

A photograph of a modern building facade. The building features a mix of materials: tan and grey horizontal panels, a dark grey brick base, and a bright yellow vertical section on the right. A prominent feature is a red cantilevered window box on the left side, housing a large window. Below it is another large window. The foreground shows a concrete curb and a patch of green artificial turf.

# The Rose

Innovative Practices for Healthier Homes

A Case Study

## Acknowledgments

### Project Team

Aeon  
Hope Community  
MSR Design & their consultants  
Weis Builders  
Center for Sustainable Building Research

For a full list of contributors please refer to page 45.  
Without their generous contribution this work would not be possible. Many thanks.

### Research & Publication Team

**The Healthy Materials Lab**  
Parsons School of Design  
The New School  
New York, NY

**Director**, Alison Mears AIA LEED AP  
**Director of Design**, Jonsara Ruth

**Research Fellows**  
Gamar Markarian  
Larissa Begault  
Mochi Liu  
Sara Minard

This study was completed in June 2016

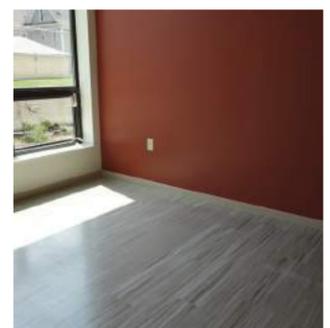
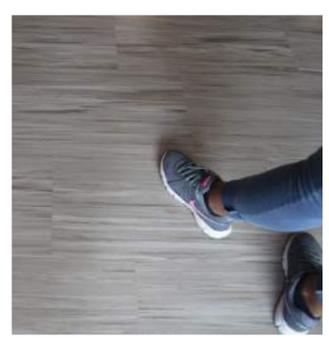
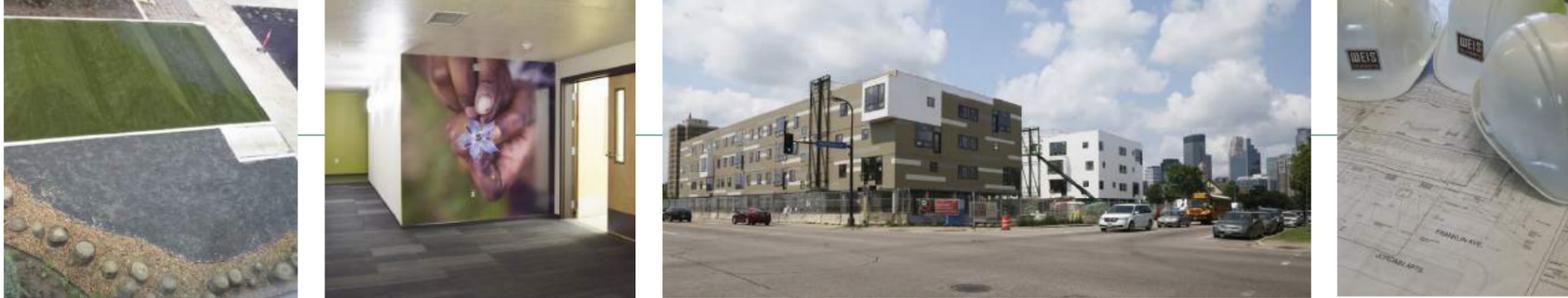


# The Rose

Innovative Practices for Healthier Homes

## A Case Study

Minneapolis, MN  
Aeon + Hope Community Partners  
Opened September 2015



# CONTENTS

## The Rose

Innovative Practices  
for Healthier Homes

<b>1. Introduction</b>	<b>p.7</b>
1a. Case study methodology	
1b. Why The Rose?	
<b>2. Overview &amp; Lessons Learned</b>	<b>p.12</b>
<b>3. Forming Partnerships and Building Trust</b>	<b>p.16</b>
3a. The Design Team	
3b. The context of The Rose	
3c. Land use policy - rezoning process	
3d. Finding appropriate funding for innovation in the affordable housing sector	
<b>4. Certifications: Innovation, Feasibility and Replicability</b>	<b>p.26</b>
<b>5. Innovation in Design</b>	<b>p.30</b>
5a. Designing innovative affordable housing	
5b. Researching and selecting healthy materials beginning with the apartment's interior	
5c. Post disposal	
<b>6. Conclusion</b>	<b>p.43</b>
6a. Identifying Strategies for Building Healthier, Affordable Housing	
<b>7. References</b>	<b>p.44</b>

# 1. INTRODUCTION

## 1a. Case Study Methodology

This report is the first in a series of five which document case studies undertaken by the Parsons Healthy Materials Lab to record systems of processes and decision-making that go into the building of new affordable housing developments across the United States.

The team investigates particular developments that incorporate healthier building products and developers that have a stated mission to advocate for and transform standard building practices within the Affordable Housing industry.

The case studies approach is based on a systems thinking methodology that interrogates the quantitative and qualitative factors that determine key decision-making factors in the Affordable Housing sector. The reports examine and identify the important decision making relationships that exist within these systems to specifically identify how, why and when building product decisions are made. The case studies will create a current baseline of existing best practices for healthier buildings within the affordable housing industry. Understanding the various construction visions adopted by Affordable Housing Developers allows us to catalogue the distinct lenses and the variety of approaches that are characteristic of this sector.

The case studies have an intentional regional distribution. By understanding the regional variation of affordable housing across the US, we are able to identify key regional drivers and obstacles in the process of healthier construction. In particular, we explore healthy building products selection, procurement and installation processes.

A systems approach highlights the challenges, drawbacks and compromises that take place when specifying and installing building products. This approach enables a critical analysis of the current processes of funding, design and construction in place within the affordable housing sector. Ultimately, such research has the potential to impact the overall housing sector through demonstrating both the health benefits for residents associated with using healthier products but also future new market potential for sales of better products.

Finally, case studies also enable a critique of the existing benchmarks and certifications that exist in the industry such as the Living Building Challenge, LEED, Enterprise Green Communities Criteria, Delos® Well

Build, and state policies that promote better building practices. Positioning these tools within the context of affordability permits an analysis of their accessibility, implementability and replicability.

Case study analysis brings together both quantitative and qualitative research to draw conclusions, allowing a nuanced and in depth analysis of particular situations. We adopted a range of research methods to capture the range of key factors including stakeholder interviews, videography, photography, analytical mapping and diagramming, media coverage, stakeholder analysis and a review of current census and other data sources.

The results of these studies reveal the innovative approaches that various developer teams utilize for achieving healthier, affordable housing. Additionally the results provide a list of existing healthy and affordable building products that can be broadly shared. This list will contribute to the making of a library of better building products to be showcased in a number of different contexts including the Donghia healthier Materials Library at Parsons School of Design, The New School. The case studies have also revealed a number of notable affordable building products worthy of analysis. Finally, other evaluation tools used by the various designers nationwide can be collected and shared to ease the specification process and to continue paving the road to innovation through collaborative practices.

This first case study was initiated by the Healthy Materials Lab in collaboration with Aeon, Hope Community and MSR Design in Minneapolis in June 2015. Each stakeholder provided critical information via in person interviews and follow-up phone conversations and emails. Without their cooperation and input this case study would not be possible. We are grateful to all of the Rose team for their time and support.

Cover page: Courtyard view of The Rose. p.4: montage of the Construction and opening day of the development  
Left: Living room of an apartment



Left: Interior corridor

Research<sup>1</sup> demonstrates that substantial human health risks can result from exposure to toxic chemicals present in both exterior and interior constructed environments. These health risks can include an increase in cases of asthma, cancer and health issues related to developmental and reproductive health. The health risks are particularly high for children, pregnant women and people living in poverty. The research in this case study focuses on the interior environment within affordable housing developments. Residents, and occupants generally in the United States, spend significant amounts of time inside and are therefore vulnerable to the health hazards posed by products used to construct the interior. Regulation controlling chemical use in common building products falls within the purview of the Toxic Substances Control Act, which has been largely ineffective in chemical oversight and regulation.<sup>2</sup> As a result of this limited oversight, many typical building products used in the interior may present possible pathways to unintended chemical exposure.<sup>3</sup> Toxic chemicals are introduced into building products for a number of different reasons including performance, maintenance and cost.<sup>4</sup> The challenge for all of us working in the affordable housing industry is to look for products that are both healthier and affordable that can be substituted for current building products. The intention of this case study is to understand how it is possible to start removing toxics from the homes of Affordable Housing residents.

<sup>1</sup> “Epidemics of pediatric disease and the studies of them established that early -life exposures to toxic chemicals and other hazards in the environment can have devastating effects on children and that these effects can be lifelong” (Landrigan PJ, 3, 2015)

<sup>2</sup> The Toxic Substances Control Act of 1976 (TSCA) is the only U.S. law regulating toxic chemicals. 84,000 chemicals are in the current EPA inventory, 62,000 of existing chemicals were “grandfathered” in 1976, under the assumption that they were safe unless proven otherwise. Only 250 chemical have been required to be tested, and only 5 chemicals have been partially restricted. [https://en.wikipedia.org/wiki/Toxic\\_Substances\\_Control\\_Act\\_of\\_1976](https://en.wikipedia.org/wiki/Toxic_Substances_Control_Act_of_1976)

<sup>3</sup> “75 substances linked to asthma are found in paints and adhesives — two products found in most typical indoor environments” (Perkins and Will, 2011).

<sup>4</sup> As noted by researchers in the environmental health field in the “Pilot Study of Urinary Biomarkers of Phytoestrogens, Phthalates, and Phenols in Girls” “Effects of hormonally active environmental agents on early child development have been of concern, as knowledge has become available about their biological activity and about effects in humans that might arise from exposure to phthalate are of concern” (Wolff MS. et al. 2014).

In the construction industry, residents of Affordable Housing are disproportionately impacted by the use of construction products that contain toxic chemicals. Other construction sectors are often able to afford healthier building products, but with restricted budgets in Affordable Housing, inexpensive, less healthy products are often used to build new homes. Unfortunately, chemical exposure also disproportionately affects the poor and working class populations who live near to, or work in factories. These communities may also be subjected to additional environmental pollutants disposed from or emitted within nearby factories. The negative impact of construction products that contain toxics is compounded, as the impact of chemical exposure may be present throughout the entire product supply chain. Workers in manufacturing plants, contractors installing products on site, and eventually residents who occupy apartments all have contact with building products and are exposed to hazardous toxics contained within.

Affordable housing development sits within a complex system of intersecting forces including (a) affordable housing policies, funding and planning process (b) building industry processes ranging from manufacturing, design, specification, procurement and construction, and (c) health including access to systems of education, employment, transport and health services as well as post occupancy practices. Though the research into these factors is not per se an outcome of the study they are important factors that impact product selection within the larger context. The case studies provide examples of current best building practices including better, healthier product selection within the Affordable Housing industry. The intention of the reports is to share a range of resources that will support the transformation of construction practices in the affordable housing sector to create healthier housing for all people.

Case study research will be disseminated through various means including a written report, short films and animations that target a wide public and aims to communicate a difficult and complex topic in a widely accessible manner. These reports and videos will be available on an ongoing basis.

This study is supported by a grant from The JPB Foundation and is part of the larger Healthy Affordable Materials Project.



Left: Interior courtyard at The Rose

## WHY THE ROSE ?

### 1b. Why The Rose?

The Rose is a mixed-income housing project in Minneapolis developed by Aeon and Hope Community. Investigating this project offers an introduction to understanding the processes and challenges of designing and building affordable, sustainable housing. It is particularly interesting to explore such a development and connect with key stakeholders of the project as all parties have demonstrated an intention to prove that sustainable, net-zero-ready, healthier housing development can be built on a stringent budget. Such a common motivation between stakeholders in the housing development industry is timely and offers a momentum to work together towards tools, mechanisms, and propositions to make the process more transparent, practical, affordable, and replicable, and thus, more easily accessible to other housing developers. The transparency and commitment to share information on promising practices from the developers, architects, contractor and consultants demonstrates a real desire to work together for positive change, moving beyond competition towards collaboration in the affordable housing sector. Our hope is that this report is a resource for the organizations involved in the building of The Rose and an aid to widely disseminate and replicate better building practices.

Dissecting the challenges of specific moments, key decisions, and negotiations brings to light the road to innovation for the creation of more sustainable, healthier buildings. The network of complex relations, partnerships and decision-making processes existing between National and State policy, Developer, Architect, Contractor, Manufacturer and local communities is an important characteristic of the project. This development would not have been as successful without the dedication and perseverance of members of the design team and the leadership of Aeon and Hope Community.

Examining The Rose as a pilot project also enables an understanding of the current benchmarks for sustainable and affordable developments. In understanding the guidelines of the two certifications the development subscribed to, the Living Building Challenge (LBC) and Enterprise Green Communities Certification (EGCC), allows for a critical analysis of the implementability and replicability of their requirements in relation to human health and affordability. LBC is a philosophy and tool for the construction industry that is defining the current highest measures of sustainability.

The LBC criteria is based on seven different petals: Site, Water, Energy, Materials, Beauty, Equity and Health. Each petal requires its own individual certification, and each petal certification must be achieved in the development in order to gain full certification. The EGCC is encouraged for Multifamily and Single Family new construction and rehabilitation projects requesting Minnesota Housing financing. EGCC has created a standard that is based on health, energy efficiency, and environmental responsibility, and informs the design, construction, and operation of a development. The EGCC method is based on a point system and promotes an integrated design process throughout the entire lifecycle of the development.

This case study uses a particular lens on the specification and procurement process of the interior building products of the development in order to uncover the relationship between affordability and the challenges of purchasing less toxic construction products. This study is part of the Healthy Affordable Materials Project that seeks to improve the lives and health of residents living in affordable housing by reducing exposure to toxic substances used in building products. The long term vision for the Healthy Affordable Materials Project is first, to understand best practices in the building industry; second, to create tools that aid the decision-making process around product specification for all stakeholders designing, constructing and occupying homes; and third, to bring transparency to the building supply chain through the introductions of mechanisms for declaring product ingredients. Sharing the resources and information of the innovation and success of The Rose, is a first step that supports the Healthy Materials Lab's initiative.

This research was carried out from May to November 2015, and includes excerpts from interviews carried out with numerous stakeholders who participated in this development. MSR Design and their documentation of the process and Aeon's expertise in affordable housing development were key resources to this research. The Rose opened in October 2015 and a post-occupancy survey and analysis has been set up and will be ongoing in the coming years.

## 2. GENERAL OVERVIEW THE ROSE

<p>Street Address</p> <p><b>1928</b> Portland ave S, Minneapolis, MN</p>	<p>Ward</p> <p><b>6</b> Voting precinct(6-6)</p>	<p>Zoning</p> <p><b>R6</b> Multi-family District and NP North Phillips Overlay District</p>	<p>Typology</p> <p><b>Multifamily Rental housing</b></p>	
<p>Number of units</p> <p><b>90</b></p>	<p>Number of Residents</p> <p><b>350+</b></p>	<p>Apartment type:</p> <p><b>47</b> Affordable Units                  Studio \$635 - \$650                  2 bedroom \$825 - \$925                  3 bedroom \$1050 - \$1150</p> <p><b>43</b> Market Rate                  1 bedroom \$1100 - \$1200                  2 bedroom \$1600 - \$1700</p>		
<p>Site Area</p> <p>100,226 sq ft</p> <p>FAR</p> <p><b>2</b></p>	<p>Streets + surface parking</p> <p>11,000 sq ft</p> <p><b>(11%)</b></p>			
<p>Landscape + open spaces</p> <p><b>52,656 sq ft</b></p>	<p>Building Footprint</p> <p><b>36,570 sq ft</b> <b>(36%)</b></p>			
<p>Gross Building Area</p> <p><b>172,587 sq ft</b></p> <p><b>(53%)</b></p>		<p>Residential Building Area</p> <p>139,815 sq ft</p>	<p>All Parking Area</p> <p>32,772 sq ft</p>	

## LESSONS LEARNED

<p><b>Strong Partnerships and supportive network</b></p>	<ul style="list-style-type: none"> <li>The Rose's success is in large part due to the strong and supportive partnerships between Hope Community, a local nonprofit organization, co-developer Aeon, and the architects, MSR Design. These relationships were built over time which allowed for trust and a clear alignment in aspirations.</li> <li>Partnering with a local organization such as Hope Community enabled the process of development to be inclusive of the population currently living in the neighborhood, and ensured local needs were targeted.</li> <li>An informal 'Integrated Project Delivery' process (IDP is an AIA contract) was implemented leading to the early integration of the General Contractor in the design team. This was critical for examining life cycle costs and establishing energy budgets at design inception. It also played an important role in bidding cycles with better product alternatives that took place during construction as grants and funding permitted.</li> </ul>
<p><b>Creative funding to support healthy products research and installation</b></p>	<ul style="list-style-type: none"> <li>In order to accomplish the health aspects driving the design of The Rose, a funding approach had to be established. Additional funds were needed to support consultants and researchers required for adhering to the Materials Petal of the Living Building Challenge certification. Further, purchasing and installing healthier materials required strategic maneuvering in the allocation of funds. Reaching out to philanthropic foundations, as well as utilizing a section of the contingency budget, proved successful for accomplishing these aspirations.</li> <li>The Rose had a total of 29 capital sources, which require a persistent and savvy approach to enable budget flexibility with regards to unplanned circumstances and mortgage terms.</li> </ul>
<p><b>Certifications as pathway to healthier homes</b></p>	<ul style="list-style-type: none"> <li>The team pursued the Living Building Challenge (LBC) aspirationally and the Green Communities Criteria. Both these, offered guidelines towards sustainable endeavors. The LBC is very difficult to achieve for affordable developments, especially achieving the Material petal; therefore, the LBC was used as a pathway to start establishing healthier building practices.</li> <li>This development was one of the first in the affordable housing sector to attempt the LBC. As a pilot, it paved the way for others to establish similar practices as a baseline approach, regardless of achieving full certification.</li> <li>Prioritizing elements which have most impact on residents, such as healthier interior products and healthy interior air quality, helped narrow the scope of research and concentrate efforts.</li> </ul>
<p><b>Innovation emerges out of Incentives + Strong aspirations</b></p>	<ul style="list-style-type: none"> <li>In order to ensure better quality of life for the residents, a decision was made to create larger apartments and provide a higher percentage of open space on the site - to build a sense of community and provide spaces for children to play.</li> <li>Specifying healthier products throughout the interior spaces was a leading aspiration. A process for choosing healthier products was established by MSR Design, which filtered products through various existing benchmarks, including the US EPA, Pharos, and various versions of the LBC. The decision to specify a product was dependent on cost, alternative options, durability and performance, aesthetics, carbon footprint, calculations of toxic ingredients, and the VOC content.</li> </ul>
<p><b>Regional factors impact design process and resolution</b></p>	<ul style="list-style-type: none"> <li>Climate: The 130 degree temperature swing from -25 to 105 degrees between summer and winter months call for a specific construction type and materials. Exterior wall construction is particularly critical. Further the envelope system has to be designed for moisture management for rapid changes in relative humidity levels as the region experiences dry cold winters followed by hot and humid summers.</li> </ul>

# MAPPING THE PROCESS

**MIXED USE AFFORDABLE HOUSING DEVELOPMENT**

- FUNDING SOURCES**
- LIHTC
  - PUBLIC DEFERRED LOANS
  - FIRST MORTGAGE
  - PRIVATE/PHILANTHROPIC

- PROJECT TEAM**
- AEON**
- GINA CIGANIK  
FORMER VP OF HOUSING DEVELOPMENT
  - JAMES LEHNHOFF  
VP OF HOUSING DEVELOPMENT
- MSR ARCHITECTS**
- PAUL N.C. MELLBLOM
  - RHYS MACPHERSON
  - SIMONA FISCHER
- HOPE COMMUNITY**
- WILL DELANEY
  - BETSY SOHN
- CONSULTANTS**
- BILLY WEBER  
UNIVERSITY OF MINNESOTA CENTER FOR SUSTAINABLE BUILDING RESEARCH.
  - ENERGY, 3M, ECP, WEIDT GROUP, PLACE, LBC

**CERTIFICATION GOALS**

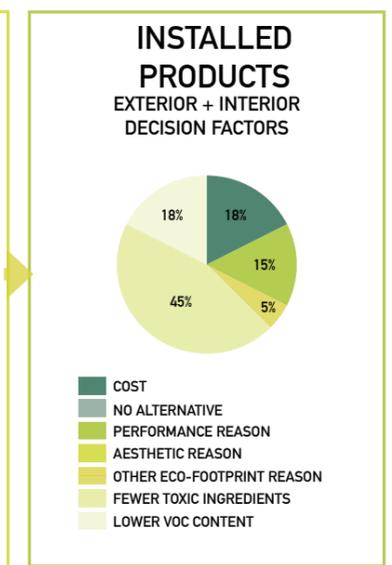
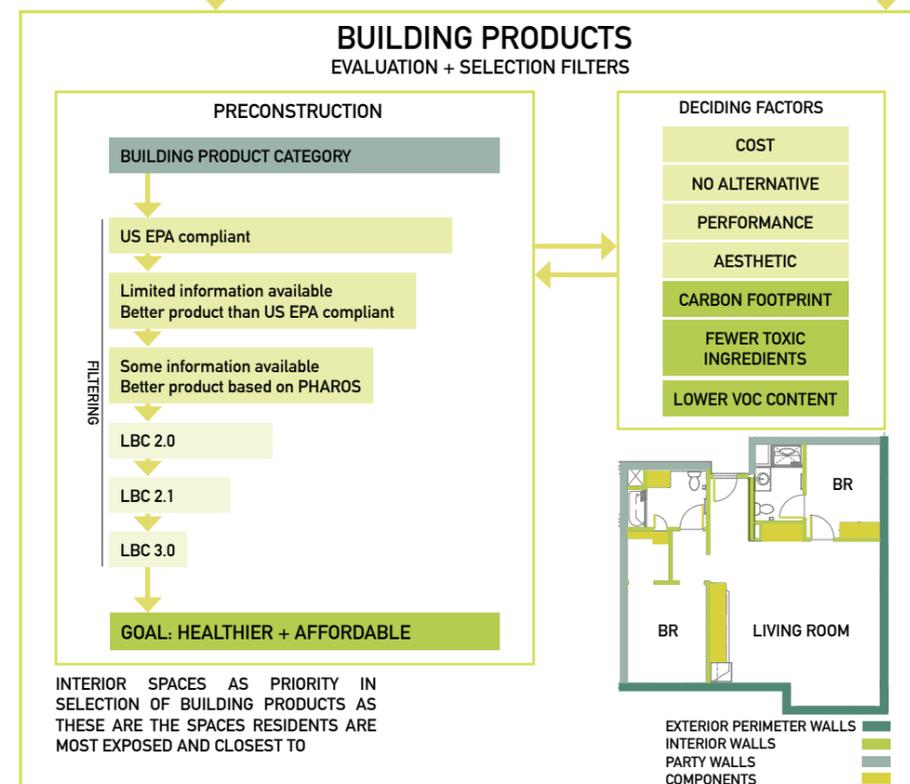
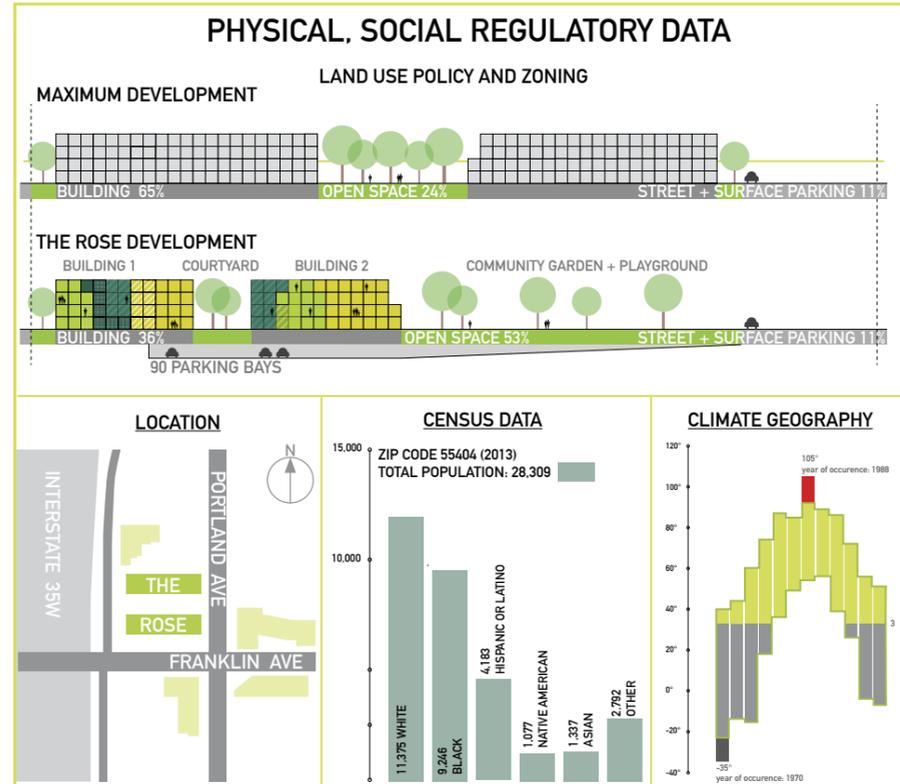
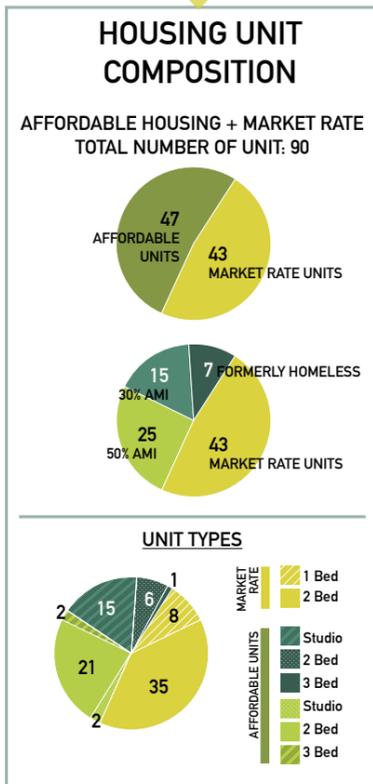
ENTERPRISE GREEN COMMUNITIES CRITERIA

THE LIVING BUILDING CHALLENGE™

- DEVELOPMENT PARAMETERS**
- ENERGY REDUCTION
  - PRIORITIZE LIGHT AND AIR
  - GREEN SPACE ALLOCATION TO FOSTER A SENSE OF COMMUNITY
  - HEALTHY PRODUCT SPECIFICATION CORE TO DESIGN PROCESS



- HEALTH**
- USE LESS TOXIC BUILDING PRODUCTS
  - MAINTAIN HEALTHY INDOOR AIR QUALITY
  - COMMUNITY ENGAGEMENT



# 3. FORMING PARTNERSHIPS & BUILDING TRUST

## 3a. The Team

The Rose, a mixed income project, is the fourth and final phase of the redevelopment of the South Quarter, centered on the intersection of Franklin and Portland Avenues. This initiative was co-led by two local organizations, Hope Community and Aeon. Hope Community has worked with local community residents since 1977 to help stabilize, provide improvements and create opportunities for the Phillips neighborhood, one of the most ethnically and economically diverse areas of Minneapolis. The neighborhood is located south of downtown Minneapolis in the Venture Village neighborhood and has almost 20,000 residents with a long history of immigrant and minority populations, including Native American and African American communities. The organization initially started as a shelter and hospitality house for the neighborhood, and their success within the community has led to their expansion as leaders in the transformation of the area.

In order to create positive change, Hope Community works with existing populations of the area and aims to represent the range of needs of various stakeholders to establish their right to participate in the making of their environment.

“What we are trying to do here is create a community that works for people who live here, low to moderate income people who often get pushed out of neighborhoods that get revitalized and for people of color who have, for decades and decades, called this place home” (Will Delaney, Hope Community, 2015)

Hope Community’s development and renovation of both affordable housing and related public spaces in the neighborhood is evidence of the organization’s community focused mission. Their goals are to build for the future by providing housing that is well designed, constructed with quality materials, and thoughtfully sited to rebuild neighborhoods.

“We focus on building environments that will support and enhance healthy community interaction and quality of life” (Hope Community, 2015)

Hope Community’s outreach and powerful connection to the neighborhood has also enabled them to understand the priorities of the local populations, and has built a culture of trust among local residents and more recent arrivals to the neighborhood.

“This is where our community is. This is where we are. This is our home.” (Betsy Sohn, Hope Community, 2015)

“What we are trying to do here is create a community that works for people who live here, low to moderate income people who often get pushed out of neighborhoods that get revitalized and for people of color who have, for decades and decades, called this place home”

Will Delaney, Hope Community, 2015

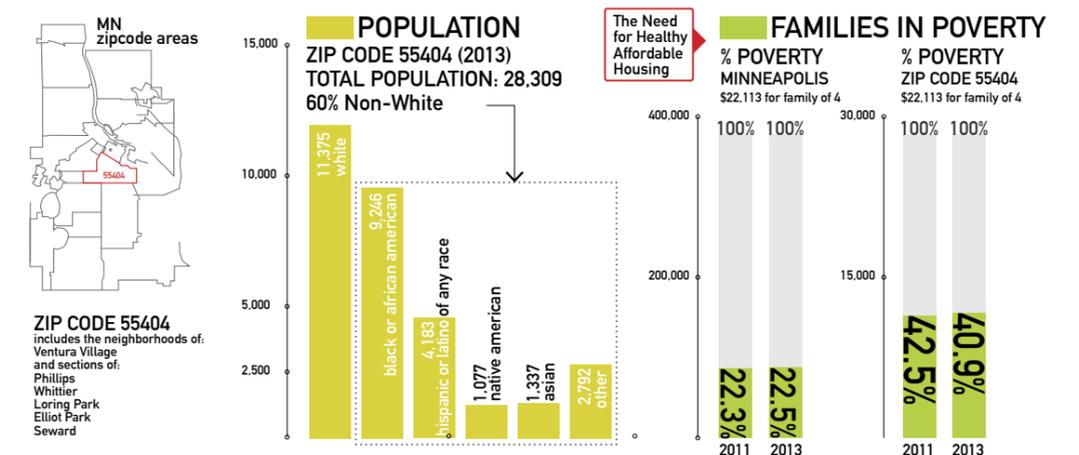
Right: Demographics of population living in the neighborhood of the Rose

Hope Community’s close community ties and interest in building for the future align well with Aeon’s core mission which aims to build affordable housing and public spaces that include a range of uses including community centers, playgrounds and gardens. Aeon is also deeply embedded in the community, providing extensive community engagement that involves hundreds of youth, adults and families each year in learning, leadership and community opportunities. Hope Community and Aeon partnered as co-developers in the early 2000s to work together on the four parcels of land in the Phillips neighborhood. The first three corners were redeveloped between 2003 and 2008 and included affordable apartments, ground-floor commercial space and the headquarters for Hope Community. The final phase, the South Quarter project, includes both The Rose and the renovation of Pine Cliff, a 30-unit apartment building on the northwest corner of the block.

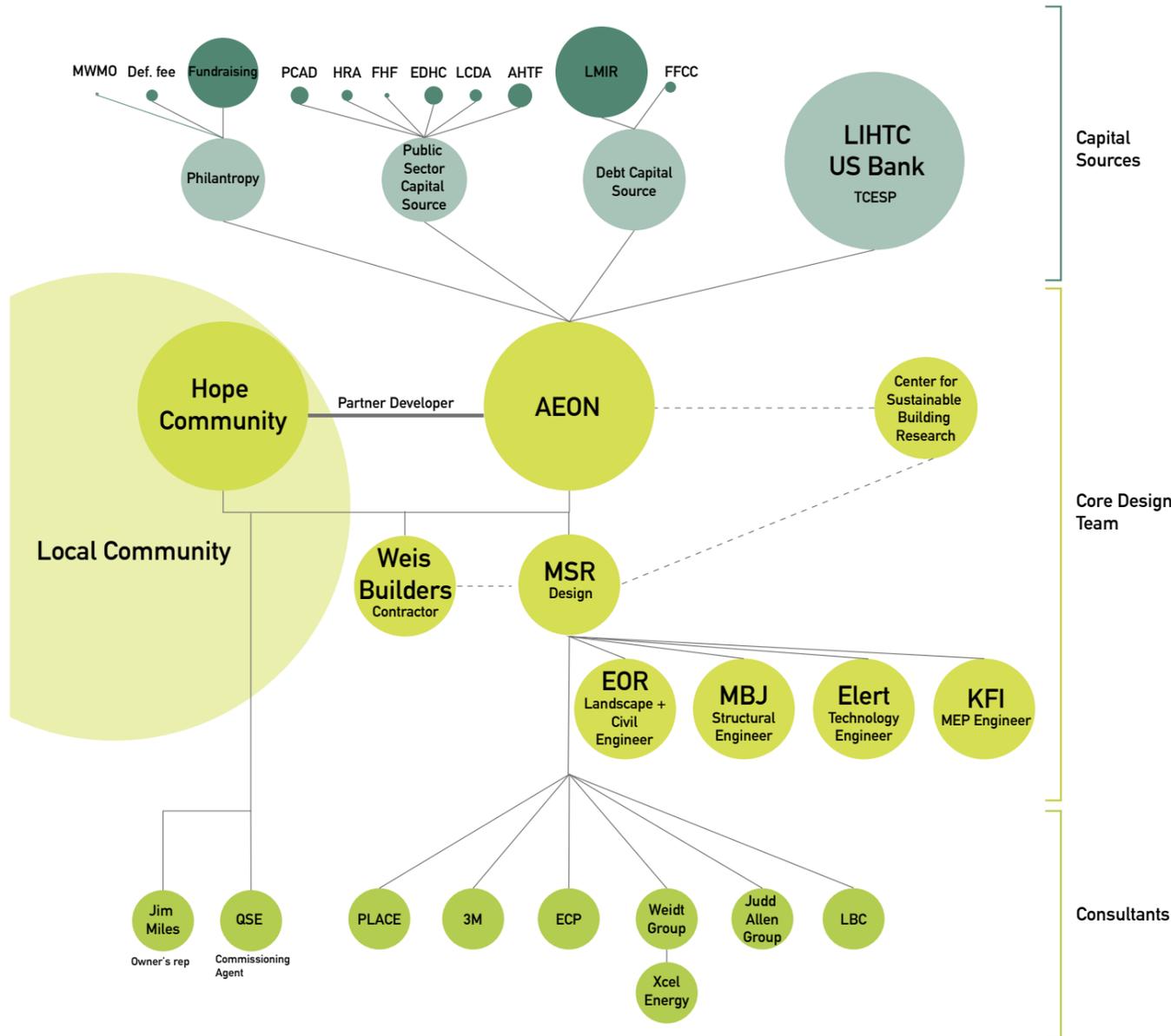
In 2006, Aeon adopted a comprehensive campaign to raise sustainability standards in construction and they embarked on a disciplined process to think holistically about better performing and healthier properties. They completed three pilot projects each adding to their growing expertise in low cost, socially and environmentally sustainable housing. As Gina Ciganik, Vice President of Housing Development at Aeon, stated, “everybody, no matter what their income level is, has a chance to live in a place that is healthy” (Gina Ciganik, Aeon, 2015). This simple objective has been the key driver for Aeon in leading the path towards continuous innovation in the affordable housing construction industry.

To date, The Rose is the most sustainable, healthy, and comprehensive development in Aeon’s portfolio. The partnership between Aeon and Hope Community has been an essential factor in the success of the redevelopment. For the design centered on sustainable and health targets, Aeon worked with MSR Design who have a reputation for designing outstanding affordable, efficient, and sustainable buildings. The team at MSR Design became indispensable in working towards the LBC certification and developing best practices in the design process and construction of The Rose, while also actively advocating for healthier practices in the construction industry.

An informal ‘Integrated Project Delivery’ process was implemented leading to the early integration of the general contractor (Weiss Builders) in the design team. This was critical for aligning incentives at the earliest stages of design and examining life cycle costs, establishing energy budgets, return on investment strategies and providing real time budget information for financing cycles. This strong and supportive partnership eased the design process and facilitated construction oversight. Further, Weiss Builders were critical to the bidding process for alternative, healthier products to install, when grant funding was acquired mid-construction. Further, consultants and the in-house property managers at Aeon participated in the early design discussions. Together, this development team initiated a strong dynamic process to work through the challenges that are inherent to such an innovative development.



# KEY STAKEHOLDERS



- AHTF - Minneapolis Affordable Housing Trust Fund
- ECP - Enterprise Community Partners
- EDHC - Minnesota Housing Economic Development & Housing Challenge funds
- FFCC - Minnesota Housing flexible financing for capital costs loan
- HRA - Hennepin County Housing and Redevelopment Authority
- LBC - Living Building Challenge
- LCDA - Met Council Livable Communities Demonstration Account
- LIHTC - Low Income Housing Tax Credit
- LMIR - Minnesota Housing first mortgage
- MSR - Meyer, Scherer & Rockcastle
- PLACE - Sustainability Consultants
- UMCSBR - University of Minnesota Center for Sustainable Building Research

## 3b. The context of The Rose

The Rose is located on a site at the intersection of Franklin and Portland Avenue, just south of downtown Minneapolis. The site, acquired by Aeon, was comprised of 13 parcels, including some that were contaminated by previous historic uses and necessitated remediation. The Franklin-Portland Gateway was proposed to be developed as one cohesive project, even though the individual phases have been funded and constructed at different times. The corner site is a challenging one, primarily because of its location between two highways that are noisy and a source of local air pollution (see map 01). The team developed both a comprehensive sound barrier strategy to mitigate the impact of traffic noise from the highway, and an air filtration system that would help filter the air pollution from the highways.

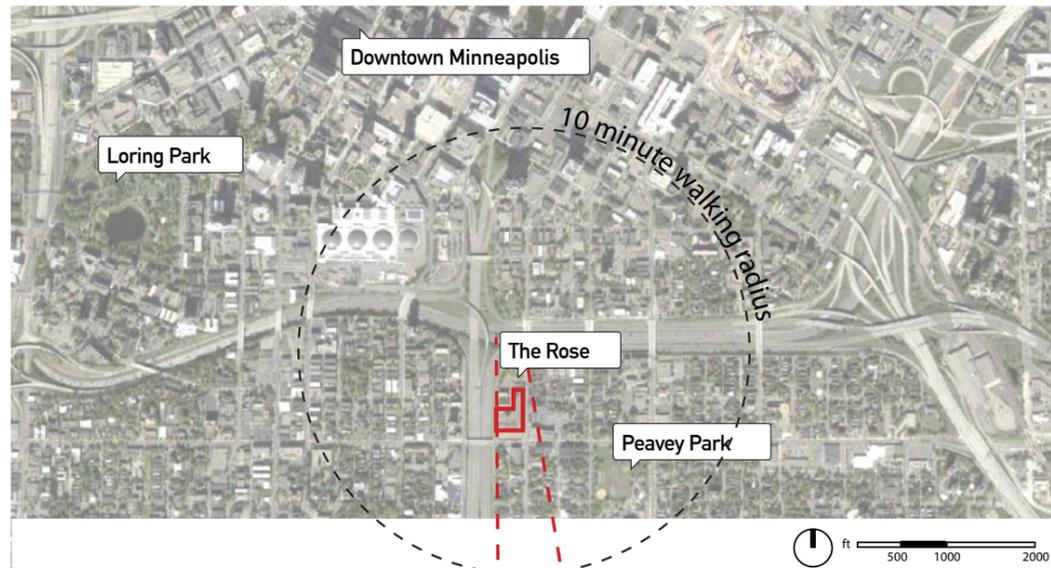
The other three corners of the intersection were redeveloped over the past decade by Aeon, Hope Community, and other partners. Phase one of the multi-phased project, Children's Village Center, was approved by the City Planning Commission in April 2002. This development includes Hope Community offices, a community center, and property management offices on the first floor. This space was conceived as a focal point of the area and provides facilities for year-round community based programming. The center also includes 30 rental units of affordable

housing on the three upper floors. Phase Two of the redevelopment, The Jourdain, was approved in May 2003. The Jourdain is a mixed-used block comprising of 41 units varying from small studios to three-bedroom units, two-thirds of which are affordable. The street level includes commercial spaces. Phase Three, The Wellstone, was approved for development in July 2007 and incorporates 49 units (75% affordable) and the Twin Cities Child Care Center that occupies 7,000 square feet at street level of commercial and community space, bringing a critical resource to the neighborhood. Further, this development was certified by Enterprise Green Communities and demonstrates the economically achievable possibilities of building sustainably. All three of the developments have been completed and are now occupied. The Rose was the fourth and final phase of this larger redevelopment scheme in the neighborhood. In total, the four buildings at the intersection add 250 dwelling units and approximately 23,100 square feet of office and commercial space to the neighborhood. We will see later that the location of the site and the regional climate had an important influence on the design and choice of materials for the development.



Left: Map of the key stakeholders involved in the development  
 Right: Map locating the Rose in relation to central Minneapolis

# CONTEXT OF THE ROSE



Left: Maps locating the Rose  
Right: diagram outlining who will reside at the Rose

## 3.c Land use policy - rezoning process

Rezoning for the Phillips neighborhood was approved in 2013, and the area became an R6, Multiple-family District with NP North Phillips Overlay District. This adds specific district regulations, such as increased height and density, and other policies detailed below. The proposed program for The Rose was to include 90 additional dwelling units in two new buildings. In contrast to the other phases, this was to be a purely residential development.

According to *The Minneapolis Plan for Sustainable Growth*, The Rose could have built up to a density ratio of 50 to 120 dwelling units per acre, equating to a high density range. Instead, a density of approximately 52 dwelling units per acre or 120 units in 2.3 acres (see diagram on next page) was designed. Aeon wanted to construct more units but the available funding could not support more apartments at the level of design and specification desired. The design decision maximized open space while limiting the height of the building to four stories in order to respect the current scale of the neighborhood. This was also a strategic decision to limit cost as a taller building would require a different structural system than wood framing (currently the most affordable) as well as additional safety systems mandated by the building code. Further, a number of new zoning policies were applied to the site of the development. These had a considerable influence on the design approach and process. A few of the most impactful policies include:

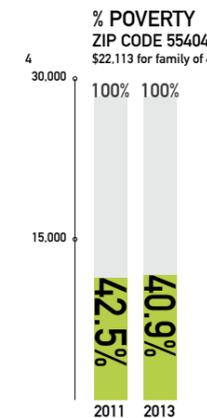
(1) Land Use Policy 1.1 states: “Ensure that land use regulations continue to promote development that is compatible with nearby properties, neighborhood character, and natural features; minimizes pedestrian and vehicular conflict; promotes street life and activity; reinforces public spaces; and visually enhances development.”

Although R6 zoning allows for six story high buildings, The Rose was developed as two four story buildings to remain consistent with the surrounding urban context and nearby properties in order to reinforce the fabric of the existing neighborhood. The Rose also features a courtyard, a productive garden, and several outdoor amenities to promote accessible community gathering.

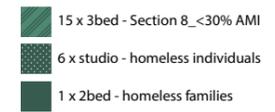
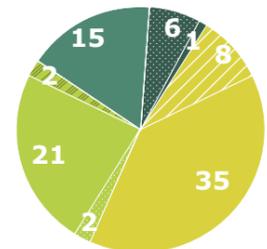
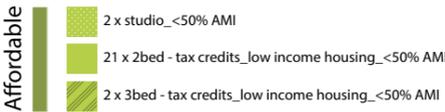
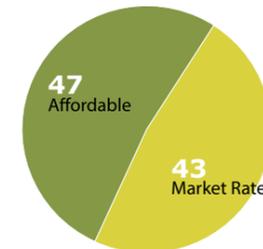
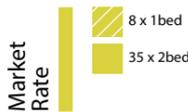
(2) Land Use Policy 1.2 states: “Promote quality design in new development, as well as building orientation, scale, massing, buffering, and setbacks that are appropriate with the context of the surrounding area.”

The Rose has a wide range of sustainable features and an intelligent approach to design in terms of aesthetics, green building and affordability. The buildings are aligned in an east-west layout, and their arrangement maximizes solar gain while the rain gardens of the setbacks collect rain and runoff water which is recycled as irrigation water for the productive garden.

## COMPOSITION OF THE ROSE TOTAL NUMBER OF UNITS AT THE ROSE: 90



**The Need for Healthy Affordable Housing**



# PROJECT SECTION

(3) Land Use Policy 1.8 states: "Promote a range of housing types and residential densities, with highest density development concentrated in and along appropriate land use features."

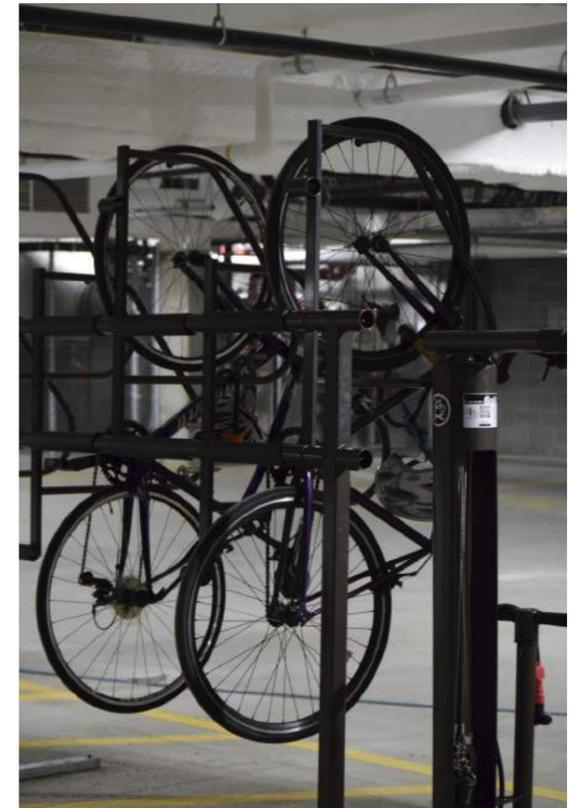
The Rose is designed using a range of strong architectural processes including contemporary approaches to building form and public space making with particular attention to the existing streetscape, including the re-creation of the street wall at the intersection of Franklin and Portland Avenue.

(4) Housing Policy 3.1 "Support the development of new medium and high density housing in appropriate locations throughout the city."

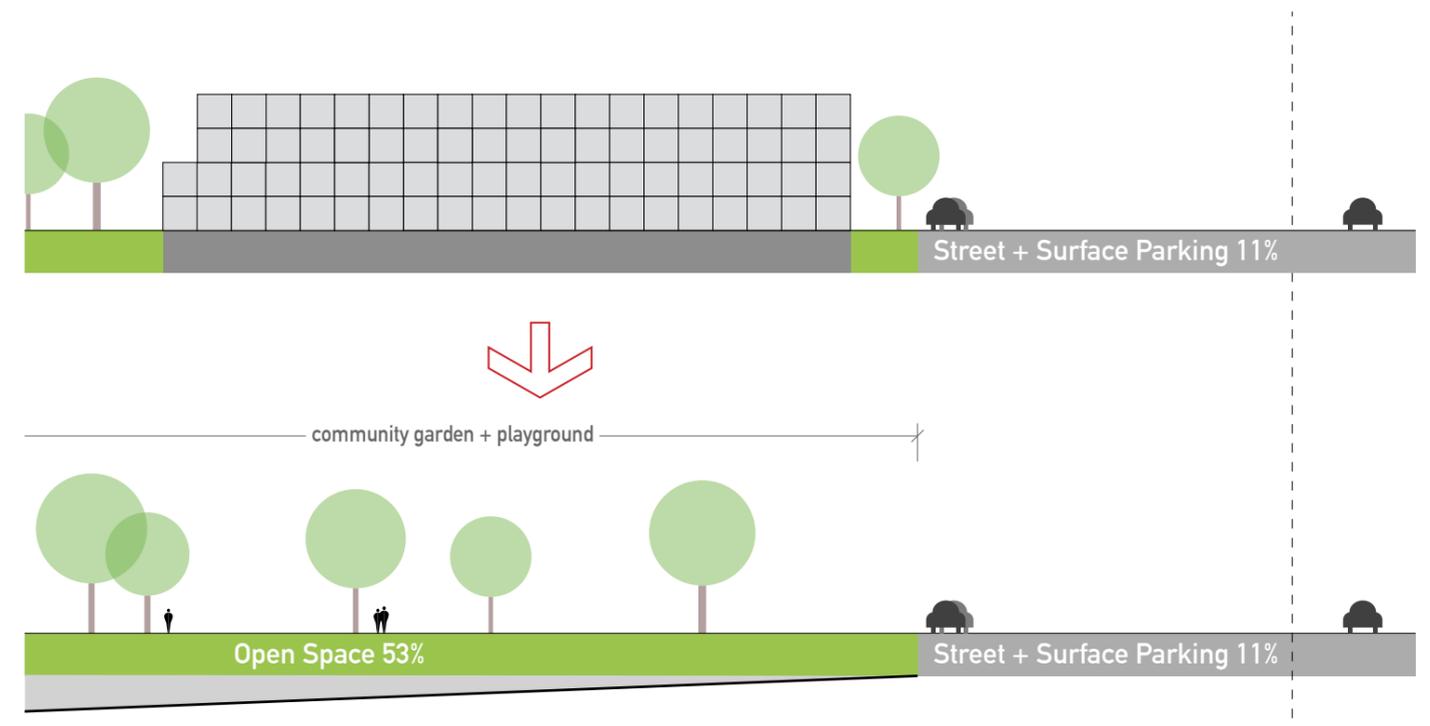
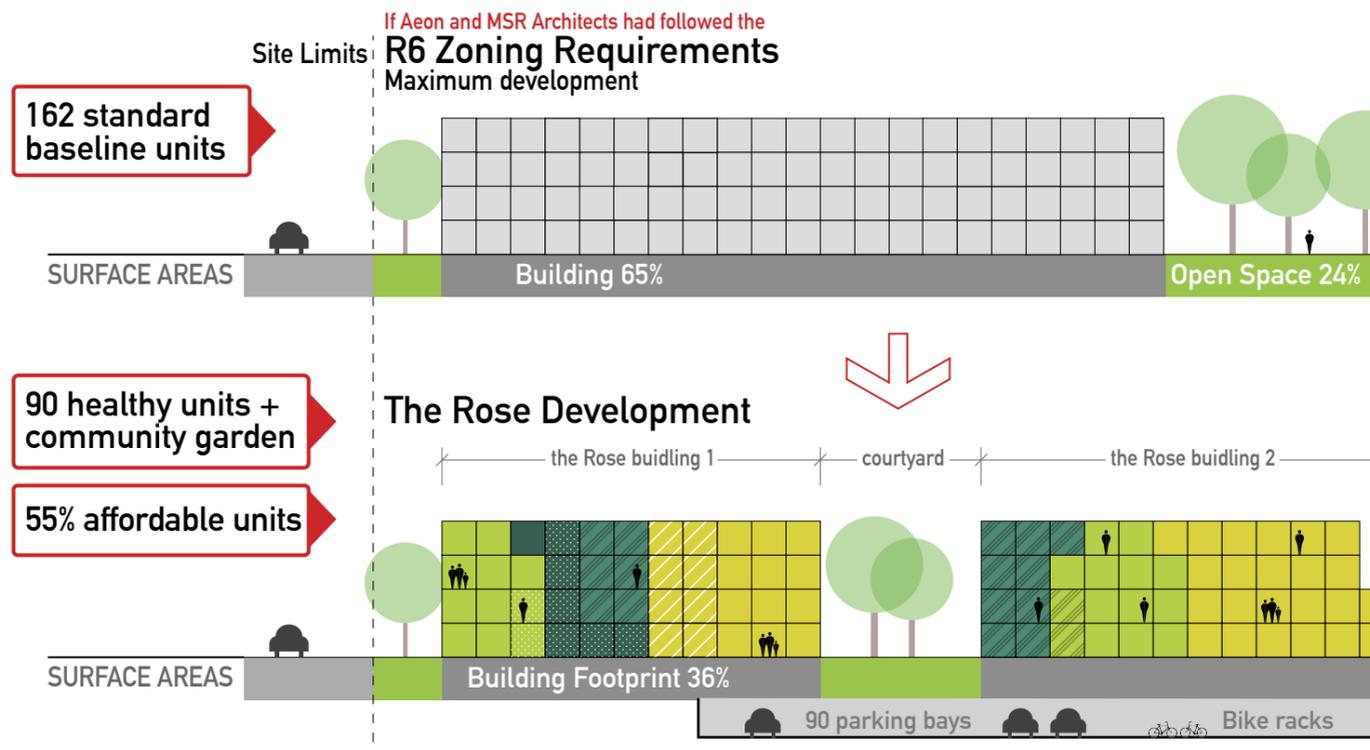
The Rose provides new housing for a range of incomes in a neighborhood close to downtown Minneapolis.

5) Housing Policy 3.2 "Encourage and support housing development along commercial and community corridors, and in and near growth centers, activity centers, retail centers, transit station areas, and neighborhood commercial nodes."

The Rose is situated at the intersection of an important historic, cultural, and commercial neighborhood. It is well connected to nearby downtown business district of Minneapolis, and is close to key destinations such as the University of Minnesota.



Right: Bike racks installed in underground parking area. Below: diagram outlining building footprint and massing



### 3d. Finding appropriate funding for innovation in the affordable housing sector

The next step of The Rose development was to acquire the financing that would support Aeon and Hope Community in their co-development of a highly sustainable proposal that promoted the health and quality of life for the residents. Every real estate deal for affordable housing is unique, and can often be complicated. It took approximately five years to secure the financing before construction could begin on The Rose.

Aeon uses the Low Income Housing Tax Credit (LIHTC) program to raise capital for construction. LIHTC is a federal plan for affordable housing development that incentivizes the private sector to invest in housing for low-income populations. Although it is a federal program in which tax credits are most often applied for through the state, developers in Minneapolis apply for the tax credits through the city, which is the sub-allocator for the credits.

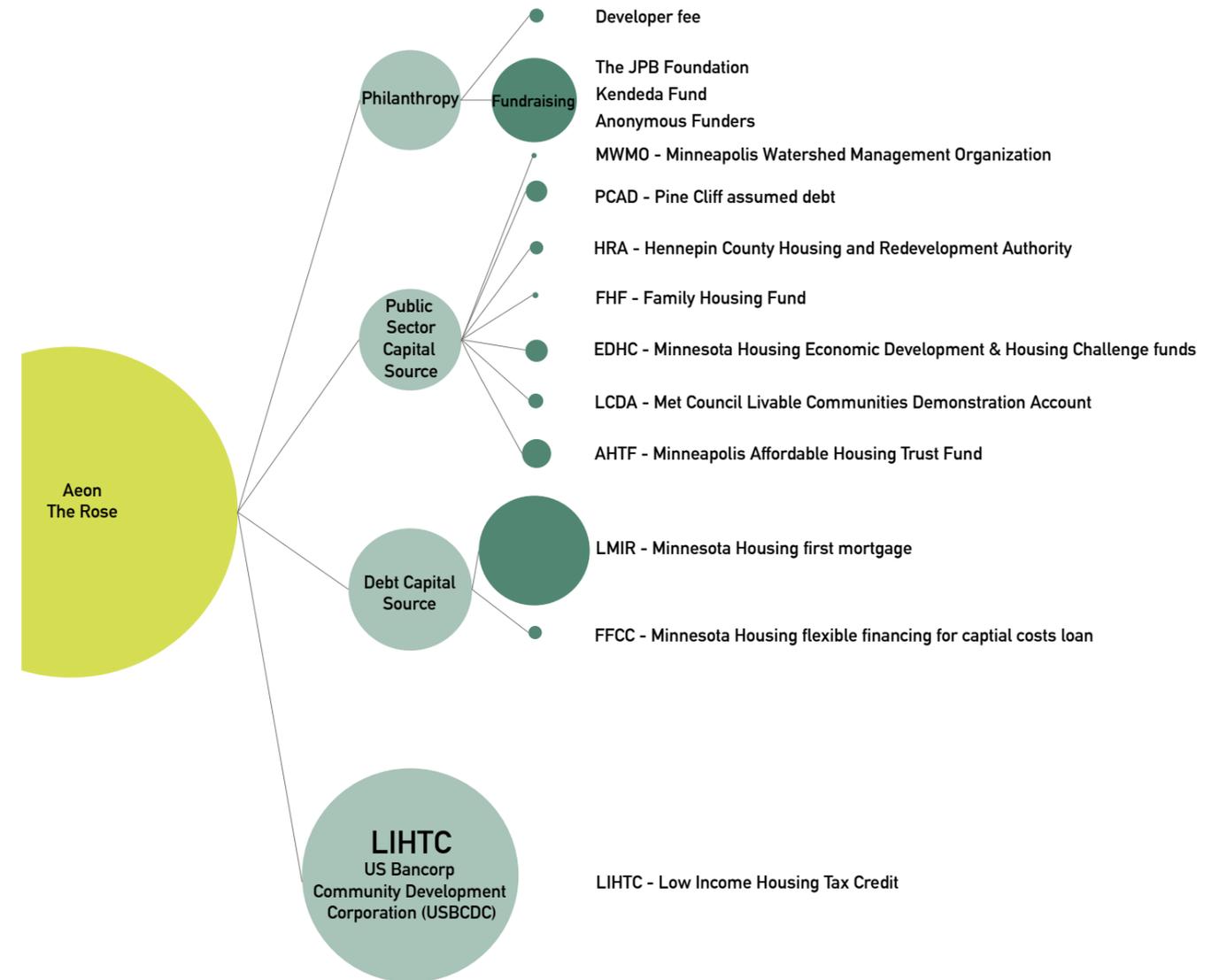
For The Rose, Aeon applied for a 9% LIHTC, which raises the most equity from the federal program but is also a highly competitive process. Developers are required to first apply for the Qualified Allocation Plan (QAP), a list of state established requirements and criteria that address specific local needs for affordable housing. Aeon was awarded 9% LIHTC in 2012, putting the project on a direct course to closing. Aeon had two years to complete the project and put the building into service.

Aeon partnered with The US Bancorp Community Development Corporation (USBCDC), who purchased the LIHTC, providing equity for The Rose's construction. Aeon has worked on previous projects with USBCDC, who have a history of being proponents of green initiatives, and this ongoing partnership makes for a more efficient process. It is standard practice that once investors for the tax credits are established, a 15 year partnership is formed between the developer and the investors. In the case of the Rose, this partnership was called The Franklin Portland Gateway Phase IV Limited Partnership, this was formed and set as the owner of The Rose.

As mentioned in prior sections of this report, unforeseen circumstances can complicate the financing plan of affordable housing developments. Changing

mortgage terms and interest rates present challenges frequently faced by developers. These changes potentially create gaps in financing that must be filled by other funds. Aeon was able to fill these gaps in financing through a specific capital campaign to help raise funds for The Rose and a few other developments. This campaign did not detract from other Aeon services. Lastly, mission driven philanthropic grants from The JPB Foundation, Kendeda Fund and other anonymous funders helped Aeon achieve their goals in healthy material selection and sustainable building practices.

Aeon is able to creatively finance the purchase of healthier materials by leveraging the 5% contingency which is built into their construction budget. Contingency is built into construction budgets to cover any unforeseeable construction problems, such as unplanned construction delays due to weather, a real concern in climates like Minneapolis. Aeon has extensive experience developing in Minneapolis and they are able to plan for most potential construction issues. Without any major construction complications, there is often funds left in the contingency budget to be reallocated to the purchase of healthier and more sustainable building products.



Right: Diagram outlining funding sources for the development

## 4. CERTIFICATIONS: INNOVATION, FEASIBILITY AND REPLICABILITY

The Rose development followed one of the most demanding certifications currently existing in the construction industry: The Living Building Challenge (LBC), while also using the Enterprise Green Communities Criteria (EGCC) – a less stringent certification adopted in most of the country as a requirement for publicly subsidized developments – to guide their design. Both involve a comprehensive design process, a high standard of sustainability, energy and water efficiency considerations, and the use of healthier materials in construction, amongst many other prerequisites less relevant to the purpose of this research. The two certifications do have some differences in their approach, focus and long-term impact. Here, we aim to highlight these differences in order to gauge their direct significance with regards to advancing the specification process of non-hazardous materials and their intersection with affordability.

EGCC is based on a point and checklist system that requires fulfilling all mandatory considerations and complying to the equivalent of an additional 35 optional points specifically for new constructions. These points were set out by the Minnesota Housing Finance Agency as a local requirement and may vary nationwide. This system makes for a relatively linear decision-making process. On the other hand, the more complicated LBC (version 2.0 and 2.1) process consists of 20 imperatives divided into seven petals based on seven themes: Site, Water, Energy, Health, Materials, Equity, and Beauty. These imperatives necessitate an integrated design process, involving various stakeholders from the very inception of the project. Integrated design is also a requirement of EGCC. Thus, in order to enact these successfully, a strong collaboration and dedication from the entire project team including the developers, designers, contractors, and consultants is mandatory, making these certifications tools for increased and more transparent teamwork.

It is important to note that the LBC is currently the only national certification to take such a strong stance on materials for both residents of new construction and the communities impacted by polluting manufacturing industries. The LBC's mission is driven by long term impact; “what if every active design and construction made the world a better place?” The LBC drastically moves beyond standard certifications and inspired the design team of The Rose to embark on this difficult path. As quoted by the developers, “We would often call the Living Building Challenge, LEED [Leadership

in Energy, and Environmental Design - another certification] on steroids” (Gina Ciganik, 2015).

Another considerable difference between these certifications lies within the material sections. The LBC not only requires the design team to incorporate certain design guidelines and a strict material specification process, but also demands that they become advocates for more transparency in the industry. Through the LBC's Red List material criteria, designers have to ensure that they do not specify any materials from the list, and also contact a minimum of 10 manufacturers to campaign for the declaration of the chemical content of their products. This works to simultaneously advance transparency in the construction industry while radically diminishing the use of the hazardous materials in new constructions.

This demand, while important and forward thinking, is time consuming and requires allocated resourcing to carry out material research effectively, adding a substantial cost to the design process. During the process of The Rose, MSR Design received less than 50% response rate from manufacturers about declaring their products. As Simona Fischer (MSR Design) stated, “I was just calling and calling and calling a lot of manufacturers and did not get any calls back, but when they did, they would just say that they are in the midst of deciding what to disclose” (Simona Fischer, 2015). Such hurdles are unavoidable when working with the LBC. Nonetheless the adoption of LBC criteria leads to measurable, lasting transformations in the long run that can bring about significant changes to the industry. Fischer added, “now a year or two later, there is so much more health and toxicity related disclosure happening” (Simona Fischer, 2015).

Additionally, healthier materials tend to cost more. Therefore, a fine balancing act between cost and health impact must be deliberated at length, further exhausting resources within the design team.

The energy sections of the LBC also take a different approach from other standards. The LBC v2.0 appears to have less rigid guidelines, with only one imperative goal to be met: “One hundred percent of the project's energy needs must be supplied by on-site renewable energy on a net annual basis” without the use of on-site combustion (LBC v.2.0 and v.2.1). This necessitates various creative and innovative strategies that can be designed by the team in relation to specific needs due to

climate, state policy, etc., making the requirement more adaptable and suited for distinct types of developments.

The LBC allows developer and designers to customize their approach for a particular project, thus enabling its application to distinct geographical and site situations. The EGCC is a simpler checklist approach to creating more sustainable buildings that has been widely adopted across the country. However, EGCC places less emphasis on material selection, the focus of this study.

While certifications, through their guidelines, undeniably support a path to innovation for the construction industry, one cannot avoid asking the questions: how can these requirements become standard practice? And, are they able to be achieved within all of the complexities of the affordable housing sector? The Rose's challenging process demonstrates that the feasibility of the LBC certification in that sector still has some way to go. The team had to continually negotiate which elements to prioritize in order to complete the development within budget and time constraints. Billy Weber from University of Minnesota questioned: “What is the right thing to do? What is the optimal solution without letting go of the LBC to actually get the project done?” (Billy Weber, 2015). These factors indicate that even when a team had the will and dedication to produce an LBC certified development, the demanding requirements made it an unattainable objective.

Through the advocacy work that the LBC promotes there is an opportunity for transformation in manufacturing practices. However, in order to impact a range of other practices in the affordable housing market, more support must be provided to developers and designers wanting to participate in this drive for change. Paul Mellblom of MSR Design adds, “there are some assumptions built in LBC that I think are valid to question, and they are not valid in terms of the value of LBC in itself, but rather questions like - is this the best thing for our circumstances?” (Paul Mellblom, 2015). The values of the LBC were wholly embraced by The Rose team throughout the design process; however, without some changes to the certification, the expansion of the applicability of the requirements into the affordable housing market is questionable. Despite this challenge, positive change can incrementally take place as transparency and collaboration are promoted by teams using the LBC process as a guideline. Further, the LBC promotes the expansion and dissemination of such

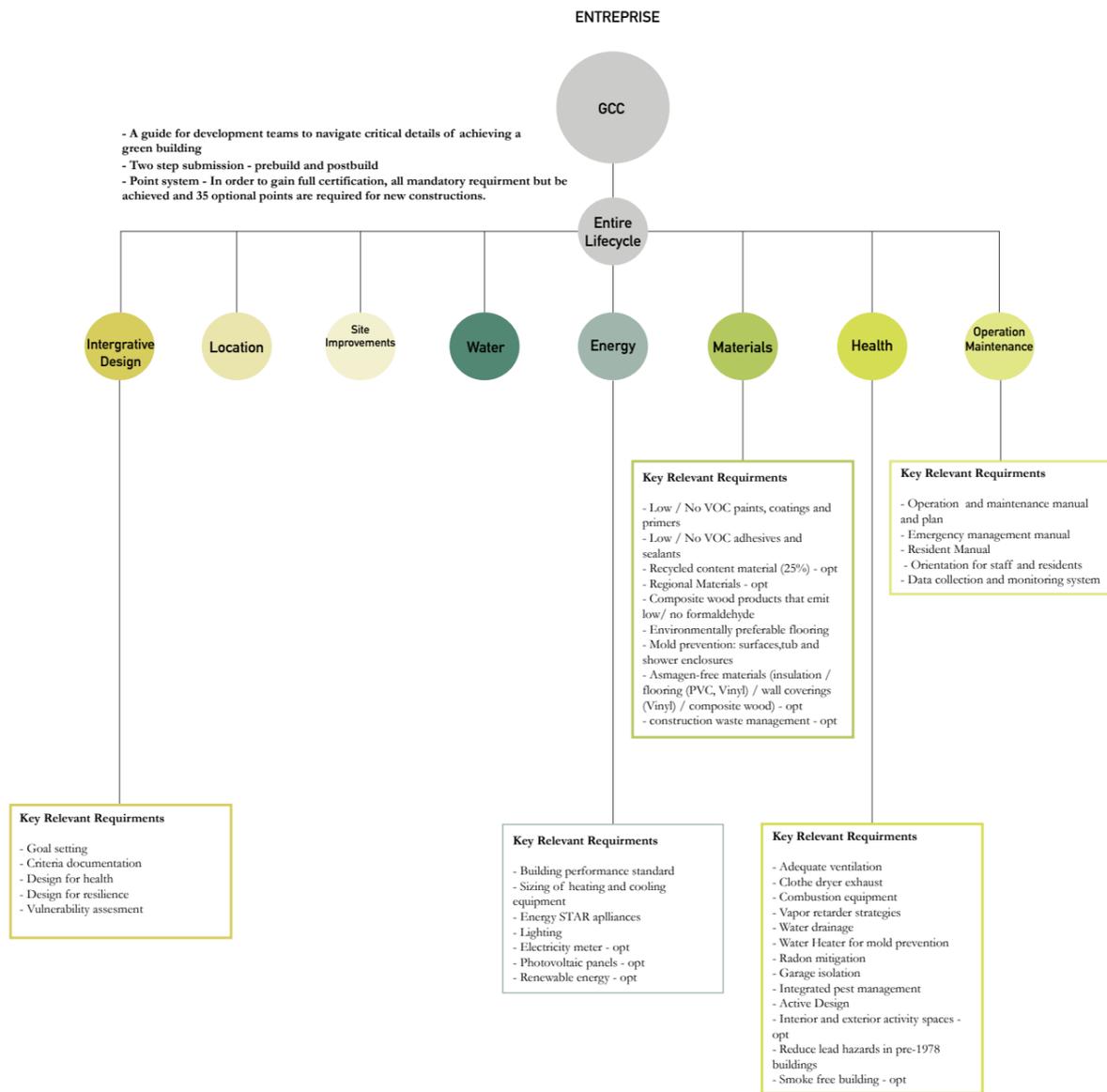
**“Now a year or two later, there is so much more health and toxicity related disclosure happening.”** (Simona Fischer, 2015)

knowledge to others wanting to make change. Finally, using this certification can change the baseline practice of designers, developers and contractors in future projects. As MSR Design mentioned “the firm is now much more aware of human health issues with materials and we are working on how to embed this knowledge within the broader practice of the office.” (Simona Fischer, 2015)

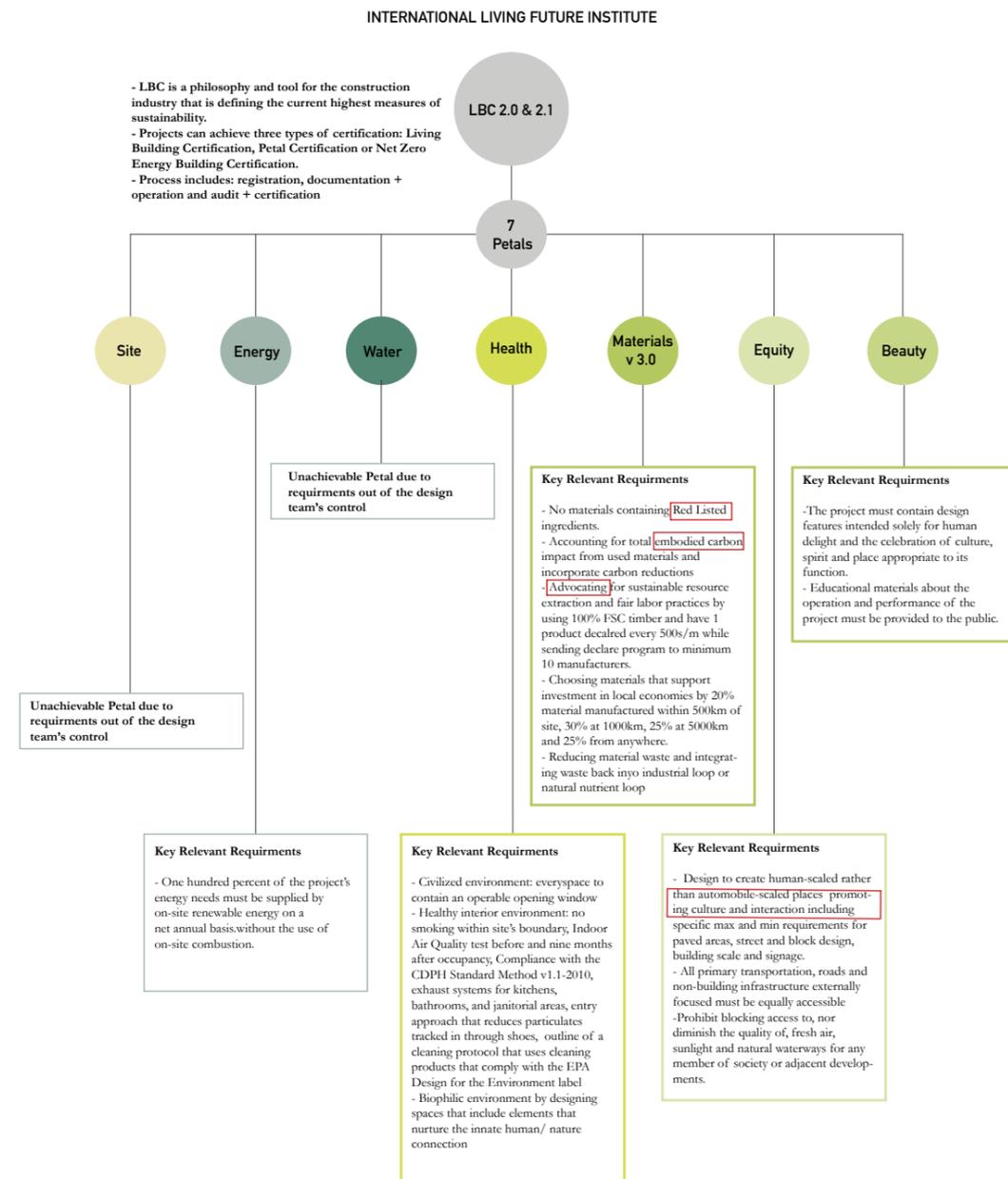
### LBC Red list

- Alkylphenols
- Asbestos
- Bisphenol A (BPA)
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethylene
- Chlorobenzenes
- Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs)
- Chloroprene (Neoprene)
- Chromium VI
- Chlorinated Polyvinyl Chloride (CPVC)
- Formaldehyde (added)
- Halogenated Flame Retardants (HFRs)
- Lead (added)
- Mercury
- Polychlorinated Biphenyls (PCBs) Perfluorinated Compounds (PFCs)
- Phthalates
- Polyvinyl Chloride (PVC)
- Polyvinylidene Chloride (PVDC)
- Short Chain Chlorinated Paraffin
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol
- Volatile Organic Compounds (VOCs) in wet applied products

# CERTIFICATIONS DIAGRAM



“What we found was that there weren’t databases that had filters strict enough to meet the Red list.” (Simona Fischer, 2015)



**Hurdle 1:** Resources on information of building products content are scattered and hard to interpret

**Hurdle 2:** Deciding which building products to prioritize

**Hurdle 3:** The Architect is burdened by the research and advocacy on building products, adding cost and time

**Hurdle 4:** Balancing using healthier products, the area of the building footprint and landscaping space with the overall budget for the project.

Hurdles in the process of The Rose

# 5. INNOVATION IN DESIGN

“We never asked *if* we can do it, we started out by asking *how* do we do it” (Billy Weber, 2015)

The Rose team has developed a design process that makes them leaders in the affordable housing sector. By designing for both net zero energy and advocating for the installation of healthier, non-hazardous building products, The Rose team is creating the next generation of buildings, and their innovative ideas for transformation have been designed to be replicated. By sharing practices and documenting the challenges of the process, the team has allowed for other Affordable Housing developers to learn from their experience and further the expansion of knowledge and collaborative implementation in new affordable housing nationwide.

To achieve this, a number of criteria were adopted by the team to guide the design process. In addition to their use of the LBC and EGCC as guidelines, the team used six key principles to impact their decision making: 1) innovative design decisions 2) constructibility and replicability 3) life cycle cost reduction 4) complexity and maintainability 5) flexibility/ability to retrofit 6) health and toxicity reduction. The design of the project was also dictated by factors such as the physical conditions of the site, project standards laid out by the Minnesota Housing Finance Agency, the harsh climate, and the concept of equity in which all affordable and market-rate units were to be designed to be similar in size, design and material finishes. MSR Design were critical in developing and executing this “balanced formula” (MSR Design, 2015). In this section, the design process is unpacked to reveal the important challenges that the team confronted in their decision to disseminate the planning process to a wider audience as a means to promote change.



Left: Street view of The Rose  
Right: diagram highlighting temperature range in Minneapolis compared with the development's EUI.

## 5a. Designing innovative affordable housing

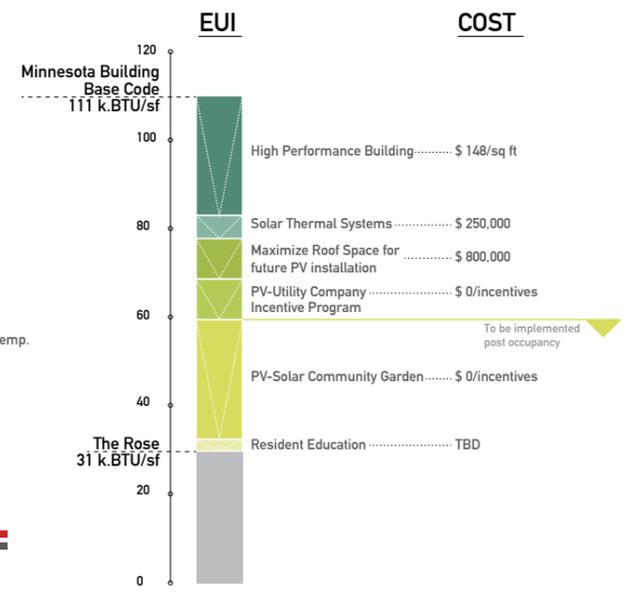
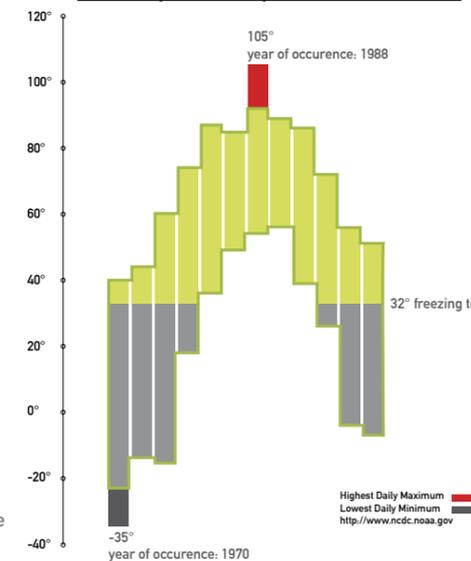
“Not only is The Rose the only registered multifamily building of scale attempting the Living Building Challenge™, it is also in a more challenging climate and has the lowest price point of all certified or registered projects in this program” (Gina Ciganik, 2015).

The climate in Minnesota, Minneapolis plays a major role in shaping the design and construction method of new buildings. The humid continental climate within the American Midwest is typified by large seasonal temperature differences, with hot and often humid summers and severely cold winters. The temperature in Minneapolis ranges from -35° to 105° which makes constructing a zero net energy building (Energy Use Intensity (EUI) =0) a difficult challenge. Within these conditions, following the Minnesota Building base code, The Rose building size and location was initially at an

EUI of 111 and had to be reduced to zero to comply with the LBC. “In cold climate, we ran into performance issues” (Simona Fischer, 2015)

This, inevitably, was a strenuous undertaking and a range of strategies, described on the following page, were devised in order to reduce the EUI to 31 k.BTU/sf. The team was able to improve the building performance by an incredible 72% compared to the standard building code base line. Further, within these strategies, “the top goal was to reconcile the performance ambitions with the cost [\$156/sq ft]” (Paul Mellblom, 2015). Thus, each design move was considered and balanced against other decisions as some implied important financial investments versus others where long-term cost savings could be achieved.

Minneapolis Temperature °F in 2014



Left: Street view of The Rose  
Right: diagram highlighting temperature range in Minneapolis compared with the development's EUI.

# ENERGY STRATEGIES

The “LBC challenges us to close loops, to utilize rather than consume energy” (Billy Weber, 2015). This effort was a key driver for the energy strategies outlined below:

## 1• Orientation and massing

The scale, massing and orientation of the design optimized solar gain, constructibility, and solar energy production by aligning buildings to maximize southern exposure.

## 2• Envelope

A robust building envelope is critical for energy consumption and the sizing of heating and cooling systems. The Rose design team tested several envelope assemblies until they found the highest return. This forms part of an essential investment opportunity as a tight envelope reduced energy consumption by half. The windows were Red List compliant and also upgraded to foam filled frames and a higher u factor glass to improve performance. This has an impact of 0.8 to 1.0 EUI reduction and also dramatically improves thermal comfort.

## 3• Heating, ventilation, air conditioning and indoor air quality (HVAC-IAQ)

The other critical investment for this property was the HVAC-IAQ system. With a tight envelope in the Minnesota climate, a robust ventilation and indoor air quality system was essential. This strategy also enabled the team to address the local air pollution from the nearby freeways to ensure cleaner indoor air for the residents.

## 4• Compact unit sizes

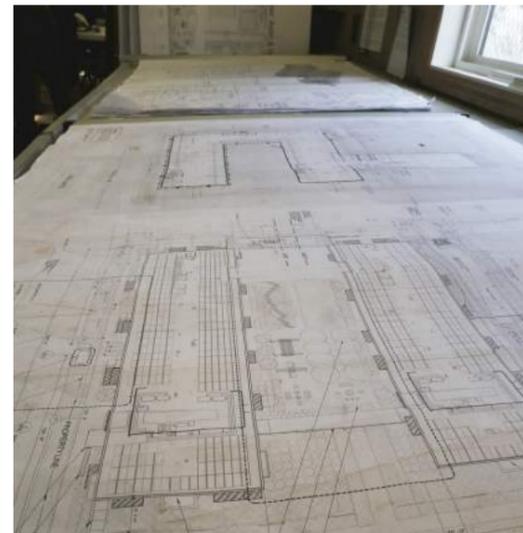
The unit sizes were designed to be compact, yet functional. Decreasing the size of units and circulation space throughout the building decreased construction costs and will further reduce energy costs over the life of the building, an important consideration for the building owner and the occupants.

## 5• Multi-functional elements

The design team sought to incorporate building elements or systems that perform more than one function as a way to reduce overall costs. For example, the water garden is designed to drain excess rainwater from the buildings acting as a water collection tank as well as an irrigation system for the community’s productive garden.

## 6• Net zero energy

The surface area available for photo-voltaic panels at The Rose is able to support less than a quarter of the units (apartments) even with the most efficient panels available and an Energy Use Intensity (EUI) at 72% less than the standard code. District-wide approaches considered the preferred method to implement in the future, such as outsourcing energy production to community solar gardens. The design incorporates the future potential of retrofitting for solar energy production and future innovation and technological advances to achieve an EUI=0.



## 5b. Researching and selecting healthy materials beginning with the apartment’s interior

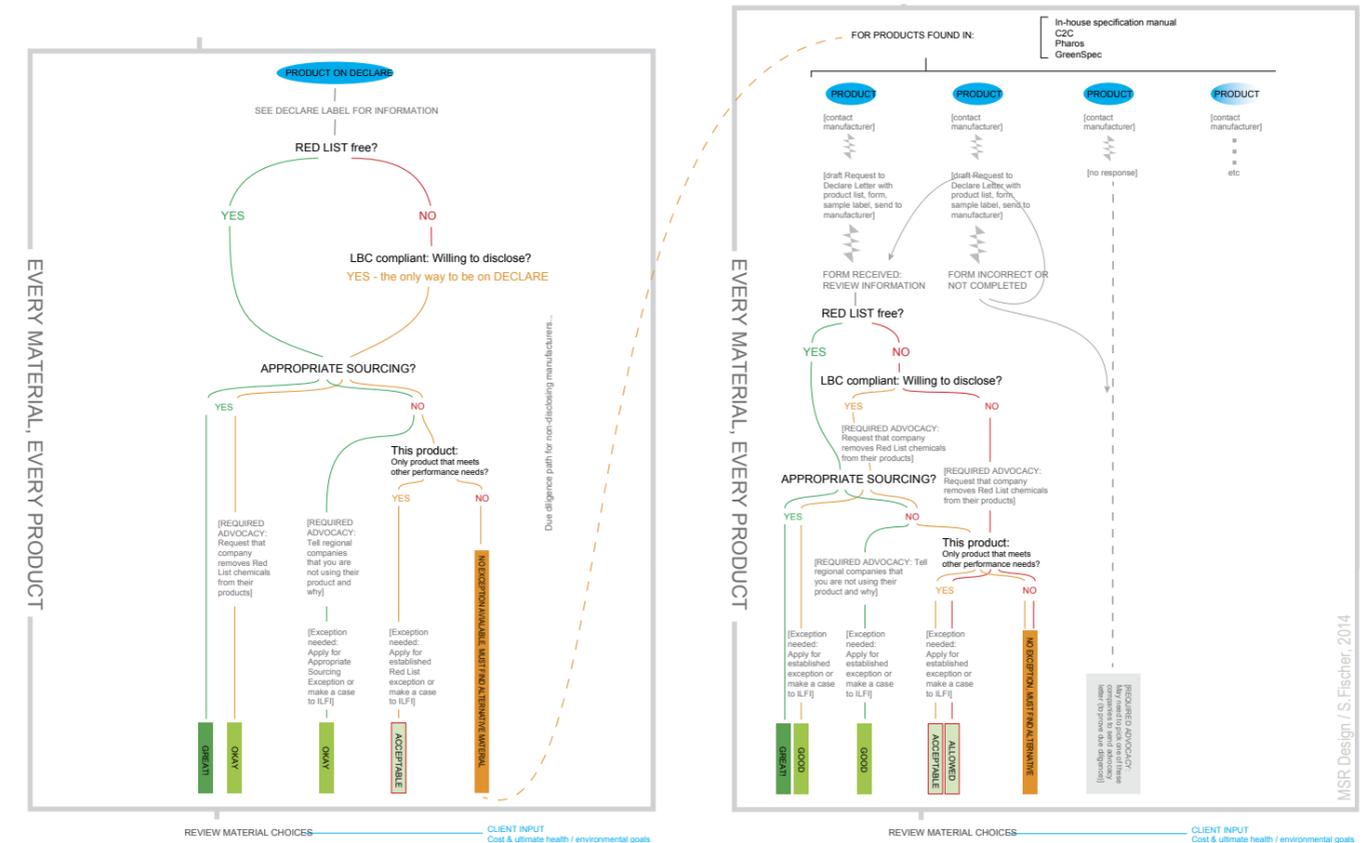
“Our goal was to find a library of materials that we could share with other housing developers, whether affordable or not, so that other people won’t have to do that investment of time and research” (Gina Ciganik, 2015).

As mentioned previously, the Living Building Challenge™ has created a “Red List” of toxic chemicals that should be eliminated from building products used on a construction site. With several thousand specified building products and component parts, meeting this goal required an efficient research process. The investigation started with twenty material categories and included items such as wallboard assemblies, paint, carpeting, flooring, countertops, joint sealants, doors, wood paneling and trim, and window shades. The design team decided to concentrate this effort on the interiors

of the apartment, to create toxin free environments where people spend most of their time. The research entailed a systematic investigation into all of these products. The results of this research aimed to upgrade products that are typically used industry wide and currently contain red listed chemicals or that are non-compliant with LBC. This additional work required that the team request additional funds. The team expanded their work to include the common areas as further financial support was obtained.

“Our material approach took the idea of focusing on the inside materials and start from the inside faces of what is the most ubiquitous surfaces and what you touch” (Rhys MacPherson, 2015).

Left: Photograph of construction drawings  
Right: Diagrams of specification process for complying with the LBC  
© MSR Design



“We did a lot of analysis to figure out what is the best deployment of dollars and where do we could spend those dollars so that we most positively affect the innate health of the people living in the building” (Paul Mellblom, 2015).

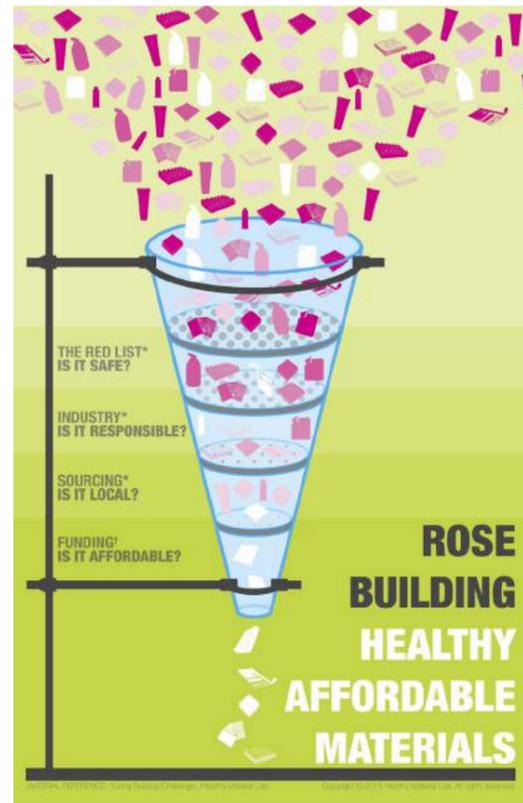
The specification process was a lengthy one, with little readily accessible or reliable information, MSR Design led the research and aggregated information from existing databases and by contacting manufacturers directly.

“We started by looking at Declare database and Green Spec and Pharos because those are some of the most common places you can find ‘green’ materials [...] what we found was that there weren’t databases that had filters strict enough to meet the Red List” (Simona Fischer, 2015).

Systems are still not harmonized but many organizations are currently working to create more robust and integrated evaluation systems to be used by designers.

The complexity of the problem and the multiple challenges that confront the specifier signals the critical need for a tool that aggregates the information from the Red List with existing databases, including Pharos and Declare. Seemingly simple decisions, such as wall types and wall finishes, became an intense investigation of fact-finding and analysis. As stated by MacPherson “we looked at 35 different wall types and we then distilled that down to 23 and from there we kept distilling that process down” (Rhys MacPherson, 2015). Other issues, such as lack of transparency of chemical content of the products and the lack of existing healthier product alternatives at a reasonable price range, further complicated the process. The key design strategies that MSR developed for the specification of materials included:

**1: Focus on the dwelling units** – The dwelling unit is where the residents spend most of their time, and a place where there is the greatest possibility of potential contamination of the interior environment and exposure to chemicals, particularly for children. Great progress was made in identifying Red List free materials. The team also identified which items have no affordable alternative, such as doors, that could, according to LBC criteria, receive an exception. The team was successful in identifying and installing healthier building products



such as wallboards, paint, resilient flooring, tiling, wood cabinetry, specialties and furnishings. This substitution - what our colleagues at the Healthy Building Network would call the Avoided Hazard - ensured that almost 90% of all the surface area of the interior spaces of the dwelling units was impacted because healthier products substituted more toxic alternatives. This was a major turning point and led to conversations with the International Living Future Institute to begin rethinking the LBC affordable housing criteria. The Institute is also introducing a tracking sheets for exceptions inspired by MSR Design as a strategy for affordable housing.

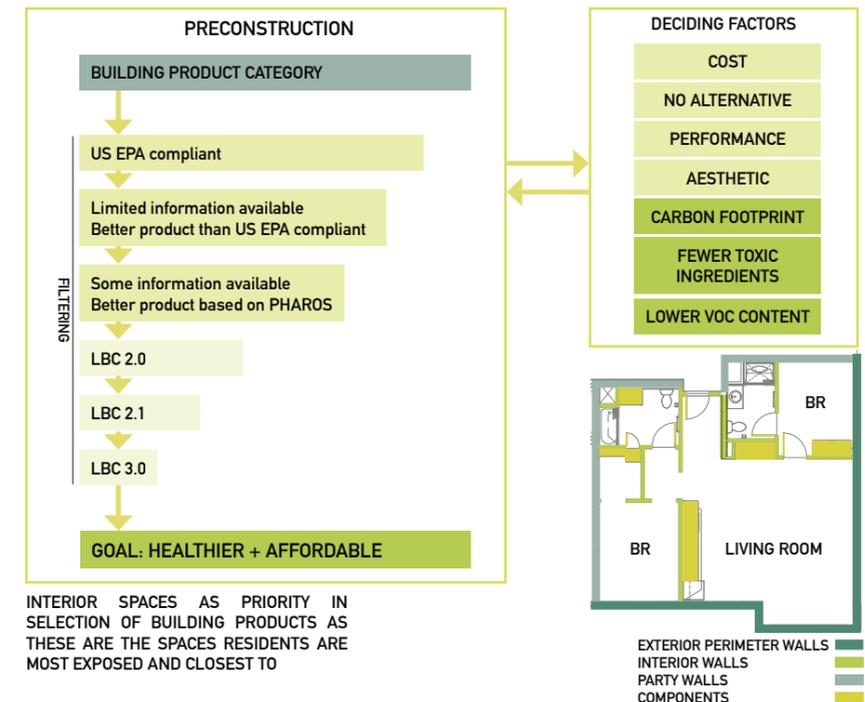
**2: Scaling to common space** – There are many elements found in the interior units that could easily be installed in the common areas. Items that were installed in the common spaces such as the wallboard, carpet and hard surface flooring, paint, bathroom tile and fixtures, and cabinetry are Red List free elements.,

meaning they do not contain any of the ingredients listed in the Red List. The impact of the installation of better products in the common areas also created better environmental interior characteristics in community spaces.

**3: Infrastructure** – Due to financial constraints and the difficulty in identifying infrastructure components that are Red List Free, the design team was not able to address all product categories. Some items were Red List compliant, including cellulose insulation, exterior siding and masonry but other items such as water pipes, electrical conduit and the spray applied air barrier did not comply.

Overall, MSR carefully prioritized what spaces and product categories to focus on for choosing LBC compliant, healthier materials that would most impact the lives of the residents by radically reducing the toxins in the interiors of their apartments. The long-term health impact will have to be measured through

post occupancy surveys and air quality data collection. The rest of the building products that were installed seemed likely, in some cases to be LBC compliant based on the teams’ research but the chemical content of the products could not be confirmed because the manufacturers did not fully disclose and document the product’s ingredients. Through their research, the design team has developed an effective and useful process for pursuing and tracking the LBC’s Materials Petal. Using existing tools such as Declare, HPD and Pharos, MSR Design have utilized these as filters to choose and track the research on each building product. Once a product’s compliance to these labels is mapped, the decision to specify is then determined based on factors such as cost, options or alternatives, durability and performance, aesthetics, carbon footprint, amount of toxic ingredients, and the VOC content. Visualizing this complex process demonstrates the fine balance between numerous factors such a decision encompass and the expertise required to make these informed selections.



Left: Diagram outlining key requirements for choosing healthier products. Right: diagram of the filtering process for choosing the healthiest possible product

INTERIOR SPACES AS PRIORITY IN SELECTION OF BUILDING PRODUCTS AS THESE ARE THE SPACES RESIDENTS ARE MOST EXPOSED AND CLOSEST TO

The main challenges encountered by the design team in the research and specification process included:

**1. The small number of equivalent options for healthy and affordable building products currently available in the market**

**2. The hesitancy of some manufacturers to disclose the full building product composition and sourcing information.**

Some manufacturers relied on a general “green” statement of sustainability of their product and were not able to provide the kind of transparency demanded by the LBC process. Of the 48 manufacturers researched, eight have returned fully completed Product Declaration Forms to the architects, three already had their products on the Declare database, and four provided a complete ingredient information in the MSDS sheet or a health product declaration (HPD). Analysis of the process demonstrates that:

- Over half of contacted companies have been responsive to the request for ingredient information.
- Of these, less than half have provided partial or complete ingredient information.

It is obvious that this transparency is one of the biggest hurdles to overcome to bring about change in product specification and enable designers to specify better building products.

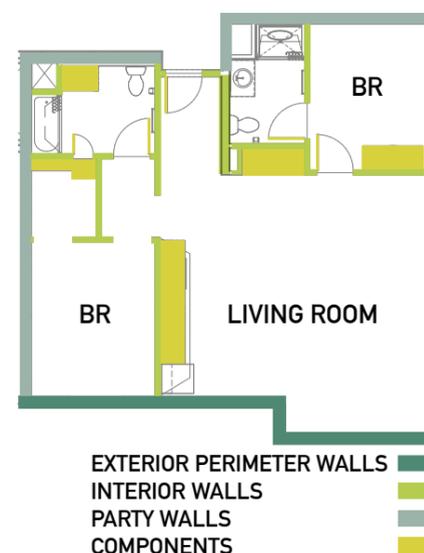
**3. The time, resources, and financial burden placed on the architects for the LBC advocacy requirements**

The time spent on a material ranged from 20 minutes (in the rare cases where there was an acceptable material on Declare and only documentation in the tracker was necessary) to 10+ hours of research when several different conversations with multiple manufacturers were necessary. On average the investigation process may be assumed to take about eight hours per building material.

(Analysis carried out by Simona Fischer, MSR Design, 2014)

**4. Finalizing the filtering process of the most healthy and affordable product was further complicated by having to also comply with the performance needs in relation to Minneapolis’ climate and building program.**

Although The Rose development did not achieve the Materials Petal certification, both the developer and the design team have gained experience in the LBC Materials process. Further, an initial list of companies and products that are either Red List free or LBC Compliant (because they have taken the step to disclose their ingredients, and do not have >1% proprietary ingredients) has been recognized, adding to the existing library of such products and manufacturers, thus participating in the process to slowly change the industry.

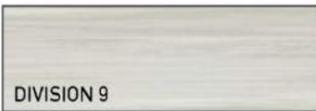
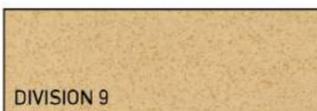
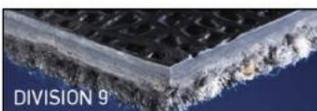


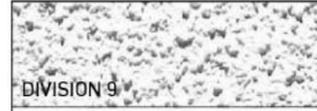
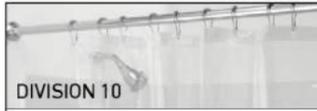
# THE FINAL SEVEN LBC COMPLIANT PRODUCT LIST FROM MSR DESIGN

The Materials List	Location
<b>1. WOOD</b> division 6 . Veneer plywood: PureBond process domestic veneer core hardwood plywood . Wood base: PureBond process domestic veneer core hardwood plywood	<b>1. WOOD</b> . Throughout in the cabinetry, casing and base trim.
<b>2. PLASTICS AND COMPOSITES</b> division 10 . Corian counters: DuPont	<b>2. PLASTICS AND COMPOSITES</b> . bathroom countertop in all bathroom + window sill
<b>3. THERMAL AND MOISTURE PROTECTION</b> division 7 . Acoustical insulation: EcoBatt . Cellulose insulation: PolarBarrier . Acoustical insulation: UltraTouch recycled denim insulation	<b>3. THERMAL AND MOISTURE PROTECTION</b> . party wall + ceiling . exterior perimeter wall . common space wall
<b>4. FINISHES - Wall Boards</b> division 9 . Wall board: National Gypsum . Ceiling board: National Gypsum . Damp board: National Gypsum . Wet board: National Gypsum	<b>4. FINISHES - Wall Boards</b> . interior wall . ceiling . kitchen wall . bathroom
<b>5. FINISHES - Tiles + Flooring -</b> division 9 . Floor/wall tile: Tweed glazed porcelain tiles . Tile base: ibid . Resilient Sheet Flooring: Marmoleum Striato . Resilient sheet flooring: Armstrong bio base tiles . Sheet Flooring: Takiron Wells sheet . Carpet tile: Superflor and Shaw	<b>5. FINISHES - Tiles + Flooring</b> . common space bathroom . level 1 shared area . living room, kitchen and bedroom . bathroom . entrance accent in hallway and shared area
<b>6. SPECIALTIES</b> division 10 . Wall protection, wall panel and corner guards: Alpar . Toilet: Niagra	<b>6. SPECIALTIES</b> . common space . bathroom
<b>7. FURNISHINGS</b> division 12 . Granite countertop: Coldspring	<b>7. FURNISHINGS</b> . kitchen and community room

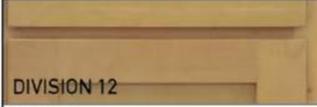
# INSTALLED PRODUCTS LIBRARY

## INTERIOR APARTMENTS

 <p>DIVISION 6 Veneer core - Columbia Forest</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen because of lower VOC Content</p>	 <p>DIVISION 6 Rubber Wall Base - Johnsonite</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Limited information available on content but suspect this is a healthier option</p>	 <p>DIVISION 6 Corian - DuPont</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen because of fewer toxic ingredients and durability</p>
 <p>DIVISION 7 EcoBatt Fiberglass - Knauf</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Lower VOC content</p>	 <p>DIVISION 7 Cellulose - Polar Barrier</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Lower VOC content</p>	 <p>DIVISION 8 Veneer internal doors: Mohawk Premium 2000</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen for cost reasons and No added urea-formaldehyde</p>
 <p>DIVISION 9 Resilient sheet flooring: Armstrong bio base tiles</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen because of fewer toxic ingredients</p>	 <p>DIVISION 9 Sheet Flooring: Takiron- Wells Sheet</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen because of fewer toxic ingredients</p>	 <p>DIVISION 9 Carpet Tile backing: Interface SuperFlor</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: The backing for this carpet contains PVC due to recycled content</p>

 <p>DIVISION 9 Carpet Tile: Shaw</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen because of fewer toxic ingredients</p>	 <p>DIVISION 9 Wall Gypsum Board - National Gyp.Co Regular</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen because of fewer toxic ingredients</p>	 <p>DIVISION 9 Wall Gypsum Board - National Gyp.Co Moisture resistant</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen because of fewer toxic ingredients</p>
 <p>DIVISION 9 Interior Paint: Sherwin Williams ProMar Zero VOC</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen as it contains NO VOC</p>	 <p>DIVISION 9 Textured finish: National Gypsum ProForm Spray Texture</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Reduced vinyl formulation</p>	<p>DIVISION 10 Toilet: Niagra</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes:</p>
 <p>DIVISION 10 Shower curtain: PEVA</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen as it contains less VOC content</p>	 <p>DIVISION 10 Shower /tub surround: Lasco/Aquatic</p> <p><b>RED LIST</b></p> <p><b>TRANSPARENCY</b></p> <p>Notes: Chosen for cost reasons</p>	

Red List free LBC v2.1  
Some level of transparency  
 Red List free LBC v3.0  
 Product containing Red list ingredient from LBC v2.1 and v3.0

 DIVISION 12 Granite Countertop: Coldspring	 DIVISION 12 Cabinetry: Smart Cabinets	 DIVISION 12 Roller blinds: SheerWeave Infinity2
RED LIST	RED LIST	RED LIST
TRANSPARENCY	TRANSPARENCY	TRANSPARENCY
Notes:	Notes: chosen for cost reason	Notes: Better than alternatives from information gathered on Pharos

## INSTALLED PRODUCTS LIBRARY COMMON SPACES

 DIVISION 7 Recycled Denim Insulation - Ultra Touch	 DIVISION 9 Resilient Sheet Flooring: Marmoleum Striato	 DIVISION 10 Wall panel and corner guards: Alpar
RED LIST	RED LIST	RED LIST
TRANSPARENCY	TRANSPARENCY	TRANSPARENCY
Notes: Chosen because of fewer toxic ingredients	Notes: Chosen because of fewer toxic ingredients	Notes: Chosen because of fewer toxic ingredients

 DIVISION 6 Wood Wall Base - Columbia Forest
RED LIST
TRANSPARENCY
Notes:

### 5c. Post disposal

One of the requirements for LBC compliance is to develop a program for the disposal of post construction debris. The imperative also demands that the project “optimizes materials in each of the following phases: 1. Design Phase, including the consideration of appropriate durability in product specification 2. Construction Phase, including product optimization and collection of wasted materials. 3. Operation Phase, including a collection plan for consumables and durables and 4. End of Life Phase, including a plan for adaptable reuse and deconstruction.” (LBC 3.0)

The importance of minimizing waste and implementing programs for potential reuse aids in creating a better environment for everyone, from the manufacturing process to construction. As a general principle it is important to reduce waste from the waste stream as discarded toxic materials can find their way back into the environment through unregulated recycling, leakage, etc. Proper disposal and recycling as a practice is an essential part of maintaining the high quality of a building.

During construction, according to LBC, the project team must divert and reduce waste material from landfills to the prescribed levels indicated below. This means that depending on the materials, a range of 80% to 100% of the disposable materials should be recycled, reused or composted.

- Metals – 95%
- Paper and Cardboard – 95%
- Soil and biomass – 100%
- Rigid foam, carpet & insulation – 90%
- All others - combined weighted average 80%

The use of certification tools such as LBC help achieve quality in maintenance of buildings. However, the overall goal of The Rose was not to purely pursue the certification, but also to build a better building for its community and maintain the development through best practices. Here, post-disposal becomes a further refinement of the definition of better buildings in relation to the supply chain. Though the LBC certification was not fully pursued, The Rose team managed to apply some of these objectives in their post disposal strategy. The GC managed to deter from a landfill, 75% of the waste through recycling and reuse. The initial goal set out by MSR Design was to reduce landfill by 55%. Weis Builders went well beyond this percentage during the construction period.

Furthermore, the owner of the development was also required to develop a program for post-construction waste diversion, including future remodeling efforts. This demands the full participation of the residents and employees as a way to maintain health standards within The Rose.

## 6. CONCLUSION

### 6a. Identifying Strategies for Building Healthier, Affordable Housing

Through this research, we were able to describe the tactics created and the substantial barriers encountered in the design, funding, procurement and construction process of The Rose. It is critical to take into account the role of the wider development ecosystem that impacts and shapes the affordable housing sector in order to understand the current challenges that complicate delivering healthier housing. The successes of The Rose are rooted in the creative navigation of the complex systems involved.

The informal Integrated Design and Delivery Process was essential in bringing a solid team together at the earliest stages of the project. The early integration of the General Contractor in the design team was particularly important for examining life cycle costs and establishing energy budgets at design inception. The contractor also played an important role in bidding cycles and installing upgraded product alternatives during construction as grants and funding permitted. The partnership between the co-developers, Hope Community, and Aeon was also key. Hope Community's strong ties to the neighborhood enabled the development process to be inclusive of current populations, and ensured local needs were targeted from the inception of the project.

Pursuing the Living Building Challenge was an aspirational goal that brought numerous benefits. While the project did not acquire full certification, The Rose project was identified as a LBC pilot for housing developers nationally, and the project paved the way for others to establish similar practices as a baseline approach to achieve better affordable housing. The certification became a tool for identifying potential material health hazards that have the most impact on residents. The revelation that the team would focus on the interior environment led to the focus on healthier interior products and interior air quality, and helped to narrow the scope of research and the team's efforts. Focusing on a healthier interior apartment is a useful strategy that could also guide future developments and may lead to the elimination of a range of "classes" of chemicals (Green Science Policy Institute, 2013).

A process for choosing healthier products was established by MSR Design, which "filtered" products for their chemical content through various existing benchmarks, including the US EPA, Pharos, and various versions of the LBC. This process provided a range of

information that informed the specification process. The decision to specify a product was dependent on a range of typical design factors including cost, alternative options, aesthetics, carbon footprint, durability and performance but also included calculations of toxic ingredients, and the VOC content. This difficult and lengthy product evaluation process was exacerbated because of incomplete chemical information and lack of transparency in the industry. It is evident that designers can only specify better products if manufacturers declare the content of their products. With the new HPD v2 (Healthy Product Declaration Collaborative) more product information is becoming available that will allow architects to use a range of information tools to evaluate and specify a wider range of better products.

The Living Building Challenge sets a high bar to achieve certification. We identified that more support must be provided to designers to be able to conduct the necessary research to identify better products for affordable housing. At the moment, it is only through the persistence of individual team members that designers are able to make any progress. As Paul Mellblom states:

"The take-aways (to address and respond to the LBC) are twofold 1) the effort is worth it since it makes us smarter and better designers, and 2) you need to have a few people on the project team that want to live and breathe LBC if you are going to be successful - Rhys, Simona and Rachelle were inspired to really do a great project and each invested their own time to be smarter and understand the nuances of LBC and its intentions (often times beyond the imperative itself) in order to build the best building we could with the limited resources we had available to us." (Paul C.N. Mellblom, 2016)

At this time there are very few healthy and affordable products on the market. This dramatically limits the potential scope of impact. We identified that a market opportunity exists for manufacturers to develop healthy, affordable substitutes particularly suited to the affordable housing sector. The manufacturing industry

has a long way to go to become leaders in changing the market. This is an issue worthy of advocacy and further research.

Out of the many products installed in The Rose apartment interior, six are compliant with LBC v.3.0, three comply with LBC v.2.1 and 11 contain a red listed ingredient. For the development team it is important to note that products covering the largest portion of apartment surface areas (wall, floor, countertop) were mostly Red List free. The team was able to fundamentally impact the health of the future occupants by avoiding many harmful chemicals by choosing healthier product options. The design team focused primarily on products that impact the interior environment. This was an intensive and costly process. The team was unable to further spend their resources in evaluating other construction materials.

The post occupancy analysis of the development is currently being established and the main challenge will be to maintain the long term interior environmental quality of the apartment through best cleaning and maintenance practices. This can only be accomplished through robust and inclusive engagement with the residents. The real life of the building begins when it becomes a new home for the residents.

The Rose has leveraged a range of creative funding sources, established and consolidated long-term partnerships within the community and with the design and construction teams, and challenged the status-quo in affordable housing through their dedication to achieving the goal of creating better healthier housing for all residents.

## 7. REFERENCES

2011 *Enterprise Green Communities Criteria*. 2011. Enterprise Community Partners.

Ciganik, Gina. “The Rose Development Process.” Interview by author. July 13, 2015.

Capen, Alison, James Connelly, Krista Elvery, Marisa Hagney, Kathleen Smith, Amanda Sturgeon, and Sam Wright. *Living Building Challenge Framework for Affordable Housing*. 2014. International Living Future Institute, WA, Seattle.

Delaney, William, and Betsy Sohn. “The Rose Development Process.” Interview by author. July 14, 2015.

“Demographic Census Data Minneapolis Zip Code 55404.” Census Bureau, 2014. Accessed July 22, 2015.

Farrah, Kim, Breeze Glazer, Carolyn Roose, Peter Syrett, Chris Youssef, and Kristina Buller. *HEALTHY ENVIRONMENTS A Compilation of Substances Linked to Asthma*. July 2011. NY, New York City.

“Health Product Declaration Collaborative - HPD Collaborative.” HPD Collaborative. Accessed April 14, 2016. <http://www.hpd-collaborative.org/>.

“Home | Hope Community.” Home | Hope Community. Accessed June 30, 2015. <http://www.hope-community.org/>.

Jossi, Frank. “Sustainable: Aeon Building Ultra-efficient Affordable Apartments.” *Finance & Commerce*, February 2, 2015. Accessed July 20, 2015. <http://finance-commerce.com/2015/02/sustainable-aeon-building-ultra-efficient-affordable-apartments/>

Landrigan PJ. *Children’s Environmental Health: A Brief History*. Academic pediatrics 2015 Oct;. Accessed February 10, 2016. <http://www.mountsinai.org/profiles/philip-j-landrigan#sthash.4scmLACZ.DYA9HPL9.dpuf>

Lehnhoff, James. “The Rose Development.” Telephone interview by author. July 31, 2015.

*Living Building Challenge V.2.0*. December 2010. International Living Future Institute, WA, Seattle.

*Living Building Challenge V.2.1*. May 2012. International Living Future Institute, WA, Seattle.

*Living Building Challenge V.3.0*. 2014. International Living Future Institute, WA, Seattle.

MacPherson, Rhys, Paul Mellblom, Simona Fischer, and Billy Weber. “The Rose Development Process.” Interview by author. July 14, 2015.

“National Weather Service Climate.” National Weather Service Climate. Accessed September 16, 2015. <http://w2.weather.gov/climate/index.php?wfo=MPX>.

Newberg, Sam. ULI Case Studies The Rose. Report. July 2015. Accessed August 15, 2015. [http://casestudies.uli.org/wp-content/uploads/sites/98/2015/12/TheRose\\_CaseStudy.pdf](http://casestudies.uli.org/wp-content/uploads/sites/98/2015/12/TheRose_CaseStudy.pdf).

*PHILLIPS WEST MASTER LAND USE PLAN*. July 17, 2009. Adopted by the Minneapolis City Council, MN, Minneapolis.

Plotz, Steve. “The Rose Development.” Telephone interview by author. July 31, 2015.

South Quarter Phase IV (The Rose). February 28, 2014. Specification document. MSR Design, Minneapolis.

“The Rose - South Quarter - Minneapolis - Aeon.” Aeon. Accessed June 30, 2015. <http://www.aeonmn.org/properties/rose/>.

“OVERLAY ZONING DISTRICTS.” Map. In Minneapolis Zoning Plate. Minneapolis: Community Planning & Economic Development, 2011. Accessed July 23, 2015.

*Rezoning Permit and Conditions*. April 8, 2013. Department of Community Planning and Economic Development (CPED), Minneapolis.

Rezoning, Conditional Use Permit, Variance, Site Plan Review, Preliminary Plat and Alley Vacation BZZ-5968, PL-275 and Vac-1613

“Six Classes.” September 22, 2013. Accessed April 14, 2016. <http://greensciencepolicy.org/topics/six-classes/>.

“Toxic Substances Control Act of 1976.” Wikipedia. Accessed January 25, 2016. [https://en.wikipedia.org/wiki/Toxic\\_Substances\\_Control\\_Act\\_of\\_1976](https://en.wikipedia.org/wiki/Toxic_Substances_Control_Act_of_1976).

“Ventura Village Neighborhood - Existing Land Use.” Map. In The Minneapolis Plan for Sustainable Growth, Land Use Chapter. Minneapolis: Community Planning & Economic Development, 2010. Accessed July 23, 2015.

Wolff, Mary S., Susan L. Teitelbaum, Kathleen Mcgovern, Susan M. Pinney, Gayle C. Windham, Maida Galvez, Ashley Pajak, Michael Rybak, Antonia M. Calafat, Lawrence H. Kushi, and Frank M. Biro. “Environmental Phenols and Pubertal Development in Girls.” *Environment International* 84 (2015): 174-80. doi:10.1016/j.envint.2015.08.008.

Wolff, Mary S., Susan L. Teitelbaum, Gayle Windham, Susan M. Pinney, Julie A. Britton, Carol Chelimo, James Godbold, Frank Biro, Lawrence H. Kushi, Christine M. Pfeiffer, and Antonia M. Calafat. “Pilot Study of Urinary Biomarkers of Phytoestrogens, Phthalates, and Phenols in Girls.” *Environ Health Perspect Environmental Health Perspectives* 115, no. 1 (2006): 116-21. doi:10.1289/ehp.9488.

Wolff, M. S., S. L. Teitelbaum, K. Mcgovern, G. C. Windham, S. M. Pinney, M. Galvez, A. M. Calafat, L. H. Kushi, and F. M. Biro. “Phthalate Exposure and Pubertal Development in a Longitudinal Study of US Girls.” *Human Reproduction* 29, no. 7 (2014): 1558-566. doi:10.1093/humrep/deu081.

### Design Team and Contributors

#### Aeon

Gina Ciganik  
James Lehnhoff  
Steve Plotz

#### MSR Design

Paul C.N. Mellblom  
Rhys MacPherson  
Simona Fischer

#### Center for Sustainable Building Research

Billy Weber

#### Hope Community

Betsy Sohn  
William Delaney

