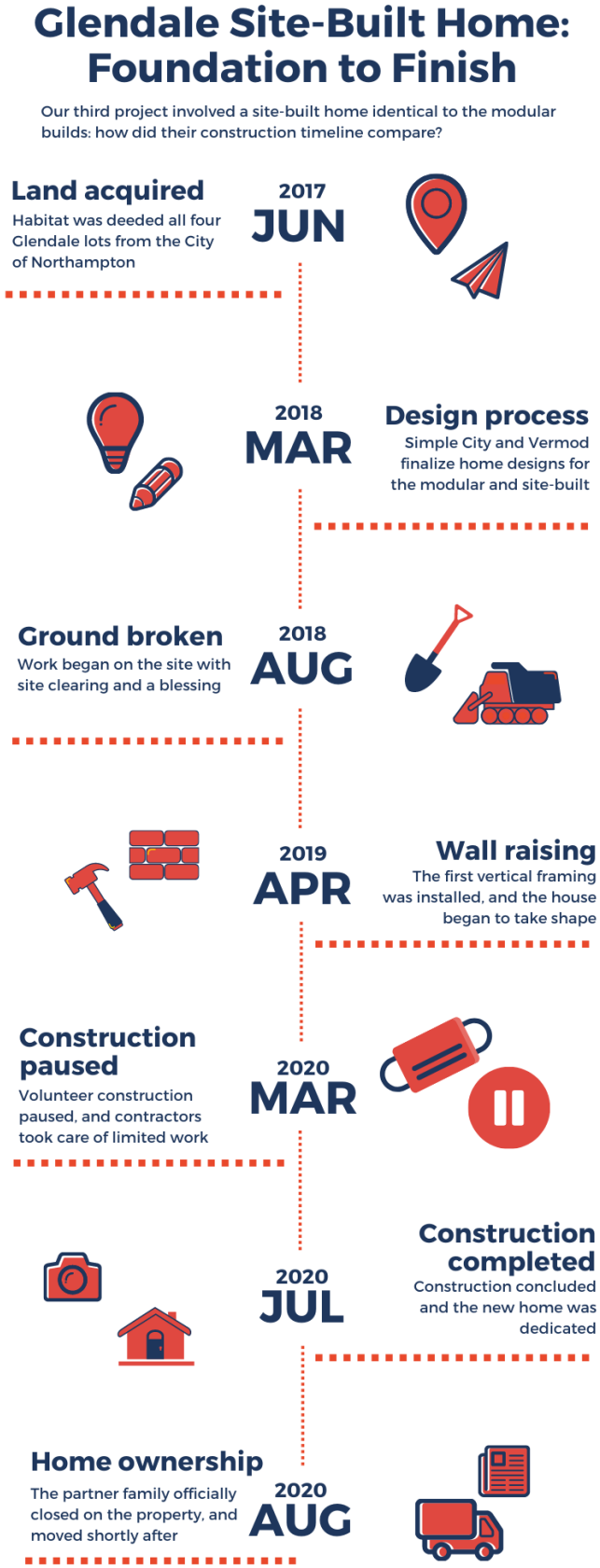
Lot 2 (site-built home) first and second floors: note the shower in the first floor bath
Designs courtesy of Simple City Studio





Lot 3 & 4 (modular) first and second floors: note the first floor half bath and stacked washer/dryer
Designs courtesy of Simple City Studio

Modular versus site-built construction techniques: This project's modular home vendor, Vermod, specializes in completely finished modular homes. We requested instead for a partially finished shell and a simple design, which enabled Habitat volunteers and homeowners to complete the finish work in a way that felt more genuine to the Habitat process. However, this complicated the build because Vermod had to prepare these modular homes differently than its standard process. Construction mistakes may have been made because Vermod was unable to do its usual finishing checks, and costs increased because Habitat had to hire additional contractors to complete partially finished tasks.



While major parts of the modular homes' construction were complete upon arrival, some aspects of construction still took a fair amount of time or required hiring outside contractors. On the other hand, simultaneous construction on all three homes at the Glendale site (in pre-Covid days) did allow for more work to be completed by a larger group of people at one time, as volunteers could spread out and accomplish the same tasks in different buildings. Volunteers and homeowners were also able to see different stages of the construction process, as the site-built construction began after the modular. The modular homes did also go up faster, even if the extra months of Covid-19 delay are removed from consideration.

Given the many manufactured components, a modular build could limit a Habitat homeowners' knowledge of their home, which might be more extensive in a stick-built home. Future homeowners have expressed how valuable it is for them to understand the core structure of their homes and how to maintain them. If modular homes are used in future Habitat builds, it may be beneficial to find a company that specializes in partially finished shells rather than complete builds, or to order a more finished product, which would simplify the process, cut down on additional costs, and allow homeowners to put in their sweat equity hours on other builds happening simultaneously.

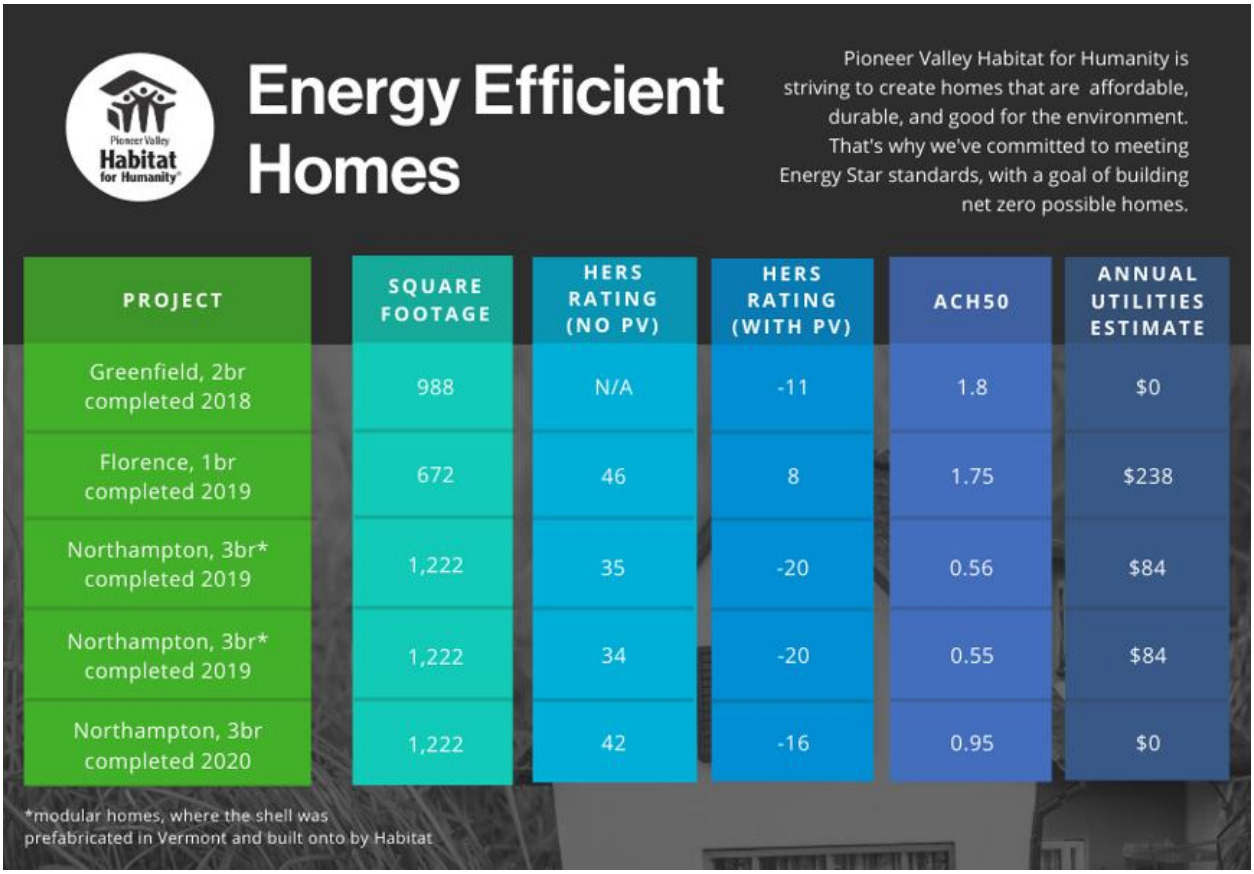
Overall, volunteers preferred the site-built process of Lot 2, both for the reasons listed above and because many felt that site-built homes were more in their comfort zone than a modular built. Being able to supervise all steps of the

process themselves also left construction leaders more confident in the craftsmanship and durability of the home.

Small footprint: Volunteers were able to build a house on-site within the strict small footprint parameters of the modular builds. However, many expressed the sentiment that keeping this narrow design was more challenging to build, and that an alternate, less narrow design with the same footprint would have been easier.

Zero net energy construction: Well-manufactured modular homes should have exceptional insulation and minimal cracks or areas for air leakage, as is the case with the homes on Glendale Rd. By building the site-built home very similarly, Pioneer Valley Habitat was able to achieve our most energy-efficient homes yet. Building well-sealed homes (seen in the ACH50 statistic below) works well with the mini-splits that Habitat often uses, as the ductless systems have few blower heads for heating and cooling, and minimize the amount of work in the walls that needs to be done for heating. When the energy needs of the house are reduced, it is straightforward to install simple mechanical systems like a single head mini-split.

But don't just take our word for it! The Glendale modular homes have also since won a Housing Innovation Award from the US Department of Energy for exemplifying innovative technologies that bring energy efficient construction techniques to affordable homes.



Cultural expectations and social acceptability

In this cluster, there is an opportunity for people to bond over and connect with these innovative homes, which could apply to other neighborhoods or cluster builds as well. Building a small community of Habitat houses can create a sense of belonging and a friendly neighborhood culture. Factory construction makes it easier to begin multiple home projects at a time, which allows the opportunity for future homeowners to meet, build relationships, and experience the construction process together, bringing both the homeowners and the Habitat community closer. The volunteers and homeowners also can function as informal liaisons to the neighbors who may ask questions about their homes and Habitat.

Some initial qualms about these modular homes revolved around the assumption that they would look and function like cookie-cutter glorified mobile homes, and that they would not fit in with the architecture of the rest of a neighborhood. Modular homes do not have to all look the same and can be designed with distinguishing features. The simple two-box design for our project was used to increase affordability and energy efficiency, but we were still able to incorporate features such as different colors, accent siding panels, and small porches. These particular modular homes have a modern look because of the low-pitch roof but do not look like "mobile homes" because of the second floor. The rest of the neighborhood is not densely developed, and the shared driveway conceals the modular development from the main road.

The site-built home fits in well as a matching design to the modular builds, and was customized to fit the accessibility needs of the homeowners. The accessible design of the home also offers lessons that Habitat will be implementing in future builds, including ensuring that all homes are visitable by individuals in wheelchairs and by considering the benefits of homes that allow homeowners to age in place.

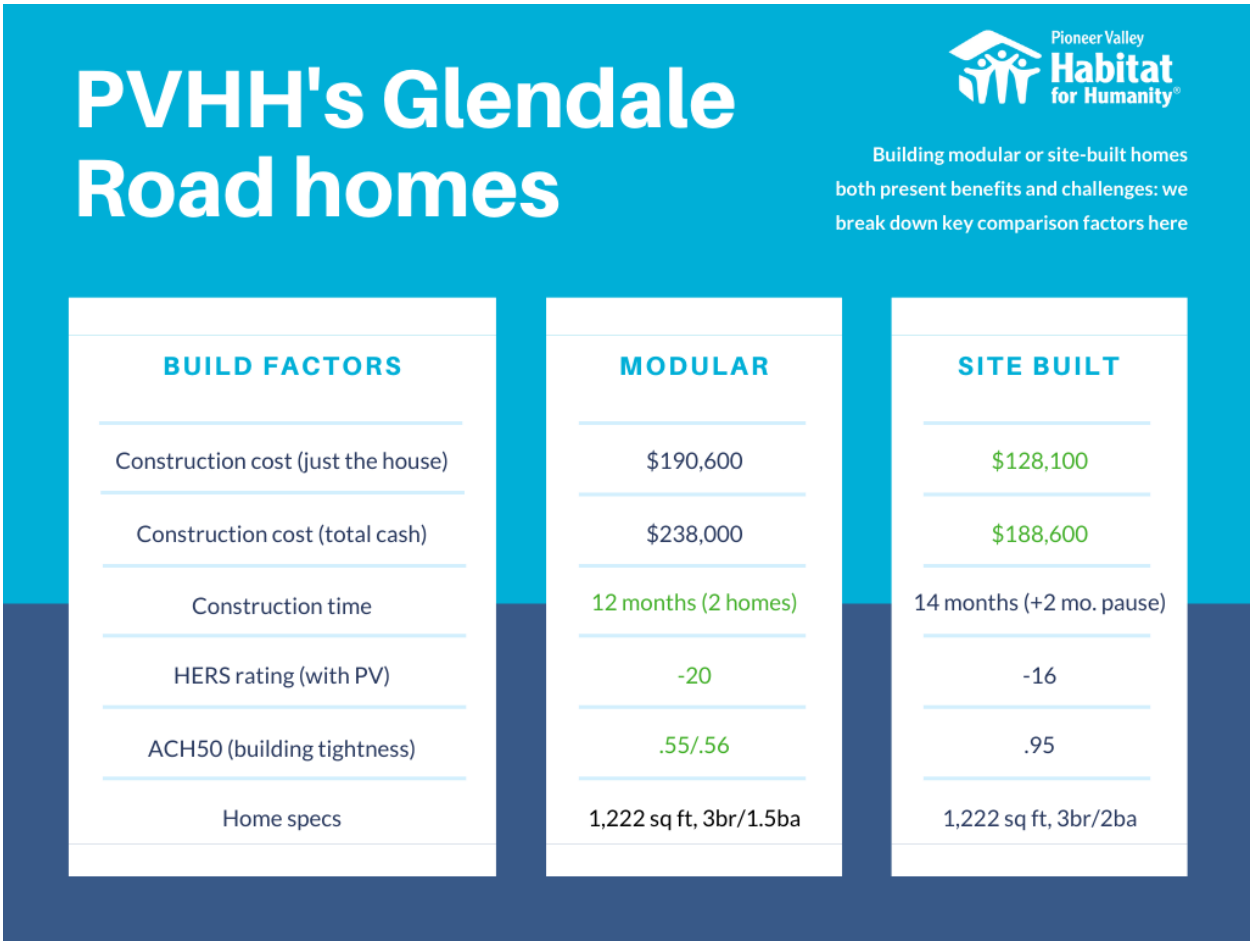
Even in 2020, Habitat was able to continue to build relationships with neighbors and other groups interested in these homes through events held virtually, including our traditional Habitat wall raisings and home dedications and our "Small Homes, Big Movement" event that highlighted both our work and the larger design realm of small homes. These events enabled us to highlight both our successes and future projects, bring together diverse groups of people interested in small or modular builds, and connect with new organizations and neighbors.

In trying to make the modular homes fit the Habitat model, we strayed from our own lessons learned about building simply, and ended up complicating our own process. However, pursuing more complete modular homes would enable us to house more individuals and families more quickly, and encourage partner families to get to know one another and build community as the future Glendale homeowners have. As the cost of living rises, people will continue to look for ways to save money and become more self-reliant. Modular homes may be one answer to that.

Conclusion

Pioneer Valley Habitat's modular project has been both innovative and eye-opening, and opened the doors for new construction techniques, civic partnerships, and community engagement. While Habitat's building committee is still undecided on the future of modular construction at Habitat, the project has pushed us to improve the energy efficiency and quality of our builds.

The comparison also remains fairly balanced, with advantages to both types of construction: while the modular homes were built faster and achieved better energy efficiency ratings, the site-built home was less expensive and enabled more thorough local construction oversight. For a nonprofit organization like Habitat, site-built remains more feasible in terms of cost unless grants continue to be available for innovative construction. However, modular homes allow more people to be housed faster, and 2020 has proven that the security of homeownership cannot be undervalued in uncertain times.



The need and desire for more affordable homeownership opportunities in Western Mass and beyond is palpable, particularly in times of crisis. While home construction projects are complex, this region has an abundance of people who care about creating affordable, energy-efficient, well-made homes. It will take a village, and building more affordable small homes is possible with the focused expertise and effort of interested residents, municipalities, non-profit and for-profit affordable housing developers. If we are able to work both individually and in

partnership to prioritize the development of small homes of many styles and building types, we can help to meet the need and desire for more affordable small homes in Western Mass.

The Big Enough Project has allowed us to pursue goals beyond Habitat for Humanity's usual parameters, including putting emphasis on sustainability and energy efficiency, attempting new construction techniques, and engaging with local partners in new ways. We were able to draw more attention to Habitat's work and the need for diverse housing opportunities, especially through focused events that brought our community together and both spurred new partnerships and revitalized old ones. We have also demonstrated that building small, durable and energy-efficient can be both possible and desirable, and can successfully contribute to the affordable housing stock of an area.

While some of our solutions are localized, many are applicable to other affordable housing developers or Habitat affiliates. It's also important to keep a realistic perspective — sometimes innovation and movement building is slow! But by working in community with local groups and more broadly with other affiliates, we can encourage and enact change on a larger scale than we would independently.

There will not be just one solution through one large project — it will involve many creative solutions spearheaded by many different individuals, companies, organizations and municipalities. As we move forward, we hope to see an increase in partnerships interested in relaying the torch for the small home revolution in Western Mass. including zoning updates, planning priorities and financial incentives. It will take leadership, innovation and focused effort to advance the realization of a small affordable home revolution in Western Mass., but our own efforts have demonstrated that through the best efforts of many, we have already started building our future one house at a time.

Future Initiatives

115 Glendale Road, Northampton

The first round of pilot homes may be complete, but Habitat plans to build a second round of affordable small homes in Franklin and Hampshire counties. Our first is again on Glendale Road in Northampton (on Lot 1, referenced in the Glendale portion of this report), envisioned to be an energy-efficient two-bedroom home. Construction is in progress, and expected to be complete in 2021.

Broughton Meadow Project, Northampton

Just Big Enough — Green housing for ALL Architectural Design Competition

In partnership with the Big Enough small house project, AIA Western Massachusetts held a small house design contest in conjunction with the City of Northampton, with an exhibition in early 2018 at APE Gallery in Northampton.

Architectural firms from around New England were invited to design three different units for a site on Burt's Pit Road in Northampton: a one-bedroom, two-bedroom, and three-bedroom home, ranging from 500-800 sq. ft. for the smallest and 800-1000 sq. ft. for the largest unit. The design contest was part of a city-sponsored limited development project whose goal is to build three affordable single-family homes in a development of 12 total units near conservation land and a future bike path. Go to http://www.northamptonma.gov/1834/Just-Big-Enough-competition to check out the City of Northampton's contest winners and to see all of the different small home designs.

The homes on the Burt's Pit Road site will be Habitat's Broughton Meadow Project, and the final parts of the design phase are still wrapping up. The three affordable small homes are part of the next stage of the Big Enough Project.

Integrating lessons learned

As we continue to innovate and construction begins on new projects, we are implementing those lessons from completed projects in many stages of our construction process. Both our staff and our volunteer build teams have newfound experience dealing with the many facets of building small, from working with town zoning laws, to utilizing prefabricated homebuilding technologies, to designing and building the house itself.

In 2020, Habitat also conducted a survey of interested homeowners to gauge the design priorities of individuals and families looking for affordable homes, and to see how the Covid-19 pandemic may have shifted those priorities. The results of this survey are currently being integrated with past lessons learned in the design process for future projects (both small and standard-size homes).

With every small home build our staff, partner organizations, and volunteers become more familiar with the process and subsequently educate others, exemplifying the Habitat model of homebuilding. By continuing to integrate lessons learned, we hope to avoid some of the pitfalls from our earliest projects while continuing to experiment with new and creative solutions to building small, durable, and energy-efficient.

Homeowner engagement

We prioritize engaging Habitat homeowners in construction and development stages of their homes, and they have remained a priority throughout 2020 even as increased safety precautions have limited the size of our build teams. We also wanted to engage future and current homeowners further in the larger goals of the small home movement.

Through surveys, current, future, and potential homeowners have shared their lived experiences, which are critical to building homes that are both small and functional for families of various sizes, especially when many family members may be working or attending school from home. The design survey also reached members of the general public, expanding Habitat's reach and adding individuals to our interested homeowner database. Current Habitat homeowners have also shared their experiences and described the stability of homeownership and the importance of the Habitat community in videos, interviews, and at Habitat events over the last year. We hope to continue to engage homeowners in the future on Habitat's planning committees so that their experiences can shape the future of the Habitat homeownership process.

Building a movement

Others in our area and beyond are interested in small home initiatives, and one goal of this project has always been to harness that interest to inspire change. In addition to continuing the Small Home Hero award and hosting another community forum focusing on small homes in 2020, we are looking at expanding the visibility of both this project and those of other local groups or individuals. Especially in an area where some towns and developers (including this Habitat affiliate) have faced opposition to building houses or developments that may not be typical to a neighborhood, cultivating "yes in my backyard" attitudes in our communities is key to a future of inclusive housing.

Beyond Habitat, there are organizations working to design, finance, and zone for backyard ADUs, organizations seeking to build small home cluster developments to house veterans, and other Habitat affiliates looking to begin their own small home projects or work with prefabricated modular homes to replace aging mobile homes in their areas. This work, which aligns so well with our own goals, is one sign of an emerging larger movement to build "big enough" that we hope to continue to encourage as a solution to our area's larger affordable home shortage.