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Aging in a Suburban Context: An exploration of how design can help maintain the quality of life and social connections, reduce cost of daily life and reconnect with nature and memory in the suburban context.

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To the Graduate Council:

I am submitting herewith a thesis written by Deepa Surendranath entitled "Aging in a Suburban Context: An exploration of how design can help maintain the quality of life and social connections, reduce cost of daily life and reconnect with nature and memory in the suburban context.." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Architecture, with a major in Architecture.

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Aging in a Suburban Context:

An exploration of how design can help maintain the quality of life and social connections, reduce cost of daily life and reconnect with nature and memory in the suburban context.

A Thesis Presented for the
Master of Architecture
Degree

The University of Tennessee, Knoxville

Deepa Surendranath

August 2013

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Dedication

I dedicate my work to my grandfather who lived independently till he was 93 years of age and recently left us.

Acknowledgements

I would like to express my deepest appreciation to all those who provided me the possibility and guidance to complete this investigation. I give my special thanks to my guide and advisor Professor Tracy Moir McClean for patiently guiding me, stimulating me constantly with her suggestions and help me finish this thesis. I also extend my thanks to the members of my committee, Professor Jennifer Akerman and Dr. Avigail Sachs for their valuable contribution towards the project. I would also like to thank Dr. Buchanan who, with his expertise in storm water management guided me through the earlier stages of the project. I would also like to show my gratitude to Professor Hansjoerg Goeritz and Professor John McRae for their suggestions when approached.

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Abstract

Retirement and Aging are very important aspects of a person's life. Many changes in lifestyle, ability to manage one's personal environment occur after retirement and are associated with emotional changes, diminishing physical and cognitive ability. Suburban single-family homes and neighborhoods that were very advantageous for young adults raising families become unmanageable in later years and contribute to the physical or psychological issues faced by aging populations.

These physical or psychological problems can be addressed through designing a community in which the aging residents feel independent, get adequate stimulation of the brain and good physical activity. The living arrangements, food, gardening, water and past memories, affect the lifestyles of the elderly retirees.

The quest of this thesis is to design a community that maintains and even improves the quality of life for people after retirement by providing them with a living arrangement which is still connected to the suburbs, a condensed neighborhood that maintains ties to familiar neighbors and places, proximity to water, food production and reliving past memories.

The goal of this thesis is to investigate issues and literatures related to aging in place and sustainable communities, and apply this to design investigation. The design investigation selected to explore this thesis is a sustainable Senior Housing community that provides a smooth transition from being employed to being retired, and supports the residents as they age in place. A successful 'Aging in Place' program and community maximizes the personal dignity and the functional independence of the residents. Design of a sustainable community for aging in place needs to include features that allow individuals to adjust their effort and contribution to community as they age; that encourage social interaction, connection with nature and conservation of resources, and put in place elements that allow residents to receive short and

longer term assistance with the activities of daily lives (Heumann & Boldy, 1993). The design investigation focuses on condensing the familiar aspects of the existing suburban condition within a more manageable neighborhood. Food, water, fitness and opportunities to create and cherish memories come together in this proposed neighborhood, community and the living unit itself.

Table of Contents

Section I Literature Studies and Identification of Issues	1
Chapter 1 Retirement and Aging	2
1.1 Introduction	2
1.2 What is Retirement? How does it affect the quality of life?	2
1.1 Phases of retirement.....	4
1.3 What is aging?	5
1.31 Successful aging	6
1.32 Demographics of aging	7
1.4 What are the issues associated with retirement and aging? Why do these occur?.....	8
1.41 Physical issues.....	9
1.42 Psychological issues	12
1.43 Economic Issues	14
For individual.....	15
For the country	15
Chapter 2 Suburban living	17
2.1 Introduction	17
2.2 Advantages of living in a suburb	17
2.3 Disadvantages of living in a suburb as one ages.....	18
2.4 Advantages of continuing to live in suburbs as one ages.....	20

Chapter 3 Living arrangements	22
3.1 Introduction	22
3.2 Aging in Place	22
3.3 Aging in Place in Suburbia – Existing options	23
3.31 Apartment buildings	23
3.32 Townhouse communities	23
3.33 Condominium communities.....	24
3.4 Aging in Place– Alternative models	25
3.41 Granny flats and extended housing.....	26
3.42 Shared housing.....	26
3.43 Amenity housing	27
3.44 CoHousing	27
3.5 Sustainable community models.....	28
3.6 Living arrangements and their role in mitigating the issues faced by the elderly	29
3.61 Physical Issues	29
3.62 Psychological Issues	29
3.63 Economic Issues	30
3.7 Aspects of a planned community that is manageable by residents of all ages.....	31
Chapter 4 Health and exercise	32

4.1 Introduction	32
4.2 How does being healthy help with issues faced by the aging population	32
4.21 Physical Issues	32
4.22 Psychological Issues	32
4.23 Economical Issues	33
4.3 Aspects of a planned community that supports and encourages physical well-being	33
Chapter 5 Food and Nutrition	34
5.1 Introduction	34
5.2 Problems associated with nutrition and proper food	34
5.3 Good Nutrition.....	34
5.31 The DASH plan	35
5.4 Importance of Fruits and Vegetables	35
5.51 Physical issues.....	35
5.52 Psychological issues	36
5.53 Economic issues.....	36
5.6 Aspects of a planned community that can support good nutrition	37
Chapter 6 Water	38
6.1 Introduction	38
6.2 How water and its conservation help solve issues faced by the elderly	38

6.21 Physical Issues	38
6.22 Psychological Issues	38
6.23 Economical Issues	40
6.3 Sustainability and rain water harvesting.....	40
6.4 Aspects of a community that could capitalize on the psychological benefits of water and also reduce economic costs by reduced use of municipal water	41
Chapter 7 Reliving and Recollecting Early Memories	42
7.1 Introduction	42
7.2 Memories	42
7.3 How memories help in the issues faced by the elderly	42
7.31 Physical issues.....	42
7.32 Psychological issues	43
7.33 Economic issues.....	43
7.4 Important memories of suburban neighborhoods and lifestyles.....	43
7.5 Aspects of a planned community that can help preserve memories of suburban life and one's personal experiences and support creation of new memories.....	44
Chapter 8 Case Studies.....	45
8.1 Danish cohousing.....	45
8.2 Garden communities/ community gardens.....	47
EcoVillage (Ithaca, New York)	47

Nubanusit Neighborhood and farm (Peterborough, NH).....	49
Fairview Village, Portland, Oregon	51
8.3 Buildings that use Harvested rain water	53
Bullitt Center, Seattle, WA, Miller Hull Architects.....	53
Section II Design Investigation	55
Chapter 9 Site	57
9.1 Criteria for site selection	57
9.2 Site inventory and analysis	60
Chapter 10 Programming	65
10.1 Introduction	65
10.2 Experiences of Daily Life the Proposed Community.....	67
10.3 Programme Requirements	68
Living arrangements.....	68
Food and Nutrition.....	69
Health and fitness	69
Water: experience and conservation	69
Cherishing and creating memories.....	70
Chapter 11 Design	74
11.0 Introduction	74
11.1 Efficient Living Arrangements	75
11.2 Food and nutrition.....	83

11.3 Water as an experience and water conservation	84
11.4 Health and exercise	86
11.5 Creating and cherishing memories.....	89
11.6 Integration.....	91
Conclusion	99
List of references	102
Appendix	107
Vita	116

List of tables

Table 1: Nutrition chart..... 108

Table 2: Daily calorie needs for women 109

Table 3: Daily calorie needs for men 109

Table 4: DASH Eating Plan—Number of Food Servings by Calorie Level 110

List of Figures

Figure 1: Sequential Phases and Transitions of retirement.....	4
Figure 2: Aging transition and retirement	6
Figure 3: Relationship between physical capacity, diseases and engagement with life.....	7
Figure 4: Onset of Physical issues as one ages	9
Figure 5: Relation between age and health	10
Figure 6: Psychological issues and retirement.....	12
Figure 7: Economic issues and retirement.....	14
Figure 8: Relationship between income and medical expense.....	15
Figure 9: Dependence on driving	19
Figure 10: Existing models and successful aging	23
Figure 11: Alternate models and suitability for the young-old	25
Figure 12: Alternate models and suitability for the transitional years	25
Figure 13: Alternate models and suitability for the old-old.....	26
Figure 14: Salient features in the Danish Cohousing community	46
Figure 15: Salient features of EcoVillage.....	48
Figure 16: EcoVillage, Ithaca, NY.....	48
Figure 17: Salient features of Nubanusit neighborhood	50
Figure 18: Nubanusit Neighborhood and farm, Peterborough, NH	50
Figure 19: Salient features of Fairview Village	52

Figure 20: Fairview Village, Portland, OR	52
Figure 21: Salient features of Bullitt Center.....	53
Figure 22: Bullitt Center, Seattle, WA.....	54
Figure 23 Site location	60
Figure 24: Aerial view of site	60
Figure 25: Existing and Proposed Greenways	61
Figure 26: Amenities within 1/2 mile radius	62
Figure 27 Proposed walkable paths	63
Figure 28: Demographics of the neighborhood.....	64
Figure 29: Programme chart.....	71
Figure 30: Traditional vs. Proposed neighborhoods in suburbia	74
Figure 31: Proposed sidewalk for the neighborhood roads	76
Figure 32: Amenities within the neighborhood.....	77
Figure 33: Proposed Site Plan	78
Figure 34: Efficiency of the proposed unit	80
Figure 35: View of the Great Room in a unit.....	81
Figure 36: Integration of Food and Nutrition in the 3 scales.....	83
Figure 37: Integration of water in the 3 scales	84
Figure 38: Analysis of the growing season in Knoxville, TN.....	85
Figure 39: Experience of water in side yards	85
Figure 40: Integration of Health and exercise in 3 scales	86

Figure 41: Private stairway	87
Figure 42: Multipurpose hall and fitness center	88
Figure 43: View of the courtyard	89
Figure 44: View of the communal garden.....	90
Figure 45: Icons used to indicate Integration of Issues in Design Investigation.....	91
Figure 46: Side yard in the unit.....	92
Figure 47: Plan at Level -1	93
Figure 48: Plan at Level 1.....	94
Figure 49: Plan at Level 2.....	95
Figure 50: Plan at Level 3.....	96
Figure 51: Plan at Level 4.....	97
Figure 52: Section A	97
Figure 53: Section B	98
Figure 54: Section C	98
Figure 55: Suitability of design in for the young-old	100
Figure 56: Suitability of design for the transitional years.....	100
Figure 57: Suitability of design for the old-old	101
Figure 58: Drought map 2012.....	111
Figure 59: Climatic analysis	112
Figure 60: Vehicular paths and logical entry	113

Figure 61: View from the pavilion	114
Figure 62: View as one approaches.....	114
Figure 63: Usage of water	115

Section I

Literature Studies and Identification of Issues

Chapter 1

Retirement and Aging

1.1 Introduction

A man's age is something impressive. It sums up his life: maturity reached slowly surmounting varied obstacles, illnesses cured, grief and despairs overcome, and unconscious risks taken; maturity formed through so many desires, hopes, regrets, forgotten things and loves. A man's age represents a fine cargo of experiences and memories.

~Antoine de Saint-Exupéry, *Wartime Writings 1939-1944*, translated from French by Norah Purcell.

However, the benefits of maturity are often ignored by the society. Though the lifespans have increased over the years and we are further working towards increasing the lifespan of humans, we fail to give the quality of life the importance it warrants. Generally, we tend to think of retirement and aging as being synonymous.

1.2 What is Retirement? How does it affect the quality of life?

Retirement is generally defined by most dictionaries as that stage when a person stops being an employee completely.

Retirement gives opportunity to spend more time on what a person desires to do most without having to rush through to meet deadlines. However, it is also associated with aging and aging brings with it, thoughts of diminishing health, failing strength and cognitive senses. Many sociologists and retirees themselves do not consider retirement as being an endpoint. They consider it to be a process of transition from full time employment to not working

(Gerontology 2005). There are many approaches to make this transition smooth.

Retirement used to be very simple when the lifespans of people were relatively short. According to the 2012 Statistical abstract published by the US census bureau, the average lifespan was just 62.9 years in 1940, 78 years in 2008 and is projected to be 79.5 years in 2020(Arias 2008). Life expectancy around the world has risen dramatically, by 11 years for men and 12 years for women over the last four decades (Boseley 2012). As longevity improves, America's baby boomers are facing up to 30 years of retired life that they cannot afford. According to the population survey, some of the wealthy choose to retire early, about one third of America's population chooses to retire between 62 and 67 years of age and rely on social security benefits and the bottom third keeps working. Yet, most of this generation envisions an "active retirement" where one continues to engage in some activity or work even after retirement. With more people relying on social security benefits, the country's treasury is likely to be dented.

"The people in their 50s now are the most educated, most tech-savvy generation in our country's history," says William Frey, a demographer and visiting fellow at the Brookings Institution. "They'll want to stay engaged in their work and be physically social." (Fetterman 2006)

Changes in environments, changes in routines and the availability of food are important factors that contribute to changes in eating habits and body weight. Retirement is a time marked by changes in the social, emotional and nutritional aspects of life for the elderly, with either positive or negative effects, depending on the meanings that were attributed (Líria Núbia, Luciana et al. 2008).

1.1 Phases of retirement

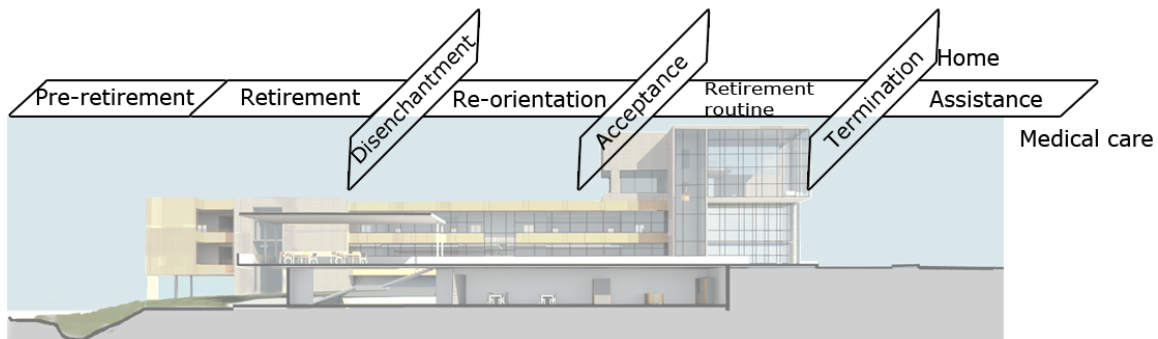


Figure 1: Sequential Phases and Transitions of retirement

(diagram by author)

Preretirement: This stage involves planning for retirement before actually retiring.

Retirement: This stage involves transition between full employment to not being employed. Retirement can often occur in two phases

Active retirement, where one continues to maintain an active lifestyle after retirement and

Full retirement, where one stops actively getting involved in any work as soon as one's employment ends.

Disenchantment: As a person retires, he may become emotionally disenchanted with his or her life conditions and suffers a loss of prestige.

Reorientation: This refers to the stage when a retiree accepts that he or she is no longer employed and begins to actively start moving on with life.

Retirement routine: Once the acceptance sets in, the retiree's life usually falls into a routine.

Termination of retirement: This is the phase where retirement no longer plays a role in the lives of people. Usually, the physical abilities and independence of the people are greatly diminished when this stage sets in (Atchley 2000).

The transition from the disenchantment phase to the reorientation and retirement routine is difficult. A smooth transition through these stages enhances a person's sense of well-being. The transitional stages are not age-related and resource-rich individuals are less likely to experience retirement-related change in satisfaction during the transitional years (Pinquart 2007). This is where design can play an important role in helping retirees make a smooth transition.

1.3 What is aging?

Simply put, aging is Growing Older.

Increased longevity poses many challenges, both to the individual and to the society. Innovations in healthcare delivery, housing, land use planning, transportation, agriculture, food distribution, and other societal activities attempt to respond to the demographic shift, along with addressing other needs of the 21st century. Ethical questions arise concerning how and where elders fit into society and what our responsibilities to them are (Jill Stein, 2009).

Aging starts from the time of conception and continues until death. We tend to think of old age as being laden with problems, though we know that old age also brings with it, rich experience and memories. Aging in humans refers to a multidimensional process of physical, psychological, and social change.

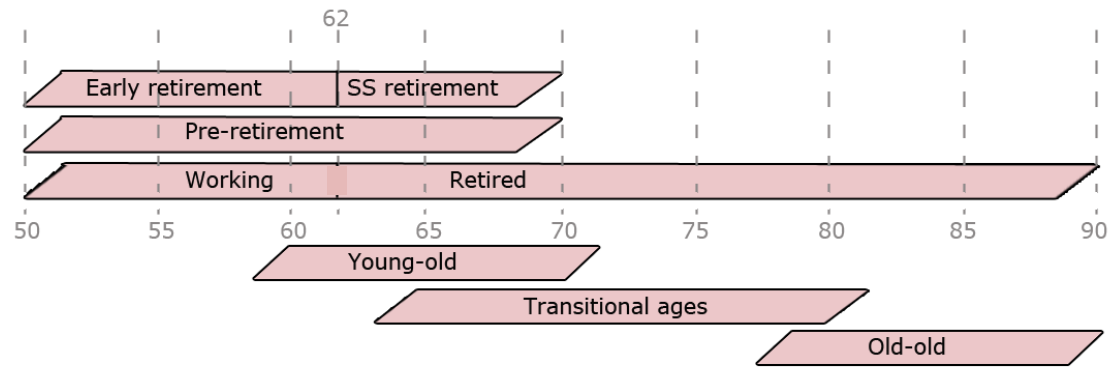


Figure 2: Aging transition and retirement

(diagram by author)

The stages of old age are generally regarded as beginning at around 65 years of age. This corresponds to retirement for many people. With the increase in life expectancy, people in their 60s are referred to as the young-old and those in their 80s are referred to as the old-old.

1.31 Successful aging

Successful aging or optimal aging as it is otherwise known consists of three main components: low probability of disease or disability, high cognitive and physical capacity, and active engagement with life. All of the above three are inter-related and do not stand alone as per figure below. (Rowe and Kahn 1997)

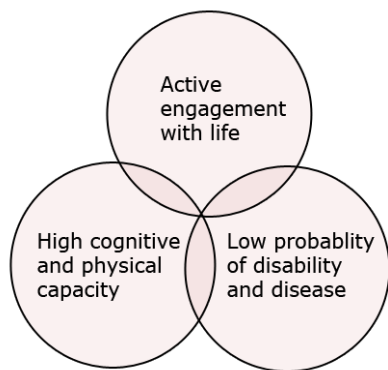


Figure 3: Relationship between physical capacity, diseases and engagement with life

(diagram by author)

1.32 Demographics of aging

Generally, the young-old are more robust and healthy. Many changes take place in them as they transition towards the old-old age. These changes do not happen overnight nor do they occur uniformly in a specific age group. Aging is a highly individual experience. Each person experiences age-related changes at a rate determined by genetic makeup. The quality of one's life and the changes depends upon many factors, including heredity, physical health, nutrition, activity levels, mental health, and other factors (Stangor).

In order to provide a smooth transition through retirement, it is best to start early. The target age group for residents to move into this community is from 60 years old to 65 years old, although some may choose to move in earlier during preretirement when they are about 40 to 50 years old. These persons would still be in a state of optimism about retirement. Hence, providing those persons with a good quality of lifestyle would help them maintain their optimism about retirement and aging and help them transit through the years in a smooth manner.

The community design proposed as a demonstration of this thesis investigation needs to provide a living arrangement that allows residents to move in during pre-retirement or their young-old years and remain in this community until they reach a stage of aging where continuous care is required. Properly supported by family, friends, neighbors, and in later stages from health assistants, residents could spend around 50 years in this community, leading independent lives, being relatively healthy and disease free.

1.4 What are the issues associated with retirement and aging? Why do these occur?

The physical issues associated with aging are well known. However, the quality of life perceived by a person or group reaches beyond physical health, necessitating a broad and complex analysis considering factors such as socio-economic level, emotional state, social interaction, intellectual activity, cultural values, lifestyle, employment and/or daily activities satisfaction, and the living environment. A successful aging process requires the maintenance of physical and mental functioning and emotional well-being. Community design that supports and creates opportunities for residents to participate in regular social meals and cooking, nutrient rich food, social, recreational, and exercise activities that support friendships can support physical, cognitive and emotional well-being.

This proposal distills the issues faced by the aging population to

- Physical issues
- Psychological issues
- Economic issues

1.41 Physical issues

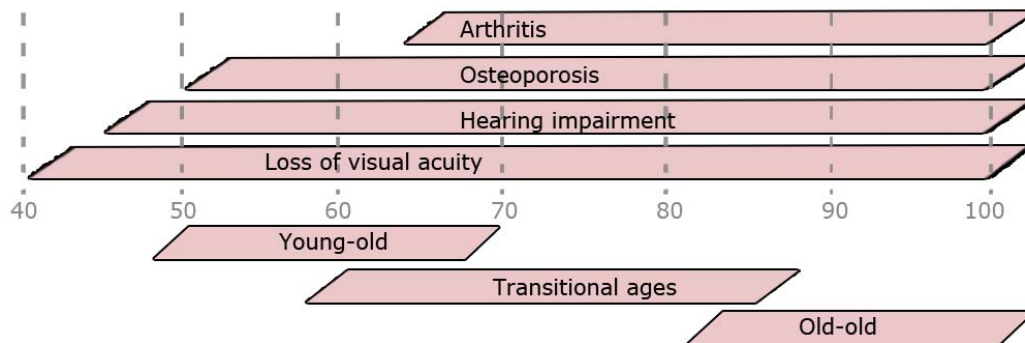


Figure 4: Onset of Physical issues as one ages

(diagram by author)

The most common health related issues faced by the elderly that also contribute to the reduction in flexibility and mobility of the individual are Arthritis, Muscular Loss, Cardiovascular Diseases, Neurological Diseases, Diabetes, Osteoporosis, Hearing Impairment, Vision Impairment and Mental Disorders (Ankerson). As seen from the figure 4 above, the onset of most of these ailments could be even during the pre-retirement stage and progress at different rates.

Physical issues of concern to retirees include poor health, threat of chronic diseases and not having enough medical care and failing of cognitive senses. As they age, the retirees feel the need for independence, yet fear that they may not be physically able to maintain the levels of independence that they are used to. Driving, an important component of suburban life becomes increasingly difficult as alertness, reflexes, and vision decline (Jill Stein, 2009).

Diminished physical stamina and capacity begin to limit ability to perform ordinary tasks like managing stairs and ladders, cleaning, vacuuming, mowing required to maintain large suburban homes and yards as a homeowner ages (Ankerson).

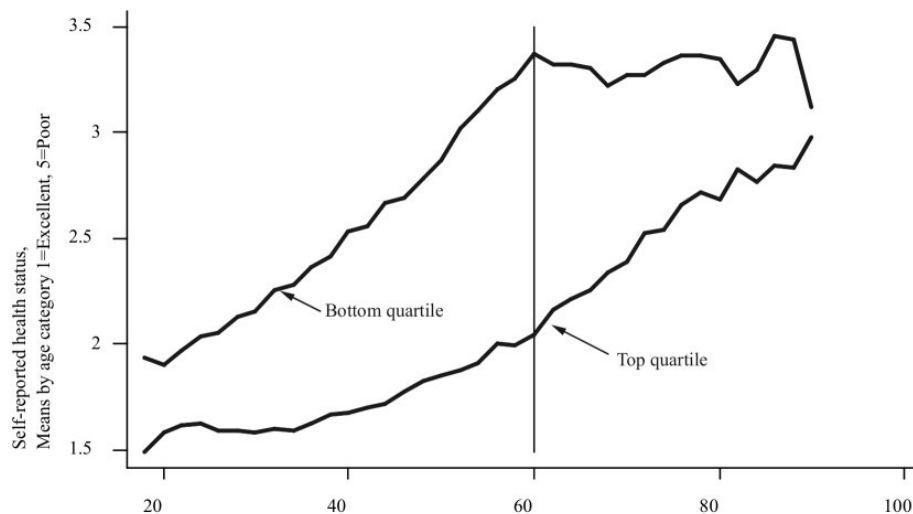


Figure 5: Relation between age and health

Source: National bureau of economic research

Many changes occur in the human body as it ages. These include changes in appearance, posture, vision, bone structure, taste and body functions. Medical studies have also shown that the cardiovascular system also undergoes many changes as a person ages. It is well known that early adoption of healthy life patterns like good nutrition, regular exercise can help people maintain and extend their personal period of physical robustness as they age.

The community design proposed in this investigation is programmed to provide ample opportunities for residents to maintain a healthy life by exercising regularly and eating right. These are discussed in greater detail in the chapters that follow. Hence, it is proposed that the best transition to a retirement community should be as soon as one retires or even a couple of years earlier to retirement, during the pre-retirement stage.

1.42 Psychological issues

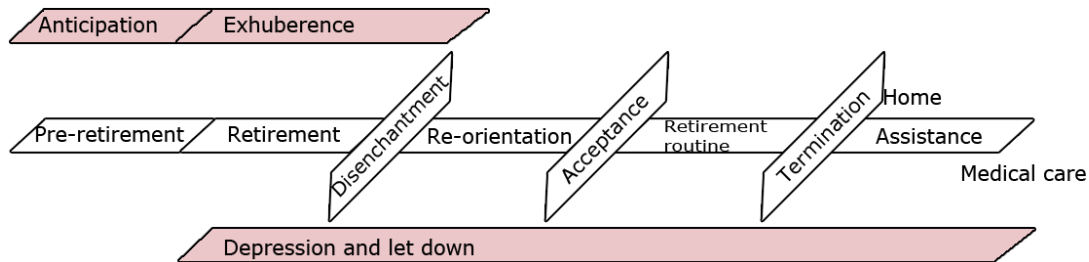


Figure 6: Psychological issues and retirement

(diagram by author)

In retirement, physical control and condition greatly influences the quality of life. However, the psychological and social changes in this stage of life cannot be ignored. For many people, retirement represents social devaluation and the loss of professional identity. Thus it triggers alterations in a person's psychology.

During pre-retirement people often dream of retirement and anticipate the increased time for leisure activities and relaxation it brings. As retirement come closer, and retirement planning becomes more reality-based some people may begin to worry about future and harbor a lot of negative perceptions, focusing on the physical, psychological and economic problems that could occur (Karen Seccombe 1991). During this retirement transition referred to as disenchantment, individuals pass through a psychological conflict between ego integrity and despair. They tend to assess their self-worth. Some view it with a very positive outlook and accept their mortality, others look at things negatively. A negative self-appraisal results in despair.

Despairing individuals may become withdrawn and ambivalent or hostile and destructive in their old age (Líria Núbia, Luciana et al. 2008). Depression is found to be present in more than 9% of adults over 65 years of age (Celia F. Hybels 2001).

"This phase parallels the stage in marriage when the emotional high of the wedding has worn off and the couple now has to get down to the business of building a working relationship together." People look forward to retirement. After retirement, many get an overwhelming feeling of letdown. Retirement isn't a permanent vacation after all; it also can bring with it feelings of extreme boredom, of uselessness and disillusionment (Cussen 2009). If a person does not feel lonely, useless and bored, most of the emotional problems are addressed. This is possible if ample provision is made for them to increase their participation in hobbies, volunteer work, and community and family activities before boredom sets in.

Ties to home, community and neighborhoods stay strong and after a certain age, a person does not wish to relocate from a familiar home and community (Golant 1987). The home is associated with many cherished memories. Smaller families and more women in work force results in diminished family support for the elderly. Increased mobility also splits family into smaller units.

Additionally, in old age a person has a need and a desire to feel wanted and not being a burden on family or society. There is also a need to feel a part of the community, being close to nature and to keep busy and not idle. These are apart from trying to be at peace with self, others and nature, and relive memories of one's younger days (From an interview of two males 67 and 83 years of age).

The community design proposed as a demonstration of this thesis investigation is expected to provide contact with nature, people of other

ages, lots of opportunities to create memories and relive past memories. Opportunities for residents to pursue their interests throughout the aging process, in every stage of life are also provided. Again, in order to ensure a smooth transition throughout the stages of retirement, it is best to start early. The proposed community would focus on the age group of pre-retirement or the young-old as the point of entry into this community.

1.43 Economic Issues

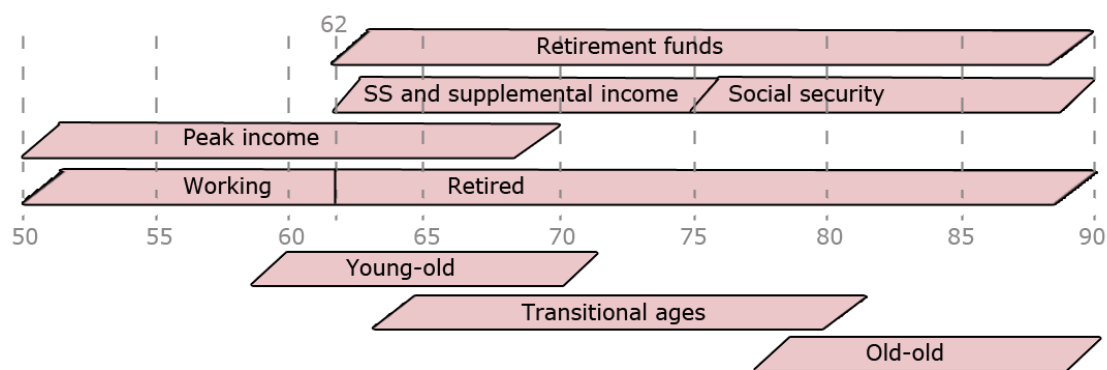


Figure 7: Economic issues and retirement

(diagram by author)

Economic issues associated with aging and retirement are easily visualized. Very few retirees have the economic means to support the lifestyle they maintained while employed. These issues affect not only individuals in the retirement stage, but also the economies of the communities and nations that provide them with services during their working and retirement stages, and that tax their income, property and purchases to support these services.

For individual

In the United States, retirement brings with it, lower family income and in today's economy, retirement also brings with it a lot of uncertainty. There is not enough money. Social security alone will not be sufficient to bring in enough income. The 401(k) plan poses a risk to the retirement savings.

This means that it may not be possible to live in a large house and maintain it anymore. Many studies have observed that aging homeowners do not maintain their homes as well as their younger counterparts (Myers 2003). Utility bills and maintenance expenditures that increase with inflation and aging homes place a significant drain the income that has already decreased.

Since health care and prescription costs often increase with age, the medical expenses of the retirees are also likely to soar (figure 8). Many retirees dread being unable to pay their medical expenses if they fall sick (Fetterman 2006).

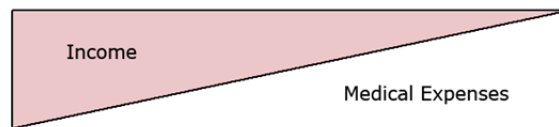


Figure 8: Relationship between income and medical expense

For the country

Increased longevity today means more drain of the country's funds in terms of social security. Nursing home and home health care accounted for almost 12 percent of personal health expenditures in 1995, and they were

approximately 14 percent of all state and local health care spending (Wiener and Stevenson 1997).

The economic impact of medical expenses can be remedied by taking steps to prolong the period of physical robustness during retirement. Simple steps like proper food, care, food, exercise and maintaining a positive outlook can both improve the quality of life and decrease the cost of living during retirement. A healthy brain is absolutely essential for successful, healthy aging. The brain is the center of thought and the seat of emotion. The brain is responsible for receiving, interpreting, and organizing data from the senses; formulating speech; guiding action; storing memories of the past; and planning strategies to shape the future. The brain directs all of our dealings with the world around us and all of our interactions with the people whom we love (Jill Stein 2009). Thus the brain needs to remain active throughout the years in order to ensure healthy living.

The community design proposed as a demonstration of this thesis investigation integrates physical well-being and emotional well-being throughout the stages of aging and also features a smaller footprint for a home, which is expected to reduce individual maintenance costs. Costs of landscaped green-space, gardens, exercise and recreation amenities that an individual paid for alone in a single family residence are now shared between residents of the community proposed as part of this investigation, and in the case of neighborhood amenities in the floodplain park surrounding the proposed project shared also with residents other multi-family communities in the area.

Again, the earlier one moves into the community, larger the life-time impact of savings on retirement costs.

Chapter 2

Suburban living

2.1 Introduction

Traditionally, suburbs as we know today grew after World War II. Suburbs offered their new residents relief from the crime, congestion, crowding and noise of central city neighborhoods. Residents enjoyed the new mobility and space.

The suburbs are traditionally associated with the men working in a 9-5 job and free time spent on leisure recreations that include activities like swimming, golf, bridge, involvement in various book clubs, writing clubs, photography clubs and the like (Spoden 2010). Suburban residents moved to the suburbs for this lifestyle, and most do not want to let go of this lifestyle in their retirement years.

Suburban communities are characterized by lower densities than the city, dominated by single family homes on separate plots of land, surrounded and flanked by similar dwellings. Residential areas in suburban communities are generally quieter than city neighborhoods, greener, more attractively landscaped, and provide more opportunities to connect with nature. Zoning patterns in the suburbs are such that residential and the commercial development are separate. Daily needs and places of work are not within walking distance from most homes, which requires suburban families to own and maintain multiple cars. However, there are many advantages of living in a suburb. These are listed below.

2.2 Advantages of living in a suburb

The suburbs offer a person independence and control of ones' space and life with no disturbance from the neighbors. They offer more room, large yard and lawn and garden space. Residents tend to share similar values, tend to

be familiar with one another, meet each other in their children's schools, their churches, at ball games or while grocery shopping. A sense of mobility exists that gives the resident a feeling of being in control. However, with age, these same advantages turn into disadvantages that are listed below.

2.3 Disadvantages of living in a suburb as one ages

Maintenance of the large homes and lots that were once a pleasure become a chore for aging residents. Often declining energy and vigor require that residents hire workers to perform maintenance tasks they once did themselves. Failing cognitive senses, especially the sight and hearing make it difficult for aging residents to drive long distances. Attending social activities, exercising at the gym or even buying food at the grocery store or farm market requires residents to be mobile and able to drive. Distances between neighboring houses are large and there is no sense of security or a feeling that help is available at close quarters. One would tend to feel isolated. The larger houses and yards also translated into higher utilities, taxes and maintenance costs.

For aging populations, these disadvantages gradually overpower the advantages.

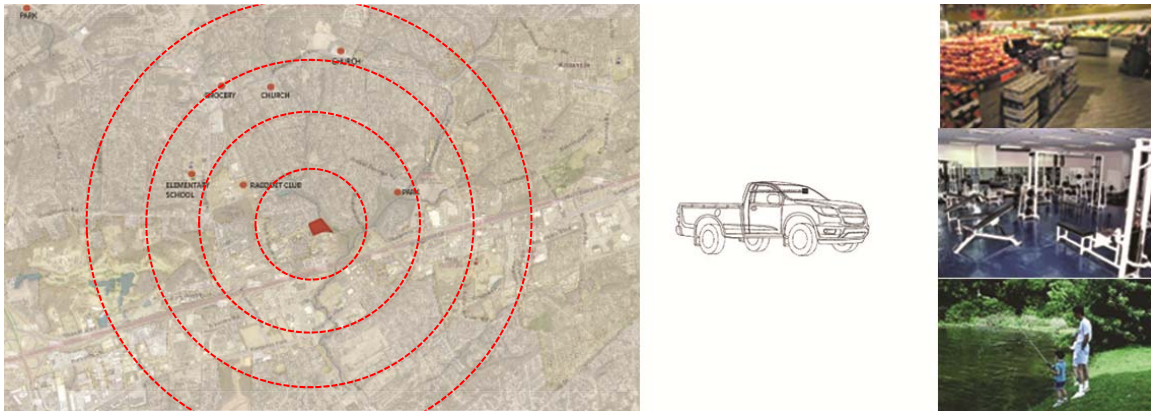


Figure 9: Dependence on driving

(diagram by author)

In spite of all these factors, suburban residents often prefer to remain within the same suburbs that they are used to. Studies have shown that the aging residents tended to move within a limited metropolitan area. There was also a strong preference towards living in suburbs as opposed to living in urban areas. (Golant 1987) One of the main requirements for the maintenance of independence and satisfaction among the aging residents, is availability of adequate means of transportation or ability to reach some of the amenities like grocery, recreation, pharmacy, etc. Driving also is a means for maintaining access to social connections and mobility is very critical to the psychological well-being of an individual who is a resident of the suburbs. If there is a lack of mobility, then they are particularly vulnerable to the spatial barriers imposed by suburban environments, and at considerable risk of becoming both socially and functionally isolated (Smith and Sylvestre 2001). For many, a car is also an emotional symbol of their independence, and they are reluctant to stop using one as they age.

2.4 Advantages of continuing to live in suburbs as one ages

Continuing to live in the same suburb, as one ages, offers a lot of advantages. Contact with the same population, more social connections in a more or less homogenous crowd, a friendly neighborhood are some of the few. Social participation also ensures good psychological health (Adams 1992). The resident has been familiar with his neighborhood and neighbors for quite some time. There is no requirement for learning about his neighbors and surroundings anew. The same people and same friends also mean better trust since they have been familiar with one another for many years. Remaining in a familiar community increases the chances that new neighbors will still share a person values and lifestyle making them agreeable neighbors and potential friends.

Generally, there is also a tendency among people to upsize their homes to accommodate a growing family and downsize when faced with an empty nest. Surveys have shown that many aging suburban residents see the advantages of moving to smaller homes to reduce maintenance and utility costs. Yet, people want to retain the same quality of design and amenities.(Handley 2012)

The community design proposed as a demonstration of this thesis investigation should ideally be located in a quiet suburb, with opportunities for people across generations to connect with each other. Programmed amenities, activities, and spaces in the project should support suburban lifestyle activities, and provide the greenery, landscape, privacy and sense of control over personal space that suburban residents value. The selected location needs to provide residents ample opportunities to maintain personal physical health and healthy eating patterns that slow down the aging process.

Neighborhood and community design need to include opportunities for residents to maintain existing friendships and build new ones, reminisce about their past, pursue hobbies like gardening and other forms of recreation that maintain their cheerfulness and morale. It is also important to include water features, landscape, bird habitat and other elements that maintain connections to nature suburban residents had in their backyards.

Finally, the community design needs to include a smaller home that is easily maintainable. A smaller home as well as sharing expenses with neighbors reduces maintenance expenses. Good health also implies lower medical expenses. These will be discussed in detail later in the document.

Chapter 3

Living arrangements

3.1 Introduction

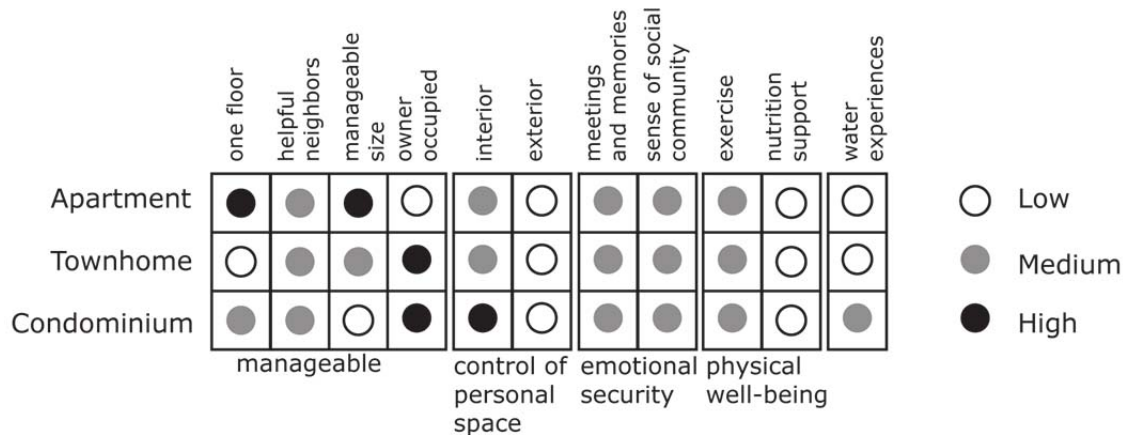
Historically, much of the care for aging people in need of assistance was done within extended families. There had been a very significant decline in the proportion of aging people living in extended families in the United States and other countries until 2000 (Roger 1989). However, extended families are making a comeback due to various economic reasons, delayed marriages and the like. New 2010 Census data show that 5.1 million households in the USA (4.4%) are multigenerational, with three or more generations sharing quarters. That's a 21% increase from the 4.2 million (3.7%) such households in 2000 (Jayson 2011). Yet both the aging population and the younger generation prefer their independence.

3.2 Aging in Place

The Center for Disease Control defines **aging in place** as "the ability to live in one's own home and community safely, independently, and comfortably, regardless of age, income, or ability level. This is expected to mitigate the fear of displacement in the elderly (Myers 2003).

A home fit for aging in place would have certain features. It would be manageable by the aging resident, be designed as a single level that is accessible, have the laundry at an accessible floor and the like. In addition, it would have wide doorways, wide treads in staircases, fixtures at higher levels that do not require the resident to bend too much, additional glare free lighting, non-skid flooring and all features that help elderly residents to move easily and independently without getting hurt.

3.3 Aging in Place in Suburbia – Existing options



Suitability of existing suburban models to serve as a place to age successfully

Figure 10: Existing models and successful aging

(assessment diagram by author)

3.31 Apartment buildings

Apartments are generally smaller than the average suburban house. They are more manageable, but owned by a management. Shared walls may have inadequate soundproofing. Residents do not usually have their own space to pursue their hobbies like gardening. Opportunities to meet people exist but they are limited. There are possibilities that the apartments have a shared gym facility, pool, or party room.

3.32 Townhouse communities

Townhomes are again smaller than the average suburban house. Master suites, bedrooms and full baths may be located on an upper floor making access difficult as a person ages. Shared walls may have inadequate soundproofing. Townhouse communities may be owned by management companies, or condominium ownership. The residents do not have their own

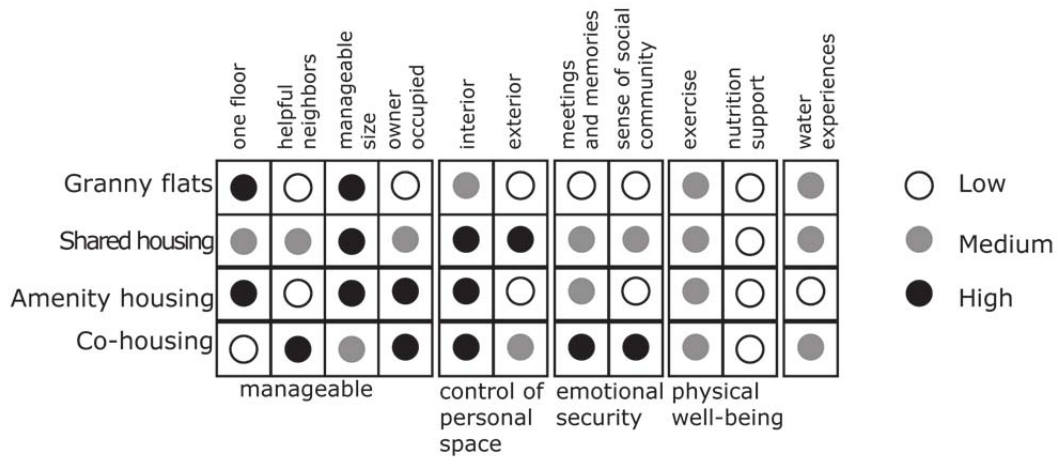
space to pursue their hobbies like gardening. Opportunities to meet people exist; they are limited. There could be a gymnasium, pool or a party room shared between the residents.

3.33 Condominium communities

Condominium communities may be designed with a variety of plans, including townhouses or one-level living arrangements, detached units, attached garages, personal exterior and other amenities that appeal to residents purchasing a unit. Only the interior of the unit is owned by the resident owner. The rest of the space is owned by the condominium association.

In all the models discussed above, the resident no longer has a sense of complete ownership and identity. These models do not do a good job of serving changing needs as a resident ages, or address needs linked to different scales of a neighborhood, site and unit. None of the models offer connection to nature and recreation opportunities. Hence these are not suitable models for successful aging in place in the suburbia.

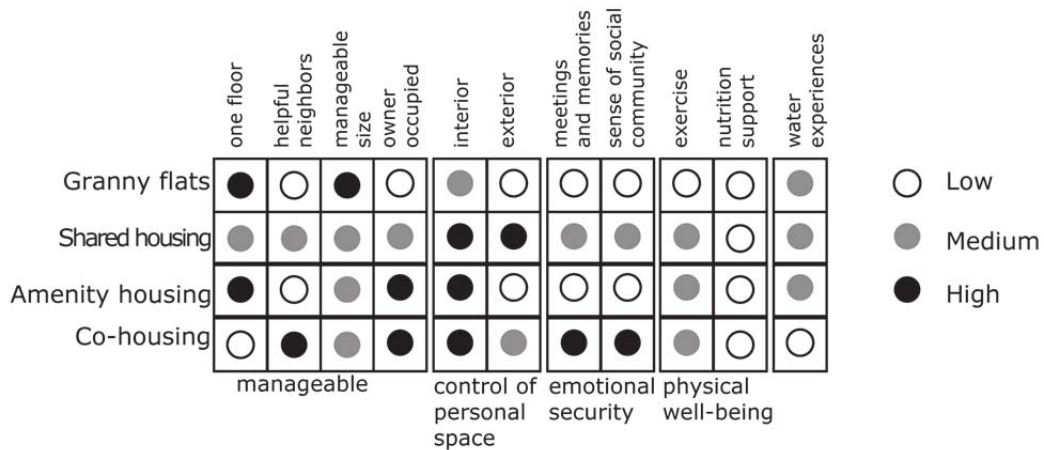
3.4 Aging in Place– Alternative models



Suitability of alternate suburban models to serve as a place to age successfully
Young-old years (neighborhood scale)

Figure 11: Alternate models and suitability for the young-old

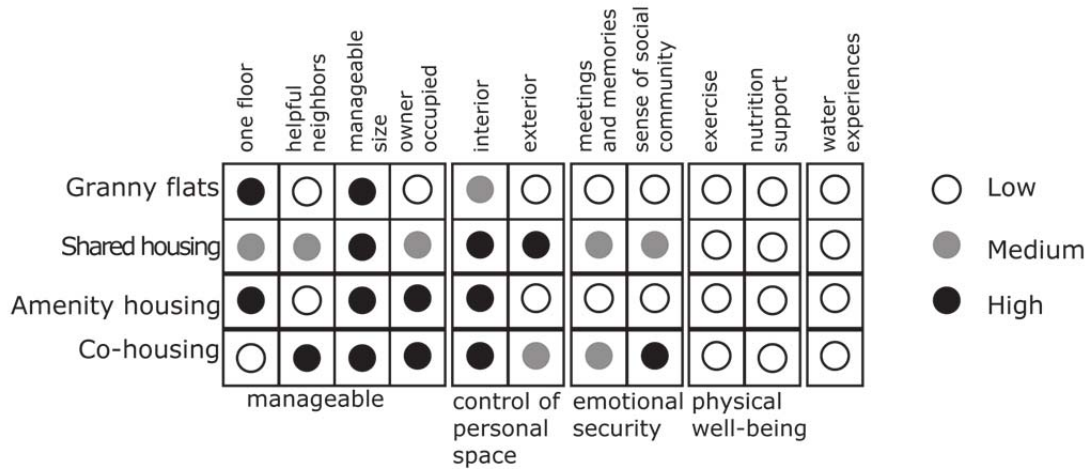
(assessment diagram by author)



Suitability of alternate suburban models to serve as a place to age successfully
Transitional years (site/ courtyard scale)

Figure 12: Alternate models and suitability for the transitional years

(assessment diagram by author)



Suitability of alternate suburban models to serve as a place to age successfully
Old-oldyears (Unit scale)

Figure 13: Alternate models and suitability for the old-old

(assessment diagram by author)

3.41 Granny flats and extended housing

In this model, a smaller home is constructed in the backyard of the family estate so that the elderly can live independently with support close by. This model may also consist of adjoining housing for the elderly (Heumann 1993). This model ensures manageability and privacy throughout the stages of aging. There may not be much room to pursue one's own hobbies during the later stages of life. Opportunities for meeting with persons other than family, physical exercise, and recreation are limited to the young-old years when the people can drive independently.

3.42 Shared housing

In this model, an aging resident remains in their home, but rents a portion of their home. This supplements their income, and if space is rented to a younger person who takes on household tasks as part of the rental agreement ensures that help is at hand. This model is not favored much

among the aged because of the fact that they no longer have the privacy that they are accustomed to (Heumann 1993). However, the additional help and income can make living arrangements more manageable, and keep a home in better repair. Opportunities for meeting with persons other than renter-helpers, family, physical exercise, and recreation are limited to the young-old years.

3.43 Amenity housing

This is common among the wealthy elderly. This consists of safe senior friendly one storied houses in good neighborhoods. These are designed so as to have minimal maintenance (Heumann 1993). These houses are well-suited during the younger years, but as age advances, they become less suited in terms of manageability, opportunities to connect with people and nature, maintenance of physical health and recreation.

3.44 CoHousing

The cohousing idea originated in Denmark. It was promoted in the U.S. by architects Kathryn McCamant and Charles Durrett in the early 1980s. In the Danish concept of "living community", communities are usually designed as attached or single family homes along one or more pedestrian streets or clustered around a courtyard. They range in size from 7 to 67 residences, the majority of them housing 20 to 40 households. There are many opportunities for casual meetings between neighbors, as well as for deliberate gatherings such as celebrations, clubs and business meetings.

The common house is the social center of a community, with a large dining room and kitchen, lounge, recreational facilities, children's spaces, and frequently a guest room, workshop and laundry room. Communities usually serve optional group meals in the common house at least two or three times a week.

Cohousing communities require community members to contribute towards care of common property. This builds a sense of working together, trust and support. Because neighbors hold a commitment to a relationship with one another, almost all cohousing communities use consensus as the basis for group decision making (Durrett 2005).

This model provides the residents a sense of ownership and is manageable for residents of all ages. It provides the residents with a lot of opportunities to meet people. However, it might lack provision of opportunities to connect with nature and for pursuing ones' hobby. Co-housing is also an unfamiliar living arrangement that suburban residents may initially resist because it is less private and decisions about community spaces are made collectively. However, co-housing also has many aspects of a close supportive suburban neighborhood - shared dinners, family nights and activities, work with each other on household and neighborhood projects, sharing tools, tomatoes and cups of coffee in the morning.

A combination of the shared housing and the co-housing models that also could provide residents with opportunities to connect with nature and to pursue their hobbies across the aging years and one that would help residents to maintain a healthy life would be the most suitable model for a community that would help residents age in place in the suburban conditions.

3.5 Sustainable community models

Sustainable communities are communities that are planned, built, or modified to promote sustainable living. They could include many aspects that relate to conservation of resources like water, growing food, contact with nature and economic sustainability.

The most suitable and sustainable community model to support suburban residents age in place combines the familiarity of remaining in a suburban house with familiar activities and hobbies; the reduced size, maintenance and

shared costs of condominium units designed for 'aging in place'; the community building aspects of co-housing models, and the opportunities to connect with nature, grow one's own food, pursue, maintain a healthy life and psychological health that sustainable communities emphasize.

3.6 Living arrangements and their role in mitigating the issues faced by the elderly

Proper living arrangements help in addressing many of the issues physical, psychological and economic issues faced by the elderly.

3.61 Physical Issues

Housing models discussed in the literature review emphasize arrangements and features that create a safe environment as physical and cognitive abilities change during aging. Thus, the risks of hurting oneself, e.g. by tripping or falling of stairs can be reduced. The difficulties of getting in and out of furniture, shower and toilets can be addressed by design. The inability to see well can be addressed by designing with a lot of daylight. The inability to bend and the need to rest can also be addressed through proper design of the living quarters. In addition, there is help close by and the driving distances can be short (Ankersen).

3.62 Psychological Issues

Well designed 'third places' and interfaces between public and private places can create opportunities for social connections that reduce isolation. Arrangement of front doors that let people comfortably bump into each other, configuration of hallways, comfortable resting places that provide opportunity to visit with a neighbor, placing garden space adjacent to a shared walkway, shared cafes, garden space or pools can all be included in a community design to discourage isolation from society. Properly designed elements like these can encourage residents to stop and get to know one another and build friendships with both contemporaries and those of other ages.

In addition to the opportunities for social interaction mentioned above, living arrangements can also be designed to offer residents opportunities to pursue both new and familiar daily routines, recreations, and special events creating multiple options for staying occupied while maintaining a sense of independence, and contribution to their community. This keeps disenchantment with life at bay. Disillusionment, boredom and uselessness are replaced with the both familiar pursuits and the new pursuits and involvements of sustainable co-housing.

3.63 Economic Issues

Living arrangements can directly and indirectly reduce economic costs during retirement.

Direct reductions occur when homes are smaller, less costly to maintain, heat and cool. Shorter driving distances and walking access to daily needs reduce number of trips and miles driven and thus the costs of automobile ownership (Gearon 2011). Good access to daily needs may also allow a retired couple to use one car -or no car and eliminate the expenses associated with owning multiple vehicles.

Indirectly, safe living arrangements and walkable neighborhoods that provide opportunities for exercise reduce healthcare costs related to accidents and to illnesses like hypertension, diabetes and dementia, and the cost of trips for additional trips to a doctor's office for appointments.

3.7 Aspects of a planned community that is manageable by residents of all ages

The design investigation of this thesis proposes a condensed neighborhood, a site and amenities that are shared by the residents and to an extent by the other residents of the community, and a living unit that has a smaller footprint than the traditional average suburban house. The proposal would consist of spaces that have multiple functions to save on space and increase efficiency of the community.

Chapter 4

Health and exercise

4.1 Introduction

The benefits of physical activity for older people are now well known, with low levels of physical activity implicated in many problems commonly faced in old age including arthritis, injuries due to falls, depressed mood, and heart disease. The American College of Sports Medicine's stand on exercise and physical activity for older adults (1998, p.992) stated that "...the benefits associated with regular exercise and physical activity contribute to a more healthy, independent lifestyle, greatly improving the functional capability and quality of life of this population."

4.2 How does being healthy help with issues faced by the aging population

4.21 Physical Issues

The benefits of regular exercise and physical activity greatly slow down the onset of many age-related health issues like arthritis, osteoporosis, and cardiovascular illnesses. Good physical health also improves balance and functional capacity and consequently reduces the risk of falling and hurting oneself.

4.22 Psychological Issues

'A sound mind in a sound body' is the English translation of a famous quotation by the pre-Socratic Greek philosopher Thales (Miletus, 624 – 546 BC). This demonstrates the close links between physical exercise, mental equilibrium and the ability to enjoy life. Regular exercise and physical activity are important to the physical and mental health of everyone, including older adults. By being physically active, one can continue to do the things one enjoys and stay independent as one ages. Exercise boosts a person's morale.

Feeling and being healthy also imbues a sense of confidence in oneself. It also helps improve symptoms of mild anxiety and depression. A healthy individual can also pursue his hobbies as well as be of help to others. For example, he can help his neighbors in fixing plumbing issues or electrical issues. This would give him a satisfaction of helping others as well as improve his self-esteem and thoughts of being able to contribute to the society.

4.23 Economical Issues

"Health is Wealth." Good health greatly contributes to material wealth. Economic well-being is very much related to physical well-being. Medical expense is directly proportional to good health. Being physically healthy and able also enables one to take up work like taking care of children for a few hours, do small appliance or household repairs, quilt or make children's clothes and the like. These hobbies are also sources of supplemental income.

4.3 Aspects of a planned community that supports and encourages physical well-being

There are many ways to be active. Physical activities like walking, raking or taking stairs are good forms of exercise and do not need any special expensive equipment. Being healthy also reduces the drain on resources for both the individual and the state in terms of medical expenses (NIA). The design investigation of thesis proposes possibilities of getting good exercise by encouraging the residents to walk throughout the course of aging. A walkable neighborhood, a walking trail connected to the existing greenway within the site, well-lit and well-ventilated stairways; encouraging the residents to take the stairs instead of the elevator would be a part of the programme envisioned. This would help the residents maintain a healthy and active life.

Chapter 5

Food and Nutrition

5.1 Introduction

Food and nutrition play an important role in a person's wellbeing. Studies have shown that proper nutrition intake by the elderly can significantly improve their immunity towards certain diseases (Institute of Medicine 2010). Eating right and being fit are keys to staying healthy throughout life. Because our nutrient needs change as we get older, it is important to know which foods offer the vitamins and minerals that will promote good health as one ages.

Healthy food choices are those that are lower in calories, packed with vitamins, minerals, fibers and other nutrition. Being physically active every day in addition to eating healthy, also helps stay in a very good shape (Dietetics).

5.2 Problems associated with nutrition and proper food

There are many physical and psychological problems that are associated with poor nutrition. Hypertension, anemia, diabetes, osteoporosis and kidney disease are some of the health problems that are prevalent in the elderly. These are often attributed to improper nutrition.

5.3 Good Nutrition

To identify the nutritional choices that support lifestyle and those healthy choices that extend the length of the 'robust' young-old stage, nutritional plans were researched. The DASH plan discussed below offers a model of nutrition that supports an aging person's health needs.

5.31 The DASH plan

The DASH (Dietary Approach to stop Hypertension) plan presents a slightly different way to look at how you eat. A number of major research studies have shown that following the DASH Plan can lower blood pressure. The diet emphasizes whole grains, fruits, vegetables, fat free or low-fat dairy, seafood, poultry, beans, seeds, and nuts. It contains less salt and sodium, sweets, added sugars, fats, and red meats than what the typical American consumes. (See Tables 1,2,3 in Appendix for information on the DASH eating plan, and age related changes in nutrient needs.) Investigation of the DASH nutrition plan resulted in the inclusion of vegetable gardens, a canning kitchen, and farm market space in the program for the design investigation of thesis to encourage and support healthy nutrition.

5.4 Importance of Fruits and Vegetables

Fruits and vegetables top the list in the diet charts of the elderly. Healthy diets rich in fruits and vegetables may reduce the risk of cancer and other chronic diseases. Fruits and vegetables also provide essential vitamins and minerals, fiber, and other substances that are important for good health. Most fruits and vegetables are naturally low in fat and calories and are filling. It is suggested that half our plates should be filled with fruits and vegetables at every meal (USDA 2011).

5.5 How does proper food and nutrition help solve issues faced by the aging people?

5.51 Physical issues

Good food and healthy eating habits can help prevent diseases like osteoporosis, hypertension and diabetes. A healthier lifestyle and healthy food choices are proven to help manage hypertension and high cholesterol. Alzheimer's disease has been linked to vitamin E. The management of

diabetes and hypertension also helps in keeping the kidneys functioning well (NIH 2012).

5.52 Psychological issues

Healthy eating habits and being healthy, in turn helps in reducing the feelings of insecurity among the elderly. Some foods like carbohydrates are also known to help elevate moods (NIH 2012).

Gardening and appreciating a garden is found to be an experience that involves all the five human senses; smell, taste, touch, sight and hearing. Thus many find it very rewarding and satisfying to engage in gardening, be it as a hobby or for food production.

We have been much insulated from the world outside our homes and offices, suffering sensory deprivations. Gardening as a craft or as a productive activity is one of the means of addressing the need for sensory expressions and perceptions (Tilly 2006).

5.53 Economic issues

In-house production of food reduces the amount a retiree needs to purchase. Canning and preservation is both a pleasant communal activity and a way to preserve surplus food for later use. There would be no need to drive to the market when you need one tomato or just enough lettuce for one salad – it would require just stepping out of the door into the garden.

In addition, production of food has enormous environmental impact at the municipal, state, and national level.

Encouraging more localized, diversified and sustainable food production rather than factory farming would enhance nutrition, decrease the environmental impacts of agriculture, and strengthen local economies. It would reduce reliance on pesticides and minimize the use of fossil fuels for

long distance transport. This in turn would reduce air and water pollution as well as greenhouse gas emissions (Jill Stein 2009).

5.6 Aspects of a planned community that can support good nutrition

Deriving ideas from the research, the program for design investigation of thesis needs to include local food production and gardening possibilities to encourage good nutrition and well-being, as well as contribute towards saving money. There should be enough produced to supply the residents and a few of the other neighbors food for the year. From the nutrition chart in the appendix, more important types of food like vegetables and fruits would be grown within the site. A henhouse would help satisfy the protein needs of the residents through consumption of eggs and chicken. For whole grains and dairy, the neighborhood should have a grocery store in close proximity where the residents could walk to shop. The proposed project needs to offer residents the option to grow some food at a range of scales that can be managed at different stages of aging. For example a resident may shift from working in a community garden, to taking care of raised beds, to caring for a personal patio planters or flower boxes over the course of their life. In the example proposed, residents are able to continue growing food, share garden talk with neighbors, and derive satisfaction as they age.

Chapter 6

Water

6.1 Introduction

Water is a very important resource and is used for drinking, gardening and other recreational purposes. In many places, water is the most important element in many types of recreation; be it fishing, canoeing, rafting, surfing, swimming or just parks with a presence of water. There is an increase in the proportion of US residents over the age of 65 and it suggests that the demand for outdoor recreational activities, particularly those that are physically demanding and depend on driving, is likely to decline. But water, its sight and sound remain soothing and calming to most people.

6.2 How water and its conservation help solve issues faced by the elderly

6.21 Physical Issues

Not Applicable.

6.22 Psychological Issues

Many studies have showed that people consider water to be an important element in any recreational activity. Not only is water essential to many water based recreational opportunities; swimming and fishing being the more important ones; but also, as studies indicate that symbolic aspects of water, such as its calming and relaxing effect on individuals, is also important to the quality of outdoor recreational activities (Stankey 2002).

Water is vital to the existence of all living beings. Many poets and artists have extolled the virtues of water more than any other aspect of the environment. It is always physically flowing from one place to another in streams, torrents, waves and currents. Even in the calmest of conditions, its

qualities are such that it reflects the most subtle changes in light, and so shimmers with movement. It could be said that water spurs reflectivity and people feel at peace with water.

Another sensory experience that humans have with water is via physical contact with it. Showering and bathing provide a range of experiences that are potentially very pleasurable. One of the most compelling sensory experiences of water is that of immersion, which can also be highly pleasurable. According to a Colin Marsh, it is possible that a lot of people take to water because it has something to do with the womb and the sound of running water is a very soothing one.

In recent years scientific texts have reflected a growing interest in the psychological and therapeutic effects revealed by experimental immersions (Suedfeld 1983). The literature on flotation experiments suggests that immersion, as well as producing measurable physiological effects, also generates consistent sensory and cognitive responses, with subjects reporting heightened imaginative activity, relaxation and feelings of well-being. Humans also have the opportunity on a daily basis to observe the presence of water. Water is visually compelling; many writers have described it as 'numinous' and hypnotic. Gazing upon water is said to be 'mesmerizing', or induced 'meditative' states of being (Strang 2005).

All these affect the person experiencing water in a positive way and improves the psychological state. It is important that the design investigation of thesis include programmed opportunities for experiencing sensory and psychological pleasures of water. Flowing water in the creek, opportunities to immerse oneself in a pool, rain chains and barrels and an operational water wheel are a few of the examples. People achieve a sense of having contributed to the society and environment if they or their property were

instrumental in conservation of water or helping the ecology in any way. This again gives a sense of accomplishment to the individual.

6.23 Economical Issues

While water is a relatively small element of a utility bill, irrigation of gardens and vegetables in the summer months does increase utility bills and every dollar saved on utilities can be spent on another need in retiree's budget. Maximum fresh water is used throughout the world just for irrigation purposes.

6.3 Sustainability and rain water harvesting

Considering the amount of expenditure on water, it makes sense to reclaim rain water and use the same for irrigation purposes before letting it runoff into the natural water body.

Rain water harvesting also greatly reduces the need for hard infrastructure for the water and water distribution system. The implementation of these systems also results in the reduction in urban runoffs, thereby reducing the potential for flash floods, erosion or pollution of the water source. The peak flows can be reduced just by collecting rain water. This also helps financially in saving where people are charged for both water supply and waste disposal (Nickels 2008).

An analysis of the drought pattern in Knoxville reveals that there are periods of drought, followed by periods of heavy rain. This becomes relevant because even places with high annual rainfall can benefit immensely with water conservation.

6.4 Aspects of a community that could capitalize on the psychological benefits of water and also reduce economic costs by reduced use of municipal water

The design investigation of this thesis needs to include water experiences and features that capitalize on psychological and economic benefits of collecting, experiencing, and making water visible and heard in all levels of the neighborhood, site and unit. Addressing the above aspect, the site chosen is close to a water body thereby creating means of recreation close to water. Surplus storm water could be potentially directed toward the adjacent creek through landscaped bio-swales or dry stream beds that would both reduce erosion and add attractive landscape and bird habitat features to paths used for recreational and exercise walks. A greenway along the creek help walkers experience the sound and view of water soothing and calming them. After it rains, dry rocky streambeds will fill with flowing water adding a pleasant variation to the experience of a daily walk. Permeable surfaces also cause awareness of the water being let back into the ground. Because Knoxville has a high annual rainfall, it is also possible to include experiences of rainwater harvest and use on site, ranging in scale from a cistern to water the community garden to a personal rain barrel on a patio. Rain chains and cisterns also remind the residents of their contribution to the environment.

Knoxville County codes presently do not permit use of rainwater for purposes other than irrigation. However in other places it might be possible to reduce total use of municipal water by using treated rainwater for drinking or treated and re-used gray water in toilet and laundry.

Chapter 7

Reliving and Recollecting Early Memories

7.1 Introduction

All of us have cherished memories. The elderly have more of them due to their rich life experiences. It is also known that as people age they enjoy revisiting and retelling stories of their earlier experiences. Research also shows that long term memory remains sharp in older people even though the short term memory fails (Gwyther 2002).

7.2 Memories

Food, and memories of food are an essential part of our lives from a very early age. It's production, preparation and sometimes preservation remind us of families, friends and events. In the Knoxville area, even relatively young retirees may have memories of a wood stove, open hearth, dutch ovens and fireplaces at their family's home place. They also have vivid memories of water in the form of rain, rain barrels, using sprinklers to cool on a hot summer day, ponds and creeks. They have memories of fishing, co-workers, familiar places and people. Memories of the kitchen and porch also top the list (Collins 1999). They also have good memories of their neighborhood and their church.

7.3 How memories help in the issues faced by the elderly

7.31 Physical issues

Regular physical activity can improve memory in the elderly (Fentem 1994). It is well established that exercise can improve acquisition of a cognitive task. Research in animals also indicate that the retention capacity is maintained in animals those are exercised regularly (Berchtold Nicole C; Castello Nicholas; Cotman 2010). Hence it is important for everyone to exercise regularly in order to have a good memory forever.

7.32 Psychological issues

Reliving early memories have helped people suffering from early Alzheimer's disease in a positive way. It is a proven fact that jogging the affected person's early memories helps remember how he used to perform certain tasks and thus help with improving his memory loss (alzheimer's 2012). This is very similar to referring to notes in everyday lives. This may also be compared to creating shopping lists for the future.

Sharing memories (sometimes called life review or reminiscence) helps older adults relive past events in their lives. By sharing memories, older adults can explore their thoughts and feelings about the past. They can put their past experiences in perspective with what is happening to them in the present or what is expected to happen in the future. When people start talking and remembering their past, they often start remembering more and more (Poinier 2011). Sharing their experiences and stories with others also help immensely in making a person more wanted and give a sense of being listened to and not shunned.

7.33 Economic issues

Not Applicable.

7.4 Important memories of suburban neighborhoods and lifestyles

As with any other place, life in the suburbs is filled with many memories, some of which are close to the hearts of the people. The quiet lifestyle where one could take a stroll and casually wave to passersby, where one could have opportunities to pursue his hobby, go on picnics occasionally with his family are all parts of suburbs. These were also places where one went to the same school to drop off one's children, went to the same grocery store and the same church and run into one another for casual chitchats.

7.5 Aspects of a planned community that can help preserve memories of suburban life and one's personal experiences and support creation of new memories

A planned community that provides a lot of opportunities in every scale for the residents to meet each other while performing their daily tasks will help in creation of new memories and sharing memories and experiences. Story telling for the neighborhood children also is an avenue for reliving past memories. One could also share one's rich experiences in certain fields like gardening, food preservation. Provision of large lobbies will also encourage people to entertain friends and family. Fishing and swimming are important memories associated with recreation and water. Rain barrels and rain chains would also act as memories of water conservation as would the water wheel.

Chapter 8

Case Studies

8.1 Danish cohousing

The Skævinge cohousing case study serves as an example of how cohousing communities provide social engagement and support for independent living in a housing community. Skævinge municipality was one of 275 municipalities located in Fredericksburg County in the North of Zealand, Denmark. When the project started the municipality had 5,000 citizens and 10% (500) were over 65 years of age. Skævinge was one of the earliest and most successful of the Danish demonstration projects. Beginning in 1984, Skævinge took what was, at the time, a radical approach. After an intensive planning process, this community decided to eliminate its one existing nursing home. The facility that replaced the nursing home became a hub for community support services that include a senior center, day care, rehabilitation, 24-hour home care, and assisted living. Nursing home staff was guaranteed jobs in the new facility. During the transition process from nursing home to community care, staff had to learn to avoid taking over responsibility for tasks residents could do for themselves, and residents had to relearn self-care skills. The community was divided into three geographic service areas and staff was divided into three teams, each assigned to serve the residents of a given geographic area (Mary Stuart 2001).

Models of cohousing in Denmark have resulted in considerable reduction in Healthcare expenses of the country. The healthcare expenses in Denmark are comparable to that of USA with both countries spending similar amounts. Hence, it has been suggested that certain models of Danish cohousing can be adapted for use in this country (Mary Stuart 2001). Cohousing provides important social support that can help aging residents maintain independent living as their physical and economic resources begin to decline.

The important observations are listed below:

- Efficient living is observed in this community; the residents are able to live independently through part of their lives.
- This community supports the residents who are old-old. This does not necessarily encourage the young-old to keep fit and healthy.
- Opportunities to create memories are provided at every stage of aging, while opportunities to relive memory are not.

Efficient living	Food and nutrition	Health and exercise	Water and conservation	Creating and cherishing memories
Yes	No	Partially	No	Yes
Independent living		Home care and assisted living are available		Different kinds of communities
Amenities required for the old old				Senior center
Smaller homes				Day care

Figure 14: Salient features in the Danish Cohousing community

(assessment diagram by author)

8.2 Garden communities/ community gardens

EcoVillage (Ithaca, New York)

The EcoVillage case study serves as an example of sustainable practices and sustainable gardening in a housing community. Ithaca, New York's answer to a modern day commune is an ecovillage, a green utopia that houses 160 residents in its 60 houses that are all low impact and energy-efficient. Eco Village has a CSA (Community supported Agriculture) vegetable farm that provides the community with high quality vegetables and a UPick berry farm along with a root cellar and community gardens. Residents volunteer 2 to 3 hours a week by building furniture, farming or assisting with other necessary maintenance. Future endeavors for ecovillage include creating organic orchards, greywater recycling, and biodiesel and vegetable oil fuel production.

The important observations that could be considered in the design proposal are as follows:

- Efficient living is observed in this community; the residents are able to live independently through part of their lives, support during their frail years is not available.
- Food and nutrition and fitness are encouraged by the farming and gardening programmes.
- Opportunities to create and cherish memories are provided at every stage of aging.

Efficient living	Food and nutrition	Health and exercise	Water and conservation	Creating and cherishing memories
Yes	Yes	Yes	No	Yes
Independent living	Vegetable farm	Gardening	Planned for the future	Different generations of residents
Amenities required for the old old	Berry farm	Building furniture		Gardening/ vegetable farm/ Root cellar
Smaller homes	Root cellar			Hobbies pursued
	Community farms			

Figure 15: Salient features of EcoVillage

(assessment diagram by author)



Figure 16: EcoVillage, Ithaca, NY

Source: Flickr photos

Nubanusit Neighborhood and farm (Peterborough, NH)

The Nubanusit case study serves as an example of a sustainable farm and cohousing community that provide social engagement and support for independent living in a housing community. Nubanusit Neighborhood and farm is a cohousing community that boasts an organic farm, communal office space and residences ranging from single family to four unit dwellings. Located adjacent to Nubanusit Brook, residents reside in their own homes yet share seventy acres of farm land, woodlands, pond and fields. The residents all participate in a CSA (Community supported agriculture) and rely on onsite cows and chickens for dairy and milk. Each residence in the commune is LEED Platinum Certified.

The observations here are:

- Efficient living is observed in this community partially. The residents do not need to travel distances for food.
- Food and nutrition and fitness are encouraged by the farming and gardening programmes.
- Opportunities to create and cherish memories are provided with the help of chicken, cows and farms.
- Adjacency to water ensures experience of water.

Efficient living	Food and nutrition	Health and exercise	Water and conservation	Creating and cherishing memories
Partially	Yes	Yes	Yes	Yes
Independent living	Vegetable farm	Gardening	Ponds	Different generations of residents
Amenities required for the old old	Berry farm Root cellar Community farms		Brook	Organic farms

Figure 17: Salient features of Nubanusit neighborhood

(assessment diagram by author)



Figure 18: Nubanusit Neighborhood and farm, Peterborough, NH

Source: <http://www.huffingtonpost.com>

Fairview Village, Portland, Oregon

The Fairview village case study serves as an example of a planned housing community that provides a compact walkable environment with ample opportunity for exercise. Selected by the Urban Land Institute as a "Great Planned Community", Fairview Village is featured as one of the most innovative of the new communities that are being juxtaposed with suburban sprawl as an alternative growth pattern. Fairview Village is a mix of houses, row-houses, and apartments built among retail, office, and other civic amenities. Already built are Bally's Total Fitness, La Petite Academy Preschool, the Woodland Elementary School, Fairview City Hall, Fairview Columbia Library, numerous public parks, Fairview's U.S. Post Office, and the retail anchor, TARGET. A variety of shops, businesses, and services (approximately 15) are available on Village "Main" Street and Market Drive.

The observations in this project are as listed below:

- Efficient living is observed in this community due to the presence of many services and amenities at close quarters.
- The fitness center provides opportunity for the residents to keep fit
- Food and nutrition and fitness are encouraged by the farming and gardening programmes.
- Opportunities to create memories are provided because of the different generations of people living in the community

Efficient living	Food and nutrition	Health and exercise	Water and conservation	Creating and cherishing memories
Yes	No	Yes	No	Yes
School, retail, offices, Library, Postoffice and other amenities are built into the community		Fitness center		Different generations of residents

Figure 19: Salient features of Fairview Village

(assessment diagram by author)



Figure 20: Fairview Village, Portland, OR

(<http://www.fairviewvillage.com/main.html>)

8.3 Buildings that use Harvested rain water

Bullitt Center, Seattle, WA, Miller Hull Architects

The Bullitt Center case study serves as an example of rainwater harvesting and use. This building is considered the greenest commercial office building. This building rises up to the living building challenge in which one of the criteria is to use Net Zero water. Rainwater will be collected on the roof, stored in an underground cistern and used throughout the building for all purposes other than drinking and shower(Newcomb 2012).

The observations here are:

- Water is conserved and rainwater is harvested to be reused. This is more to do with ecological issues than providing people experiences of water.
- A stairwell that provides breathtaking views of the city skyline encourages people to use the stairs rather than the elevator.

Efficient living	Food and nutrition	Health and exercise	Water and conservation	Creating and cherishing memories
No	No	Yes	Yes	No
		Irresistible stairwell	Rainwater harversting and reuse	

Figure 21: Salient features of Bullitt Center

(assessment diagram by author)



Figure 22: Bullitt Center, Seattle, WA

Source: <http://www.danielldevelopment.com>

All these projects address one or more of the five relevant aspects in their design. However, none of the projects considers all the aspects and their implications throughout the course of aging. These need to be incorporated into the design project to work at the three different levels of the neighborhood, site and unit.

The observations listed could be used in a smaller scale in the design proposal. These will have to be revised as to consider that the design is for an aging in place community. How these are modified and incorporated into the design will be elaborated in the later chapters.

Section II

Design Investigation

In the design investigation of thesis, issues identified in the literature investigation are explored through

- Identification of a compact neighborhood area in an established suburban community where daily needs and services can be met,
- Selection of a site in that neighborhood that allows full exploration the issues identified in the literature review and is suitable for both aging in place and a sustainable housing development.
- Development of program for a self-sustaining housing community where residents may purchase smaller more maintainable homes without losing the quality of life or the suburban lifestyle that they have been accustomed to.
- Planning for a neighborhood park that provides social, exercise, memory, water, and nutritional program experiences. This park needs to be close to the proposed housing and other neighborhoods and include water and community garden elements.

Chapter 9

Site

This section discusses identification of a suburban area with potential to become a compact mixed use walkable neighborhood, and the selection of a site within this area that allows for full exploration of design issues identified in the investigation of literature and issues for this thesis.

Goals for this section include

- Identification of a compact neighborhood area in an established suburban community where daily needs and services can be met and
- Selection of a site in that neighborhood that allows full exploration the issues identified in the literature review and is suitable for both aging in place and a sustainable housing development.

From the literature studies, a set of criteria was derived for selection of a suitable site. These criteria are selected to address physical, psychological and economic issues that are faced by the aging population. The selected site should support design investigation of thesis issues identified in the literature survey, and design of a neighborhood, project and community park where residents can age in place successfully and gracefully. The site also plays a major role in the creation of a sustainable neighborhood and a housing community.

9.1 Criteria for site selection

- Other communities and amenities like grocery, library, post office, restaurants, and pharmacy within a ½ mile walking radius

This will ensure efficiency of living while providing the same lifestyle that the residents have been used to. The walkable distances also help

the residents of the neighborhood maintain good physical activity. The familiar places can also help in jogging one's memories of the past.

- Possibility of garden space for vegetable garden as well as an orchard

These would be spaces that promote good food and nutrition that translates into healthy lives. The garden will also become a hub for social activity, recreation and sharing experiences. This will also showcase water conservation.

- Proximity to a water body

Since water is an important element in many forms of recreation, it would be preferable for the site to be in close proximity to water. It will also make it easier to provide the residents with experiences of water.

- Possibility of exercise

Enough space for easy, moderate and strenuous exercise will help residents choose to exercise according to their means and encourage them to maintain good health.

- Recreation possibility within walking radius

Recreation and pursuing one's interests are vital to improve the psychological health.

- Sidewalks in the neighborhood streets

Designed well, these could be used to create memories, bring back old memories and also create awareness about water conservation. These also will encourage physical activity.

- Possibilities of future development in the neighborhood

A possibility of future development to enrich the experiences and expand the neighborhood so as to become a **self-sufficient sustainable neighborhood** will be addressed by availability of enough land and spaces within the walkable neighborhood for such development.

9.2 Site inventory and analysis

The site is located in Knoxville in the Cedar Bluff area of the I-40. It satisfies all the criteria spelt out for a suitable site.

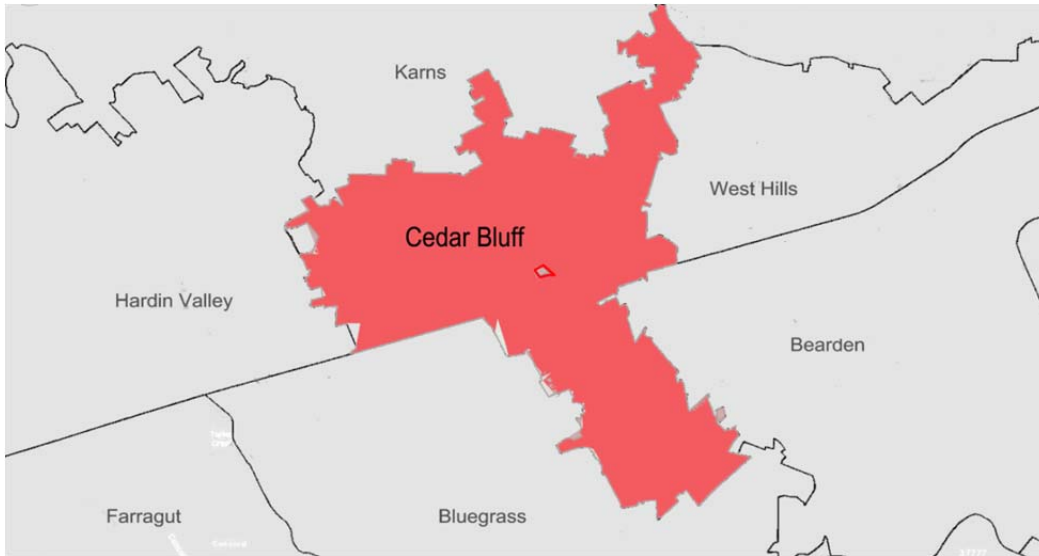


Figure 23 Site location



Figure 24: Aerial view of site

Source: Google maps

Many amenities are available within the walkable radius of the site and more land and spaces are available for future improvements and development. It is adjacent to the Sinking Creek and in close proximity to the Ten Mile Creek and greenway. It has ample space to have a planned garden and orchard.



Figure 25: Existing and Proposed Greenways

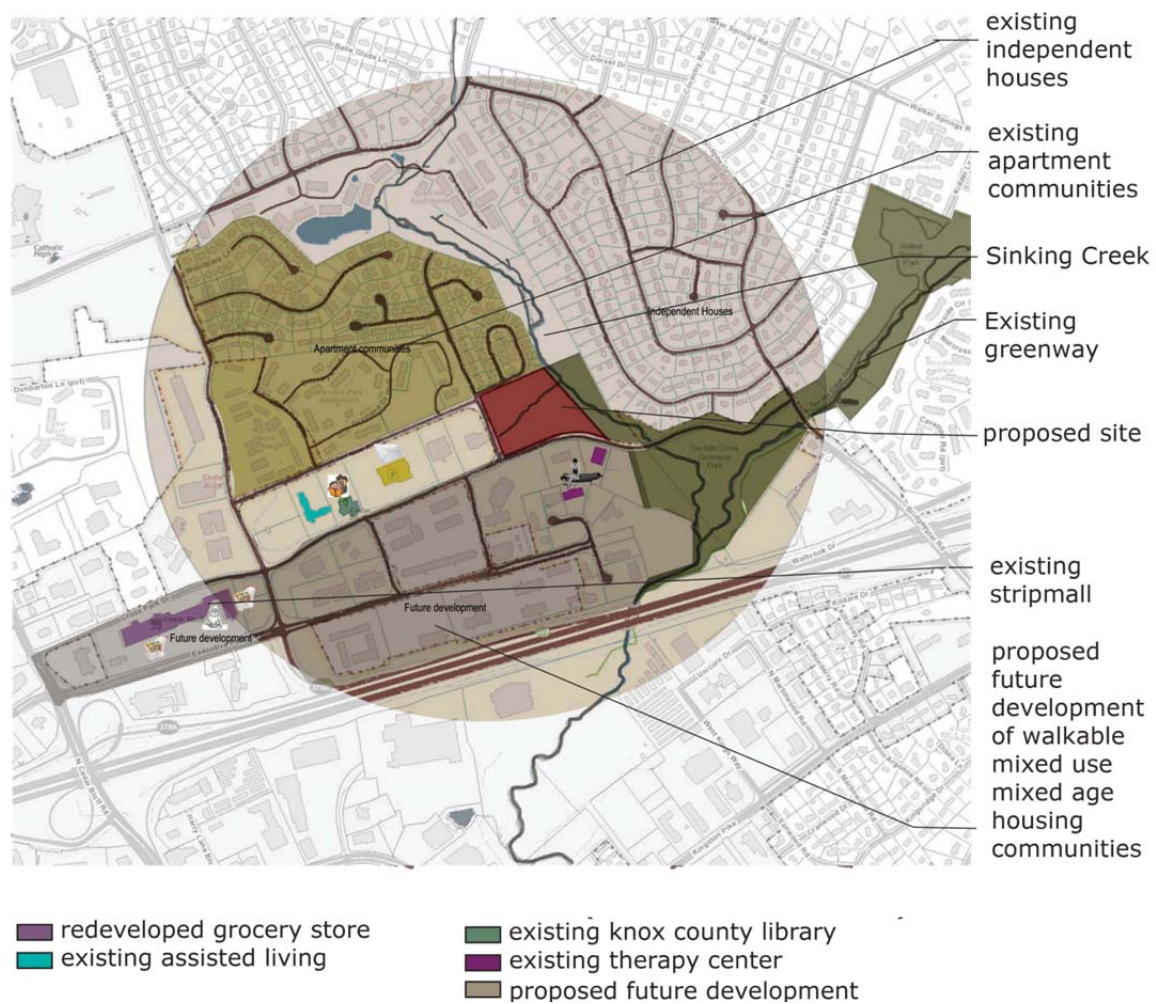


Figure 26: Amenities within 1/2 mile radius

The walkable neighborhood has an existing strip mall that can be redeveloped to contain a grocery store, pharmacy, restaurants and a coffee shop (figure 26). The neighborhood also has a lot of spaces available for development of similar communities as well as other residential communities in the future to convert this neighborhood into a sustainable one. With reference to the location of the amenities within this radius, sidewalks are proposed along certain streets. Locations for new sidewalks needed to

connect the proposed site to library, post office, shopping, and the adjacent multi-family housing communities are indicated with red lines in Figure 27.

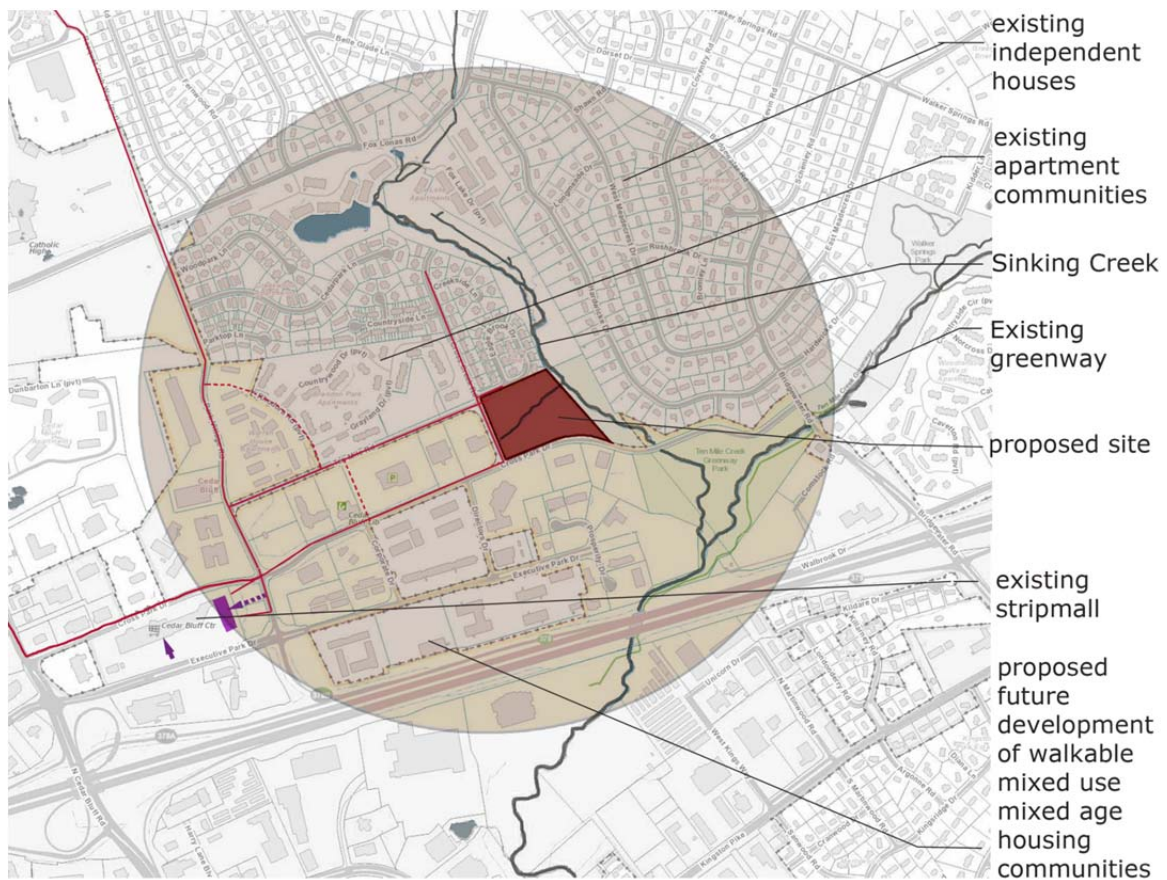


Figure 27 Proposed walkable paths

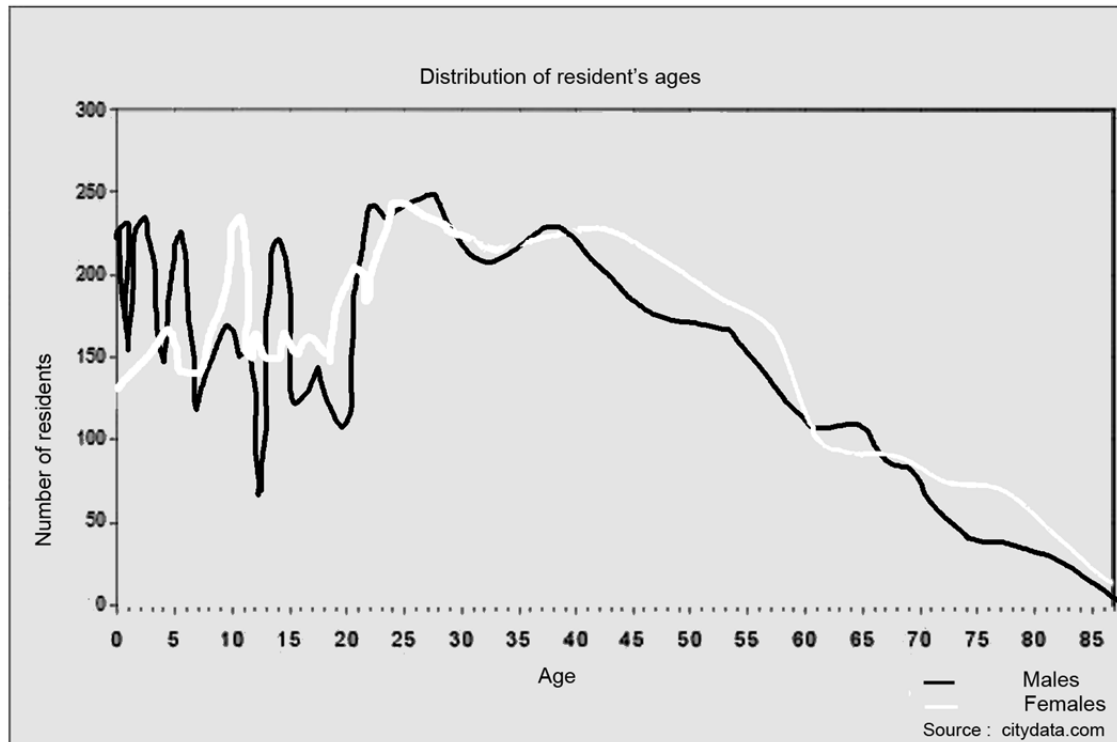


Figure 28: Demographics of the neighborhood

Source : citydata.com

The chart above shows that the much of the population of the neighborhood is in their pre-retirement years and will soon face retirement, and progress on to the young-old years.

The number of houses and condos in this neighborhood is more than the renter occupied apartments implying that choices for the senior residents to downsize their homes within this community are limited.

For other site inventories, refer to the appendix.

Chapter 10

Programming

10.1 Introduction

From the literature that has been reviewed, it is understood that a successful Aging in Place program is one that preserves personal dignity and functional independence for residents of a proposed project, while providing only the support needed at each stage of aging.

The program development for the neighborhood park and sustainable aging-in place housing community is discussed in this section of the document.

Programme development for the walkable suburban neighborhood, Neighborhood Park, and housing community has been made so as to include both qualitative experiences and quantitative responses to the needs and desires identified in the section 'Literature Studies and Identification of Issues'.

The goal of this thesis is to design a sustainable community in a self-sustaining neighborhood where the residents get to live in their own maintainable homes without losing the quality of life or the suburban lifestyle that they have been accustomed to.

Goals for the HOUSING include

- Provision of smaller homes that meet the following criteria for living arrangement.
 - Maintainability
 - Efficient spaces that serve multiple functions
 - Safety
 - Accessibility

- Sustainable features that include
 - Contact with nature
 - Water conservation
 - Economic and social sustainability
- Preservation of important aspects of suburban lifestyle
 - Mixing with neighbors
 - Gardening, exercising/ walks
 - Shopping
 - Entertaining friends and family
- Features that prolong personal periods of independent living
 - Spaces designed to minimize injury
 - Opportunities to be physically active
 - Easy access to good nutrition and healthy food

Goals for the NEIGHBORHOOD PARK include

- Proximity to the housing community and other neighboring communities
- Provision of social experiences and activities to people of all ages
 - Covered areas and gazebos where people can meet one another or from where they can watch children at play
 - Space that can be used for a farm stand
- Provision of exercise opportunities for residents of the neighborhood
 - A walking trail with connection to existing greenway
 - Tennis courts
 - Space to practice golf

- Provision of memory opportunities,
 - Walkways with seating
 - Community garden
 - Space for story-sharing sessions
 - Fishing pond
- Provision of water experiences,
 - Creekside walkway
 - Bioswales and raingarden
 - Fishing pond
- Provision for nutritional aspects and experiences of food
 - Community garden
 - Orchard
 - Hen house
 - Canning kitchen

10.2 Experiences of Daily Life the Proposed Community

Residents would feel that they are an important part of the community in which they play an important role in every stage of their lives. Their peers and friends live just a door opening away. Memories of the earlier years and activities are shared with friends who constitute a part of their experience in the community. Every day brings new and enjoyable activities to keep the residents occupied.

In such a community, the residents would be able to walk out of their houses, and casually meet neighbors while shopping for grocery or taking a stroll. They could also spend time in doing things they love and pursue their hobbies like practicing golf, fishing and gardening. They could have dinner together with their extended family, get to spend time and also entertain visiting families.

The design provides the residents with opportunities to keep fit and active through exercise and eating nutritious food, some of which has been grown and preserved by the residents themselves. Eating nutritious and healthy food that has been produced by themselves give them immense sense of achievement and satisfaction. The residents feel at peace with themselves, with others and with their surroundings. They are close to nature and closer to their community.

This programme seeks to allow elders to maintain an active lifestyle. This design also aims to save money in food and water expenses by storing harvested rain water and using the same for irrigation purposes.

10.3 Programme Requirements

The requirements for the design that would have to be considered under the five aspects of the community are:

Living arrangements

Efficiency should be considered in all three scales of the neighborhood, site and unit. The neighborhood should be a walkable radius that houses all the amenities suburban life demands as well as all points of interest that are likely to be frequented by the residents.

The housing community and neighborhood park need to perform multiple functions, like providing residents with food and opportunities to grow food, enjoy gardens, keep fit, pursue hobbies and recreation, and connect with nature as well. The housing community and units need to have spaces that perform multiple functions, e.g. a living space could be used for dining, meeting others, entertaining family and jogging memories as well. The more private areas could be smaller. It would also help if these are also designed to be able to offer the residents opportunities to earn additional income.

Food and Nutrition

Opportunities for the residents to eat healthy and right throughout their stay in the community need to be provided. This implies that the neighborhood park houses a vegetable garden and an orchard. There should exist a possibility of preserving the food for the whole year. The neighborhood should have a grocery store that supplements the residents' need of dairy. Spaces to grow their own food should be provided in smaller scales closer to the residences and within the unit itself to cater to the transition from being robust to frail. Produce grown at the large community garden in the neighborhood park could also be used to generate extra income for gardening residents at the farm market stand.

Health and fitness

The residents need to be able to age independently in place. For this they have to slow down the transition between being robust and being frail. This means that they need to maintain physical activity throughout. Sidewalks in the neighborhood road, a walking trail within the site and connection to the existing greenway are to be incorporated into the design. The residents should have an opportunity to exercise within the building itself within perhaps a fitness center and be encouraged to use the stairwell instead of the elevator. Other recreational activities like gardening, golfing and playing tennis that improves a person's fitness should be considered to be a part of the programme.

Water: experience and conservation

The water features the site has to offer have to be made visible to the public. The residents of the community and their neighbors need to be made aware of the water conservation that is done. A streamside greenway, raingarden, bioswales and permeable pavements in sidewalks should be considered. In a smaller scale closer to the building, a water wheel and permeable pavements in addition to visible channels where rain water could flow should be

designed. Additionally, within the unit, a rain barrel and rain chain and windows through which the rain can be experienced and heard could provide the resident with experiences of water.





Cherishing and creating memories

































































Opportunities for the residents to create new memories and cherish their rich past should be provided. A development of the neighborhood that includes a grocery, pharmacy, restaurants and a coffee shop could help with this aspect at the neighborhood level. Residents should be able to run into one another and their neighbors outside their residences. Fond memories of their past should surface during performance of everyday activities as well. The henhouse, garden, water wheel, canning and food preservation and the farmer's market all bring back memories. Telling stories to neighborhood children is one way to relive memories. Knowledge can be shared by teaching children about gardening and trees and by teaching the younger women of the neighborhood about food preservation.

10.3 Quantitative Programme

The desired experiences discussed above are tabulated into a list of spaces that are required to be provided for in the design investigation. Figure 29 gives an exhaustive list of the space requirements and the functions that they are expected to perform.

Figure 29: Programme chart

Programme requirement for the community									
Efficient living									
Food and Nutrition									
Water									
Health and fitness									
Memories									
Neighborhood scale			Community scale			Unit Scale			
					Min area (sft)			Min. area (sft)	
Amenities			General spaces			Daylighting			
	Grocery Store	  		Internal streets	 		Views		
				Courtyard, space for neighborhood children to play	  				
				Space for residents to watch the children at play	  				
				opportunities for casual meetings					
	Pharmacy						high contrast		
	Library	 					connect to street visually		 
	Martial arts	 		Landscape			experience rain		
	Restaurant	 		easy transition paths	 				
	Post office	 					informal assistance		
	Other residential	 	Garden				one level		
							Helper as a resident		 
	Therapy			Vegetable garden residents	    		Close neighbors		 
				Community garden	    				

Walkable streets			Orchard, floral garden	  	individual units		
(to be developed)			Space for golf, tennis courts	 		small units	
	Rest benches every 100'					1 bedroom + 1 office (6 numbers)	1250
	storm water drainage					1 bedroom + 1 helper (6 numbers)	1000
	ease of walking		Other spaces				
	plants		Rain water storage, underground sump			Living room	 
			Storm water drainage			kitchenette	 
			Rain garden			Dining	  
			Bioswales			Storage	
			Water experiences, water wheel	 		Memory wall	
			Space for farmer's market	  		private porch	
			Common			semi private front porch	
			(visual connection with dining)	400  		garden	   
			Refrigerator, stove, sink, garbage disposal			Bedroom	
			dining	400   		Space for guests	
			outdoor dining	  		Some units with extra bedroom for a helper	 
			multipurpose hall (story telling, dance, exercise)	  		large bathrooms well lit with water saving fixtures	
			Maintenance, admin and records	200 			
			lounge	200  			
			deck/ porch for sundrying	100  			
			root cellar	50  			
			canning	 			
			kitchen	100			
			decks overlooking garden				
			laundry	400 			
			lobbies	200 			
			guest rooms	1000 			
				4550			13500

Chapter 11

Design

11.0 Introduction

The proposed design considers the lifestyle of the residents of the Cedar Bluff area and how they proceed with their daily lives. It integrates the five aspects of efficient living, food and nutrition, health and fitness, experience and conservation of water and opportunities to cherish and create memories. This is done at the levels of the neighborhood, site and the living unit. The proposal attempts to provide opportunities for these suburban residents to maintain a similar lifestyle in a more manageable setting as they age. As an aging resident's energy, ability, and desire to travel across larger suburban distances lessens the neighborhood and housing community enable them to access similar experiences and services closer to their home in a self-sufficient neighborhood and a sustainable community. The community remains connected to the suburbs that the residents are so much used to and provides a sense of personal private home with an outdoor yard, green landscape, street and community of neighbors who share daily activities.

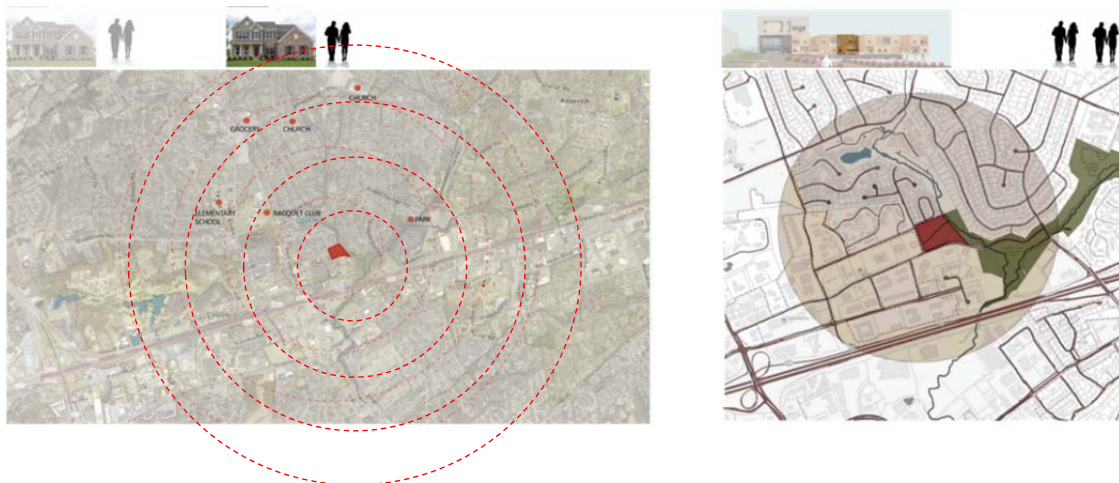


Figure 30: Traditional vs. Proposed neighborhoods in suburbia

11.1 Efficient Living Arrangements

The primary design goal is to provide the elderly residents with a manageable living environment that still provides all the features and experiences of the Cedar Bluff suburb. This is sought to be provided at the three levels: neighborhood, site and unit. The amenities within the walkable radius of ½ a mile contribute to increasing the efficiency at the neighborhood level.

The young-old residents of this community could still drive to the grocery store, the church or for recreation purposes, although there would not be a need to go so far. The proposed plan is designed to have sidewalks added (Figure 31). The sidewalks would also have seating for the elderly to rest or watch passersby. The proposed design also allows the residents to do their own shopping, run their own errands or take a stroll after dinner on a good summer day. It also allows the residents to watch from their front porch or from the courtyard the neighborhood children play like they did in their younger years. A permeable pavement is also proposed which would account for good drainage of storm water and prevent urban run-off.



Figure 31: Proposed sidewalk for the neighborhood roads

The surrounding area also has a lot of space available for potential future development of other communities, amenities that are required for this community, some adjacent apartments and duplexes; bringing in all these communities together and creating a richness of diversity. A revamp of the existing strip mall is also proposed. This would also include a grocery store, a pharmacy and perhaps an inexpensive restaurant and coffee shops as well.

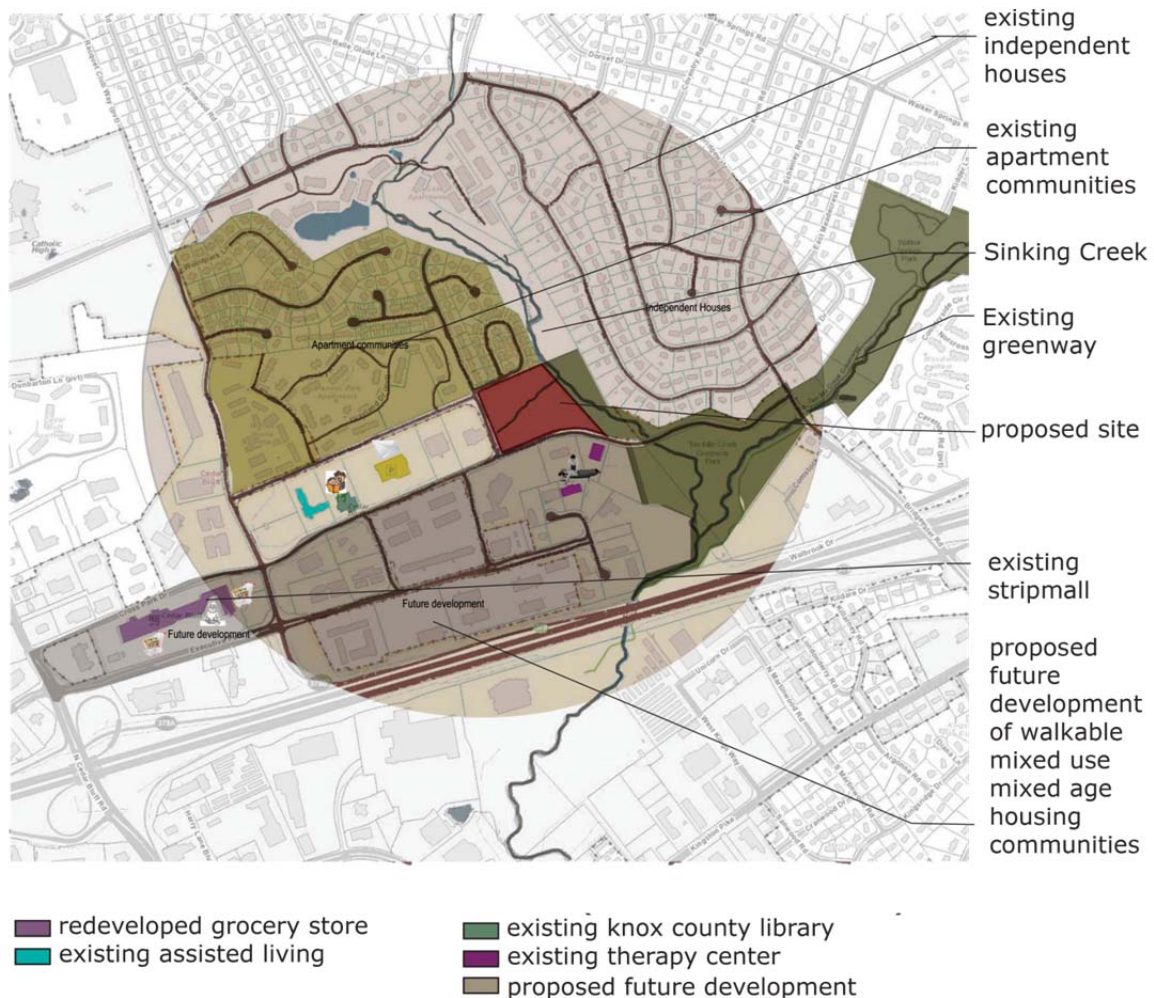


Figure 32: Amenities within the neighborhood

For the resident who is not able to walk too much and who is in his transitional old age, neighborhood park and housing community site house the amenities of a recreation and health club. These include a greenway, a walking trail, a tennis court, space for residents to practice golf and the like. There is also close proximity to water and opportunities for recreation like fishing. The community garden, orchard, canning kitchen and spaces that

provide the residents with opportunities to cherish memories are also included in this proposal. The resident does not need to travel too far to practice his golf or to fish. He virtually has these spaces in his backyard. He could manage smaller gardens in the courtyard or adjacent to the canning kitchen when he no longer feels fit enough to perform strenuous work. He can still walk along the trail within the site or around in the courtyard and still sit in his front porch or the gazebo to talk with friendly neighbors.



Figure 33: Proposed Site Plan

The unit; again in conjunction with the neighboring facilities like the common laundry, fitness center, communal kitchen (580 sft.) and dining (950 sft.) brings together every space that is present in today's average house within a smaller footprint of around 1000 sft.

Figure 34 illustrates how infrequently used spaces like spare bedrooms, and large formal rooms and patios for entertaining are located outside of the personal unit and shared between residents to create a smaller personal unit that is easier for an aging resident to use and clean on a daily basis. To discourage use of cars for daily trips, automobiles are stored in a common basement garage.

The hallway becomes the street where one can meet passersby. As one walks along, he will also get an identity of his space looking at the adjoining houses. The front porches along the hallway give it more identity as a street.



Figure 34: Efficiency of the proposed unit

Within each unit, an open floor plan offers the resident with a large space that has good visual connection with the neighboring spaces. All spaces are designed so that they perform multiple functions; e.g. the living room is eliminated from the unit and an open space that houses the kitchen, dining and living spaces is created. A resident still has his side yard and patio for lounging and gardening, a front porch to sit on and visit with passersby; the hallway becomes a neighborhood street that connects the units. Occasionally, he could use the stairways or the multipurpose hall for exercising.



Figure 35: View of the Great Room in a unit

The unit like the rest of the neighborhood park provides the same experiences that one would get in terms of exercise, food and nutrition, experiencing and conserving water and reliving memories at a smaller scale for the old-old who are really frail.

11.2 Food and nutrition

The aspect of providing the residents with good food and nutrition is also considered at the three levels. A resident in his young-old years could engage in gardening and produce his own food. He could also walk to the grocery store for the dairy and grains that he might need to supplement the food produced in the community. (Refer to figure 26, 27)

Taking ideas from cohousing and Eco communes, the neighborhood park includes a large garden that engages the neighboring apartment community for collective gardening. Enough garden space is available for the residents to possibly produce enough fruits and vegetables for the whole year: that they could eat fresh or preserve in the canning kitchen or the root cellar for the future days. A henhouse is also proposed and would be a source of eggs. As the resident grows into his transitional old age, he still does not need to go far to get his food. To supplement his needs of grain and dairy, he could car-pool to the grocery or get help from his neighbors.

The courtyard and the personal side yard and the planter boxes along the hallways in the unit also offer opportunities for the residents to grow their own food. This is helpful for the frail old-old who can still opt to grow some of their food and gain a sense of satisfaction. Thus the aspect of food and nutrition is brought in the scale of the unit as well.

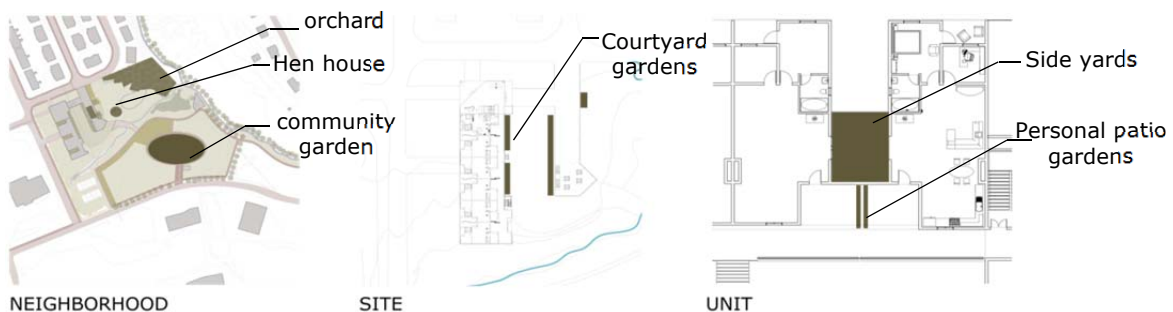


Figure 36: Integration of Food and Nutrition in the 3 scales

11.3 Water as an experience and water conservation

Being sensitive to water and the ecological issues is one of the ways of contributing and connecting to the neighborhood and the nearby Sinking Creek greenway and walking trails. The permeable pavement in the sidewalks helps reduce runoff. The neighborhood water runoff is channelized into the site's bioswales. This also makes the water visible and makes the people conscious of the water conservation.

The Sinking Creek and the greenway along the Ten-mile Creek and the fishing possibility create the experience of water. Permeable grass pavers in the courtyard and the spinning water wheel create the experience of water at the scale of the site.

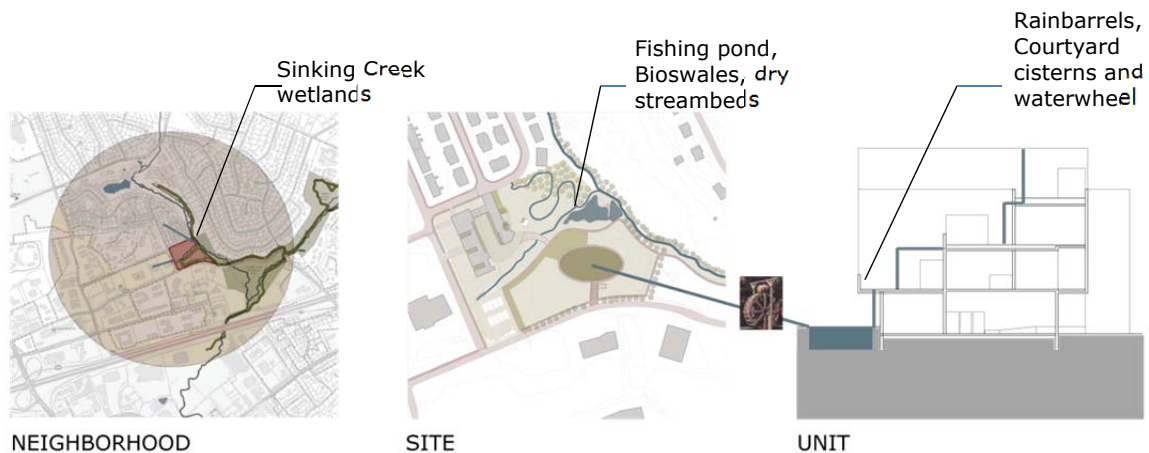


Figure 37: Integration of water in the 3 scales

Again, the irrigation of the garden during dry days is effected by the water collected from the rooftops in an underground sump (figure 37).



Figure 38: Analysis of the growing season in Knoxville, TN

The side yard in the unit also offers an opportunity to experience water as rain in rain chains and rain barrel. All these ensure that water is experienced in a positive way by the residents. Contributing to the community and the neighborhood also gives a sense of importance to the residents.

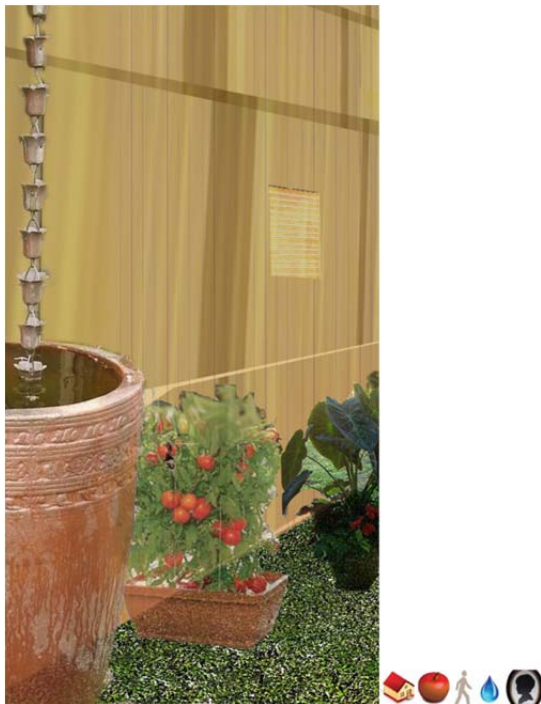


Figure 39: Experience of water in side yards

11.4 Health and exercise

Ample possibilities for exercising exist in the levels of the neighborhood, site and unit. Exercise is important to maintain physical and mental robustness and creates opportunity for social connections that support an aging individual. The neighborhood, by itself is being proposed as a walkable one, with good sidewalks.



Figure 40: Integration of Health and exercise in 3 scales

A walking trail within the site and a greenway along the creek that connects with the existing ten-mile greenway are proposed. In addition, tennis courts and space for practicing golf are available within the site.

Gardening, by itself is a good physical activity. It improves both physical and mental health. A community garden is planned where the residents of the neighborhood can unwind and get some exercise. A smaller personal garden space closer to the residences is also planned for.

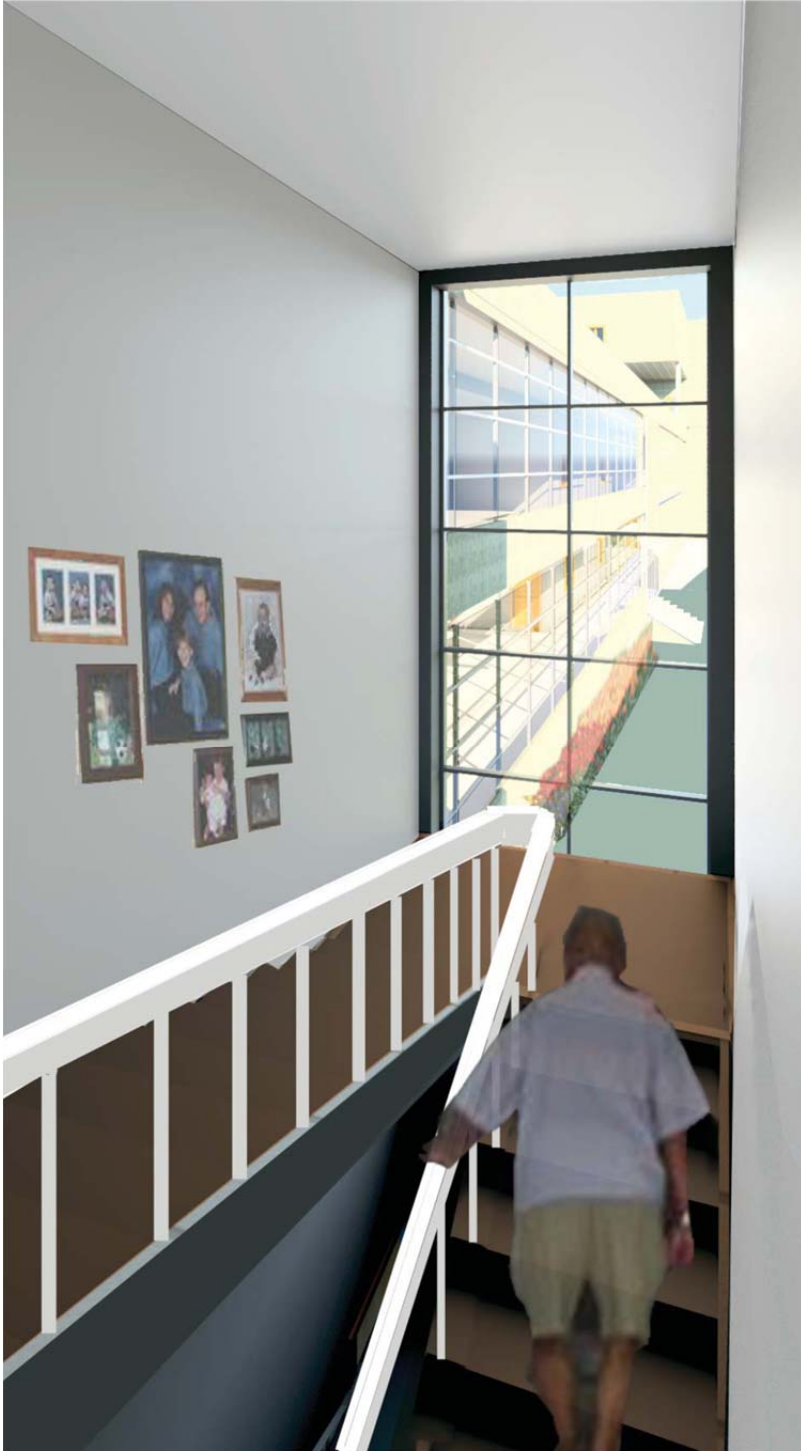


Figure 41: Private stairway

For one who cannot manage long outdoor walks, there are still many opportunities for exercise. Within the building, the staircases are well lit and ventilated and are made into pleasant areas where one could exercise. The building features a multipurpose room that can be used as a fitness center: a gymnasium or for dance sessions or taichi sessions.



Figure 42: Multipurpose hall and fitness center

11.5 Creating and cherishing memories

Memories are not only about the past, but also about the present. This again is addressed in this project at the levels of the neighborhood, site and the unit. The neighborhood remains the same one where the resident has spent much of one's years. The sidewalk acts as a space where people could meet others and make new friends, or just sit down and reminisce about the past.

The site is woven with programs that kindle past memories of the residents: the garden, fishing, canning kitchen, and henhouse. There are ample numbers of porches that offer spaces where the residents could meet others and create new memories. Story telling sessions also help revive old memories in addition to providing intergenerational connection.



Figure 43: View of the courtyard

Within the unit, it is proposed that the residents use their own furniture that they are used to and that they cherish. A picture wall to display fond memories, a front porch where they can meet their neighbors and a more private patio all serve as spaces that kindle memory. The side yard also is home for rain chains and rain barrels that would be successful in kindling past memories. The great room offers a large continuous space where visiting family can be entertained in the comfort of their own home.



Figure 44: View of the communal garden

11.6 Integration

All the aspects discussed earlier in this chapter are brought together. The design is such that privacy and identity are maintained throughout the three scales of the neighborhood, site and unit. People have their private spaces. Most spaces in the proposal are so designed that they cater to more than one aspect.

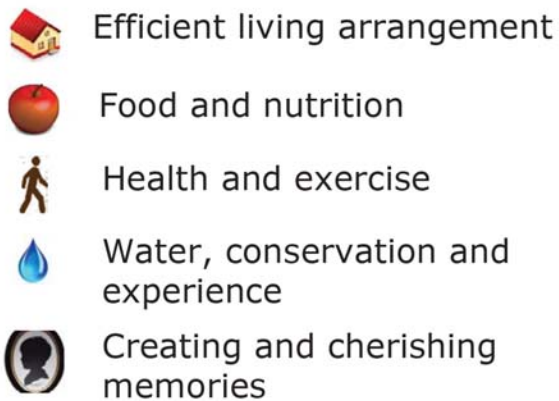


Figure 45: Icons used to indicate Integration of Issues in Design

Investigation

A reader will notice small symbols on many of the diagrams and drawings. These symbols show the multiple uses and issues that each space designed for this project addresses.



Figure 46: Side yard in the unit

For example, the side yard brings together food and nutrition, memories, water and efficient living.

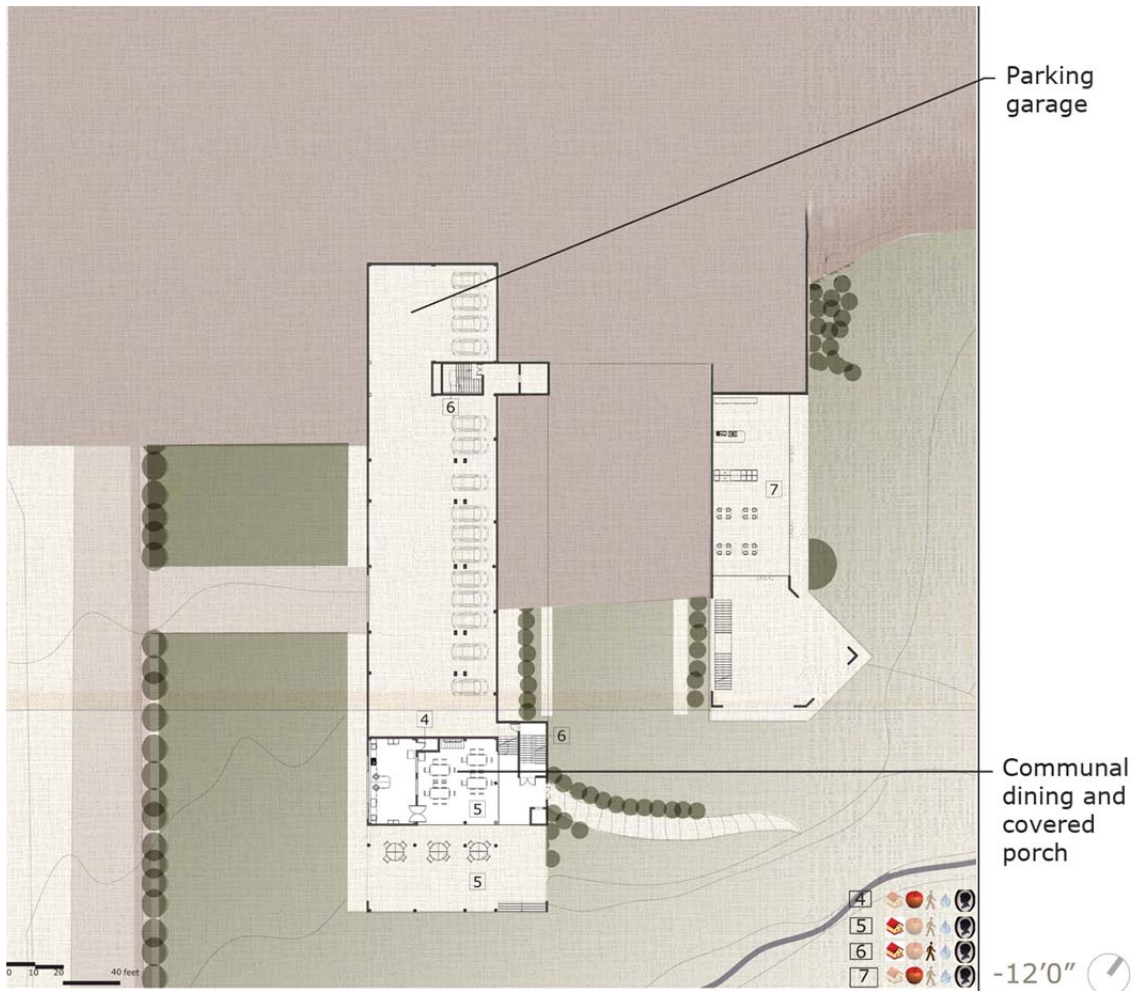


Figure 47: Plan at Level -1

Figure 47 shows the arrangement of spaces in the lower level. This level constitutes the parking garage designed for 1.5 spaces per unit. This is connected to the rest of the unit, yet distinctly separated from the more important communal space that has an outdoor dining overlooking the garden.

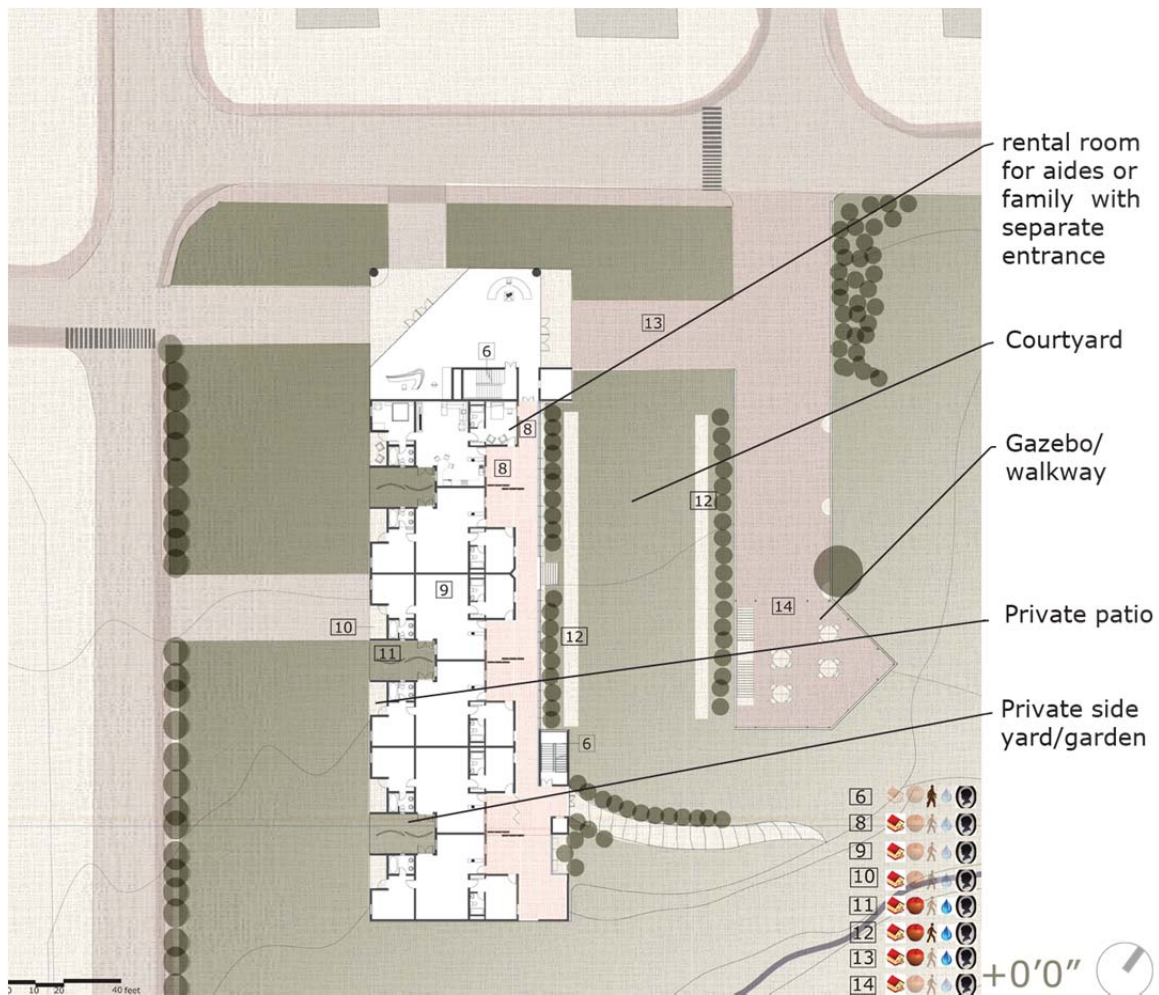


Figure 48: Plan at Level 1

Contacts with people of other generations are also made possible in every scale of the neighborhood and overall efficiency is maintained. In addition to the courtyard and the walkway to gazebo, where the neighborhood children can play, some of the units also are designed with a room that could be rented at discretion (see figure 48). This would serve as supplemental income as well as a means to have informal assistance or help at call. The friendly neighbors can also be considered as people who can be counted on for help. All this is achieved while the residents still maintain their privacy.

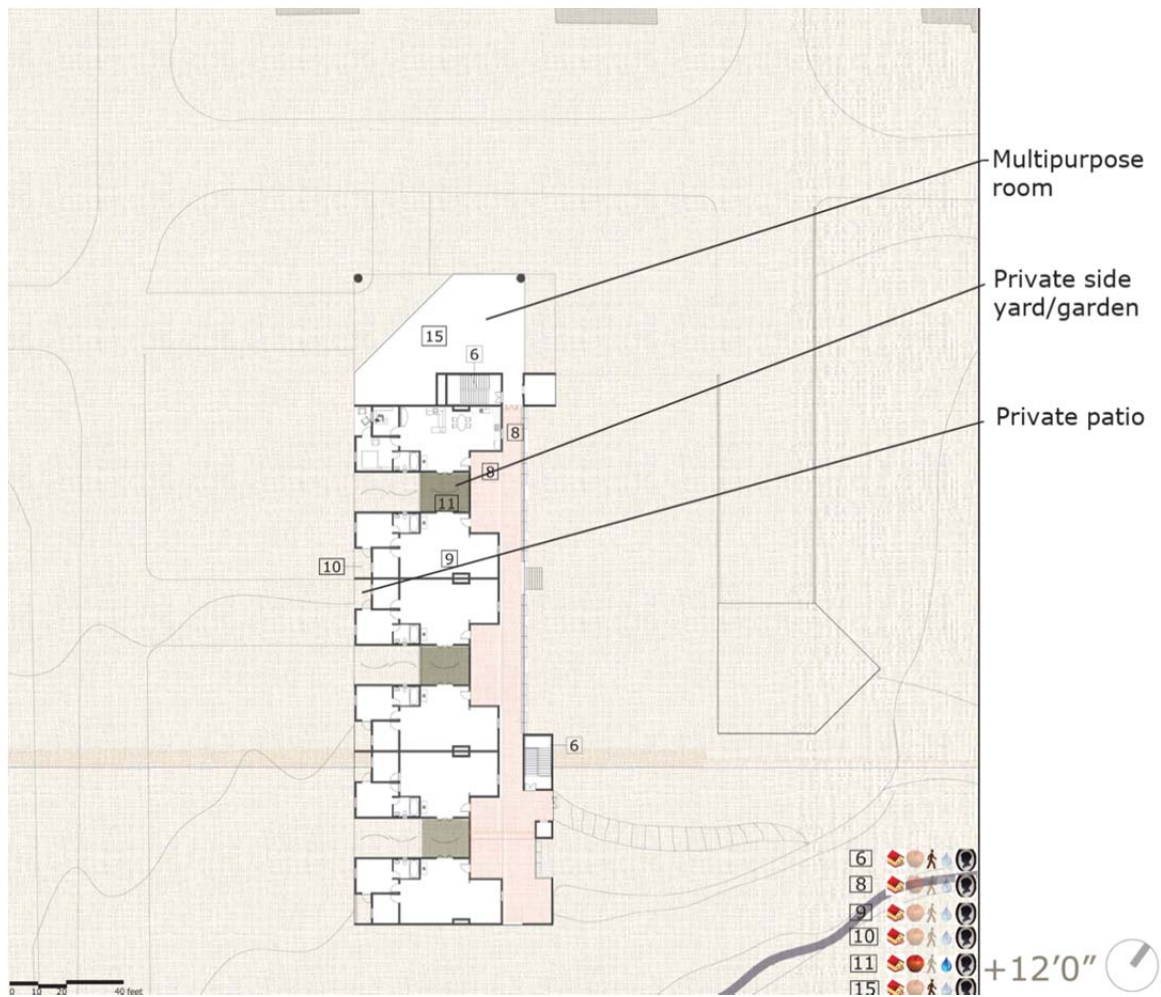


Figure 49: Plan at Level 2

The living units are designed to be on the main entry level (see figure 48) and the level above (see figure 49). The ones in the entry level (see figure 48) are the ones designed with an additional rentable room. The location of the room allows the resident ample privacy.

The common spaces are detached from the residential units, while still being connected to them. The multipurpose room in level 2 (figure 49) is designed to serve multiple functions of being a gymnasium, dance hall, meeting room, movie room and the like. The pool is proposed at level 3 (figure 50) so that both the residents and the guests occupying the guest rooms at level 3 can avail of it.



Figure 50: Plan at Level 3

The level 4 is the uppermost level and is designed to house a chapel in addition to the laundry and administrative offices (figure 51).

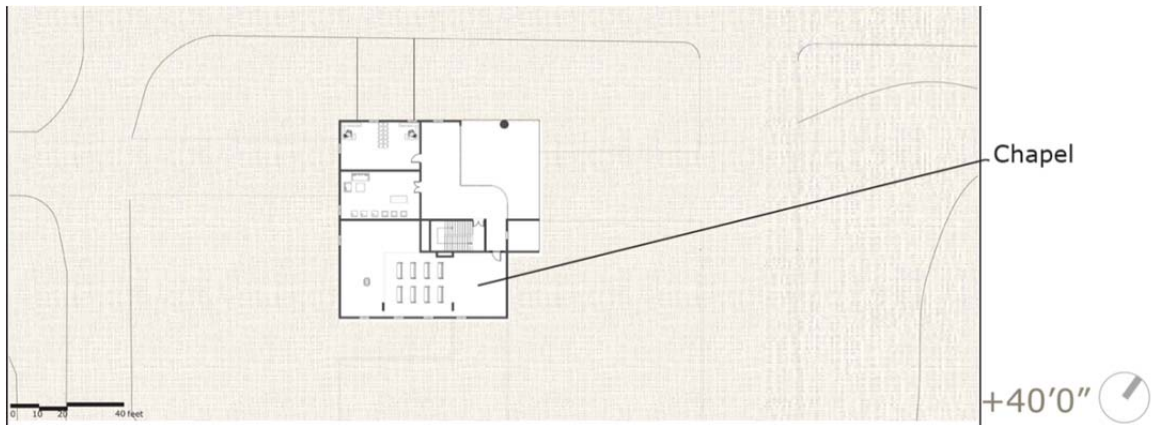


Figure 51: Plan at Level 4



Figure 52: Section A



Figure 53: Section B



Figure 54: Section C

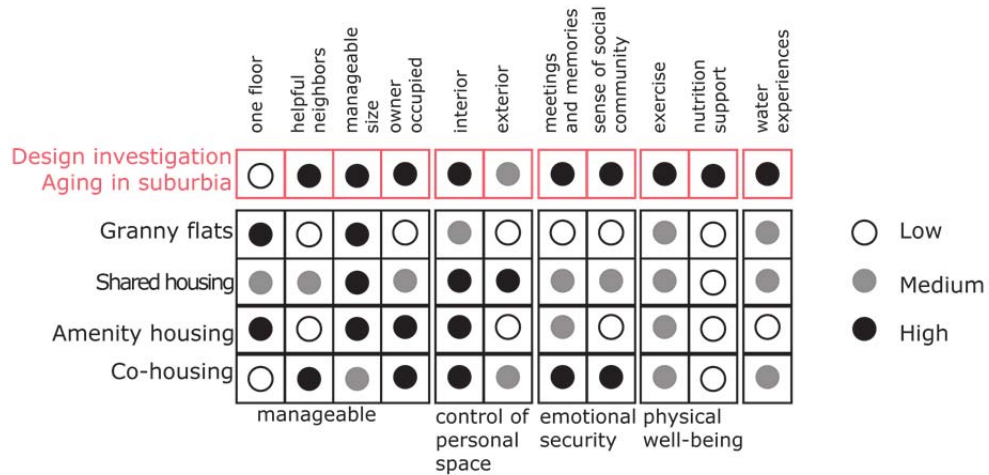
Conclusion

Thus, this thesis and design investigation explored the possibility of condensing the existing suburban condition into a more manageable and sustainable neighborhood. Food, water, fitness and opportunities to create and cherish memories come together in this proposed neighborhood, community and the living unit itself.

Most spaces in the design serve multiple functions and hence the efficiency of the living arrangements is maximized. For example, fitness, water, food and memories come together in the garden which also engages the neighboring communities. The courtyard brings together all these aspects too. Within the unit, the side yard and the great room all improve the efficiency of the living quarters.

The neighborhood becomes a sustainable and a self-sufficient one in which the residents can continue to live until they need medical care; becoming smaller as the resident ages. The neighborhood and the community continue to offer the same quality of life throughout the aging years.

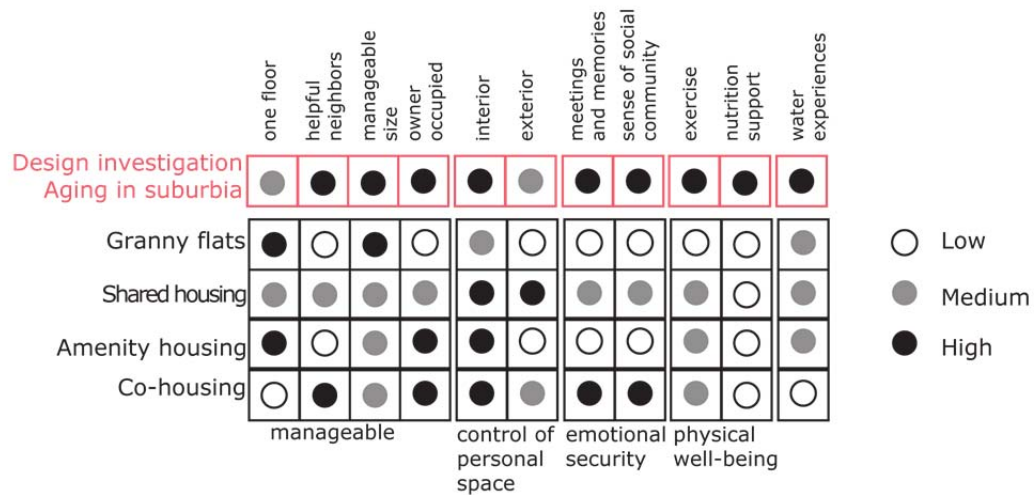
Figures 55, 56 and 57 illustrate how various issues are addressed in the design investigation through the integration of the models into a pattern for an integrated neighborhood, and housing community for aging in suburbia.



Suitability of design investigation to serve as a place to age successfully
Young-old years (neighborhood scale)

Figure 55: Suitability of design in for the young-old

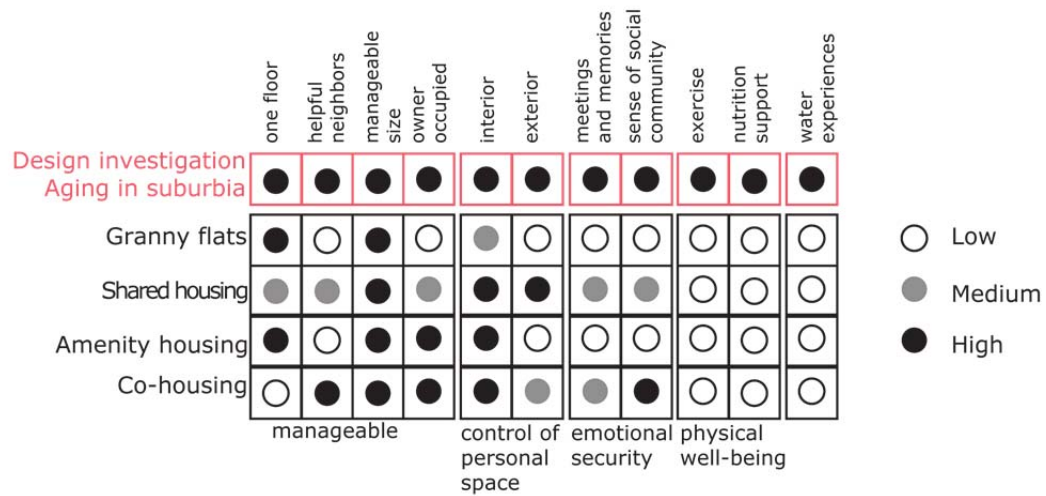
(assessment diagram by author)



Suitability of design investigation to serve as a place to age successfully
Transitional years (site/ courtyard scale)

Figure 56: Suitability of design for the transitional years

(assessment diagram by author)



Suitability of design investigation to serve as a place to age successfully
Old-oldyears (Unit scale)

Figure 57: Suitability of design for the old-old

(assessment diagram by author)

Ultimately, the goal of aging in a suburban place will ensure that residents would contribute positively to their own social well-being as well as the society which houses them.

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Appendix

Appendix 1

Table 1: Nutrition chart

	1,600 calories	2,000 calories	2,600 calories
	5 ounces or equivalent	6 ounces or equivalent	9 ounces or equivalent
Grains			
Vegetables	2 cups	2-1/2 cups	3-1/2 cups
Fruits	1-1/2 cups	2 cups	2 cups
	5 ounces or equivalent	5-1/2 ounces or equivalent	6-1/2 ounces or equivalent
Protein foods			
Seafood	8 ounces/week	8 ounces/week	10 ounces/week
Meat, poultry, eggs	24 ounces/week	26 ounces/week	31 ounces/week
Nuts, seeds, soy products	4 ounces/week	4 ounces/week	5 ounces/week
Dairy products	3 cups	3 cups	3 cups
Oils	22 grams	27 grams	34 grams
Solid fats and added sugars (SoFAS)	121 calories	258 calories	362 calories
Daily Calorie Count Examples for the USDA Food Patterns			

Table 2: Daily calorie needs for women

Age (years)	Calories Needed for Sedentary Activity Level	Calories Needed for Moderately Active Activity Level	Calories Needed for Active Activity Level
19–30	2,000	2,000–2,200	2,400
31–50	1,800	2,000	2,200
51+	1,600	1,800	2,000–2,200

Table 3: Daily calorie needs for men

Age (years)	Calories Needed for Sedentary Activity Level	Calories Needed for Moderately Active Activity Level	Calories Needed for Active Activity Level
19–30	2,400	2,600–2,800	3,000
31–50	2,200	2,400–2,600	2,800–3,000
51+	2,000	2,200–2,400	2,400–2,800

Table 4: DASH Eating Plan—Number of Food Servings by Calorie Level

Food Group	1,200 Cal.	1,400 Cal.	1,600 Cal.	1,800 Cal.	2,000 Cal.	2,600 Cal.	3,100 Cal.
Grains	4–5	5–6	6	6	6–8	10–11	12–13
Vegetables	3–4	3–4	3–4	4–5	4–5	5–6	6
Fruits	3–4	4	4	4–5	4–5	5–6	6
Fat-free or low-fat dairy products	2–3	2–3	2–3	2–3	2–3	3	3–4
Lean meats, poultry, and fish	3 or less	3–4 or less	3–4 or less	6 or less	6 or less	6 or less	6–9
Nuts, seeds, and legumes	3 per week	3 per week	3–4 per week	4 per week	4–5 per week	1	1
Fats and oils	1	1	2	2–3	2–3	3	4
Sweets and added sugars	3 or less per week	3 or less per week	3 or less per week	5 or less per week	5 or less per week	≤2	≤2
Maximum sodium limit	2,300 mg/day	2,300 mg/day	2,300 mg/day	2,300 mg/day	2,300 mg/day	2,300 mg/day	2,300 mg/day

Source : National Institute of Aging

Appendix 2

According to the US drought monitor, most of the United States was in moderate drought earlier in the year. Analysis of the latest drought monitor data revealed that 46.84 percent of the nation's land area was in various stages of drought in July 2012.

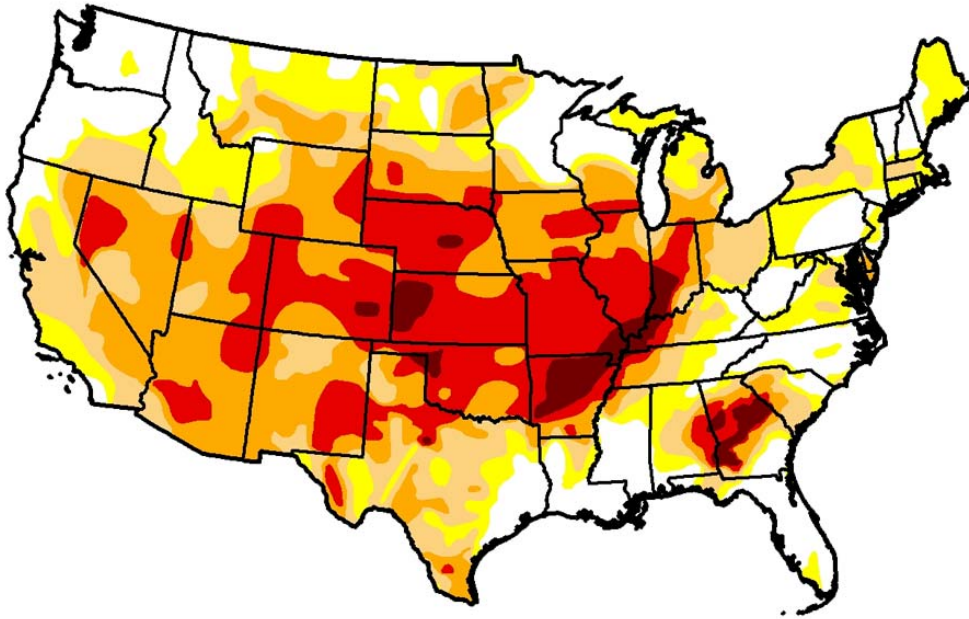
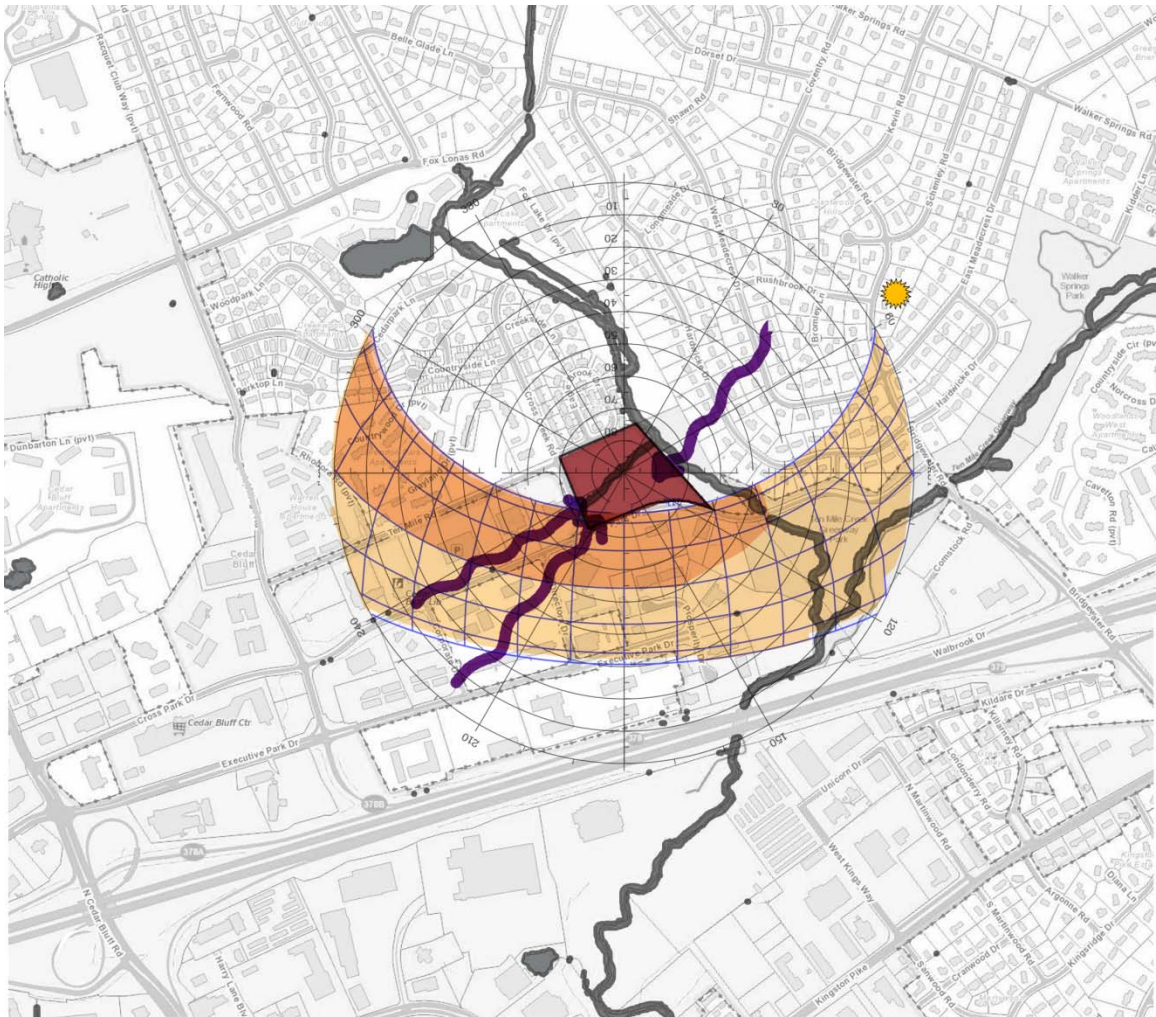


Figure 58: Drought map 2012

Source : United Nations (UN, UNESCO, and FAO publications)

Appendix 3



latitude, longitude - 35.9606° N, 83.9208° W
predominant wind - sw and ne
max. avg. high - 88 deg F
min. avg. low - 27 deg F

Figure 59: Climatic analysis

Appendix 4



Figure 60: Vehicular paths and logical entry

Appendix 5



Figure 61: View from the pavilion



Figure 62: View as one approaches

Appendix 6

Though the Earth is made up of largely water, only 3% is fit for human consumption and 66% of that is locked away in glaciers. We use this fresh water indiscriminately for many purposes with freshwater withdrawals tripling over the last 50 years. Demand for freshwater is increasing with most of the freshwater being used for agricultural purposes.

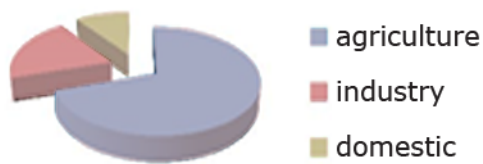


Figure 63: Usage of water

Vita

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