OLD IVY ROAD RESIDENTIAL DEVELOPMENT

INCORPORATION OF SUSTAINABLE INFRASTRUCTURE INTO AFFORDABLE HOUSING DEVELOPMENTS

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

The city of Charlottesville's 2018 Housing Needs Assessment highlighted a significant issue: approximately 1,866 households are on a waiting list for Housing Choice Vouchers, a federal program aiding low-income families in affording housing. The average wait time is eight years, or seven years for elderly and disabled individuals (Charlottesville, 2018). Charlottesville Redevelopment and Housing Authority emphasizes the extreme lack of affordable housing, with Virginia having only 32 affordable units per 100 families in need (*Gap Report 2023*, 2023; *The GAP*, 2023).

A new housing development, known currently as the Old Ivy Road development, looks to create a mixed-use development that includes affordable housing units, commercial buildings, green spaces, and thorough stormwater management and other green infrastructure. The client, Greystar Real Estate Partners, would prefer to maximize the number of potential housing units, and through density incentives outlined in the Albemarle County Zoning Ordinance, the original maximum density of 15 dwelling units per acre can be increased by 30%, if at least one half of the dwelling units allowed in the increase are affordable housing units (Affordable Housing Bonus Factors, 2021).

“Sustainable infrastructure” or “green infrastructure” includes green construction practices, stormwater management, and public infrastructure like green spaces and transportation opportunities such as bus stops, sidewalks, and bike lanes. However, implementing sustainable infrastructure into affordable housing developments is challenging and often avoided due to limited budgets and the complex problem-solving involved with the process (Tan & Olanrewaju, 2019).

A case study of housing certified through Earthcraft, an organization that awards housing in Georgia for using construction and design that reduces environmental impacts, shows that there is not a significant difference in the cost of construction for an Earthcraft certified home versus a home of equal size and location that is not certified, though there is a 15% increase in the selling price for the homes (*EarthCraft House*, n.d.; Jeddi Yeganeh et al., 2019). This study proves that in certain cases sustainable infrastructure comes at no additional cost, it simply increases the hypothetical property value. Countless studies have proven that low socioeconomic areas have far less access to green spaces. A 2008 study suggesting that low-income neighborhoods are 4.5 times less likely to not have recreational facilities than high-income neighborhoods (Moore et al., 2008). Simultaneously, recreational and green spaces have been proven to boost mood, and lower depression rates, a phenomenon that those who live in affordable areas unfortunately miss out on (Lee & Maheswaran, 2011).

This combination of affordable housing and sustainable infrastructure would appease the client by allowing more density, and thus more housing units, lightening the incredible need in Albemarle County for affordable housing, as well as satisfying the client's requests for sustainable infrastructure. A strategy towards implementing sustainability into affordable housing is EPA's "Smart Growth" strategy, in which accessible public transportation and sustainably engineered utilities to lower usage rates are at the forefront (US EPA, 2013). Following EPA's Smart Growth strategy allows for the initial planning and documentation to display more easily what can be done to allow the housing to stay affordable and apply sustainable building techniques. This project focuses on the redesigning of affordable housing infrastructure using green and sustainable infrastructure technologies and how to procure information regarding their implementation.

Technical Topic

The Old Ivy Road Residential Development project is design oriented and involves the creation of documents and maps that outline theoretics. Deliverables to Greystar Real Estate Partners include site, grading, stormwater management, traffic and pedestrian access, traffic relocation, construction, and Rivanna trail relocation plans. The documents that are most closely associated with the plan of incorporating sustainability into affordable housing developments are the main site, pedestrian access, and construction plans. According to the client, the site plan must include a minimum of 200 housing units total, with 300 preferred, split between apartment buildings, townhomes, and single-family homes, adequate parking for the number of units, a minimum of two commercial buildings, and unspecified amenities throughout the parcel to increase appeal for residents.

The general design of the development is formed from the collected inspiration of other successful mixed-use developments, as well as the many design standards of Albemarle County and the Virginia Department of Transportation. Zoning laws and transportation regulations provide the most constraint to the design process. Albemarle County zoning laws require that there be an 18 foot setback from the front of buildings to roads or sidewalks, and a 20 foot setback from the back of buildings (Setbacks and Stepbacks in Residential Districts, 2019). Additionally, a 100 foot buffer distance must be maintained from perennial streams and nontidal wetlands on the site, reducing the building envelope more (Extent of Stream Buffers; Retention and Establishment, 2014). The two setback requirements alone greatly decrease the available space for building. Transportation regulations that limit the space available on the site include parking regulations, in which a minimum of 1.5 parking spaces must be available per 1 bedroom unit, and 2 spaces per 2 or more bedroom unit (Minimum Number of Required Parking Spaces

for Scheduled Uses, 2003). Since the development includes single family homes and townhomes, all roads must be constructed following school bus and firetruck design standards, which require a minimum of 45 foot outside turn radius for curves, intersections, and cul-de-sacs (VDOT, n.d.). A source of inspiration for the layout of the development comes from a mixed-use development in Lorton, Virginia, going by the name of Liberty. The still under construction development is reclaiming the abandoned site of the Lorton Reformatory, a prison complex build in the early 20th century to serve Washington D.C. ("Lorton Prison History," n.d.). Recommended by the client, the development boasts impressive use of green space throughout the site, as well as having similar housing to the Old Ivy development, with a mix of apartments, townhomes, and single-family homes. Both design constraints from the county and the state as well as design inspiration from other mixed-use sustainable development projects have guided the designing of the Old Ivy Road Residential Development.

While incorporating sustainable infrastructure into affordable housing, a focus must be on reducing energy usage, increasing green space, and reducing stormwater runoff. Focusing on incorporating basic amenities such as a park, tennis courts, and a walking trail into the development rather than energy intensive amenities such as a pool will help to lower prices for dwelling units while still providing appealing amenities to bring in consumers. Green building techniques that are slated for the construction plan include urban forestry to lower urban heat island effects, allowing for a more regulated climate inside of buildings that receive shade from the trees, and installation of low-flow toilets. Both technologies would decrease utility costs, making units more affordable while also incorporating green infrastructure (McPherson et al., 1997). Despite the constant development of new green infrastructure technologies, affordable

housing has stayed relatively consistent. The relationship between green infrastructure and affordable housing is imperative to improving affordable housing.

Green Infrastructure, Ethics, and Affordable Housing

Thomas Seager's Sustainable Engineering Science approach is a framework that is a perfect fit for analyzing the relationship between affordable housing and sustainable infrastructure. This approach classifies certain sustainability-related engineering problems as "wicked problems" that require specifically engineered solutions. Seager specifies that wicked problems of sustainability in engineering often require solutions that incorporate ethical awareness, adaptability and resilience, and cross-disciplinary expertise, qualities often overlooked in conventional solutions (Seager et al., 2012). Bryan Norton, in his paper *Sustainability: A philosophy of adaptive ecosystem management*, outlines five key characteristics of wicked problems: "difficulty in problem formulation, multiple yet incompatible solutions, open-ended timeframes, novelty, and competing value systems or objectives" (Norton, 2005). The incorporation of sustainable infrastructure into affordable housing exhibits all these characteristics, meaning an alternative solution must be found.

The current approach in both sustainability within the housing market and affordable housing is the 'Business-As-Usual' approach. This method tends to overlook environmental and social issues, or optimistically assume business as usual addresses these problems without considering their broader contexts. This approach is typically one that allows for advances in technology although it "disproportionately benefits the rich" who can afford such innovations (Woodhouse & Sarewitz, 2007). The approach that Seager argues works best for solving wicked problems is known as sustainable engineering science, a methodology that covers what business-as-usual fails to by reviewing ethical requirements beyond professional ethics, using a resilient

and anticipatory perspective rather than risk management, and allowing for interdisciplinary research. To fully understand sustainable engineering science, wicked problems can be reinvented as "conditions to be governed," and the approach viewed as managing these conditions, rather than solving the problem. This change in perspective allows for wicked problems to be viewed as several smaller but broad, interdisciplinary, constantly fluctuating issues. This recontextualizes sustainable engineering science as a plan to mitigate the effects of each issue through creating resilience in all parts of the system and anticipating further issues.

When approaching sustainability in affordable housing with the wicked problem framework, the Business-As-Usual approach falls short. Each affordable housing development operates within a unique social, economic, and environmental situation, making a one-size-fits-all solution to incorporating sustainable infrastructure impractical. Using a sustainable engineering science approach, a plan to incorporate resilient sustainable infrastructure that can adapt to changes like climate change and sea level rise as well as social and economic disparities faced by residents such as rent fluctuations, inflation, or a recession is necessary. This raises the question: what will a plan to incorporate sustainable infrastructure into affordable housing entail?

Research Methods

The implementation of sustainable and green infrastructure into affordable housing has not progressed far because of a major lack of research and development in the field (Tan & Olanrewaju, 2019). The cause of the lack of research can be attributed to the lack of a universal definition of sustainable and green infrastructure, leading to unclear research boundaries. By formulating a project-specific definition for sustainable infrastructure, boundaries are more clearly defined, and research can be performed. The importance of this research cannot be understated, as the current state of affordable housing shows an extreme inequality and injustice

for affordable housing residents, something that can and should be undone by the improvement of technology in this field.

To investigate, I plan on performing several case studies of successful affordable housing developments that have incorporated sustainable infrastructure and design. The sustainable engineering science approach for wicked problems provides a clear pathway for examining these developments. Solutions employed in the developments must show resilience and have infrastructure that is specific to the environmental, social, and economic situation of the development. The studying of these cases will allow for the formulation of a specific sustainable infrastructure plan that can be implemented to the affordable housing developments following Greystar's requests.

One development to be studied is Via Verde, a mixed-use development in New York City, the design of which won a national competition for design in affordable housing, and post-construction won an award for Smart Growth Achievement through the EPA (Donovan, 2012; US EPA, 2014a). Another development would be the Cooperative Building in Brattleboro, Vermont. This development is a multi-story affordable housing building and green infrastructure showcase with "innovative, money-saving environmental features" and doubles as a grocery store and food co-op for the local community (PD&R, n.d.; US EPA, 2014b). The aforementioned Liberty development in Lorton, Virginia, as well as countless other housing developments across the country are available to be included in the case study as well.

Conclusion

Affordable housing has fallen behind current housing technologies, leaving already vulnerable people in a more vulnerable situation as they are forced into residing in housing units

that are frequently of low quality, unsafe, and far away from essential services and facilities. Sustainable infrastructure will improve housing quality, increase safety, provide public transportation opportunities, and allow for the development of a nurturing neighborhood community. Residents of affordable housing already face inequalities and injustices because of their economic status, designing and building sustainable, green, affordable housing will create neighborhoods of happier and healthier people, and allow residents to no longer suffer from the negative effects that low quality housing has. Research in this area will provide a small list of sustainable infrastructure and sustainable practices, likely construction practices such as waste reduction and adaptive reuse, as well as stormwater management practices such as green rooves and bioretention facilities that can lessen utility bills.

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