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Westport Affordable Housing Design

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Westport Affordable Housing Design

Community Partner:
Westport Affordable Housing Trust Fund

Academic Partner:
The School of Architecture, Art
and Historic Preservation

Spring 2014



The Roger Williams University Community Partnerships Center

The Roger Williams University (RWU) Community Partnerships Center (CPC) provides project-based assistance to non-profit organizations, government agencies and low- and moderate-income communities in Rhode Island and Southeastern Massachusetts. Our mission is to undertake and complete projects that will benefit the local community while providing RWU students with experience in real-world projects that deepen their academic experiences.

CPC projects draw upon the skills and experience of students and faculty from RWU programs in areas such as:

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- Architecture and Urban Design
- Business
- Community Development
- Education
- Engineering and Construction Management
- Environmental Science and Sustainability
- Finance

- Graphic Design
- Historic Preservation
- History
- Justice Studies
- Law
- Marketing and Communications
- Political Science
- Psychology
- Public Administration
- Public Relations
- Sustainable Studies
- Visual Arts and Digital Media
- Writing Studies

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Proposed community center perspective
by Jack Hamm.

Table of Contents

Introduction.....	4
About Westport.....	5
Precedent Analysis.....	7
Site Analysis	15
Duplex Sketch Problem.....	17
Student Designs	22
Conclusion.....	69

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Introduction

The graduate studio of spring 2014 focused on a project entitled **“In-between Water/Land and the Villages: Affordable Housing Design, Westport, MA”** as part of Roger William University’s Community Partnerships Center (CPC) projects. The students worked on alternative proposals for affordable housing for the town of Westport, Massachusetts, investigating single and multiple units while reactivating dormant infill properties owned by the town.

Westport has developed a unique settlement pattern where water interlocks or intervenes with land through rivers and joins the Atlantic Ocean. Because of the pattern of topography, water inlets and ponds and the harbor, Westport has evolved as clusters of villages, fragmented but connected through roads, in-between wetlands and waterways. Water became an important aspect of ecological infrastructure and Westport culture.

Therefore, the studio focused on developing landscape and water infrastructure alongside a housing design that responded to the demands of low and moderate income residences. Each student was responsible for designing two projects: (1) Sketch



Problem: To develop affordable duplex units on one of the small or medium sized town-owned properties; and (2) Semester Project: To develop approximately 24+ affordable housing units with

a community facility and an aquatic center (living machine) on two of the properties Westport owns (Drift Road and State Road).

The significant tasks of this graduate studio included the planning of affordable housing proposals, establishing a vision to positively impact the town’s existing ecological and historical background, and coming up with alternative proposals to improve the town’s ecological infrastructure.

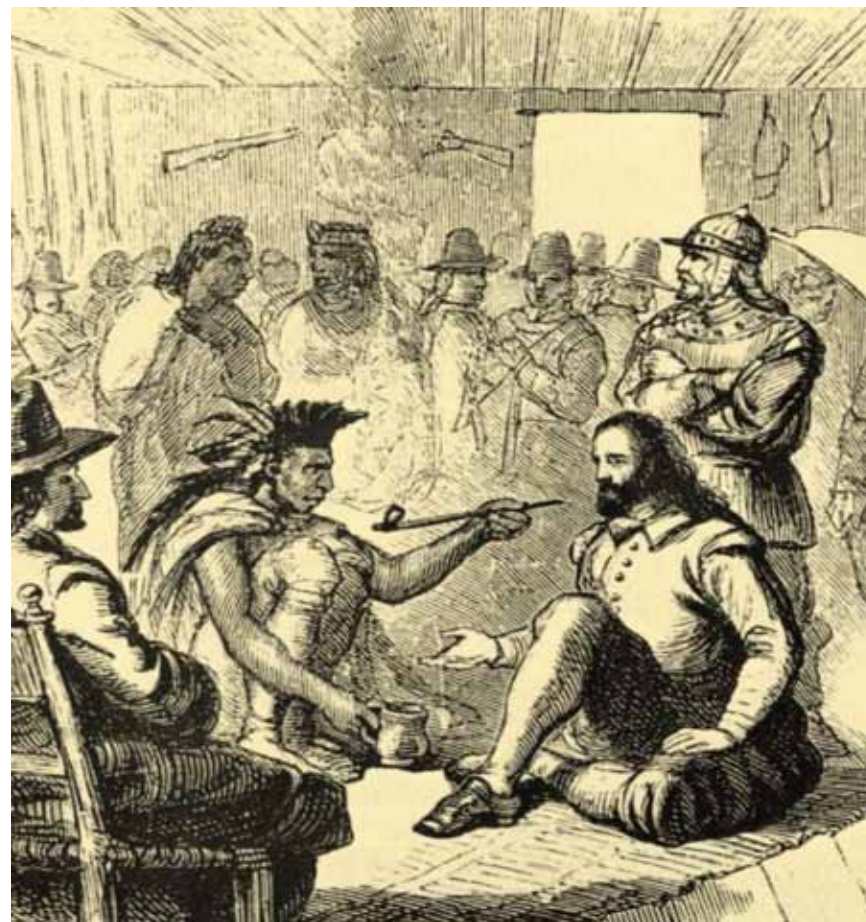
The affordable housing project alternatives were articulated in context of this new vision where residents with low and modest incomes will be able to engage as a community supporting the social, cultural, historical, ecological and aesthetic assets of Westport. Unique and creative housing development responding to issues of affordability, sustainability and accessibility was a major challenge of this semester’s project.

Duplex sketch perspective
by Jake Wheeler.

About Westport, MA

History of Westport

- Originally the land of the Wampanoag Indians, later settled by English colonists in 1670.
- Part of the Town of Dartmouth in Bristol County.
- Water in the area has created a pattern of water inlets, ponds, wetlands and a harbor. This has created a cluster of fragmented villages connected through roads, waterways, bridges and a tram in the past.
- Town is described as a semi-urban setting.
- Town contains five villages: North Westport, Westport Point, Central Village, Head of Westport and Westport Harbor.
- Due to the fragmented layout and development pattern of the town, it is important to not add stress to the existing fragile natural resources in Westport.



Demographics

- Population: 15,532.
- 5,386 households.
- 4,082 families.
- Population density: 283.4 people per square mile.
- Estimated median income (2011): \$68,070.
- Estimate median house or condo value (2011): \$317,457.
- 3.7% of families and 4.9% of the population are below the poverty line.
- 21% of Westport residents ages 5+ have a physical or mental disability.



1. The Wampanoag Indians were the original settlers of Westport.

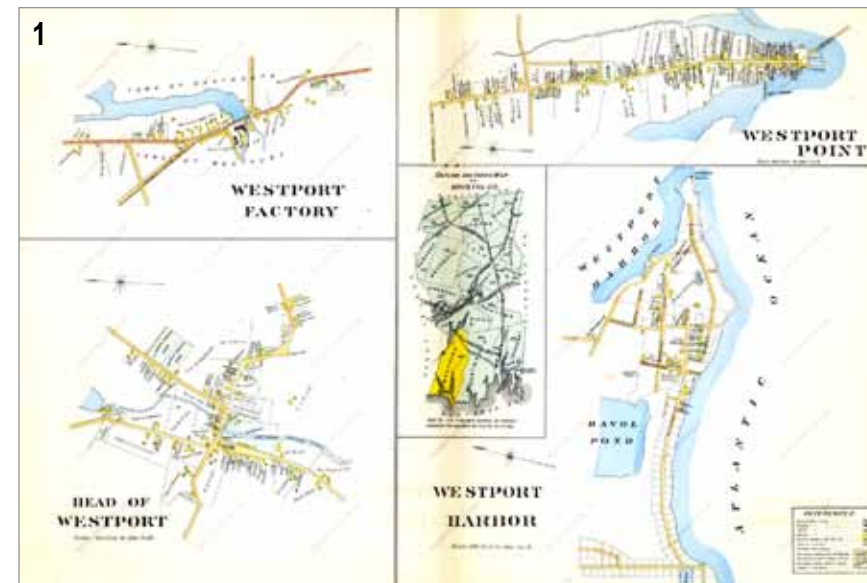
2. Housing developments in the area have a history of being clustered.

Issues Facing Housing and Development in Westport

- Many current residents, especially younger people, seniors and others on fixed incomes, are unable to afford the standard homes being created on large subdivision lots in Westport as a result of the current housing market and regulatory environment.
- Increased valuation and taxes in areas such as Westport Harbor, which attracts buyers of seasonal second homes and those seeking a desirable retirement community, create financial hardship for year-round resident elders on fixed incomes who cannot afford to stay in their longtime homes.
- Westport lacks affordable housing alternatives for seniors and lacks programs to assist those who would prefer to remain in their homes.
- The five villages developed in relation to the local industries — fishing, farming, textiles — and the layout was closely related to the common New England green. However this layout is being threatened by urban sprawl.
- Westport Point is protected as an historic district but the other surviving villages are subject to development.
- Much of the land used today is still very agricultural, with dairy farms very prominent.

Current Housing in Westport

- The town morphed from small cabins with centralized chimneys to saltbox houses with centralized chimneys to larger mansions and contemporary homes.
- Each village has a variety of different home styles and sizes. This is a positive aspect when designing new property in Westport, as designs can range from traditional to contemporary or a mix of various types.



1. 1895 maps of Westport villages.
2. The surrounding water is an important cultural and ecological aspect of Westport.
3. Much of Westport is located on preserved wetlands with numerous parks throughout.
4. The town's architecture is a mix of small cabins, saltbox houses and larger contemporary mansions.

Precedent Analysis

The studio conducted a precedent analysis to analyze and learn about significant issues pertaining to affordable houses and housing. The students investigated spatial, social, historical, cultural and typological aspects of Westport to understand the diversity of issues specific to the town's settlement and housing. They also examined cases of affordable/sustainable housing and common facilities that will support the proposed affordable neighborhood in Westport.

There are a number of communities that are identified as affordable and sustainable housing. Usually during an economic crisis, we see an increase in planned development of affordable housing projects: during the depression of the late 1920s and 1930s; during the energy crisis of the 1970s; and in the 1990s and later we see examples of affordable eco-villages developed with sustainable initiatives. The objective of this precedent analysis was to see what the parameters of affordability are, how these cases have responded and what aspects could be applied to Westport Affordable Housing Design.

Affordability starts during the design phase and continues through construction and maintenance. The choice of construction materials, availability of local materials, efficient design principles

(including the size of spaces, orientation of living spaces, exposure to south, passive heating and cooling), energy conservation issues and shared services are some choices to consider.

Affordable communities are human-scaled neighborhoods with diverse population cohorts in which basic human needs can be met in healthy ways. "Sustainable" neighborhoods or eco-villages are also affordable, with non-profit forms of land and housing ownership, community space for exchange of information, formal and informal meetings, etc. They might engage also in organic community gardens and orchards, local recreational opportunities and participation of the residents in issues affecting the neighborhood. In affordable and sustainable communities, social, economic, and physical systems are integrated and planned to be in balance with available natural resources. Eco-villages and affordable housing communities have mixed land-use patterns and are designed to partially relieve the need for automobile dependence.

The precedent analysis was conducted in five groups of two and one group of three. On the following pages are several examples of affordable housing projects and sustainable initiatives that were investigated.



A tree planting demonstration for residents in Ithaca's EcoVillage.

Precedent Analysis

Affordable Housing and Community Facilities

EcoVillage, Ithaca, NY

- Located in the Finger Lakes region, the EcoVillage is accessible to water and is in a prime environmental spot for agriculture.
- The total site incorporates 175 acres, 80% of which is to remain greenspace. 55 acres are in a conservation easement held by the Finger Lakes Land Trust.
- Houses are located in one location on the site with the rest of the land used for farming, self-sustaining features, water pumps, water tanks, greenhouses and more.

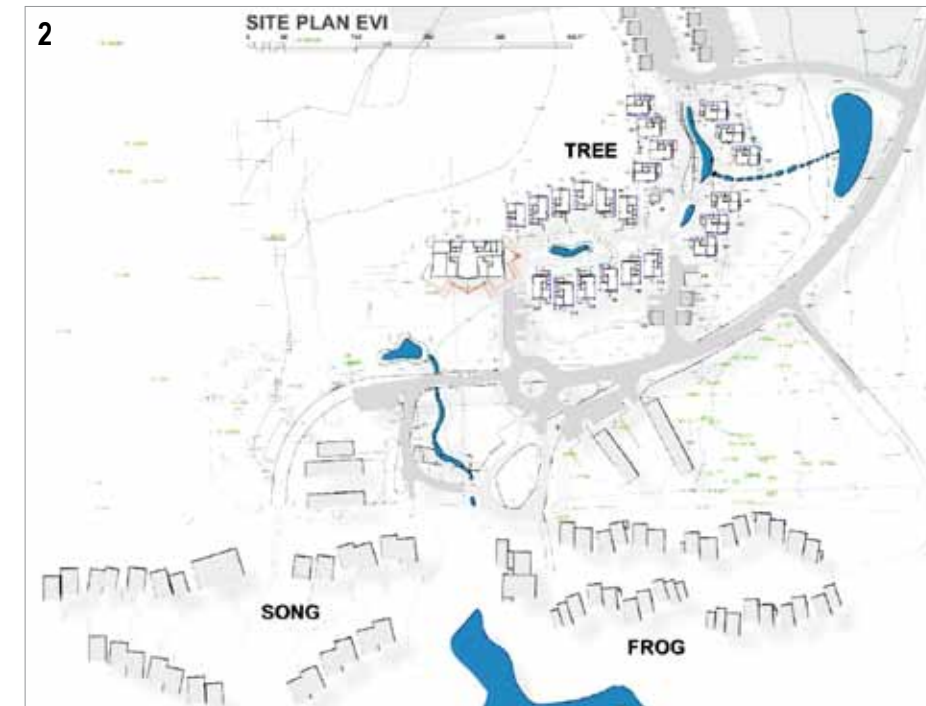


- Contains 20 30-home cohousing neighborhoods in two (soon to be three) villages. The first village, Frog, was completed in 1997 as the first co-housing neighborhood in the state of New York. The other villages are Song and Tree.
- Contains an organic CSA vegetable farm and U-Pick berry farm.
- Office space for cottage industry, which also includes a neighborhood root cellar.
- Community gardens and varied natural areas.
- Residents have the opportunity to indulge in common dinners several times per week in the two common houses, and the opportunity to volunteer 2-3 hours per week on various work teams to keep the village running smoothly.

EcoVillage – Frog Village

- All homes include passive solar, 14-foot-high windows on the south side, super-insulated walls, centrally powered by a 50kW array of solar panels.
- Pedestrian paths are lined with flowering and fruiting trees.

- The village itself hosts many events including community meals, workshops, concerts, parties, etc.
- A large pond is the central focus of the community for seasonal activities including swimming, skating and bonfires.
- Homes are made of local woods and include super-insulated walls, double-pane, south-facing windows for maximum solar heating and lighting and non-toxic stains and paints.
- Super-efficient, natural gas boilers send hot water through radiant heated floors. Electricity is provided primarily by solar panels, using programmable thermostats to keep energy use down, and appliances and lights are kept unplugged and off as much as possible.
- No car traffic between houses makes the neighborhoods completely emissions free.



1. Interior of a Frog home that uses passive solar south-facing windows and panels.

2. EcoVillage site plan.

3. Frog's common house hosts meals, events and other large gatherings.

EcoVillage – Song Village

- Completed in 2006, the neighborhood consists of 30 duplex homes.
- This village uses a self-development model, allowing the home owners to individually customize their own home, making it personal and unique.
- The village has a large common house to promote communal eating and is more affordable because it decreases the size and cost of each individual house.



- Homes use 40% less energy than other middle-class homes in the U.S.
- Homes include: low-flow toilets, radiant heating, rainwater catchment systems, compost-



ing toilets, clustered housing to create shared heating systems, large triple-glazed southern-facing windows, trellises with grape vines for shade and cellulose insulation.

EcoVillage – Tree Village

The ultimate goal is for the residents to “live simply, reducing costs while making ecologically responsible and non-toxic choices.” The community also serves as a learning center for sustainable living by teaching tourists how the village works.

Tree homes will include:

- Passive solar and other alternative energy sources.
- Sustainably-produced non-toxic materials.
- Water-saving storage and reuse features.
- Accessibility for those with special needs.
- Attractive exteriors.
- Readily adaptable to first-level living. Doorways, bathrooms and traffic flow are ADA-compatible on the first floor.



- Song and Frog Villages were not planned to be convertible into ADA-approved housing. Tree Village is meeting the need of residents who wish to have an accessible home as they age.

The Tree Village includes programs such as:

- A monthly course in trees is offered as part of the Grow Program to expand general knowledge.
- Groundswells Farm Incubator program.
- Communities that Work, a program that expresses the ideas behind Trees neighborhood to help inspire future architects, planners, homebuilders and buyers.

1. Song homes use 40% less energy than other middle-class homes in the U.S.

2. Tree homes will include water-saving features and non-toxic building materials.

3. Aerial view of Song neighborhood.

Jamaica Plain Co-Housing, Boston, MA

- Built in 2005 and designed by Kraus-Fitch Architects, Jamaica Plain Co-Housing features 30 apartment flats and townhouses, as well as a common house. The designers were able to fit 30 units on only $\frac{3}{4}$ of an acre and to include parking for 34 cars, which can be difficult to come by in Boston.
- The overall form of the building focuses on a central courtyard, which can be seen from balconies and walks that provide access to all of the units.



- The building is designed to differentiate between public and private as well as pedestrian versus vehicular traffic. Designating the traffic and parking to be towards the outer perimeter of the building allows a large open gathering space in the center.
- The building features a range of individual unit types and sizes. There are studio apartments as well as one, two, three and even four-bedroom apartments. The sizes range from 700 sq. ft. to 1,350 sq. ft., and all include their own kitchen and laundry units.
- Buildings have a balcony walk that offers a grand entry/focal point. This allows visitors to understand how entry works into the building. Units on the first floor have direct access from the road, while units on the upper floors are accessed using the balcony walks.
- The common house allows individuals to interact with each other at social gatherings and events. Also included in the common house is a visitor suite — a place to stay for those visiting friends or family.
- The building uses a photovoltaic and solar water roof system to cut down on energy consumption. In addition, a low-maintenance green roof was implemented to assess some stormwater drainage issues of the site.
- Sustainability was a top priority for this project. Energy-efficient construction helped make the community environmentally green, while the form of the building and common areas make it socially and culturally sustainable. Some of the features of the building include:
 - A clustered design which reduces heat.
 - Maximized amount of south-facing walls and windows.
 - High insulation in walls, roof and foundation.
 - No central air conditioning because natural ventilation is used properly.
 - Fluorescent lights limit energy usage.
 - Landscape is watered by drip irrigation from rain barrels that catch rain water.
 - Secured bicycle racks/shelters to promote cycling instead of vehicular traffic.



1. The design centers around a common courtyard and keeps vehicular traffic away from the pedestrian flow.

2. The building features a range of unit sizes plus balcony walkways with a view.

- A community garden is located on the site as well. There is on site composting and there are 8 raised beds with organic soil. Individuals are able to have gardening groups and are able to supply themselves with fresh produce. Often times, the produce that is collected from the garden is then cooked for a large dinner gathering.

Findhorn Ecovillage, Scotland

- Findhorn Ecovillage contains 55 ecological buildings onsite, half of the United Kingdom's average ecological footprint.
- The ecovillage has an extensive recycling program that includes metal, glass, paper, batteries and a clothing bank.



- Homes use renewable energy, including solar, wind and wood. Homes are built to incorporate passive solar design. Wood used for space

and water heating is from sustainably managed forests. The site also houses a wind farm with a 75kW wind turbine and four 200kW wind turbines.

- Homes are built from locally grown and harvested timber and local stone. Roofs are made of natural clay tiles. Buildings all contain cellulose (recycled paper) insulation.
- Rather than a traditional vapor barrier, the homes use a vapor permeable structure that creates a “breathing wall.” This construction system has dramatically decreased energy use.
- The village contains a biological treatment plant, which treats all household black and grey sewage.

Duplex Precedent Study

Students studied the following duplex options:

- Multi-level, see-through duplex with common interior space.
- Single-level, see-through duplex with separate entrances, garages and cookie-cutter design.
- Multi-level, two-family split house concept with a shared driveway but separate garages.



1. Aerial of Scotland's Findhorn Ecovillage.

2. Sustainable, local construction includes these houses made of whiskey barrels.

3. This duplex in Ibiza, Spain uses a stepping concept, open floor plans and a shared staircase.



- Privacy from neighbors is important in duplex living.
- Side by side living promotes separation.
- Stacked duplexes have the advantage of using the roofs as terraces, while side by side housing utilizes the ground plane for gardens and decks.
- Duplexes built in an irregular form design help break up space between dwellings and combat the repetition that can come with duplexes.

- Many duplex homes use recycled materials, solar panels and open floor plans to allow for cross ventilation and better circulation.
- Local affordable housing duplex projects studied includes Newport Heights in Newport, Rhode Island.



Village Homes, Davis, CA

- Built between 1975 and 1980, this 70-acre subdivision provides a sense of community and encourages the conservation of energy and natural resources.
- The development contains 242 housing units, 22 apartment units, 15 small businesses, 12 acres of open space, 12 acres of common agricultural land, two village greens, a swimming pool, community center, restaurant, dance studio and daycare center. 25% of the site is public and community open space.

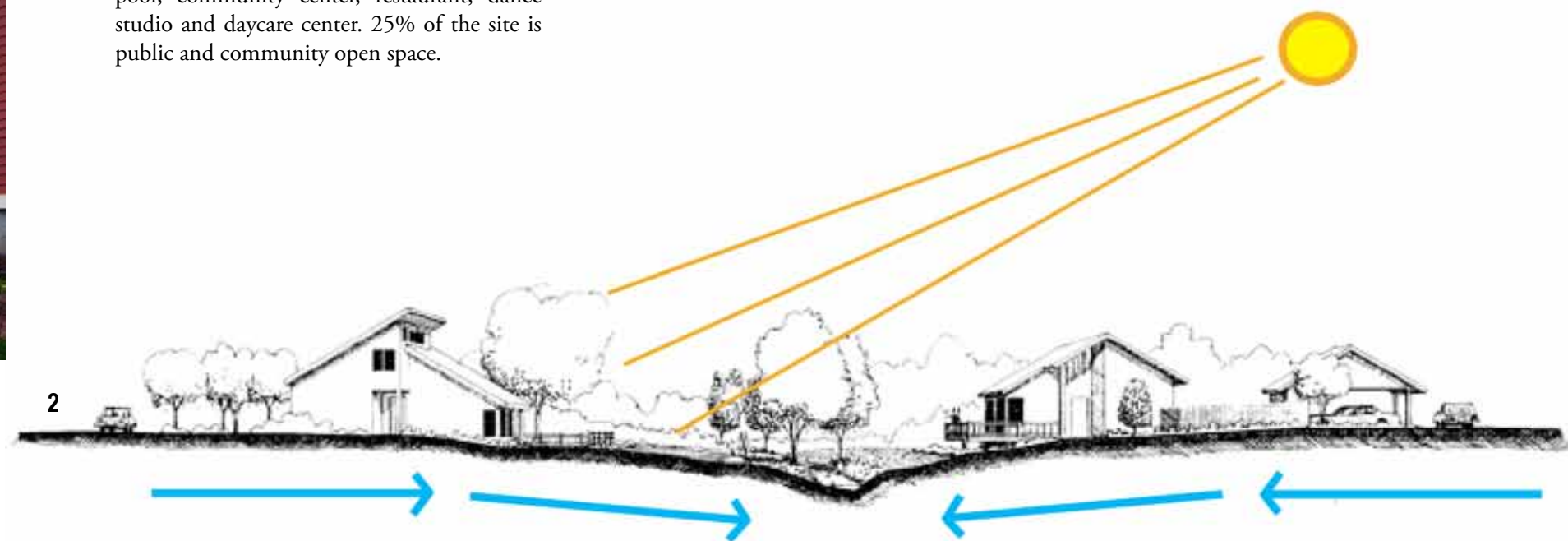
- Common area is centralized in the complex so that it is no more than a five-minute walk.
- Streets are laid out east to west, and lots are oriented north to south. This optimizes the sun's energy for the houses.
- The development uses natural drainage systems, edible landscaping and narrow roads to decrease the amount of pavement and runoff.



1. Newport Heights, an affordable duplex housing project in RI.

2. All of the lots in Davis' Village Homes are oriented north-south to maximize the sun's energy.

3. Village Homes contains 242 housing units.



Precedent Analysis

Aquatic Centers

Boyne River Ecology Center, Shelburn, Ontario

- Off-power grid potential: harnesses power from sun, wind and water to reduce dependency on electricity.
- Low impact on surrounding environment: located in half of a hill, the site helps reduce heating and cooling costs. Also uses a sod roof.
- Environmentally benign building materials: renewable, durable materials with low energy usage in their manufacturing process.
- Conservation of resources and renewable heating sources: circular plan provides lower surface area for heat gain/loss.
- Reclamation of wastewater: building designed to treat all of its wastewater using a bio-engineered wetland.

Living Machine, Weston, MA

- In 2006, Weston was required by the Massachusetts Department of Environmental Protection to update their waste management system. Weston decided to

partner with Ecological Engineering Group to build a Solar Aquatic Wastewater System (SAS).

- This was the state's first SAS system and was funded and managed by the property owners and cost approximately \$750,000 to install.
- The system processes 10,000-12,000 gallons per day, including 30 businesses and a super-market. The system also serves as an educational tool.

Kolding Denmark Ecological Center

- All sewage effluents and rainwater are biologically treated in tanks inside the glass pyramid, after which they are channeled through a biological treatment plant and further down into the groundwater.
- System connected to the municipal sewage plant but the connection is not intended to be used, and residents do not pay a discharge fee.
- Surrounded by modern block housing.



1. Boyne River Ecology Center in Ontario.

2. The Kolding Denmark glass pyramid treats wastewater less expensively than the municipal treatment plant.

3. Massachusetts's first Solar Aquatic Wastewater System. Photo by Ulker Copur.

Sidwell Friends Middle School, Washington D.C.

- The school was designed to use 60% less energy, while creating 5% of its own energy.
- The site features rain gardens, which capture rain water run-off from impervious surfaces on the site. Once collected the water is naturally filtered by the vegetation



and absorbed into the surrounding soil. Water that is not absorbed is recirculated into the pond on site.

- Water flushed from toilets and used in sinks is pushed in to settling tanks that begin the filtration process. From here the water runs through a constructed treatment wetlands where the water is processed and cleaned. From the wetlands, that water moves to a trickle filter system and interpretive kiosk tank. The water then runs into the basement of the building and is kept in tanks and filtered for grey water storage.

Findhorn Living Machine, Scotland

- Europe's first living machine, located in Findhorn Eco-village, was built in 1995.
- The natural, non-chemical biological system cleans sewage, creates a mini-ecosystem, provides a greenhouse environment and mimics nature's water cleaning system.
- Treats sewage for a population of 500.



1. Diagram of the wastewater and storm water systems that were implemented at Sidwell Friends Middle School.

2. The Findhorn living machine was Europe's first.

3. Sidwell Friends Middle School was designed to use 60% less energy and create 5% of its own.



Site Analysis

Students in the ARCH 515 Studio studied two sites — Drift Road and State Street — in addition to participating in a sketch problem of creating a duplex at 284 Briggs Road in Westport.

Drift Road Site Analysis

The Drift Road site, just south of the main businesses district, is a 30-acre site located in a rural part of town consisting of mostly residential lots. Much of the area is heavily wooded with a few open fields mixed in. A big component of the site is its water frontage. The east branch of the Westport River runs directly in front of the site.



The site contains wetlands near the river. This area is preserved and not able to be built upon. The Drift Road site also contains brushland/forest land. Because this area would not likely be cleared, it is not buildable. Houses could be built in the center of the parcel.

Once developed, the site could be accessed in three areas:

Entrance 1 is the established entrance to the Drift Road site. The access road is gravel and connects the buildable area to Drift Road. Because Entrance 2 is the only other option of entering the site by vehicle, Entrance 1 is favorable because Drift Road is more public than Fallon Drive.

Entrance 2 would occur between two designated sites and would connect the buildable area to Fallon Drive. Currently, the potential location of this entrance would mean clearing a long path through the forest to access the buildable area, which is undesirable. Additionally, Fallon Drive is a private, cul-de-sac neighborhood. Keeping in mind the potential program of the site, this is another reason why Entrance 1 would be the best option.

Entrance 3 would connect the east branch of the Westport River with the buildable area of the site. Because of the kayak and paddleboard activity on the river, the installation of a dock or boat ramp may serve as a secondary access point to the site.

The Drift Road site is adjacent to a river that often floods, and the site has a very high water table, meaning that the water is only a few feet under the



1. Heading south on Drift Road with the Westport River in view.

2. Aerial of Drift Road site.

3. Map showing three potential entrances to Drift Road site.

earth. The high water table could cause flooding with rainy weather. The site slopes gently down to the river, which provides for excellent drainage and runoff. As a totality, the site is relatively flat with minimal ups and downs; ideal for a housing development project.

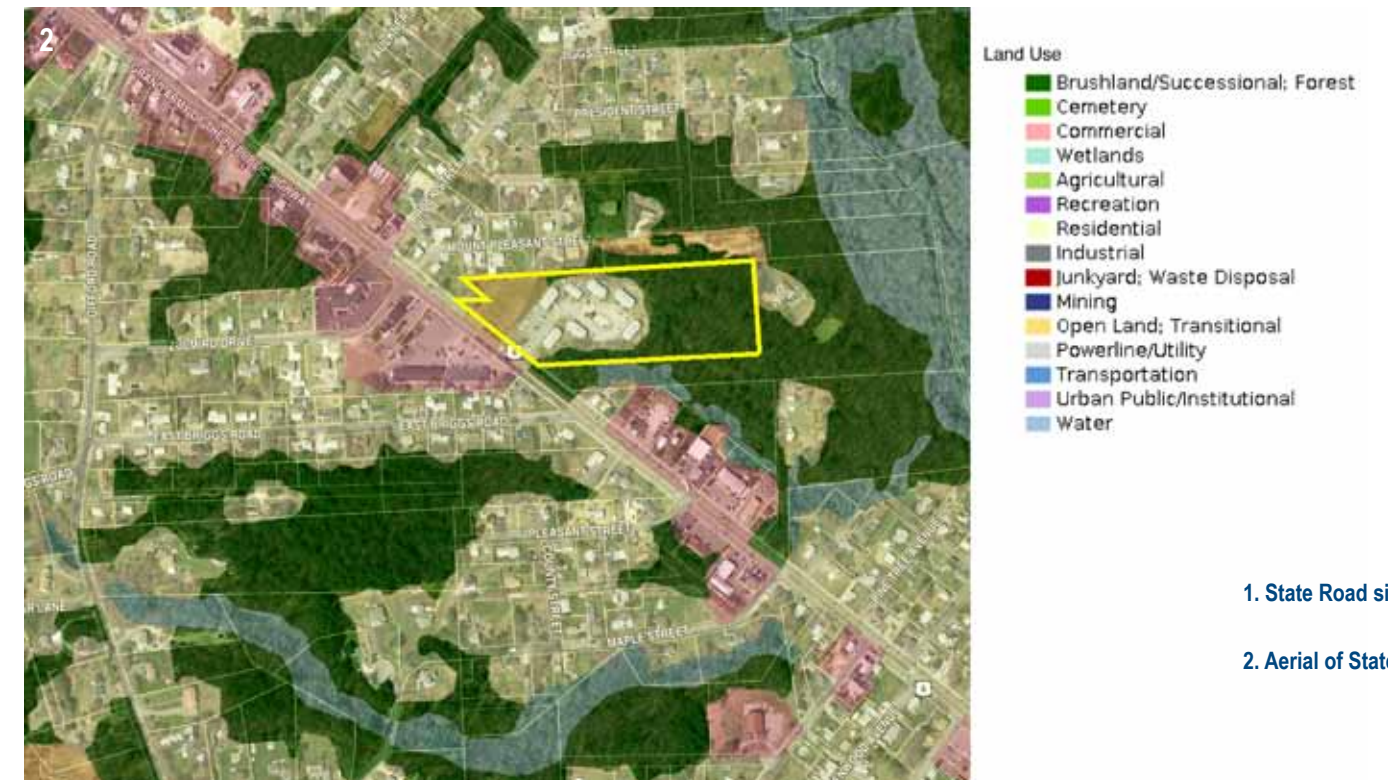
Currently, there are not any fire stations within an appropriate range for development on the Drift Road site. This will make it essential for a proposed development to contain a pond and pump onsite for immediate fire control until further assistance arrives. Should municipal water not be available for residents on this site, private well systems will need to be built on each property, a minimum of 100 feet away from any septic system.



State Road Site Analysis

This site is located at 666 State Road, which is one of the main roads that goes through the village. Several different business and residential areas are located off State Road. This proposed site is set in from the road in a densely forested area, which provides a sound buffer from the street. There is no water onsite, but several bodies of water are nearby. The parcel currently contains apartment units and parking spaces, with the remainder of the site free for development. The entire parcel is town-owned.

The site has a slight slope that goes downward from the northeast to the southwest. This slope will affect the way new structures are built and the approach to the development. The slope goes down into a wetland area, so there is potential to incorporate swales for water runoff.



1. State Road site entrance.

2. Aerial of State Road site.

Once developed, the site could be accessed in three ways:

1. Route 6 south site entrance; however, this site would not be an option due to underground septic systems.

2. Mouth Pleasant Street cross over.

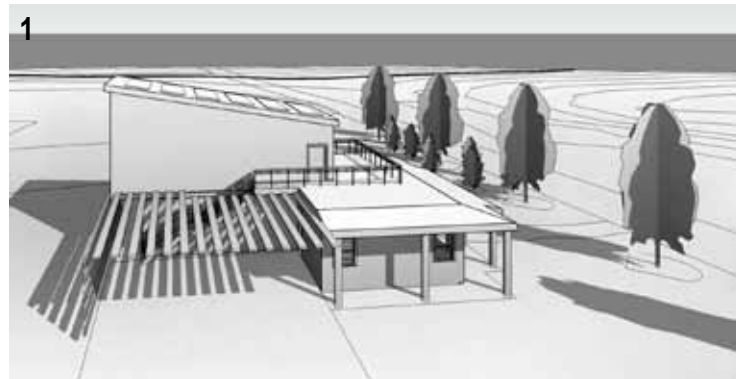
3. Westport Authority Housing entrance.

Duplex Sketch Problem

Some of the students in the studio developed sketches for duplex units on various sites throughout Westport. Students were asked to design with sustainability in mind and to create duplex units that were innovative, affordable and designed for 1-4 individuals per unit.

Kyle Baron, 284 Briggs Road

- The duplex will consist of one two-bedroom unit and one one-bedroom unit.



Joseph Cardella, 189 Reed Road

- The duplex will have two two-bedroom units, with one being ADA-accessible.
- The duplex design allows for controllable water runoff to be collected and implemented into a new living machine on the northern area of the site. This will create a dynamic unit.

Eric Figueredo, George and Raymond Street lot

- Unit 1 is an ADA-accessible 1-2 bedroom unit.
- Unit 2 is not ADA-accessible and functions as a 2-3 bedroom unit.
- The units will be side by side with a common wall that contains the piping for bathrooms and kitchens.
- The arrangement of the two units is ideal to provide close living quarters for a family to a loved one or caretaker.



1. Duplex perspective by Kyle Baron.

2. Duplex perspective by Eric Figueredo.

3. Duplex perspective by Joseph Cardella.

April Gaddis, 284 Briggs Road

- The duplex allows for equal shared views and access to landscape. Parking on either side allows for a private interior and exterior for residents. The units also have divided patio space on opposite sides of the building to provide privacy for residents.
- Construction is minimized with a shared wall and overlapping volumes. The roof is designed for optimal rainwater collection to be used in the properties for plumbing.



Heather Gillock, Hix Bridge Road

- Existing wetlands on the site limit the amount of land available to build on. The area is bordered on the west elevation by an industrial site.
- Unit 1 will be a one bedroom/one bathroom, single-story unit. Unit 2 will be a one bedroom/one bathroom, single-story, ADA-accessible unit.
- Each unit will be separate structurally but will share a connecting carport.
- Wastewater will be collected into a settling tank that leads to a constructed wetland where it is broken down naturally. The water will be sent through a series of filters to a storage tank where water will be UV treated and then pumped back into the units to be reused. The site will also contain a bio-swale, which will filter runoff before it leads to the existing wetlands.
- Photovoltaic panels will be placed on the south-facing pitched roofs to power the units.

2



1. Duplex perspective
by April Gaddis.

2. Floor plan by Heather
Gillock.

3. Section by Heather
Gillock.



Jack Hamm, Raymond Street

- A one-story duplex on the Raymond Street site will provide an affordable option that's more accessible for older residents. The center of the unit will have a central chimney, reminiscent of the central chimney in other homes in the Westport area.
- Large and small windows on the southern façade and glass sliding doors will optimize sunlight to help heat the home in colder weather.
- Units can be designed with a shared chimney and no carport or no chimney and a shared carport.



Ben Horst, Roberts Street

- Create a unique duplex design using sleek, prefabricated 15'x50' containers.
- Containers are rotated, creating a courtyard or gathering space between the two units for more of a community feeling. They

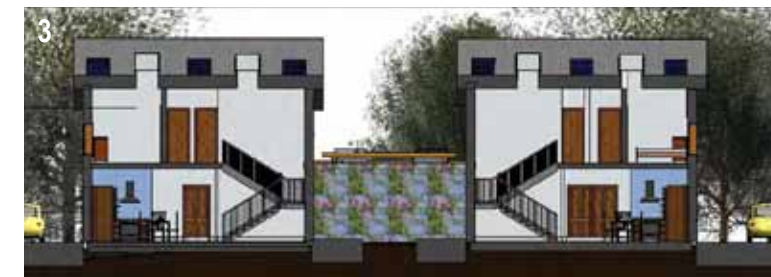


also contain individual private deck areas with shade and protection from the elements.

- Units are exactly the same, but flipped. The first floors contain the kitchen, dining and sitting areas, while the top level contains three bedrooms and two bathrooms.

Jake Levine, Roberts Street

- Site has a slow slope that leads to the adjacent body of water. Most of the land on the north side is unbuildable due to wetlands.
- The units will not stand out from other buildings in the area, but will have a feel of always having been there.
- Southern orientation will maximize sun exposure, and photovoltaic panels on the roof will provide the units with ample energy. The saltbox shape of the units, coupled with the trees on the site, will provide shade in the summer months.
- Two-story, three-bedroom units, an open floor plan and shared outdoor space create functional and desirable spaces.



1. Duplex perspective
by Jack Hamm.

2. Duplex perspective
by Ben Horst.

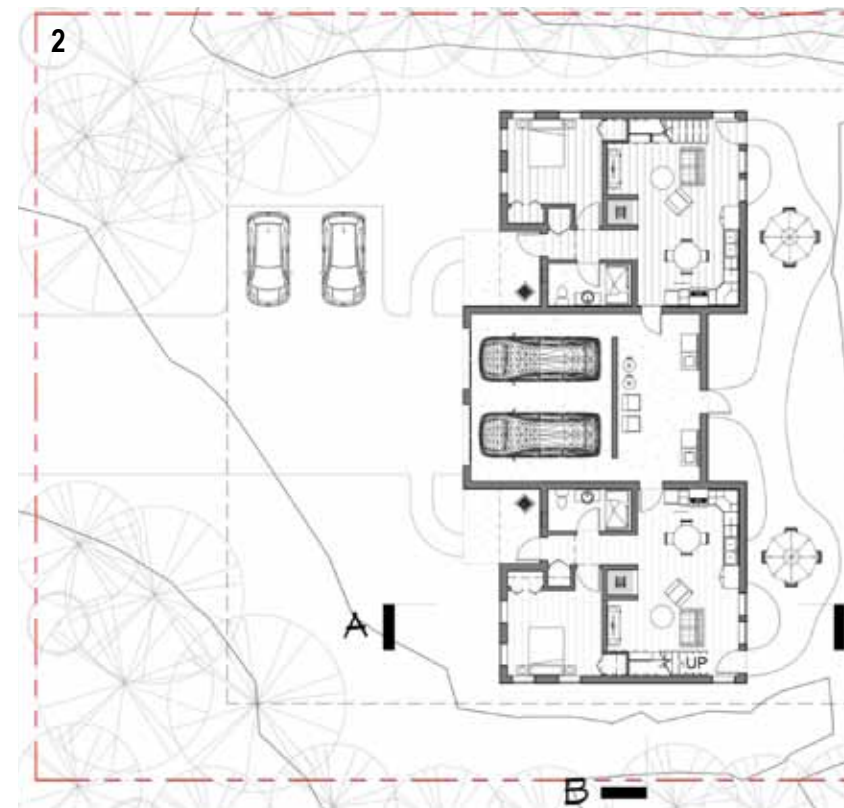
3. Section by Jake Levine.

4. Duplex perspective
by Jake Levine.

Evan Mozzer, 165 Hix Bridge Road



- With a concept focused on recycling water, a strong wall divides while it also serves as the plumbing wall for both units. This wall will extend higher than the roof and will serve as a large gutter to control runoff. Water will be collected in a cistern to be pumped back into the building for use in the toilets.
- Sustainable building features include low-e window coatings, rainwater integration, passive solar and natural cross ventilation.



Tim Pranaitis, 276 Tickle Road

- Inspired by the historical saltbox style of the area, the duplex will contain two two-bedroom units.
- A shared central garage, laundry and mechanical area will reduce the footprint of the structure and the size of the individual units.
- Pervious asphalt will be used on the driveway and pathways to allow for more controlled water runoff. The longest pitch of the roof is oriented towards the southeast to capture sunlight and provide a future location for solar panels. Two swales will be incorporated on the northern and southern borders of the property to collect runoff.



1. Duplex perspective
by Evan Mozzer.

2. First floor plan by
Tim Pranaitis.

3. Duplex perspective
by Tim Pranaitis.

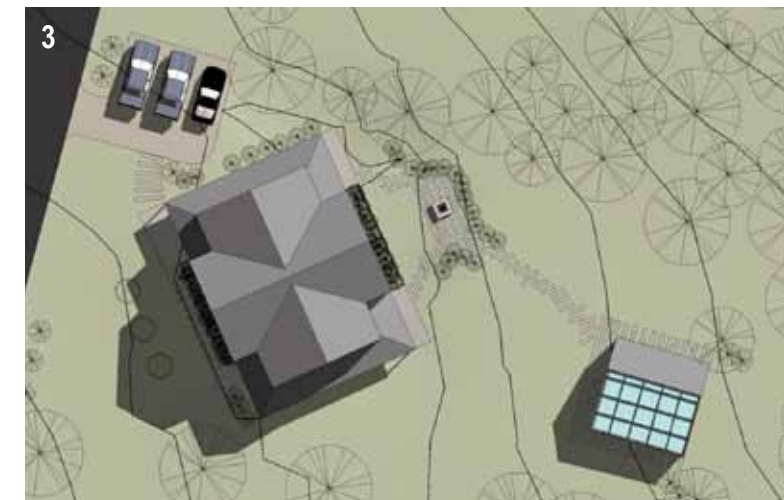
Chris Rossi, 284 Briggs Road

- The duplex consists of a three-bedroom and a one-bedroom option with both units oriented to allow for the most natural light to enter the space as well as a view of the wetlands to the north.
- Sustainable options onsite for the units would include a rainwater collection system, swales to collect runoff and a modular window layout to maximize heating and cooling costs.



Jake Wheeler, 276 Tickle Road

- 20,000 square foot site is located in a densely residential neighborhood, with densely packed trees and wetlands on the rear of the site.
- Instead of a grid layout like the rest of the homes on the street, the duplex would be skewed due to the east-west orientation of the site. This will allow the unit to capture the southern sunshine and energy. A living machine would be located on the western portion of the site. Permeable pavers would be used on the site to limit runoff to the surrounding wetlands and river.
- The units will share a central wall to lower construction costs.
- The units will be set back from the road to provide some privacy and shade.



1. Duplex perspective by Chris Rossi.

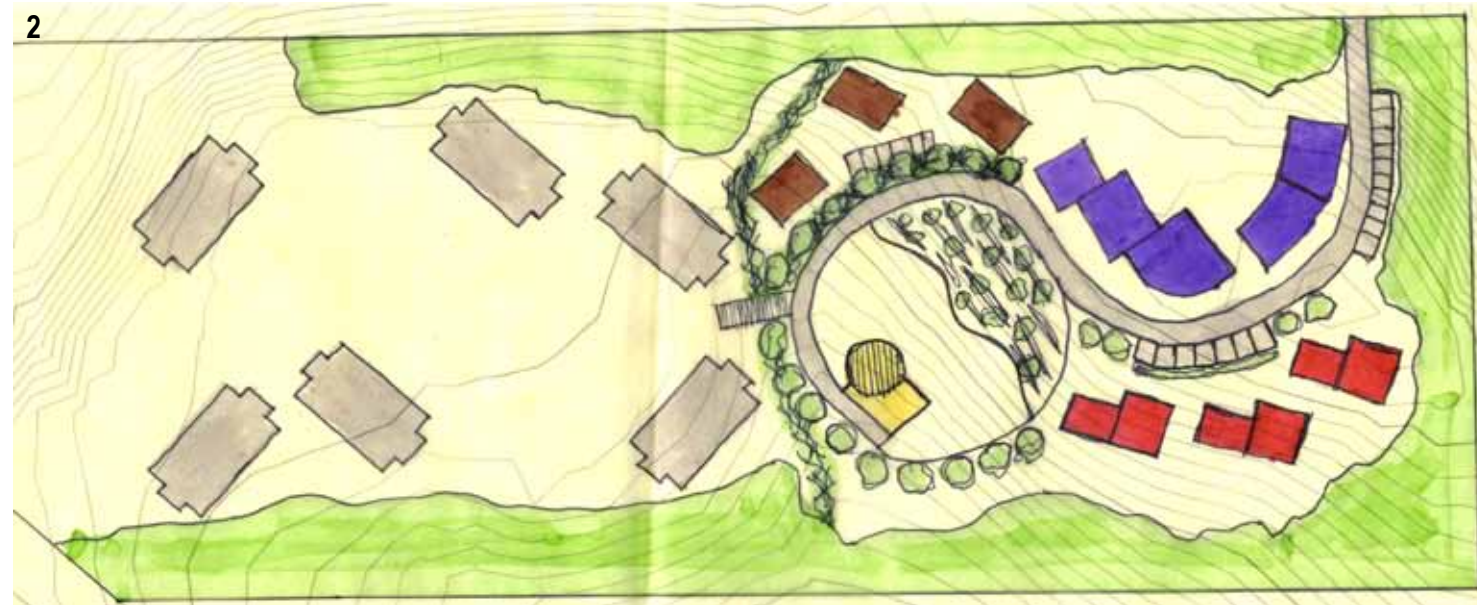
2. Duplex perspective by Jake Wheeler.

3. Site plan of duplex and living machine by Jake Wheeler.

Student Designs

Kyle Baron, 666 State Road, “Westport Hillside Commons”

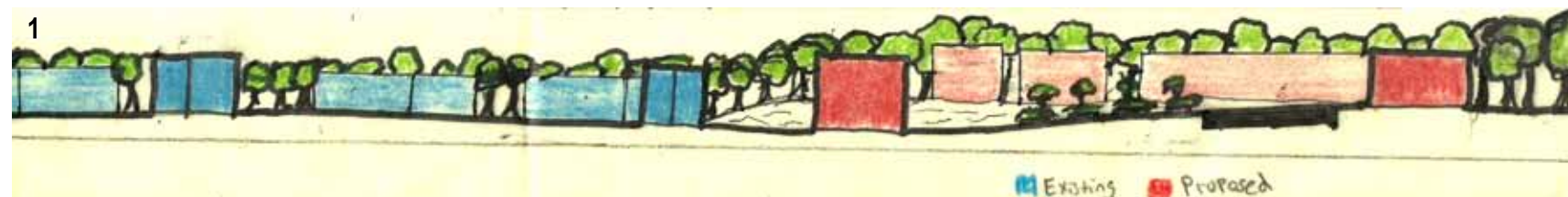
- Three buildable acres to coincide with the existing housing units onsite.
- Units designed to be sustainable, affordable and accessible.
- In total, 24 units will provide affordable housing to 72 residents.
- A central community center will be placed onsite to provide communal and public meeting space with a mail room, exercise room and laundry facilities.



1. Site plan.

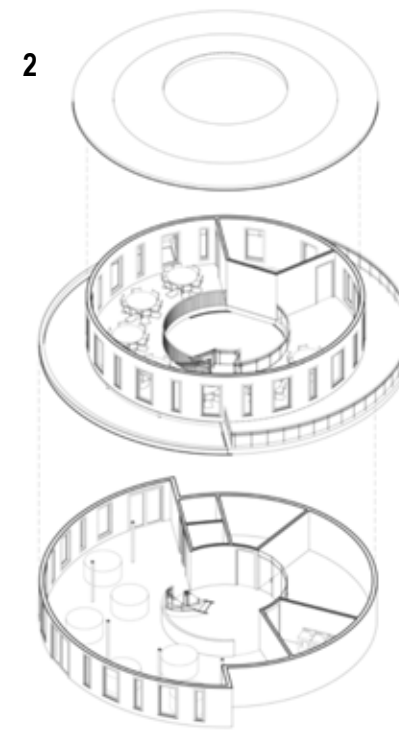
2. View of the existing and proposed communities.

3. Unit distribution.



3

Unit type	# of units	% Distr.	# of res/unit	# residents
1 Bedroom	6	25 %	1-2	9
2 Bedroom	12	50 %	3	36
3 Bedroom	3	12.5 %	4	12
4 Bedroom	3	12.5 %	5	15
TOTAL:	24	100 %	-	72



- 1. One bedroom unit perspective and floor plan.
- 2. Community center axonometric.
- 3. Perspective.
- 4. Site perspective.

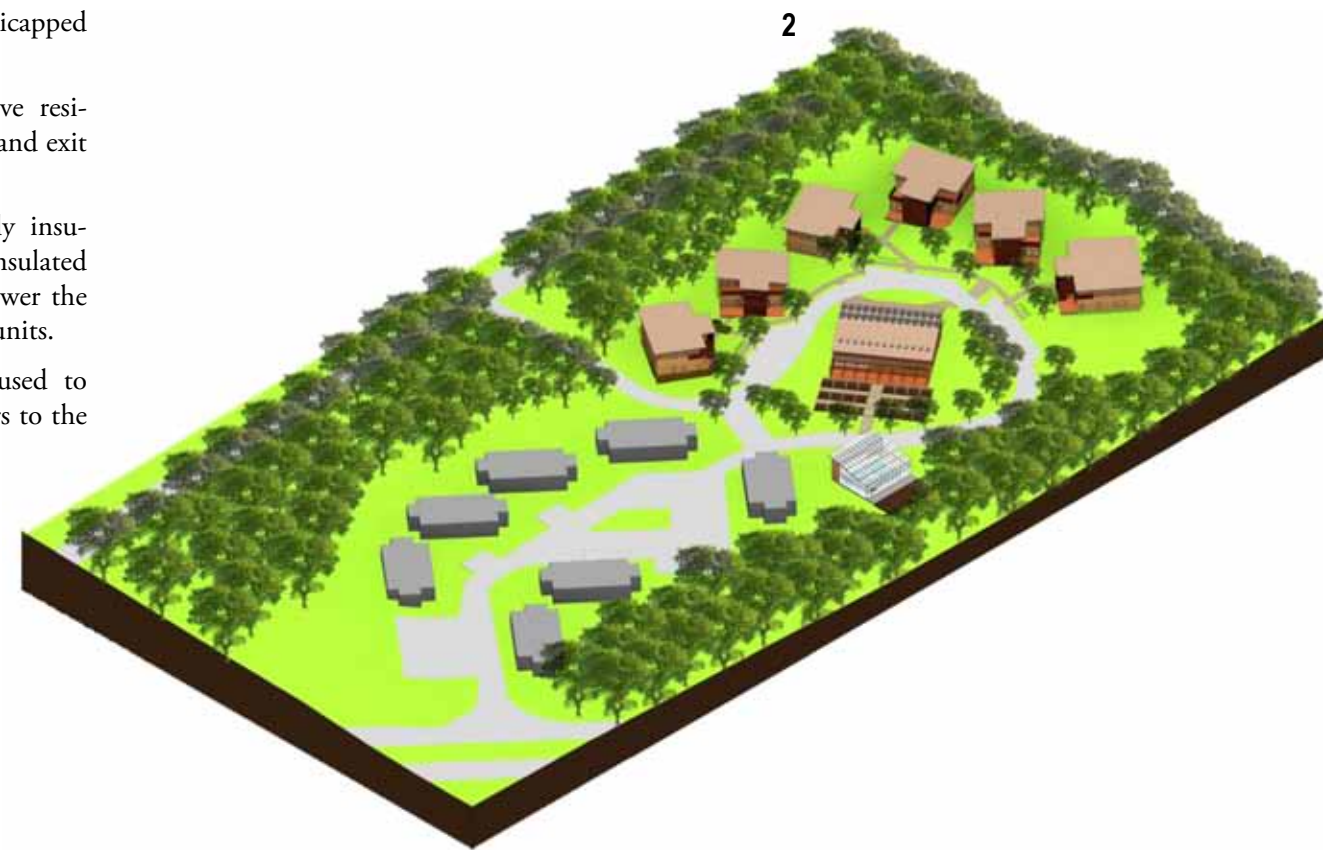
Student Designs

Joe Cardella, 666 State Road, “Village of the Vine”

- Inspired by the Westport Rivers Vineyard, the design for the site will be reminiscent of grape clusters with five units per cluster. The vine will be representative of the road, and the leaves on the vine will be represented by exterior public spaces. The site will house a large centralized community center and a living machine.
- In total, 24 units would provide affordable housing to 68 residents.



- 12 of the 24 units would be handicapped accessible.
- One-way vehicular traffic would have residents and guests enter on State Road and exit on Mt. Pleasant Street.
- Units will be built using structurally insulated panels (SIPs) to provide a well-insulated enclosure for the units, which will lower the costs and energy consumption of the units.
- Reclaimed wood pallets would be used to create decks and a screen to hide stairs to the second level for each unit.



1. Inspired by the local vineyard, Cardella's concept of grape clusters is translated to the site plan.
2. Aerial perspective of site.



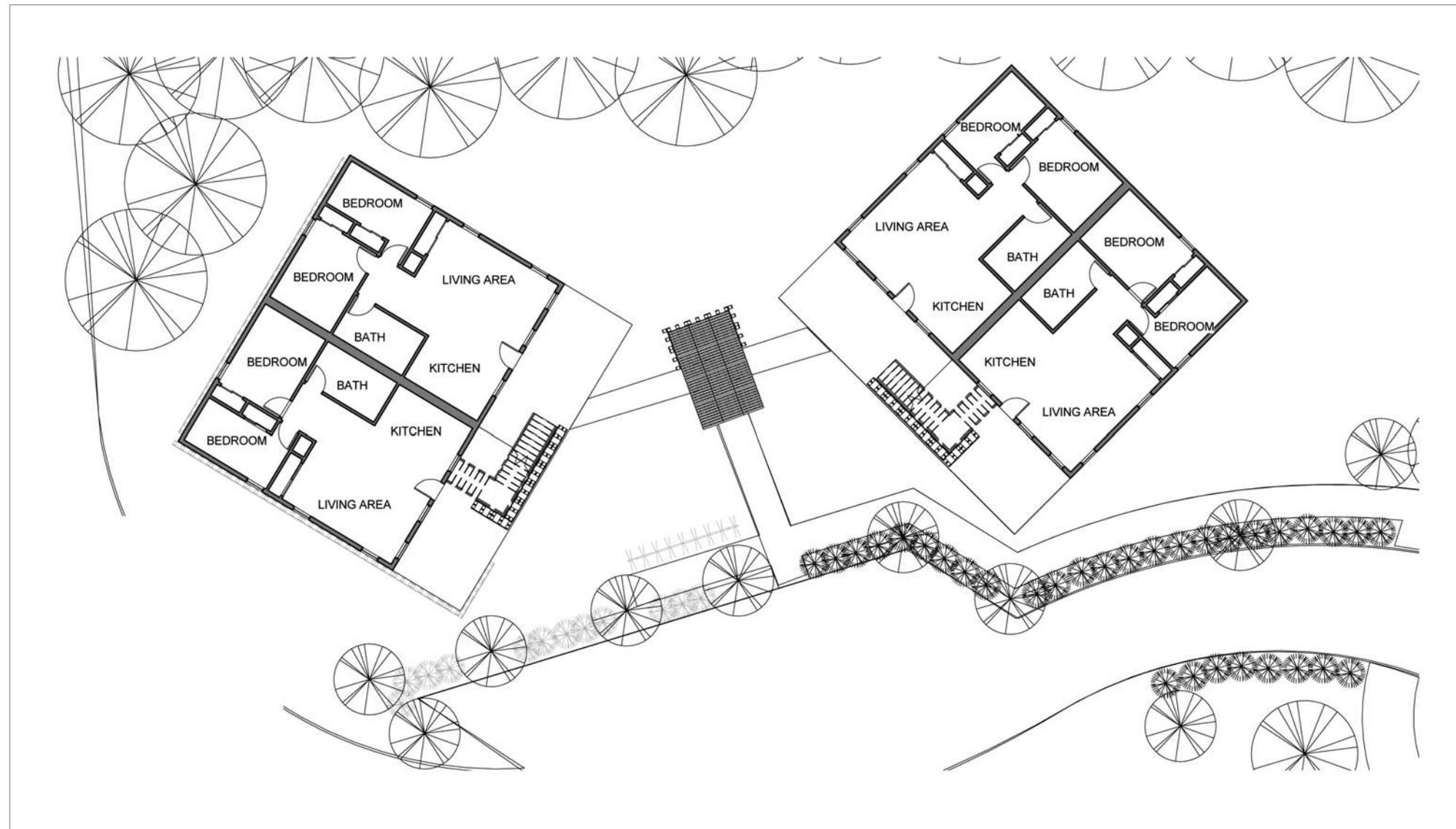
1. Perspective.

2. Master plan layout.

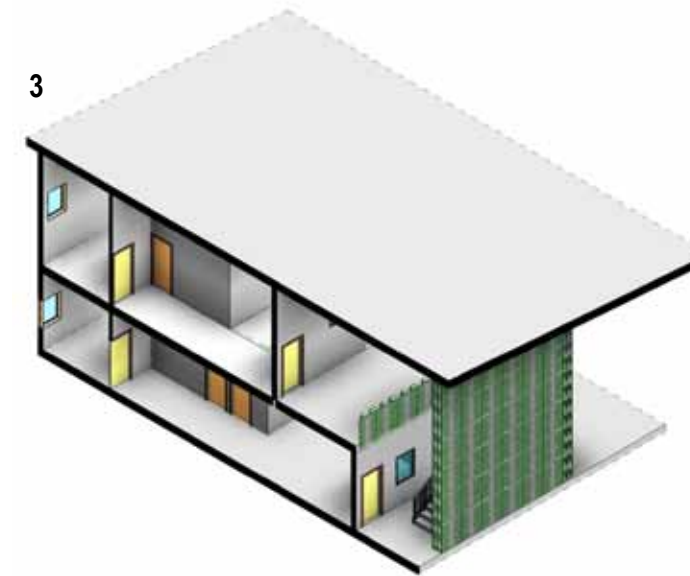
3. Site plan.

- 2
- Building Type 1:
- 2 – 2 Bedroom Units
 - 2 – 1 Bedroom Units
- Building Type 2:
- 1 – 3 Bedroom Units- 3,000 SF
 - 2 – 2 Bedroom Units- 3,000 SF
 - 1 – 1 Bedroom Units – 800 SF
- Building Type 3:
- 2 – 3 Bedroom Units- 3,000 SF
 - 2 – 2 Bedroom Units – 2,400 SF
- Living Machine
- 1,000 sf
- Community Center:
- 5,000 sf





Floor plans for Cluster 1
in which the bottom
apartments are handi-
capped accessible.



- 1. Perspective.
- 2. Unit distribution.
- 3. Perspective of a community unit.

2

UNIT TYPES	SQ. FT.	Min. Residents	Max Residents	Number of Units	Max Total Residents
1 Bedroom	750	1	2	8	16
2 Bedroom	900	2	3	12	36
3 Bedroom	1,200	3	4	4	16
4 Bedroom	1,400	4	5	0	0
					68 Residents

Student Designs

Eric Figueredo, 666 State Road, “MULI Village” (Minimal Use Lower Impact Village)

- Cluster of houses based on a uniform model will provide different experiences but with similar dimensions to help reduce costs. The layouts of the housing units have been determined by the contours of the site and access to natural light. Each unit will receive southern light.
- The three clusters of housing communities will be named Oak, Maple and Pine.
- Each cluster of housing will be comprised of varying combinations of one, two, three and four-bedroom units.
- Pine Community: six one-bedroom units, one two- bedroom unit, one three-bedroom unit, and one four-bedroom unit. Three of the units will be accessible. This community will consist of a mix of housing accessible for the elderly and those with disabilities.
- Maple Community: two one-bedroom units, two two-bedroom units, one three-bedroom unit, two four-bedroom units. No accessible units. This community will have an emphasis on family living with three and four-bedroom units available for larger families.
- Oak Community: four one-bedroom units, four two-bedroom units and one three-bedroom unit. Six units will be accessible.
- Units will share a common green space which can be used for community gardening or recreation. A larger green space will be shared by all communities next to the proposed community center.
- In total 25 units would provide affordable housing to 52 residents with this design. The community center would be able to accommodate 92 residents and guests.



Aerial perspective.

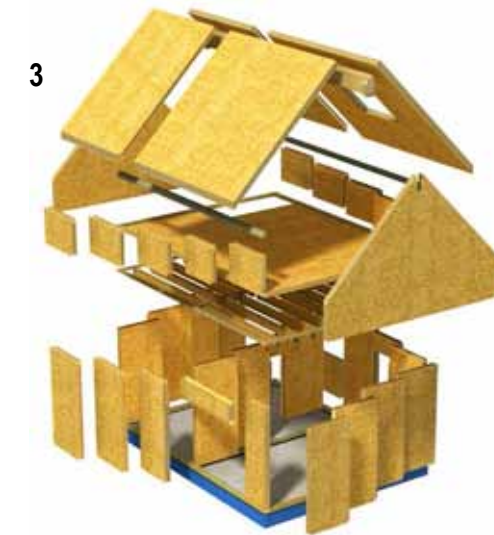
- Roofs for the units will be constructed from recycled, white metal. Metal roofs are more durable and longer lasting than a standard shingled roof.
- Each individual unit will be part of a module where only one dimension will change while two on the other side will stay the same. This will make manufacturing easier and more efficient.
- Each unit will share at least one other prefabricated wall with another unit in order to create efficiency in design and to serve as a shared service wall for piping. By this system only five different wall lengths will be needed for the entire project.
- A living machine placed at the bottom of the hill on the site will take advantage of stormwater runoff into the lower wetlands area to ensure that water needed for the living machine will be available.
- A community center equipped with a dining hall, gym facilities and gathering space will bring the three communities together.



Site plan.

1

	Unit Type	Sq. Ft	Unit #	% Distribution	Res/Unit #	Res #	Total Sq. Ft.
76%	1 Bedroom	672	12	48%	1 to 2	12	8,064
	2 Bedroom	896	7	28%	2 to 3	18	6,272
24%	3 Bedroom	1024	3	12%	3 to 4	10	3,072
	4 Bedroom	1296	3	12%	4 to 5	12	3,888
Totals		3,888	25	100%		52	21,296
Community Center						92	1750- 2000
Living Machine						92	1000



- 1. Unit distribution.
- 2. Floor plans of various sized units.
- 3. Affordable modular design using SIPs.





1. Stormwater management includes vegetation, retention basins, bioswales and permeable concrete pavers.
2. Section.
3. Perspective of community center.

Student Designs

April Gaddis, 666 State Road, “Hillside Retreat”

- Community will be accessed from the north through Mt. Pleasant Street.
- In total 24 units would provide affordable housing to 54-78 residents.
- Units will step down gradually with the natural slope of the site. This will allow for minimum excavation during construction.
- A community center will be placed at the base of the site with a living machine to collect water and return it to the units or pre-existing wetland. The center of the site will contain a swale for rainwater runoff collection. The swale will have bridges to serve as minor access points through the property.
- The community center will open up to provide garden space, a community kitchen, deck, mail center, office space and multipurpose room. The community center will also boast solar panels on the roof to provide alternative energy for the development and to serve as an education aide.
- Units are placed strategically upon the site based on the needs of the intended residents. Units for larger families are located on the steeper portion of the site for privacy and noise. ADA-accessible units are placed upon the more level portion of the site for ease of entrance.

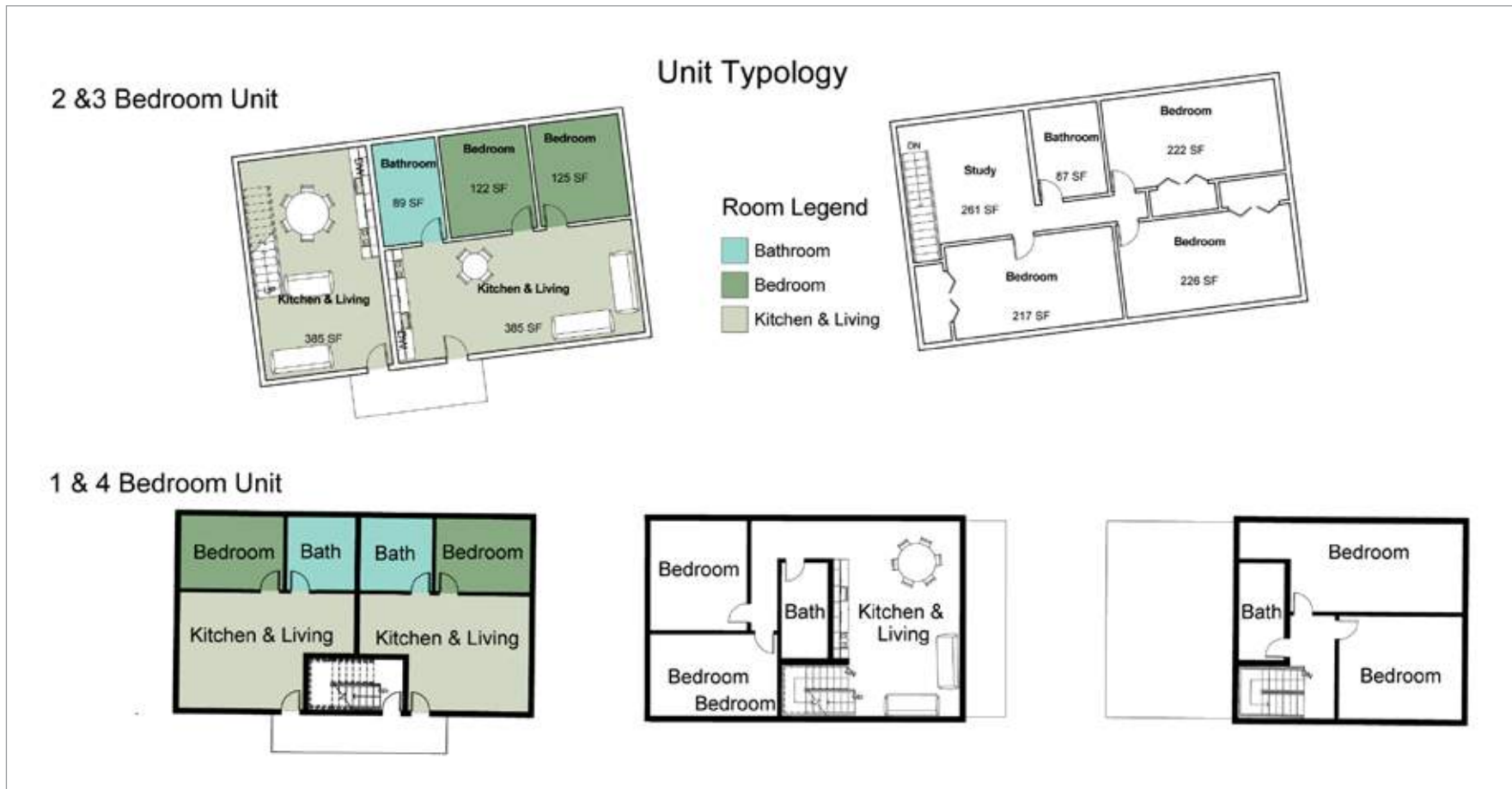
1



1. Elevation.

2. Site plan.

1



2



3

Unit Type	sq.ft	# of Units	% distr.	# of res/ unit	# res	Total sq.ft
1 Bed	700	8	33%	1-2	8-16	5,600
2 Bed	900	6	25%	2-3	12-18	5,400
3 Bed	1200	6	25%	3-4	18-24	7,200
4 Bed	1400	4	17%	4-5	16-20	5,600
TOTAL		24	100%		54-78	23,800

1. Floor plans.
2. Interior perspective.
3. Unit distribution.



1. Perspective of community center.

2. Section.

3. Exterior perspective.



Student Designs

Heather Gillock, 278 Drift Road, “The Nexus Habit”

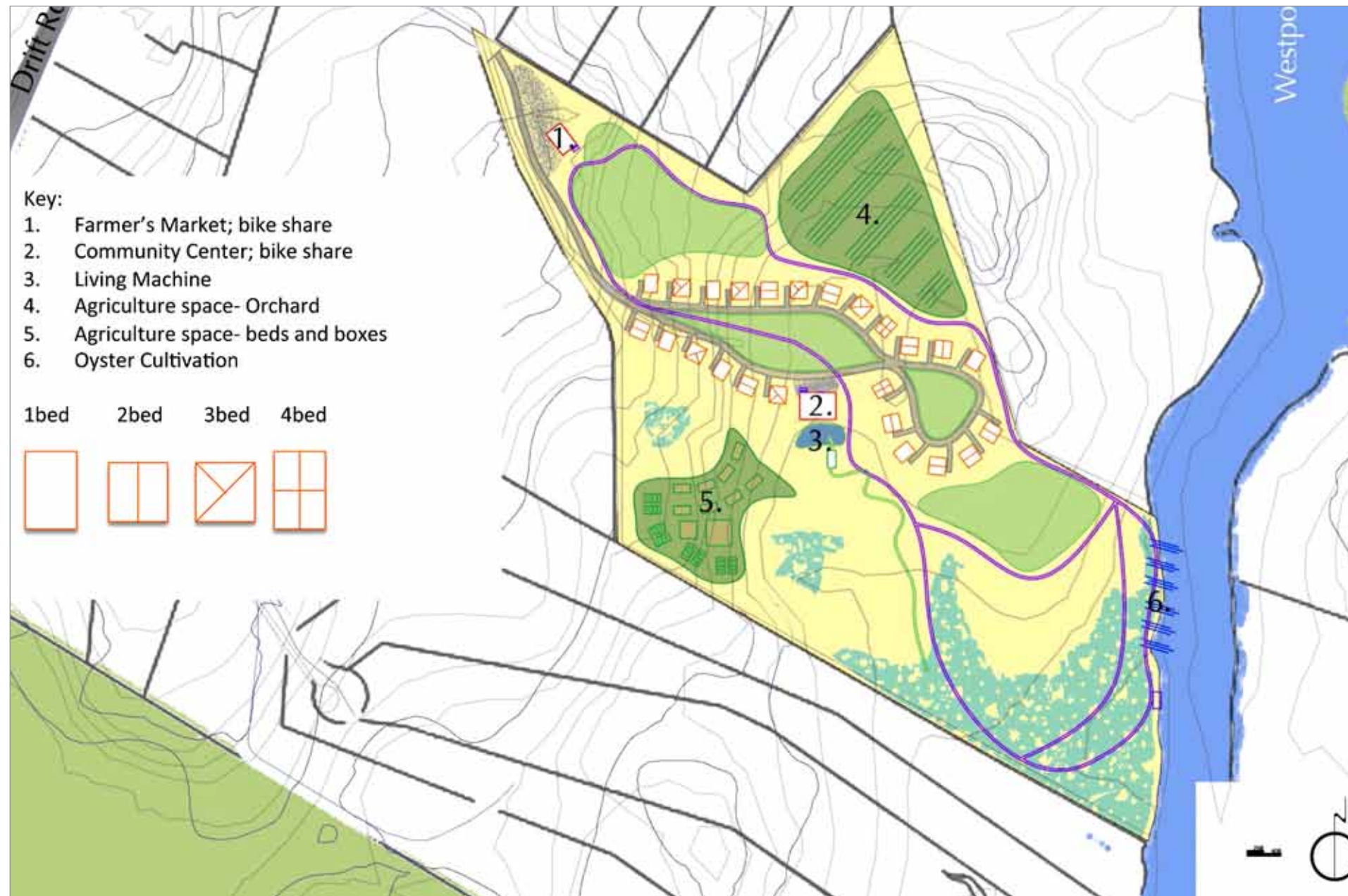
- A farmers market will be open to the public onsite and will generate revenue from the excess food produced from the agricultural areas. This will also provide a co-op setting with other growers around the site. In the future, oyster cultivation along the shoreline could prove beneficial to the ecosystem and produce a sustainable harvest and revenue.
- Agricultural areas on the site would be managed by residents, providing food and revenue for residents who sell items at the farmers market.
- The community center will serve as the main gathering space and will support communal meals, exercise space, classes, daycare and public programs.
- Using Sidwell Middle School as a precedent, each structure will use systems that tie into the communal systems, each system feeding into others. A living machine and bioswale-constructed rain garden will tie the entire circuit together. Boulders on the site will remain and be incorporated into the bioswale to reduce construction costs.
- Large green spaces will be maintained on the site and will be interspersed throughout the housing groups. These spaces will provide areas for socialization.
- Permeable roads will help reduce impact on the site. Pedestrian paths will be created from a product called FILTERPAVE, specifically designed for paths. A bike share station will be located at the farmers market and at the community center to service the neighborhood.
- In total 26 units would provide affordable housing to 76 residents. Units would be available for rent or purchase.
- Units will be designed similar to bungalows. They have a small footprint with simple foundations and open floor plans. They also lend themselves to a prefab/modular design and allow for more efficient and inexpensive heating and cooling of the units. Units will be a detached style.



1. The site will be designed around existing large boulders that will be used to construct the retention pond and bioswale.

2. Perspective.

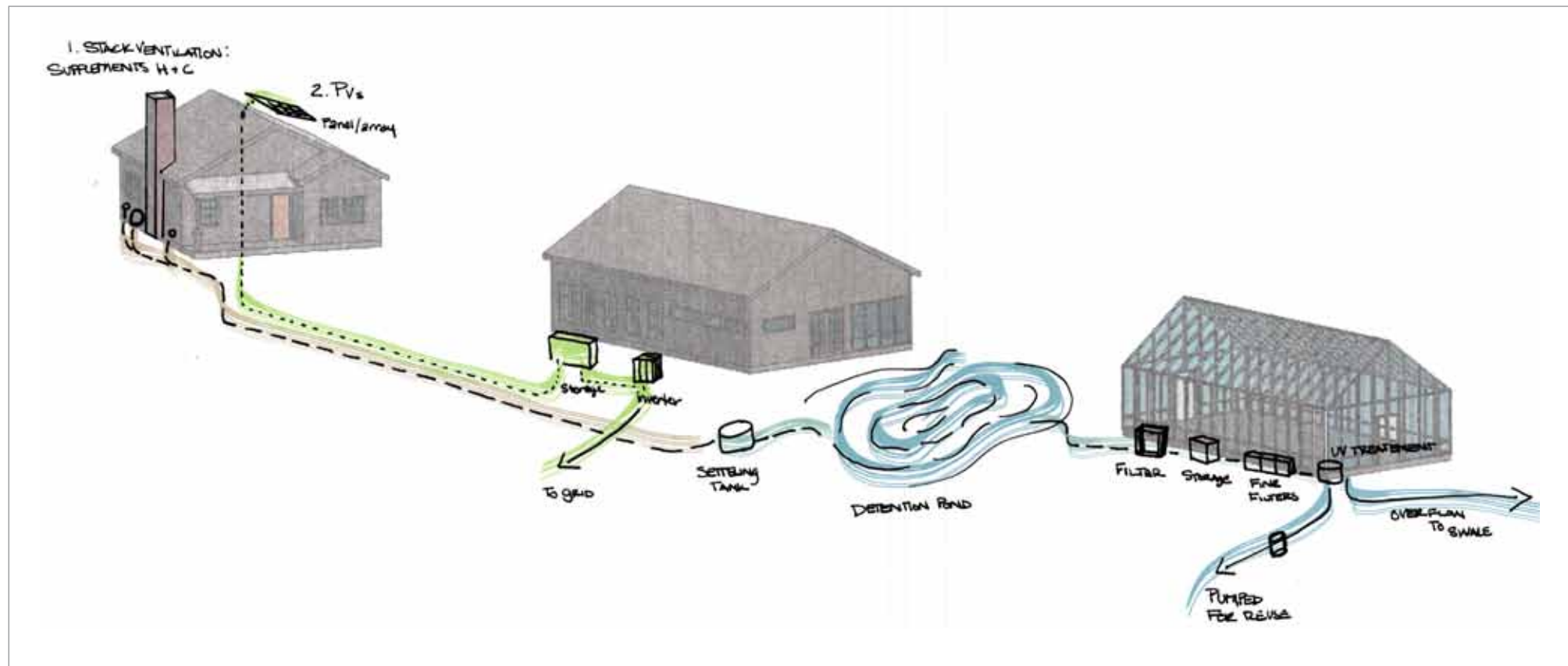




Site plan.

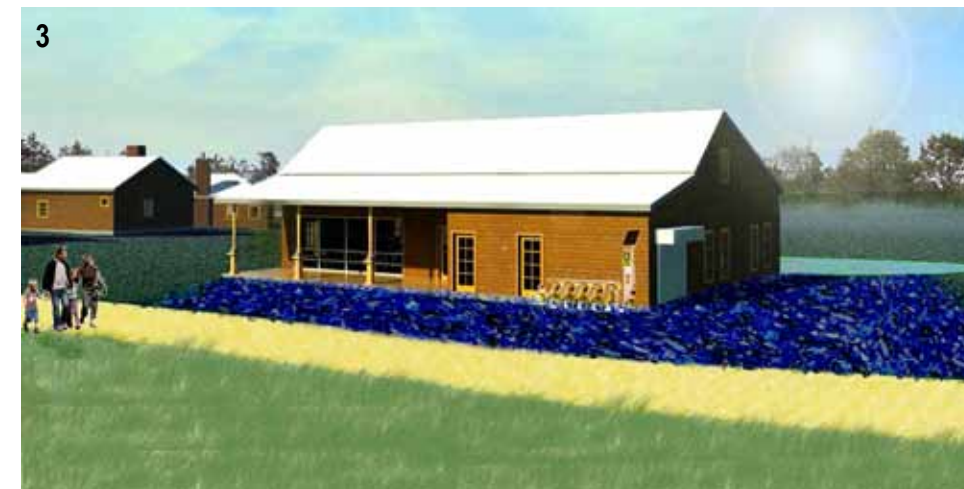


2



1. Elevation.

2. Diagram of solar energy use and wastewater flow from unit to community center to living machine.

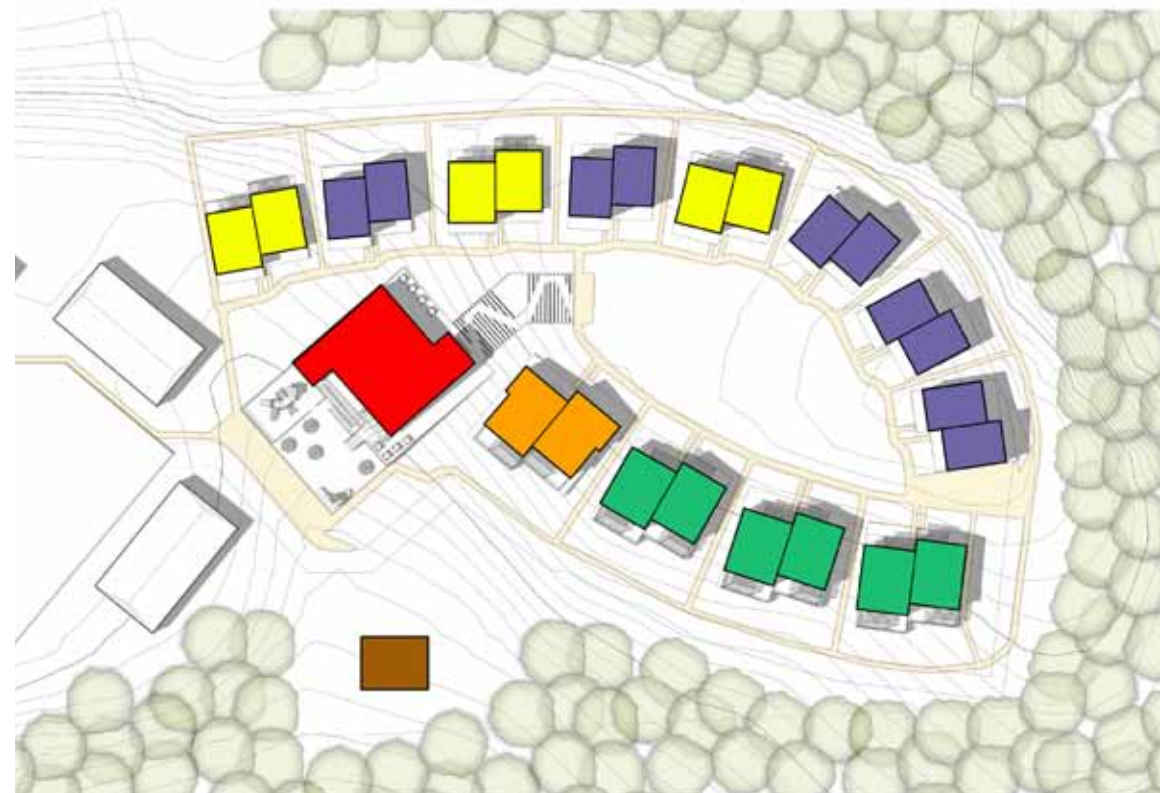


1. Expansive agricultural areas for growing food would be managed by residents.
2. Unit floor plans.
3. Community center perspective.

Student Designs

Jack Hamm, 666 State Road

- Two crescent-shaped rows of housing are placed at the top of the site around a central green space for the community. The community center would be at the bottom of the crescent, creating a connection between the existing and proposed communities.
- In total 24 units would provide affordable housing to 52-63 residents.
- Units would include six one-bedroom units, ten two-bedroom units, six three-bedroom units and two four-bedroom units.
- Units will be constructed from timber frames enclosed with structural insulated panels. Units will have high performance insulation to help reduce heating and cooling costs.
- Units will have raised foundations to reduce the risk of flooding. Runoff will flow to a rain garden, an underground pipe and a swale.
- Units will have a shared wall to allow for easier construction and shared plumbing.



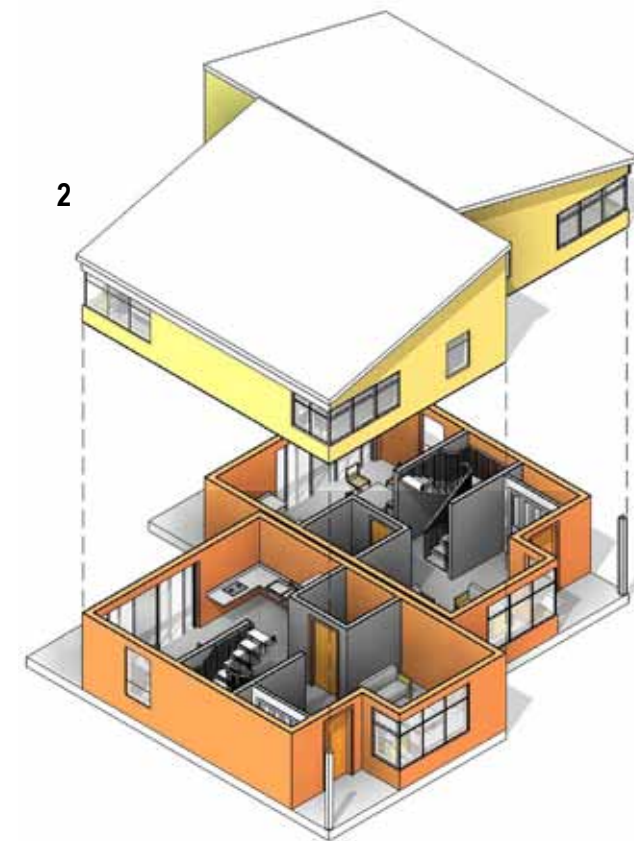
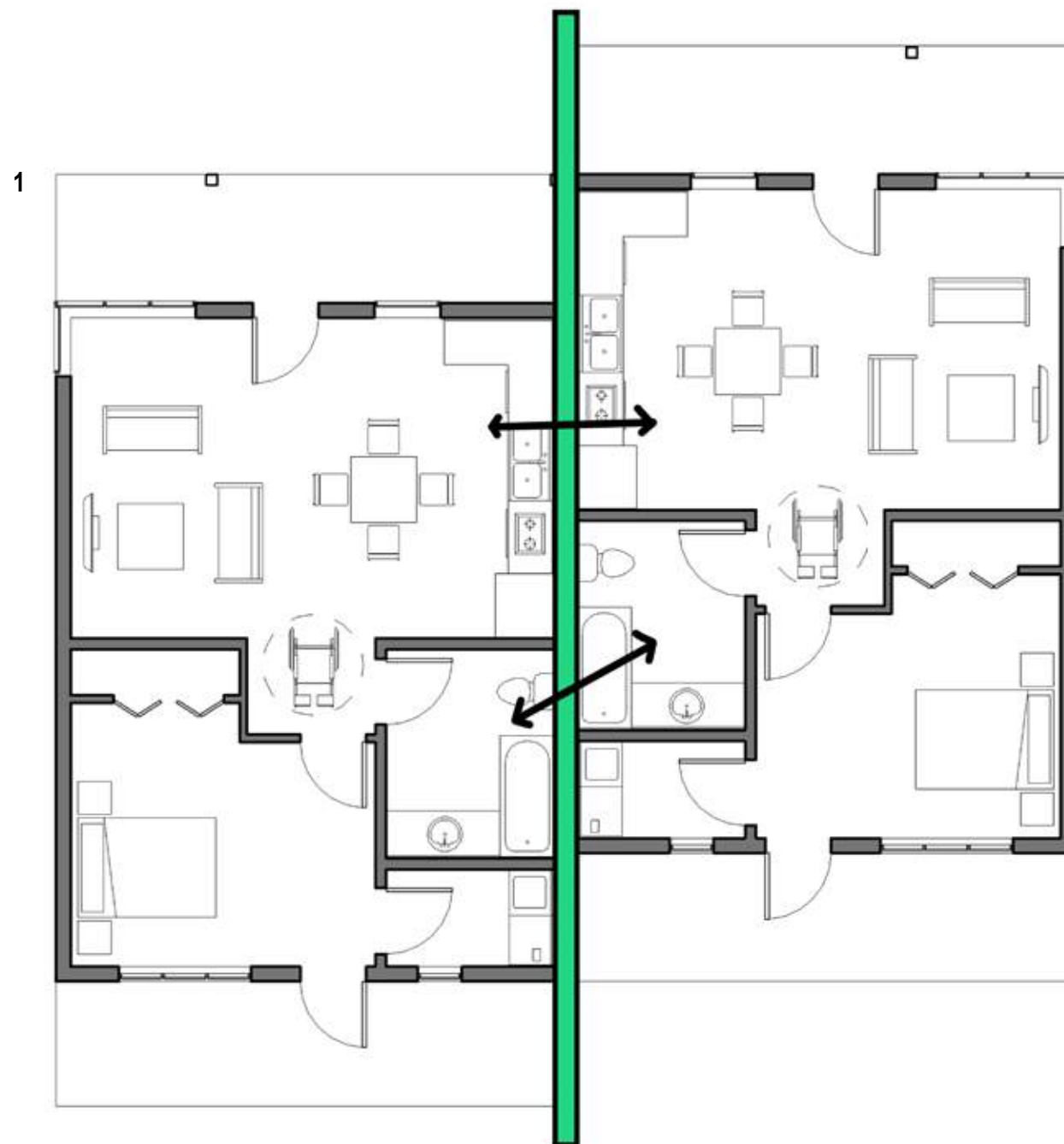
Program: all duplexes

- 1 Bedroom Duplex (6 Units)
- 2 Bedroom Duplex (10 Units)
- 3 Bedroom Duplex (6 Units)
- 4 Bedroom Duplex (2 Units)

24 Total Housing Units

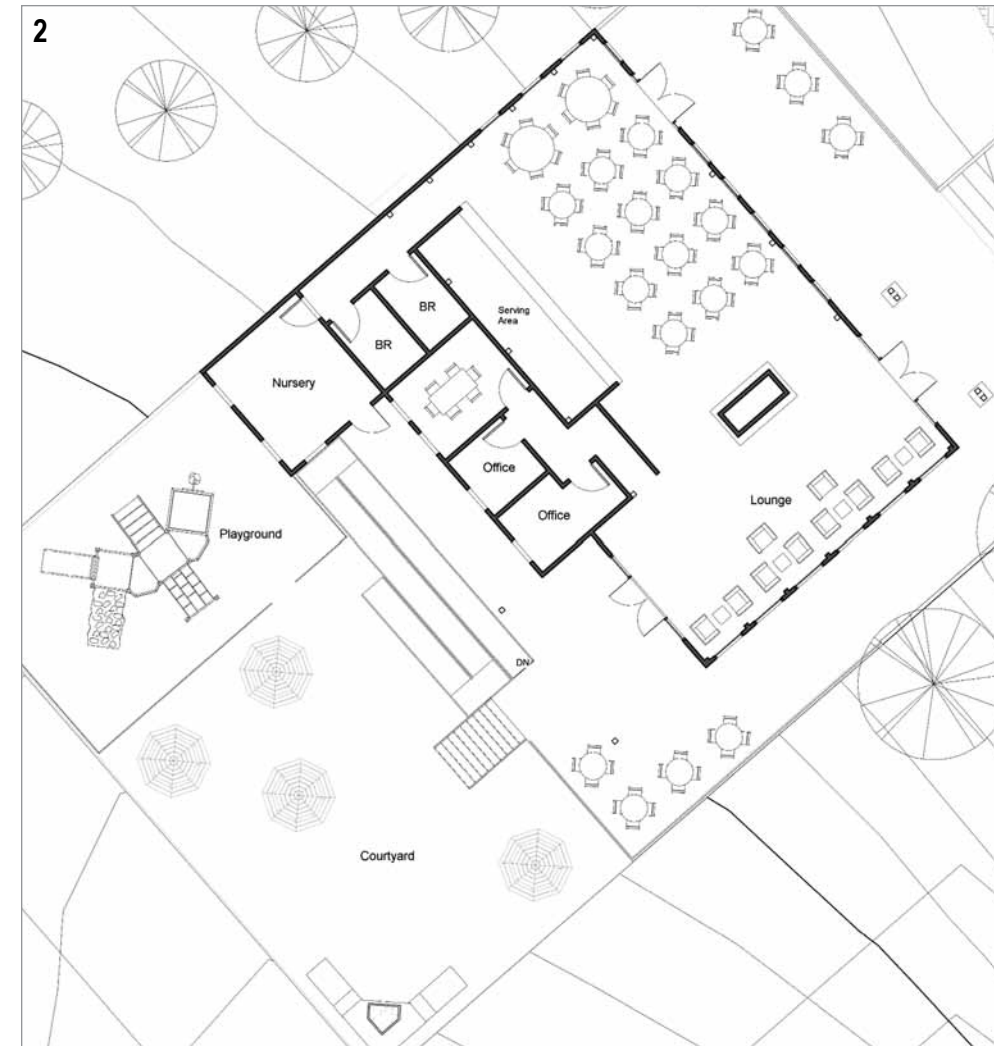
- Community Center
- Living Machine

Site plan and unit
distribution.



1. House floor plans
use a shared wet
wall for more efficient
construction.

2. Modular construction
for affordability.



Community center:

1. Perspective.

2. Floor plan.

3. Section.



1. Site section.

2. Perspective of a housing cluster designed to work with the slope of the site.



Student Designs

Ben Horst, 278 Drift Road, “Siena Woods”

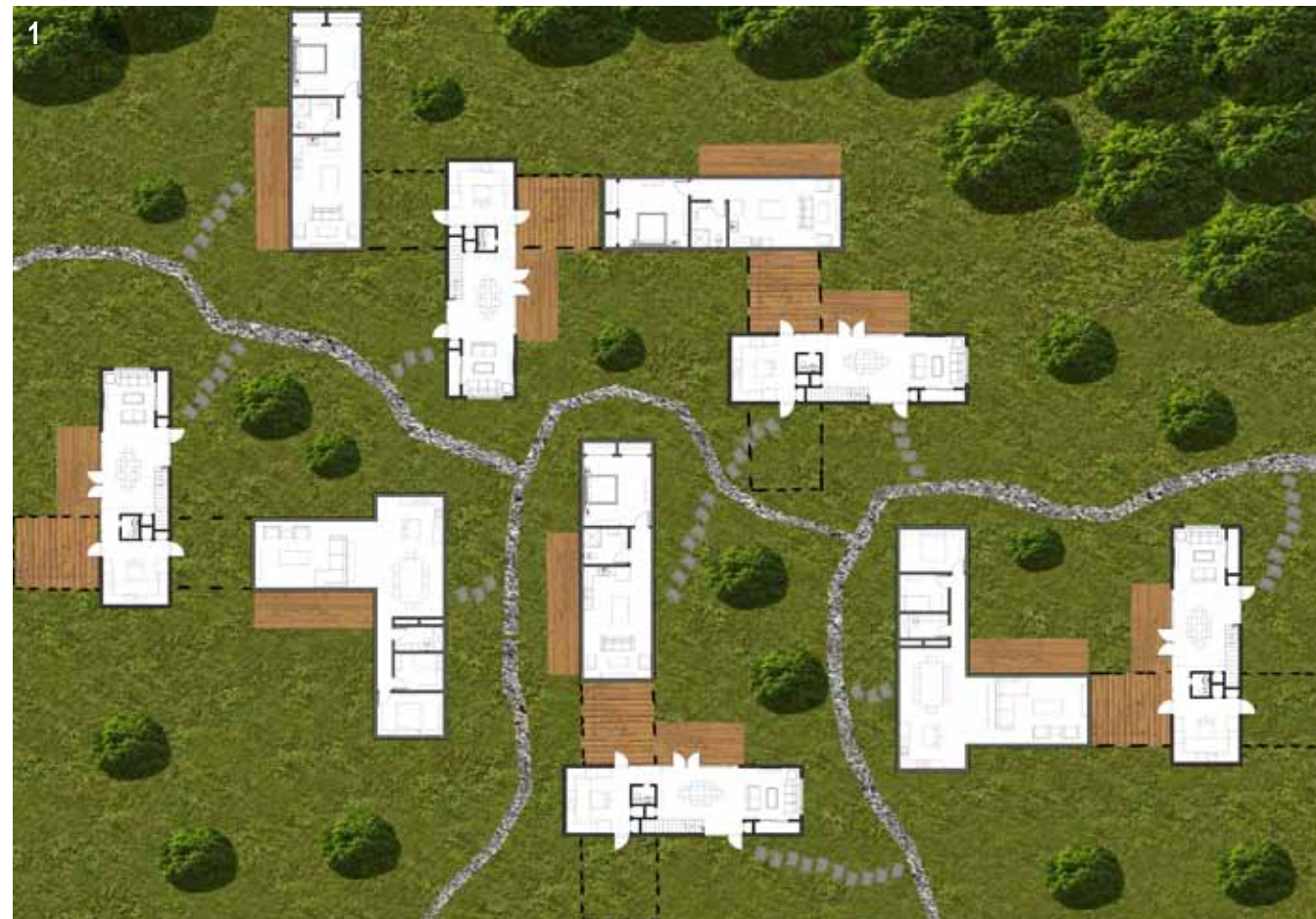
- This complex will consist of multiple types of unique housing units combined into clusters spread throughout the site. This allows for more private spaces while also creating a large common space at the center. These clusters will overlap in a commons gathering space in-between the groupings.
- In total 30 units would provide affordable housing to 66-117 residents.
- The development would include fifteen three-bedroom units, six two-bedroom units and nine two-bedroom units.
- Units would be prefabricated modular containers for efficiency and cost effectiveness. Cost estimates for this type of construction range from \$70-75 per square foot for the construction of a fully complete module.
- Site features include: waterside dock, pond, three rain gardens, bioswale, constructed wetland and gathering nodes.
- Each unit will have two solar panels and two photovoltaic panels on the roof to help with electricity and hot water in the units.
- Permeable eco pavers onsite will allow storm water to filter through the pavement and return to the ground. Under the pavement will be a three-foot uniformly graded stone aggregate where water will filter through to the ground.
- Units also have the option to have a green roof.



Perspective.



Site plan.



2

TPOLOGY	# OF UNITS	# OF RESIDENTS	TOTAL RESIDENTS
3 BEDROOM UNIT	15	3-5	45-75
2 BEDROOM UNIT	6	2-4	12-24
1 BEDROOM UNIT	9	1-2	9-18
TOTALS	30	6-11	66-117



- 1. First floor plans of a housing cluster.
- 2. Unit distribution.
- 3. Perspective.



Community center
perspective.

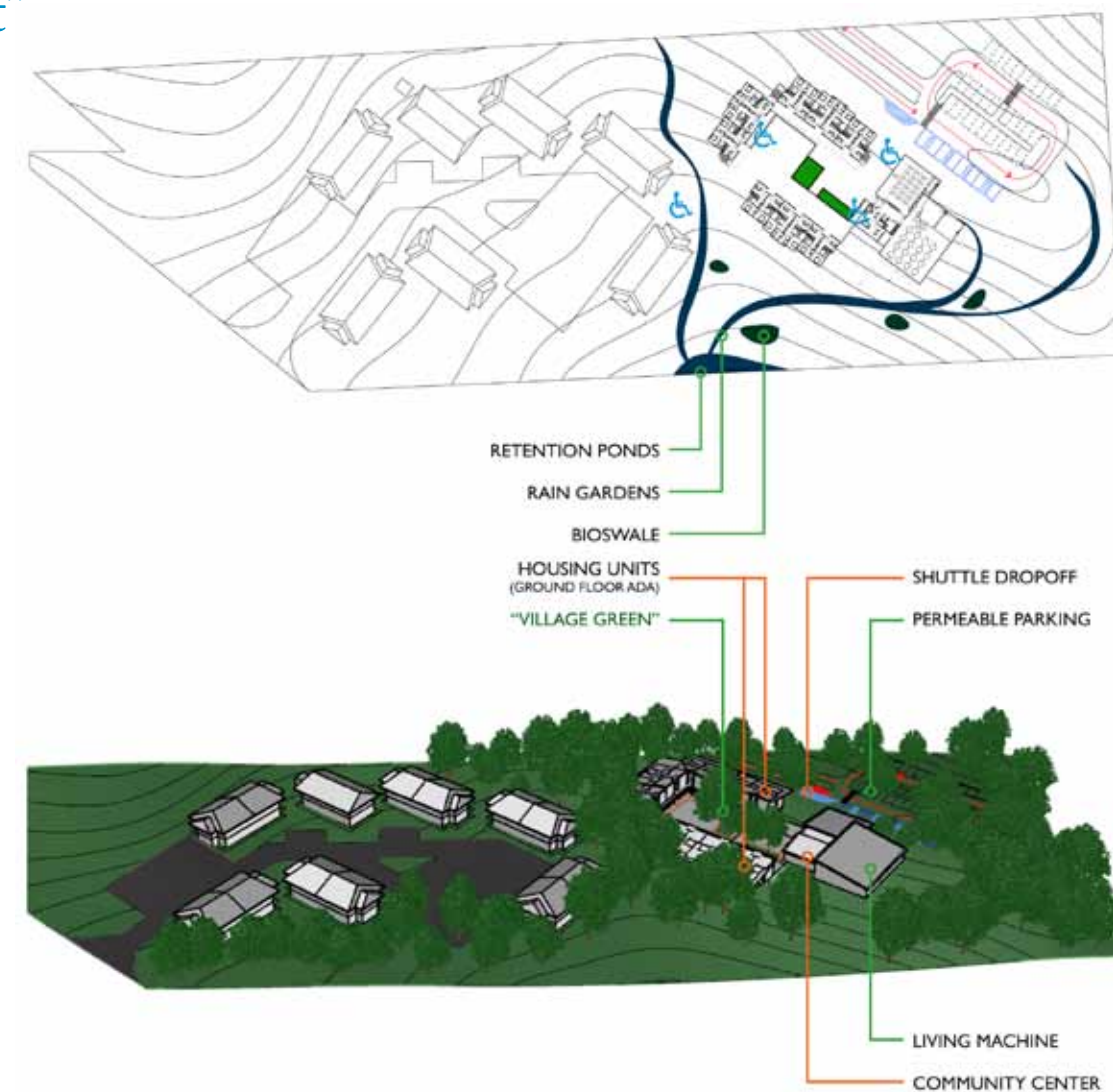
Student Designs

Colby Karambelas, 666 State Road, “Hillside Court”

- The concept for this development is to provide a sustainable, accessible and pedestrian friendly affordable housing solution for Westport.
- Hillside Court uses density to provide comfortable affordability for its occupants. Density provides for lower market-rate cost housing, more housing within a smaller footprint, less “useless” designed land area and allows for a possibility of density bonus incentives.
- This project also uses density to provide for greater efficiency, locating and rotating the design to increase southern exposure where needed.
- A living machine onsite is situated and angled to increase sunlight exposure while also removing all tree blockages to its south. The living machine provides sustainable sewage treatment to the occupants of the existing housing units to the west and to the newly created units in this design. This also pumps water back into the units for non-potable

uses, such as flushing toilets. The excess water from the living machine is collected, as well as excess rainwater, and is directed to one of two bioswales to the east or the west of the development.

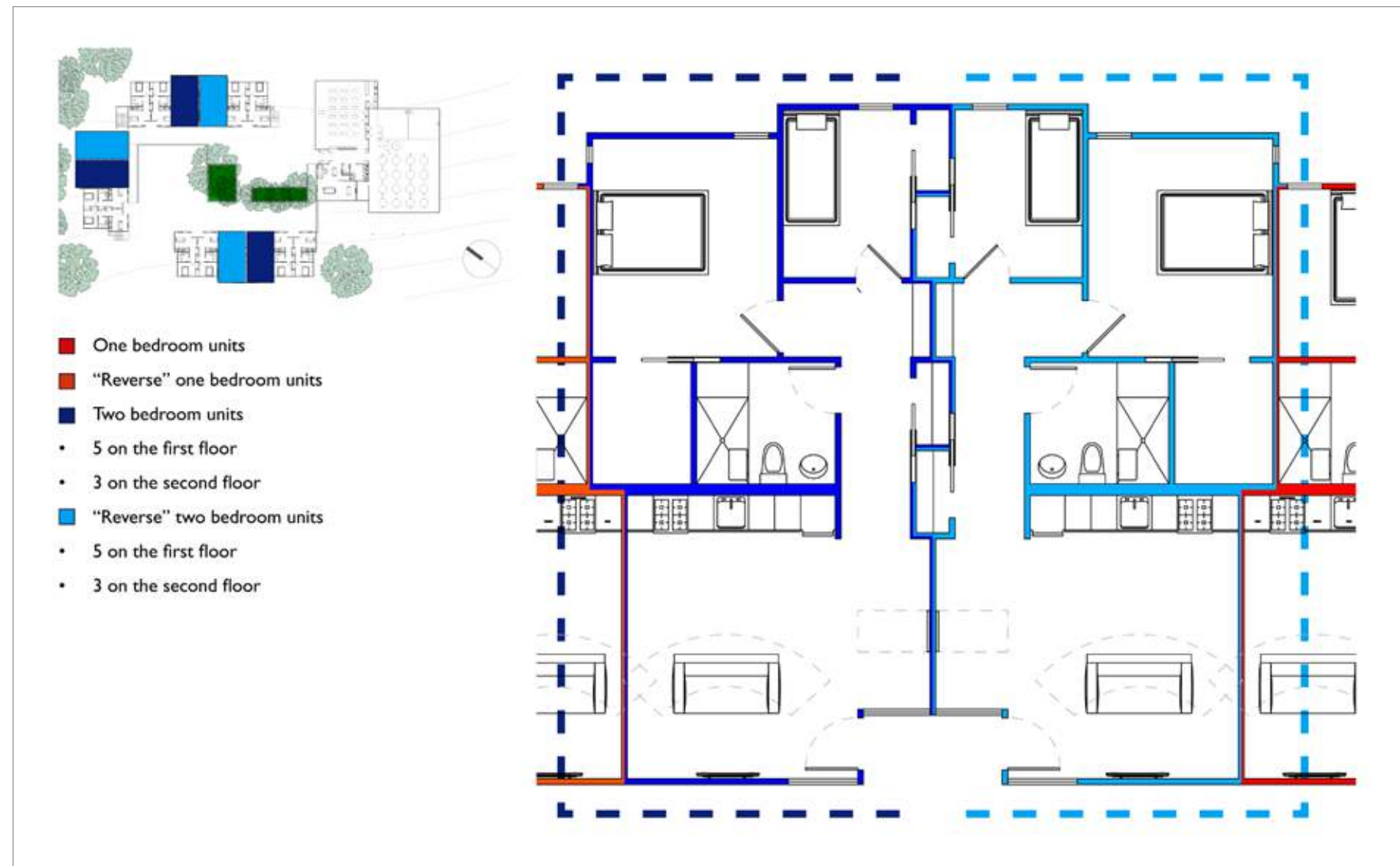
- Housing units to the north are two-story, increasing the southern sunlight exposure. The design also incorporates deciduous trees to the south of each unit to increase sunlight exposure in the winter when it is cold and decrease the sunlight exposure in the summer when it is warm. Southern-facing roofs, such as those on the southern housing units and the top most portion of the living machine roof, have an application of photovoltaic panels to allow the use of the sun’s rays for energy.
- The entire ground floor of Hillside Court is ADA-accessible. There is a procession of ramps stemming from the existing 48 units to the west and leading directly to the parking east of the site. All units on the ground floor



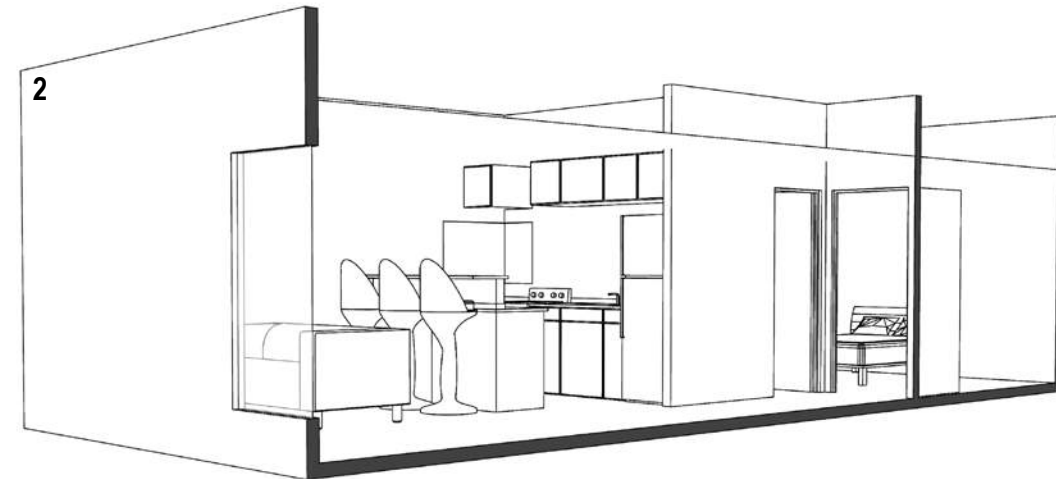
Site plan and diagram of sustainability features.

are also ADA-accessible both inside and out. This includes door widths, door pull distances, door push distances, hallway widths, counter heights, table heights, fixture sizes and much more that corresponds with ADA guidelines. The community center and living machine are also entirely ADA-accessible.

- In total 26 units would provide affordable housing to 67 residents.
- The community center onsite will serve as a place for residents to hold public meetings and events, participate in activities and volunteer.



Floor plan for two-bedroom units.

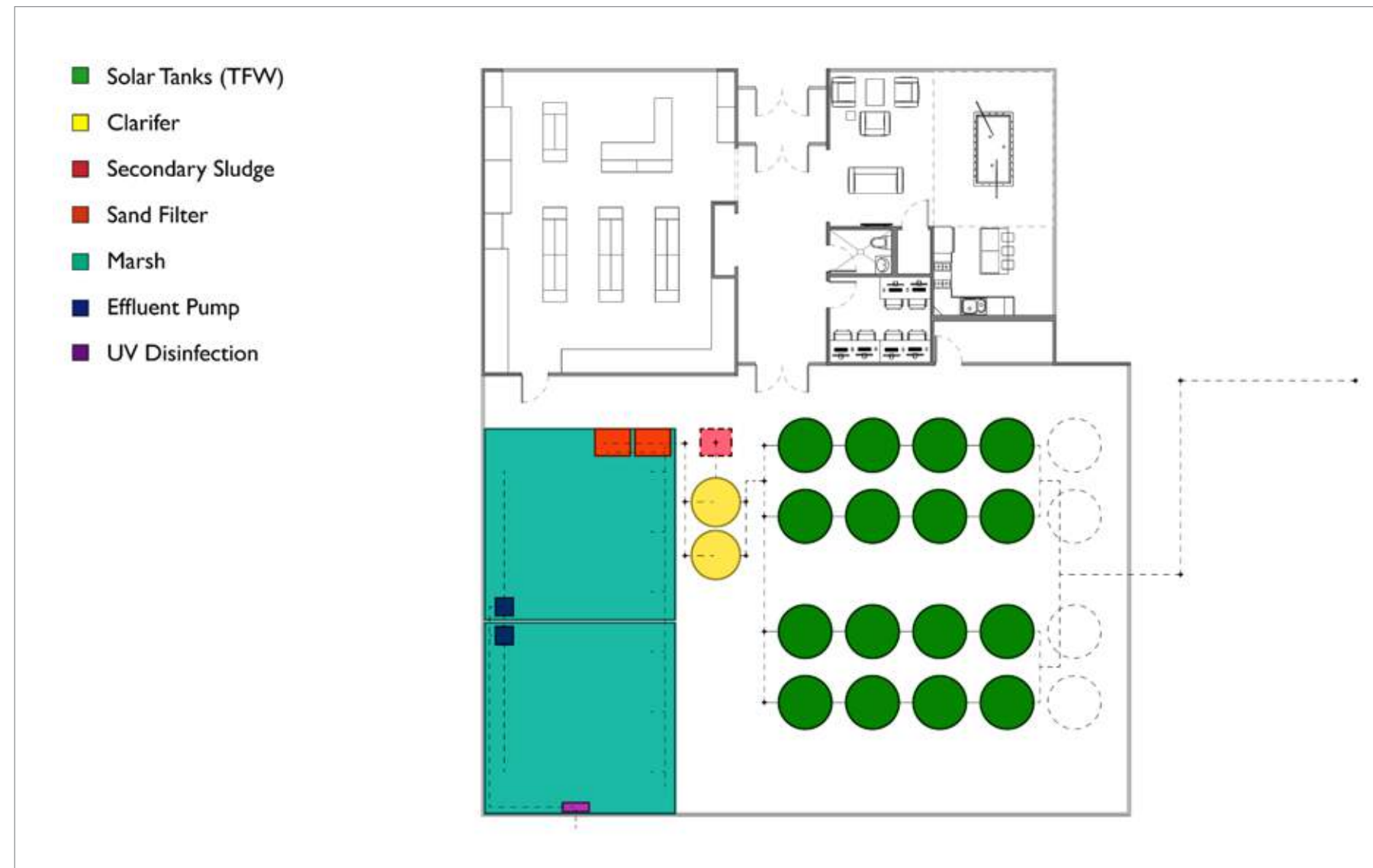


1. Interior perspective of second-floor loft.

2. Section perspective.

3. Aerial perspective.



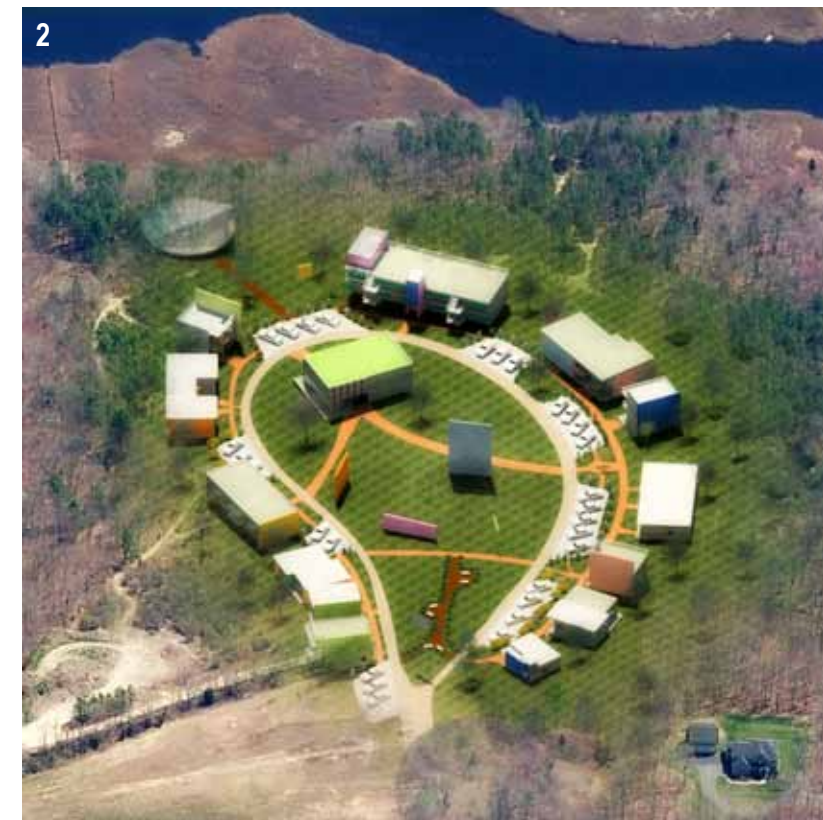


Plan for living machine.

Student Designs

Jacob Levine, 278 Drift Road

- The concept for this development is to offer different typologies or units, which are affordable and ADA-accessible and to promote a healthy and social living “campus” with room for families to grow.
- By moving paths and streets to fit the topography, the community will have a minimal impact on the site. A turnaround at the end of the campus with daytime/nighttime parking on the perimeter creates a barrier between the outside world and the inner oasis.
- The complex will have a range of housing types on site — duplexes next to single family homes near large, condo-like structures — to help blend the community and increase sociability.
- A 1,000 square foot living machine will be placed onsite to capture runoff.
- The development will also offer a 3,000 square foot community center, community gardens, sculpture gardens, walking paths, private driveways, green roofs and photovoltaic panels.
- In total 30 units would provide affordable housing to 50 residents.



1. Unit perspective.

2. Site plan to promote a social living “campus.”

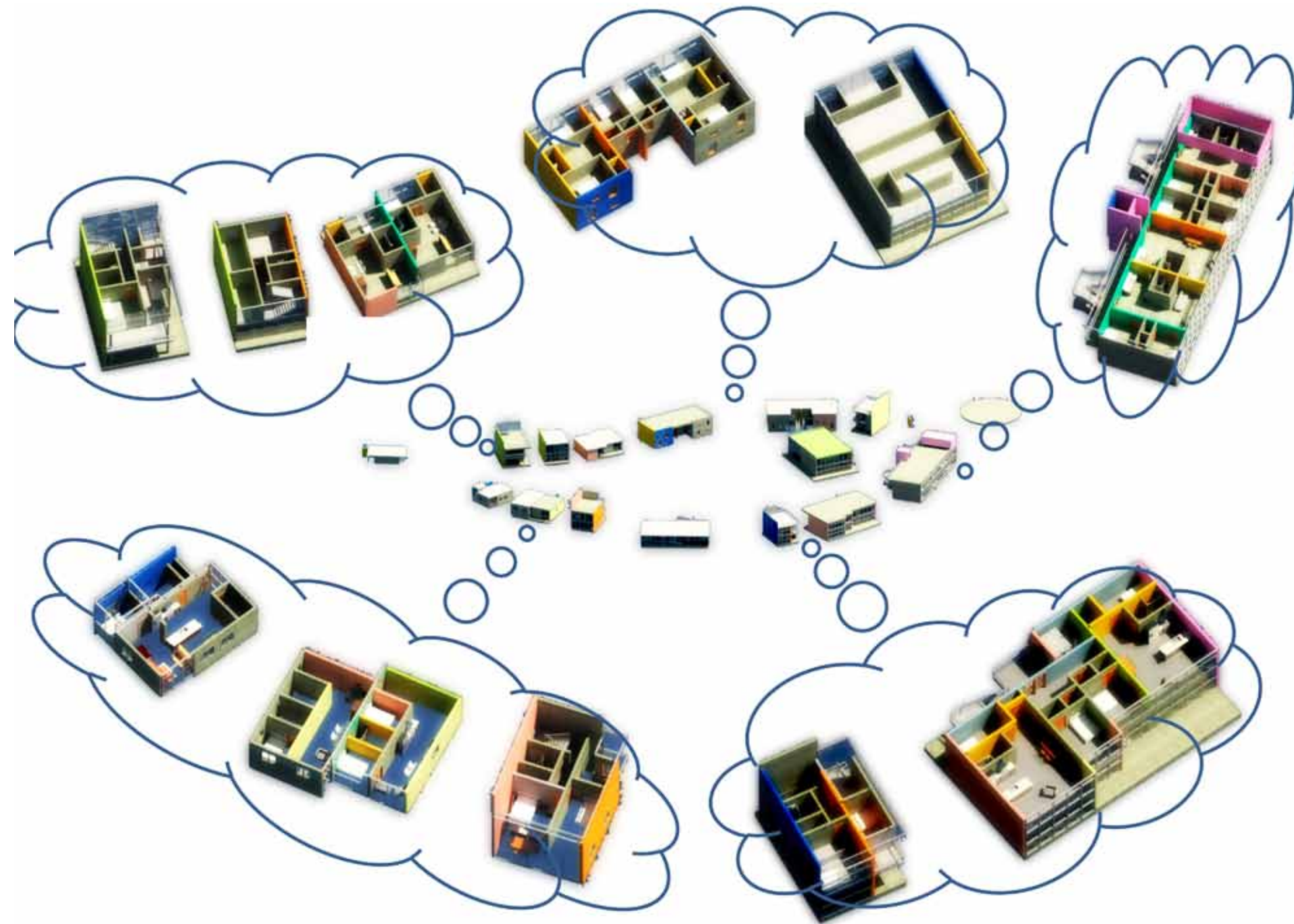


1. Site section.

2. Aerial perspective from south showing solar roofs.

3. Perspective.

4. Living machine perspective.



Aerial perspective of mixed
unit interiors. All ground
units are ADA-accessible.

Student Designs

Evan Mozzer, 278 Drift Road, “Westport Riverside Community”

- The goals for this project are to maintain a sustainable design, to create affordable modular row houses that minimize construction and labor costs, and to generate a community within the development.
- In total 35 units would provide affordable housing to 77-112 residents.
- The development will consist of 14 one-bedroom units, seven two-bedroom units, seven three-bedroom units and seven four-bedroom units.
- The concept for the design is to create an open-ended community that faces towards

the river. In the master plan there are a series of connections created between row houses, pedestrian pathways, vehicular pathways and waterways to generate an active community.

- Sustainable features onsite include: cisterns to store rainwater for later use, photovoltaic panels on the roofs, swales to collect water runoff and maintain proper drainage, and recycled wood siding from local barns.
- Units will share a central wet wall to reduce construction costs.



1. Southwest site section.

2. Aerial perspective.





Site plan.



1. Community center perspective.

2. Perspective.

3. Southeast section.





1. Ground floor plans.
2. Perspective of house with cistern for capturing and storing rainwater.
3. Unit distribution.

3

Unit Type	Sq. Ft.	# of Units	# of Res/Unit	# of Res.	Total
1 Bedroom	700	14	1-2	14-28	9,800
2 Bedroom	900	7	2-3	14-21	6,300
3 Bedroom	1200	7	3-4	21-28	8,400
4 Bedroom	1400	7	4-5	28-35	9,800
Total	4,200	35	10-16	77-112	34,300

Student Designs

Tim Pranaitis, 278 Drift Road, “Aviary Way”

- The Aviary Way housing community will be structured similarly to the way a bird weaves its nest of many elements.
- The center of the community is a “New England Town Green” with a community center and a living machine, which will replace the need for septic tanks. The Eagle Community Center will contain a daycare, mail collection, multipurpose room, kitchen, lounge and meeting spaces that would be accessible to the Aviary Way community as well as the greater community of Westport.
- Housing will consist of four smaller communities within the development: Gull, Robin, Owl and Crow. Each would be made up of a mixture of one, two, and three-bedroom dwellings.
- A network of walking paths would connect the community center with the waterfront and Drift Road.
- The site will incorporate units that could function as an assisted living duplex. This style will address the needs of affordable senior housing in the area. This duplex will consist of two two-bedroom units where a caretaker could either live in the unit with an individual or in the unit upstairs.
- In total, 32 units would be available for affordable housing.



1. Elevation.

2. Model of site.





Site plan.



2

	1 BEDROOM	2 BEDROOM	3 BEDROOM	4 BEDROOM	TOTALS
ROBIN 9,430 SQ. FT.	4	2	2	0	8
CROW 9,200 SQ. FT.	4	2	2	0	8
GULL 7,705 SQ. FT.	4	2	2	0	8
OWL 7,475 SQ. FT.	4	2	2	0	8
TOTALS	8	8	8	8	32
TOTAL UNIT SQUARE FEET	805 (STACKED)	1,035	1,380	1,610	

1. First floor plan of Robin
housing community.

2. Unit distribution.

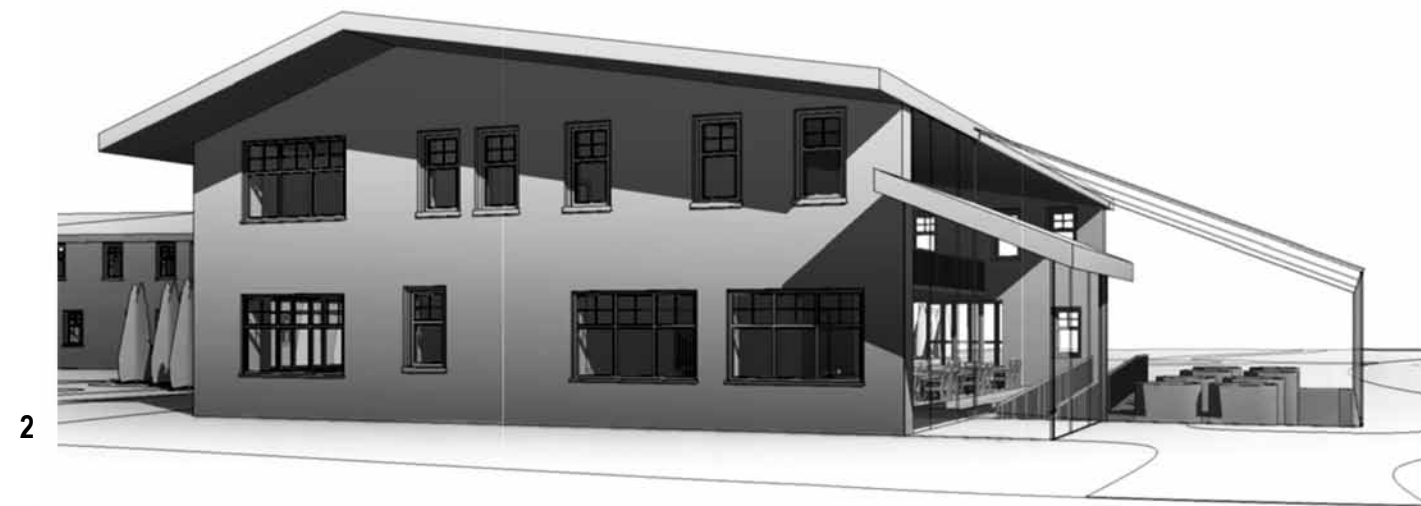
3. Perspective.

3





1



2

- 1. Southern elevation.
- 2. Western perspective of community center.
- 3. Community center section.



3

Student Designs

Chris Rossi, 278 Drift Road

- In total 30 units would provide affordable housing for 76-106 residents.
- Enter the site using the access road from the northwest and you are greeted by a beautiful rain garden. You can park in one of two lots along the road. The village itself is a bridge



between the garden corridor to the west and the water corridor to the east. You can find a wide range of natural elements and trails including open fields, ponds, swales, trees/bushes and bike trails.

- The village is set along a central spine with the community house and living machine as two important endpoints. To the back of the community center and living machine is a deck looking over an open area, which includes a retention pond capable of hosting events.
- Rain gardens on the north and west allow for rainwater to be cleaned and slowed as it makes its way to the swale which runs throughout the whole site into the wetlands.
- Two locations on the site are dedicated to agriculture for the village; they can be for personal use or for selling at a centralized market in the community center.
- Sustainable aspects of the development include: PV panels on each unit, large southern-facing windows, open floor plans, deciduous trees on the south of the property, evergreens on the north of the property, trellised porches, wood construction, a working living machine, and permeable surfaces.
- Affordable housing aspects for the development include: shared wet walls, local building materials, recycled materials for furnishings, local shrubbery throughout the village, modular designs and pre-fabricated portions of the units.



- 1. Section.
- 2. Aerial perspective.
- 3. Perspective.







1. Common cluster
floor plan.

2. Community center
perspective.

3. Perspective.

4. Section.

Student Designs

Jacob Wheeler, 278 Drift Road, “Water’s Edge: Healthy Living Community”

- The main concept of this project is to make connections with nature while connecting the two heritage corridors of Westport, Massachusetts. The lower portion of the site will be given to the Westport Land Conservation Trust.
- This master plan addresses the corridors and seeks to connect the two by providing an affordable home community as well as numerous nature walking trails for the general public. The built site for this project will be approximately 3.5 acres.
- The development will include a total of 30 units which will provide affordable housing to 85 residents. There will be ten studio apartments, ten two-bedroom units and ten three-bedroom units. These variations will provide opportunity for disabled individuals. Single room variations will be ADA-accessible.
- In front, each unit includes a small green garden space clearly differentiated by pathways. In the rear, plantings delineate green space boundaries.



- A 2,000 square foot community center will be placed on the site and will include a kitchen, bathrooms, mailboxes, guest suite, conference room and a large outdoor gathering space. There is also the possibility for including a small gym facility and convenience store.
- A living machine will be placed onsite to provide a sustainable approach to cleaning grey

water leaving the buildings. This recycled water can then be combined with the cistern water to provide irrigation for the community gardens.

- A rainwater cistern collection system will be used onsite to provide water for laundry facilities and irrigation to the gardens on site.

- A walking trail will provide a scenic pathway with views of the Westport River. Having a nature trail available will promote good health and access to the waterfront. This trail could also be accessed by the public.
- Modular housing systems will be used for the units, and all units will be based off similar dimensions for more cost effective construction. Interior wall lengths will be based off of 8' x 4' modules. This will reduce the amount of waste during the construction process.
- Sustainable features include: large southern facing windows, southern-facing green roofs, implementation of local materials, southern-facing solar panels, insulated vinyl siding, sun shading devices, community gardens, rain gardens, an orchard and living machine.

Aerial perspective
from the south.



2

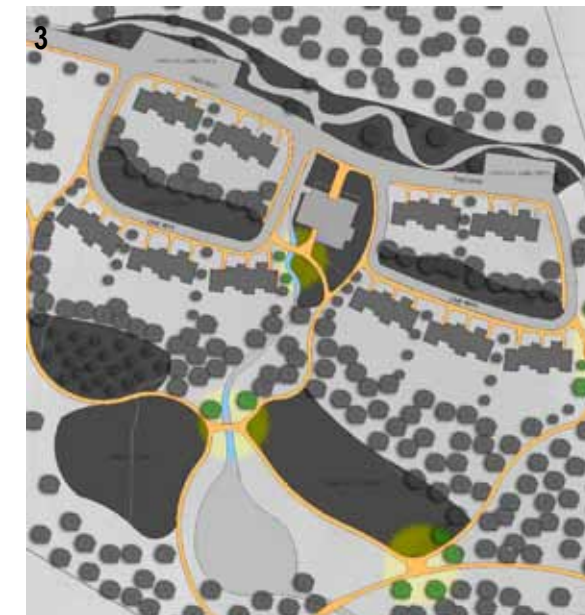
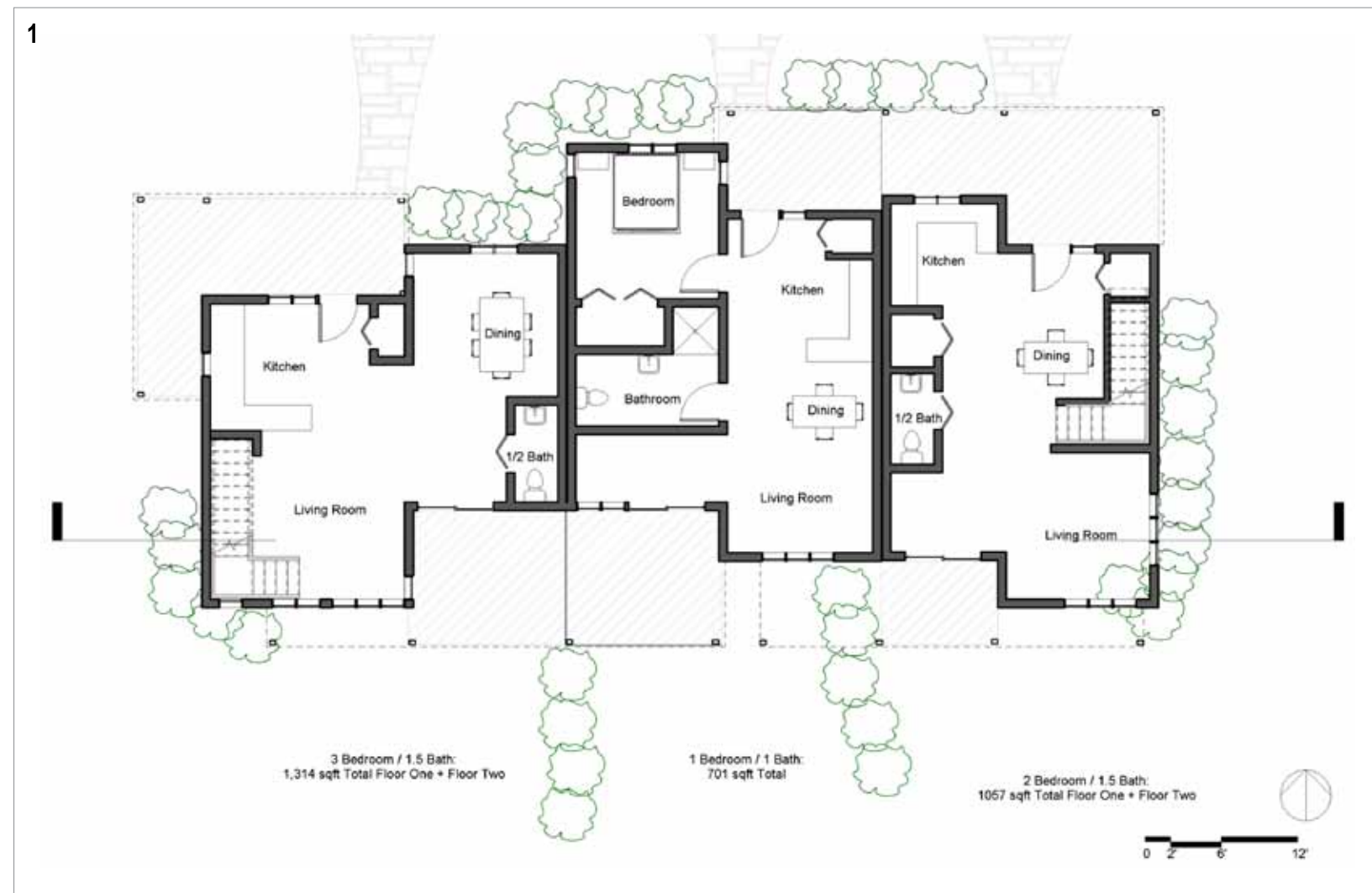
Unit Type	Sq. Ft.	# Units	% Distr.	Res/Unit	Total Res.	Total Sqft.
Studio	672	10		1 to 2	15	6,720
2 Bedroom	1,026	10		3	30	9,000
3 Bedroom	1,249	10		4	40	12,000
Community Center	1,200	1				2,000
Living Machine	1,000	1				1,000
TOTAL		30			85	30,720



1. Site plan.

2. Unit distribution.

3. Perspective of community center and living machine.



1. First floor plan of a unit cluster.
2. South elevation.
3. Map of large nature trail system to be part of the site.



Conclusion

In conclusion, the Westport Affordable Housing Project was a unique experience for the students: collaborating with a project consultant, working with the Westport Housing Authority, foreseeing the client/architect relationship and working on a real project. Thank you to the students who have worked so hard and enthusiastically to contribute their work to Westport residential community.

The project could not be materialized without the information provided by the Westport Affordable Housing Trust members and support by the Town of Westport. In this context, we would like to express our thanks to Leonardi Aray, AIA, housing consultant to the Town of Westport, who has worked diligently all semester with the students; and also to Liz Collins, Chairperson, Westport Housing Authority; Elaine Ostroff, founding Director Institute for Human Centered Design; Brenda Clement, Executive Director of Citizen's Housing and Planning Association (CHAPA), all, who made this project an exceptional experience for the students. We would also like to thank RWU Faculty; Janet Baldwin from Ecological Engineering; Karen Hughes from Architecture who helped the advancement of the project; and finally to Arnold Robinson, Director of CPC and Stephany Hessler, CPC Project Coordinator, for their continuous support and organizational initiatives.



Perspective of living machine south facade by Joseph Cardella.



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