DEPARTMENT OF COMMUNITY DEVELOPMENT SERVICES

Grants Management Division

m e m o r a n d u m

TO: Laurel Lunt Prussing, Mayor

FROM: Elizabeth H. Tyler, AICP, Director, Community Development Services

DATE: January 28, 2008

SUBJECT: Kerr Avenue Project Phase I Final Report

Attached to this memorandum is the Final Phase I Report on the Kerr Avenue Project by Farr Associates.

In 2006 the Urbana City Council set a goal to create a nationally recognized model neighborhood that would be affordable and would only use 10% of standard energy consumption. The neighborhood was proposed to be developed on 3.19 acres of land that the City owns on Kerr Avenue. A Request For Proposals was issued in the spring of 2006 to select an architect to design the neighborhood, and Farr Associates was chosen later that summer. Farr subsequently held a design charrette in May of 2007 with city officials and neighborhood stakeholders. At that charrette two design concepts were chosen for the Kerr Avenue site.

Farr Associates has now completed the final report as specified in the Phase I RFP. The report contains two possible site designs for the neighborhood. These designs have evolved from the design charrette and contain dimensions and an analysis of storm water detention requirements. There are street sections showing geo-thermal wells and bio-swales. Also included are architectural studies of housing types that would best fit the goals of affordability and energy-efficiency specified in the RFP. An energy analysis of the neighborhood design concludes that a 75% reduction in energy consumption may be possible; but a 90% reduction would be difficult while maintaining the affordability of the homes. A recommendations section summarizes what the City needs to do to make this project a reality. One of the recommendations is to "embrace diverse construction methods" and make the neighborhood a showcase for different technologies at the forefront of energy efficiency. These technologies include straw bale construction, passiv haus design, and factory-built housing. The report concludes with a brief overview of the LEED-ND standard for sustainable neighborhoods. Farr advises that the City aims for a LEED-ND Gold certification.

With the completion of Phase I, staff is now preparing to issue an RFP for Phase II in February. The RFP will allow the City to select a developer to finalize the site design and build and market the homes to potential buyers. The 2008-09 Annual Action Plan will include additional funding for the project.

Kerr Avenue
Model Sustainable Community
Master Plan Report

Urbana, Illinois

Prepared for:

City of Urbana
Department of Community
Development Services

FARR ASSOCIATES
Architecture | Planning | Preservation

Sponsoring Organization:

City of Urbana
Department of Community
Development Services

Kerr Avenue Model Sustainable Community

Consultant:

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This report should be reevaluated and revised after 5 years
as implementation progresses.

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Executive Summary

In 2006, the Urbana City council voted to authorize design work to proceed for a pilot sustainable community development on an approximately 3.19 acre site on Kerr Avenue, north of downtown Urbana. An RFP was issued to prepare such a plan and a sustainability-focused team lead by Farr Associates was selected.

The team convened in a two-day workshop on May 23rd and 24th that included daily public presentations of the ongoing work. Working in close collaboration with City of Urbana staff, the consultant team developed a total of three alternative site plan concepts. One alternative was ruled out because it proposed streets perceived as excessive in length and cost.

Two remaining land use plans were presented at a public meeting on the second night of the workshop. These schemes incorporated for innovative layouts, integrated stormwater filtration and detention, a diversity of housing and construction types. Both schemes were well received by the Mayor, members of the City Council in attendance, and the public at large. The audience found strengths in each of the plans and decided to include both plans in the final report. Each plan offered challenges to a business as usual approach to development. Plan A proposed housing clustered around a naturalized detention basin with remote parking. Meetings with the Fire Chief addressed concerns regarding access to the dwellings in case of fire. Plan B chose not to align the proposed street with the existing Highlands Drive; the offset from the existing intersection does meet industry standards, but some misgivings were lodged regarding this offset.

Next Steps

The greatest challenge to Urbana regarding the Kerr Avenue Sustainable Development Pilot are not the differences between the plans, but the absence of enabling policies and financing tools. The following list of recommendations and next steps are discussed at the back of this report (see page 30).

These include:

1. Sorting out City financing and commitments
2. Endorsing a single site plan
3. Developing a Form-Based Code
4. Developing Overlay Zoning for the Adjacent Commercial Development
5. Requiring a LEED-Neighborhood Development Certification
6. Embracing Diverse Construction Techniques
7. Requiring the adjacent public housing redevelopment to connect to the new street.
8. Securing a developer who embraces urban sustainability

Introduction and Process

Overview

In 2006 the Urbana City council voted to authorize design work to proceed for a pilot sustainable community development with the ambitious goal of achieving an overall 90% energy reduction. An RFP was issued to prepare a sustainability-focused master plan and Farr Associates was selected. Farr Associates structured a master planning and building design process that engaged and sought input from the Urbana Community. This section is a step-by-step description of the process of developing that plan.

Market Study Reconnaissance

In early May, Christine Williams and members of Goodman Williams Group toured Urbana with representatives of the project team. The tour visited numerous development projects in Champaign County, some already built and others underway.

It is worth noting that while these projects served as sales and rental comparables in the market study, none of the projects contained sustainable features or promoted a sustainable lifestyle.

Planner/Architect Site Reconnaissance

On May 10th, Doug Farr and Jason Chochola of Farr Associates did a preliminary visit to the site and toured comparable development projects. This tour was conducted by Jeffrey Engstrom, Robert Myers and Ryan Brault and included many of the same sites toured by the Goodman Williams Group. This second tour included the additional exploration of two single-family homes that featured innovative energy efficient and sustainable construction.

The first of the two homes employed the Eco-Passive approach that is increasingly popular in Germany. This house, designed by Katrin Klingenberg of e-co lab, was conceived to be 90% more energy efficient than a conventional home. The design features 14" prefabricated 'TrusJoist' floor joists for the wall framing containing blown-in insulation worth R-60, and a roof employing 16" 'TrusJoist' members also containing R-60 blown-in insulation. The windows were all highly-insulating triple-pane units and the floor slab was thoroughly insulated as well. The ventilation system featured an energy-recovery ventilator (ERV) and the heating system employed electric resistance baseboards. This 1,300 square foot house cost roughly $110 dollars per square foot to build (not including land and donated labor) and was able to achieve a 55% reduction in energy use as compared to a conventional house; somewhat short of its ambitious goals. Ms. Klingenberg indicated that each additional Eco-Passive house her organization is able to build shows an incremental progress toward this eventual goal.

The second house was built by New Prairie Construction, measures approximately 2,000 square feet in area, and features straw bale walls. These massive walls are as thick as 23 inches and have an estimated R-value between 40 and 45. This house also features an innovative summer (outdoor) kitchen. Outdoor kitchens isolate cooking-generated heat from the living space during summer months and allow enhanced outdoor living. While the documentation on the energy performance of this house was anecdotal, it seemed likely that the air tightness and thermal massiveness of the house would allow it to perform far better than conventional construction.

Design Workshop

Participants

Doug Farr and Jason Chochola of Farr Associates combined efforts with Tom Price of Conservation Design Forum and members of the city staff, including Jeffrey Engstrom, Tom Carrino, Libby Tyler, William Gray and Robert Myers. Home builders Joel Carney of Neighborhood Homes, LLC. and George Bielecki of Alternative Energy Builders, Inc. were also invited to participate and share their perspective and knowledge regarding modular and energy efficient building techniques.

Daily Meetings with Urbana Staff

Once each day a large working meeting was held with City staff and the consultant team. These sessions covered a broad range of topics focused on current City of Urbana practice and on how to implement the innovative plans and housing development proposed in the workshop.

A point of continued debate centered on the proper use of the funds for acquiring the property. If the funds remained as the source for acquiring the land, there would be restrictions imposed on the types of housing that could be built (essentially whether rental units would be allowed).

Attendees of the 2-day charette.

I. Overview

Introduction and Process

Developer Input

In order to develop a realistic plan, Farr Associates invited two developers to participate in the workshop and to critique the design as it progressed. The two developers were Joel Carney of Neighborhood Homes, LLC in Valparaiso, Indiana and George Bialecki, President of Alternative Energy Builders, Inc., based in Moline, Illinois. Mr. Carney develops modular single-family homes in Indiana targeted at the moderate income population demographics. A Goodman Williams study corroborated Mr. Carney's target demographic as the likely market. Mr. Bialecki has a national reputation as a developer of energy efficient senior housing, and has been a leader in adopting stormwater best-management practices in new street design. Both men provided design input and gave informal presentations of their prior projects. A speculative home, developed by Mr. Carney in Chesterton, Indiana was considered very attractive, contrary to the generic look of many factory built homes.

Attendees of the 2-day charette.

Public Presentations

A public presentation was conducted in the Urbana Council chambers on each day of the 2-day workshop. Attendees at the workshop included the Mayor, several City Council members, landowners from the vicinity of the Kerr Avenue property, and citizens at large. The first meeting featured a presentation of preliminary architectural concepts describing housing types consistent with the market study and two different site plans. A discussion of the two site plans identified strengths and weaknesses of each. This lead to an overnight redesign of one of the site plans.

The second public presentation included revised architectural and site plan designs as well as the beginnings of three-dimensional representations of the project. The resulting discussion of the two site plans revealed that the audience was split on which site plan they preferred. One site plan was perceived as lower cost and the other as a more interesting design.

Mr. Bialecki's development was highly energy efficient and featured up to R-23 walls, R-50 roofs and Heat Mirror windows (R-8.5) as standard features. The homes enjoy up to 80% reductions in their energy bills.

Site Context and Analysis

Context

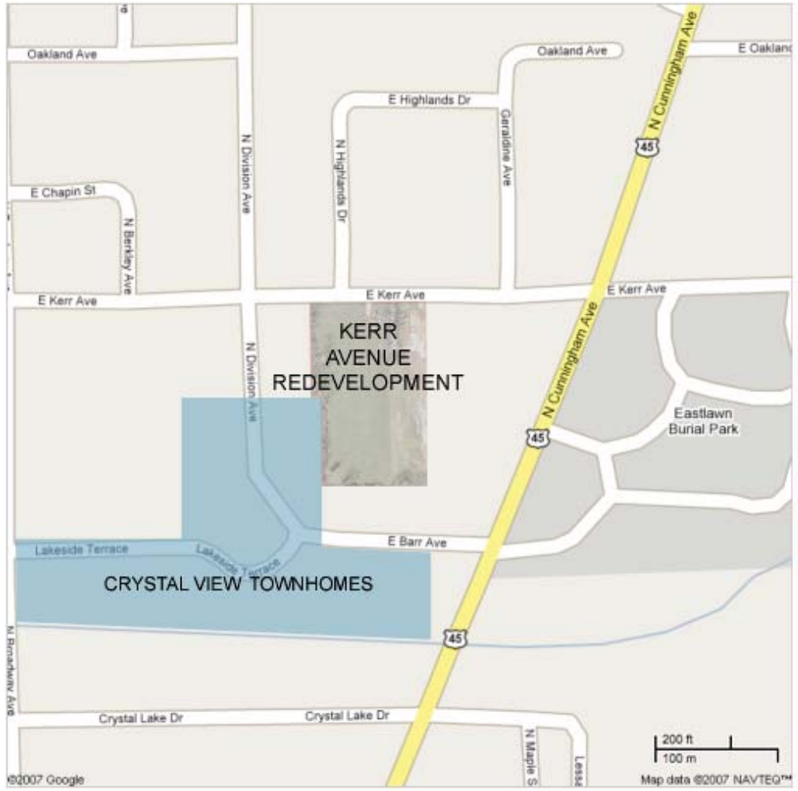
The Kerr Avenue project site is bounded by an existing residential neighborhood to the north, south and west, commercial uses to the east, and a redeveloping public housing site to the southwest. Highlands Drive intersects the site at the western end of its northern edge.

Current fire safety codes would require a land-consuming cul-de-sac to allow trucks to enter and turn around, hindering development density on the site. Linking any new streets in the development to the proposed street system in the public housing redevelopment, offers an opportunity to build density.

The scale and density of the surrounding residential fabric is lower than is anticipated for the Kerr Avenue site. The excessive paving, stormwater runoff and high bay commercial lighting of the commercial land uses to the east are inconsistent with any proposed residential redevelopment on the Kerr site.

Analysis

The site plan presents opportunities for urban design and enhanced privacy by using non-straight streets and by positioning buildings to terminate both axial and deflected views. These basic urban design strategies are rare in Champaign-Urbana and could create free real estate value for the project by making the Kerr Avenue project site a special place.



Map locating the Kerr Avenue redevelopment within its surrounding neighborhood, and in relation to the Crystal View Townhomes.

II. Master Plan and R.O.W. Studies

Plan A - Street to the West

Plan B - Street to the East

The consultant team developed two alternative site plans to incorporate the sustainability practices called for in the original RFP. These include:

- Site orientation for optimum passive solar energy access
- Use of natural features and vegetation for shade and wind protection
- Reduction of infrastructure capital costs by use of "green" materials, recycled materials and customized design standards
- Location of structures on site to minimize automobile activity-access to pedestrian and mass transit facilities
- Zero lot-line configuration and efficient land design

Narrative Discussion

Streets & Access

This plan aligns its new street with the existing Highlands Drive. Once the street is internal to the plan, it bends slightly to the east only to turn ninety degrees to the west to connect with the Crystal View Town homes public housing redevelopment. This plan proposes the shortest length of public street, though may simply shift much of the cost of accessing the east edge of the site to private development. This plan is also accessed by a public alley running along the east side of the site.

Urban Design

Plan A places attached row houses along Kerr Avenue to screen the interior of the site. They are setback the same distance as the residences to the east along the south side of Kerr avenue. Emphasis is given to orienting buildings across the site in an east-west direction to optimize them for solar access and to allow shared walls, an energy efficiency strategy.

Stormwater

The stormwater management plan features interlocking concrete permeable pavers in the row house courts, bioretention swales along the streets, drainage swales along the east and west property lines, and naturalized detention in the two areas shown. These features would work as a system to slow the rate of runoff, provide opportunity for infiltration and evaporation of runoff, and provide detention to meet the City of Urbana's existing conditions of a 5-year release rate standard. The approximately 0.7 acre-feet of detention storage required to meet the allowable stormwater release rate would be distributed throughout the site within the gravel storage beneath the pavers and bioswales and within the surface storage of the detention areas and bioswales.

Reducing Energy Use Through Site Planning

This site plan embeds four different strategies for increasing energy efficiency and incorporating renewable energy.
The first is to incorporate shared (or party) walls between dwelling units. This single strategy can reduce annual heating and cooling loads between 10 and 20%. Secondly, attached rowhouses are oriented in an east-west direction that allows for relatively easy sun control using exterior overhangs and awnings. The relatively short distances between buildings makes a district geothermal system viable and the strategy of placing the wells under street trees provides more than enough land area to accommodate the geothermal wells. This strategy may further improve energy efficiency by as much as 15 – 20%. Finally, by designing virtually all of the dwelling units to present a sloping roof to the south, they are all capable of installing solar hot water systems. These systems are economical for providing hot domestic water, returning a premium investment in 6 to 7 years, and reducing energy use between 5 and 10%. Together these site planning interventions create the potential to reduce building energy use by somewhere in the range of 25 – 50%.

Conceptual viw looking East, showing liner housing surrounding a naturalized detention basin.

Conceptual view illustrating integration of walkable urbanism with high performance infrastructure and buildings

II. Master Plan and R.O.W. Studies

Plan A - Street to the West

Land Subdivision, Infrastructure and Common Amenities

The chart and diagrammed plan of Scheme A has been developed to a conceptual level. All dimensions are subject to further refinement as the plan is developed. Despite this, several aspects of the plan are worthy of comment. First, by conventional standards the percentage of the land area that can be sold—the "efficiency" of the plan—indeed of both plans, is low. However, the emphasis on sustainability has led us to allocate a fair amount of land to shared amenities including gardens and stormwater/habitat areas.

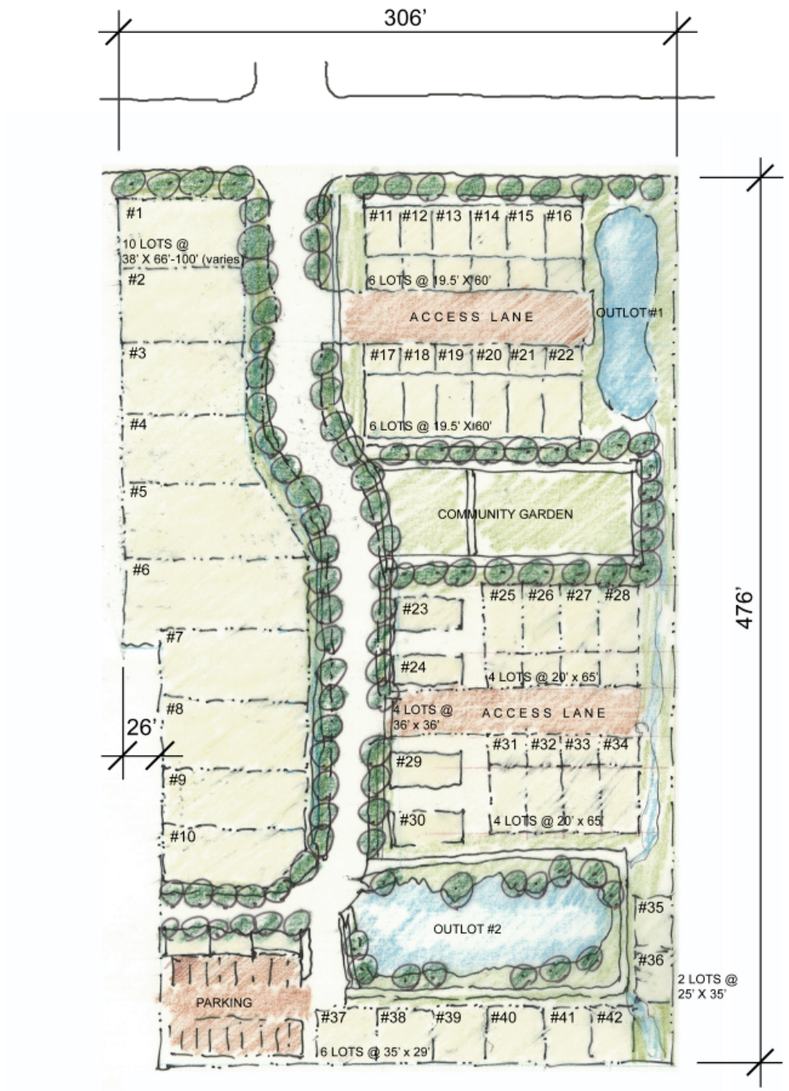
While these areas are not allocated to private land, they are amenities that will increase land values, quality of the environment and quality of life.

Scheme A has slightly more lots than Scheme B, but has less private land. Overall the lot sizes in Scheme A are smaller than in scheme B. Scheme A is likely to incur some greater regrading costs than Scheme B because it requires extensive regrading to build house lots 23 to 34. This cost is likely offset by the shorter street.

Scheme 'A' - No Hill Scheme

Private Lands

Lot Numbers	No. of Lots	Area (sf)	Total Area (sf)	Housing Types Intended	Corresponding Plans
1-10 (size varies, ave. listed)	10	2846	28,460	Single Family	F, C
11-22	12	1170	14,040	Townhouse, Shared Wall	G, H
23,24,29,30	4	1350	5,400	Single Family, 1 Shared Wall	B
25-28	4	1300	5,200	Townhouse, Shared Single Wall	G, H, B (with D)
31-34	4	1300	5,200	Townhouse, Shared	G, H, B (with D)
35-36	2	750	1,500	Tower	E
37-42	6	1015	6,090	Liner	A
			65,890	Lot Yield	
Private Lands - Subtotal					**47.3%**
Common Lands					
Landscape Amenities					
Community Garden			8,000		**5.7%**
Scattered Greenspace			3,450		
Stormwater Filtration & Retention					
Outlot 1 (dry-bottom naturalized detention)			7,500		
Outlot 2 (dry-bottom naturalized detention)			12,750		
Water Bioswale			5,766		**18.7%**
			37,466		**26.9%**
Access & Parking					
Parking			4,800		
Access Lanes			8,200		
Street R.O.W.			23,040		
			36,040		
Common Lands			**73,506**		**52.7%**
Total Area			**139,396**		**100.0%**



SCHEME 'A': 3.19 ACRES @ 139,396 S.F.
NET YIELD 1.37 ACRES 42 LOTS @ 60,000 S.F.

Site plan diagram showing allocation of private lots, public infrastructure and common amenities.

Narrative Discussion

Streets & Access

Plan B intentionally offsets the new proposed street from the existing Highlands Drive. This is done to increase privacy and to position the street to allow an existing sloped area to be retained as a small green. Retaining the slope responds to the original RFP's request to consider "environmentally friendly design and construction process that uses existing features and topography in an efficient manner." This plan increases the length of public road by roughly 300' linear feet, but would create value through the creation of the sloping green.

Urban Design

The entrance to the site has been highly studied for dramatic effect. The entry road is slightly angled and directs the view toward a community garden and beyond it to two "tower" buildings. The road bends past the tower buildings and descends down a gentle slope. A naturalized water feature at the west side of the street falls at the bottom of the small sloped green. Again the buildings are oriented in an east-west manner.

Stormwater

Like Plan A, the stormwater management system for Plan B features: interlocking concrete permeable pavers in the row house courts and two-family units, bioretention swales along the streets, a drainage swale along the west and south property lines, and naturalized detention in the three areas shown. These features would work as a system to slow the rate of runoff, provide opportunity for infiltration and evaporation of runoff, and provide detention to meet the City of Urbana's existing conditions of a 5-year release rate standard. The approximately 0.7 acre-feet of detention storage required to meet the allowable stormwater release rate would be distributed throughout the site within the gravel storage beneath the pavers and bioswales and within the surface storage of the detention areas and bioswales.

Reducing Energy Use Through Site Planning

This site plan embeds four different strategies for increasing energy efficiency and incorporating renewable energy. The first is to incorporate shared (or party) walls between dwelling units. This single strategy can reduce annual heating and cooling loads between 10 and 20%. Secondly, attached rowhouses are oriented in an east-west direction that allows for relatively easy sun control using exterior overhangs and awnings. (Unfortunately, the liner housing along the east property line does not conform to this ideal.) The relatively short distances between buildings makes a district geothermal system viable and the strategy of placing the wells beneath the under street trees provides more than enough land area to accommodate the geothermal wells. This strategy may further improve energy efficiency by as much as 15 – 20%. Finally, by designing virtually all of the dwelling units to present a sloping roof to the south, they are all capable of installing solar hot water systems. These systems are economical for providing hot domestic water, returning a premium investment in 6 to 7 years, and reducing energy use between 5 and 10%. Together these site planning interventions create the potential to reduce building energy use by somewhere in the range of 25 – 50%.

View looking South showing entry road with naturalized detention to the left, fruit orchard to the right and Tower housing framing the views beyond.

SCHEME 'B': 3.19 ACRES, 46 DWELLING UNITS

Conceptual plan illustrating integration of walkable urbanism in high performance infrastructure and buildings.

II. Master Plan and R.O.W. Studies

Plan B - Street to the East

Land Subdivision, Infrastructure and Common Amenities

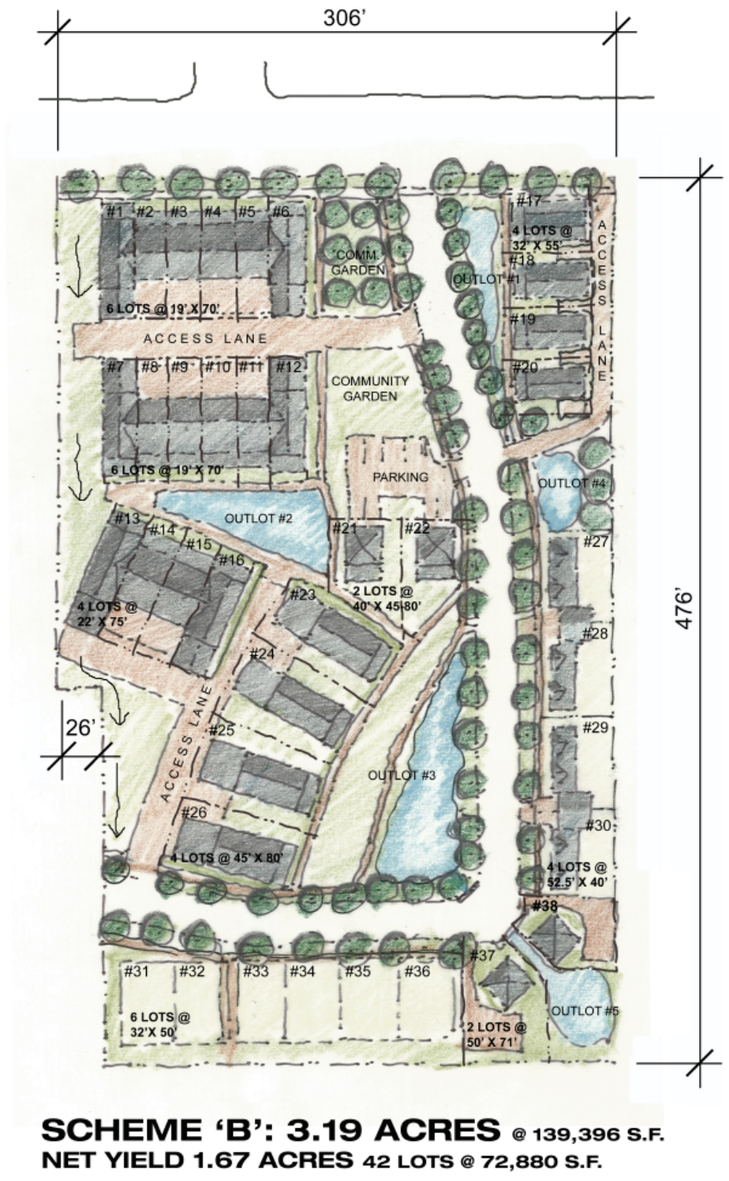
The chart and diagrammed plan of scheme A has been developed to a conceptual level. All dimensions are subject to further refinement as the plan is developed. Despite this, several aspects of the plan are worthy of comment. First, by conventional standards the percentage of the land area that can be sold—the "efficiency" of the plan—is low. However, the emphasis on sustainability has led us to allocate a fair amount of land to shared amenities including gardens and stormwater/habitat areas. While these areas are not allocated to private land, they are amenities that will increase land values, quality of the environment and quality of life.

Scheme B has slightly fewer lots than scheme A but has more private land. Overall the lot sizes in scheme B are larger than in scheme A. Scheme B is likely to incur less grading expense than Scheme A is it retains and works around the small sloping portion of the plan. This savings is likely offset by the longer street.

Scheme 'B' - Hill Scheme
Private Lands

Lot Numbers	No. of Lots	Area (sf)	Total Area (sf)	Housing Types Intended	Corressponding Plans
1-12	12	1330	15,960	Townhouse, Shared Wall	G, H
13-16	4	1650	6,600	Townhouse, Shared Wall	G, H
17-20	4	1760	7,040	Single Family	B, F
21-22	2	2240	4,480	Tower	E
23-26	4	3600	14,400	Single Family	G, H, B, C (with D)
27-30	4	2100	8,400	Liner	A
31-36	6	1600	9,600	Liner	A
37-38	2	3200	6,400	Tower	E
			72,880	**Lot Yield**	

Private Lands		**52.3%**
Common Lands		
Landscape Amenities		
Commmunity Garden	6,000	**4.3%**
Scattered Greenspace	800	
Stormwater Filtration & Retention		
Outlot 1 (dry-bottom naturalized detention)	1,100	
Outlot 2 (dry-bottom naturalized detention)	2,600	
Outlot 3 (dry-bottom naturalized detention)	6,600	
Outlot 4 (dry-bottom naturalized detention)	2,300	
Outlot 5 (dry-bottom naturalized detention)	2,000	
Water Bioswale	4,416	**13.6%**
	25,816	**18.5%**
Access & Parking		
Parking	2,000	
Access Lanes	7,500	
Street R.O.W.	31,200	
	40,700	
Common Lands	**66,516**	**47.7%**
Total Area	**139,396**	**100.0%**

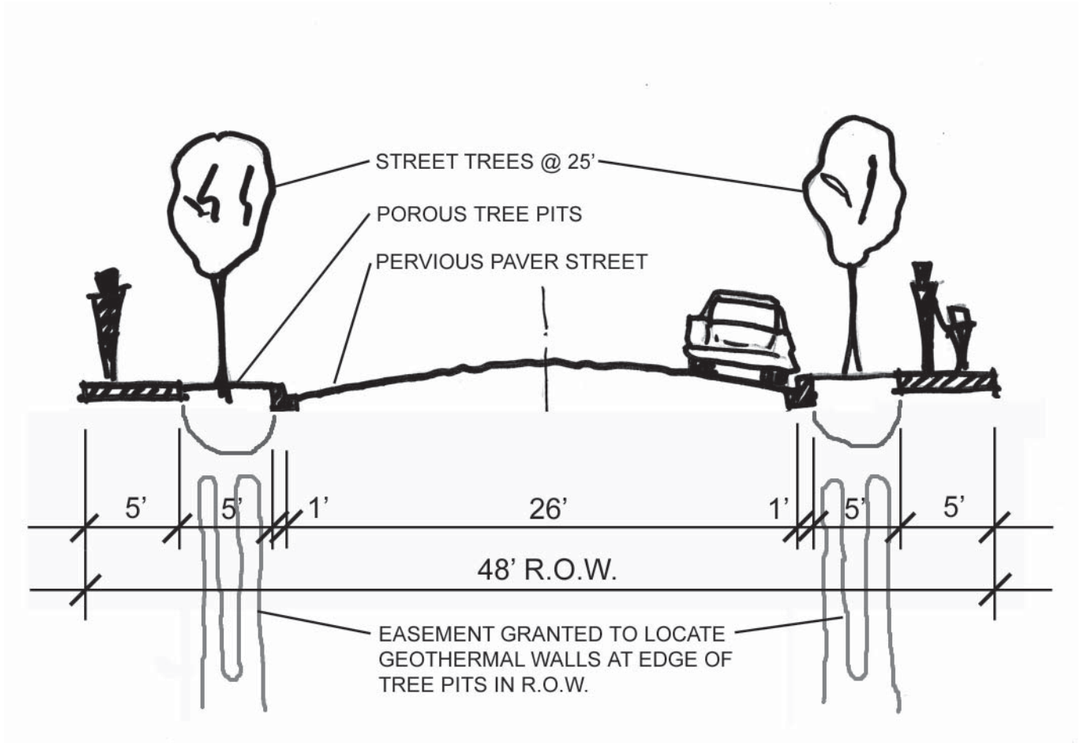


Site plan diagram showing allocation of private lots, public infrastructure and common amenities

III. Street Sections

Typical Street Sections

Sustainable urbanism integrates walkable urbanism with high performance buildings and infrastructure. This integration of systems is made evident in how a street right of way is reconceived in the image on the right of this paragraph. For instance, the hard surface of the street itself is made of pervious pavers to infiltrate and filter stormwater. Secondly, the trees are set in pits that benefit from the lateral underground flow of water from the street. Beneath this sits the wellhead for a geothermal system that serves the adjacent buildings. Placing the wells in saturated soils can enhance the efficiency of their heat transfer by as much as 50%. This integrated approach delivers enhanced benefits at a low marginal cost.



IV. Architectural Studies

In order to be able to plan the Kerr Avenue site with a reasonable level of accuracy, we needed to develop prototypical house designs that fit the demand for housing on the Kerr Avenue site. The architectural studies that appear in this section are preliminary and have been prepared to comply with the square footage and cost requirements set forth in the market study copied below. The designs are preliminary but hold promise to be developed into viable house plans by a future development team.

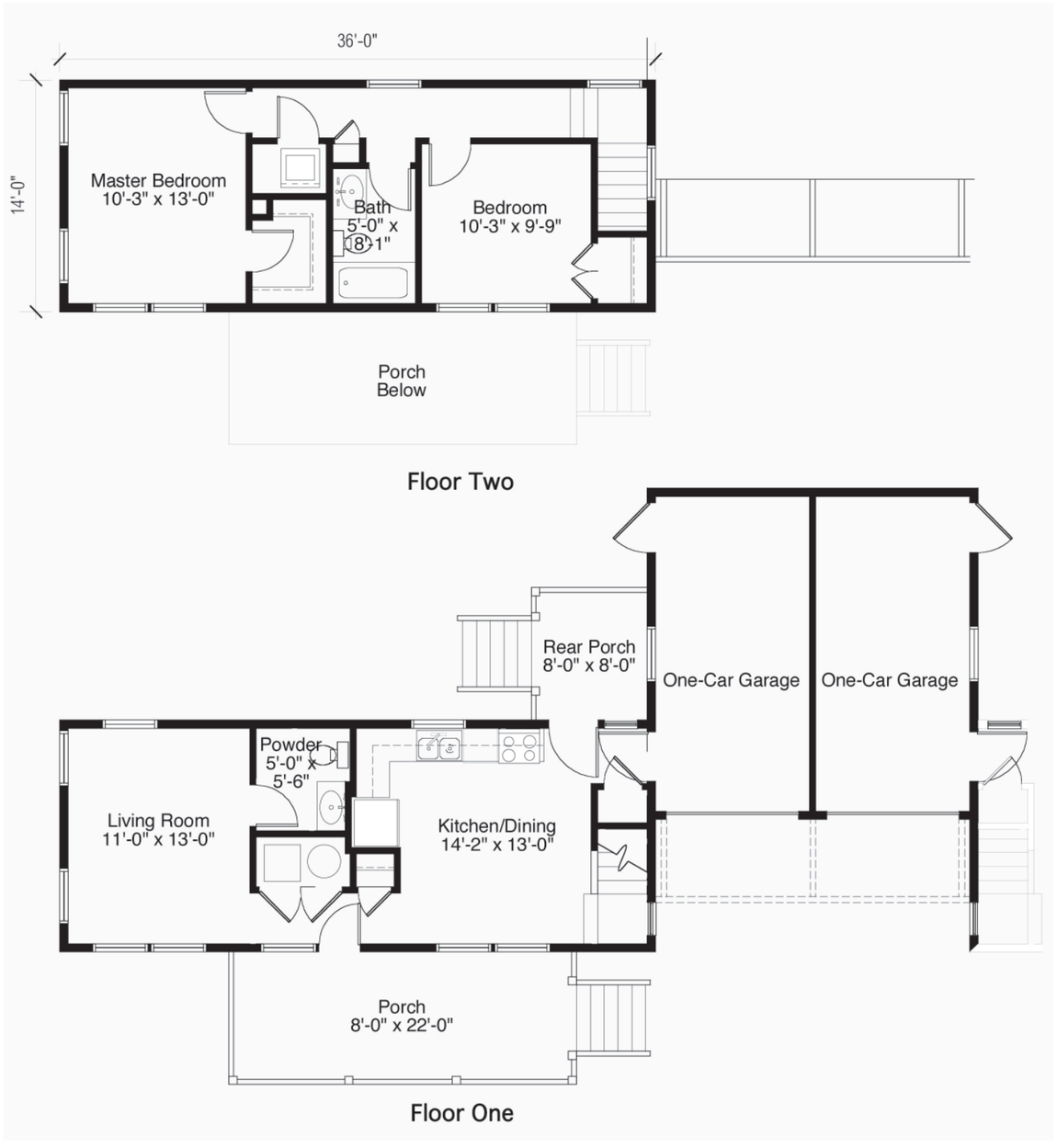
While not illustrated here in detail, many of the plans were conceived to be built using modular or factory built technology. This approach can save costs both by mass production and by time savings of having the house erected quickly. The houses were also conceived to be built using Eco-Passiv and/or straw bale or other assembly methods that hold the promise of greater sustainability. Rather than select a single approach as best overall and exclude competing ideas, this report recommends pursuing a diversity of sustainable design and green building strategies.

Preliminary Unit Types and Prices

					Price	
Mix	*Type*	*BR*	*Baths*	*Size (SF)*	*PSF*	*Total*
20%	*Attached flats*	*2*	*1.5*	*1,000*	*$115*	*$115,000*
20%	*Attached flats*	*2*	*2*	*1,250*	*$110*	*$137,500*
40%	*Duplex*	*3*	*2*	*1,600*	*$95*	*$152,000*
20%	*Townhouse*	*3 or 4*	*2.5*	*1,750*	*$90*	*$157,500*

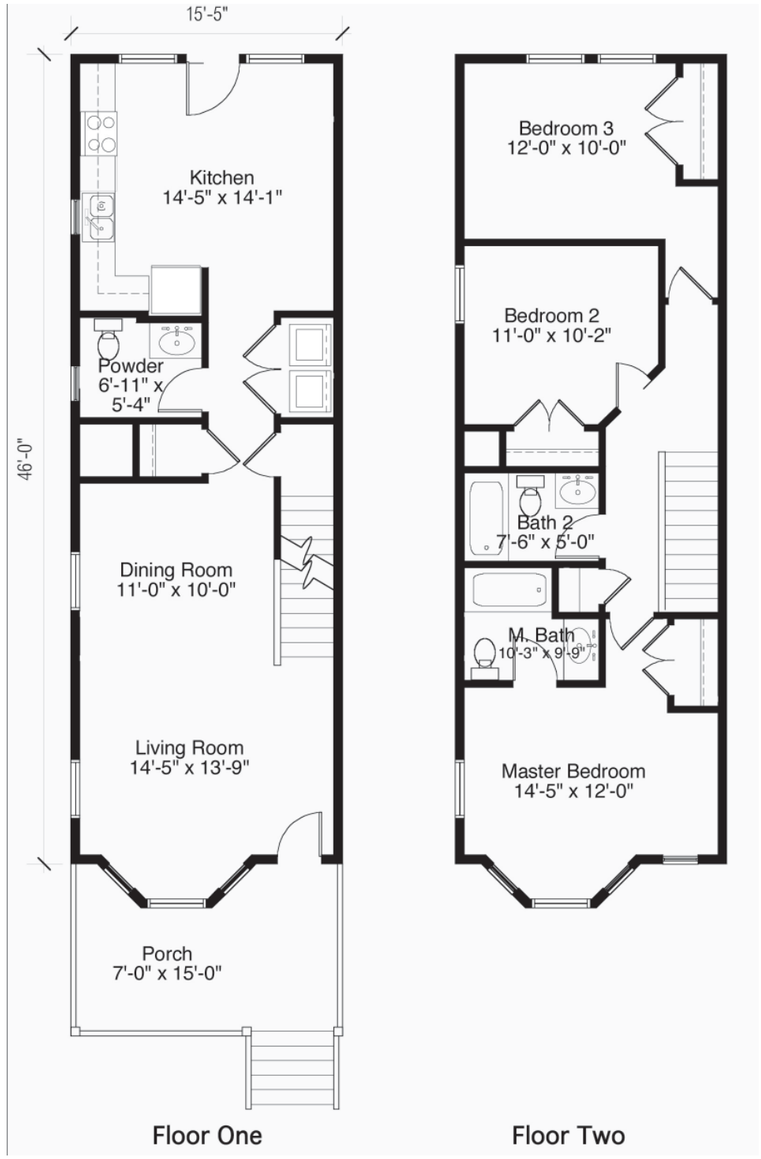
A-Home: Liner House

1008 s.f., 2 bedroom, 1.5 bath
Designed to be part of the "liner houses" at the edge of the site, and configured for modular construction, they also create semi-private yards to the rear. Common with the majority of the designs, it has a large porch facing the public space.



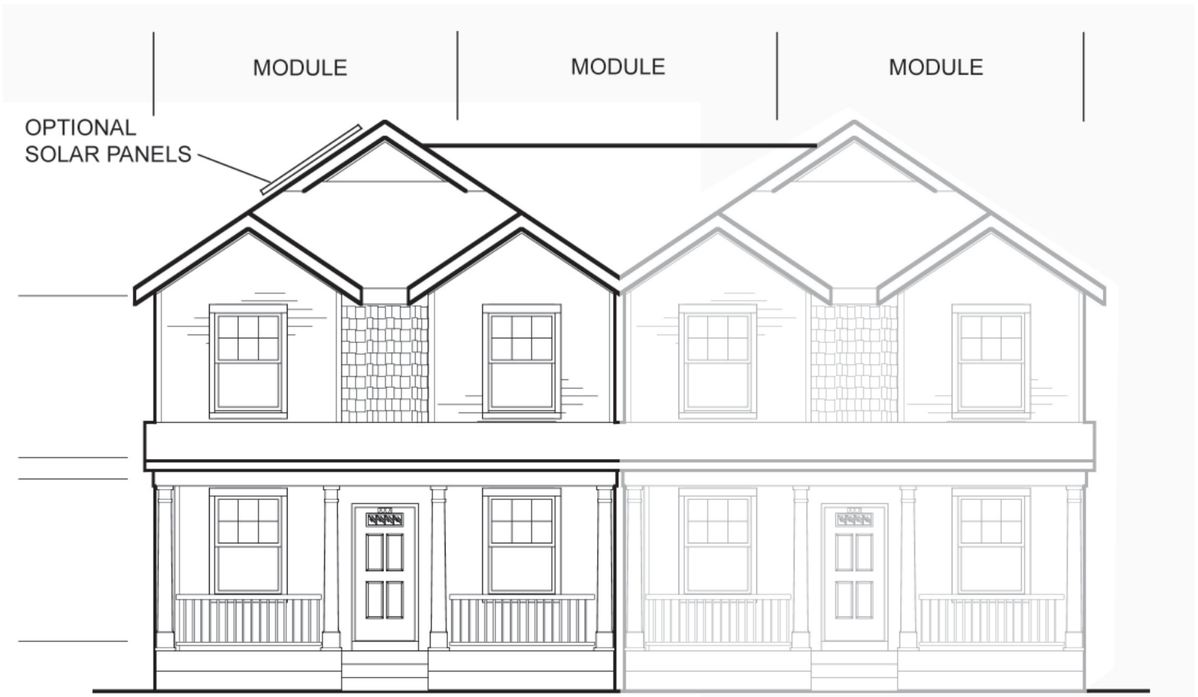
B-Home: Shotgun or Duplex

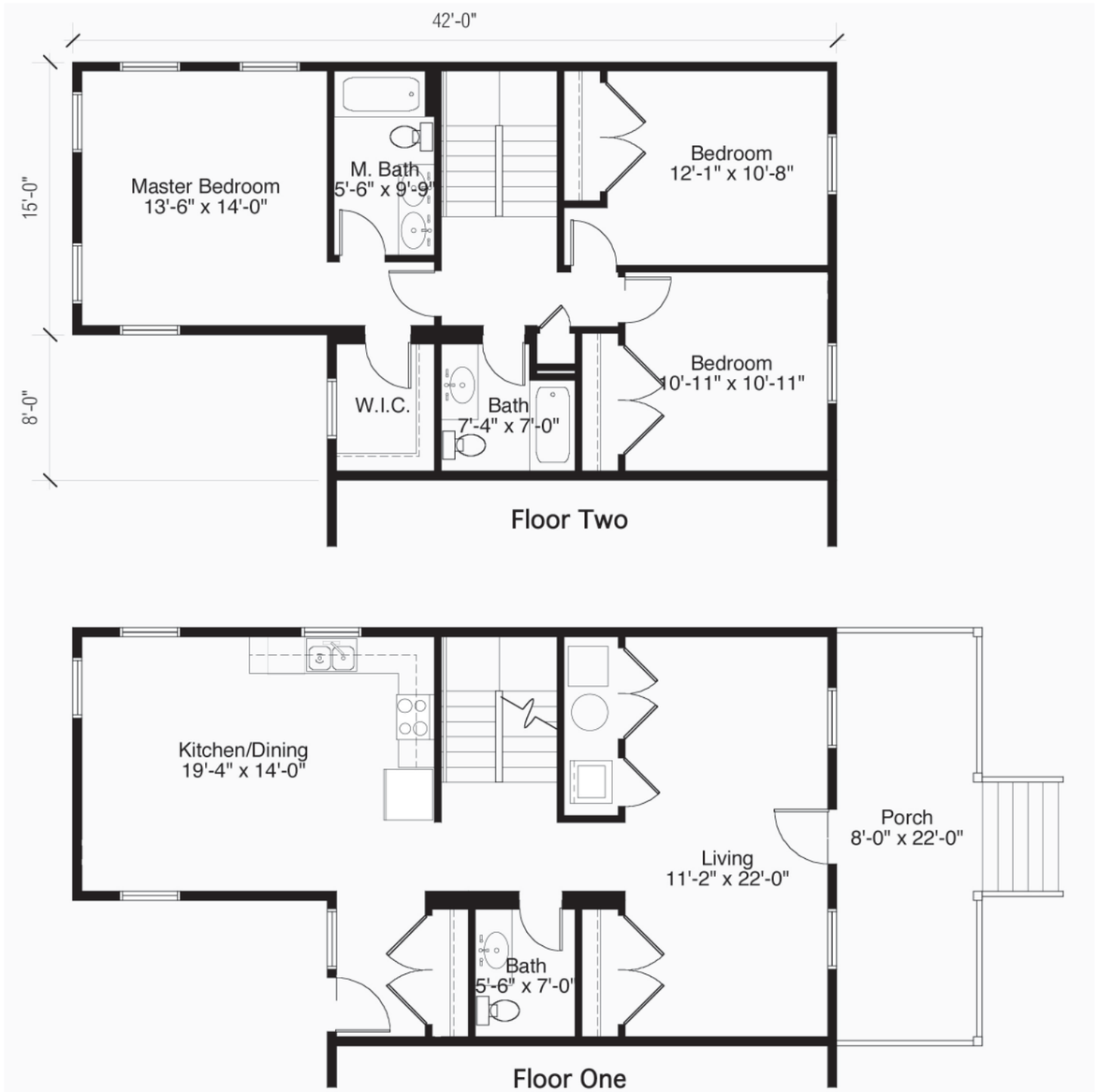
1420 s.f., 3 bedroom, 2.5 bath
Emblematic of what can be accomplished with modular construction, it is based on one of the designs in Neighborhood Homes' library. These homes have 2x6 exterior wall construction for excellent insulative value and they can also be combined to form 2-wide town homes.



C-Home: Paired House

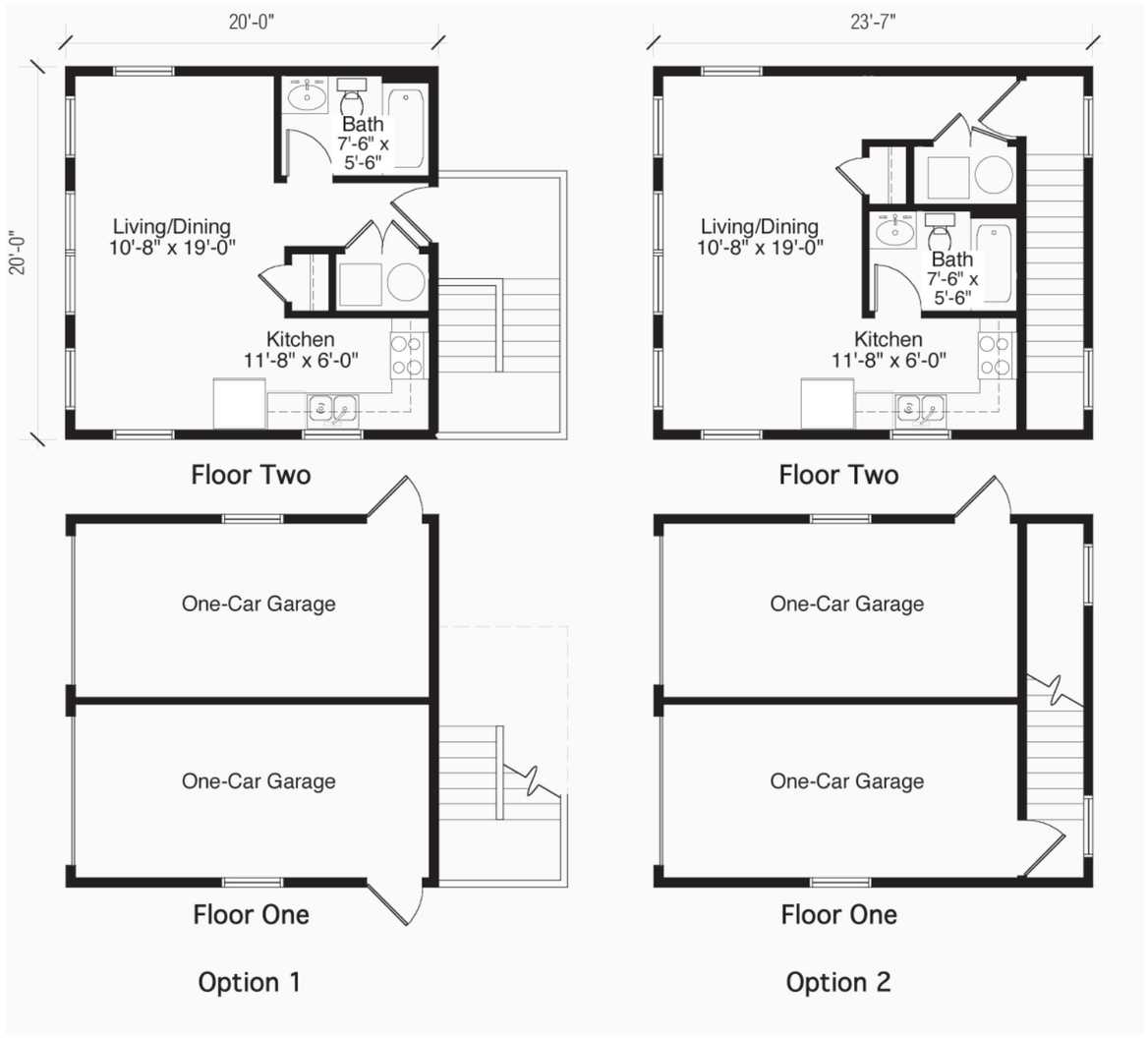
1200 s.f. 3 bedroom, 2.5 bath
Modular design for townhomes "splitting" one of the modules between the units for wider units. Full width front porches embrace the community.





D-Home: Coach House

400 s.f. 1 bedroom, 1 bath efficiency
Designed as a possible renter unit, these coach houses or "Granny shacks," would sit over a garage and be suitable for students or singles needing less living area.

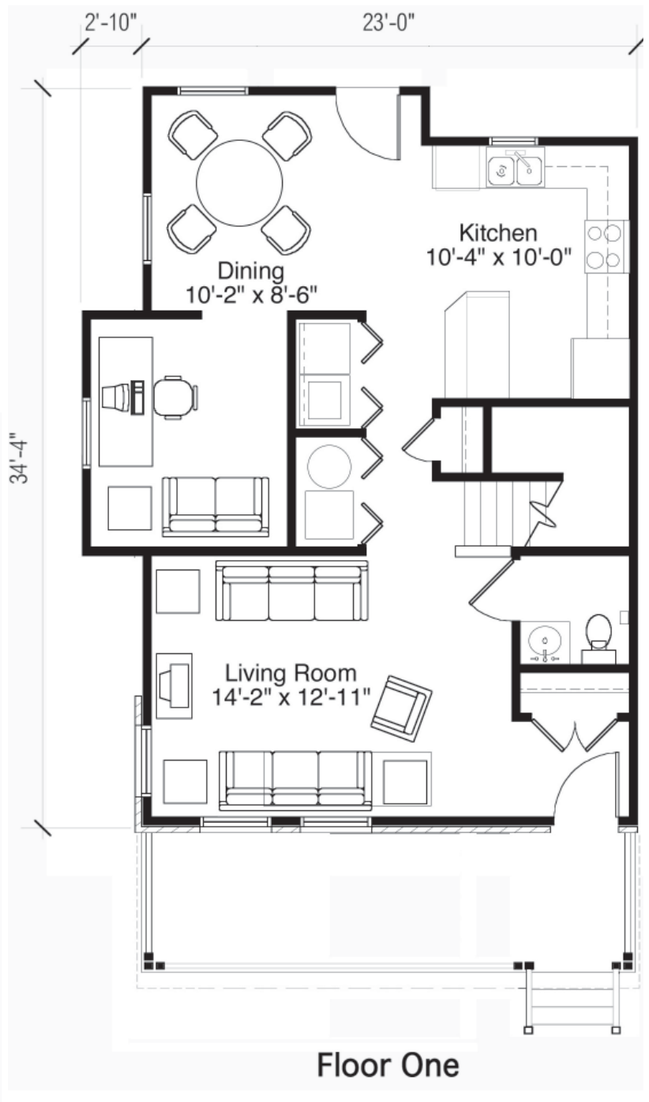


E-Home: Tower House

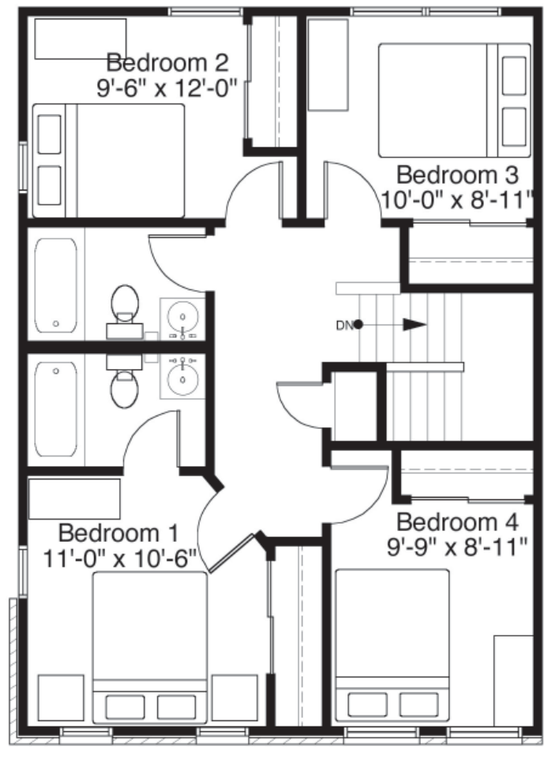
1200 sq. ft. 3 bedroom, 2.5 bath
The emblematic "Tower House" places the living area on the "piano nobile" top floor and the bedrooms below. A bridge-like deck linking 2 of these units offers views of the entire development, providing a sense of community.

F-Home: Large Single Family House

1536 sq. ft. 4 bedroom, 2.1 bath
This large single family home is well suited to the larger lots along the western boundry of the Kerr Avenue site.



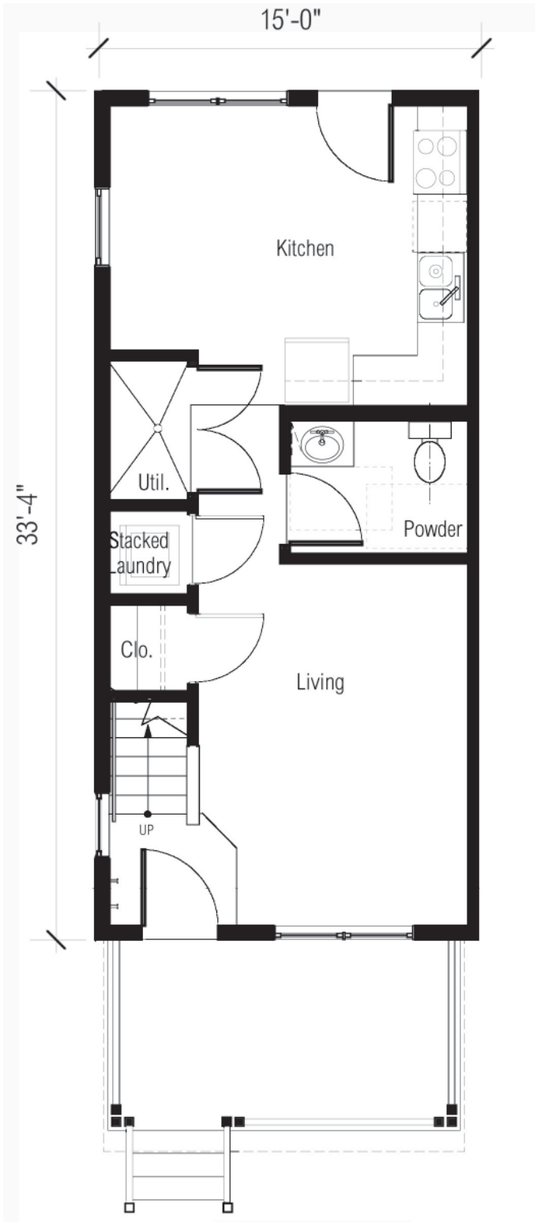
Floor One

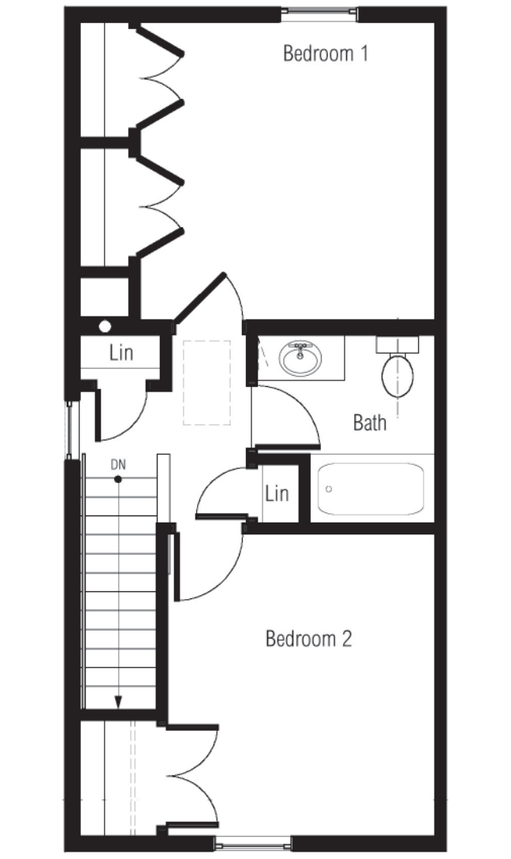


Floor Two

G-Home: 2 Bedroom Cottage House

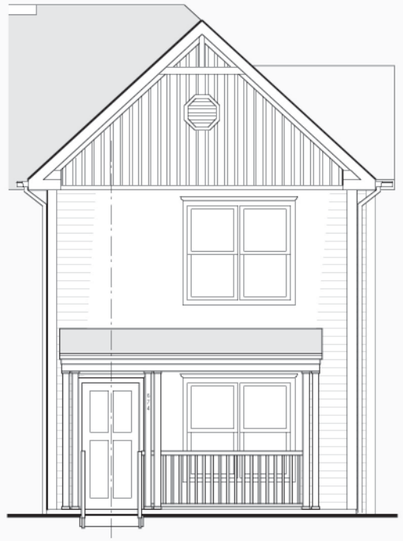
965 sq. ft. 2 bedroom, 1.5 bath
This compact 2 bedroom cottage house is an ideal starter home for a younger family, or a low-maintenance retirement home for empty nesters.

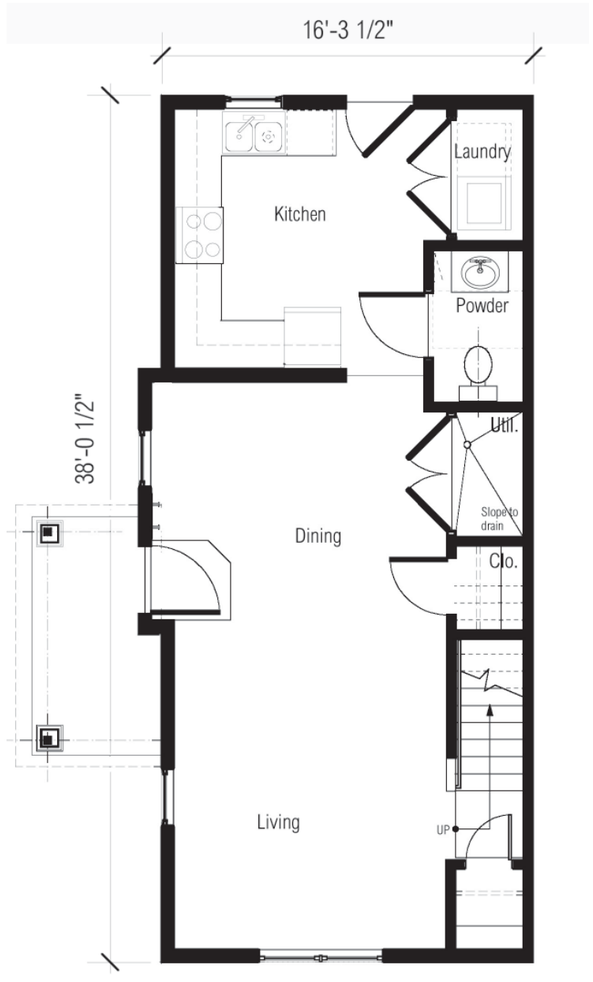




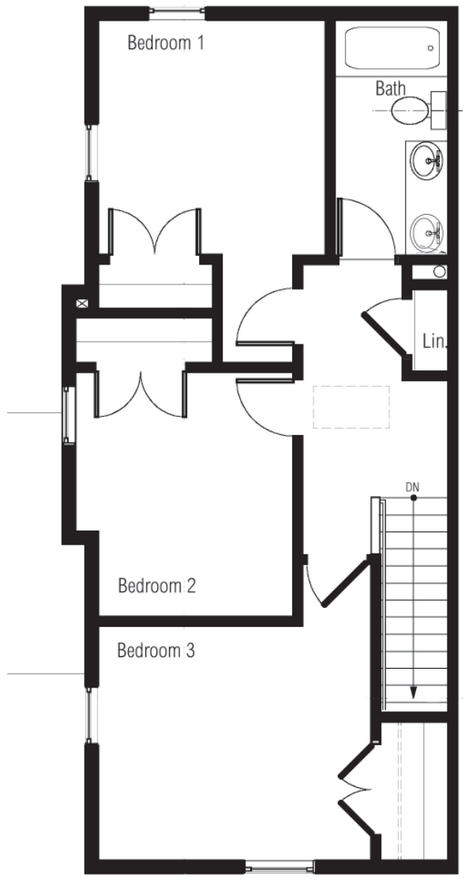
H-Home: Move-up House

1262 sq. ft. 3 bedroom, 1.5 bath
This three bedroom house is an ideal move-up home for a growing family with children. It can be built either stand alone or paired.





Floor One



Floor Two

V. Energy Analysis

Overview and Modeling Assumptions

A primary goal of the Kerr Avenue project is to demonstrate the viability and extent of energy use reductions of us to 90%. To evaluate this possibility, Farr Associates contracted with Alan Chalifoux principal of ETA Engineers of Champaign, Illinois. We asked ETA to model four different construction types: conventional, high performance (akin to an OVE house using 2 x 6 wall construction and enhanced ceiling insulation, a straw-bale house, and a Passivhaus. In addition we asked him to model these four construction types in four different configurations listed below: 1) the long side of the house faces south, 2) the long side faces east or west, 3) a party wall condition, and 4) a conventional with high-efficiency energy equipment. The initial results are summarized in the chart below. The full report results appear on the next page.

Results of Initial Energy Modeling

	South-Facing	Rotate 90	Duplex	SEER 16
Conventional	$767	$918	$737	$719
High-Perf	$699	$765	$697	$680
Straw-Bale	$704	$817	$693	$677
Passivhaus	$689	$764	$689	$673

Analysis and Remodeling

The results of the modeling were promising indicating that a combination of building orientation and construction technology could reduce energy use by as much as 27%. However the results did not correspond to the anecdotal reports from both George Bialecki of a 35% to 40% reduction and of Katrin Klinkenberg of a 50% reduction as compared to a conventional house. The modeling also did not take into account energy innovations that had previously worked effectively to reduce energy consumption: solar hot water and district geothermal. (Note: photovoltaics were not considered viable for this project based on their high initial cost and long payback. Grant funding could make such an approach far more viable.)

Consequently we asked ETA to rerun the models to account for a tightly constructed building envelope as is typical of the Passivhaus approach. The results summarized below show only modest gains, roughly a 1% reduction in energy use. The modeled results still fell far short of what the best practitioners reported that they could achieve. Based on the limited scope of this project, we were not able to contract for further modeling.

Conclusion on Energy Analysis

In the end, all of the modeled results and anecdotal reports on energy efficiency fell well short of the ambitious goal of a 90% energy reduction. Furthermore, the modeled and actual results were inconsistent with one another, and required a more detailed study to sort out. However a path forward did reveal itself.

The energy modeling confirmed that building orientation and construction can produce dramatic reductions in energy consumption, as much as 50% or possibly more. Significant additional energy savings can be anticipated by shifting to more multi-family housing, installing solar hot water systems for domestic hot water (and supplemental space heating) and by considering a district geothermal system.

While it is beyond the scope of this project to quantify the performance likely to result from the application of all of these approaches, it is possible to speculate on the results. It is conceivable that by applying all of these strategies in tandem that an energy savings of 75% or more is technically feasible. Only a handful of projects internationally have targeted or achieved a level of energy efficiency performance this high. (Among others these include BEDZED in England and Dockside Green in Victoria, British Columbia.) Based on this analysis, the City of Urbana can conclude that a nationally significant model sustainable and energy efficient development is viable on this site.

Results of Revised Energy Modeling

Infiltraion (AC/Hour)			South-Facing	Rotate 90	Duplex	SEER 16	Infiltration (AC/Hour)	
Win	Sum						Win	Sum
.30	.30	Conventional	$767	$918	$737	$719	.30	.30
.18	.18	High-Perf	$692	$765	$697	$680	.30	.30
.10	.13	Straw-Bale	$689	$817	$693	$677	.30	.30
.10	.13	Passivhaus	$686	$764	$689	$673	.30	.30

VI. Energy Analysis

Modeling Software: Trane TRACE
The modeling does not include energy used for appliance usage or hot water heating. It includes heating, cooling and lights. As one can see from reviewing the literature on residential energy use (see separate papers I have forwarded via email), appliance usage is a large part of residential energy use.

Plan Layout and Wall/Roof Sections
Per Farr Associates' previous information, transmitted via tele-cons and emails. The modeling was executed on the "F-1262" unit.

HVAC System
Air source heat pump with electric resistance back-up

Utility Rates
Per Ameren "post deregulation" residential electric rate: $0.093/kWh

Analysis
1. The energy consumption of the south-facing, conventional unit is 16,274 BTU/SF/year. This compares favorably to the 5,000 BTU/SF/year requirement for a house to be classifies as a "Passivhaus" (http://www.passivhaus.org.uk/index.jsp?id=668).

2. Rotating the unit so that its front entrance faces west produces the most marked effect (in a negative direction). The western exposure decreases solar gain significantly in the winter, requiring more fuel for heating.

3. The massing of two units into a duplex decreases the annual energy consumption (of each unit) a little due to the common wall, but not significantly, since the common wall does not have a lot of glazing.

4. The modeling of the Passivhaus was executed without the benefit of discussions with Katrin Klingenberg, due to time constraints.

	South-Facing	Rotate 90	Duplex	SEER 16
Conventional	$767	$918	$737	$719
High-Perf	$699	$765	$697	$680
Straw-Bale	$704	$817	$693	$677
Passivhaus	$689	$764	$689	$673

Figure 1 - The Raw Data produced by the Energy Modeling

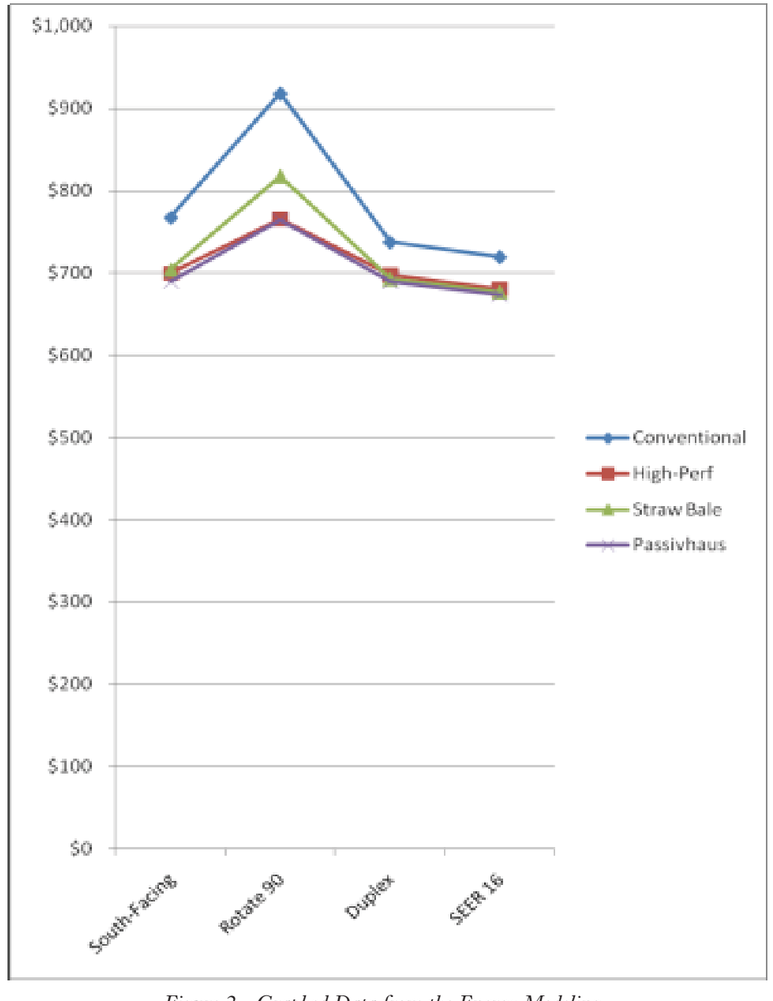


Figure 2 - Graphed Data from the Energy Modeling

VI. Stormwater

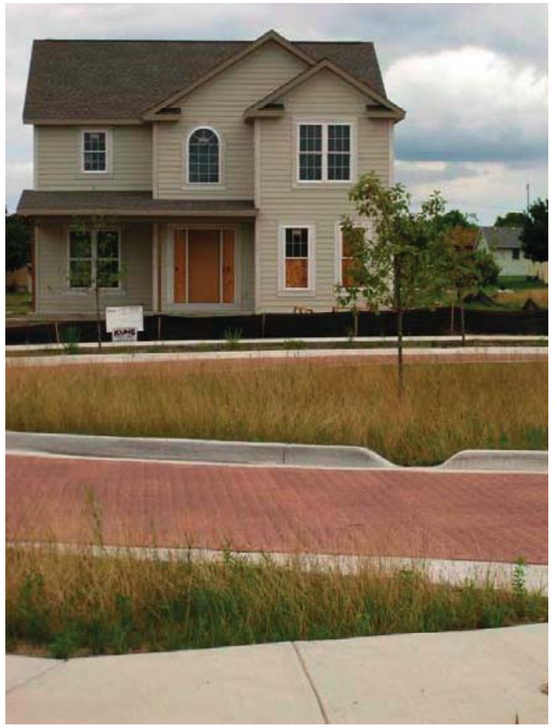
Best Management Practices

VI. Stormwater

Best Management Practices

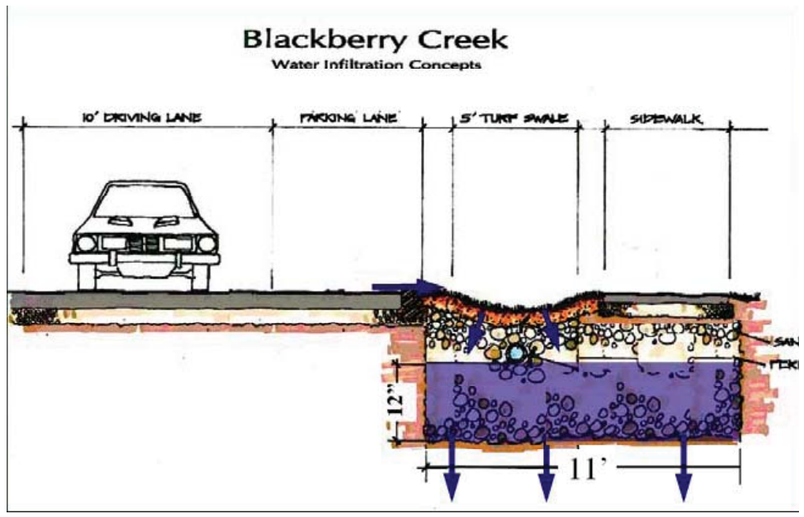
Best Management Practics

The plans approach stormwater in a way that emulates and restores natural hydrology and embraces the use of native species. The following images illustrate relevant BMP's.



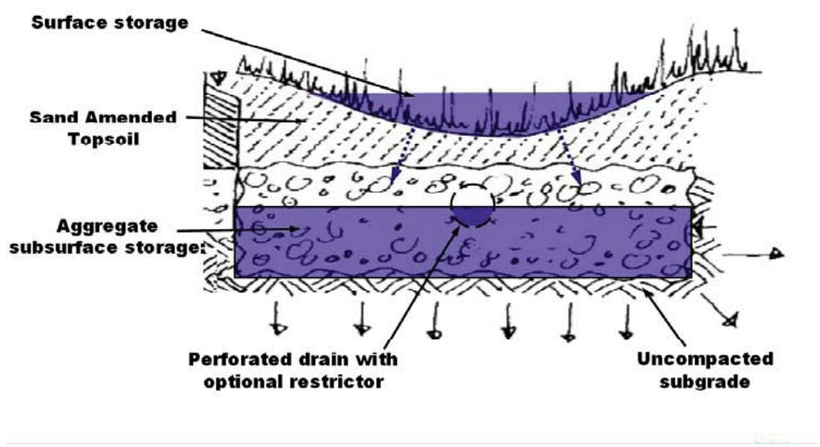
Pervious paver street with slotted curb leading to naturalized detention in median.

Pervious paver parking lot.



Substrate detail for pervious paver parking lot. Illustration curtesy of CDF.

Rain garden features colorful native species.



Rain garden section. Illustration curtesy of CDF.

VII. Recommendations and Next Steps

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Recommendations and Next Steps

This Kerr Avenue master plan fulfills the City of Urbana's request for a model pilot sustainable affordable development. However there are a number of obstacles to address in order for the project to succeed. Included below are a number of key recommendations and next steps.

1. Sort out financing and City of Urbana commitment to the Project
This master plan has proposed multiple strategies to fulfill the goal set forth by the City of Urbana to create a pilot sustainable and affordable development. However, as owner of the land, sponsor of its affordability, and advocate for its aggressive sustainability, the City of Urbana has a key financial role to play.

The City of Urbana needs to assess the sources and uses of funds on the project and identify the funding sources necessary to attract a private sector developer. While the potential of being able to offer the land to a developer for little or no money is appealing, the affordability and sustainability will both prevent many conventional developers from responding to an RFP.

The consultant team is especially interested in creating the opportunity to sell dwellings with rental units. These "two-flat" units have helped many American families with moderate incomes to amass equity with a rental income to cover a disproportionate share of the mortgage. This is a traditional method of providing both affordable rental housing and generating wealth. Current funding terms prevent rentals from being included in the plan.

2. Endorse Site Plan B
While the final two site plans are both viable, site plan B is superior in fulfilling the mission of a model sustainable affordable development. While Plan B proposes a longer road than Plan A and elects not to align with Highlands Drive, retention and development around the existing slope on the site makes Plan B superior. This design strategy also sets up the opportunity to retain water in the southeast (lowest) part of the site. The entry sequence and street progression of Plan B creates more real estate interest and value as compared to that of Plan A, creating a unique place through urban design and architecture. Should the Council endorse Plan B, Plan A should still be issued for reference as many ideas can be pulled from A and applied to B.

3. Develop a Form-Based Code Overlay for the Project
While beyond the scope of this project, we recommend that the City of Urbana develop a form-based code overlay to guide the private sector development of the plan. This code would specify building placement, setback requirements, yard screening, vegetation requirements, stormwater and green building requirements and other sustainable urban criteria. Time and again well-conceived master plan projects such as this are poorly executed and fail to meet the within-reach goals of the plan. This project represents too great an opportunity to leave design issues to chance with a largely unenlightened building sector.

4. Develop Overlay Zoning for the Adjacent Commercial Development
Develop a zoning overlay district that requires stormwater to be captured on the site of the car sales lot and that prevents light trespass or glare from the adjacent commercial uses. The current land use is a deterrent to adjacent residential development.

5. Require LEED-Neighborhood Development Certification
LEED-Neighborhood Development (LEED-ND) is a newly developed certification standard for sustainable land developments. Jointly developed by the Congress for New Urbanism, the Natural Resource Defense Council and the United States Green Building Council, this national standard is currently in its pilot phase. Like the LEED Green Building system, LEED-ND is a system of pre-requisites (criteria you must meet) and credits (criteria you have to do enough of to achieve a threshold of Certified, Silver, Gold or the highest level, Platinum).

A detailed analysis of how the Kerr Avenue project might score under the LEED-ND protocol is out of this scope of this contract. However, were the project to pursue full LEED-ND certification, it is all but certain to meet the minimum requirements (pre-requisites) and to achieve an advanced level of certification. On this basis, we recommend that any development RFP for the Kerr Avenue site be issued with a minimum target LEED-ND level of Gold.

6. Embrace Diverse Construction Methods
Urbana's City Council guidance to develop a national model of sustainable affordable development with a target 90% reduction in energy consumption is unprecedented. "A sustainable development model comprised of ultra energy-efficient single-family homes for low to moderate-income home buyers and/or moderate income residents." The Eco-passive approach holds great promise at being able to deliver significant energy efficiency increases without adding excessively to construction cost. The more ambitious 90% level of energy efficiency is achievable only through the addition of renewable energy technologies such as solar hot water and photovoltaic.

For the foreseeable future, the 90% increase in energy efficiency is technically attainable at construction costs higher than the market is willing to pay for housing at the Kerr Avenue location. In order to offer such housing at an affordable price, significant subsidies will be necessary.

Given the slow uptake of energy-efficient housing in the Champaign-Urbana area, Farr Associates recommends a repositioning of the Council's idea of a model project. Rather than pick a single design approach or technology as the most likely to succeed, we recommend nurturing a diverse local industry in energy-efficient, green buildings. The specific strategy we have proposed to accomplish this is to earmark a specified number of building lots in the Kerr Avenue project to showcase promising approaches and technologies. By locating these competing design approaches within site of or a short walk of one another allows a home buyer or interested party to easily compare them and for a healthy cross-fertilization of ideas to occur. The three most promising approaches that emerged during the workshop and design process were 1. eco-passive, 2. straw bale, and 3. modular.

7. Require the public housing redevelopment to connect to the new street
Both master plans schemes achieve a sustainable design and interconnect with adjacent development by avoiding a dead end street. The City of Urbana needs to require the affordable housing developer to provide a stub connection to the proposed extension to Highlands Avenue. The City should distribute this report or the two proposed site plans to the developer with a cover letter highlighting this intention.

8. Securing a developer committed to urban sustainability.
The development industry is conservative and thrives on repeating a prior successful approach and expecting a similar outcome. Sustainability is focused on shifting how things are done to benefit both people and natural systems. Developers and designers experienced in sustainability can often deliver better results at little or no additional cost but still expect some premium either in terms of quicker sales or higher rents or prices. The demand for housing on the Kerr Avenue site is at a low to moderate price point, allowing little premium to invest in greening. Consequently the developer who agrees to take on the Kerr Avenue project has to be highly committed to the project.

The LEED-Neighborhood Development Scorecard presented herein is necessarily based on assumptions and incomplete information. While a more thorough evaluation will be necessary to determine a precise level of certification, a Gold level is within reach and should be the project's target level of certification.

LEED for Neighborhood Development Pilot
Project Checklist

Project Name:

Yes	?	No			
5	5		**Smart Location & Linkage**		**30** Points Possible
Y			Prereq 1	**Smart Location**	Required
Y			Prereq 2	**Proximity to Water and Wastewater Infrastructure**	Required
Y			Prereq 3	**Imperiled Species and Ecological Communities**	Required
Y			Prereq 4	**Wetland and Water Body Conservation**	Required
Y			Prereq 5	**Farmland Conservation**	Required
Y			Prereq 6	**Floodplain Avoidance**	Required
			Credit 1	**Brownfield Redevelopment**	2
			Credit 2	**High Priority Brownfields Redevelopment**	1
4	2		Credit 3	**Preferred Location**	10
			Credit 4	**Reduced Automobile Dependence**	8
			Credit 5	**Bicycle Network**	1
	3		Credit 6	**Housing and Jobs Proximity**	3
1			Credit 7	**School Proximity**	1
			Credit 8	**Steep Slope Protection**	1
			Credit 9	**Site Design for Habitat or Wetlands Conservation**	1
			Credit 10	**Restoration of Habitat or Wetlands**	1
			Credit 11	**Conservation Management of Habitat or Wetlands**	1
Yes	?	No			
10	10		**Neighborhood Pattern & Design**		**39** Points Possible
Y			Prereq 1	**Open Community**	Required
Y			Prereq 2	**Compact Development**	Required
1			Credit 1	**Compact Development**	7
2	2		Credit 2	**Diversity of Uses**	4
			Credit 3	**Diversity of Housing Types**	3
	1		Credit 4	**Affordable Rental Housing**	2
2			Credit 5	**Affordable For-Sale Housing**	2
2			Credit 6	**Reduced Parking Footprint**	2
	5		Credit 7	**Walkable Streets**	8
			Credit 8	**Street Network**	2
			Credit 9	**Transit Facilities**	1
	2		Credit 10	**Transportation Demand Management**	2
			Credit 11	**Access to Surrounding Vicinity**	1
			Credit 12	**Access to Public Spaces**	1
1			Credit 13	**Access to Active Public Spaces**	1
1			Credit 14	**Universal Accessibility**	1
1			Credit 15	**Community Outreach and Involvement**	1
			Credit 16	**Local Food Production**	1
Yes	?	No			
7	10		**Green Construction & Technology**		31 Points Possible
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
			Credit 1	**LEED Certified Green Buildings**	3
1	2		Credit 2	**Energy Efficiency in Buildings**	3
1			Credit 3	**Reduced Water Use**	3
			Credit 4	**Building Reuse and Adaptive Reuse**	2
			Credit 5	**Reuse of Historic Buildings**	1
1			Credit 6	**Minimize Site Disturbance through Site Design**	1
1			Credit 7	**Minimize Site Disturbance during Construction**	1
			Credit 8	**Contaminant Reduction in Brownfields Remediation**	1
	5		Credit 9	**Stormwater Management**	5
1			Credit 10	**Heat Island Reduction**	1
			Credit 11	**Solar Orientation**	1
			Credit 12	**On-Site Energy Generation**	1
			Credit 13	**On-Site Renewable Energy Sources**	1
			Credit 14	**District Heating & Cooling**	1
	1		Credit 15	**Infrastructure Energy Efficiency**	1
			Credit 16	**Wastewater Management**	1
1			Credit 17	**Recycled Content for Infrastructure**	1
	1		Credit 18	**Construction Waste Management**	1
	1		Credit 19	**Comprehensive Waste Management**	1
1			Credit 20	**Light Pollution Reduction**	1
Yes	?	No			
1			**Innovation & Design Process**		6 Points
			Credit 1.1	**Innovation in Design**: Provide Specific Title	1
			Credit 1.2	**Innovation in Design**: Provide Specific Title	1
			Credit 1.3	**Innovation in Design**: Provide Specific Title	1
			Credit 1.4	**Innovation in Design**: Provide Specific Title	1
			Credit 1.5	**Innovation in Design**: Provide Specific Title	1
1			Credit 2	**LEED® Accredited Professional**	1
Yes	?	No			
23	25		**Project Totals** (pre-certification estimates)		106 Points

Total Possible: 48 **Certified:** 40-49 points, **Silver:** 50-59 points, **Gold:** 60-79 points, **Platinum:** 80-106 points