2023

Ebenezer Village

A Vision for a Clean Energy Community

West Seneca, NY

University at Buffalo
School of Architecture & Planning
Department of Urban & Regional Planning

EBENEZER VILLAGE:

A Vision for a Clean Energy Community in West Seneca, New York

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ACKNOWLEDGMENTS

We would like to thank the Town of West Seneca and the Office of the 142nd District for working with us throughout our project. The completion of this report would not have been possible without the contributions provided by members of the Town, University at Buffalo faculty advisors, and subject matter experts on geothermal, clean energy technologies, and real estate development. A special thanks to the following individuals who took time out of their schedules to assist us with our research:

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West Seneca Town Officials

West Seneca Chamber of Commerce

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Eric Recoon, VP of Development & Leasing for Benderson Development
Johannes Rosemann, VP of Operations for Buffalo GeoThermal

VISION FOR EBENEZER VILLAGE

Our overall vision for the underutilized 475-acre parcel in West Seneca is to create a community that runs almost entirely, if not completely, on clean energy, and is constructed using passive and/or nearly net-zero emission methods, specifically geothermal energy. This community, Ebenezer Village, will feature a village common, named Ebenezer Commons, surrounded by a variety of housing options for residents. Ebenezer Commons will include commercial spaces for small shops and residential apartments above the commercial spaces. It will include an adjoining enclosed pavilion-like structure that can be used as an all-weather community space. Our added objective is to increase the walkability of the area, so that all residents of West Seneca can enjoy the adjoining parks, conservation area, and the new commercial spaces.

We also aim to provide a wide variety of housing options within Ebenezer Village to meet market demands. There is a need for market-rate and affordable housing options within the Town of West Seneca, which will allow young professionals and families to settle in the town. Additionally, there is also a need for more infrastructure to support the aging population of not only West Seneca, but New York State and the United States as whole. We are suggesting the inclusion of smaller 1-story only housing options for independent older residents, an assisted living or supportive facility, and a unique memory care facility. All of these housing options would utilize geothermal energy to heat and cool their homes. Utilizing geothermal energy would provide residents with a significantly decreased carbon footprint, and it would also allow residents to benefit from government subsidies relating to geothermal and economies of scale to keep pricing on the heating/cooling systems low.

Ebenezer Village will have four sections: the green perimeter with a walking route, the residential community, which will include single-family homes for varying incomes, townhomes; the separate memory care facility; and the Ebenezer Commons section which will be mixed-use with small commercial spaces and apartments. It is our hope and intent that this underutilized parcel of land can become a thriving new community and family-oriented space for West Seneca.

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Report Introduction

ABOUT THE STUDIO

This report was prepared by graduate urban planning students from the University at Buffalo's School of Architecture and Planning. It is part of a required "practicum" in which students learn about the professional practice of planning.

For the 2023 Spring semester, the Department of Urban and Regional Planning was approached by the NYS 142nd District Assemblymember Patrick Burke regarding the site in the Town of West Seneca currently occupied by New York State Office for People with Developmental Disabilities (OPWDD). The Office of the 142nd District asked that we examine this site, which is currently underutilized and potentially in need of redevelopment. Elected officials in West Seneca, including Town Supervisor Gary Dickson, expressed a strong interest in our project.

Beginning in January 2023 we toured the site, sought advice from stakeholders, and consulted with experts to produce this report assessing the current conditions and propose future directions for the site. We appreciate the Office of the 142nd District for providing us with this opportunity, and the leadership of the Town of West Seneca for giving us great feedback and guidance throughout the project.

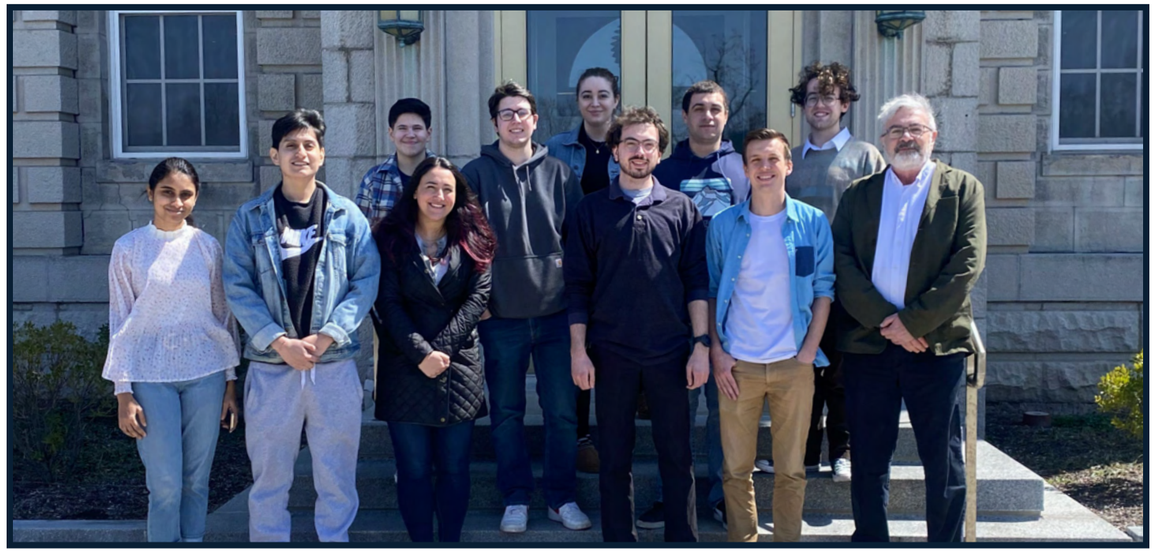


Figure 1.1: Studio Participants

Back row left to right: Reilly Dzielski, Colin Curry, Kaety Ashkar, Frank Iemmiti, and Nathan Barbara

Front row left to right: Madhumitha Kodimyala, Peter Uruchima, Elizabeth Aranguiz, Brendan Kelly, Eric VanDeWall, and Dr. Ernest Sternberg

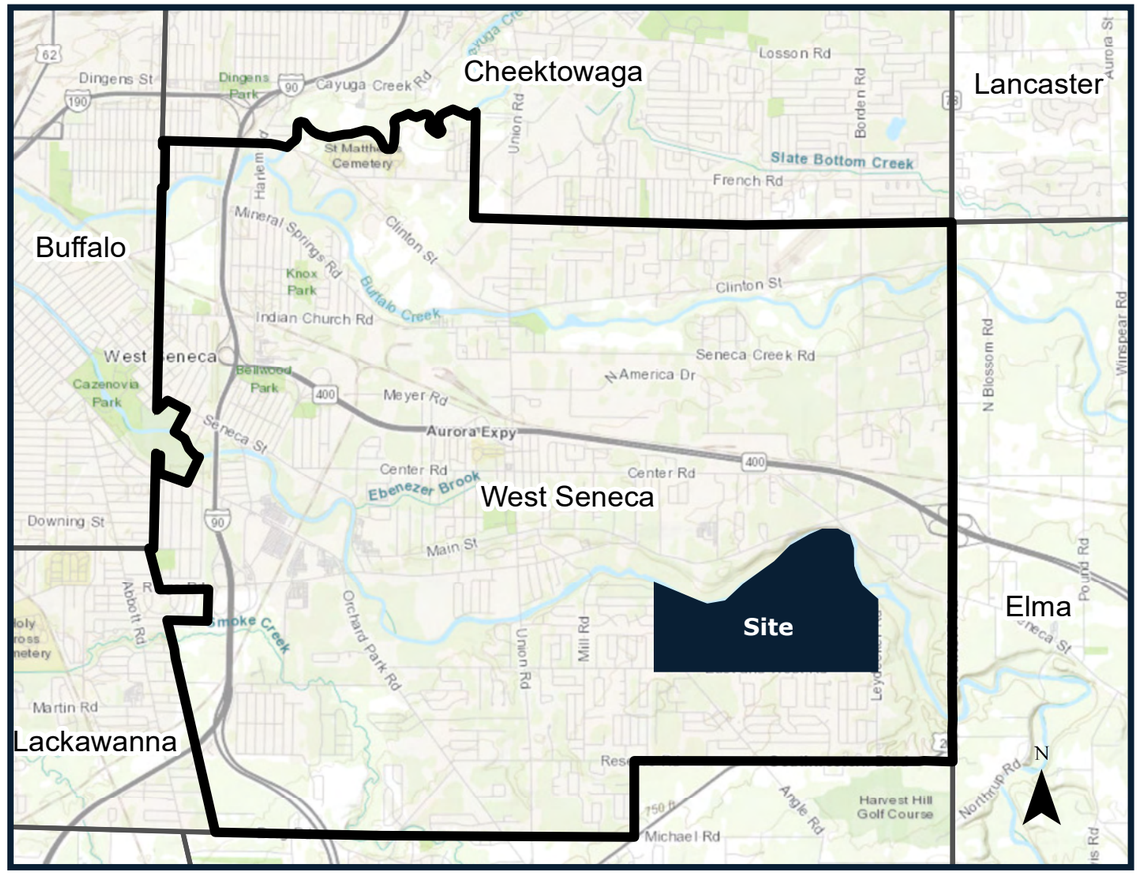
PROJECT SITE & PURPOSE

This report was prepared to provide the Town of West Seneca with an assessment of the current conditions and a proposal of future directions for an approximately 475-acre parcel located within the town. The site is largely underutilized, and is located in a predominantly residential suburban portion of West Seneca, NY. The site is owned by New York State, and was originally used as housing for individuals with developmental issues under the care of the New York State Office for People with Development Disabilities (OPWDD). OPWDD still has a few offices for administrative and social services located on the western portion of the site, specifically the Western New York Children's Psychiatric Center operated by the NYS Office of Mental Health. There are 32 buildings on the site, not counting out-buildings; however, only about five of those buildings remain in use by OPWDD, other state agencies, or tenants. As will be described in Chapter 2, the rest of the buildings on the site are vacant, most of them condemned.

Our main goal with this report is to identify how the site can be better utilized to meet the needs of the Town of West Seneca, look toward a future that is in keeping with directions expressed in their comprehensive plan, while also considering environmental and sustainability opportunities and values. With regard to clean energy usage on the site, we plan to focus predominantly on geothermal and ground source heat pumps, and to discuss the many federal and state incentive programs provided for this type of development. We chose geothermal energy because one firm in West Seneca is the leading commercial provider of geothermal installation services in Upstate New York. Our proposal aims to provide the Town of West Seneca with a vision for the future of sustainable, environmentally friendly homes that utilize clean energy and are close to net zero in greenhouse gas emissions while also fitting with the needs of the surrounding area.

We would like to acknowledge the land on which Ebenezer Village operates, was once the territory of the Seneca Nation. Today, the region surrounding Ebenezer Village is still home to many Native people, and we are grateful for the opportunity to live, work, and share ideas alongside them.

Figure 1.2: Site Location within West Seneca



Source: NYS Office of Information Technology Services GIS Program Office (GPO)

West Seneca Town Boundary

Other Municipality Boundaries

Project Site Boundary

ABOUT WEST SENECA

The Town of West Seneca is a suburban community on the southeastern outskirts of the City of Buffalo. It is considered a first-ring suburb of Buffalo. It boasts the amenities of a big city with the safety and calm of a small town. It offers residents a sparse suburban feel, and a majority of residents own their own homes [4]. The town has many parks, bars, restaurants, and activities for families and individuals. It is a beautiful place to live, work, and raise a family.

Natural Geography

The town is located within Erie County, in the western corner of the State of New York. A majority of Erie County is within the Erie-Ontario Lowlands, which is a plain of horizontal sedimentary rock deposited by glaciers and is characterized as having gentle slopes and low elevations compared to the rest of the region. A small portion of Erie County contains the Allegheny Plateau, which is part of the larger Appalachian Plateau. The Allegheny Plateau is characterized by its steep slopes and numerous changes in elevation, which are less severe in the western portions [2].

One of the most prominent natural features within the Town of West Seneca is the Cazenovia Creek. The East and West branches of the creek come from the edges of Erie County and join together in the Town of Aurora, which is southeast of West Seneca [3]. Cazenovia Creek passes through West Seneca to the City of Buffalo where it empties into the Buffalo River.

History

The Native Americans who settled on the land that would one day be called West Seneca were known as the Senecas. In the late 1790s, 2.6 million acres of land were purchased by the Seneca tribe to create the Buffalo Creek Indian Reservation. In 1835, the Senecas were forced to leave the Buffalo Creek Indian Reservation and migrate to the Cattaraugus Indian Reservation in what is now southwest Erie County. A group of German Lutheran settlers, known as the Ebenezer's, purchased approximately 5,000 acres of the vacated land for $10.50 per acre. In 1851, the settlement was organized and named the Town of Seneca, and received its incorporation as an official town on October 16th, 1851. In 1852, the name was changed to West Seneca to avoid confusion with another town in eastern New York also named Seneca [4].

The Town of West Seneca has a long history as a farming community, which was transformed into a residential suburb as the City of Buffalo began to flourish in the mid 1900s. With the invention of the automobile more and more people moved out of Buffalo, and into the surrounding towns and communities. West Seneca began to attract commercial and industrial development, and became a thriving suburban community.

Demographic Trends

Over the last two decades West Seneca has experienced very little population change. From 2000 to 2010 the population shrank from nearly 46,000 people to a little under 45,000 [5]. However, that population decline reversed from 2010 to 2021 during which the population went back up to just under 45,400 residents [1]. The biggest change in West Seneca's demographics has been in the median age of the population. From 2000 to 2010, the median age increased from 41.1 to 44.7 [5].The median age continued to increase slightly from 2010 to 2021 to 45.3 [1]. A related trend is the decline in the number of persons under 18 years old. These trends are common in New York, and the US as a whole. The US is experiencing a clear shift in the median age of the population, and we need to be prepared for this change with infrastructure for older and elderly Americans.

Within the context of our proposal, Ebenezer Village will propose a section for age-in-place (1-story only) patio homes for older residents, an assisted or supported living facility, and an innovative memory care facility. Creating this type of infrastructure is essential as the population of the area gets older.

Table 1.1: West Seneca Demographic Trends 2000-2021

West Seneca Demographic Trends						
Statistic	**2000**		**2010**		**2021**	
Total Population	45,943		44,711		45,390	
Population Density (Per Sq. Mile)	2,148.60		2,093.50		2,122.4	
Area (Land)	21.38		21.36		21.39	
Age						
Under 18 Years	10,238	22.30%	8,839	19.80%	8,224	18.1%
18 to 34 Years	8,352	18.20%	8,170	18.30%	9,723	21.4%
35 to 64 Years	18,973	41.30%	18,827	42.10%	18,163	40.0%
65 and Over	8,380	18.20%	8,875	19.90%	9,280	20.5%
Median Age by Sex						
Median Age	41.1		44.7		45.3	
Male Population	39.7		42.8		44.8	
Female Population	42.4		46.4		46.0	
Race						
White Alone	45,074	98.10%	43,472	97.20%	43,489	95.8%
Black or African American Alone	213	0.50%	383	0.90%	774	1.7%
American Indian and Alaska Native Alone	80	0.20%	96	0.20%	51	0.1%
Asian Alone	229	0.50%	280	0.60%	129	0.3%
Native Hawaiian and Other Pacific Islander Alone	4	0.00%	4	0.00%	29	0.1%
Some Other Race Alone	86	0.20%	130	0.30%	233	0.5%
Two or More Races	257	0.60%	346	0.80%	685	1.5%

Sources: Census 2000 and 2010, U.S. Census Bureau and Social Explorer
ACS 2021 (5-Year Estimates), U.S. Census Bureau

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Economy

A majority of West Seneca residents over the age of 25 are high school graduates with at least some college education. The City of Buffalo and Erie County also have a majority of resident over the age of 25 who have had at least some college education. In Erie County a majority have a Bachelor's degree or higher [2]. This is important information because it characterizes the education level of workforce. Observing employment status for non-military residents over the age of 16, we see that 96% of West Seneca residents are employed compared to just 92% in Buffalo. Erie County as a whole is 95% employed [2]. Considering these statistics, we see that West Seneca is above the curve in this category.

The industry with the most employed non-military residents for West Seneca, Buffalo, and Erie County are all the same. Educational services, health care, and social assistance are the industries that employ the most residents. Retail trade is the second largest employer for West Seneca, and this is also true for Erie County [2]. When considering this information in the context of the Ebenezer Village site, it is important to note that we are proposing a mostly residential development with a small mixed-use commercial/residential area at the heart of the new development.

Table 1.2: 2021 Jobs & Education Comparison: West Seneca, Buffalo, and Erie County

2021 Jobs and Education Comparison: West Seneca, Buffalo, and Erie County			
Statistic	**West Seneca**	**Buffalo**	**Erie County**
Educational Attainment for Population 25 Years and Over			
Population 25 Years and Over:	33,701	182,907	670,059
Less than High School	1,803	25,637	52,956
High School Graduate (Includes Equivalency)	9,700	49,718	175,869
Some College	11,566	53,727	200,762
Bachelor's Degree or Higher	10,211	49,951	224,198
Professional School Degree	421	3,874	16,274
Employment Status for Civilian Population 16 Years and Over			
Civilian Population 16 Years and Over	25,405	133,070	490,712
Employed	24,352	122,838	465,474
Unemployed	1,053	10,232	25,238
Industry by Occupation for Employed Civilian Population 16 Years and Over			
Total Employed Civilian Population 16 Years and Over:	24,352	122,838	465,474
Construction	1,414	4,702	22,691
Manufacturing	2,559	10,653	47,267
Retail Trade	2,844	12,756	51,031
Transportation and Warehousing, and Utilities	1,114	6,334	22,504
Finance and Insurance, and Real Estate and Rental and Leasing	2,654	8,761	38,958
Professional, Scientific, and Management, and Administrative and Waste Management Services	2,411	12,759	47,609
Educational Services, and Health Care and Social Assistance	6,594	37,523	133,163
Arts, Entertainment, and Recreation, and Accommodation and Food Services	1,547	14,032	41,171
Source: ACS 2021 (5-Year Estimates); U.S. Census Bureau			

NATIONAL IMPLICATIONS

Throughout the United States, communities are attempting to be more sustainable in the way they are built and run over time. Suburban communities especially are having a challenging time satisfying the needs of residents while also following sustainable practices; however, clean energy technologies such as geothermal and ground source heat pumps are gaining attention as a means for these communities to achieve these goals. It is our ambition that the Ebenezer Village proposal can be used as a model for a sustainable suburban community that not only addresses greenhouse gas concerns, but also confronts the need for elderly and senior housing that will become even more in demand as the median age of Americans continues to rise.

Currently, very little information exists relating to how a geothermal community would be set up, and there is even less information regarding how a networked geothermal community would work. This is a limitation for planners because there is a clear need for communities across the country to find sustainable and green heating and cooling methods. Geothermal, and the accompanying ground source heat pump technology, is one of the most efficient systems that can be used. The main purpose of this report is to rectify this issue by providing information on creating a community that utilizes geothermal.

Not only is geothermal an efficient method for heating and cooling, but it also provides an opportunity for economic development. Geothermal investment and entrepreneurship with geothermal and clean energy represent a growing green industry, especially when factoring in state and federal governments' interest in subsidizing clean energy projects. Our hope is that even though Ebenezer Village is meant as a redevelopment project to revitalize an underutilized parcel of land in West Seneca, the project may also become a model for geothermal communities in other parts of the US.

ORGANIZATION OF THE REPORT

This report aims to provide the Town of West Seneca and New York State with a proposal for the redevelopment of a parcel of land currently underutilized by New York State. The report is organized into eight chapters containing useful research and information about the site, and rationales for development recommendations.

Chapter 2 consists of a site analysis including information on existing buildings and infrastructure, land use and zoning information, and an environmental analysis. Chapter 3 provides information regarding sustainability practices and guidelines such as sustainable development and clean energy usage. It also provides precedent studies for other communities that are similar to those of the proposed Ebenezer Village. Chapter 4 dives further into clean energy with a look into geothermal and ground source heat pumps. It presents key information regarding distinct types of geothermal set ups and their associated costs including government subsidy information. Chapter 5 describes the residential development possibilities for the site by going into detail about different housing types that could be offered, and doing a market analysis on why those housing types would be beneficial to the Town of West Seneca. It also provides multiple precedent studies for more unique types of housing. Chapter 6 delves into the mixed-use and commercial section of the proposal, referred to as Ebenezer Commons. Chapter 7 will investigate the possible traffic implications for the major roads near the site. Chapter 8 will be an overview of the community design recommendations.

References:

[1] American Community Survey 5-Year Estimate 2021. U.S. Census Bureau, (2021). https://www.socialexplorer.com/tables/ACS2021_5yr

[2] Callister, Jeffrey C. "The Physical Setting." Essay. In Brief Review for New York Earth Science, The Physical Setting , 2004th ed., 487–88. Boston, MA: Prentice Hall, 2004. http://srixner.weebly.com/uploads/2/8/8/3/2883058/landscapes_and_environmental_change_packet.pdf.

[3] Conheady, Matthew. "Information / Accessibility / Accommodations." Cazenovia Park Falls. NY Falls, n.d. https://nyfalls.com/waterfalls/cazenovia-park-falls/.

[4] "History." Town of West Seneca. Town of West Seneca, n.d. http://www.westseneca.net/about-west-seneca/history#gsc.tab=0.

[5] U.S. Decennial Census 2000 and 2010. U.S. Census Bureau, (2010). https://www.socialexplorer.com/explore-tables.

2

Site Analysis

SITE CONDITIONS

The site for the proposed Ebenezer Village development is located between East and West Road, to the south, and Cazenovia Creek, to the north. The site, owned by New York State, encompasses approximately 475 acres. The Cazenovia Creek Wildlife Management Area, operated by the New York State Department of Environmental Conservation, serves as a protective buffer between our site and the creek.

The western portion of the site is used by the Western New York Children's Psychiatric Center, taking up about a fifth of the site. This facility is currently occupied and in use. Our recommendations do not apply to it, and our proposal regarding Ebenezer Village does not intend to impact the psychiatric center's operation on the site. The rest of the property is controlled by the New York State Office for People with Development Disabilities (OPWDD). OPWDD still maintains a few administrative and social services on the site in a collection of multi-story office buildings on the central portion of the site. There are a few buildings which are currently in use by various state agencies. However, most of the buildings are vacant, abandoned, deteriorating, and/or ready for demolition. OPWDD only uses a small portion of the site.

Community members in West Seneca have expressed concerns regarding the safety of the site due to its abandoned buildings and sparsely used lawns and wooded areas. According to news reports, there was an assault on the site, which sparked interest in redevelopment of the area. In addition, the site is surrounded by a residential community, but provides no services or tax revenue to the town. This section will describe the current conditions of the site.

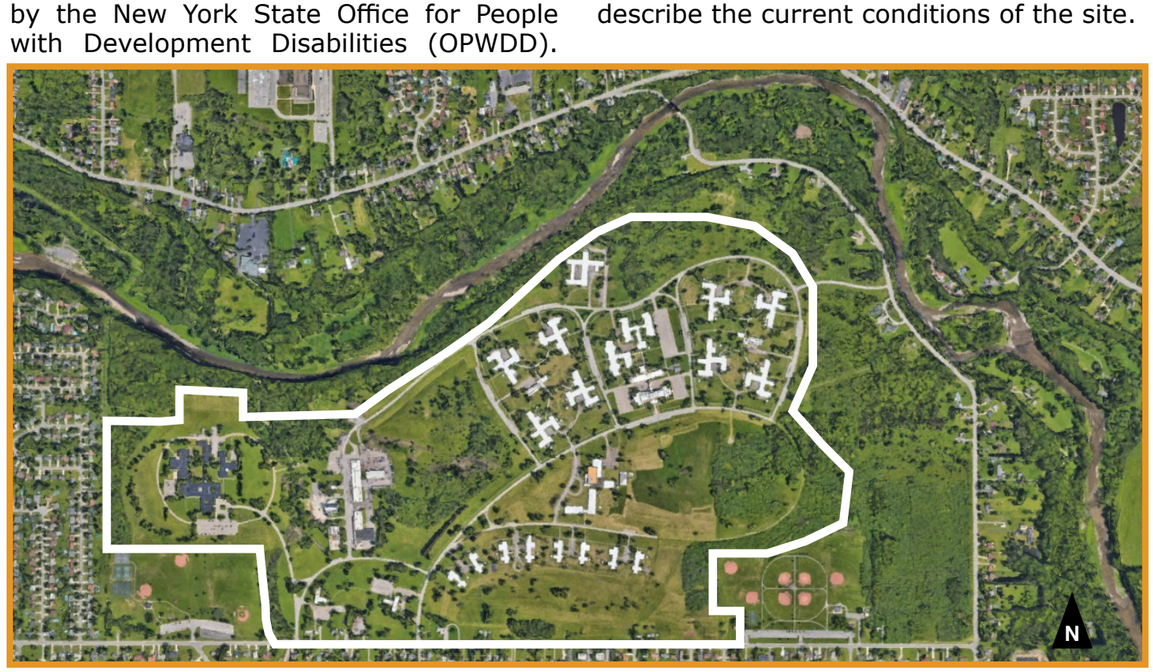


Figure 2.1: Existing Google Earth Site Plan

EXISTING INFRASTRUCTURE

All of the existing buildings on the site, except for Building 80, the WNY Children's Psychiatric Center, are under the control of the OPWDD, with their main operation being located in Buildings 16, 17, and 18. Buildings 61 and 63 serve as workspace for OPWDD staff and tradespeople who maintain group homes around WNY.

The majority of the vacant buildings were once part of a large residential campus for people with developmental disabilities. Buildings 40 – 47, which line Cottage Drive toward the front of the site near East and West Road, were once dormitories for patients living on campus. Building 20, toward the north of the site, served as a school for the campus's patients. Buildings 8 and 9, located on Cottage Drive and Main Drive in the center of the site, were originally the campus's gymnasium. Buildings 10-15 and Buildings 22-27 that surround Building 16 mostly served as general buildings for recreation and rehabilitation.

There should be special note made of Buildings 62 and 64 which were used as the site's laundry facility and power-plant, respectively. The buildings are now vacant. We were not able to inspect them, so it is unclear whether they could be used and rehabilitated for new uses.

The existing internal road structure is poorly maintained and in poor shape. The roads' loop-style arrangement was meant for building layouts that are likely no longer relevant to future development. Therefore, we assume in this report that a completely new internal road layout will be necessary.

Figure 2.2: Main OPWDD Headquarters

Figure 2.3: Tradespeople Workspace

Figure 2.4: Former Dorm Building

Figure 2.5: Former Laundry Building

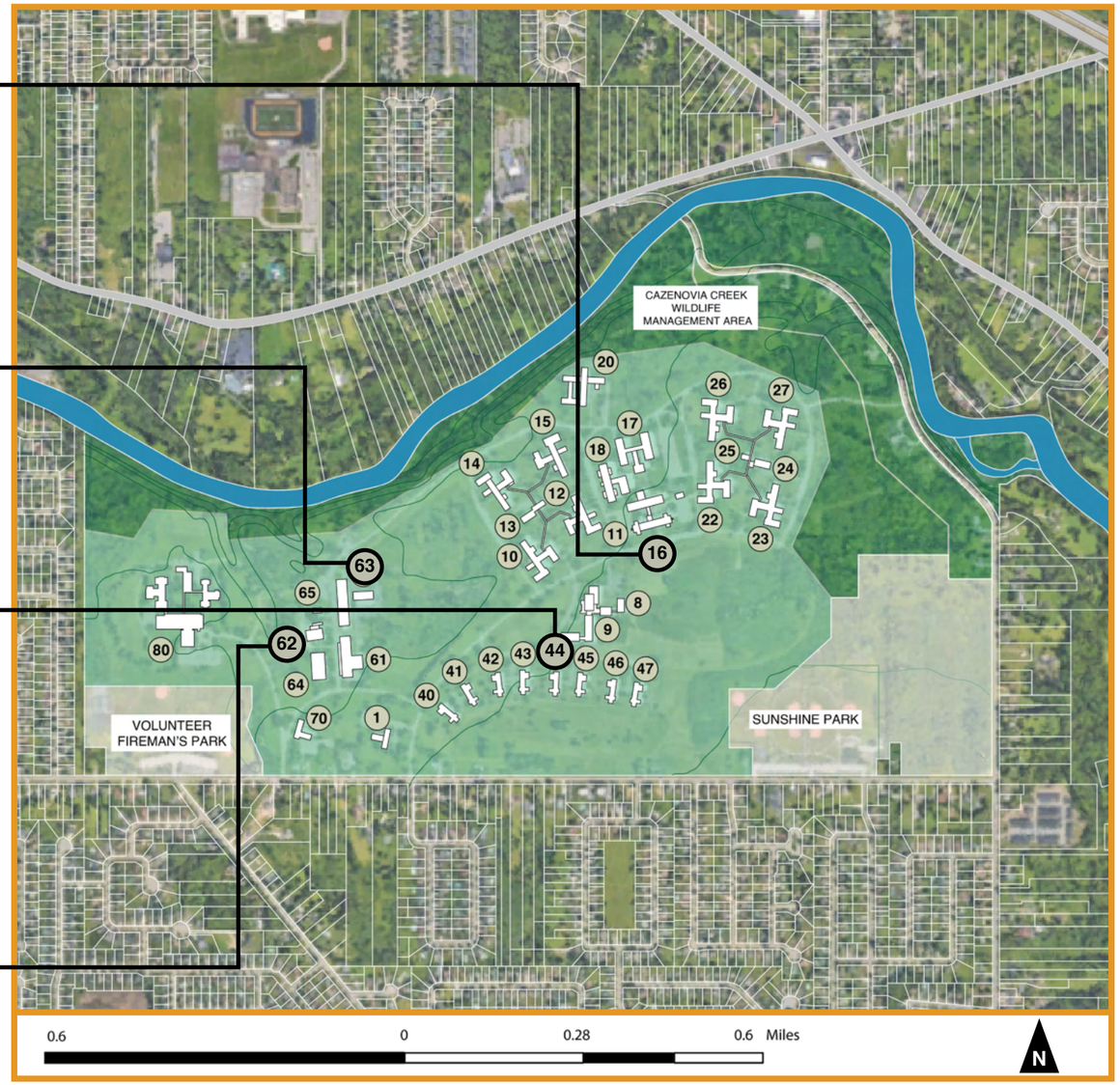


Figure 2.6: Existing Buildings of the OPWDD Campus

Traffic Abbreviations

Annual Average Daily Traffic: The mean traffic volume across all days for a year for a given location along a roadway - estimated as the total traffic volume passing a point (or segment) of a road in both directions for a year divided by the number of days in the year.

Design Hour Volume: The maximum efficiently flowing traffic volume (both directions) for which the road segment is designed during the peak hour of the day.

Peak Hour Volume: The total volume of traffic during the peak hour. It represents the number of vehicles using a particular roadway or transportation facility during the busiest hour of the day.

Source: Traffic Data Computation Method Pocket Guide, U.S. Department of Transportation.

Figure 2.7: Existing Roadways around the Site

Table 2.1: Current West Seneca Traffic Conditions

West Seneca Current Traffic Conditions Surrounding Site		
	East and West Road	**Leydecker Road**
Annual Average Daily Traffic Type	Enumeration	Enumeration
Annual Average Daily Traffic	5,634 trips/day	1,656 trips/day
Design Hourly Volume (rate of trips/hour the road was designed for)	543 trips/hour	157 trips/hour
Morning Peak	184 trips	96 trips
Afternoon Peak	266 trips	78 trips
Evening Peak	321 trips	134 trips
Source: NYS Traffic Data Viewer 2019		

The site is adjoined on its south side by East and West Road, a two-way, two-lane street running horizontally; and on its east side by Leydecker Road, a two-way, two-lane street looping to the north of the site crossing over Cazenovia Creek. In general, these roads are underutilized relative to their potential, as seen in Table 2.1.

As shown in Table 2.1, the main roads that connect the OPWDD campus to the rest of West Seneca see low but consistent traffic throughout the day. Peak hourly traffic never exceeds the Design Hourly Volume: the hypothetical maximum trips the current road design allows to maintain consistent traffic flow. We assess that there is capacity for significantly increased traffic generated by the proposed Ebenezer Village. One likely provision is that East and West Road will need to be widened to include a central turning lane for increased traffic.

Water, sewage, and electric infrastructure does exist on the site with connections to the main power grid. However, documentation for this piping and its connections were not available to us.

LAND USE & ZONING

The current land use of the site is centralized in a few key buildings. Much of the site's open space remains underutilized and is lacking in definition or character. The largest and primary land use of the site is the active OPWDD buildings. Occasionally, joggers and walkers may pass through.

The Cazenovia Creek Wildlife Management Area is situated to the north of the site bordering Cazenovia Creek and Leydecker Road. There are no buildings or facilities on this section of the site. A small walking trail exists in the Wildlife Management area, but its scope in comparison to the entire management area is small.

Sunshine Park and Volunteer Fireman's Park, two town parks, are situated near the southeast and southwest portions of the site. Sunshine Park has baseball diamonds and a basketball court. Volunteer Fireman's Park offers a greater variety of activities with some available green space to allow for other uses beyond recreational sports. The park includes fields for baseball, batting, soccer, basketball, and tennis.

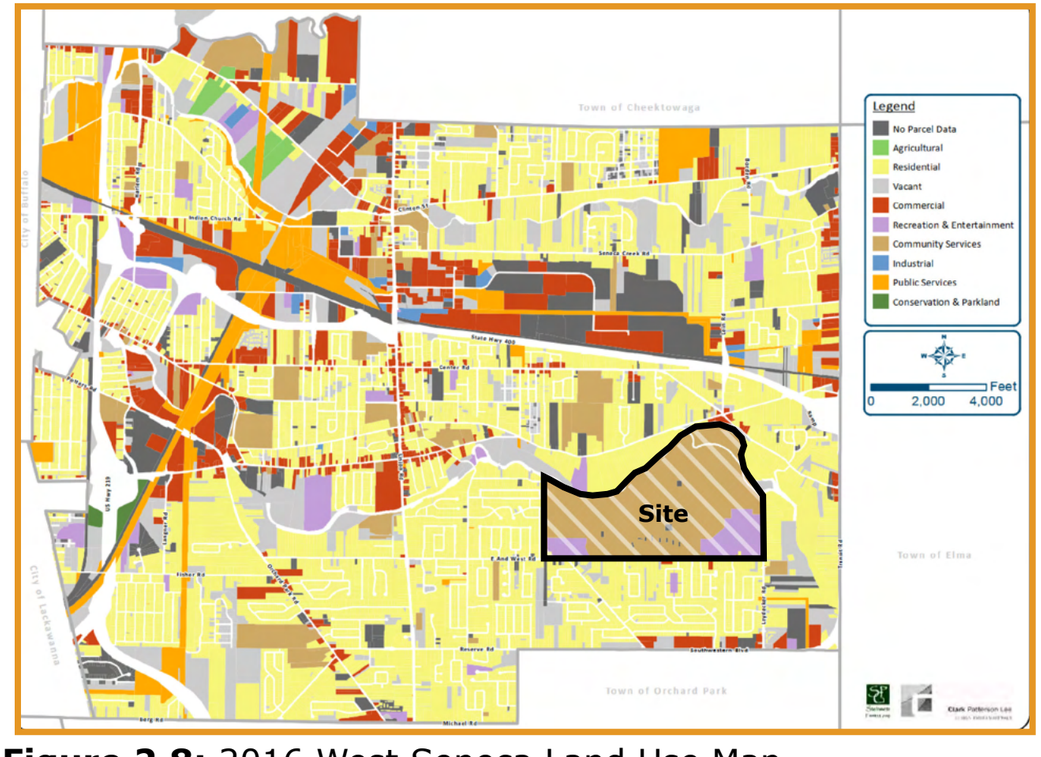
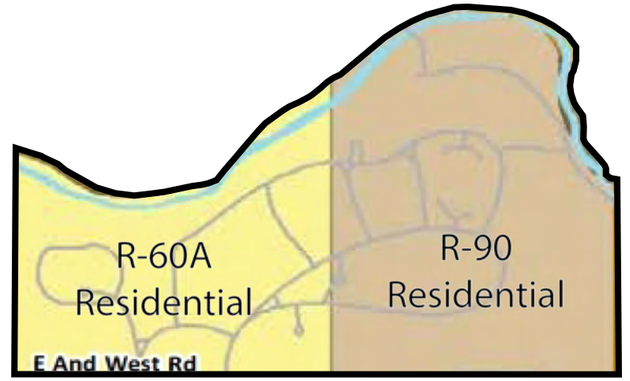


Figure 2.8: 2016 West Seneca Land Use Map

Prepared by the Town of West Seneca, as seen in the West Seneca Comprehensive Plan (2016)

As of the West Seneca Comprehensive Plan of 2016, our site is divided into two zones, R-60A to the west and R-90 to the east. Zoning code R-60A, which includes the Western New York Children's Psychiatric Center, is zoned for primarily service-based employment such as libraries, hotels, fire stations, and hospitals. Zoning Code R-90 allows for single-family residential and organized public congregational use such as private schools and churches. There currently is no explicit mention of other types of residential use under the current zoning code for the area. As it stands, the current zoning code is incompatible with any major scale development intended for residential or mixed-use. Zoning for the site will have to be entirely reworked to accommodate for such a project.



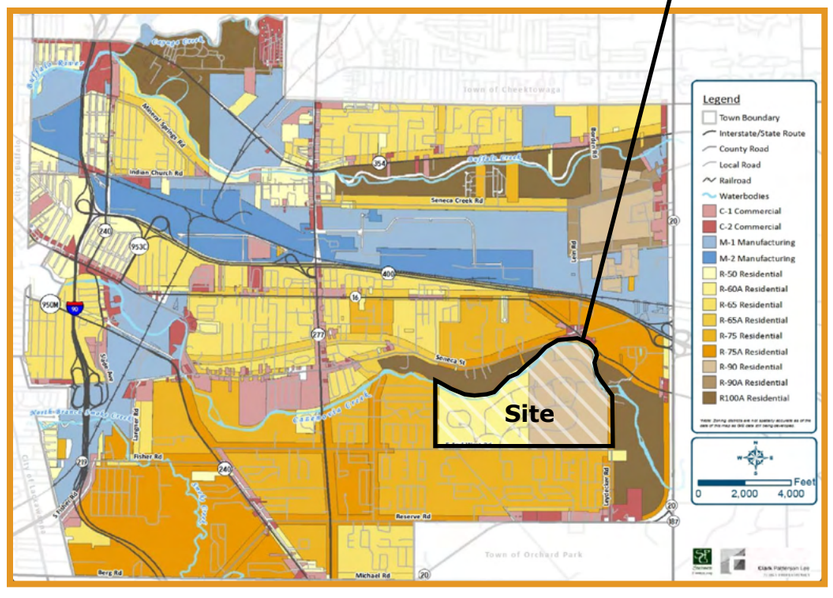


Figure 2.9: 2016 West Seneca Zoning Code Map

Prepared by the Town of West Seneca, as seen in the West Seneca Comprehensive Plan (2016)

ENVIRONMENTAL CONDITIONS

Due to size, the site has extensive environmental considerations. The site has a wide range of soil and drainage types, and a topography that lends to multiple flood plains. The site is in close proximity to Cazenovia Creek Wildlife Management Area, which protects diverse types of flora and wildlife.

Soil Contents

The predominant soil profiles on the site are Cayuga silt loam and Niagara silt loam. These fall between moderately well drained and somewhat poorly drained.[1] We have been informed that the soils on this site are appropriate for geothermal development from local experts.

Soil

- Cayuga Silt Loam
- Niagara Silt Loam

Bedrock

- Cashaqua Shale
- Limestone

There are two main geologic types on the site. The Ludlowville Formation gives the northern portion of the site a primarily limestone rock layer. Cashaqua Shale, which typically has a shallow depth to bedrock, comprises most of the southern portion of the site [5].

Figure 2.10: Site Soil Map

Source: United States Department of Agriculture Natural Resources Conservation Service

Topography

The lowest elevation on the site is 650 feet above sea level, by Cazenovia Creek. A majority of the site is between 710-730 feet above sea level, with a gradual rise in slope around the southeast area of the site, towards Sunshine Park, shown in Figure 2.11. The flood plain on this site is category AE around Cazenovia Creek, which means there is a 1% chance of annual flooding, and a 26% chance of a flood over a 30-year period. Homes or businesses in an AE category flood zone will need to purchase flood insurance and likely utilize a federally backed mortgage that mitigates the costs of flood damage. The stream is protected by the Environmental Conservation Law of New York State. This means the stream must not be altered without a permit. The stream is listed as Class B by the Department of Environmental Conservation, meaning it is suitable for recreation and fishing [4].

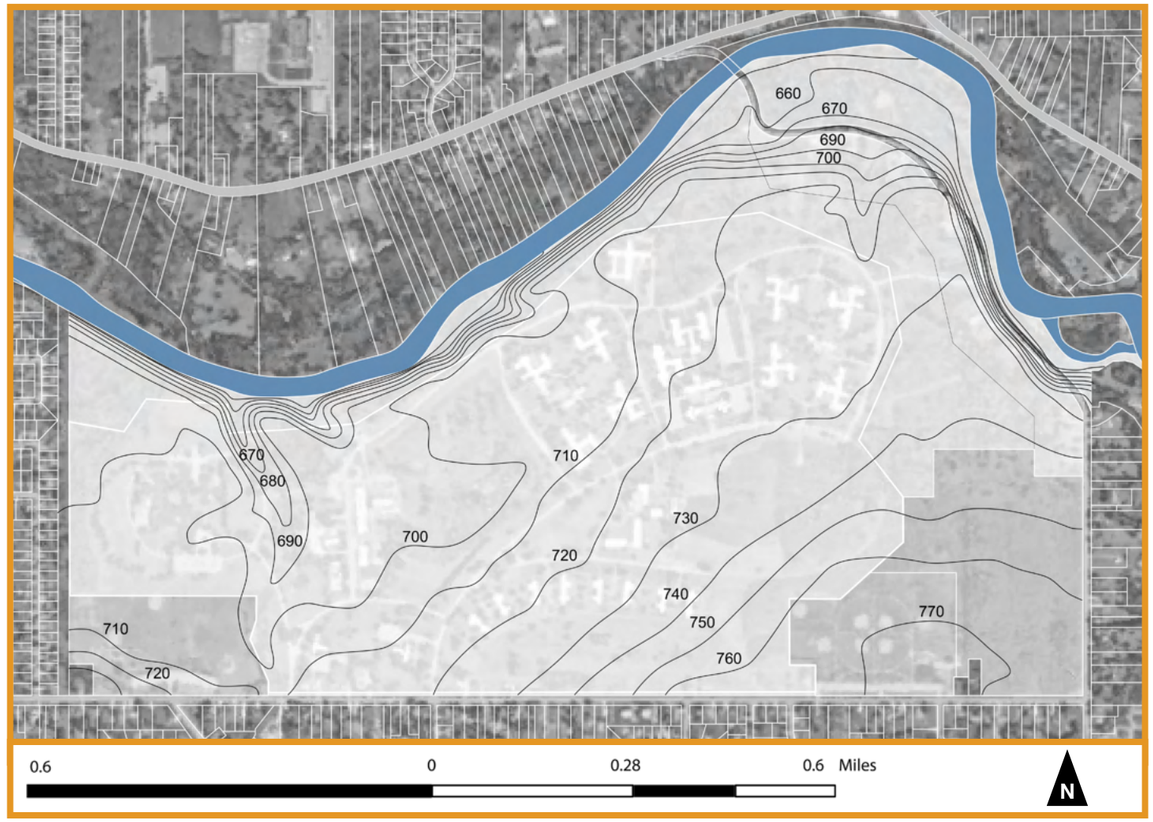


Figure 2.11: Site Topography Map

Invasive Species on Site

Ash trees on site have been infested by the Emerald Ash Borer for quite some time. Most trees die after being infected for 2-4 years. New York State's combative efforts to prevent the spread of Emerald Ash Borer includes a restriction on the movement of firewood of any tree species to within 50 miles of its source or origin. Signs of Emerald Ash Borer infestation on site are characterized by the S-shaped grooves carved by larva on the trees [3], shown in Figure 2.6. It is important to note that this infestation has affected a majority of the mature trees on the site meaning that few healthy mature trees would be displaced by the proposed development of Ebenezer Village.

Figure 2.12: Emerald Ash Borer

Image of a tree on site showing the Emerald Ash Borer infestation damage

Cazenovia Creek Wildlife Management Area

The Cazenovia Creek Wildlife Management Area is to the northeast part of the site. It is in a non-hunting area, covering about 127 acres. The property was acquired by Department of Environmental Conservation in 2015 through a transfer of two parcels of land. Allowable uses on the management area include hiking and fishing. Notable species observed in the wildlife area include songbirds, ducks, woodcocks, osprey, and bald eagles [2].

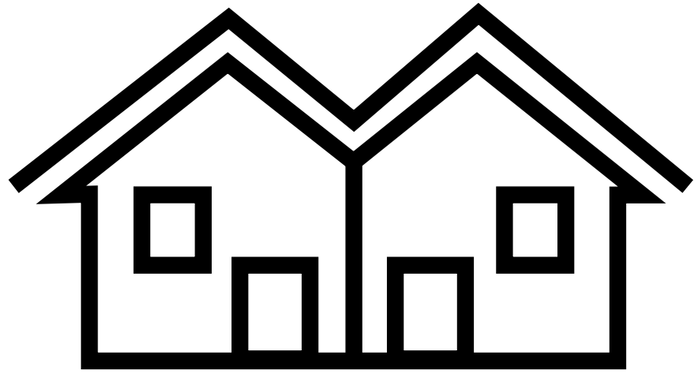
Figure 2.13: Cazenovia Creek Wildlife Management Area Signage

Table 2.2: List of Species Found in the Cazenovia Creek Wildlife Management Area

Species Found in Cazenovia Creek Wildlife Management Area		
MBTA= Migratory Bird Treaty Act	PB= Protected Bird	GS= Game (season Set)
Common Name	**Federal**	**State**
Deer	Unprotected	Game (Season Set)
Red-winged Blackbird	MBTA	PB
Eastern Bluebird	MBTA	PB
Bobolink	MBTA	PB
Indigo Bunting	MBTA	PB
Northern Cardinal	MBTA	PB
Gray Catbird	MBTA	PB
Black-capped Chickadee	MBTA	PB
Brown-headed Cowbird	MBTA	PB
Brown Creeper	MBTA	PB
Mourning Dove	MBTA	PB
Purple Finch	MBTA	PB
Great Crested Flycatcher	MBTA	PB
Least Flycatcher	MBTA	PB
Olive-sided Flycatcher	MBTA	PB
American Goldfinch	MBTA	PB
Common Grackle	MBTA	PB
Ruby-throated Hummingbird	MBTA	PB
Blue Jay	MBTA	PB
Eastern Phoebe	MBTA	PB
American Robin	MBTA	PB
Song Sparrow	MBTA	PB
Wood Thrush	MBTA	PB
Blue-headed Vireo	MBTA	PB
Red-eyed Vireo	MBTA	PB
Nashville Warbler	MBTA	PB
Northern Waterthrush	MBTA	PB
Cedar Waxwing	MBTA	PB
Winter Wren	MBTA	PB
Wood Ducks	MBTA	PB-GS
Mallard	MBTA	PB-GS
Turkey	Unprotected	PB-GS
American Woodcock	MBTA	PB-GS
Osprey	MBTA-CA2	PB-SC (Special Concern)
Bald Eagle	MBTA-T-CA2	PB-T (Threatened)
Source: New York State Department of Environmental Conservation		

LOOKING AHEAD

Currently, the site is underutilized. Utilization of the property is defined by two office buildings, and a service/repair area. Actual use encompasses a small area of the site. There are deteriorating buildings on the site that fail to meet modern standards. Overall, this is an uncharacteristically underutilized area in a well populated suburb adjacent to the City of Buffalo. Given the site's location in a residential area and lack of good road connections to major arterials, the area should remain primarily residential. This area has great potential to become a widely utilized and appreciated section of West Seneca.



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[2] "Cazenovia Creek Fish & Wildlife Management Area." Cazenovia Creek Fish & Wildlife Management Area - NYS Dept. of Environmental Conservation. Accessed May 4, 2023. https://www.dec.ny.gov/outdoor/112518.html.

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[4] FEMA, 7 May 2019. FEMA Flood Map Service Center. FEMA.

[5] NYS Museum Geology GIS. New York State GIS Clearinghouse: Unknown. 23 March, 2023.

3

Principles, Guidelines & Precedents

NYS ENERGY GOALS

The expected availability of the OPWDD site presents an opportunity to build a sustainable residential neighborhood that is apt to the future of clean energy development. The proposed Ebenezer Village is an opportunity to make West Seneca a model sustainability demonstration community. This is especially due to the amount of open space on the site. West Seneca has the capacity to utilize the geothermal industry which has become a large, sustainable industry in the country and a viable, affordable option for residential development. With the addition of other energy approaches such as Passivity in homes, which will be explained in further detail later, and the option for Solar Energy, we have come to the conclusion that this is an opportunity to build a residential neighborhood that is sustainable and apt to the future of clean energy development that is aligned with state and national ambitions. We believe pursuing sustainable development can help the community of West Seneca have access to a healthier, more resilient community that can be a neighborhood of longevity and prosperity.

It is important to pursue development that can keep up with the state's energy goals. New York State's Climate Leadership and Community Protection Act strives for 70% of the state's electricity to be derived from renewable energy sources by 2030, and 100% derived from renewable energy sources by 2040 [4]. More state and federal tax incentives, credits, and subsidies are becoming available to help residents and businesses push toward this goal.

Sustainable development is becoming a higher priority to the State of New York and its residents as the future points to cleaner, lower operating cost energy options. Our site provides an opportunity to create a model clean energy community that can be used as a precedent across the country. Due to the nature of the site's open space and the support of a local geothermal firm, Buffalo Geothermal, there is great potential to utilize this space in West Seneca to provide a future-focused sustainable project. Our recommendations are in line with the energy goals of NYS, create a state and nation-wide model clean energy community, and bring attention and investment to West Seneca.

2019

Climate Leadership & Community Protection Act signed

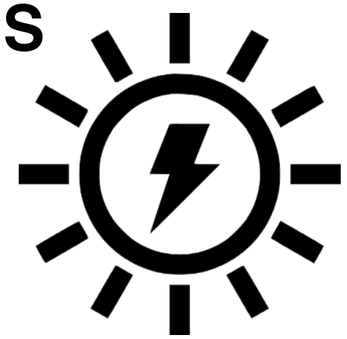
2030

70% Renewable Energy

2040

100% Renewable Energy

ENERGY ALTERNATIVES



We first approached Ebenezer Village by looking at alternative energy approaches, such as renewable energy, as a guiding principle for cleaner energy to align with NYS's zero-emissions goal.

Types of Energy

Non-renewable energy is power that is produced using fossil fuels. This includes oil, gas, and coal. These sources are not able to be replenished at the rate at which humans use them and are therefore limited within the earth. The extraction of non-renewable energy sources and use of fossil fuels can also drastically harm the environment. **Renewable energy** is an alternative approach that offers lower or no carbon emissions, creates less pollution, less **embodied energy***, and is derived from natural energy sources that can be constantly replenished. This includes solar, wind, water, geothermal, bio-energy, nuclear, and hydrogen & fuel cells [5].

Geothermal energy has been the main principle for our renewable energy approach as a viable but up-and-coming approach to sustainable residential development. There have been very few geothermal-based residential developments. However, West Seneca has the support of Buffalo Geothermal's local expertise as well as the region's expanding skill set. Secondly, we would like to emphasize that using renewable energy is a great approach that can be used in tandem with other strategies such as Passive home design principles that limit energy needs. Additionally, we recognize the benefits of including optional solar energy in residential development as well. However, we also take into consideration NYS's electricity grid goals, which aim to have an energy grid that is entirely sourced by clean energy. Therefore, this would be an optional approach on a household by household basis.

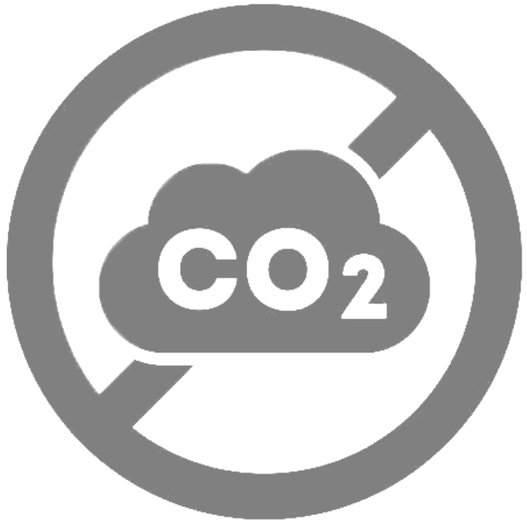
<u>Embodied Energy</u> is "the energy that is consumed in order to build a given usable object. This includes material extraction, refining, processing, transporting, and fabricating" [2]

ENERGY GOAL: ABSOLUTE ZERO

There are several energy goals that can be pursued for sustainable development with renewable energy. Upon further research we have decided to strive for an energy goal of **absolute zero**, which should not be confused with net-zero.

Net-zero is an energy goal that requires a balance between the number of emissions expended and the number of emissions reduced or removed. Thus, negating the energy in with the energy canceled to a net of zero. Net-zero is often referred to as the comprehensive state of the earth; achieving such a goal would in turn stop global warming. It is a good goal to strive for in smaller projects. In our case, we are aiming to limit the amount of energy as close to zero as possible rather than attempting to make up for our energy in emission reduction. This is because net-zero can be very difficult to measure and execute as with the inclusion of an emission reduction plan.

Our approach, **absolute zero**, is an energy goal that emits zero greenhouse gases (GHG). This goal does not require a balance or offset of emissions and removals. The main priority is using clean, renewable energy so there is no GHG emissions to offset in the first place. This is a similar approach to **greenhouse gas neutral**, which contributes to global net emissions of zero. Absolute zero is a more comprehensive approach that considers embodied energy in addition to energy sources.[5] This allows us to pursue a more realistic energy approach that is less emission-intensive.



Ultimately, striving for an energy goal of absolute zero GHG utilizing clean energy and pairing this with Passive house design principles, later discussed in our energy recommendations, West Seneca can use this site to create the first clean energy community in Western New York. Although clean energy communities are novel to the region, there are many precedents we studied where communities have created clean energy-based development. We reviewed four precedents that help inform our strategies moving forward to make Ebenezer Village in West Seneca a stand-out model clean energy community.

COMMUNITY PRECEDENTS

Precedent 1: Drake Landing Okotoks, Alberta, Canada

Drake Landing is a solar and geothermal community in Okotoks, Alberta. More than 90% of the community's space heating needs for the 52 single-family detached homes is met by solar thermal energy. It uses "seasonal solar thermal energy storage," which interfaces solar and geothermal heating systems to supply space heating year-round. Solar panels for the community are placed on the parking garages located behind the homes, allowing for the actual housing types to include more varied roof design. The most innovative part is that heat acquired in the summer is stored in a "geothermal battery" into the winter months [1].

Drake Landing's borehole thermal energy storage system is an underground network of geothermal piping used for storing massive quantities of solar heat in the summer to be used in the winter. The system consists of equidistant boreholes resembling a standard drilled well that collect heat from the surrounding soil and store it in an energy center in the top left sector of the community. When heating is needed, the energy center expunges heated water through the U-shaped pipes of the house requesting heat before returning to the center as cooled water. It took roughly three years to fully charge Drake Landing's thermal storage system. However, once it reached maximum capacity, the system was able to provide to the entire community for an entire heating season [1].

Table 3.1: Drake Landing Information List

General Drake Landing Precedent Information	
Square footage of site	~87,660 square feet (2.01 acres)
Amount of Total Housing Units	52 housing units
Unit Envelope	Super-insulated walls
Type of Alternate Energy Source Used	Hybrid (Solar, Geothermal)
Cost to Implement Alternate Energy Technology	None, already implemented on site
Amount of money saved per year on energy bills	Roughly $3,542
Housing Cost	Roughly $380,000
General Building Typology	2-story, 3-bedroom, single family
Source: Drake Landing Solar Community, retrieved from https://www.dlsc.ca/	

Figure 3.1: BTES System Installation

Figure 3.2: Drake Landing Aerial Perspective

Source: Drake Landing Solar Community www.dlsc.ca

Precedent 2: Whisper Valley Manor, Texas, US

Whisper Valley is a development outside of Austin, Texas, designed for all aspects of life, work, shopping, and play. Set on 2,607 acres, this development features parks, scenic trails, existing and planned residential neighborhoods and emergency services, retail, office space, and a transportation center [6]. Not only is this a new style of community, but it also prides itself on being energy sustainable. With the use of geothermal and solar energy systems, Whisper Valley uses two-thirds less energy than the average home according to the developer. These houses also receive 26% tax credits on solar energy. Whisper Valley also has community gardens [6].

Whisper Valley is being planned in multiple phases. It is currently envisioned to be a 7,700-home community, built around seven different town centers. Houses start in the mid $300,000, on par with the average cost of a new build in West Seneca currently. The cost to implement solar and geothermal energy is included in the build. Residents' houses receive between a 20-26 HERS (see previous chapter for definition) rating on their homes. There are different developers handling the buildings on a phase-by-phase basis [3].

Table 3.2: Whisper Valley Information List

General Whisper Valley Precedent Information	
Square footage of site	113,560,920 square feet (2,607 acres)
Amount of Total Housing Units	7,700 (planned)
Type of Alternate Energy Source Used	Geothermal and Solar
Cost to Implement Alt. Energy Tech	None, already implemented on site
Tax Credit Received	26%
Housing Cost	$300,000 and up
General Building Typology	1 story and 2 story single homes
Source: Whisper Valley, retrieved from https://www.whispervalleyaustin.com/	

Figure 3.3: Whisper Valley Home Examples

Source: Google Street View

Precedent 3: Eversource Geothermal Pilot Project Framingham, Massachusetts, US

A neighborhood in Framingham, Massachusetts is currently being renovated, converting its energy source to geothermal energy. The Geothermal Pilot Project is meant to bring a cost-effective, low-carbon source of heating and cooling to residents, businesses, and municipal facilities. This project is due to be completed by the end of 2023 [3]. If successful in this neighborhood, it may be expanded further within Massachusetts. As this is a new technology, a lot of community outreach has taken place, educating residents on the benefits of geothermal energy.

Though already constructed, and going under redevelopment, the community will maintain its identity. The addition of geothermal will simply be a new energy source, in hopes to create a more energy-efficient community. The plan consists of 45 buildings, 30 of which are residential. The program is intended to pay for the building cost and installation, while the residents pay a low cost monthly for access to the geothermal network, and the energy required to power the pump [3].

Figure 3.4: Geothermal Installation

Table 3.3: Framingham Information List

General Framingham Precedent Information	
Square footage of site	2,610,000 square feet (60 acres)
Amount of Total Housing Units	30
Type of Alternate Energy Source Used	Geothermal
Cost to Implement Alt. Energy Tech	access
Source: Eversource Geothermal Pilot Program, retrieved from https://www.framinghamma.gov/3416/Geothermal-Pilot-Program	

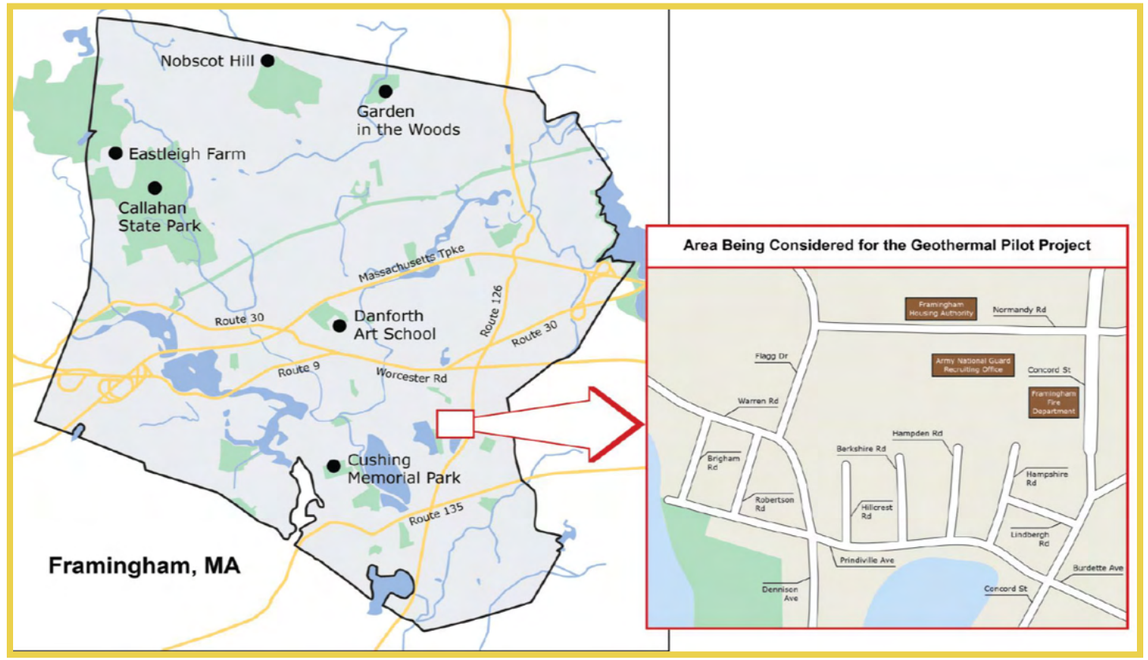


Figure 3.5: Framingham Site Plan

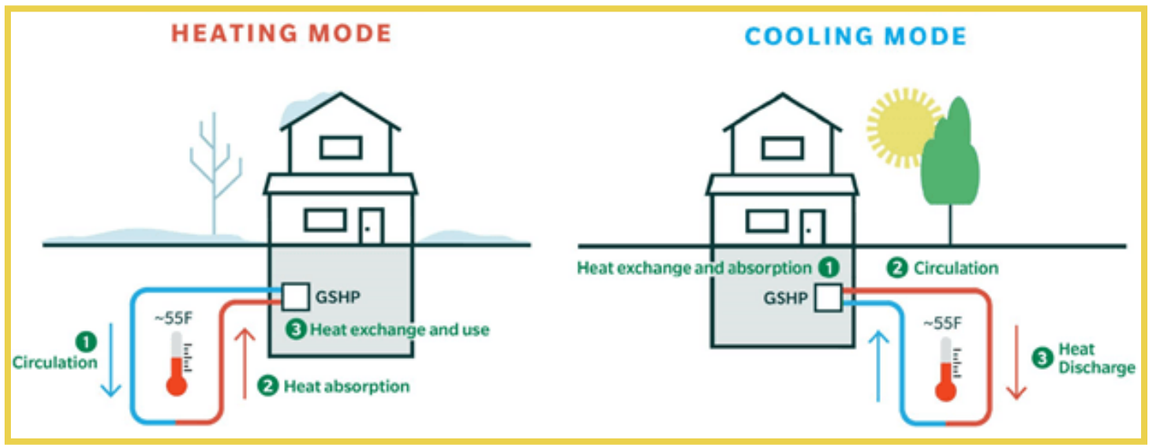


Figure 3.6: Framingham Ground Source Heat Pump Diagram

Source: Eversource Geothermal Pilot Program
https://www.framinghamma.gov/3416/Geothermal-Pilot-Program

PASSIVE CONSTRUCTION

Geothermal is the main priority of Ebenezer Village, but we also recommend a secondary supplemental strategy of passive design. While energy sources are an important aspect of development, we also recognize that there is a large benefit to non-active energy approaches, referred to as passive approaches, to be used in conjunction with active energy approaches.

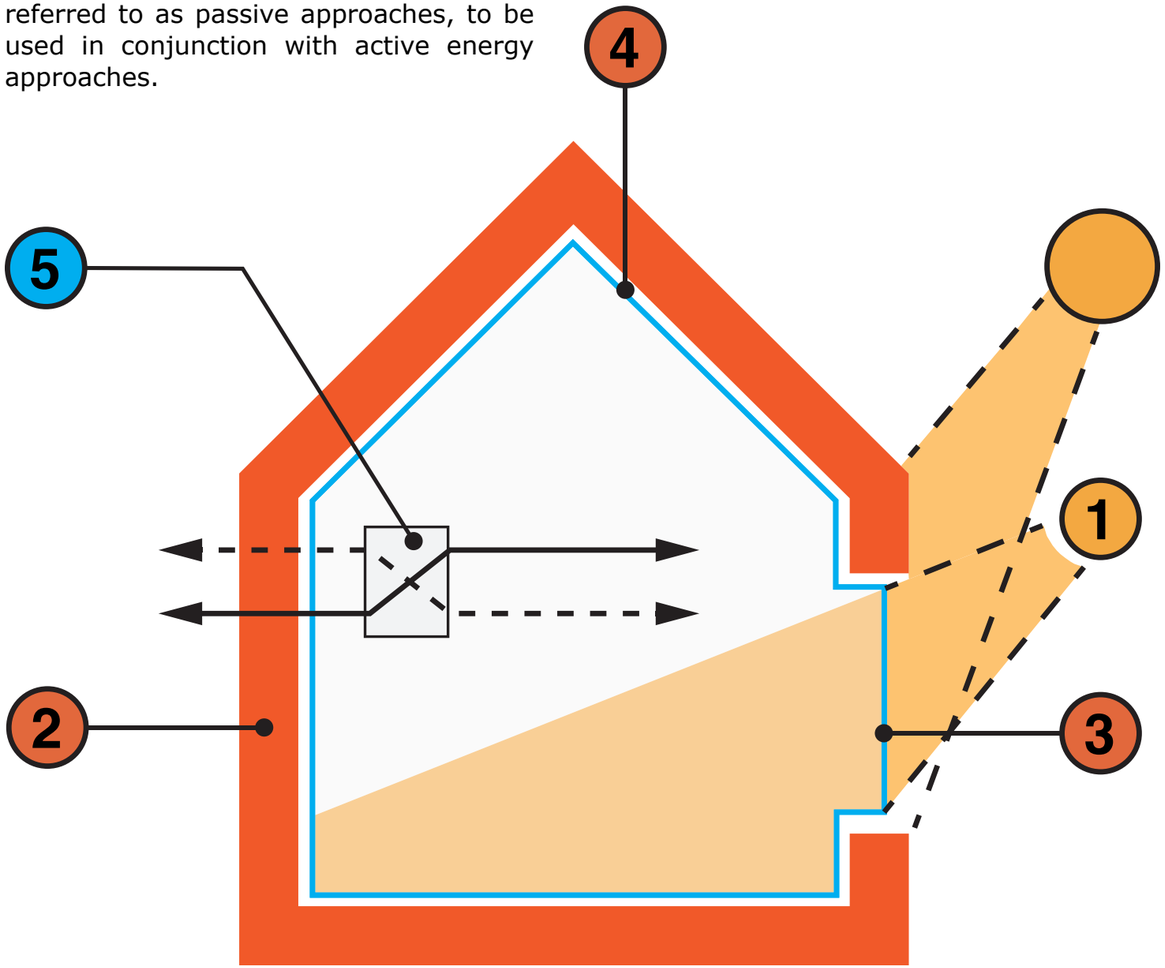


Figure 3.7: Passive House Principles Diagram

Source: Passive House Accelerator
https://passivehouseaccelerator.com/articles/five-principles-of-passive-house-design-and-construction

Passive Principles

Passive construction is a fundamental building strategy that addresses energy use at the design level. While 'Certified Passive Homes' are a high standard to achieve, it is important to utilize the core principles in residential construction whether a home becomes certified or not. Designing a home with passive principles can help reduce the energy required greatly. Therefore, limiting the amount of energy needed to heat and cool a home further reduces the amount of emissions expelled.

While 'Certified Passive Homes' can lower heating and cooling energy by up to 90% in comparison to conventional homes, striving for homes that have *some level of passivity* would be a large benefit to lower the total energy needed. Using geothermal is an efficient renewable way to heat and cool in residential, commercial, and mixed-use buildings. Lowering the amount of heating and cooling needed to begin with would assist in lowering carbon emissions.

1 SOLAR ORIENTATION

By properly orienting a home with the fenestrations, a home can utilize solar heat gain in the colder months, and with proper solar shading, preventing heat gain in the warmer months.

2 HIGH INSULATION

Super-insulating a home's exterior walls, roofs and floors can increase heat resistance and maintain home temperature for long periods of time, even with power failure.

3 HIGH PERFORMANCE WINDOWS

Windows cannot be as highly insulated as wall, roofs and floors, but increasing the number of glass layers, adding insulating gas such as argon, and coating finishes can increase window performance.

4 AIR-TIGHT ENCLOSURE

Reducing leakage is imperative to reduce thermal bridging. Proper installation of building elements ensures that the performance of these elements such as walls and windows are working at their full extent.

5 BALANCED VENTILATION HEAT RECOVERY

Due to air-tight enclosures, it is important that there is proper ventilation to bring fresh air in and exhaust inside air. Passive Homes use a Heat Recovery Ventilator (HRV) which does not mix 'in' and 'out' air streams.

ENERGY RANKING

In collaboration with Buffalo Geothermal, we were able to conduct five simplified energy models with varying home specifications to see the annual energy emitted. We looked at traditional construction methods using the 2020 IBC (International Building Code), levels of passivity, and the use of geothermal. This study was used to see just how efficient homes could be utilizing Passivity and Geothermal. Ultimately, we found that utilizing geothermal and passivity can greatly reduce the amount of energy required to run a home. Additionally, we recognize that current energy codes are much more intensive than older homes, and the use of these energy strategies can make some homes very close to a **Zero Energy Home**. While traditional construction 2020 IBC homes are not necessarily inefficient homes, compared to older construction, they fall into average energy efficiency, see HERS Index, Figure. 3.9. 2020 IBC homes that use typical heating and cooling methods powered by electricity, however, are not able to reach an energy goal of Absolute Zero. In Figure 3.8 you can see that homes that do not use geothermal energy, Home #1 and #3, have significantly higher energy outputs than those that do, Home #2, #4, and #5. Home #2, #4, and #5 all use geothermal, but homes #4 and #5 use passivity. Based on these calculations, we are striving for homes to land around Home #4 in terms of energy performance.

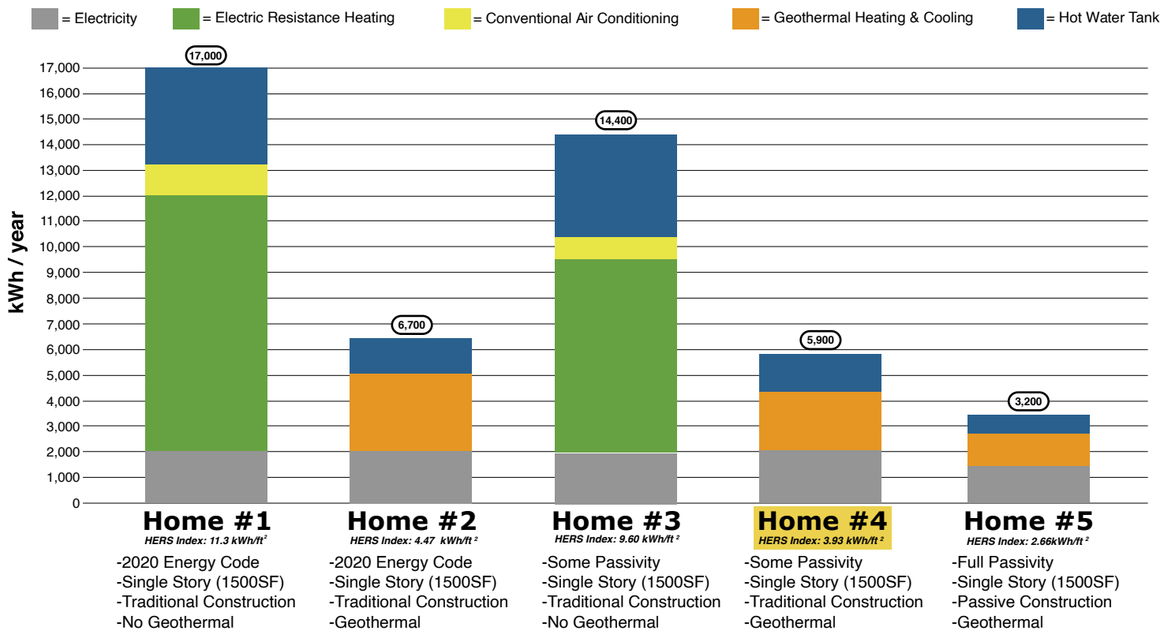


Figure 3.8: Annual Energy Savings Comparisons - 2023 Estimates
Passivity and Geothermal Specifications

A home's energy efficiency can be ranked when implementing these energy strategies. (HERS) The Home Energy Rating System, is a useful index to compare the energy efficiency of homes to understand how the implementation of geothermal energy and passivity can greatly reduce annual energy and therefore lower the amount of greenhouse gases.

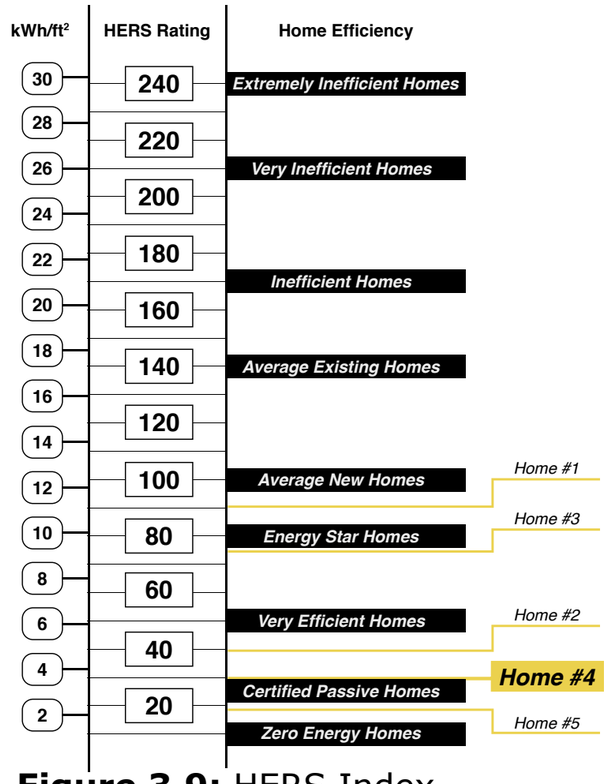


Figure 3.9: HERS Index

Source: Resnet HERS Index https://www.hersindex.com/hers-index/what-is-the-hers-index/

We are anticipating most homes to land within the HERS index number of 20-40. Per Figure 3.8, homes that do not utilize geothermal or passivity are well above that range, landing toward home inefficiency, while homes that utilize geothermal and passivity are much closer to achieving absolute zero. The addition of the clean energy grid NYS is pursuing, these homes could soon be fully 'zero-energy homes'.

Optional Solar Electricity

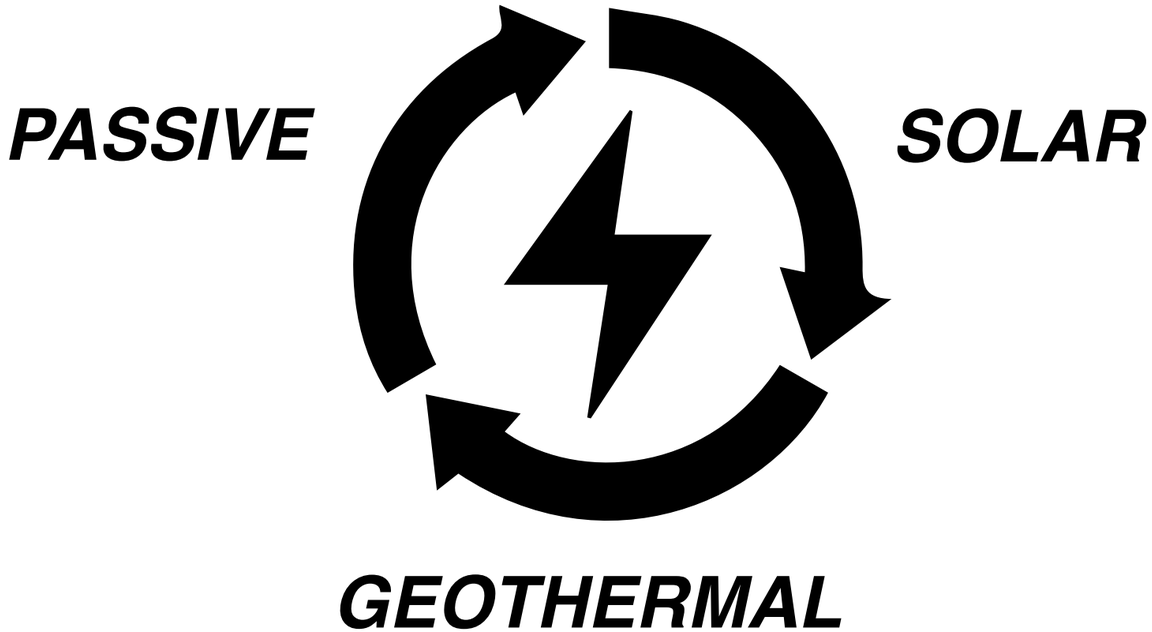
Moving away from natural gas means that there is a shift to electric energy. However, electricity is often more expensive than natural gas. Therefore, implementing passivity in homes, as well as geothermal will help ease the amount of electricity needed. While geothermal systems require electricity for the ground pump, a home with passivity will reduce the amount of heating and cooling needed overall, therefore reducing electricity needed.

If a homeowner wanted to achieve absolute zero on their own, it is recommended that buildings utilize solar 'PV' panels on an individual basis to power the ground pumps required in a geothermal system. However, we recognize that NYS may be able to provide a completely renewable electric grid that corresponds with their energy goals of 2040.

CLEAN ENERGY COMMUNITY

The goal of Ebenezer Village is to create a "clean energy community" that promotes sustainable lifestyles and carbon-conscious approaches to residential development through geothermal energy and passive construction. Approaching the site development with these large energy goals in mind, we recognize that we are limited in the feasibility of a true absolute-zero approach. However, we believe that pursuing site development that promotes renewable energy in the form of geothermal energy as a primary focus in addition to other sustainable attributes, such as passive house principles, we can create a new, clean energy forward community in West Seneca. This can set the stage for other clean energy communities around the country.

Our goal home incorporates geothermal energy, has some level of passivity, and recognizes solar energy supplementation



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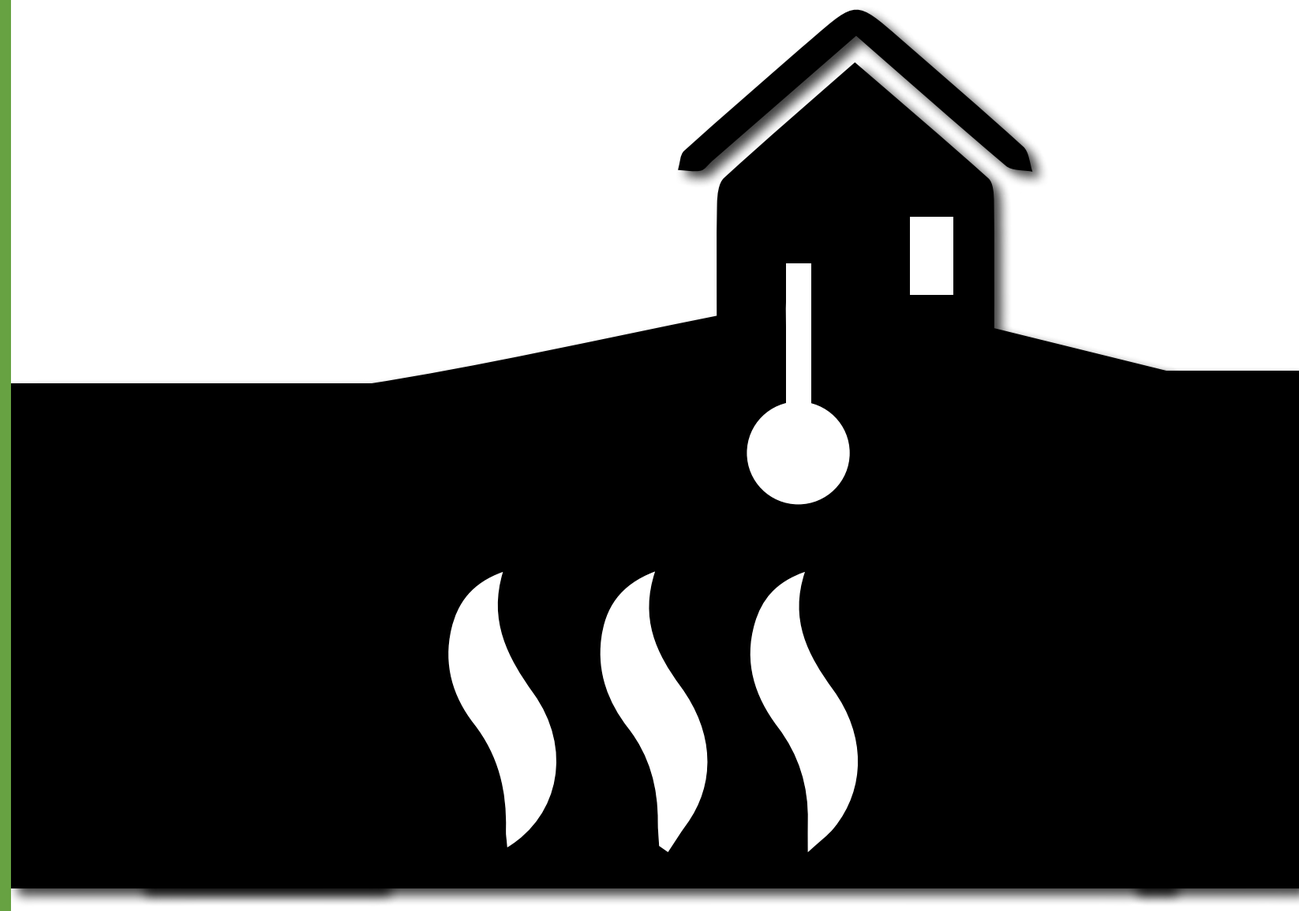
4

Building a Geothermal Community

OVERVIEW

Community geothermal heating and cooling is a promising, safe, and effective part of the solution to achieving a clean energy community. Ebenezer Village, given its size and unspoiled greenfield potential, is particularly well suited for a community geothermal system. Community geothermal systems are a cutting-edge research topic in urban planning. West Seneca has the potential to establish a one-of-a-kind model geothermal community. We anticipate that this model village will generate attention for West Seneca on a worldwide scale. Beyond the novel aspects of community geothermal, it is a legitimate, practical, and efficient method of heating and cooling Ebenezer Village. This chapter will examine how geothermal works, its benefits, routes of achieving a geothermal community, costs and funding opportunities to collaborate with NYS Electric and Gas (NYSEG), and our ultimate recommendations for Ebenezer Village.



WHAT IS GEOTHERMAL?

Geothermal systems supply the heating and cooling needs of a building by using the earth's constant temperature, roughly 55 degrees, mere feet below the surface. An indoor heat pump in tandem with buried underground piping loops works to exchange thermal energy between the ground and the connected building. Geothermal systems use a mix of water, antifreeze, and refrigerant as the heat exchange fluid. In the colder months, the system draws the warmer temperature from the underground loop into the building. In the warmer months, the heat pump removes heat from the air and returns cooler air throughout the building. Figure 4.1 demonstrates a ground source system operating in heating and cooling modes.

Horizontal & Vertical Loops

Horizontal and vertical piping are the two main options for installing an individual geothermal system. Horizontal geothermal piping, consisting of a set of loops, is laid in trenches 8-10 feet below the surface of a building's property. Horizontal geothermal piping is coiled, in a similar fashion to a slinky toy. Horizontal geothermal is particularly well suited for detached, single buildings with adequate space to install the piping "loop field", the combined area of the geothermal trenches and required setbacks from neighboring properties. Where conditions are appropriate, horizontal loops are less expensive than vertical boreholes.

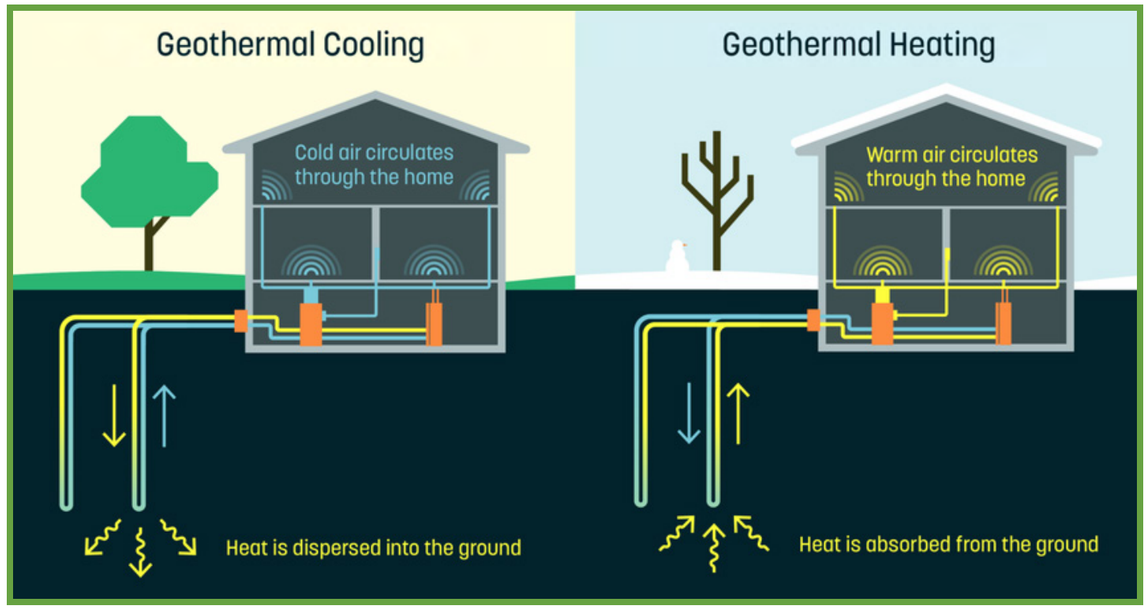
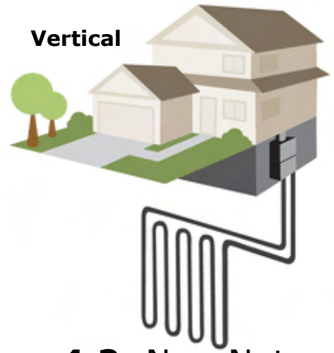


Figure 4.1: Seasonal Geothermal Heating & Cooling Diagram

Source: RMI Clean Energy 101 https://rmi.org/clean-energy-101-geothermal-heat-pumps/

Vertical systems require drilling deeper into earth's surface. Rather than being coiled along a property in trenches, vertical geothermal piping is laid in a borehole about 200-500 feet below the earth's surface. Vertical geothermal systems are frequently "networked", meaning that multiple buildings share the heating and cooling supplied by the vertical boreholes. This type of system is better suited for denser, more urban settings where the space for geothermal piping is limited, and a horizontal loop field is not possible.

Home design plays a major role in the efficiency of geothermal systems. Homes built in line with passive house principles require very little energy to meet their heating and cooling needs. By reducing the heating and cooling needs of a house by roughly 80% compared to a conventional house, very little additional input is required. Geothermal is an excellent option to meet this need. The only utility required to run a geothermal system is the electricity for the heat pump. Electric bills would still be minimal with a passively designed home with a geothermal system. Such a system could meet functional heating and cooling independence.



Networked & Non-Networked

There are two routes a locality may choose in establishing a geothermal community, each with their own advantages and disadvantages. Networked and non-networked geothermal systems are two approaches to achieving a community geothermal system. Both are related to whether the community shares thermal load across a connected system of piping and geothermal loops.

In a non-networked system, shown in Figure 4.2, each building has its own geothermal system that is totally independent of other buildings. This approach is particularly well suited for residential and suburban communities with adequate space. A non-networked system allows for individual homes to install horizontal geothermal systems, where geothermal piping is run around a parcel mere feet below the ground. This avoids vertical borehole drilling for individual residences. Certain aspects reminiscent of networking may be present in a non-networked system. For example, larger, multistory buildings may be connected to shared vertical boreholes in cases where there isn't adequate space to set up a horizontal piping system for the thermal load these types of buildings require.

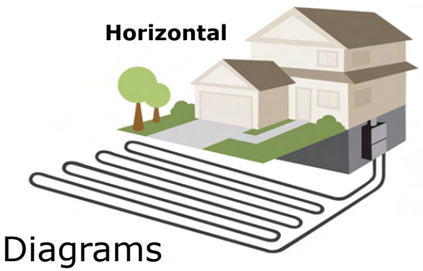


Figure 4.2: Non-Networked Geothermal Diagrams

Source: Manitoba Hydro https://www.hydro.mb.ca/your_home/geothermal_heat_pumps/components/

Networked systems, shown in Figure 4.3, differ in that the geothermal utility is connected and shared by several or all the buildings in the community. Rather than residences having their own horizontal loop fields, buildings are typically connected to shared vertical boreholes. This type of system is typically implemented when connected buildings have complementary energy uses. For instance, heating can be exchanged between a residential building needing warmth and a building with an ice rink. Alternatively, geothermal heat can be moved from buildings having nighttime demand (homes) to those having daytime demand (schools, businesses).

The remainder of this chapter will examine the benefits of geothermal in greater detail, an overview of types of geothermal communities, costs and funding, potential collaboration with electric utilities, and our ultimate recommendations for Ebenezer Village.

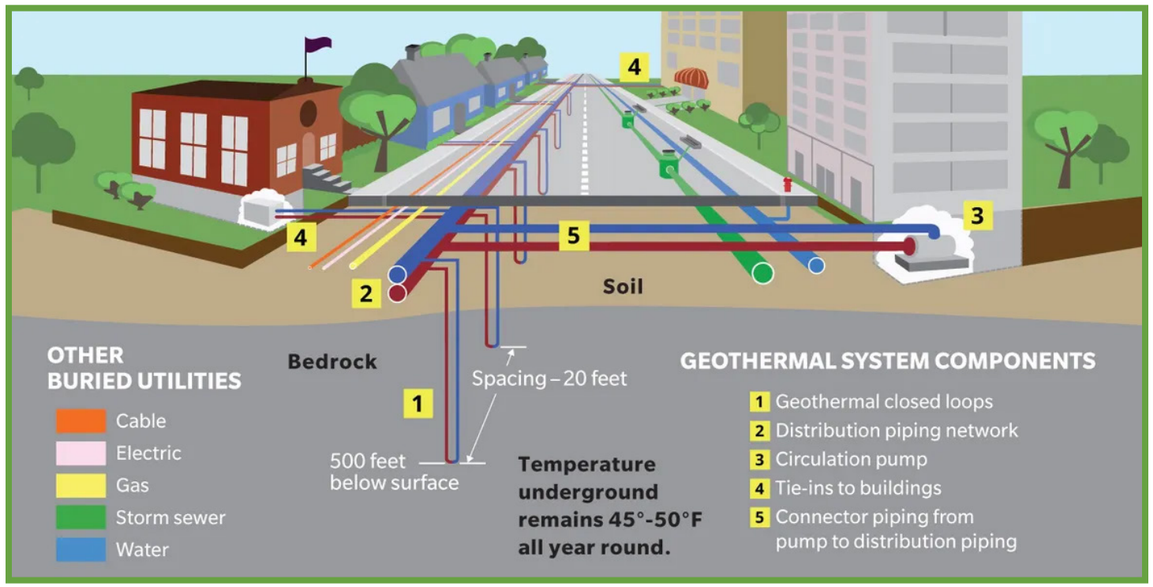


Figure 4.3: Vertical-Networked Community Geothermal Diagram

Source: Eversource Energy
https://www.canarymedia.com/articles/utilities/a-net-zero-future-for-gas-utilities-switching-to-underground-thermal-networks/

BENEFITS OF GEOTHERMAL

Geothermal systems offer many advantages such as:

Sustainability

Geothermal systems are environmentally friendly because they use no fossil fuels and use a small amount of electricity to run the heat pumps. Geothermal systems are the most environmentally friendly way to heat and cool buildings, according to the US Department of Energy and the Environmental Protection Agency [4]. They do not emit greenhouse gases and avoid urban air pollution.

Longer Lifespan

The loop field's one-time installation is expected to last 50 to 100 years. Because geothermal systems are underground and indoor systems, they are not subject to wear and tear from rain, snow, ice, debris, extreme temperatures, or vandalism. As a result, they are very reliable systems that require little maintenance. The heat pump lasts for 20-25 years, comparable to other household appliances.

Lower Operating Costs

Geothermal systems reduce monthly heating, cooling, and hot water bills by up to 70% in a conventional house. In a passive house, the heating and cooling bills should completely disappear, except for pumping costs (electrical costs are already lowered with passive house design).

Positive Return on Investment

Though initial installation is expensive, the homeowner benefits from far lower energy bills, long system lifespans, and government subsidies and rebates.

NON-NETWORKED GEOTHERMAL

A non-networked geothermal system is a possible heating and cooling solution for a large portion of Ebenezer Village. This type of system requires each individual building to have its own ground source heat pump and geothermal piping loop field. This is a particularly attractive option for residential neighborhoods of Ebenezer Village. Since most of the village's proposed housing is single-family residential, in line with the surrounding West Seneca community, the space for this type of system is available. Each single-family residence has the required parcel size to accommodate the necessary geothermal piping. There is even an opportunity for geothermal contractors to work with homebuilders to shrink the loop field size by wrapping it around the foundation or basement of a building.

There are initial cost savings expected with a non-networked community geothermal system. Since horizontal systems are only 6-10 feet deep, vertical borehole drilling is not necessary. Buffalo Geothermal uses excavators and backhoes to dig loop field trenches. Usually, this work is done separately for each building, requiring expensive shifting of the equipment from place to place. In our proposed Ebenezer Village system, installations can be dug and filled quickly and in succession, generating economies of scale. In short, we have received estimates that the economies of scale will reduce installation costs per residential unit by about 15%.

There is also increased efficiency associated with a non-networked geothermal system. Since each system is self-contained, there is not reliance on sharing thermal load with other residences or buildings. Each building draws and consumes its own heating and cooling needs. This is particularly relevant for residential buildings due to personal heating preferences and near 24-hour heating during the winter months.

Figure 4.4: Horizontal Geothermal Installation

Excavator digging the trenches to lay the geothermal loopfields

Source: Home Guide https://homeguide.com/costs/geothermal-heat-pump-cost

Tables 4.1 and 4.2 have important considerations for designing a non-networked geothermal neighborhood. These tables outline the typical thermal requirement per hour of a home and the required loop field trenches and size for a home being considered for Ebenezer Village. Note that BTUH is an acronym for British Thermal Units Per Hour. Cooling and heating capacities are measured in BTUH. As shown in Table 4.2, a typical 1500 rectangle one-story residence requires 18,500 BTUH. In this BTUH category, this type of home would require only three geothermal trenches and a 1600 sq. ft. loop field size. A larger home with higher heating requirements, for instance, would require up to as many as seven geothermal trenches with a loop field size of 4100 sq. Ft.

These tables are relevant to conventionally built modern homes. The BTUH range and corresponding number of geothermal trenches can be greatly reduced should the homes in Ebenezer Village be built with passive home design principles.

Table 4.1: Required Geothermal Trenches & Loopfield Size

Required Number of Geothermal Trenches & Loopfield Size for Typical Homes			
BTUH Range	**Number of Trenches**	**Loopfield Size (sqft)**	**Loopfield Size including Setback (sqft)**
12,000 to 19,000	3	1600	4000
19,000 to 27,000	4	2300	4800
27,000 to 35,000	5	2900	5600
35,000 to 43,000	6	3500	6400
43,000 to 51,000	7	4100	7200
Data provided by Buffalo Geothermal			

Vertical boreholes can be implemented with a non-networked geothermal system. This would make sense for larger buildings where the space for a horizontal loop field may not be sufficient or affordable. Developers may opt to install vertical boreholes for apartment buildings and institutional buildings, for instance.

It is our recommendation that a majority of Ebenezer Village use non-networked, horizontal geothermal systems. We reached this recommendation based on the following factors: relative ease of installation, lack of complementarity with thermal demand (homes usually have very similar thermal demands), and cost savings. Independent systems will be most desirable for single family residential, the predominant component of Ebenezer Village. Non-networked geothermal systems in the residential neighborhoods of Ebenezer Village will also be easier and less expensive to install, as trenches can be dug in succession before homes are built. We expect advantages of geothermal networking to be critical in other parts of Ebenezer Village, examined later in this chapter.

Table 4.2: Heating Needs of a Typical Home

Heating Needs of a Typical Home			
Building Size (sqft)	**Shape**	**Stories**	**Annual Heating & Cooling Energy Load (BTUH)**
1000	square	1	15,000
1000	rectangle	1	16,000
1000	square	2	17,500
1000	rectangle	2	18,500
1500	square	1	15,500
1500	rectangle	1	18,500
1500	square	2	20,250
1500	rectangle	2	22,000
2000	square	1	21,000
2000	rectangle	1	21,500
2000	square	2	18,250
2000	rectangle	2	19,000
Data provided by Buffalo Geothermal			

COSTS & FUNDING OF NON-NETWORKED GEOTHERMAL

Due to the nature of geothermal heat source pump systems, costs can add up to become quite expensive. Typically, the costs of geothermal systems are dependent on the various components and processes needed. Costs are divided between the price of equipment, materials, and labor. Equipment costs include the price of the heat pump and its components. Material costs include the piping and geothermal fluid as well as any duct work needed.

Geothermal heating requirements are often expressed in "tons" of capacity. A ton is equated to 12,000 BTUH. About 500 feet of piping is needed per ton of capacity for the heat pump. Typically, three-ton systems are used. Heat pumps can cost $2,500 to $5,000 per ton. If passive home design is implemented, the BTUH can be reduced. This means fewer tons can be used, saving costs.

New York State has a variety of options for funding to make geothermal heating systems more accessible. The New York State Energy Research and Development Authority (NYSERDA) has a Clean Heat Program that provides incentives for residences. These programs are operated as community campaigns that are partnered between the local utility companies and NYSERDA.

In Erie County, NYSERDA and National Grid have partnered with PUSH Buffalo (People United for Sustainable Housing) to create and support the PUSH for Clean Heat outreach program. This program helps residents in Erie County by providing information and resources regarding incentives, rebates, and financing for clean heating and cooling in their homes (including geothermal heat source technology). NYSERDA has also partnered with many contractors that can provide free energy assessments to help residents evaluate the types of systems they need and more. In Erie County alone, there are 29 contractors who are available for this service.

Federal tax credits for geothermal systems are available as part of the Inflation Reduction Act of 2022, The Energy Policy Act of 2005, and the Consolidated Appropriations Act of 2021. The Residential Clean Energy Tax Credit allows existing homes and new constructions to receive credits if using Energy Star systems.

Table 4.3 is a list of different incentives and subsidies available to homeowners in New York State. The table breaks down the funding available for households to help pay for installing geothermal systems and how this affects the cost. This is a list of various sources, both state and federal, of funding types that homeowners can take advantage of. The federal and state tax credits are blanket incentives available that will benefit most homeowners. These two credits alone can result in a reduction of 55% of the cost of installation. The remaining incentives reflect efforts made by New York State to meet clean

energy goals. Utility companies provide incentives based on the parts purchased for the heating and cooling system. This requires the parts to meet certain Energy Star and New York State standards of efficiency. An extra incentive can also apply if a desuperheater is installed. A desuperheater is an additional part that is optional in a geothermal system but can allow for homes to have their water heated by geothermal energy as well.

New York State Clean Heat program has additional funding available to lower-income homeowners. Based on certain income eligibility requirements, Clean Heat funding will cover significant portions of energy efficiency upgrades in a home. If a homeowner is ineligible for this funding, NYSERDA has a variety of loan options available. Overall, these funding sources can add up to significant savings.

Table 4.3: Heating Needs of a Typical Home

Sources of Funding for Home Geothermal Heating Systems, 2023		
Type of Funding	**Funding Sources**	**Details of Funding**
Federal		
Federal Tax Credit	Residential Renewable Energy Tax Credit	30% Tax Rebate applied to existing homes and new constructions with GHSP
Federal Tax Credit	Inflation Reduction Act of 2022	Tax credits and deductions for single-family and multi-family homes with energy efficient systems.
New York State		
State Tax Credit	Geothermal Energy System Credit	Covers 25% of the cost, up to $5,000. Homeowners must fill out tax form IT-267 to receive this credit.
Utility Incentive Program	New York State Electric and Gas Incentives	NYSEG provides incentives depending on the components installed. $1,500 per 10k BTUH of heating. Additional $100 with a desuperheater. Equipment must meet Energy Star and New York State standards & criteria.
NYSERDA Clean Heat		
Energy Efficiency Funding Program	EmPower New York	Eligible residents must be making 60% or less of New York State's median income. Covers 100% of the cost for energy efficiency upgrades, up to $8,000
	Assisted Home Performance with Energy Star	Financing program for income-eligible households to make energy efficiency home upgrades. The program covers 50% of the cost, up to $5,000 to single-family households.
Financing with a NYSERDA Loan	Smart Energy Loan	Loan Amount: $1,500 to $25,000 Loan Term: 5,10, or 15 years Loan Type: Unsecured (Requires no collateral) Interest Rate: 3.49% or (3.99% if paid by check) The On-Bill Recovery Loan is paid through added charges to resident's utility bill.
	On-Bill Recovery Loan	
	Renewable Energy Tax Credit Bridge Loan	
	Companion Loan	If above loans exceed their caps, residents can apply for the companion loan. The only difference is the interest rate is raised to 6.49% or (6.99% if paid by check).
Sources: Energy Star, NYS Tax Code, National Grid, and NYSERDA		

NETWORKED GEOTHERMAL

Networked geothermal is a potential solution for larger, denser settings in Ebenezer Village. This type of geothermal is more like a traditional utility like electric or gas: the geothermal infrastructure is shared among buildings rather than independent of each other. We expect networked geothermal to be implemented in what we will call "Ebenezer Commons." It will consist of multi-use buildings and multi-unit apartment complexes, along with an iconic greenhouse/winter garden/pavilion structure. These will be described in future chapters.

Networked geothermal requires vertical borehole drilling for geothermal piping. These boreholes are typically 300-500 feet in depth below the earth's surface. Vertical drilling has a more expensive installation cost than horizontal digging, but fewer boreholes need to be drilled. Figure 4.5 shows how networked geothermal systems operate in a city setting.

The most groundbreaking and ambitious models for networked geothermal are called District Heating and Cooling Systems. This is a networked module where a centralized system provides heating and cooling to multiple buildings or facilities from a centralized repository. These systems enable the efficient transfer of thermal energy to the connected buildings by distributing thermal energy (in the form of hot water, steam, or chilled water) through a network of underground pipes. While district cooling systems are typically used to cool big buildings and facilities like hospitals, data centers, and universities, district heating systems are frequently used to heat residential, commercial, and industrial buildings. The primary advantages of DHC systems are increased energy efficiency, lower carbon emissions, and increased energy security.

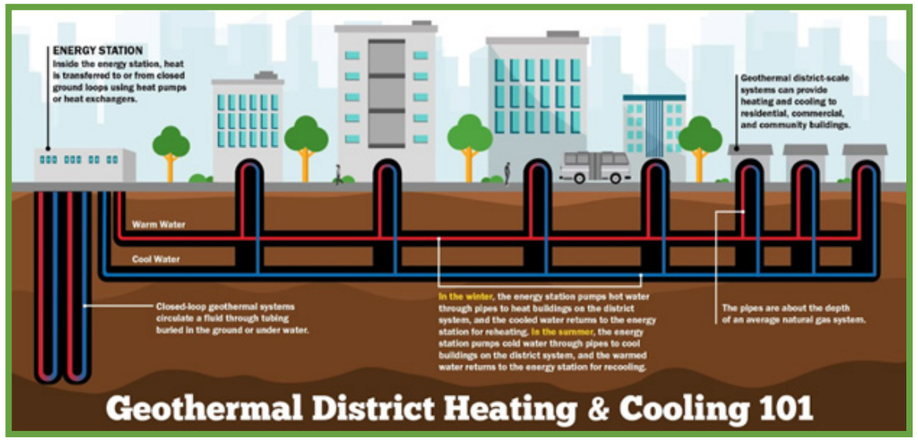


Figure 4.5: Networked Geothermal System Diagram

Source: U.S. Department of Energy https://www.energy.gov/eere/geothermal/articles/community-geothermal-heating-and-cooling-design-and-deployment

Figure 4.7 depicts the evolution of district heating and cooling through five different development stages, or generations.

The first district heating network was built in the 1870s in Lockport, New York, using steam as a heat carrier [8]. Because steam posed a high risk of explosion, it was replaced in the second generation by pressurized water. Because traditional radiators in buildings were designed to cover space heating at around 176 degrees Fahrenheit, a new generation with lower supply temperatures was developed. The new third generation, also known as Scandinavian district heating, was designed to operate at a network temperature of approximately 176 degrees Fahrenheit. Despite its widespread use today, this generation faces several challenges. For example, centralized heat production causes high thermal heat losses. Furthermore, the third generation limits the incorporation of low-heat renewables such as shallow geothermal and solar thermal, which can reduce carbon emissions. The fourth generation addressed these issues by lowering the operating temperature of the network to 104 degrees Fahrenheit. Despite the significant reduction in network temperature, the fourth generation still has two major issues. For starters, the network does not provide both heating and cooling via the same pipe network. Second, centralized heat production restricts network expansion [9].

These challenges are met by today's cutting-edge fifth-generation district heating and cooling systems). Fifth-generation district heating and cooling capitalizes on synergies between connected buildings with concurrent heating and cooling demands. This type of system us still in development, and is not widely in use. The heat carrier in the pipes can flow in either direction due to demand simultaneity, resulting in a bidirectional network. This generation of the network is not intended to provide the required supply temperature at each connected building. Instead, decentralized heat pumps and/or chillers adjust the network temperature to match the supply temperature of the building. This network design allows for the supply of both heating and cooling through the same pipe network, lowering the network operating temperature to near-ground level. Furthermore, fifth generation systems can use waste heat from decentralized chiller condensers to supply other connected buildings with heating demand [10].

Fourth generation district geothermal networking is most similar to what we recommend for parts of Ebenezer Village. We expect that parts of Ebenezer Commons, for instance, will have complimentary energy needs that will be best met with a networked geothermal system. A warm greenhouse, for instance, would be complementary to a cooling dominated restaurant. If these buildings share vertical boreholes, less will have to be drilled indicating cost savings. A similar model can be implemented on a smaller scale in "campus-like" settings, such as the memory care facility, to be described in the next chapter.

We recommend the fourth-generation district geothermal network for campus-like areas of the Ebenezer Village

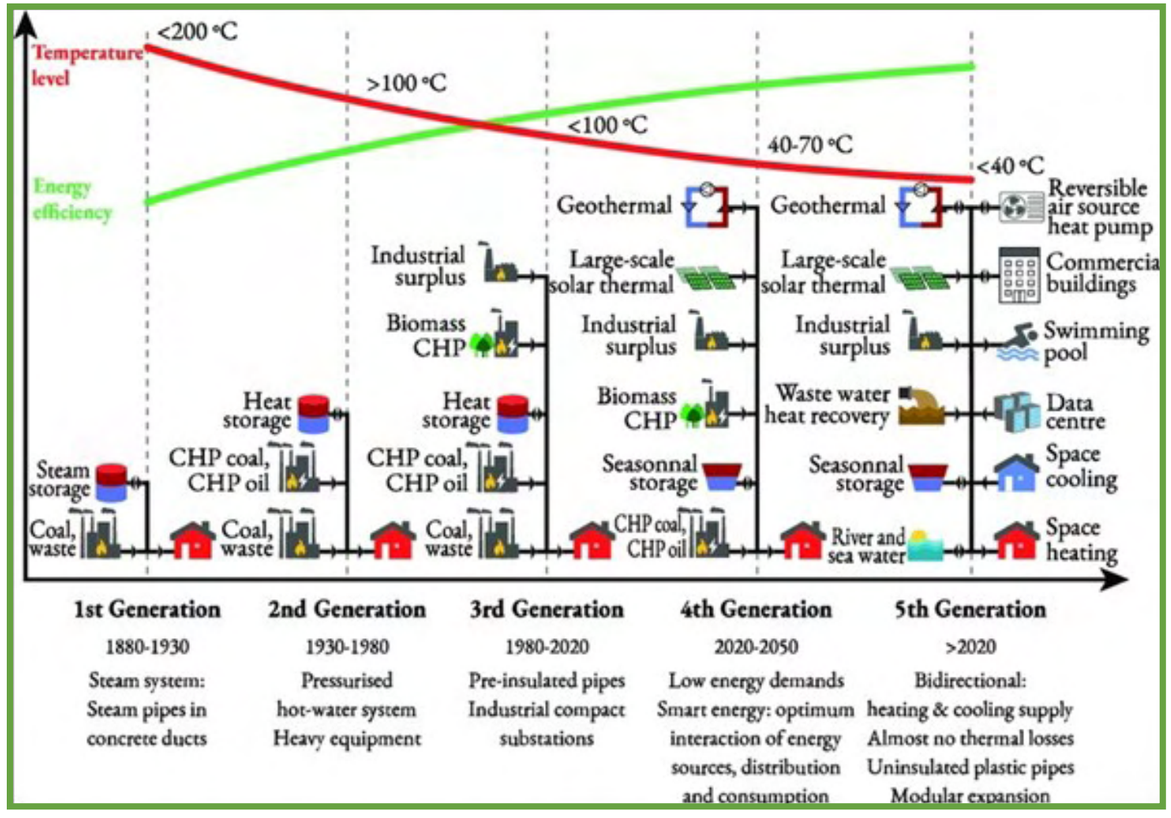


Figure 4.6: Evolution of District Heating & Cooling Networks

Source: Lund et al [7]

COSTS & FUNDING OF NETWORKED GEOTHERMAL

Networked geothermal heating systems can vary in cost depending on the scale of the project and network. Previously mentioned networked systems, like Drakes Landing and Whisper Valley had costs reaching into the millions of dollars. However, networked geothermal systems can result in reduced costs for homes. The installation of a geothermal network can be expensive, but the improved efficiency in heating and cooling distribution, along with economies of scale means costs are cut in these areas. Drilling vertical boreholes can cost anywhere from $5-$40 per foot. Typically, three to five holes are drilled. If networked buildings can share these boreholes, it brings down costs. Districted networks use heat interface units to distribute the heating from the central network to the individual units. While an individual home might use a heat pump to bring in heating and cooling from their yard piping, an apartment building would use this heat interface unit to bring in heating and cooling from a networked piping system. In apartment buildings with 30-35 units, we can expect the heat interface units to cost $79,000 for one of these buildings. Centralized heating production in a networked district also brings the opportunity for more funding as well.

Currently, New York State and the US Department of Energy have dedicated funds to supporting geothermal communities. The DoE released a Funding Opportunity Announcement for geothermal communities. The Community Geothermal Heating and Cooling Design and Deployment FOA has the potential to award $300,000 to $13 million for geothermal district heating projects. NYSERDA has a Community Heat Pumps Pilot Program which has dedicated $26.7 Million to community geothermal projects in New York. Two proposals have been submitted for projects in Buffalo.

Recently, the Inflation Reduction Act of 2022 dedicated $370 billion nationwide to tackling climate issues [11]. The act opens further funding opportunities to networked geothermal. The 179D tax deduction included in the bill applies to commercial and multi-family buildings. This will benefit our Ebenezer Commons area. This tax deduction is based on the energy efficiency of the property. If a building is at least 25% more energy efficient over typical constructions, then it can qualify for this deduction. A sliding scale of efficiency determines how much the tax is deducted. The deduction starts at 50 cents per square foot and goes up to one dollar per square foot. The buildings in Ebenezer Village will use a mix of geothermal systems and passive design. This allows for greater building energy efficiency over traditional constructions. Due to the improved efficiency, buildings in Ebenezer Commons can potentially qualify for the dollar per square foot deduction. The 179 tax reduction would make this project even more affordable. Assuming the rate of a dollar per square foot, applying this credit to the multi-use buildings in the Commons will result in almost $100,000 in savings.

CALCULATING COSTS FOR A HOUSEHOLD

Table 4.4 is a breakdown of how the cost of installation is impacted by the various sources of funding discussed. Local geothermal experts, Buffalo Geothermal, were able to provide an estimate of around $35,000 as the cost of installing a geothermal system in a conventional 1,500 sq-ft home. This cost comes from the equipment and materials needed, the yard work required, labor costs, as well as the price of the parts themselves. However, due to the nature of the project and economies of scale installation, Buffalo Geothermal estimates that 15% of the cost can be reduced. If multiple systems are being installed in succession, the machinery and workers do not need to move far, resulting in initial savings. This removes around $5,000 from the original $35,000 price tag. Following this, both the federal and state tax credits are applied, in that order. This results in an additional $14,000 saved just from these credits. Finally, the utility incentives are applied based on the equipment that homeowners can purchase for their system. This results in a final price of around $12,750. This price tag is almost a third of the original price estimate given. The savings possible for installing geothermal systems are very significant. The final three rows break down the cost if the homeowner is income eligible for additional Clean Heat funding from NYSERDA. These apply to a minority of customers but have the potential to result in even more savings.

Geothermal systems allow for the elimination of natural gas heating needed in a home. Instead, electricity is used to power these systems. The nature of the efficiency of the system can affect how much your electricity usage changes. However, the benefits of losing a gas heating bill are significant. If some Passive design guidelines are followed and a geothermal system is applied, estimated electricity usage can be estimated to be around 5,900 kilowatt hours a year. The average price for electricity in New York is around 19 cents per kilowatt hour, which means a monthly electric bill can be around $93. This is less than what the average electricity bill is for typical residential homes, which is around $102. This price, along with eliminated natural gas bills can lead to significant savings.

With tax credits and economies of scale, geothermal installation cost can be reduced by 63.6%

Table 4.4: Calculated Estimated Costs of Geothermal Systems

2023 Estimates for Savings on a Home Geothermal System Per Household From Successive Subsidies	
Explanation	**Cost**
Unsubsidized installation in a 1,500 sq-ft conventional home.	$35,000
Savings from economies of scale from successive installations on one site: 15% = $5,250.	$29,750
Federal tax credit, 30% of installation cost. $8,900	$20,850
NYS tax credit = 25% of the cost, up to $5,000. Assumes $5,000.	$15,850
NYSEG incentives for eligible equipment, depending on type: $1,600 to $4,600. Assumes $3,100.	$12,750
Cost after subsidies for households	$12,750
Clean Heat Program: By income qualification per household: max $8,000. Assume $4,000	$8,750
Additional Income-Qualified Clean Heat Program (for some people who qualify for above program): $3450 - $4950. Assumes $4,100	$4,650
Total Cost - if qualified for income-eligible programs	$4,650

ROLE OF ELECTRIC UTILITY

Geothermal implementation has generally occurred in private homes on a single-unit basis. Networked systems require significant resources and planning to implement successfully. New York State's Climate Leadership and Community Protection Act (2019) has encouraged utility companies to seriously explore the option of establishing geothermal networks as new utilities. As of 2023, seven regulated utilities in New York State are on record as dedicated to "provide customers, contractors, and other heat pump solution providers with a consistent experience and business environment throughout New York State." (NYS Clean Heat 2023). Among those are National Grid and New York State Electric and Gas. They have begun developing various pilot project proposals for geothermal networks. Electric utilities have the potential to work with West Seneca local government and geothermal companies to facilitate the geothermal infrastructure for Ebenezer Village. One of the first steps for implementing our recommendations will be to establish a working group that brings together local government with New York State and NYSEG to explore geothermal development on our site.

A Geothermal Utility can "*provide customers, contractors, and other heat pump solution providers with a consistent experience and business environment throughout New York State*"

CONCLUSIONS & RECOMMENDATIONS

Geothermal is a powerful and efficient part of achieving a climate-conscious clean energy community. It is our ultimate recommendation that Ebenezer Village takes advantage of this blossoming and unique opportunity for a community geothermal system.

This studio recommends a mixture of non-networked, horizontal geothermal systems with some elements of networked geothermal. Non-networked, independent geothermal systems are recommended for single-family homes and will meet the needs of a majority of Ebenezer Village. Installation for this type of geothermal system can be completed before home construction with relative ease and cost effectiveness. Networked geothermal is recommended in denser, more built-up areas. We anticipate that The Commons will have a networked geothermal system based on the fourth-generation framework. Other "campus-type" buildings such as the memory care facility will also benefit from a form of networked geothermal.

We anticipate that a fourth-generation network geothermal system would present an opportunity for a utility company to become involved in the operation and maintenance of the system. There is potential for West Seneca to become a leader in developing a geothermal utility – the first new type of utility in New York in over 100 years.

Networked

Denser built up areas such as the Ebenezer Commons, Memory Care and Supportive Care will have vertical geothermal, networked systems

Non-Networked

Less dense areas such as single-family homes, duplexes, and townhomes in the general residential will have horizontal geothermal, non-networked systems

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5

Market Analysis

OVERVIEW

Our studio proposes a new residential district called Ebenezer Village. One of the biggest challenges we face is to figure out what could reasonably be located on this site. On the one hand, this should be something desirable for the town of West Seneca. On the other hand, our proposal must be economically viable. In this chapter, we start to analyze market variables that economic and real estate development professionals typically take into consideration.

The online analytics software program REIS provides in-depth property data and interprets past, present, and future property trends. Realtor.com is one of the leading websites that indicates prices for residential and vacant pieces of property. From these methods, we concluded that the market demand was for the following type of properties, each to be discussed.

The first is patio homes, usually meant for young family starters or older individuals nearing retirement. The second is housing of a variety of types for our mixed-income general residential area, to include single-family detached homes (not necessarily patio homes) and multi-unit buildings such as duplexes, triplexes, and other multiplexes. Some of the homes should be for lower income residents, and should take advantage of the many state and federal affordable housing programs now available. Options for the general residential area include homes also meant for higher-income buyers, for reasons we explain below.

Note that we delve into multi-unit buildings consisting of about 30 units per building in the next chapter for what we are calling “Ebenezer Commons”. This will be the denser part of the Ebenezer campus, with mixed-use commercial, residential, and recreational spaces in chapter 6. All these can be integrated to create a vibrant community known as Ebenezer Village.

Methods

- **The national real estate data software REIS**
- **Conversations with real estate experts**
- **Data from real estate web sources such as realtor.com**
- **Information from the West Seneca Comprehensive Plan**
- **Property sales information from the West Seneca Tax Assessor**

NON-RECOMMENDED USES

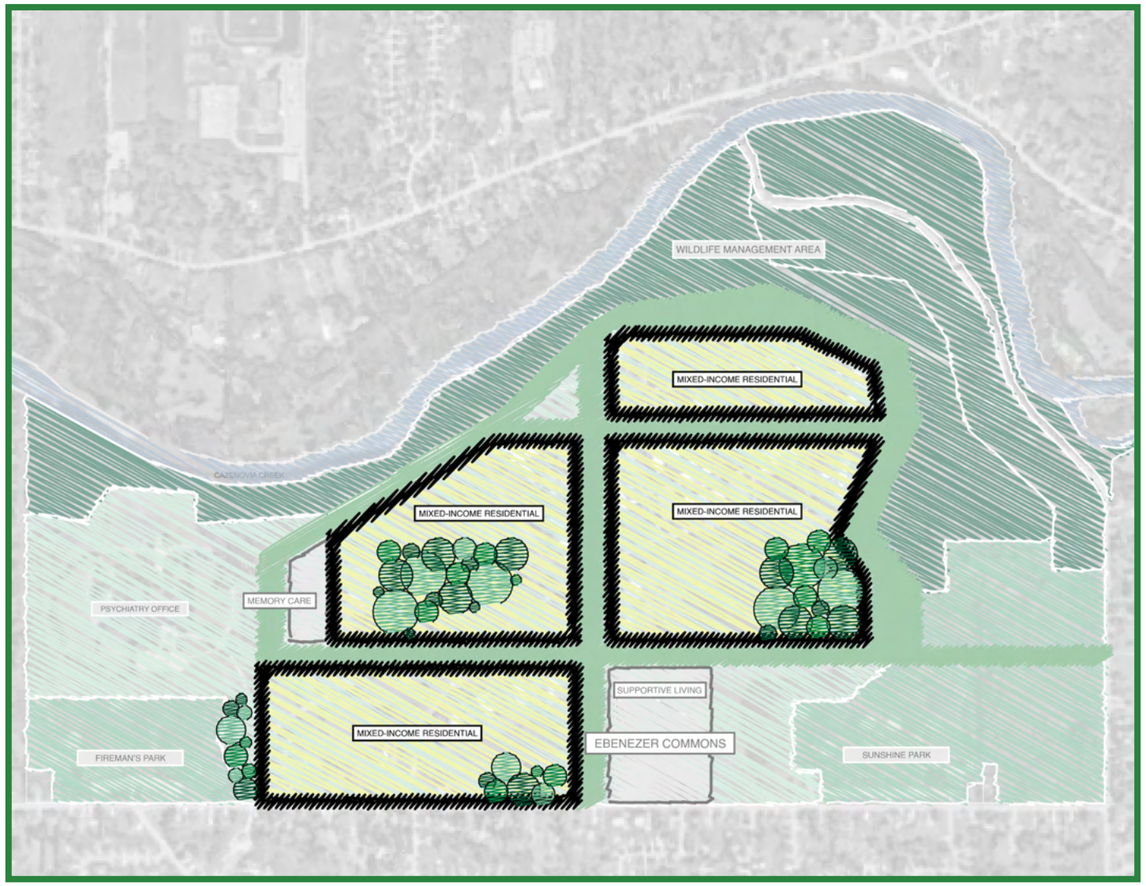
From the recommendation of real estate specialists, we recommend that this site has little opportunity for land uses other than the ones discussed so far and in the next chapter. It is not suitable for warehousing even though it is a growing sector of the real estate industry. First, warehousing and trucking would interfere with the surrounding residential uses. Second, the road connection between the site and the surrounding area are inappropriate for trucking. Third, Western New York has more appropriate sites in Lackawanna that are current brown-fields. In terms of office space, there has been a downward trend in dedicated office space in the region and the United States as a whole.

A small co-working space could work in Ebenezer Commons, as suggested in the next chapter. Also, it is possible that OPWDD's offices could be relocated to a new facility alongside Ebenezer Commons.

Table 5.1: Discouraged Land Uses for Ebenezer Village

Land uses discouraged for Ebenezer Village	
Warehousing	• Not a brownfield • Inadequate road connections • There are better places in the region
Industrial	• Not a brownfield • Manufacturing has better locations. • Inadequate road connections
Office	• Demand for office space in drastic decline • However, there is a possibility of relocation for OPWDD • However, there is a possibility for coworking space
Large commercial retail	• Retail has been on a downturn lately • There are already many large retail spaces on transit and union • However, small, charming commercial could work

Figure 5.1: Program Use Site Plan



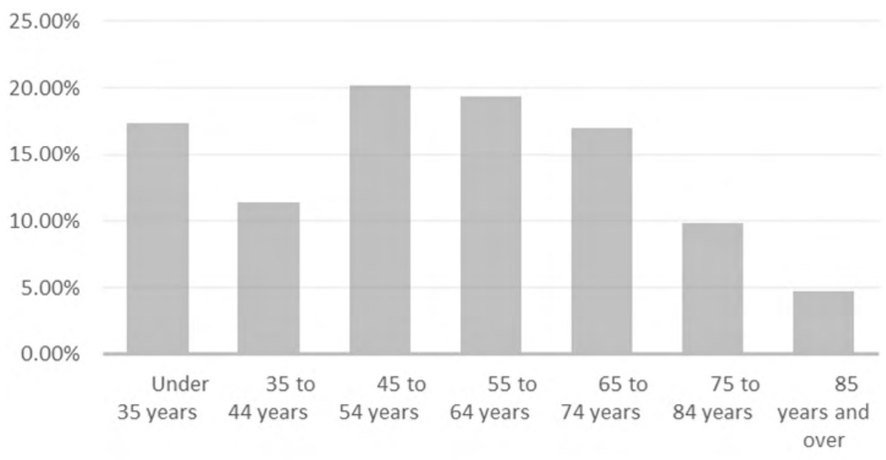
PATIO HOMES

It is our suggestion that a portion of the homes built in Ebenezer village be "patio homes." These homes are typically one story and 1000-1500 square feet. An article published by realtor.com on national trends states, "These developments usually offer relatively easy access to nearby neighborhoods and communities, but often at a more affordable price point," The article continues, "Patio homes are in relatively high demand right now, as they tend to be popular with empty-nesters and others nearing retirement" [1].

These homes are also appropriate for new families looking to purchase their first home. The appeal of patio homes is that they require little maintenance due to their small scale. They are also easily modifiable to fit the needs of seniors looking to age in place. Aging in place refers to older adults' ability to stay in their homes and communities rather than move into an assisted care facility. In addition, a 2021 Home and Community Preferences survey conducted by the AARP, a senior advocacy group, found that an overwhelming 75% of respondents desire to age in their homes [2].

We propose such housing because there is an increasingly aging population in West Seneca. As noted in Figure 5.3 and 5.4, the demographic of 65 and older is at 20.1% which is only expected to grow. We believe these homes will be a good opportunity for people to downsize while also staying in a familiar neighborhood.

Figure 5.2: Age Distribution of Homeowners in West Seneca



Source: American Community Survey

Figure 5.3: Age Range - Erie County

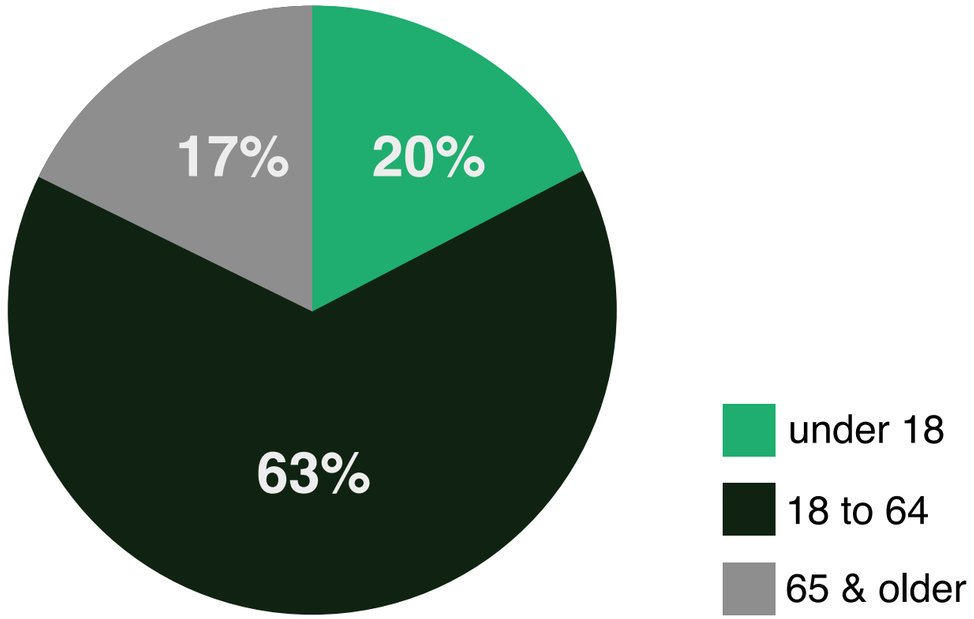
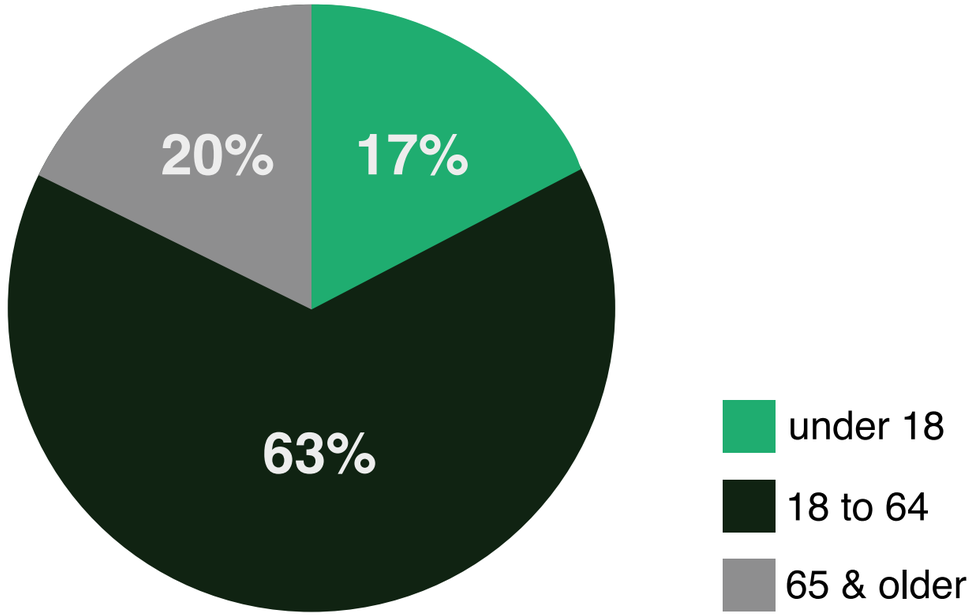


Figure 5.4: Age Range - West Seneca

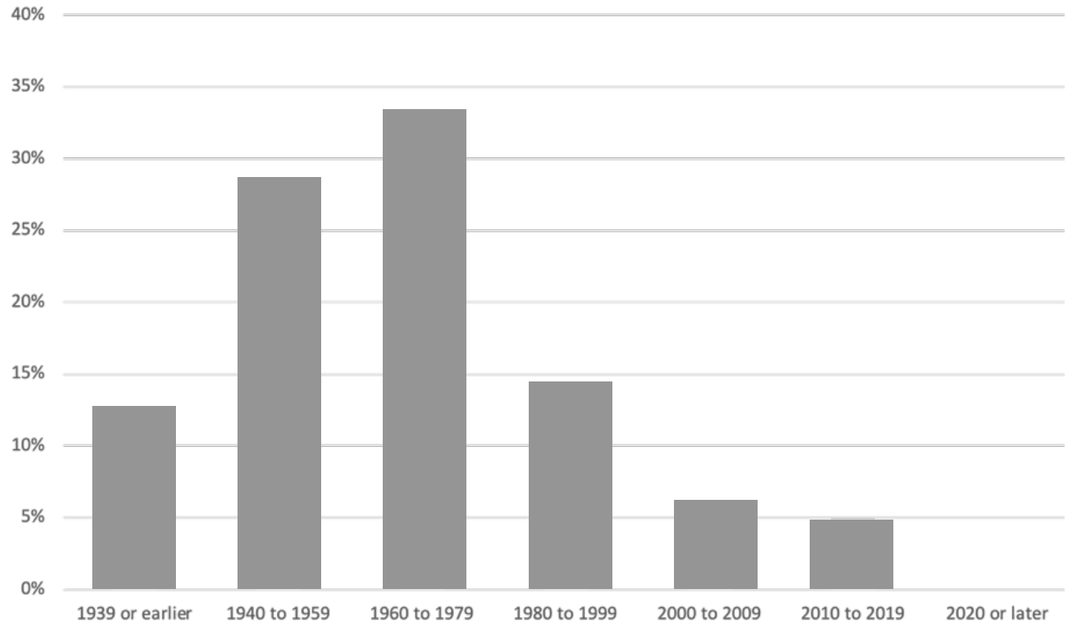


Source: American Community Survey

Figures 5.6 and 5.7 indicate that West Seneca has a smaller renter population in comparison to Erie County. This could indicate the demand for not only high-quality multiplexes and apartments but also more single-family housing as well. Figure 5.5 also indicates that the majority of housing was built before 1960-1979 indicating the need for new housing stock for citizens to downsize into.
We have found that the "patio home" sized structures are already common in West Seneca. We found information on them from the West Seneca Tax Assessor's Office. We found that of 520 homes sold in West Seneca in 2022, almost half, fell within the 1000 to 1500 square foot range. Additionally, we found that the median home size was 1420 square feet. For these reasons, we conclude that "patio homes" continue to be good prospects for the future.

One way our team gained insight as to how these types of homes are planned is by seeing precedents. The best nearby precedent having a whole community of patio homes is in Williamsville, NY. The developer, Marrano homes, has constructed three communities holding a significant percentage of patio homes in the Buffalo Metro Area. One of the largest developments in West Seneca, Carriage Lane, as of March 2022, has sold two-thirds of its inventory of 30. Their homes vary from 1,301 to 2,071 square feet.

Figure 5.5: Home Age Characteristics of West Seneca



Source: American Community Survey

Figure 5.6: Homeownership Characteristics - Erie County

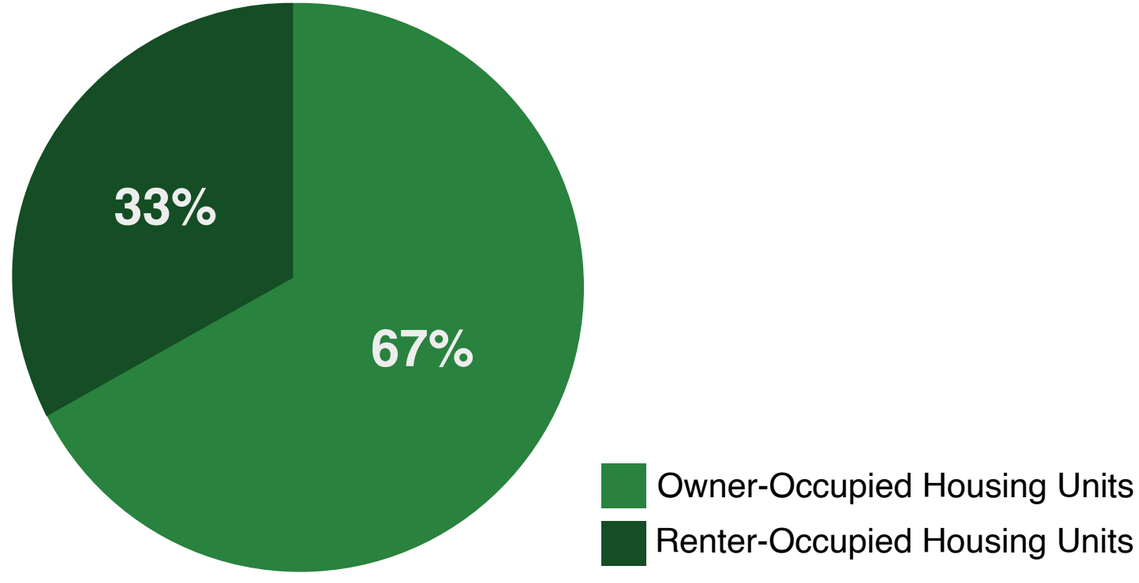
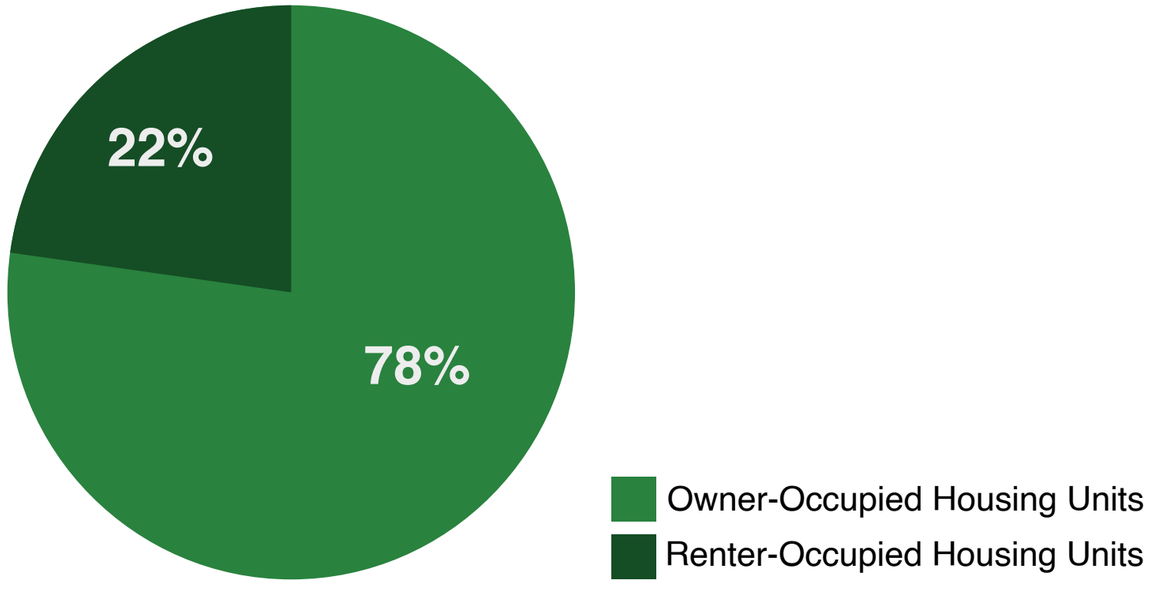


Figure 5.7: Homeownership Characteristics - West Seneca



Source: American Community Survey

MIXED-INCOME RESIDENTIAL

Upper-Income Homes

In contrast with the previous subsection, upper-income homes represent another real estate type that we believe would have good market demand on the site. The main reason we believe there would be a demand for such homes is the excellent views to Cazenovia Creek and the wildlife management area. Some of these homes can be built with spacious views in secluded locations. In addition, Ebenezer Village will be a high-quality walkable community attractive to people from all backgrounds. Developers responsible for large sections of the site will also want to be able to sell more expensive parcels as a way to fund the rest of the development. More expensive homes would also boost tax revenues for the town and the local school district.

We believe that seekers of upper-income houses will prefer areas near Cazenovia Creek, due to the scenic beauty of this amenity. Figure 5.8 illustrates the landscape of Cazenovia Creek and the impressive views it holds.

Figure 5.8: Cazenovia Creek, West Seneca, NY

Source: National Oceanic and Atmospheric Administration (NOAA)

Townhomes

A paramount aspect of a good plan is to provide housing that supports individuals from a wide variety of economic backgrounds. Including affordable townhomes and multiplexes into our study area will aid in fulfilling this aspect. Townhomes are multi-story houses that share at least one wall with other townhomes. Typical examples of these types of residential properties can be seen in Figure 5.9. It's important to note that the architectural arrangement of townhomes does not have to be linear.

Multiplexes

Multiplexes are another form of residential housing that should be available in Ebenezer Village. Multiplexes are buildings that accommodate multiple residents, but do not take the linear form typically found in rowhouses or townhouses. Examples include duplexes, triplexes, and beyond.

There are many benefits of including such real estate types in Ebenezer Village. First, incorporating buildings that take up less space and house more people is attractive for creating a walkable neighborhood. Second, there are also energy benefits to townhomes and multiplexes because of shared walls. Third, they potentially provide more low-cost housing.

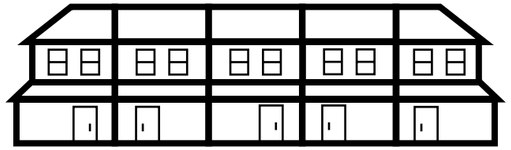


Figure 5.9: Townhouse Example

Source: Belmont Housing Resource

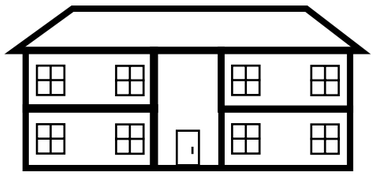


Figure 5.10: Multiplex Example

Source: Google Earth Street View

Though West Seneca is predominately a single-family detached home community, it does have significant areas with multi-unit buildings. To examine demand for multi-unit housing in the town, we examined data from REIS, which presents it for the "sub-market" consisting of West Seneca and immediate neighbors (Figure 5.11). Results for vacancy rates and asking rent for apartments in its geographic area are shown in Figure 5.12. Note the information below applies to all multi-unit properties consisting of four units and above. For the general residential area, the data are applicable to town homes and multiplexes of four or more units. In the next chapter, for Ebenezer Commons, the data is applicable to apartment buildings.

As shown in the figure 5.12, vacancy rates have continually declined while asking rent has continually increased over time, indicating more supply is necessary. Furthermore, absorption trends illustrated in Figure 5.13 demonstrate that multifamily units are being occupied soon after construction. For example, as seen in Figure 5.13, newly constructed units after 2011, 2015 and 2017 were quickly absorbed.

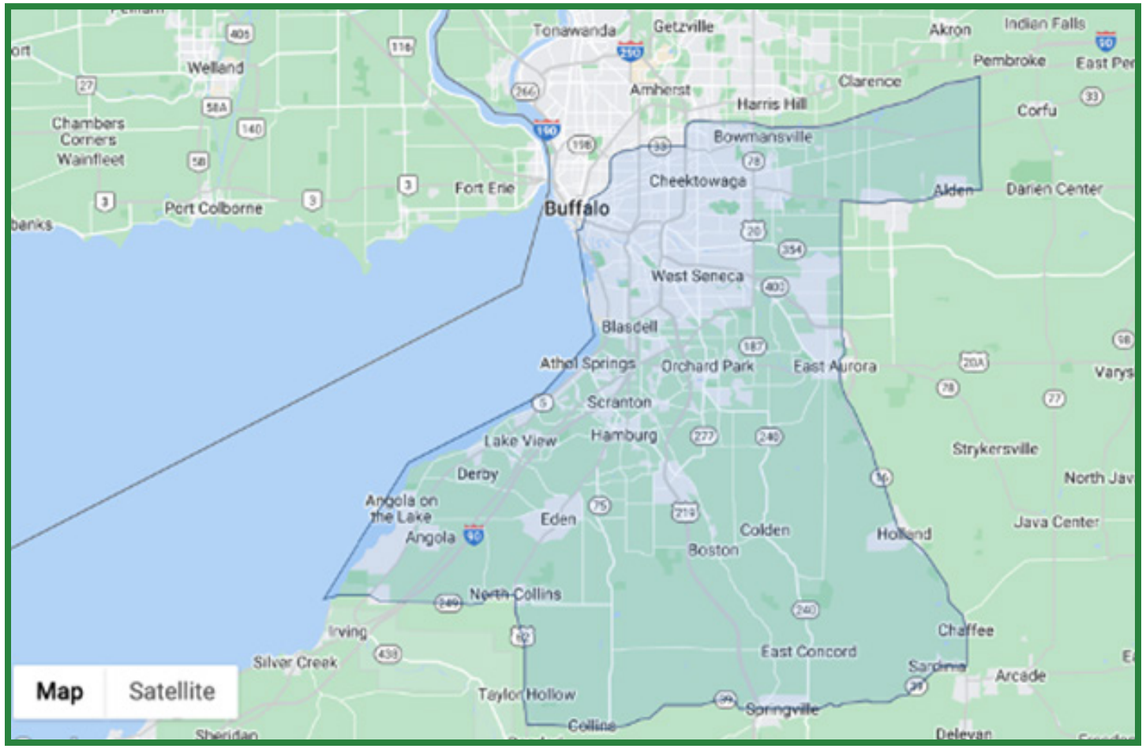


Figure 5.11: Geographic Boundaries of REIS Multi-Unit Data - West Seneca

Source: Moody's Analytics, 2023

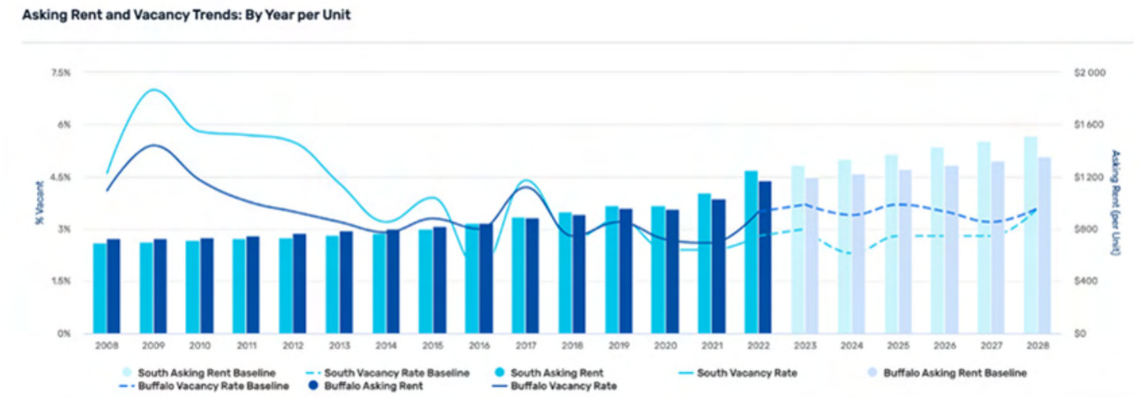


Figure 5.12: Multi-Unit Vacancy & Asking Rent Trends within REIS Geographic Boundary

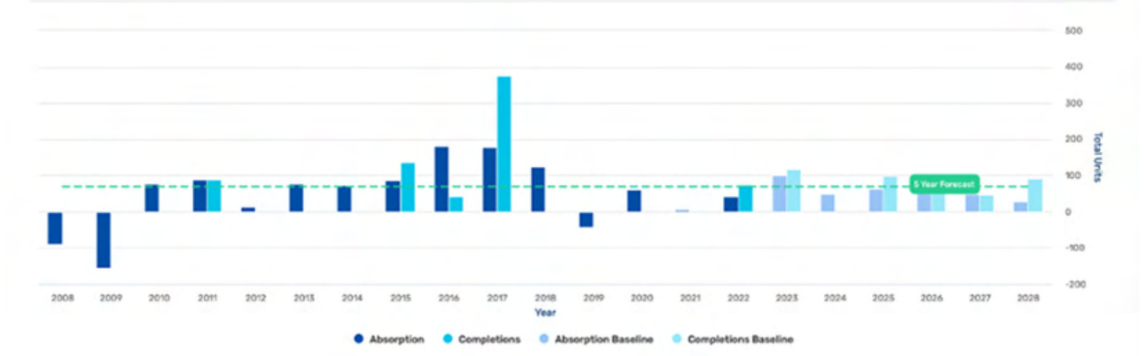


Figure 5.13: Absorption Trends for Multi-Unit Development Within REIS Geographic Boundary

Source: Moody's Analytics, 2023

AFFORDABLE HOUSING PROGRAMS

It is important for West Seneca to be a community that serves people from all economic backgrounds. One of the largest challenges is making low and mixed-income housing worthwhile for developers to build. There are a variety of different programs that can help developers and communities including affordable and mixed-income housing that will not put the burden directly on taxpayers.

Some of these funds include the Low-Income Housing Tax Credit (LIHTC), the state Housing and Community Renewal Funds (HCR), and the Erie County Industrial Development agency programs.

Federal: Low-Income Housing

The Low-Income Housing Tax Credit (LIHTC) gives state and local LIHTC agencies around $8 billion in annual budget to issue tax credits for new developments that aim to build low cost and affordable housing. This helps developers offset the cost to build such housing even though there is a low profit incentive. Eligible housing developments for LIHTC are multi-family housing, single-family dwellings, duplexes and townhouses.

State: Housing & Community Renewal

Housing and Community Renewal (HCR) is a state agency with the purpose of investing affordable housing. It is working towards the states 5-year plan to increase and preserve around 100,000 homes and developments with the sole purpose of providing mixed-income families the housing they need. The program is looking to revitalize accessory dwelling units, increase housing safety and foster rent regulation.

Erie County: ECIDA

At the local level, under the ECIDA, Erie County has promoted the PILOT program or Payment in lieu of taxes. This program helps to foster and develop low and mixed-income housing. The program will be able to lift the tax burden for developers for up to 15 years given that 60% of the development goes to low-income housing. Erie county has numerous programs that promote and foster the development of mixed-income housing.

SUPPORTIVE LIVING

Supportive living communities are very similar to assisted living, but with several distinctions that set them apart. For example, a supportive care facility is provided at a reduced and subsidized cost.

Assistive Care

Assisted living communities provide a care environment for Senior Citizens who are independent and mobile and can live in their own apartment. However, residents who live in an assisted living environment are unable to perform all basic daily tasks. Assisted living facilities provide registered nurses or other staff members who offer basic care and assistance with daily living and functions. Typically, to qualify for residency at an assisted care facility, individuals must be at least 55 and present at least 2 or more daily activities that they are uncomfortable with.

Supportive Care

Subject to qualifications, residents living within a supportive community who are unable to pay for the care, may have payments for supportive care covered by Medicaid or another financial program. Supportive housing is also geared towards aging individuals with lower household income which justifies the need for medical care through a program. Supportive care may also be available for younger persons and those with pre-existing medical conditions.

For our site in West Seneca, we propose a residential facility that provides assisted care or supportive care for aging individuals. In keeping with multi-unit elderly housing already found in the area, we propose a facility that has about 30 units. Decisions on supported versus assisted housing can come at a later stage in planning.

West Seneca and the surrounding areas have seen resumption of low vacancy since the COVID-19 pandemic for Assisted Living Facilities as shown in Figure 5.15.

The information provided in the graph shows that through the last decade, the median asking rent has stayed consistently above $3,500/month, a remarkably high level for middle income residents. In contrast, there have been various changes in terms of the overall vacancy rate. The vacancy trends show a significant decline in senior living due to the COVID-19 pandemic. The current senior living vacancy rate in the graph shows a drop from 13% to 10% since the start of the pandemic in 2020. Planners need to watch the trend over the coming year. If vacancies continue to decline, the time is coming to resume investment in such housing. However, what is also clear is that persons with low incomes or with disabilities have, at these prices, few options for supportive living.

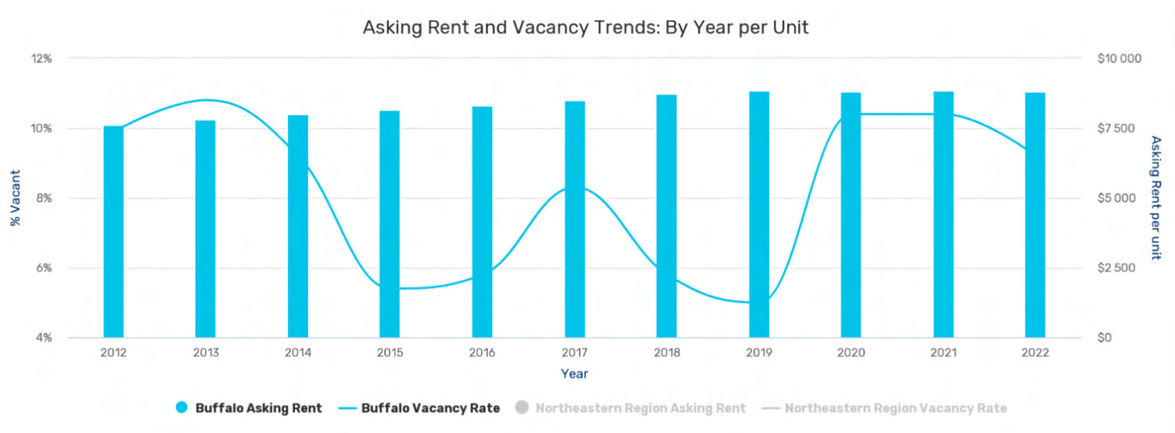


Figure 5.14: Rent & Vacancy Trends for Assisted Living Facilities

Source: Moody's Analytics, 2023

ASSISTED & SUPPORTIVE LIVING PRECEDENTS

Elderwood Assisted Living

Address: 580 Orchard Park Road

Elderwood is an apartment style assisted-living facility located within West Seneca. The facility stands at three Stories on 10 acres of lot space and the community is situated nearby Western New York medical park. Elderwood houses 24-hour staff that is available to aide residents with various activities daily. Elderwood also provides enhanced assisted living services through the NYS certified Assisted Living Program.

Figure 5.14: Elderwood Facility

Image showing the front entry-way of Elderwood Assisted Living Facility

The Amberleigh

Address: 2330 Maple Road

Located in Williamsville, NY, The Amberleigh provides a combination of independent as well as assisted living and memory care. The facility provides a significant amount of lawn space throughout its three acres. The facility provides numerous activities to bring the residents together.

Due to the current high demand for Assisted Living within West Seneca, the site should include at least one Assisted Living facility. The assisted living facility should contain a living environment that is similar to that of multi-family apartment buildings.

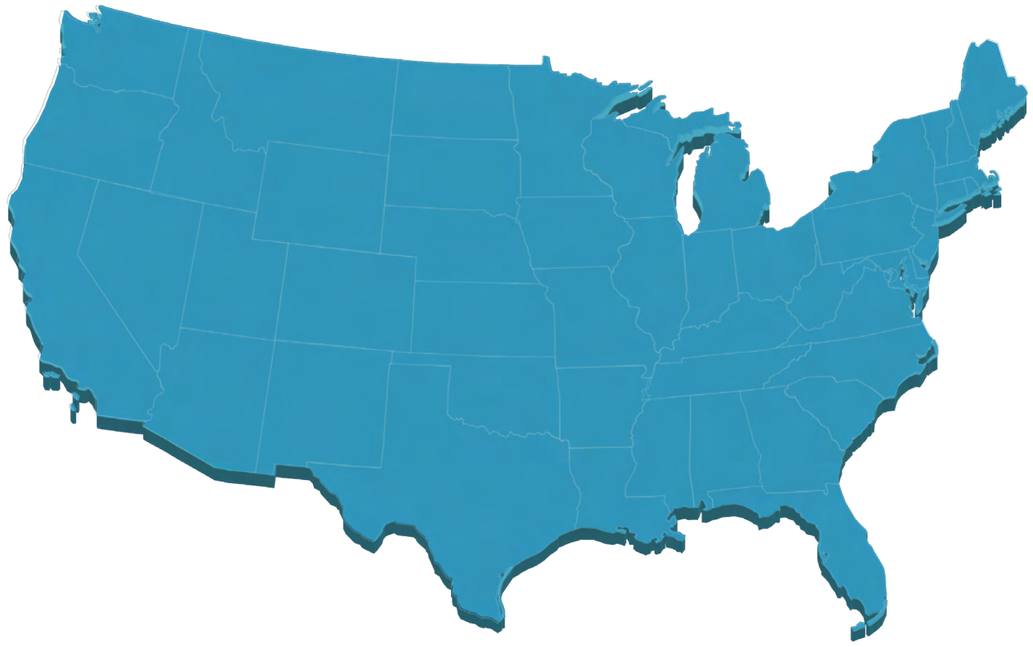
Figure 5.15: Amberleigh Facility

Image showing the front signage at Amberleigh Assisted Living Facility

MEMORY CARE

With greater longevity and for other reasons not yet fully verified, the number of persons with dementia or other related memory disorders has been increasing in the United States. As part of Ebenezer village, we are offering the possibility of a new kind of memory care facility.

According to Alzhiemers.org, there are about “410,000 people living in New York State that are affected by Alzheimer’s while 563,000 family caregivers bear the burden of the disease in New York” [3]. There is a need for more care facilities that can ease these families' burdens.



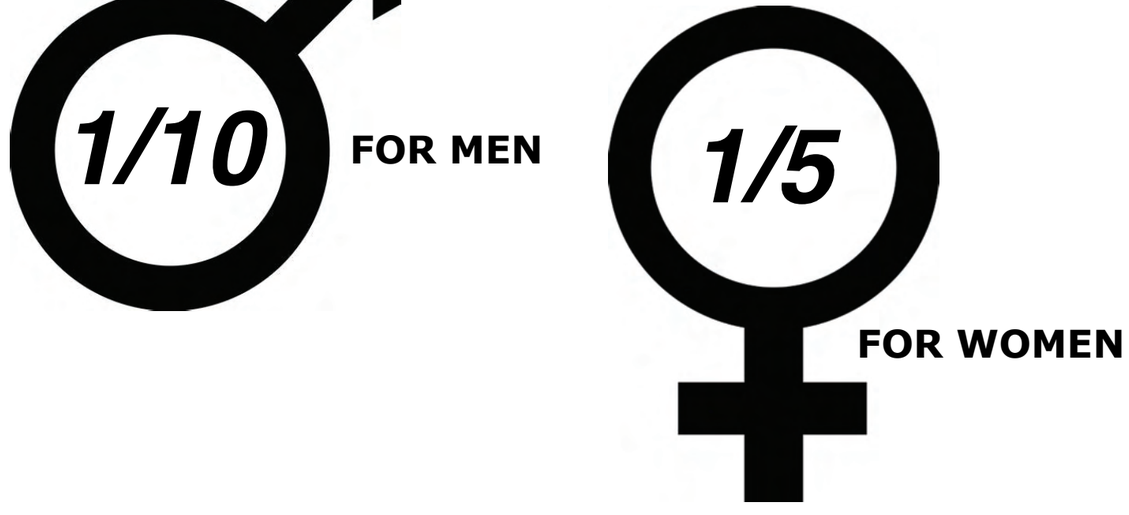
More than **6 million** Americans are Living with Alzheimer’s. By 2050, this number is projected to rise to nearly **13 million.**

Source: Alzheimer's Association

In Europe, there have been precedents of a dementia care “village.” Most of these precedents are in Nordic countries such as the Netherlands and Norway.

The significant difference provided by the European model is that patients are not mainly residing inside a building all day, but rather are given opportunities to wander the outdoors in a safe environment designed specifically for them. We propose a memory care village model development within Ebenezer village. With considerable, attractive space available at Ebenezer Village within a significant metropolitan area, we suggest that it is an opportunity to implement aspects of the Nordic model.

Following European precedents, we propose a facility with a resident patient population of about 200-250. In the design, we want to continue the model of a natural self-containing border and to stray away from the building-enclosed institutional models of the 60s and 70s. The European models typically include shops, restaurants, and welcoming courtyards (patients may have cards that identify them) serviced by the facility’s workers. This would allow residents to get fresh air, shop, and feel that they are in a familiar town setting instead of a hospital. To establish such a facility in West Seneca will be a complex process, requiring collaboration between memory care institutions and New York State, but the outcome will be one of the first such developments in the United States.



The lifetime risk for Alzheimer’s at age 45 is **1 in 5 for women and 1 in 10 for men.**

DEMENTIA VILLAGE PRECEDENTS

The examples below include a list of memory care or designated dementia villages that offer a more inclusive living environment. Mostly located in Europe specifically in Denmark, Norway, and the Netherlands, the examples include centers that provide not only intensive care for seniors with dementia but contain open and public spaces within the care facility to increase overall daily activity for residents.

De Hogewyck

De Hogewyck is a 1,430,800 square foot facility with 23 units with 3-6 people in each unit. The facility provides care for patients with severe dementia. The care village is designed as a general residential center that provides a normal living environment setting for senior citizens who are struggling with dementia. The care center features a park, theatre plaza, alley with linden trees, small gardens, and a fountain. These features to the care center make up 50% of the overall grounds.

Figure 5.16: De Hogewyck Courtyard

Source: Dementia Village Associates

Figure 5.17: De Hogewyck Site

Source: Dementia Village Associates

Figure 5.16 is an example of an area consisting of open space surrounded by units within the facility. The courtyard provides residents who suffer from dementia a sense of normalcy by creating a natural community feel that is located within a medical facility.

Figure 5.17 provides a better explanation for the overall design of a dementia village. As shown in the image, it consists of various courtyards and open space to give the residents more of a community feel. All of this is surrounded by a larger building structure that keeps the residents within its borders providing a sense of exclusivity for the residents.

Carpe Diem

Carpe Diem is a 6,467,788 square foot facility located in outside of Norway's capital Oslo. The facility offers 136 communal units along with 22 high-intensity care dementia units. Carpe Diem is designed to look like a recognizable home rather than an institution. The building as well as the outdoor spaces designed within the complex are designed to help residents increase their activity as well as provide them with a familiar communal setting. Like De Hogewyck, Carpe Diem features a center for open green space and courtyards. The open space features a community like setting with convenience stores providing residents with options for basic service all within its own borders. The open courtyard space also provides a sense of normalcy for residents needing assistance with daily activities.

Overhead view

Views of the courtyards

Figure 5.18: Views of Carpe Diem

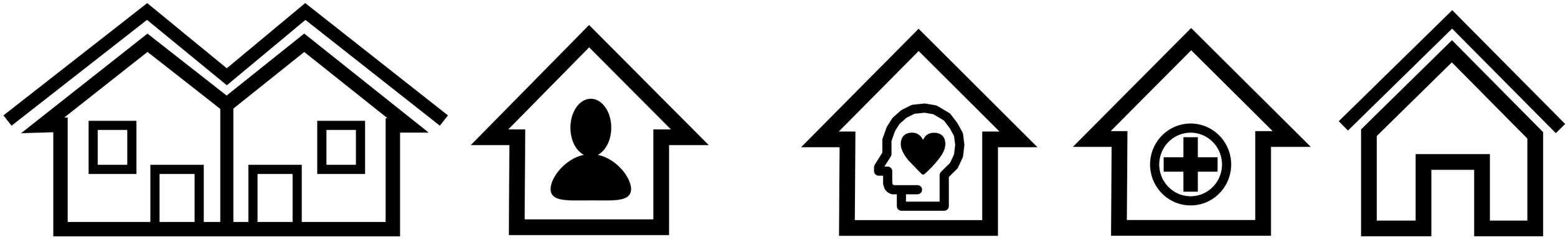
Source: Benjamin Ward/Nordic Architecture

RESIDENTIAL VISION

With the addition of Ebenezer Commons noted in chapter 6, Ebenezer Village offers a good opportunity to increase the density and the number of housing types to make sure the commons have enough people to sustain it. It will be important to develop design guidelines that allow different size and types of buildings while also maintain some common characteristics such as porches, gables, front setbacks, and the possibly frontage proportions.

As noted above, there is an increased need for low-cost and diverse housing. We believe that the inclusion of 'patio homes' and mixed-income housing in the area could provide the needed density while also still preserving the nature and charm of West Seneca. With the aging population of West Seneca, residents will need smaller homes to transition to. There is also a need for mixed-income housing within the area. It is important to provide opportunities for people to live in Ebenezer Village no matter what economic background they come from. As noted, there are a variety of programs that can assist with increasing the economic diversity of the area.

We have also included our plan of including an assisted living and memory care facility on the site. There is a direct need to take care of the aging population of West Seneca, and providing direct transitional care allows residents to change their lifestyle while also living in the same community.



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6

Vision of Ebenezer Village

OVERVIEW

For our community, we propose a mixed-use multi-unit commercial-residential center to act both as the village center and as an appealing recreation and retail attraction for the Town of West Seneca and beyond. According to the Urban Land Institute, "Many of the new mixed-use commercial developments are walkable, with a pedestrian scale and a definite main street character and have offices and housing components located nearby" [1]. While we do not recommend a "main street" character, but rather a "commons," we do intend the same kind of walkable center that the Urban Land Institute finds so promising.

Our site is situated in between the major corridors Union Road and Transit Road that contain multiple commercial businesses. It's important to note that our objective is not to compete with these businesses but, instead, to provide an active, walkable space with additional amenities for persons residing within Ebenezer Village as well as the Town of West Seneca. As seen in Figures 6.1 Ebenezer Commons will be located directly on East and West Road.

Figure 6.1: Program Use Site Plan

MULTI-UNIT & MIXED-USE BUILDINGS

One component of our study area is the inclusion of multi-unit buildings, of which five would have retail on the bottom floor and the sixth would be all residential. The buildings would have about 32 residential units each.

Multi-unit vacancy rates, asking rent prices, and absorption trends have already been discussed in the previous chapter: the data indicate continual decline in vacancy rates combined with steady increases in asking rent. The result suggests West Seneca needs more supply of multi-unit buildings. It is our suggestion these large multi-unit buildings be placed within Ebenezer Commons. The residential density will support the small-scale businesses and increase the sense of outdoor activity that is so important in creating a vibrant mixed-use area.

Building styles could vary a great deal and will depend on architectural design that is beyond the scope of this report. However, potential examples or inspirations may be found in Figures 6.2 and 6.3.

Figure 6.2: Lexington Apartment Complex

Source: Bliss Construction

Figure 6.3: Mosey Apartment Complex

Mixed-Use building in Williamsville, NY

Source: Google Earth Street View

LIFESTYLE COMMERCIAL CENTER

The proposed community of any size must have commercial businesses to support the people residing there and add new service options for the Town. One paramount aspect of the commercial space we envision is a lively, highly walkable atmosphere. Despite competition from Union Road and Transit Road retail in West Seneca, there are multiple reasons why Ebenezer Commons is well situated for success.

We have developed a five-point strategy for success. First, the small commercial center within Ebenezer Commons will serve and support the new community of around 2,500 residents at full build out (10-20 years) and Town residents more generally. Second, Ebenezer Commons will focus on charming, lifestyle oriented, high amenity businesses which do not have major competition in West Seneca, NY. Third, the proposed open commons area combined with greenway access to the natural features of Cazenovia Creek will further promote visitors. Fourth, the highly compact nature of the community surrounding Ebenezer Commons facilitate pedestrian access. Last, Ebenezer Commons will have a major iconic structure, the pavilion, regularly drawing leisure visits year-round.

The Ebenezer Commons, as mentioned above, is likely to accommodate a variety of uses to meet the needs of the new neighborhood. We foresee five mixed use buildings with retail on the ground floor adding up to about 120,000 square feet of retail space.

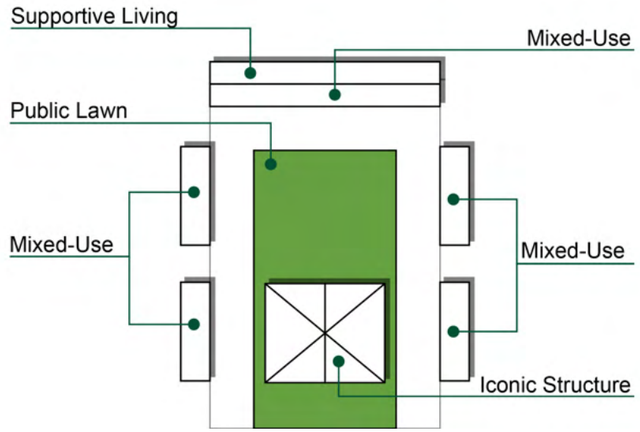


Figure 6.4: Commercial Center Site Layout

Proposed Tenants

- **Coffee Shop**
- **Restaurant**
- **Bakery**
- **Ice Cream Shop**
- **Brew Pub**
- **Convenience Store**
- **Hair/Nail Salon**
- **Boutique**
- **Daycare**
- **Medical Office**
- **Co-Working Space**

While service businesses are widespread in West Seneca (Figure 6.5), they are absent near our site, which is surrounded on three sides by residential neighborhoods. Southgate Plaza is currently the largest retail hub within the Town of West Seneca. To access Southgate Plaza from our site, one must either walk 40 minutes or drive 5 minutes.

Iconic Pavilion

The most outstanding part of Ebenezer Commons will be the iconic structure, a pavilion, winter garden, or green house. We foresee it being made of translucent materials and being enclosed in winter but potentially opened up to the outdoors in the summer. Importantly, it will be heated with geothermal coils immediately under the walking surface, providing cost-effective year-round partial climate control.

Proposed Activity

- **Walking loop**
- **Playground**
- **Ice skating**
- **Roller skating**
- **Town celebrations**
- **Geothermal exhibit**
- **Private events**
- **Public events**
- **Leisure**
- **Food court**

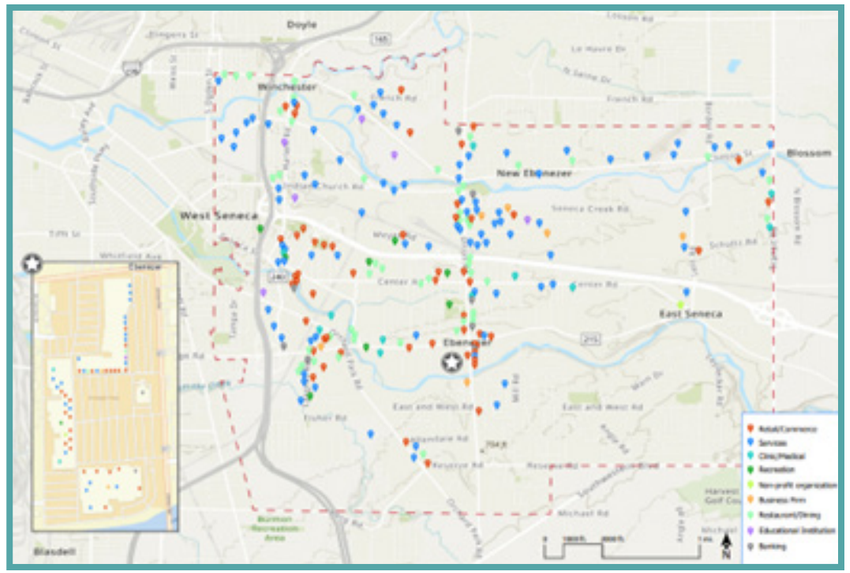


Figure 6.5: Service Businesses Map - West Seneca

In terms of building size, we recommend a square footage of around 80 to 100,000 square feet. Additionally, geothermally heated floors would, and geothermal exhibit or museum may qualify the facility for state and federal financial support. If a pavilion is to be developed, the City of Reston, Virginia's rendering seen in Figure 6.6 serves as a good example of what we envision.

Figure 6.7: Detroit, Michigan Anna Scripps Whitcomb Conservatory

Figure 6.6: Reston, Virginia Town Center Pavilion

Source: Google Earth Street View

Figure 6.6: Kuala Lampur, Malaysia Canopy Project

VISION FOR EBENEZER COMMONS

We believe that adding a mixed-use center to Ebenezer Village could provide a wide range of benefits. Not only will this center have a strong iconic element such as our pavilion to help bring the community together and draw visitors, but it will also have many amenities it will contribute to the activity levels needed to make the Commons a success. It will also serve the purpose of providing a walkable, healthful neighborhood with the convenience of amenities located within a 10-minute walk. Geothermal heating will contribute to making Ebenezer Village a clean energy community. It will become a gathering place and become a symbol of pride in West Seneca.

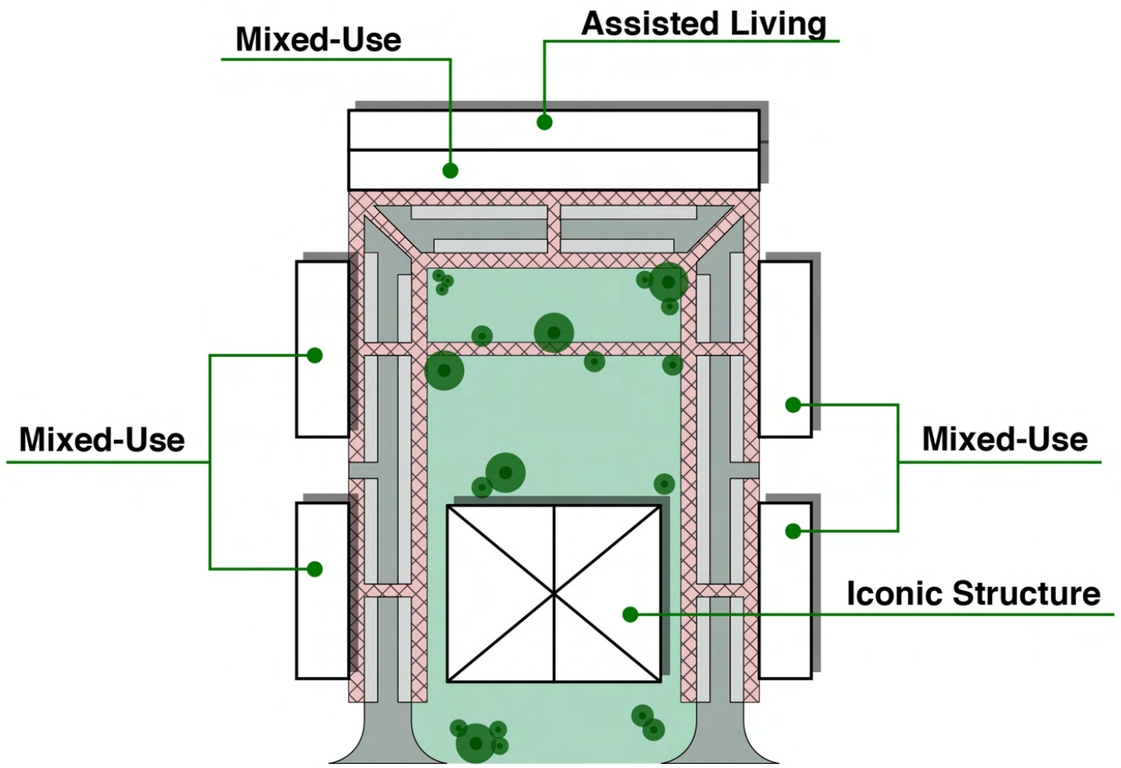


Figure 6.7: Ebenezer Commons Site Plan

References:

[1] Schmitz, Adrienne, and Scully, Jason. Creating Walkable Places : Compact Mixed-Use Solutions. Washington: Urban Land Institute, 2006. Accessed March 27, 2023. ProQuest Ebook Central.

7

Transportation

TRANSPORTATION CONSIDERATIONS

Studying traffic data before planning a new community with residential and commercial development is important as it allows us to understand how the flow of people and vehicles will be affected by the new development. By analyzing traffic data, we can determine the potential impact on existing roads and infrastructure, including potential congestion, safety concerns, and environmental impacts. So, given the large-scale project area, we investigated the existing traffic conditions for each road through which the project area can be accessed and calculated the traffic implications that the new development can bring on these roads.

Traffic Abbreviations

Annual Average Daily Traffic: The mean traffic volume across all days for a year for a given location along a roadway - estimated as the total traffic volume passing a point (or segment) of a road in both directions for a year divided by the number of days in the year.

Design hour volume: The maximum efficiently flowing traffic volume (both directions) for which the road segment is designed during the peak hour of the day.

Peak hour volume: The total volume of traffic during the peak hour. It represents the number of vehicles using a particular roadway or transportation facility during the busiest hour of the day.

Source: Traffic Data Computation Method Pocket Guide, U.S. Department of Transportation.

The site for the future Ebenezer Village is accessed primarily through East and West Road, followed by Leydecker Road, as shown in Figure 7.1.

Table 7.1 contains traffic data for all the roads surrounding the project area, broken down by road name and station numbers. It is evident that the existing Peak Hour Volume is lower than the Design Hour Volume on major roads. At present, East and West Road can further accommodate 200-300 more vehicles at peak hours. Leydecker can accommodate 50-80 more vehicles at peak hours, but exceeding this number would slow down the vehicle flow during peak hours.

Table 7.2 provides information on the number of planned units for four phases in the development of Ebenezer Village. It provides an estimate of added vehicle trips per unit per day and the added impact on the Peak Hour Volume for the East and West Road. For estimating the traffic impact, the 30-region database and the Institute of Transportation Engineers, Trip Generation Manual 10th edition are used as a reference.

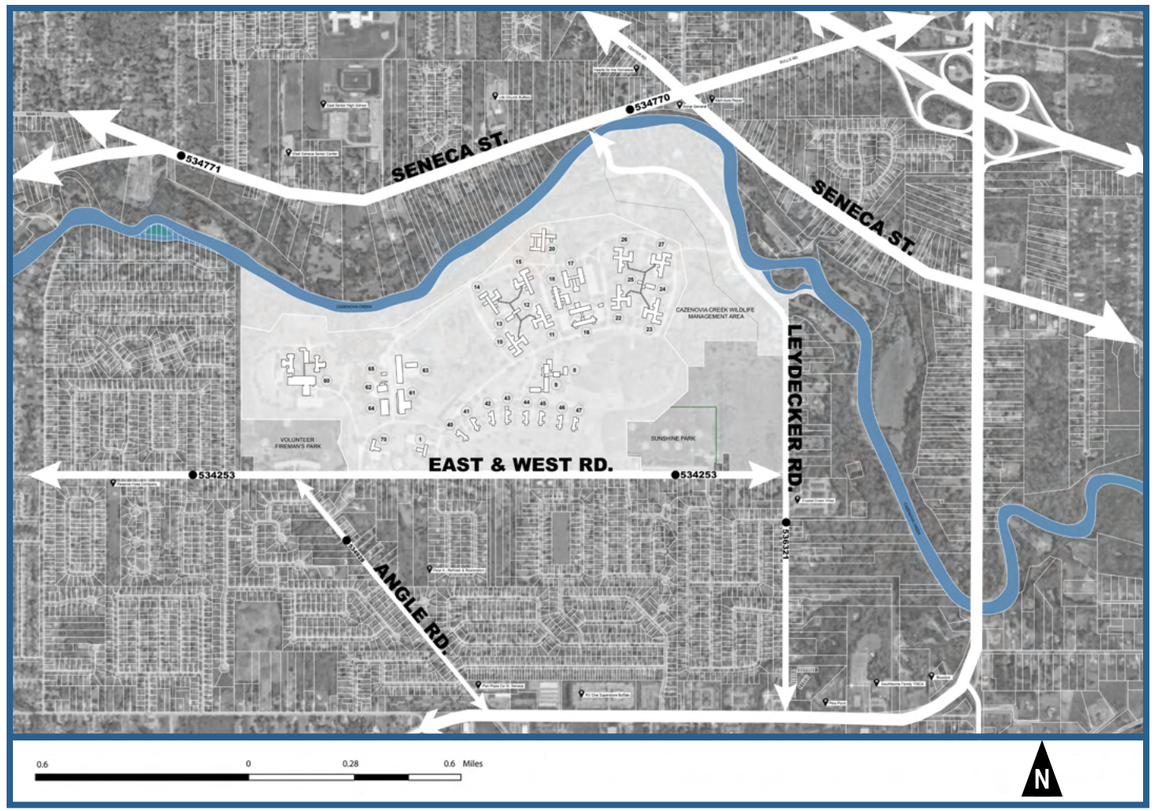


Figure 7.1: Existing Roadways around the Site

Table 7.1: Roads Serving the Project Site

Traffic Around the Site			
	Annual Average Daily Traffic (AADT)	Design Hour Volume (DHV)	Peak Hour Volume (PHV)
East and West Road	6452	565	360
Leydecker Road	1656	157	134
Seneca Street	7986	735	545
Seneca Street	6812	667	498
Mill Road	3061	287	325
Shilbey Drive	517	44	45
Source: NYS DOT			

Table 7.2: Estimated Traffic Impacts of Ebenezer Village Development Over a Series of Four Phases

Traffic Impact of Ebenezer Village on East and West Road							
Phase	Housing Type	Number of Units per Phase	Per Day		Per Hour		
			Vehicle Trips per Household*	Added Vehicles Trips per Unit	Vehicle trips per household**	Added vehicles trips per unit	Added impact on PHV (Existing PHV=360)
1	General Residential	333	5.04	1678.32	1	333	1109
	Multi-Use	160	3.1	496	2.5	400	1109
	Supportive Care	32	(2.7/bed)	86.4	0.5	16	1109
	Combined	525		2260.72		749	1109
2	General Residential	285	5.04	1436.4	1	285	1394
3	General Residential	243	5.04	1224.72	1	243	1637
4	General Residential	209	5.04	1053.36	1	209	1846
Sources: *30-region database ** Institute for Transportation Engineers, Trip Generation Manual 10th edition.							

TRAFFIC ANALYSIS

It is evident that the new development will eventually bring in a high volume of vehicles which will exceed the Design Hour Volume. To determine the phase at which volume exceeds the Design Hour Volume, we can compare the estimated Peak Hour Volumes to the Design Hour Volume provided for East and West Road, which is 565 vehicles per peak hour (Table 7.1). Phase 1 generates an anticipated 1075 vehicles per peak hour, which alone exceeds the design hour volume for the East and West Road.

Therefore, it is crucial to develop a plan for additional traffic. One approach could be to increase the capacity of the East and West Road through the addition of wider shoulders to accommodate faster and safer flow. Another approach is to add a central turning lane. Another option is to expand East and West Road by adding two more lanes.

According to the Engineering Standards Traffic Facts, the theoretical maximum saturation flow rate per lane or the ideal capacity per lane is 1,900 passenger car equivalents per hour per lane. Certain deductions are taken for different circumstances and assuming roads rarely end up at capacity in both directions at the same time. According to one source, you could benchmark the capacity at 1,600 vehicles per hour per lane as a rough starting point [1].

For the full build-out we anticipate, we tentatively conclude that it will be necessary to add two more lanes to accommodate the additional traffic generated by the new development. However, since full build-out may be significantly far in the future, we anticipate that an added turning lane will be adequate through phase [1].

Note that any approach to accommodate additional traffic would require a detailed feasibility study and analysis of potential impacts, costs, and benefits. Factors such as the availability of space, environmental impact, and community input must also be considered before making a final decision. Our suggestions here are tentative and based only on preliminary use of reference materials.

In addition, alternative modes of transportation must be highly encouraged to cater to this area, such as public transit and bike lanes, to reduce the number of vehicle trips generated by the development project and to promote a walkable community.

References:

[1] Spack, Mike. "Numbers Every Traffic Engineer Should Know." Mike on Traffic, December 9, 2011. https://www.mikeontraffic.com/numbers-every-traffic-engineer-should-know/.

[2] Tian, Guang, Keunhyun Park, and Reid Ewing. "Trip and Parking Generation Rates for Different Housing Types: Effects of Compact Development." Urban Studies 56, no. 8 (June 1, 2019): 1554–75. https://doi.org/10.1177/0042098018770075.

8

Community Design

OVERVIEW

In this chapter, we offer a proposal on the layout and features of the future Ebenezer Village. We start with the expectation that over the coming years, OPWDD will start moving to another location, demolitions will occur, and the site will become available for redevelopment. When that happens will be a political decision made by New York State, at local representatives and elected officials' discretion. Due to the site's situation in a residential neighborhood and current market trends, we conclude that the site is best suited for residential development.

Design Consideration for Neighborhood Development

The aspiration for Ebenezer Village is to create a mixed-income neighborhood with a coherent design. Therefore, we do not specify which type of home is located on a specific part of the site. For example, larger homes can be near smaller homes, and detached homes can be near townhomes. We propose a variety of housing types interspersed throughout the site. This allows for flexibility for residents and does not create isolated pocket neighborhoods that separate households by size or income. All residents have equal opportunity on the site.

The starting challenge was ensuring compatibility to accommodate the needs of geothermal loops, site sizes, building sizes, and roadways. Energy efficiency is the main priority of each building and plot. Therefore, guidelines are needed to specify the geothermal loop size, open yard space, and building footprint for multiple building types. Overall, we expect that our recommendations will allow Ebenezer Village to become a lively, innovative, sustainable community. Guidelines for housing, mixed-use, memory care, and site design are explained in this chapter.

Design Considerations

- **Walkable area with strong pedestrian greenway connections to the Wildlife Management Area**
- **Phased development so not to overwhelm adjoining roadways**
- **Residential uses that fit current demand projections**
- **Lifestyle-oriented, mixed-use, commercial center**
- **Sustainable design, focused on passive construction methods, geothermal and optional solar power.**

GEOTHERMAL DESIGN

We begin describing our community design by summarizing the underlying logic of geothermal development.

Non-Networked Horizontal Geothermal: Residential

After weighing the pros and cons of networked and non-networked, horizontal, and vertical geothermal options (Chapter 4), we concluded that non-networked, horizontal geothermal would be the most efficient for the general residential area that makes up most of the future village. The area will have single-family, duplexes, and townhomes. These residential buildings have similar energy usage throughout the day: therefore, a networked system would not be as efficient for heating or cooling. In the general residential area, each home being built will be slightly different in passivity, so the sizing of the loop needed will vary. Horizontal loops are much more home specific than vertical and are designed to lessen ground disturbance. Horizontal geothermal would also allow more flexibility for the size of the home, the loop field desired by the resident, and create easier access for construction teams. It will be far more efficient to bring machinery to the site to dig a sequence of several horizontal loop fields at once before the construction of the homes.

As compared to horizontal systems, vertical systems make more sense for larger buildings with multiple users. Vertical systems require expensive drilling, which would be more appropriate for other uses than single-family.

Non-Networked Vertical Geothermal: Memory Care

Non-networked, vertical geothermal would be the most cost-efficient option for the Memory Care facility due to the compact size of the facility. If these buildings were to use horizontal loops, they would require exceptionally large square footage of lawn space. Additionally, it would be impossible to build on top of that loop field. Vertical loops allow the buildings to be built **on top or adjacent** to the loop field and allow load bearing. Vertical loops are drilled first, and then connected to the building's HVAC system. Then the foundation can be poured directly on top of or near the vertical loops. Therefore, we propose that the Memory Care facility should be heated and cooled with a vertical geothermal system.

Networked Vertical Geothermal: Mixed-Use

For Ebeneezer Commons, we suggest a networked vertical geothermal system to link mixed-use buildings and the adjacent supported living facility to one another. To make the networked system more efficient (and to create an iconic community gathering space for all of West Seneca), we propose a central pavilion that can help balance the heating and cooling needs of the geothermal system.

With the vertical networked geothermal system, residential and commercial uses in Ebenezer Commons will complement each other, and these uses will complement the community space in the pavilion.

SITE DESIGN

Figure 8.1: Proposed Site Program

The future Ebenezer Village sits on a large site, which will take years to develop into a complete residential community. We anticipate about 1500 housing units at full build-out. Once we were able to understand what type of geothermal arrangements were needed for the village's general residential area, memory care facility, and the Ebenezer Commons, we considered how the development of sections of the site would be phased.

We anticipate that the site will be developed in four phases, each new phase to be planned as the previous one approaches full occupancy. The phasing will allow for the gradual addition of site density, systematic addition of geothermal installation, and completion of road upgrades on East and West Road. The completed site will hold roughly 1,500 +/- housing units, including a large general residential area, supportive care & memory care, and apartments. Considering multiple people will be living in each unit, we expect the population of Ebenezer Village to be approximately 3,200 people.

SITE DESIGN

Phase 1

The first phase will consist of Ebenezer Commons and the adjacent general residential area. This will create 160 apartment units in the Commons, 30 units in the Supportive Care, and 333 housing units in the general residential area.

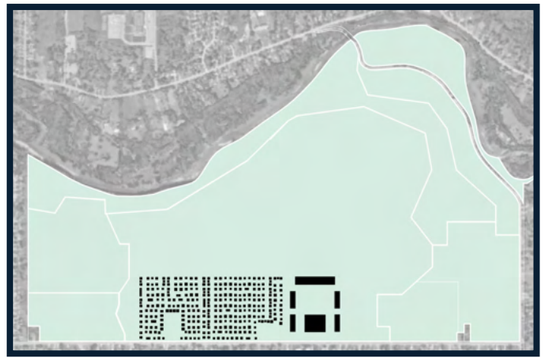


Figure 8.2: Phase 1 Diagram

Phase 2

The second phase will add an additional 243 housing units in the general residential area, and approximately 200 housing units in memory care.

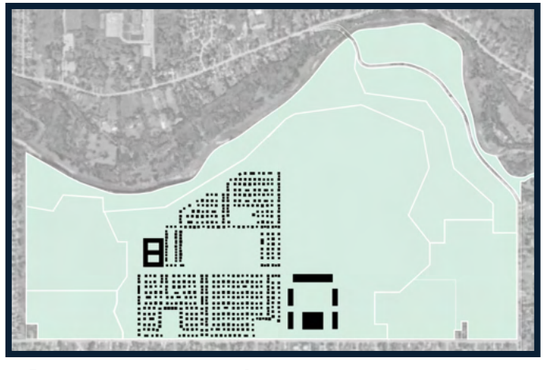


Figure 8.3: Phase 2 Diagram

Phase 3

The third phase will add 315 housing units in general residential, situated behind the Commons.

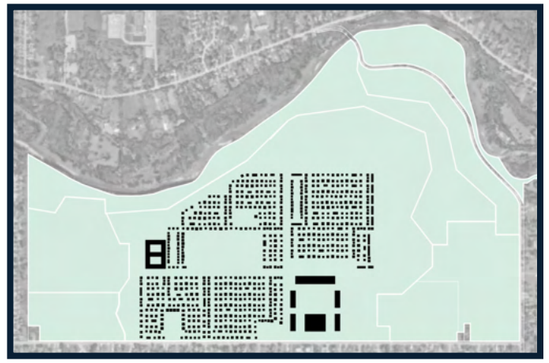


Figure 8.4: Phase 3 Diagram

Phase 4

The last phase will include 180 housing units in general residential, situated at the very back of the site, closest to the Wildlife Management Area. Development near the conservation area is limited and gradual, to reduce ground disturbance. Additionally, Phase 3 and Phase 4 are in the latter half of the development because Leydecker Road has less capacity for increased traffic.

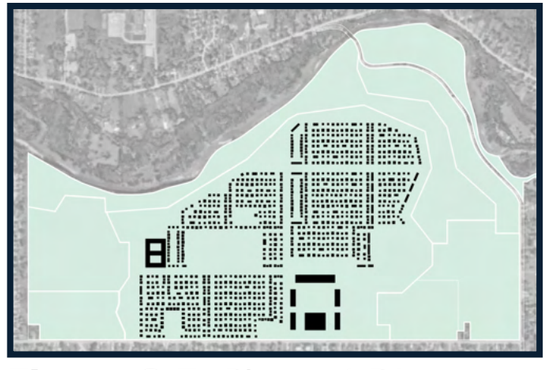


Figure 8.5: Phase 4 Diagram

CAR & PEDESTRIAN CIRCULATION

Ebenezer Village will have to have two linked systems for internal circulation: streets and greenways.

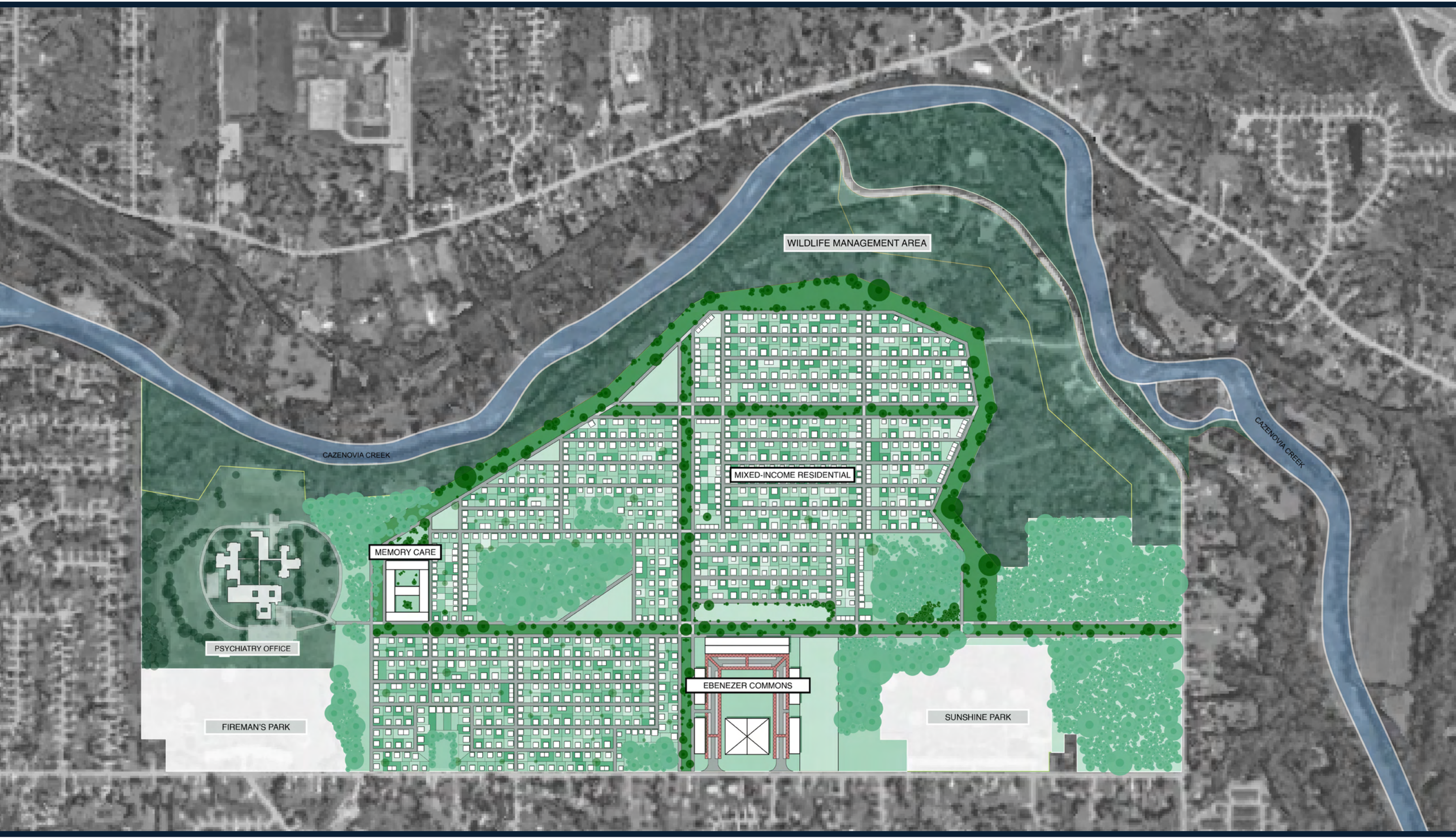
The existing internal car circulation system on the OPWDD site is unsuitable and will have to be removed. Roads will have to be configured into streets serving the residential community. Cars will enter from and exit to East and West Road and Leydecker Road, as seen in Figure 8.1. Streets will be of two types: primary and secondary. Primary streets will allow entry from perimeter roads and distribute traffic to local streets; they will also collect traffic from local streets. Secondary streets will be the local streets serving residences.

Additionally, circulation in Ebenezer Village will be distinguished by a large, interconnected greenway system. The greenway plays several roles in the community. Its primary role is to give residents and visitors a safe pathway for walking, bike riding, and exploring nature on a path that is primarily for pedestrians. Secondly, it creates a buffer between development and the Wildlife Management Area to protect wildlife, while allowing users to have a wonderful view of the wildlife and forested areas. This greenway acts as a landscape-rich connector to the Wildlife Management Area, so all residents can enjoy a green, natural view from their homes, even if they are not directly adjacent to the Management Area.

Greenways will be of two kinds: greenway boulevards and greenway trails. The greenway boulevards will have two traffic lanes on either side separated by an extra wide median. The median will be heavily landscaped and will have trails for pedestrian, bike, and light e-mobility use.

The greenway is laid out in a grid on the site so users can choose a variety of circulation routes, short or long. The greenway can be used by village residents as well as visitors. It will be fully available to residents of West Seneca. It will be linked into Ebenezer Commons to encourage visitors to engage in recreation opportunities. Moreover, this greenway connects the adjacent parks of Volunteer Fireman's Park and Sunshine Park.

Figure 8.6: Circulation Diagram


WILDLIFE MANAGEMENT AREA
CAZENOVIA CREEK
CAZENOVIA CREEK
MIXED-INCOME RESIDENTIAL
MEMORY CARE
PSYCHIATRY OFFICE
EBENEZER COMMONS
FIREMAN'S PARK
SUNSHINE PARK

HOUSING GUIDELINES

One of the lessons we learned through our collaboration with Buffalo Geothermal, is that there is a correlation between housing shape and the quantity of geothermal loops needed. According to energy models, square-shaped homes produce better energy results than rectangular-shaped homes. In addition, our collaboration allowed us to estimate the square footage of the horizontal loop field needed for detached homes and townhouses. Figures 8.7, 8.8 and 8.9 will illustrate the possible arrangements appropriate for single-family detached, duplex detached, and townhouses.

We recommend these variations as a starting point for an approach that should be further explored through future architectural and engineering consultation. We are not indicating any specific architectural design guidelines such as roofing type, cladding, color, window arrangement, or material. In this report, we will suggest possible styles that best complement the region but are offered as only style recommendations.

Geothermal loops can be laid out in various arrangements, but there are certain principles that can serve as guidance for spatial efficiency. Loop field sizes relate to building size. All horizontal loop fields require a minimum clearance of 5’-0” and a proposed maximum of 10’-0” around the field to protect adjacent infrastructure and the loop field itself. The guidelines below apply only to the general residential area of Ebenezer Village, and not to large multi-unit buildings in Ebenezer Commons, nor to the memory care facility.

General residential will have the largest number of units on site, and at full build-out will include approximately 1,200 units. These will include single-family, duplexes, and townhouses.

Design Recommendation Scope

- **Geothermal loopfield layout & size**
- **Parcel shapes & size**
- **Building square footage**
- **Building shape**

Single-Family Detached

For single-family detached homes, we recommend the following plot variations shown in Figure 8.7.

It is recommended that single-family homes range between 1000 SF and 2000 SF +/-. Appropriate square massing ensures that the site is organized efficiently and with the proper density. Single-family homes that wish to exceed 2000 SF will have a further expense for larger geothermal loop fields and may diverge from energy expectations calculated in this report.

According to information we received from Buffalo Geothermal, homes that are two stories, such as the two-story 2000 SF example, end up needing less geothermal loop field square footage than a 2000 SF one-story home. Therefore, for homes that are greater than 1500 SF we recommend a two-story home for greater economic and environmental efficiency. Additionally, we recommend that plots that are more rectangular in shape are placed on the ends of blocks and that square plots run left to right in order to maintain block sizes. However, it is the choice of the residents to choose the plot arrangement that works best for them.

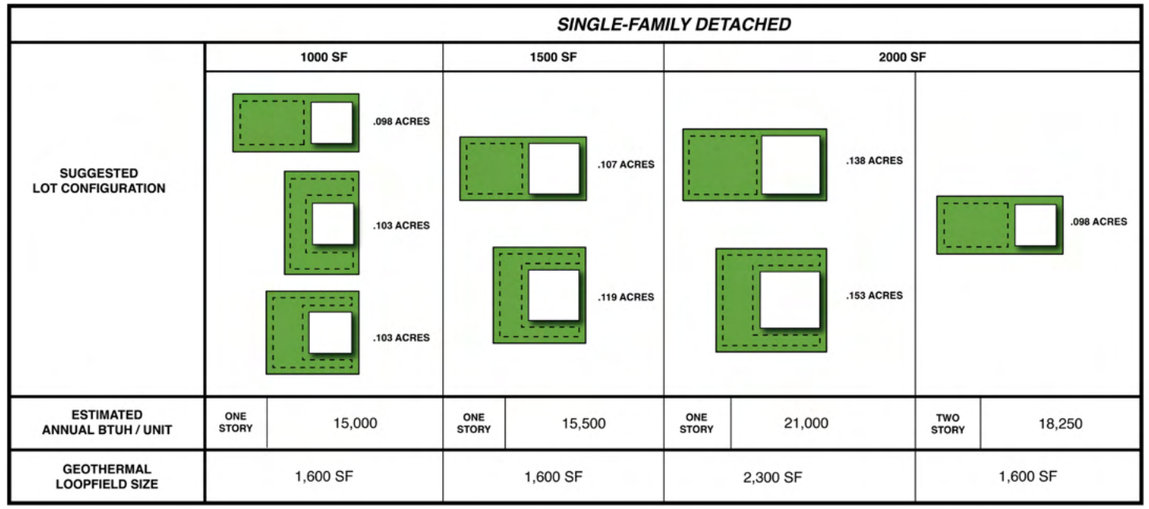


Figure 8.7: Single-Family Housing Plot Variation Diagram

Duplex Detached

For duplex detached homes, we recommend the following plot variations in Figure 8.8.

Duplexes can be organized simply by putting two single plots together. Each home will have its own horizontal geothermal loop field. Duplexes that share a common wall may be more energy efficient than single detached homes, which have more exterior walls exposed to the elements.

Townhouses

For townhomes, we recommend the following plot variations in Figure 8.9. Each townhouse is a 2000 SF, two-story unit abutted to another. Similar to the duplex, sharing walls in this arrangement may limit the amount of loop field needed to maintain heating and cooling needs. Therefore, we recommend a minimum of three townhouses abutted and a maximum of five abutted to limit the ratio of housing to lawn needed for loop fields. Similar to the other housing types, we do not recommend a specified zone of townhouses on the site. However, we do recommend that townhouses cap the end of blocks or fill in incomplete blocks such as smaller triangular blocks that are difficult to fit with single-family homes and duplexes. This will add density and viewsheds along long major streets, but also will not create too much density if placed across from a series of smaller one-story single-family homes.

Memory Care

After looking at various precedents of memory care facilities, we recommend a stand-alone, campus-style organization that faces an internal courtyard. This campus will have vertical geothermal loops due to the size of the buildings and the energy needs required.

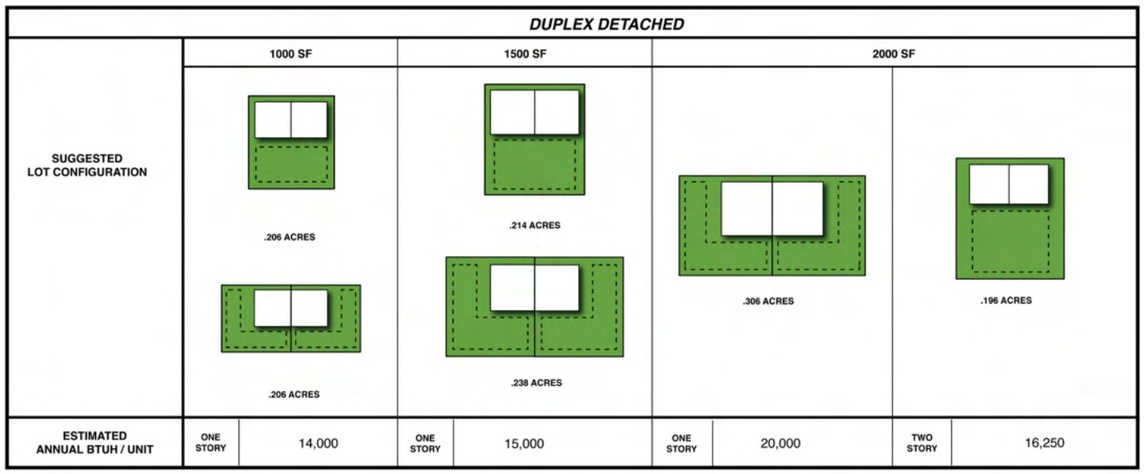


Figure 8.8: Duplex Detached Housing Plot Variation Diagram

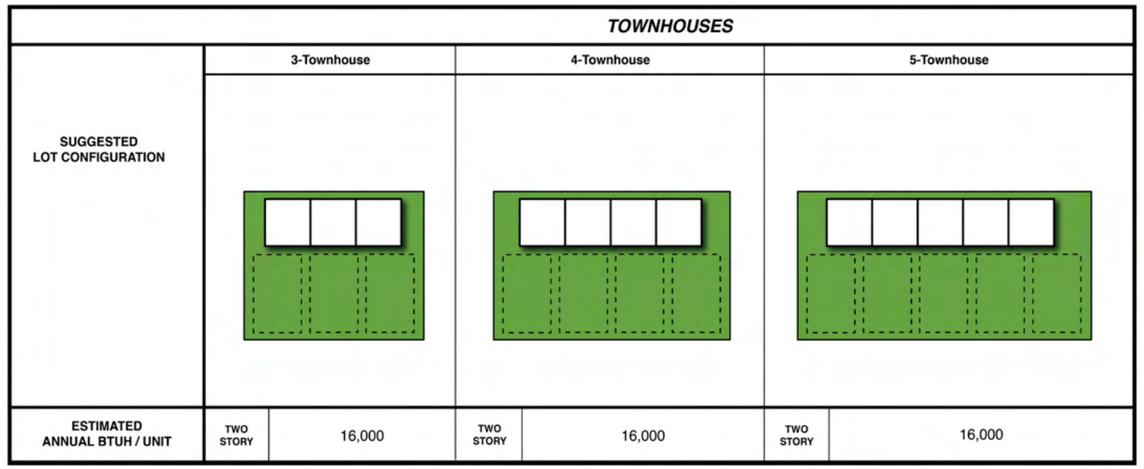


Figure 8.9: Townhome Plot Variation Diagram

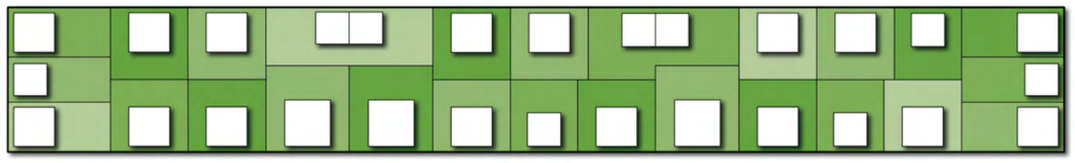


Figure 8.10: Possible Block Variation Diagram

EBENEZER COMMONS DESIGN

Based on our market analysis, we recommend a lifestyle center environment, which is quite different from the traditional shopping plazas that are located a few miles away on Union and Transit Roads. This mixed-use center will be organized around an open rectangle situated between five buildings, see Figure 8.13). These will be multi-use buildings with local businesses and services on the ground floor and multi-unit housing on the upper floors. Some of the styles recommended for the mixed-use buildings are shown in Figure 8.12.

Types of Activity

- **Local mobility by the residents of Ebenezer Village**
- **Shopping by residents and visitors**
- **Recreational & community use of the pavilion**
- **Extended stay for entertainment & for exploring the Greenway**

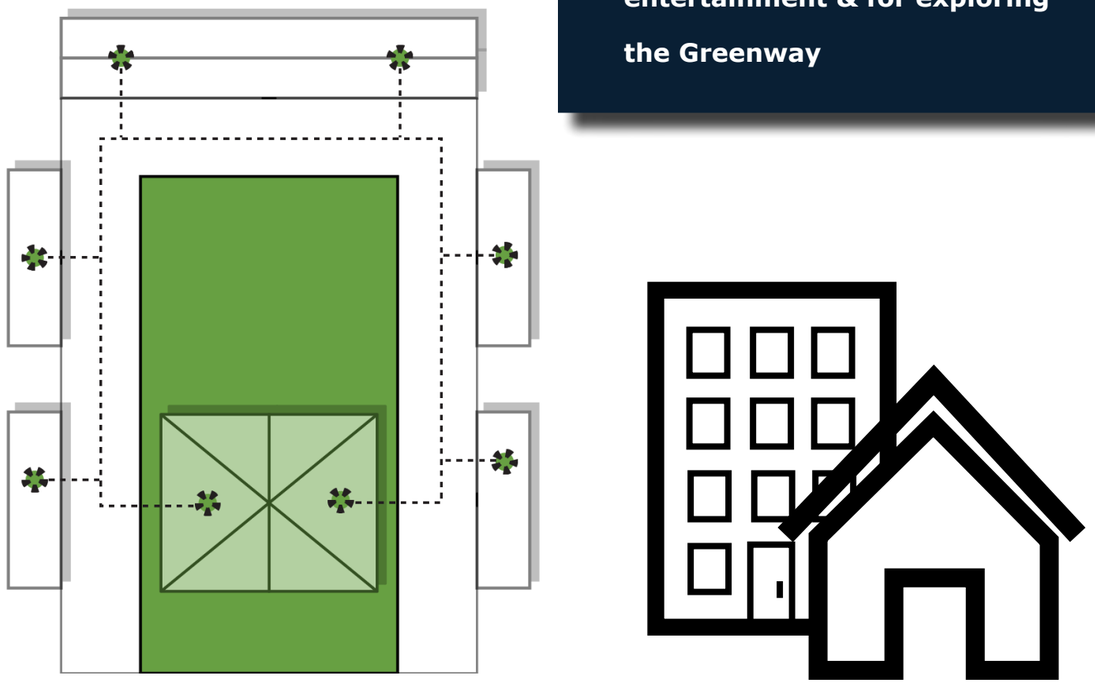


Figure 8.11: Ebenezer Commons Vertical Network Geothermal

The design of Ebenezer Commons partially encloses a central lawn that faces a signature pavilion. This will allow pedestrians to have a view of all the retail available as well as have a partially enclosed area that is visible from the street and within but does not disturb the surrounding homes. The Commons is designed to maximize activity to create a vibrant, well-used space.

Ebenezer Commons will have connectivity to the rest of the greater Ebenezer Village through greenways and streets to the wildlife conservation area. Therefore, all residents will have access to the Commons and users of the Commons will be able to explore the village and wildlife management area.

Figure 8.12: Mixed-Use Lifestyle Building Precedents

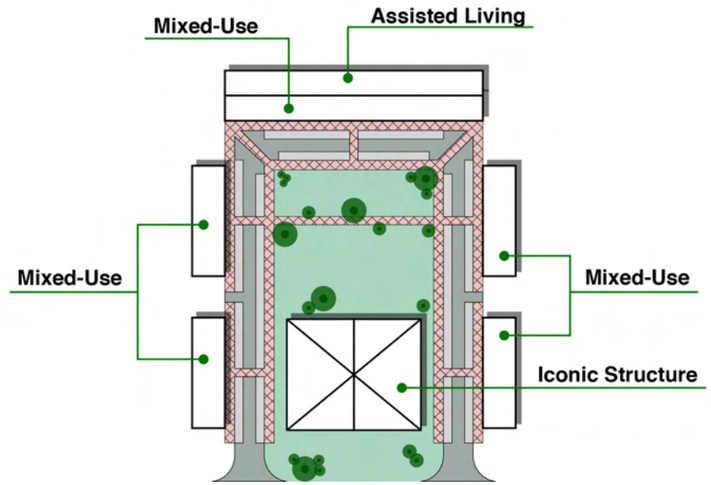


Figure 8.13: Ebenezer Commons Site Plan

PAVILION DESIGN

We believe that the Ebenezer Commons should have an iconic structure (pavilion) that can bring in the community in many ways. An open floor pavilion of 80,000 SF to 100,000 SF will have a variety of uses that can support the community, residents, and visitors. The addition of a geothermally heated floor slab will allow the pavilion to change uses easily to balance the networked geothermal system, and also facilitate changes in the activity inside. There are a few design characteristics we suggest in order to allow the pavilion to be adaptable to all kinds of uses and programs.

Pavilion Character

- **Translucent or semi-translucent exterior**
- **Adjustable or removable openings such as doors, windows and walls, in order to adapt the pavilion to the various uses desired**
- **Open floor plan to allow for program flexibility**

Pavilion Activities

- **A walking loop and playground for indoor recreation during colder months.**
- **Seating areas to eat, relax, and watch children in the playground, or in extreme temperatures, heat up or cool down.**
- **Public events such as community meetings, school programs, concerts, farmers' markets, and craft fairs, etc.**
- **Private events such as weddings, birthday parties, and business dinners, etc.**
- **Seasonal public skating rink**
- **A location to highlight a geothermal exhibit or geothermal museum**

NEXT STEPS

Utilizing the principles and design guidelines we have described in this report, Ebenezer Village will become a vibrant community, with pleasant geothermally heated and cooled homes, beautiful greenways, and a special mixed-use lifestyle activity center. It will replace the neglected and unoccupied facilities that now fill the space, enhance the Wildlife Management Area, and increase West Seneca's population. Above all, it will be the first geothermal, absolute-zero residential community in the state.

How to get there!

1. Community Geothermal Working Group
- a. Community Leadership
- b. Electrical Utility (NYSEG)
- c. State Agencies (NYSERDA)

2. Disposition of OPWDD Property
- a. Community Leadership
- b. OPWDD
- c. Office of the Governor

3. Transfer of property to Empire State Development
- a. Demolition
- b. Contractual processes with developers

4. Revision of Comprehensive Plan
- a. Public participation
- b. Land Use for site
- c. Road Installation