KASVUN PAIKKA
Sustainable housing design for a growing community in Suomenlinna

ISABELLA POLLAK
Master’s thesis
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Examiner: Professor Harry Edelman

Examiner and topic approved by the Faculty Council of the School of Architecture on 8 November 2013.
I still remember the first time I set foot on Suomenlinna. A ferry carried me away from the busy city life of Helsinki over the rippling ocean while followed by screaming seagulls fighting for fish followed behind. After anchoring, the pace suddenly changed. Although being so close to the city, Suomenlinna is miles apart. No modern traffic breaks the sounds of nature, the picturesque wooden houses convey a friendly feeling and the sense of community can be felt all around.

When I was looking for a thesis topic about sustainable housing, Professor Harry Edelman and I came to the same conclusion that there is no better place in Helsinki to be architecturally challenged in this field than Suomenlinna. A meeting with Heikki Lahdenmäki, the Restoration Director at Suomenlinnan hoitokunta and Restoration Architect Tiina Koskenniemi indicated that there was indeed demand for development and new ideas as two old buildings need to be replaced.

I started the thesis process by providing a survey to the residents of Suomenlinna since it was my utmost concern to include the needs of the residents into my design. The answers and personal messages by the people made me realize their actual needs and I was able to combine them with the new insight of sustainable architecture.

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This Master’s thesis combines a wide range of sustainability into one architectural design solution. It begins with the historical background of the UNESCO world heritage site of Suomenlinna and continues with an analysis of the site, its buildings, climate and environment. A survey of 86 residents of Suomenlinna gives answers to the needs of the inhabitants and the results of the survey were combined with the factors of sustainability and translated into architectural design.
ACKNOWLEDGMENT

I would like to express my gratitude to my teacher and supervisor Professor Harry Edelman for his advice, guidance and commitment through the writing and design process of this Master’s thesis. Furthermore I would like to thank Professor Markku Hedman for his comments and suggestions in matters of housing. Also, I like to thank Heikki Lahdenmäki and Tiina Koskenniemi of Suomenlinnan hoitokunta for giving me this opportunity and providing me with all the necessary information. A special thanks goes to everyone in Suomenlinna, who participated in my survey and willingly shared their precious time to provide me with the answers that helped me in finding my design solution.

A very warm thanks goes to my family, especially my parents for their continues support during my studies. Without your support I would not have made it this far. Ich danke euch! A special appreciation goes to the man on my side Jukka for always supporting me and being there for me during the ups and downs of my thesis. Thank you for your endless support and your encouraging and loving words.
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To comprehend the architectural design in this Master’s thesis, it is essential to learn about the background of the building site and the theory of sustainability. This thesis is not only focusing on the practical outcome of architecture as a design tool, but on architecture as a whole: the building’s context to the surroundings, its impact on the environment, its ecological value and its social importance to the inhabitants. Housing for a new generation will be the design task.

Part one of this thesis concentrates on the importance of the site’s history and analyzes its social and environmental surrounding.

Part two focuses on the general rules of sustainability. What is sustainability and why does it play such an important role in architecture? A special focus is paid to the social pillar of sustainability.

Part three describes the concept of the architectural design. Sustainable design tools are described further.

Part four combines the previous parts into a design solution which not only respects the building site, but also plays a significant role for the inhabitants’ social well-being.
Suomenlinna is a sea fortress off-shore of Helsinki, the capital of Finland. The fortification is built on a cluster of eight islands: Kustaanmiekka, Susisaari, Iso Mustasaari, Pikku Mustasaari and Länsi-Mustasaari, which are connected with bridges and the separate islands Särkkä, Lonna and Pormestarinluodot.

Around 850 inhabitants currently live on the islands and about 700,000 people visit the fortress throughout the year. The unique landscape is not just a recreation area for locals, but also one of Finland’s most popular tourist attractions. The history of the islands also has a high educational value and is therefore a popular destination for schools. The islands count around 200 buildings on 160,000m², with 330 rental apartments. Just a few houses are privately owned, whereas the property is always owned by the state. The majority of apartments are state-owned rentals. The responsibility for renting and maintenance lies at the Governing Body of Suomenlinna. One third of the flats are rented to the staff of Defense Administration.

Suomenlinna can only be reached by sea. Residents and visitors have to cross the two kilometers distance by ferry, which runs from Kauppatori, the market square of Helsinki, throughout the year. A service boat to Suomenlinna operates from Katajanokka. A bridge to connect the islands to the mainland was planned but never realized.

A service tunnel connects Suomenlinna with the city. Starting at Kaivopuisto in the south of Helsinki, the 1630m long tunnels leads 63m below sea level to Länsi-Mustasaari. It was built in 1976-1980 and routes district heating, water pipes and electricity cables to the islands. To keep the tunnel functional, 500 cubic meters of leak water have to be pumped out daily. It is too narrow to be used for the public and only service and emergency cars are allowed to pass.

Suomenlinna offers different services like a supermarket, an Evangelical-Lutheran church, a kindergarten, an elementary school, a library and a kiosk, which also offers postal service. These services, as well as restaurants, cafés and museums, offer jobs for 400 people around the year and 500 in summer.
A major issue is to maintain the 6km wall of the fortification. To achieve that, The Governing Body of Suomenlinna cooperates with The Finnish Ministry of Justice. An open prison has been operating on the islands since 1973, allowing 95 inmates to resocialize. Through working on the granite walls, they acquire stonemason skills, which increases their chance in the job market on one hand, and helps maintain the wall on the other hand.
In 1991, Suomenlinna was declared a UNESCO world heritage site. The area stretches over 210ha and a surrounding buffer zone of 2.641ha fully protects the site. The buffer zone ensures the safety of the UNESCO site, according to the Operational Guidelines for World Heritage Sites. Development is limited within this zone "to ensure the preservation of the Outstanding Universal Value". The buffer zone also guarantees that important views of the site stay functional.

The historical and architectural value of the fortification, the community living on the islands and the transformation to a landscape monument were amongst the selection criteria of the World Heritage Committee: "Suomenlinna is a historical, architectural and landscape monument and a living community. It is representative of a significant era in the history of fortification and experimentation in dock construction." Another criteria of selection was that Suomenlinna is not only a fortress built under harsh Nordic conditions, but also the challenge of the difficulty of an unsteady terrain spread over several islands makes this fortification a unique and protectable item of its history. Every island functions as an independent bastion and the cooperation of the cluster as one represents a significant piece of military architecture.

The fortress was built through various stages of history: partly under Swedish command, partly under Russian command, and finally restored and maintained by the Finnish government. These different influences of military architecture give the fortification its global value as a cultural heritage.
1.2 Responsible Parties
1.2.1 The City of Helsinki

Suomenlinna belongs to the City of Helsinki and is therefore entitled to municipal services. The city is responsible for Suomenlinna’s educational institutions - like a school, kindergarten and library – passenger traffic, roadwork and maintenance of the landscape. The order for maintaining roads or parks is given by the City of Helsinki and carried out by the Governing Body of Suomenlinna as a paid service.
The cultural heritage site of Suomenlinna is owned by the state of Finland. The Governing Body of Suomenlinna is a governmental agency, consisting of 90 employees and operating under the Ministry for Education and Culture, which is responsible for properties and monuments at Suomenlinna. The responsibility lies in managing, maintaining and restoring the fortress, preserving the Outstanding Universal Values, developing the vitality of the community, maintaining and renting out apartments, developing the landscape and tourism coordination. Founded in 1973 as a planning unit, it soon turned into a governmental agency in 1988. Renting out apartments, conference rooms and other premises covers most of the expenses of the Governing Body of Suomenlinna.

Another function of the Governing Body of Suomenlinna is to gather the fortress’ stakeholders. Decisions are made by the Board, which consists of representatives of the City of Helsinki, the National Board of Antiquities, the Senate Properties and residents of Suomenlinna. This Board is the highest policy-making body of Suomenlinna and meets three to four times a year.
In 1747, when Finland was part of the Swedish realm, Sweden had lost strategically important fortresses in the eastern part of the kingdom. To strengthen the border of the realm towards the East, the Diet/parliament of Stockholm decided to build a fortress with a naval base off shore of Helsinki. A group of rocky islands (skerries) in the bay of Helsinki, known as Susiluodot, would be combined to erect a chained fortification to control the entrance to the city.

In 1748, the construction of the fortress began under the lead of the Swedish admiral Augustin Ehrensvärd (1710-1772). The fortress - soon called Sveaborg, the castle of Sweden – was planned to be the main base for army forces in Finland and became the largest construction project of the Swedish realm in the 18th century. The construction crew of Finnish and Swedish soldiers consisted of more than 6500 people. Drawings by Ehrensvärd show buildings for residential and public use as well as wooden homes for the soldiers. The society of Sveaborg at this time was described by Daniel Clarke: “The Sveaborg officers live rather comfortably, and they have all brought their families with them. The society is lively: sometimes more than 40 women can be seen at the balls and parties, and many of them are true beauties.”

Nevertheless, the soldiers’ and their families’ lives in the fortress was usually harsh, especially in the cold winter months. Considering the soldier’s families, Augustin Ehrenvård erected a school for the Finnish soldiers’ children in 1760.

After the death of Ehrensvärd in 1772, his plan of the fortress was carried out, but not his further plan to build strategic points along the coastline of Helsinki. Although already functional, King Gustav III (1771-92) continued to further expand the fortification.

After the war in 1808-09, Finland fell under the siege of Russia as a consequence of a treaty between Napoleon and Alexander I. Sveaborg became a Russian garrison for the next 110 years and around 4000 Russian soldiers besieged the fortress. The walls were strengthened again, a church, hospital and barracks were built to house the additional soldiers and the name Viapori was used instead of Sveaborg. The garrison community was very diverse at that time due to the mix of Russian Orthodox, Lutherans, Muslims, Jews and Polish Catholics.

In the time of the Russian siege, large barracks were built at Iso Mustasaari and the island was full of wooden buildings and small gardens. A Russian journalist named Faddei Bulgarin, who visited the fortification in 1840, described the home of chief engineer Nybäck as such: “The home of the honourable N.I. Nybäck was located in a wonderful place! It is a small wooden house by the sea. There is a tiny vegetable patch under the windows only a few steps away on the rocks, against which the waves dash. During stormy weather, the splashes are sure to fly all the way to the windows. The view from the windows towards the sea and islands is beyond compare.”
As a consequence of the bombardment in 1855
by the Anglo-French fleet during the Crimean War, damaged buildings had to be torn down and a new defense line of earth banks was constructed along the coast. The damage the bombs caused can still be seen at the center point of Suomenlinna, the courtyard, where gaps between the row of houses and newly constructed roofs, incoherent with the original building style, show the force of destruction.

During World War I, Helsinki along with Tallinn formed a Naval Fortress of Peter the Great, which was hoped to guarantee the security of St. Petersburg, the Russian capital city, by blocking the Gulf of Finland.

In 1918, when Finland gained independence and the Russian garrison left Viapori, Finnish military forces controlled the islands and the name of the fortress was changed to Suomenlinna, the castle of Finland. The islands hosted prisoners of war and due to a shortage of flats in Helsinki in 1920, residents had to move to temporary accommodations in Kustaanmiekka. As the inhabitants had to live amongst soldiers and under poor conditions, the discontent amongst them grew. To add more services to the islands, shops, a ground school and a nursery were erected.

During World War II, Suomenlinna served as Helsinki’s air surveillance center, which was the last time the fortress was in active military use. But the living conditions of the inhabitants were still very poor. Akateeminen magazine wrote about it in 1964 as follows: “Half of the flats are lacking in basic conveniences. There is no water distribution, no sewage, and no central heating. A lavatory may be 200 meters away from a flat, and the woodshed 200 meters in the opposite direction. Some live within the stone walls dating from the time of Ehrensvård, which must be heated even in the summer to keep the moisture out. Water is delivered by horse and by carrying it.”

But despite these conditions, the residents of Suomenlinna appreciated living in peace and nature after many years in war. In 1952, there were 1,649 civilians residing in Suomenlinna, which is the highest number in the history of the islands. During this time, apartments for workers of the Valmet shipyard were built in Länsi-Mustasaari.

Until 1973, Suomenlinna served as garrison, but military occupation ended and the islands were taken over by civilian administration. Since 1963, Suomenlinna has become a tourism and recreation center and home for around 850 people. In 1991, UNESCO accepted Suomenlinna as a world heritage site.

Today 6km of wall and 190 buildings are preserved and Suomenlinna is one of the largest maritime monuments worldwide. Today, the Naval Academy is still operating on Pikku Mustasaari and educating around 250 soldiers per year.
1.4 THE ENVIRONMENT

Suomenlinna is a unique combination of historical and natural landscapes. But before being civilized, the islands of Suomenlinna were virtually treeless. The lime falling off buildings over time made the soil fertile for trees and other plants to grow. Today Suomenlinna’s nature is full of variety. The rousing waves of the open sea are blazing against the rocky shores, which on some secret corners of the islands form bays padded with sand. The granite cliffs rise and fall along the coastline where seagulls are gather and the view towards the center of Helsinki gives a feeling of closeness to the urban lifestyle. The exposure of the islands to the open sea makes it a windy and very humid location whereas the reflection of the sun on the water surface keeps the rain clouds away. The tunnels of the fortress form hills, covered with grass and only the ventilation pipes telling their secret. Small gardens in-between meadows and parks create diverse landscape zones.

Alli Sarrola is narrating her childhood at Suomenlinna in the book Linnoituksen iloiset lapset – Happy children of the fortress: "One cannot describe a childhood in Suomenlinna briefly. It was paradise. The sky, the sea and nature all around. The lovely trees, shrubs and flowers. There was nothing to fear, no broken beer bottles on the beaches where we went swimming. There were plenty of places to play: tunnels, shrubberies, and piles of leaves in the autumn."
1.5 Threats

Suomenlinna has had to face several man-caused and natural threats. The increased number of visitors – who have no boundaries of where to set foot around the islands – cause dangerous erosion to the landscape. The imbalance of visitors throughout the year also creates economic challenges. The number of tourists and visitors in summer is disproportionately high compared to winter. Another threat is the rise of sea level caused by global warming. Suomenlinna lies at sea level, which means a drastic change of landscape in case of rising waters. Furthermore, the harsh climate of the north sets Suomenlinna under extreme conditions. The weather can be rough on the open sea and the Ministry of the Environment stated a danger to docks, piers and bridges in case of high storm waves. Global warming causes the winters to be warmer and more humid and Suomenlinna might have to face the problem of mold and decay in wooden buildings and structures. Other problems are large vessels passing the islands; the resulting waves are eroding the fragile shoreline.

All these reasons together form a threat to Suomenlinna’s shore, which is mostly obvious at Kustaanmiekka. Looking at Suomenlinna’s shorelines, however, shows no prospective changes, according to the Helsinki City Planning Office.

1.6 The Visitors

Approximately 700,000 people are visiting Suomenlinna annually. Tourists from all over the world are exploring the sea fortress, which is considered one of Finland’s most interesting places to discover.

Suomenlinna is not only a tourist attraction, but also a recreation destination for residents of the surrounding area. In summer, the ferries are filled with people who want to escape the city life and are seeking a place to linger and enjoy nature. Equipped with picnic baskets and swimming gear, one can differentiate the urban population seeking recreation from the tourists. The favorite place for these visitors is the sandy beach at Kustaanmiekka. Despite the cold water of the Baltic Sea, the Finns are eager to seek sun on the rocky shore and enjoy the cooling breeze from the open sea on hot summer days.

In winter, Suomenlinna tries to attract visitors with activities, art markets and concerts during the Christmas season. Even some tourists find their way to the snow and ice-covered sea fortress. One can even walk from the shore of Helsinki over the meter thick ice covering the sea towards the islands, which is an attraction by itself.

The high amount of visitors also bears a high risk for nature. No boundaries are set for people when walking. Every part of the islands is accessible to everybody (except the prison area). Climbing on slippery cliffs or the high waves of passing cruise ships might present a danger to visitors. But also this free movement is a risk to nature and the historic buildings. People can climb up and discover most of the fort and canons, which are not supervised by any authorities. As a UNESCO world heritage site, one would expect explanatory signs for each part of the fortification, which might lead to more respect and understanding for the value of such a place.

The number of visitors is increasing annually, which is a threat to nature on one hand, while on the other hand, they are important stakeholders for education and cultural travel.
1.7. Living in Suomenlinna

Suomenlinna counts around 850 residents, the majority of whom live in 330 rental apartments. The Defence Administration Construction Establishment rents one third of these apartments to the Defence Force staff. Becoming a tenant is not easy, since the amount of living space is limited and an apartment seldom becomes available. Once in the selection process, the Governing Body tries to evaluate the tenant’s assets to the fortress; people who can ensure the livability and preserve the value of the UNESCO site are preferred."

The Governing Body of Suomenlinna provides the residents the possibility to regularly give feedback about their satisfaction. Residents can also participate in the municipal election to be a representative on the Board of Suomenlinna. Amongst others, “Suomenlinna-seura” is an association of residents.

The residents of Suomenlinna have disadvantages caused by the high amount of visitors when it comes to the noise level and damage, but also a high advantage: visitors ensure the inhabitants of the islands steady jobs, especially in summer season. The amount of services has also risen, which is a high benefit for the locals.

Services and their Seasonality in Suomenlinna

<table>
<thead>
<tr>
<th>Services</th>
<th>Summertime</th>
<th>Year-round</th>
</tr>
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<tbody>
<tr>
<td>Cafes and Restaurants</td>
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<td>5</td>
</tr>
<tr>
<td>Shops and Kiosques</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Other services (school, kindergarten, library, gym...)</td>
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<td>4</td>
</tr>
<tr>
<td>Museum and Exhibition Space, Theater</td>
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<td>2</td>
</tr>
<tr>
<td>Conference and Banquette Facilities</td>
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</tr>
<tr>
<td>Office and Work Space, Storage Space</td>
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<td>90</td>
</tr>
<tr>
<td>Office and Work Space</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Storage Space, Boat Sheds, Technical Space</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Empty (undergoing renovation)</td>
<td>148</td>
<td>134</td>
</tr>
</tbody>
</table>

1.8. The Community of Suomenlinna

Living on an island builds a strong bond amongst the residents of Suomenlinna. It is like living in a small village – everybody knows each other. The closeness of Helsinki gives the possibility of a big city life, while the services provided at the islands fulfill the basic needs of the people. It is a life in a capitol city, but still remote.

Getting an apartment at Suomenlinna is challenging. The Governing Body of Suomenlinna favors people who can serve and maintain the fortress. They look for and believe “A versatile population, consisting of different age groups, social groups and professional groups, best serves the objective of maintaining the community structure characteristic of the old garrison town”. This versatility makes the community so special. Artists are living next door to doctors, young families are living under the same roof as elderly couples. Everybody has something to give to the community.

A woman who has been living in Suomenlinna since 1945 describes the community: “This is a very comfortable community. We share our joys and sorrows here. You can be alone if you want, but you won’t feel lonely here. Helpful neighbors and friends is a given at Suomenlinna. We sometimes talk of the disturbance caused by tourists. Young people previously thought there was a party every weekend at Suomenlinna similar to the May Day celebrations. We celebrate that, too – once a year. This is what we share.”
Suomenlinna lies at earth’s 60th latitude in the hemi boreal zone, which is characterized by warm summers and freezing winters. The reasons why Helsinki has a warmer climate than other cities in this latitude are the Baltic Sea and the airflow from the Atlantic Ocean, warmed by the Gulf Stream. The weather can change very rapidly, especially in winter, since Helsinki lies in a zone where tropical meets polar air mass.

Being situated that far in the north results in long days in summer and short days in winter. The winters can be very dark since in addition to the low sun, it is also very cloudy at that time of the year.

Climate data for Helsinki:

<table>
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<tr>
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<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>Average high °C</td>
<td>-1.3</td>
<td>-1.9</td>
<td>1.6</td>
<td>7.6</td>
<td>14.4</td>
<td>18.5</td>
<td>21.5</td>
<td>19.8</td>
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<td>3.7</td>
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<td>6.3</td>
<td>10.9</td>
<td>14.2</td>
<td>13.1</td>
<td>8.7</td>
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<tr>
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<td>10.2</td>
<td>14.6</td>
<td>17.8</td>
<td>16.3</td>
<td>11.5</td>
<td>6.6</td>
<td>1.6</td>
<td>-2.0</td>
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Sun altitude:

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<th>Mar</th>
<th>Apr</th>
<th>May</th>
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<tr>
<td>Sun altitude °</td>
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<td>30</td>
<td>41</td>
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<td>53</td>
<td>50</td>
<td>41</td>
<td>30</td>
<td>19</td>
<td>9</td>
<td>7</td>
<td>30</td>
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</tbody>
</table>

Sunshine hours:

<table>
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<tr>
<th>Month</th>
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<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
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<tbody>
<tr>
<td>Sunshine h</td>
<td>38</td>
<td>70</td>
<td>138</td>
<td>194</td>
<td>284</td>
<td>297</td>
<td>291</td>
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<td>150</td>
<td>93</td>
<td>36</td>
<td>29</td>
<td>1,858</td>
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Snowfall:

<table>
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<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
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<tbody>
<tr>
<td>Snowfall cm</td>
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<td>24</td>
<td>15</td>
<td>0.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>72</td>
</tr>
</tbody>
</table>
1.0.2 Snow

Snow and ice have a very strong impact on Suomenlinna. Temperatures go below 0 in November and the ground starts to freeze. Snowfall can start very lightly in some years and very heavily in others, covering everything under a white blanket. The water of the Gulf of Finland starts freezing around December. Last time it was completely frozen was in 2003. The area of the Helsinki harbor towards Suomenlinna is frozen every year, which would make it possible to walk to Suomenlinna on the thick layer of ice, but to reach the harbor, the big cruise ships have to break the ice on the east side of Suomenlinna. Around April, Suomenlinna starts to be snow and ice free again.

1.4.3 Seasons

The length of seasons in Suomenlinna can vary greatly from year to year. The temperatures can also greatly vary every year. The temperature differences of the seasons can be very high, from -30°C up to 30°C. The ecosystem, people and their homes have to adapt to these conditions.

Spring

In the southern region around Suomenlinna spring begins in April, when the temperatures start to rise above 0°C and snow and ice start melting. The coolness of the sea extends the duration of spring around Suomenlinna, from 45 days on the inner mainland of Finland to up to 65 days. The growing cycle of the plants starts when the temperature exceeds 5°C, around one month after spring has begun. The time it takes until the snow melts depends on the amount of snow. Usually snow and ice thaws quicker on Suomenlinna than on the mainland due to the humid maritime climate, however, the absence of traffic slows down the melting process in comparison to the city.

Summer

Summer starts around June. The altitude of the sun rises and the sun does not seem to set around Midsummer at all, when the longest day is 19 hours long. The hottest time of the year is around the end of July, when the temperature can climb up to 30°C.

Autumn

In southern Finland, autumn starts in September. In late October or early November the temperature drops below 5°C and plants are at the end of their growing cycle, which typically lasts around 140-175 days. In these last warm days of the year, innumerable migratory birds fly over Suomenlinna.

Winter

Winter is the longest season in Finland. Winter in Helsinki usually starts in late November and lasts until late March, which means a total of 5 months. The temperature can go from -25° down to -30°C and the blistering wind can make it feel even colder. The shortest day in winter is only 6 hours. During this time of the year, the sky is covered with snow clouds which darken the days even more. The coldest days are in the beginning of February, when the sky starts to be brighter again.

The low temperature, ice, snow and wind are
the biggest threats and challenges for the buildings of Suomenlinna. An average amount of 20 cm of snow is falling per winter month and the ocean around Suomenlinna is covered with a thick layer of ice.

1.4.4 The Gulf of Finland

Suomenlinna lies in the waters of the Gulf of Finland, which is a mixture of ocean water and fresh water brought by numerous rivers, which results in a very low salinity. The ecosystem of the Gulf of Finland is very sensitive. Pollution by industry, agriculture, atmosphere and poor wastewater management has taken a toll on the ocean’s natural ability to clean itself, which forces aquatic species to live at their limits of tolerance.

Suomenlinna is situated in this weak ecosystem. 80 ha of its perimeter is water. In these waters lies not only a unique and protectable aquatic ecological system, but also historical relics of great value which have been studied by the Maritime Archaeology Unit of the National Board of Antiquities. 22 to 44 wrecks of various ages, 18 submerged structures and 13 individual underwater relics are stranded in the deep waters around Suomenlinna. In the northwest of Länsi-Mustasaari lies a relic of national importance: A defense structure of wooden coffer dams and ships sunken amongst them, dating back to the 19th century.

The sea level of the Gulf of Finland varies regionally. The sea level records on the Finnish coast are +151 cm.

In winter, the water in the Gulf of Finland freezes. Due to its salinity, the ice is weaker than freshwater ice. The greatest ice cover is between January and March. In some years the entire Gulf of Finland freezes; the last time this occurred was in 2010.

<table>
<thead>
<tr>
<th>Station</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Observations since</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helsinki</td>
<td>+151 cm</td>
<td>-93 cm</td>
<td>1904</td>
</tr>
</tbody>
</table>
The building site is located on the island of Länsi-Mustasaari, which means the "west black island". It is located northwest of the island compound. A bridge connects it with Pikku Mustasaari, which is also connected to Iso Mustasaari.

Länsi-Mustasaari is the most loosely built island of the compound. Only eight buildings are located on the isle. A number of fortification tunnels and bunkers blend into the insular landscape. On the northwest coastline, cannons which used to protect the fortress from intruders still stand. The shoreline is jagged by granite cliffs which rise from the sea.

Arriving by ferry at Iso Mustasaari, the signs lead the visitors along the main route towards Susisaari and Kustaanmiekka. The visitor’s map clearly shows them the direction to walk. A blue path along numbered attractions leads them towards the King’s Gate. Not many tourists cross the bridge in the west towards Pikku Mustasaari and Länsi-Mustasaari seem to be taken out of the picture of interest. The military appearance of Iso Mustasaari might scare the visitors off and dissuade them from exploring the west of Suomenlinna further.

At the building site of around 500m², the residential houses E16 and E17 with ten small apartments are located. The Governing Body of Suomenlinna stated a need of more living space at this site. The buildings will be demolished to give space for residential housing for at least 50% more square meters, a total of 750m².

At the moment approximately 850 people are living in Suomenlinna. Most of the residential buildings were not originally built as apartments, but as military stations or barracks. They were converted into housing in the 19th century. At that time, there was a smaller demand for living space than today. This results in residents moving away from Suomenlinna due to the need for more living space. The movement has to be stopped and a design solution has to be figured out in this thesis. Housing for a new generation will be the design task.

The threshold of this building site is very delicate. Located on a UNESCO world heritage site, the building site is bound to certain rules and limitations. The fact that the building site is located on an island in the Gulf of Finland, which is constantly exposed to the harsh northern climate, is a special challenge in the design task.

The site is located in a bay with Pikku Mustasaari on the opposite site. The shore is moored with granite rocks against the forces of tides. A small wooden pier lies in between the two buildings and serves as a fast and safe way into the refreshing water for visitors of the public sauna. Between the bridge and building E16 lies a small harbor. A wooden pier connects several boats to the shore. In winter the boats are hauled on land and stored on different places at the island. Some can be found at the mainland of the harbor and some in front of storage buildings.

Although Suomenlinna faces strong winds, the site is almost windless. The reason for this is the tunnel system, which forms hills and blocks the wind.

Big cruise ships such as Viking Line and Silja Line pass Suomenlinna on their way to the harbor of Helsinki, which offers a unique sight.
2.1 The buildings of Länsi-Mustasaari

There are no street names in Suomenlinna. The buildings have been given numbers. Every island has its own letter of identification:

Kustaanmiekka A (1-32)
Susisaari B (1-79)
Iso Mustasaari C (1-106)
Pikku Mustasaari D (1-26)
Länsi-Mustasaari E (1-29)
Särkkä F (1-11)
Lonna H (1-8)
Pormestariniuodot G (1)
E1: Battery 4 (temporary ground battery)

This pentagonal structure, erected in 1869, was used as an ammunition cellar. It is built of roughly hewn granite and filled with red brick. Until 1878, there was a zinc roof; however, it was removed and the structure was covered with earth to blend into the landscape so enemies from above could not see it. Today it is used as storage and is overgrown by grass, which makes it only visible as a building structure from the front façade. An old wooden door keeps intruders away.

E2: Battery 3

This totally overgrown and demolished tunnel was used as ammunition storage at battery 3 and was built in 1869. Just as with E1, the zinc roof was dismantled in 1878 and covered by soil. In the Finnish era of Suomenlinna it was used as storage. Nowadays there seems to be no access to the storage facility anymore.

E3: Barracks/Residential Building

E3, E4 and E5 are the landmark of Länsi-Mustasaari. Crossing the bridge from Pikku Mustasaari, these three buildings form a courtyard and welcome the visitor. Their bare, pale yellow plastered brick façade, heavily fretted by the salt of the sea, the massive exterior walls and the grey windows of the three residential buildings form a unity.

E3 was built from 1757-1760. It served as a barrack and was part of the plan of a service center on Länsi-Mustasaari. The courtyard should form a hospital yard, but due to the damage during the Crimean War bombardment, the original plans had to be changed. The former arched windows, which can still be seen in E4, were changed to a rectangular shape.

In the Russian era the building was used to accommodate troops and it held a large kitchen, a dining room and workshops. After the building served as prison camp from 1918-1919, it was used to quarter troops again by the Defence Forces. In 1947, the building was renovated to accommodate Valmet workers. Ever since it has been used as residential building.
E4: Residential Building

The first and second floor of this residential building has, in contrast to E3 and E5, rectangular-shaped windows, but the top floor has slightly arched windows. Two vertical rows of windows have been filled up with bricks and just the outlines tell the former appearance of the windows.

Along with buildings E3 and E5 it was part of a service center plan and would have closed up the hospital yard, which explains its unusual asymmetrical shape. Constructed from 1759-1761 it was used to house officers; from 1815 on, it housed Russian officers. In 1918, it housed Prison District II and a physician’s consulting room and was taken over afterwards by the Defence Forces and used as barracks. From 1949, E3 Valmet workers resided there and it is still a residential building today, administered by the Governing Body of Suomenlinna.

E5: Barracks/Residential Building

E5 is the northernmost of the three buildings of the barrack yard and, like E3 and E4, is a three storey building with simple elevations. It has no foundation or basement and was directly erected on bedrock.

Built from 1756-1761, it was used as a troop barrack and from 1810 on, it housed a hospital. Like the other buildings of the courtyard, E5 was used as a prison barrack in 1918. After renovation work in 1949 by Valmet Oy, it was used as a residence for its workers. Just like the other buildings of Suomenlinna, the Governing Body of Suomenlinna is taking care of the building now and after being reconditioned in 1993, it is currently used as a residential building.

E6: Storage

Although not marked in the official map of the Governing Body of Suomenlinna anymore, the storage building E6 has not been demolished and can still be found hidden behind building E4. Like the other storages, it is made of roughly hewn granite filled with red brick, which forms an arch above a wooden door.
**E7: Tessin-Gyllenborg curtain**

This elongated wall building is made of roughly hewn granite and demolished parts were filled up with red brick. Wooden doors cover the storage, and contrary to the other storages, the roof is not covered with soil and grass.

Constructed from 1749-1751, this building was used to connect battery 1 and 2. It had ten casemates, which were used as powder stores and a firing platform was on top of the curtain. During the Russian Period in 1827, a kitchen with stoves and ranges was built into five of the casemates, which were demolished in 1877. The space was turned into a storehouse and still serves this function until today.

**E8: demolished**

**E9: Sauna**

The sauna building is made of red brick and a concrete base and is covered with a green roof.

It was built in 1949 by plans of Heikki Sysimetsä, who hoped the appearance of the building with its turf roof would connect it into the historic setting. Besides a sauna, the building houses a laundry and an apartment. The heating for the whole island of Lånsi-Mustasaari is housed here. It was renovated in 1988 and reconditioned in 1994.

**E10: demolished**

**E11: Military Courthouse/Residential Building**

This yellow and red wooden building next to the water is hidden behind a wall of trees. It is made of logs which are cladded with a wooden façade.

It was built in 1875 as a rifle cartridge production laboratory. Renovated in 1885, it was used as courtroom with chambers, a witness’ room and lobby. In 1897 it housed a pharmacy and a surgeon’s consulting and waiting rooms. Before WWI, it was used
as troop accommodation and from 1918-1919 it was home to German troops and civilian guards. This lasted until the Finnish era when it became a residential building housing two apartments. The last renovation was in 2004 and now it is one apartment.

**E12: Bakery/Residential Building**

The massive, yellow-plastered brick building with its granite foundation has a similar appearance to E3-E5.

Built in 1762, the building was part of a planned service center, which was to include a bakery, brewery and distillery. The building which can be seen now is only one third of the originally planned bakery. The bakery was located on the ground floor, with a storage space in the basement and accommodations in the second and third floors. During the bombardment of the Crimean War in 1855, the roof and windows were heavily damaged. After renovation, the building was used residentially. From 1918-1919 Finnish and German troops lived in the former bakery. It later became a barrack for Defence Forces and was used as staff housing after renovation work from 1949-51. The bakery room was used as a clubroom and gym for residents.

The Governing Body of Suomenlinna, which renovated the building in 2003, combined small apartments into seven larger ones and tried to preserve the 1950s appearance.

**E13: District Heating Tunnel**

Beneath a massive granite rock foundation lies the entrance to a tunnel which connects the island with the mainland. Under the island of Särkkä it leads all the way to Kaivopuisto, a park in the south of Helsinki.

It was designed by Maa ja Vesi Oy and built from 1978-1980. The tunnel lies 63m below sea level, is 4m wide and high and 1.300m long. Suomenlinna’s district heating, water and sewage pipes as well as its telephone cables run through the tunnel, which can only be used by service vehicles due to its narrowness.
E14: Caponniere Löwen/The Mine Classroom (Miinaluokka)

Camouflaged as a grassy hill on the island of Tallholmen, northeast of Länsi-Mustasaari, this part of the fortification currently contains teaching facilities for the Naval Academy.

Originally built from 1753-1756, the caponniere Löwen was replaced in 1826 with a powder magazine (after being demolished). The danger of explosion made this a perfect location, far enough away from other buildings. In the 1950s, the building’s use was changed into a training facility called “The Mine Classroom” until the 1970s. The high ceiling was divided into two storeys and the space was used as shooting ranges by the Naval Academy staff and storage. In 1984, the building was connected to the district heating.

This building is still administered today by the Ministry of Defence.

E15: demolished

E16: Cabin

This one storey wooden building painted in light blue was erected in 1962. Planned by Puutalo Oy, it was originally meant as temporary accommodation for workers of Valmet Oy. After renovation works in 1987 by Tapani Launis, today it serves as temporary accommodation for inhabitants of Suomenlinna during the time when their apartments undergo construction work.

E17: Cabin

This cabin was built in 1965 and is a twin building to E16.

The Governing Body of Suomenlinna administers both buildings E16 and E17.

E18 – E19: Ammunition Store/Battery 1

This red brick building blends into the surrounding with its grassy roof.

It was built in 1867 as a powder magazine for E20-E25 and was renovated in 1876, when it was covered with soil. What can still be
seen today is a concrete emplacement, decayed with time, on top of the cellar, which was used as storage.

**E20 – E25: Battery 1**

An unimposing granite tunnel under a grass-covered hill reveals the dilapidated battery E20. On top of the vault, an imposing cannon on a movable steel reel still stands.

The battery, built from 1863-1868, consists of a firing platform with two mortar positions on its end, linked by a subjacent granite vault. E21-E25 were used as troop shelters, built in the 1870s.

**E26: Powder Magazine/Battery 2**

Though not displayed on the official map of Suomenlinna, you can still find this building. It is built of granite which is filled up with red brick in the middle part of the front wall. Five locked doors keep the secret of today’s use of the building. The turfed roof used to hide a powder magazine (like E27).

**E27: Battery 2**

A pentagonal roof, covering granite walls and red bricks surrounding the entrance, is covered with turf and cannot be seen from above.

Battery 2 was constructed in 1868 as an ammunition store. It was used as storage during the Finnish era. In the 1880s, it was reconstructed with a stone wall and its appearance remains the same today.

**E28 - E29: Battery 3**

Buildings E28 and E29 are round, curved bunkers of massive concrete with heavy rusty steel doors.

Battery 3 was constructed as gun positions on top of the bastion Tessin during the Crimean War. From 1900-1901 troop shelters were built between the gun positions.
2.2 Neglected places

The northwest side of Länsi-Mustasaari calls for development. No residential buildings can be found here - only the old walls of the fortification and canons tell the history of this place. The condition of these parts of the fort is poor. Dilapidated tunnels and decaying staircases silently lie here in the hidden part of Suomenlinna and scream for maintenance. A site which is so valuable to mankind that it has become a UNESCO world heritage site calls for more attention in all parts of the fortress.

A small, abandoned sandy beach on the north side of the islands would offer a great opportunity to linger and enjoy the view towards the city, if maintained. Another beautiful and unique place is the coastal shore on the west of Länsi-Mustasaari. The round rocks form a hidden bay protected from wind. This beach could attract as many visitors as the beach at Kustaanmiekka, but only a few people know this secret place and enjoy hot summer days there.

2.3 Views

In the east, Länsi-Mustasaari is positioned on the opposite site of Pikku Mustasaari, which grants views towards the military buildings and their actions. On the southeast side lies Susisaari with its marina. Towards the north lies Helsinki. The white church, town hall and the harbor with its big cruise ships are clearly visible from the northernmost part of Länsi-Mustasaari. Although separated by the ocean, the view gives the feeling of closeness to the city life. Towards the south and west of the islands lies the open sea. No island stands in between Suomenlinna and Estonia.

The terrain towards the west is banked up with soil, under which the tunnels of the fortification lie. On one hand, this blocks the view towards the southern and western shore, but on the other hand, protects the buildings from the wind of the open sea.
2.4. Accessibility

Arriving by ferry on Iso Mustasaari, a wooden bridge leads the way to Pikku Mustasaari, which is further connected to Länsi-Mustasaari. The street pavement on Iso and Pikku Mustasaari consists of rough granite cobblestone. Länsi-Mustasaari’s streets, courtyard and paths are gritted with sand and gravel. This results in limited accessibility by wheelchair. However, not only people with limited mobility have their difficulties getting around. Visually impaired people face the risk of falling over the unsteady terrain.

Bicycles are an important form of transportation to the residents of Suomenlinna for getting around the islands. Counting the bicycles in the yard of the residential compound E3-E5 shows approximately one bike per resident. Plenty of racks for parking the vehicles in summer have been built.

Cars can also be found on Länsi-Mustasaari at a parking place behind E12. To reach the island by car, residents have to cross the sea with either the ferry, which goes from either Kauppatori or Katajanokka.

2.5. The Residents

The bond between the residents is strong. In summer, they play parlor games in between the little gardens where some people harvest their self-planted vegetables and others have barbecue. Children play games together in the courtyard or at the small playground next to the bridge.

The public sauna is a meeting point for the community and an important part of Finnish culture, not only in cold winter days.
Lifestyle

Setting foot on Länsi-Mustasaari makes you realize immediately the care that the community takes of their island. Planting pots with blooming flowers on all sides of the courtyard welcome the visitors. Although the façades of the residential buildings E3-E5 do not show any embellishments or the love of the residents for their home, it can be seen on so many other places of the island. Behind the housing compound, a little blooming paradise can be found. Small gardens are set between the rocky shore and the buildings. Although no fences are put up, the border of every little yard is clearly visible. Garden furniture and barbecues are set between vegetables, fruits, flowers and trees. This unique and surprising atmosphere makes one want to explore the variety of the different gardens.

The residents have chosen their own piece of nature freely. The size of the little gardens seems to vary. Some yards are attached to historical parts of the fortification, which makes the setting even more unique. The grass is accurately cut in summer, and in autumn, the residents take care of the falling leaves and prepare their plants for the harsh winter.

The residents have overtaken the historic buildings of Länsi-Mustasaari. The ones which are not usable for housing purposes are used as storage facilities. The responsibility of maintaining the historic buildings lies with the Governing Body of Suomenlinna. Although the residents do not have any permission to change the outward appearance of their homes, some try to soften the harsh look of the former military building by hanging flowers onto the façade, which can be seen on E16 and E17.
3. Survey

To evaluate the current situation and needs of the residents of Suomenlinna I made an online survey, in which 86 residents participated. The questions try to figure out the residents’ satisfaction with their current living situations at Suomenlinna. To be able to create sustainable architecture, the first step is to listen to its residents.
### How Many People Live in Your Apartment?

<table>
<thead>
<tr>
<th>Number of People</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16.00%</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>33.30%</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>13.60%</td>
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</tr>
<tr>
<td>4</td>
<td>23.50%</td>
<td>19</td>
</tr>
<tr>
<td>&gt;5</td>
<td>13.60%</td>
<td>11</td>
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### How Big Is Your Apartment?

<table>
<thead>
<tr>
<th>Size (m²)</th>
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</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>4.00%</td>
<td>4</td>
</tr>
<tr>
<td>40-60</td>
<td>21.00%</td>
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</tr>
<tr>
<td>60-80</td>
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</tr>
<tr>
<td>&gt;100</td>
<td>22.20%</td>
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</table>

### Which Is Your Favorite Room?

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<tbody>
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<td>Living room</td>
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<td>45</td>
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<tr>
<td>Bedroom</td>
<td>7.40%</td>
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<tr>
<td>Kitchen</td>
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<tr>
<td>Other (please specify):</td>
<td>12.30%</td>
<td>10</td>
</tr>
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### Do You Like Your Apartment? If Not, Why?

<table>
<thead>
<tr>
<th>Reason</th>
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</thead>
<tbody>
<tr>
<td>Yes, I like it as it is</td>
<td>35.00%</td>
<td>48</td>
</tr>
<tr>
<td>Too small rooms</td>
<td>5.10%</td>
<td>7</td>
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<tr>
<td>Not enough windows</td>
<td>4.40%</td>
<td>6</td>
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<tr>
<td>No balcony</td>
<td>3.60%</td>
<td>5</td>
</tr>
<tr>
<td>Outdated layout</td>
<td>11.70%</td>
<td>16</td>
</tr>
<tr>
<td>No ocean view</td>
<td>3.60%</td>
<td>5</td>
</tr>
<tr>
<td>Poor indoor ventilation</td>
<td>8.00%</td>
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</tr>
<tr>
<td>Apartment is cold in winter</td>
<td>10.90%</td>
<td>15</td>
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<tr>
<td>Apartment is hot in summer</td>
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<td>6</td>
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<tr>
<td>Other (please specify):</td>
<td>13.10%</td>
<td>8</td>
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### Is There Anything You Would Like to Change in Your Apartment?

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<td>19</td>
</tr>
<tr>
<td>Size</td>
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<td>Layout</td>
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<tr>
<td>Price</td>
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<td>Location</td>
<td>3.80%</td>
<td>3</td>
</tr>
<tr>
<td>Other (please specify):</td>
<td>28.30%</td>
<td>30</td>
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### Why Is It Your Favorite Room?

<table>
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<th>Percentage</th>
<th>Count</th>
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<tbody>
<tr>
<td>Size</td>
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<tr>
<td>Big windows</td>
<td>14.30%</td>
<td>22</td>
</tr>
<tr>
<td>Ocean view</td>
<td>18.80%</td>
<td>29</td>
</tr>
<tr>
<td>Many functions combined</td>
<td>20.80%</td>
<td>32</td>
</tr>
<tr>
<td>Untypical layout</td>
<td>6.50%</td>
<td>10</td>
</tr>
<tr>
<td>The use of materials</td>
<td>4.50%</td>
<td>7</td>
</tr>
<tr>
<td>Other (please specify):</td>
<td>13.00%</td>
<td>20</td>
</tr>
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</table>

### Do You Work From Home?

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>6.20%</td>
<td>5</td>
</tr>
<tr>
<td>No</td>
<td>51.90%</td>
<td>42</td>
</tr>
<tr>
<td>Sometimes</td>
<td>42.00%</td>
<td>34</td>
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</tbody>
</table>
Would you share facilities that you do not use daily (sauna, workshop, storage...) with your neighbors?
- Yes: 65.00% (52)
- No (please specify): 35.00% (28)

Do you feel as part of a community in Suomenlinna?
- Yes: 93.50% (72)
- No: 3.90% (3)
- Please specify why: 2.60% (2)

Should there be more apartments in Suomenlinna?
- Yes: 41.90% (21)
- No (please specify): 58.10% (43)

What was the reason for you to move to Suomenlinna?
- Location: 15.80% (27)
- Living on an island: 17.50% (30)
- Peaceful living in the capital: 20.50% (35)
- No traffic: 10.50% (18)
- Price: 6.40% (11)
- Neighbourhood: 7.00% (12)
- Other (please specify): 22.20% (38)

What would be a reason to leave Suomenlinna?
- A bigger rental apartment: 7.50% (6)
- The possibility of buying property: 7.50% (6)
- The convenience of a city life: 27.50% (22)
- Expanding family: 1.20% (1)
- Rising sea level: 6.20% (5)
- Other (please specify): 50.00% (40)

What is missing in Suomenlinna?
- Services: 37.50% (51)
- Tunnel connection usage for inhabitants: 11.80% (16)
- Bridge to Helsinki: 0.70% (1)
- More apartments: 8.80% (12)
- Community building: 15.40% (21)
- Private gardening possibilities: 6.60% (9)
- Other (please specify): 19.10% (26)

How important is sustainable living for you?
- Very important: 50.60% (39)
- Important: 42.90% (33)
- Not important: 1.30% (1)
- What is sustainability: 5.20% (4)
IF SO, IN WHAT WAY DO YOU LIVE A SUSTAINABLE LIFESTYLE?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don't</td>
<td>0.00%</td>
<td>0</td>
</tr>
<tr>
<td>Use of sustainable materials (like wood)</td>
<td>13.40%</td>
<td>39</td>
</tr>
<tr>
<td>Recycling</td>
<td>22.90%</td>
<td>67</td>
</tr>
<tr>
<td>Buying local goods</td>
<td>11.00%</td>
<td>32</td>
</tr>
<tr>
<td>Keeping CO2 emissions low (ex. bicycle instead of car)</td>
<td>15.10%</td>
<td>44</td>
</tr>
<tr>
<td>Planting own food</td>
<td>3.80%</td>
<td>11</td>
</tr>
<tr>
<td>Saving electricity</td>
<td>18.80%</td>
<td>55</td>
</tr>
</tbody>
</table>

WHAT IN YOUR OPINION IS PART OF SUSTAINABILITY?

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>13.00%</td>
<td>36</td>
</tr>
<tr>
<td>Society</td>
<td>16.70%</td>
<td>46</td>
</tr>
<tr>
<td>Environment</td>
<td>20.30%</td>
<td>56</td>
</tr>
<tr>
<td>Culture</td>
<td>13.80%</td>
<td>38</td>
</tr>
<tr>
<td>Politics</td>
<td>10.90%</td>
<td>30</td>
</tr>
<tr>
<td>Equity</td>
<td>8.00%</td>
<td>22</td>
</tr>
<tr>
<td>Education</td>
<td>14.10%</td>
<td>39</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>3.30%</td>
<td>9</td>
</tr>
</tbody>
</table>

IF YOU COULD CHOOSE A BUILDING MATERIAL FOR YOUR HOME, WHICH ONE WOULD IT BE?

<table>
<thead>
<tr>
<th>Material</th>
<th>Percentage</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>57.60%</td>
<td>57</td>
</tr>
<tr>
<td>Brick</td>
<td>31.30%</td>
<td>31</td>
</tr>
<tr>
<td>Concrete</td>
<td>7.10%</td>
<td>7</td>
</tr>
<tr>
<td>Steel and glass</td>
<td>4.00%</td>
<td>4</td>
</tr>
</tbody>
</table>

WHAT WISHES DO YOU HAVE ON A NEW RESIDENTIAL BUILDING IN SUOMENLINNA?

<table>
<thead>
<tr>
<th>Wish</th>
<th>Percentage</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>The design should respect the Finnish building tradition of the island</td>
<td>31.40%</td>
<td>50</td>
</tr>
<tr>
<td>More spacious apartments</td>
<td>7.50%</td>
<td>12</td>
</tr>
<tr>
<td>Private outdoor space</td>
<td>8.80%</td>
<td>13</td>
</tr>
<tr>
<td>Including the shoreline to the design</td>
<td>10.10%</td>
<td>16</td>
</tr>
<tr>
<td>Many small buildings instead of one big size block</td>
<td>10.70%</td>
<td>17</td>
</tr>
<tr>
<td>Advantages for the neighboring buildings (use of new piers, sauna, community building,...)</td>
<td>14.50%</td>
<td>23</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>17.00%</td>
<td>27</td>
</tr>
</tbody>
</table>
3.1 Survey Evaluation

The survey gives clear answers to the needs and satisfaction of Suomenlinna’s residents.

The size and people per household seem to vary from single to family apartments and from 40m² to over 100m². The majority of people like their apartments as they are, but some would like a balcony, which seems to be a rare feature at Suomenlinna. The favorite room is the living room because of the size, ocean view and combination of many functions. If there is anything to be changed it would be the layout, size and price of the apartment. The majority of residents do not work from home, or at least rarely. The reason why people moved to Suomenlinna varies. Most of them stated the advantage of peaceful living in a capital city, others living on an island or the location in general. The main reason why people would leave Suomenlinna is the convenience of a city life. Bigger rental apartments and the possibility of buying property come as a second reason. Some residents are aware of the threat of a rising sea level and stated this as a possible reason to leave Suomenlinna.

The question of what would be the ideal building material for a home was clearly answered with woo, by 57.6% of participants. The residents’ main wish for a new residential building in Suomenlinna is that the design should respect the Finnish building tradition of the island. An advantage for the neighboring buildings (like the use of new piers, sauna or a community building) is welcomed by 23 participants.

The question of what is missing in Suomenlinna was clearly answered with services. A bridge to Helsinki is not wished, but the use of the service tunnel for residents would be welcomed. Almost all residents feel like part of the community in Suomenlinna and a community building seems to be a wanted feature to unite the residents. Some people also stated the wish for private gardening possibilities. An important outcome of this survey is that the residents are willing to share facilities that are not used daily, like sauna, workshop or storage, with their neighbors.

The opinions about the need of more apartments in Suomenlinna differ. The reason for this might be the fear that too many people would move to the islands and that the uniqueness of the surroundings and the community would change. That is why it is so important to include the residents in the new design and place focus on social sustainability. Sustainability is an important factor for almost every resident in Suomenlinna: 93.5% stated it was very important or an important part in their lives. None of the respondents answered that they would not like to live a sustainable lifestyle. The majority implements their green lifestyle in recycling, saving electricity and trying to keep CO₂ emissions low, for example, by using a bicycle instead of a car. 39 participants use sustainable materials like wood and 11 of the 86 respondents grow their own food.

To find out about their understanding of sustainability, I asked their opinion on what is part of sustainability, knowing that there is no right or wrong answer. Economy, society and environment are commonly stated as the main pillars of sustainability, but so many more factors can play a role in the sustainable circle. Culture, politics, equity and education are a part of the network of understanding sustainability. The interesting outcome of this question is that 20.3% of participants answered that environment plays the biggest part in sustainability. Although society often seems forgotten in the eyes of the experts, the society itself (46 out of 86 people) answered that society plays a big role in sustainability.

The results of the survey show the importance of community and sustainability to the residents.
PART II
Let us dive deeper now into the topic of sustainability. What does it stand for, what does it mean, why is it so important and how can we make it work?

"Sustainability" is a very present word nowadays: sustainable food, sustainable clothes, sustainable appliances, sustainable design or sustainable architecture. But what does “sustainability” really mean? Allow me to cite today’s quickest source of information on the internet, Wikipedia, which states that “sustainability is the capacity to endure”. However, it can mean so much more. The word “sustainability”, “the ability to sustain” comes from the Latin word sustinere – to support (tenere – to hold; sus – up). “Sustain” can mean many things: to endure, to obtain, to conserve, to pursue, to maintain, to survive, to bear or to incur. It seems that sustainability has become an “in”-word; a word whose essential meaning is manipulated for self-serving or opportunistic ends. Not many people look behind the curtain of sustainability. A green roof does not make architecture sustainable. Regional food might be more sustainable than non-regional, but does this one factor make it a sustainable product? An apple which is shipped from New Zealand can have a better eco-balance in late spring than a regional apple, which consumes high energy for keeping it cooled from autumn until spring.

There is a lot more behind the word “sustainability”. The most used and cited definition comes from The World Commission on Environment and Development defining “sustainability” as “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

The concept of sustainability first occurred in 1972 in the article Blueprint for Survival, published in the journal The Ecologist with the words: “The principal defect of the industrial way of life with its ethos of expansion is that it is not sustainable. Its termination within the lifetime of someone born today is inevitable-unless it continues to be sustained for a while longer by an entrenched minority at the cost of imposing great suffering on the rest of mankind. We can be certain, however, that sooner or later it will end (only the precise time and circumstances are in doubt), and that it will do so in one of two ways: either against our will, in a succession of famines, epidemics, social crises and wars; or because we want it to—because we wish to create a society which will not impose hardship and cruelty upon our children—in a succession of thoughtful, humane and measured changes. We believe that a growing number of people are aware of this choice, and are more interested in our proposals for creating a sustainable society than in yet another recitation of the reasons why this should be done.” The authors Edward Goldsmith and Robert Allen are clearly stating that without a change in human behavior and excessive material consumption, the extinction of the human race will be inevitable.
In 1982 the United Nations declared the World Charter for Nature, with its five principles:

1. Nature shall be respected and its essential processes shall not be impaired.
2. The genetic viability on the earth shall not be compromised; the population levels of all life forms, wild and domesticated, must be at least sufficient for their survival, and to this end necessary habitats shall be safeguarded.
3. All areas of the earth, both land and sea, shall be subject to these principles of conservation; special protection shall be given to unique areas, to representative samples of all the different types of ecosystems and to the habitats of rare or endangered species.
4. Ecosystems and organisms, as well as the land, marine and atmospheric resources that are utilized by man, shall be managed to achieve and maintain optimum sustainable productivity, but not in such a way as to endanger the integrity of those other ecosystems or species with which they coexist.
5. Nature shall be secured against degradation caused by warfare or other hostile activities.

The United Nations followed up their principles at the 2005 World Summit, resulting in the three pillars of sustainability: ECONOMY, ECOLOGY and SOCIETY. These systems should function together as a whole into the indefinite future - without running out of key resources.

4.1 The pillars of sustainability

Sustainability is not a singular value, but consists of many factors which make it a whole. Like different notes create one harmony. There are many different diagrams about these factors, the so-called pillars of sustainability, and there are as many discussions around them. The Venn diagram by John Venn from 1880 corroborates the theory that three E’s - environmental protection, economic development and social equity - have to be in equal balance to achieve a sustainable wholeness. In this most common theory, all three pillars must be given equal weight to have a balanced sustainable system. The confluence of all three constituent parts results in sustainability. Combining only environment and economy is viable, economy and society equitable and society and environment bearable.
Another diagram is the *nested dependency model*. It shows that the pillars of sustainability are in a relationship with each other and are not of equal size. Economy is constrained by society, which is further constrained by environmental limits.

The environmental gear wheel can only turn with its functioning teeth, which are an intact ecosystem, habitat, energy, land, water, air and resources. If one tooth is missing or not fully intact, the wheel does not turn and an imbalance of the system occurs.

The second biggest wheel is society. Society has to understand the importance of living a sustainable life. People have to be educated and informed about sustainability to comprehend its gravity. That is why its teeth consist of education, culture and community as well as health, well-being and politics.

Economy is the smallest wheel, because it is constrained by society and environment. Economy ensures fair distribution and efficient allocation of available resources by providing long-term benefits. Its teeth are wealth, consumers, finance, and technology.

Many other diagrams can be found and one can argue the rights and wrongs of these illustrations. But instead of discussing existing material further, I would like to present my own image of sustainability.

I advance the view of seeing the sustainable system as a machine, as I see it as a process rather than a static outcome. The motor consists of three gear wheels: environment, society and economy. In my vision, these wheels are not of equal size, but their importance dictates their size. Environment is the main wheel. Without a functioning environment none of the other wheels will prevail, no matter how well they are functioning. If mankind exploits our planet’s resources, we do not have another planet as a backup. Earth is our only home, so we should do everything to keep its ecosystem intact and fight the current imbalance. Therefore, respecting the environment is of highest importance.
However, what is the role of the architect in the crusade for a sustainable lifestyle? The duty of the architect is to combine all factors such as durability, longevity, appropriate materials and sense of place. The goal of sustainable architecture is to guarantee the well-being of humans and to find architectural solutions to decrease the building’s impact on the global ecosystem. Future buildings have to be ‘energy conscious’, ‘eco friendly’ and ‘energy efficient’. A combination of values such as efficiency, cost, design, effectiveness and environmental friendliness constitute architectural sustainability. Sustainable architecture is defined as “the creation and responsible management of a healthy built environment based on resource efficient and ecological principles”. The aim of sustainable architecture is to lessen the impact on the environment during the entire lifecycle of the building through energy and resource efficiency. The aim of environmentally friendly architecture is the balance of occupants and nature. The location, climate, material and building practices have to be taken into account. Sustainable housing should embrace:

- Affordability
- Marketability
- Appropriate design
- Resource efficiency
- Energy efficiency
- Durability
- Comfort
- Health

4.1.1 Environment

The environment forms the strongest pillar of sustainability. After decades of destructing our planet, time is running out to fix the wounds humanity has created. By demanding more resources than the planet can provide, Earth compromises to sustain life. Already by the mid-1970s, humanity’s consumption had exceeded the resources our planet could reproduce. According to calculations of the Global Footprint Network, humanity now demands the resources of 1.5 Earths, heading to 2 Earths well before the middle of this century. The results of rising CO₂ emissions, deforestation, overfishing, extinction of species and pollution are degrading the earth’s ecosystem, which is on the verge of collapse. The climate is changing and populations are suffering under heat and cold waves, floods and tornados. This man-made chaos is a result of a mass of greenhouse gases which can no longer be absorbed by forests and oceans. Our time to push the brake ran out several years ago. All that is left is to seek damage control.

There are different ways architecture may respond to the growing environmental problems. To minimize our impact on the environment, we have to create a healthy place for living. The architect’s duty is to design and build in harmony with the environment, by planning for the right settings, using renewable resources, including alternate sources of energy and passive heating and cooling. The use of natural building materials such as wood, stone or rammed earth – which do not involve CO₂ emissions while being produced – is essential for a sustainable design. The impact on nature on site should be kept to a minimum. A sustainable home has to create a balance between its residents, the environment and ecosystem. By considering the existing topography, flora and fauna, the architect should minimize the impact of a building on its local ecosystem.
An environmentally friendly house should be energy efficient, which means that the building’s use of energy is minimized. The building materials should come from renewable resources and producing them should emit minimal CO₂. The shape of the building should always respond to its surroundings: the site and region, as well as the climate and available construction materials. The design of the building has to create a good atmosphere and the interior should enforce the occupant’s well-being by using non-toxic materials and providing a maximum of fresh air and natural light.

4.1.2 Economy

“Architecture is one of the most conspicuous forms of economic activity.” So how can architecture be sustainable in an economic context?

Building a house costs not only money, but also energy. The costs of maintaining a house can exceed the building’s construction costs. But heating and electricity costs can be saved by building energy efficient. Thermal bridges can be avoided with an airtight construction and the heating costs can further be saved with adequate insulation. A well-insulated and airtight building hull reduces the ecological footprint of a passive house. Little or no additional energy for heating or cooling is required. A plus energy home, on the contrary, produces even more energy from renewable energy sources than it consumes. The cost-effectiveness of a zero energy house derives from its produced energy, which is equal to its consumption. The building consumes as much energy as needed.

Building in a sustainable way provides financial rewards for the dwelling’s residents. A house constructed according to sustainable standards has lower annual costs for energy, water and maintenance. This does not come necessarily with higher starting costs. Using local construction materials can reduce the building costs. It may occur that the asset costs of a sustainable building feature exceed the asset costs of a more traditional building, but the lifecycle costs are typically lower.

Another economic benefit of a sustainable building style is the persistence of the building structure. The building can promote better health and well-being, which increases comfort and productivity.

4.1.3 Society

As important as the two other pillars is the most forgotten pillar, called society. Society is the missing link of sustainability, which adds ethics to aesthetics. Without society, sustainability does not prevail. In sustainable discussions, the focus is on economic and environmental sustainability, in particular on new building materials and resources, renewable energy or low carbon footprints. Only few sources give answers to the question of how our behavior within society is in correlation with a functioning eco-system. That is why I want to put special focus on this neglected part of sustainability in my thesis.

People spend more than 70% of their lives indoors. The important role of architecture is to create a healthy and comfortable shell for its occupant, which enforces well-being and productivity. First, however, the architect has to understand the needs of the building’s users before being able to provide a sustainable surrounding for people to evolve, supporting their cultural needs and providing social amenities. Architects might be able to create a sustainable setting by choosing the right materials and equipping the building with the right technology, but it needs the people within to fulfill the wholeness of sustainability. Without the users being willing to live a sustainable
life, sustainable architecture cannot fulfill its purpose. It needs the people to make green development work. Considering the residents, living a sustainable life can start with reducing and recycling waste, using energy efficient appliances and shopping for local goods.

A building itself functions as a catalyst for social and environmental change. Just as it is shaped by humans, the built environment shapes and structures human activity. A building which appears to be in neglect is more likely to create discontent to its inhabitants or neighbors than a building which has a warm and orderly appearance. Buildings and people are in constant interplay with each other and therefore affect each other at all times.

To create a socially sustainable unit, the architect needs to combine the design of the physical realm with the social world. The built environment is a technology that shapes human activity. The architect has the power to lead people into directions by creating common areas people can be led to interact. It is in the architect’s hands how much privacy or company is given to people. Architects must always be aware of this unique power they have. Of further importance are the materials they choose; choosing the right building material is not only of ecological and environmental importance, but also has influence on people’s health and well-being. High quality housing stands alongside social and cultural infrastructure, social amenities and space to evolve. Space to grow is essential in every new community for people to make the space their own and adapt to new possibilities. In the incompleteness of a community might lie new possibilities for creation. “You can’t have a totally structured place and then just expect people to fit in,” states sociologist Marcus Menzl.

The origin of the word community lies in the French word communer, which means to share and also in the Latin word communis, where com means with and munius stands for duties. The word implies “close relationships and the notion of commitment.”

A community is a social unit with common values and it plays a significant role in sustainable housing design. It is the heart of social sustainability. Mostly unrelated people live together in close proximity and place high value on the sharing of land, goods, housing and facilities. The sharing of common goods and facilities symbolizes communal values and goals.

A community strengthens social and cultural life: the feeling of identity and belonging, support, tolerance and respect, co-operation, engaging with people from different backgrounds, low level of crime and anti-social behavior. These factors help people put down roots and feel at home. Engaging in common activities strengthens a community.

A Finnish strategy plan for social and health policy, called “Socially Sustainable Finland 2020” of the Ministry of Social Affairs and Health states: “Sustainable housing design and community planning contribute to safety and independent coping, reduces the incidence of many social problems and prevents segregation of housing districts. An obstacle-free environment will be created by developing the community structure, ensuring ease of access and the availability of services.”
The term **cohousing** was first introduced in the mid 1980s by Kathryn McCamant and Charles Durrett in their book “Cohousing: A Contemporary Approach to Housing Ourselves.” Cohousing means collaborate housing, where residents are living together in a community. Several households are linked together, typically clustered around a community house, where the community can gather to discuss collaborative decisions, share their free time or enjoy amenities of a community life. Unlike communes, people have their private homes and the idea of living together is not based on full resource sharing.

The graphic below shows generic site plans of cohousing after McCamant and Durrett (1994). The first illustration shows the pedestrian street. Private houses of a community are erected alongside a pathway, where social interactions are possible. The second visualizes the courtyard. Houses are organized around a courtyard, in which the community can gather and interact. The third graphic represents a hybrid form of the pedestrian street and the courtyard, which combines both functions. The last illustration shows single buildings along an internal atrium. A glass-covered pedestrian street is separating two rows of attached townhouses.

Cohousing should be as flexible as possible to allow residents to stay if their family needs space to grow.

The members of the community are responsible for their homes, but share responsibility for communal areas. The access to shared facilities like a community building or a shared garden gives more possibilities to every individual member of the community, by having more, but owning less. “The relationship between sustainability and communities is interdependent. The survival of the planet is not just about plants, animals and natural resources but also about people and resources.”

Another positive effect of cohousing is that the high density of buildings and shared spaces use less land and therefore has a smaller ecological footprint. Sharing goods allows every individual member of the community to have more but own less.

There are many examples of cohousing projects, some successful, some not. Belk and Meltzer both describe six typical characteristics of cohousing:

1. Participatory process
2. Neighborhood design
3. Common facilities
4. Self-management
5. Absence of hierarchy
6. Separate incomes
Common facilities include a community room where matters can be discussed within the community, meetings can be held or festivities can be celebrated. A common kitchen and dining room invites members to join in communal meals, a children’s room helps parents take care of their kids and children without siblings can form close bonds to other children of the community. A guest room might be a valuable addition, which could be used by visitors of the community. A workshop is free for everybody to use and tools can be shared within. Instead of every household having their own equipped workshop, a communal working and crafting area helps people have more flexibility and variety without owning everything themselves.

The list below shows an example of a cohousing list of household items. Things that are not used daily can be shared within the group. For example, a drill is not needed daily. So why have 25 drills in the community if three would be enough? On the list, community members can extract where the tool or equipment can be found and borrowed.

It is important that all stakeholders like the architect, engineers, landscape architect, owners, users, community organizers and others work together to achieve social sustainability. The focus should not lie on building houses, but homes. It is the most intimate of all building construction an architect can work on.

The ten Cs of sustainability

The ten Cs, which all play an important role in a sustainable community according to Jennifer Fosket and Laura Mamo, authors of *Living Green – Communities that sustain* are:

<table>
<thead>
<tr>
<th>Category</th>
<th>Item</th>
<th>Lender Unit #</th>
<th>Category</th>
<th>Item</th>
<th>Lender Unit #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gardening</td>
<td>Hand trowel</td>
<td>A5, A6, B1, B4</td>
<td>Outings</td>
<td>Backpack</td>
<td>A6, A7, B1, C7, D3</td>
</tr>
<tr>
<td></td>
<td>Lawn mower</td>
<td>A6</td>
<td></td>
<td>Bicycle tools</td>
<td>A7, B1, C7, D3</td>
</tr>
<tr>
<td></td>
<td>Leaf rake</td>
<td>A2, A5, A6, B1, B3</td>
<td>Car bike rack</td>
<td>A5, A6, B1, C5, C7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weed scythe</td>
<td>C4</td>
<td></td>
<td>Maps</td>
<td>A6, B1, B4, C7, D4</td>
</tr>
<tr>
<td></td>
<td>Wheelbarrow</td>
<td>A2, A4, A6, B1, C4</td>
<td>Snowshoes</td>
<td>D3</td>
<td></td>
</tr>
<tr>
<td>Building &amp;</td>
<td>Back belt</td>
<td>A6, B1, B3</td>
<td>Cooking</td>
<td>Coffee pot</td>
<td>A6, D5</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Bucket</td>
<td>CH, B1, B3</td>
<td></td>
<td>Oversize mixer</td>
<td>CH, D4</td>
</tr>
<tr>
<td></td>
<td>Jigsaw</td>
<td>A6</td>
<td></td>
<td>Wok</td>
<td>A6, B1, B4, D4</td>
</tr>
<tr>
<td></td>
<td>Sewing machine</td>
<td>A6, B3, B4, C7, D3</td>
<td>Wok</td>
<td>A6, B1, B4, D4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staple gun</td>
<td>A6, B1, C7</td>
<td>Other</td>
<td>Blow up bed</td>
<td>C4, D5</td>
</tr>
<tr>
<td></td>
<td>Toilet plunger</td>
<td>A5, B1</td>
<td></td>
<td>Single futon</td>
<td>D5</td>
</tr>
<tr>
<td></td>
<td>Toilet snake</td>
<td>B1</td>
<td></td>
<td>Folding tables</td>
<td>B1, D3, C6, C7</td>
</tr>
<tr>
<td>Cleaning</td>
<td>Mini vacuum</td>
<td>A7, C4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rug cleaner</td>
<td>B1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To add your valuables to the list, call Ken.

“Table: Part (about a third) of a lending list of household items available to others.”
1. Culture

Culture is an important factor of sustainability. Culture is reflected in language, rituals, symbols, heritage and religion and it is what defines and shapes us. A sustainable community takes culture into consideration in its development. It is easier for people to adhere to sustainability if they see the cultural value behind it. For creating a successful sustainable design, the architect must know and understand the socio-cultural heritage.

2. Context

The location in time and place is an important sustainable factor. The architect has to consider factors like the surroundings, terrain, sun and climate because these are already there and cannot be changed. The context of a site is not only of environmental, but also of social and economic, importance.

3. Citizenship

Citizenship ensures a sense of “mattering”. By belonging to a certain group or place, people feel included in decisions. Citizenship is a prerequisite for health, political will and public support.

4. Commitment

Sustainable architecture needs the commitment of its residents. Without the community being willing to live a green life by cutting down their personal energy use, recycling, composting, growing their own food and buying local products, a green design would not function. Furthermore, it needs the commitment of the architect, engineers and authorities to make a design sustainable.

5. Collaboration

Good communication between various actors like the architect, engineer, owners, developers and others is crucial for a sustainable outcome.

Different viewpoints and multi-disciplinarity are important factors for maintaining a sustainable community.

6. Connection

A sustainable community only functions by creating a connection between residents for interaction. The architect's influence on the built environment is of high importance. Places where the community can gather have to be created.

7. Care

Through the ethic of caring, the kind-heartedness/goodness of the members of the community is addressed. This important factor is crucial for a functioning community. People think beyond their own needs and will therefore not act in a selfish way, but will provide good actions to one another, trying to make the world a better place.

8. Contact

Contact with nature allows people to understand and value it more. Whether it be the actual contact with nature or just a visual contact, like a view from a window, nature has beneficial effects on people’s well-being and health.

9. Commons

Sharing is what makes a community special. By sharing goods they own less, but have more. Their quality of life increases but the environmental impact on nature decreases.

10. Continuity

Continuity stands for the community’s ability to maintain and sustain over time. Only by ensuring and committing to sustainable life standards is a community truly sustainable.
PART III
5. THE CONCEPT

Suomenlinna is predestined for a new sustainable housing project: A steady community, a clean and safe environment, school, shops, health care and other social facilities. Although not completely traffic free, Suomenlinna is not designed for car traffic, which is the biggest source of urban air pollution. Bicycles are the main means of transportation.

The identity of Suomenlinna is rooted in its history, which unites its inhabitants. It is a special community, where everyone has to contribute to their unique surroundings. My approach to this delicate building site – after having carefully studied the site and evaluated the residents’ survey – is to design not only houses, but homes for this unique community. These homes shall fulfill all aspects of sustainability: economical, environmental and social. The plan for a cohousing project in Suomenlinna is not to fit a new community into an existing one, but to extend the existing community and present more opportunities for all residents.

Länsi-Mustasaari is the only of Suomenlinna’s islands which offers the community enough space to grow. The soon to be demolished buildings E16 and E17 will make way for a new housing project, where sustainability in the long-term is the goal. Flexible housing systems will have the ability to grow with their residents, so families will not have to leave their community when they are expanding. A central community building will unite the members and will expand their private living space.

Building on a UNESCO world heritage site is very delicate, which is why I have decided to touch it as little as possible, but take the most out of this unique building site. Using the waterfront as building ground seemed to be the perfect solution for connecting the buildings to the historic scenery and at the same time taking the opportunity of working with a very unique building ground.

The recipe for this architectural design is combining the historic context with the existing community and spicing it up with sustainable building assets. In the following chapter I will describe tools for a sustainable building design further.

5.1 BUILDING FOR THE FUTURE

Since we are facing unpredictable, ongoing changes in the future, we have to ‘future-proof’ our building design. A residential building’s life span can last up to 60 years, which means designing a building now might mean it is still standing in 2080 and beyond. A possible climate change during that period has to be taken into consideration, although it is never predictable. The buildings we design today have to cope with the changing temperatures of the future to avoid temperature-related health problems. Issues such as thermal comfort, natural ventilation, summer solar shading and winter solar gain, have to be addressed by the architect from an early stage on.

Furthermore, we have to deal with the issue of finite resources and how to maintain a building in the future. We are designing now for the future. Different approaches can contribute to biodiversity, which brings social, economic and environmental benefits to any development.
5.1.1 Urban Green

“We need to turn the negative impact of development into a positive support for biodiversity by creating habitat opportunities and migration routes in the landscapes and buildings we design.”

Thoughtful planting of urban greenery does not only have ecological benefits by providing a habitat for local wildlife by providing food, shelter and nesting places, but also contributes to CO₂ sequestration. Furthermore, urban green has economic value for the inhabitants through the impact of vegetation on energy consumption such as wind speeds or shading in summer. The social benefit of urban green is the improved well-being of residents and the shared commitment for the upkeep of the green area.

Choosing the right vegetation for the right climate is essential. In northern climates plants have to be strong and durable to survive the harsh Finnish winters. Planting exotic species is furthermore useless to native wildlife.

The most common local trees are:

- Birch: broadleaf
- Pine: conifer
- Spruce: conifer

Birch, pine and spruce make 97% of total volume in Finnish forests.

Evergreen: protection from unwanted views. Noise buffer, shelterbelt (wind buffer)

Leaf trees: protection from sun in summer, by shedding leaves in winter lets sun in

Wind barrier

The islands of Suomenlinna face towards the open ocean, where strong winds can become a problem. Vegetation can have an impact on wind speeds, if located correctly. Trees, in particular evergreens, can function as so-called shelterbelts, breaking down the wind speed in summer as in winter. A shelterbelt consists of trees of approximately the same height, planted in a width of 2-5m and 5m in height. Leaves or needles should cover at least 50% of the tree and should be denser at the bottom than at the top. The ideal distance towards buildings should be 2-5 times the height of the shelterbelt.

Solar shading

Planting trees in front of a building can protect it from direct sunlight in summer and they allow sunlight to penetrate the building’s façade by loosing leaves in winter. When using vegetation as solar shading, the distance of 1-1,5 times the height of the building has to be considered to guarantee the safety of the building’s foundation (depending on the tree species). In summer an average tree can lead to a reduction of 80% of summer solar gain/shading. In winter a reduction of solar gain up to 30% can be achieved.

*Example*: birch

15-30m max height

75-85% sunlight blocked in summer

12-52% sunlight blocked in winter

Plant the tree in east/west position for good results of shading.
One reason why timber is sustainable building material is because trees absorb CO₂ emissions during their lifetime. When a tree dies the removal has to be carefully considered, since using heavy machines will throw back the sequestered CO₂. Using the wood for a new building, however, will retain around 80% of the tree’s sequestered CO₂.

**Birch**
- Moderate growing
- 4 tons of CO₂ after 60 years
- 118 tons of CO₂ over a lifetime
- Life span: 125-135 years

**Pine**
- Fast growing
- 5.9 tons of CO₂ after 60 years
- 126 tons of CO₂ over a lifetime
- Life span: 250 years and more

**Spruce**
- Moderate growing
- 3.2 tons of CO₂ after 60 years
- 120 tons of CO₂ over a lifetime
- Life span: 250-400

In the south of Länsi-Mustasaari residents plant their own yards. Flowers, trees, vegetables and fruits grow in the mild climate of the shore, providing their owners with food.

Vegetables are carbon neutral. During their growth they absorb CO₂, but when harvested, the CO₂ is emitted back into the atmosphere. Fruit trees stand in stark contrast to vegetables: The fruits can be harvested annually (by hand) and when the tree dies the wood can be used further. An apple tree, for example, absorbs 2.5t CO₂ over its lifetime.

A vast amount of Finland’s CO₂ emissions comes from importing food. CO₂ emissions can be reduced by planting seasonal food locally instead of importing products from far away. The residents of Länsi-Mustasaari will be given the opportunity to plant their food throughout the year. The floating homes in this thesis have a green house, which allows the residents to plant fruits and vegetables in all seasons and consume them together in the community kitchen.
5.1.3 Water and flooding

The building site is right next to the water. In this case, working with the water is more reasonable than working against it. A rise of water caused by increased rainfall in the future due to climate change has to be taken into consideration.

Given the opportunity to work with the water, building right on top of it seems to be a good approach. The site is especially windless due to the fortification hills. The water is very still because the site is in a calm bay between the bridge and the artificial peninsula of building E14 - Caponniere Löwen.

The residential buildings should be floating on the water, while the community building should be the link between the new dwellings and the existing ones. That is why it is built on stilts and half on land, half above the water.

The graphic shows possibilities of architecturally using the site.
Dealing with wastewater

150 liter of wastewater is flushed down the drain daily, which sums up to about 130kg CO₂ per household. The so-called blackwater or foul water mostly comes from flushing the toilet. Greywater is cleaner wastewater from showers, baths or sinks. Both groups of wastewater end up in the sewer and are then treated with chemicals for further reuse. However, greywater could be intercepted and recycled on site for flushing the toilet or landscape irrigation for example. Instead of flushing the toilet with clean water, using grey water could save 18-30% of water per household.

Rainwater harvesting systems

The main function of a roof is to protect its residents from the impact of nature. It keeps snow and rain away and insulates the building hull. However, instead of just stopping rainwater from penetrating the building, the water falling on the building’s surface can be utilized. In combination with cisterns, a roof can become a rainwater-collecting device. Rainwater harvesting systems can reduce CO₂ emissions by 15-40%. The collected water will be used for watering the green house and the seasonal outdoor plants.

Water consumption breakdown and CO₂ impact

<table>
<thead>
<tr>
<th>Average uses</th>
<th>%</th>
<th>Liters per day per person</th>
<th>Household kgCO₂ per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet flushing</td>
<td>30</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>Baths and taps</td>
<td>13</td>
<td>19.5</td>
<td>17</td>
</tr>
<tr>
<td>Shower</td>
<td>20</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Clothes washing</td>
<td>13</td>
<td>19.5</td>
<td>17</td>
</tr>
<tr>
<td>Drinking water</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Washing up</td>
<td>8</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Outdoor</td>
<td>7</td>
<td>10.5</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>7.5</td>
<td>7</td>
</tr>
<tr>
<td>CO₂ impact of water supply and treatment</td>
<td>150</td>
<td>130 kgCO₂ per year per household</td>
<td></td>
</tr>
<tr>
<td>Additional 1000kgCO₂ per household per year for energy needed to heat hot water</td>
<td>1000 kgCO₂</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total per household per year</td>
<td></td>
<td></td>
<td><strong>1300 kgCO₂</strong></td>
</tr>
</tbody>
</table>
5.2 DESIGNING FOR COOL CLIMATE

Designing an energy efficient home requires working with the site. The orientation of the site, its exposure to wind, integration or blocking views and the consideration of the site’s vegetation and terrain are important factors to consider. The cool climate of Finland produces further challenges. Long and extreme winters collide with warm summers. It is important to reduce heat loss in winter and heat gain in summer. Solar energy should be collected during winter, but should be avoided during the summer months. Considering the different angles of winter and summer sun is crucial in the design phase. The asset costs of energy efficient building materials – like high performance windows instead of double-paned glass – might be higher, but heating costs can be saved significantly in the long-term. A good insulation, airtight construction, controlled ventilation and an energy efficient heating system are the key elements for a cost and energy effective home.

5.2.1 SOLAR GAIN

The design of a residential building in Finland should carefully consider its geometry. It should have a maximum exposure to the winter sun, cooling winds in summer and views, but a minimum exposure to the summer sun, winter winds and noise. Certain rooms require more daylight than others, like the living space. A minimum opening of 10% of the floor area and an ideal of 20% is reasonable. Good daylight does not only depend on the size of the window, but also on possible shading vegetation, reflecting surfaces, location and proportion of the window opening, room depth and, of course, the weather. A window does not only enable daylight to intrude the building hull but also permits views to the outside, provides ventilation and supports solar heat gain.

The internal spaces of the building have to correlate with the sun path. The different angle of the Finnish winter and summer sun has to be carefully studied. The sun’s angle is very low in the winter months, so artificial light is inevitable. Nonetheless, solar shading has to be considered in a Finnish home. An external shade is most effective at keeping the warm sun rays away. It deflects solar radiation before it enters the building. Also the shape of the building itself can provide shading without compromising daylight.

Windows are the most fragile and weak point of the thermal envelope. They cause heat loss and heat gain. Heat is not only lost through the glazing but also through the frame and seals. Coating the glass with metal oxide permits sunlight but blocks the warmth from emitting the inside temperature.

In a northern climate, choosing the right glazing to minimize the heat loss but maximize the daylight transmission is of high importance. Solar shading is important in the warm summer months and provides different options. The most natural way of blocking the sun is trees. Up to 80% of the summer solar gain can be reduced.
Window specification and light transmittance

<table>
<thead>
<tr>
<th>Window specification</th>
<th>Daylight transmission</th>
<th>Solar transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>single glazing</td>
<td>88%</td>
<td>83%</td>
</tr>
<tr>
<td>double glazing</td>
<td>77-80%</td>
<td>65-76%</td>
</tr>
<tr>
<td>double-glazed tinted</td>
<td>29%</td>
<td>39%</td>
</tr>
<tr>
<td>triple glazing</td>
<td>70%</td>
<td>40-60%</td>
</tr>
</tbody>
</table>

5.2.2 Insulation

Homes in northern climates need to be well-insulated. Choosing the right insulation can make a big difference, since the U-value can vary greatly. The U-value is the thermal transmittance coefficient. It shows the heat loss of an element of 1 m² in a temperature difference of 1°C. The lower the U-value, the better the insulation material.

U-value standard of Finland [W/m²K]:

<table>
<thead>
<tr>
<th>City</th>
<th>Country</th>
<th>ISO 3166-1 country code</th>
<th>Wall</th>
<th>Roof</th>
<th>Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helsinki</td>
<td>Finland</td>
<td>FIN</td>
<td>0,25</td>
<td>0,16</td>
<td>0,25</td>
</tr>
</tbody>
</table>

Reference values

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall, U-value (W/m2,K)</td>
<td></td>
<td>0.40</td>
<td>0.29</td>
<td>0.28</td>
<td>0.25</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>Roof, U-value (W/m2,K)</td>
<td></td>
<td>0.35</td>
<td>0.23</td>
<td>0.22</td>
<td>0.16</td>
<td>0.15</td>
<td>0.09</td>
</tr>
<tr>
<td>Floor, U-value (W/m2,K)</td>
<td></td>
<td>0.40</td>
<td>0.40</td>
<td>0.36</td>
<td>0.25</td>
<td>0.24</td>
<td>0.16</td>
</tr>
<tr>
<td>Window, U-value (W/m2,K)</td>
<td></td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>1.4</td>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Door, U-value (W/m2,K)</td>
<td></td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>1.4</td>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Air-tightness, n50 (1/h)</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>The yearly exhaust air heat recovery efficiency</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>30%</td>
<td>30%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Thermal transmittance (W/K)</td>
<td>2017</td>
<td>1905</td>
<td>1879</td>
<td>1367</td>
<td>1353</td>
<td>917</td>
<td></td>
</tr>
<tr>
<td>Change 1976 =100</td>
<td>0%</td>
<td>-6%</td>
<td>-7%</td>
<td>-32%</td>
<td>-33%</td>
<td>-55%</td>
<td></td>
</tr>
<tr>
<td>The EPDB-effect</td>
<td></td>
<td>-1%</td>
<td>-33%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
There are three types of insulations: organic, such as straw, flax, hemp, sheep’s wool, cork and wood wool or wood fibers; mineral based like rock, glass mineral fiber, cellular glass or slag; and petrochemical, including expanded or extruded polystyrene, polyurethane and phenolic foam. Petrochemical insulations have a heavy impact on the environment since they cannot be absorbed by nature after the building has been demolished. So designing a sustainable home in a northern climate would indicate using an organic insulation with a low U-value. It has a low impact on nature, good acoustic and hygroscopic characteristics, it comes as a waste product (such as wood wool or wood fiber), has a low carbon footprint and is recyclable. One negative aspect might be that a greater wall thickness is needed.

5.2.3 Airtightness

People tend to believe that an airtight house is not healthy because it does not allow fresh air to intrude. The problem is that fresh air can also bring a temperature difference into the building. Significant heat loss can occur through window frames of poor quality, doors, bad insulation and any joint or junction of elements. These leaking gaps of a construction are called thermal bridges. Where cold air intrudes the building, warm air emits. High energy costs and moisture, which can lead to mold and an unhealthy climate, are unavoidable. The solution is to build an airtight home and install controlled ventilation. Including a layer such as polyethylene sheet (PE) makes the construction airtight and prevents moisture from intruding the insulation and allows moisture to exceed the building at the same time. A PE-sheet of 1mm has the same barrier effect as 10m of air. The layer should be in one continuous layer and should not be nailed or perforated to avoid air and moisture leaking through the holes.

5.2.4 Natural Ventilation

The laws of physics have to carefully be taken into consideration when involving natural ventilation into the design: Hot air rises and cold air falls. The natural forces of the temperature difference between warm inside and cool outside air are used for drawing fresh cool air through the house. The so-called stack effect pushes hot, stale air into openings in higher parts of the room and simultaneously draws in fresh cool air from lower openings. The height difference between the outlets must be a minimum of 1.2m. A cross-ventilation can be achieved by two opposed window openings. The air flows freely if the temperature differs a minimum of 2°C. Window openings close to the ceiling ensure that the risen hot air and thermal mass cool down overnight. The ideal window design for good ventilation is a small inward top opening which can be moved separately from a larger opening.

Considering the amount of cold winter months in Finland, ventilation with heat recovery (VHR) is reasonable. The extracted warm and stale air is used to preheat the fresh air supply. The exiting and entering air never mix, but are conducted through adjacent metal ducts, allowing the air to exchange heat. To prevent heat exchange in summer months, a bypass is required.

5.2.5 Water Source Heat Pump

Building a house directly on the water should take advantage of its energy. A heat pump is a device that retains the thermal energy of the water (heat source) and moves it into the building structure (heat sink) by absorbing energy of a cold space and releasing it into a warmer one. The maximum heat that can be obtained from heat pumps is 45-50°C.
the basic requirement for the device to work efficiently is an airtight and well-insulated building hull.

How can a water source heat pump retain thermal energy from frozen water? The answer lies in the deep: Throughout the year, the temperature of the bottom layer of fresh waters is 4°C, irrespective of the temperature changes in the atmosphere. Depending on its salinity, seawater freezes at a lower temperature than fresh water. When the seawater reaches warmer temperatures in summer, the thermal energy of the 4°C water will be used to cool the dwelling. When the surface freezes in winter and the ice floats on the surface, the thermal energy of the warmer temperature of 4°C accumulating at the bottom will be used to heat the dwelling.

The graphic above shows the temperature distribution in summer and winter.

5.3 CONSTRUCTION MATERIALS

Considering the building history of Suomenlinna and the resources of Finland, timber seems to be the right building material in the context of Länsi-Mustasaari. Wood is one of the most sustainable building materials since it is derived from a renewable resource and has low embodied energy. The construction should rather be of solid timber than of panel products, such as glue-laminated timber or cross-laminated timber, since these products have high-embodied energy and carbon. Furthermore, the glue makes it harder to recycle the wood.

Following the Finnish building history would lead to painting the façade. Houses have been painted red since the 17th century, when wood was the main building material. The so-called Falu red made houses appear like more expensive brick buildings, which were rare at that time. The tradition has been pursued until today and naturally wooden homes are seldom. But there are several other ways to treat a wooden façade to protect it from sun, rain, snow, fungi and vermin than paint:

- Heat-treating wood makes it more durable to weather conditions and greying caused by the UV-light. The look changes it to a darker color, but the patterns remain visible.
- Waxing is more commonly used for furniture, since it is not very durable and needs maintenance. It does not penetrate the wood, but stays on its surface and gives it a shiny look.
- Oiling changes the color of wood into a slightly more yellow tone when seeping into it. It is very easy to work with.
As good as timber is as construction material, it is that bad as foundation. In Finland, timber should be used no lower than 30cm above ground. Snow and rain moisten the wood, which starts swelling and it becomes vulnerable to fungi. More moisture resilient materials are concrete or stone. Granite is very common in Finland and is commonly used as foundation material. The rocks have to be exploded to even building sites and are then further used as foundation. Sometimes no foundation is needed when the building can be set right on top of a granite plate.

Concrete alone does not have good load bearing properties. It can only bear compression load but not tensile stress. If tensile stress will occur, reinforcement with steel is necessary.

Concrete alone does not have good load bearing properties. It can only bear compression load but not tensile stress. If tensile stress will occur, reinforcement with steel is necessary.

5.4 LIFE CYCLE DESIGN

Life Cycle Design is a methodology of considering not only a sustainable production and upkeep of a building, but also its afterlife. What happens to the home when it has fulfilled its needs and has to be demolished? Using the right building materials is crucial for a good life cycle design. Materials that are eco friendly and can be absorbed or reused in the building’s afterlife have to be wisely chosen. Materials or even whole parts of the building should be reusable and recyclable. A building must holistically balance design, construction, maintenance and reuse of architectural resources. The figure below shows the input and output streams of resource flow. Upstream designates the energy and materials as input into the building ecosystem. Downstream indicates the output of the building ecosystem. Whatever resources flow into the building will eventually enter it at some point of its life. “This is the law of resource flow conservation.”

Life Cycle Design consists of three phases:

Pre-Building Phase

The selection of materials and their environmental impact can have a long-term influence on the ecosystem. Materials should be made from renewable resources, which are grown and harvested at a rate which exceeds human consumption. Incorporating reclaimed or recycled materials for construction should also be considered. Materials should have a long life span and should be of low maintenance.

UPSTREAM

building materials
energy
water
consument goods
solar radiation
wind
rain

BUILDING

used materials
combustion byproducts
greywater sewage
recyclable materials
wasted heat
polluted air
groundwater

DOWNSTREAM
Building Phase

The construction of the building should have a minimal impact on the site. Flora and fauna should be respected and carefully treated. Non-toxic materials should be used to ensure the health and well-being of construction workers and end users. Regular maintenance is important to elongate the building’s life span.105

Post-Building Phase

In this phase the components have to be evaluated by their usefulness, followed by three possibilities: reuse, recycle or dispose. By reusing and recycling materials, the outlived building becomes a resource for a new building. Disposal means a heavy impact on the eco-system and its already overburdened waste stream.106 Take a look below at the sustainable building life cycle.
PART IV
The location of the floating homes is between the bridge to Länsi-Mustasaari and the Caponniere Löwen. Four residential buildings are floating along the shore and a community center, which is built on stilts, is settled in between them to form the heart of the community.

The design of the floating homes and the community building are reminiscence of the Finnish building tradition. The shape of the steep roofs is a repetition of the surrounding historical building structure. The use of wood as a building material represents the native building style. Local wood is not only used for the structure, but also for its cladding. The pine façade is intentionally left with an unpainted surface to show the beauty of the material. Wood has a unique way of aging when UV light and weather conditions turn its warm color into a rough grey texture. By heat treating the pine wood, its shade will darken slightly. This chemical free timber preservation process increases its resistance to fungi and vermin, and improves its durability and its properties with respect to water.

Adding a greenhouse facing towards the south gives the residents the opportunity to plant fruits and vegetables throughout the year, which can further be consumed in the community kitchen. This should, on one hand, give the residents responsibility within the community and, on the other hand, reactivate the natural process of planting your own food. The distinctive feature of the greenhouse is its social function. All residents have access to the greenhouse to socially interact with their neighbors. The greenhouse also gives the opportunity to all residents to have access to a semi outdoor space from where they can enjoy the view towards the sea. The glass façade can be opened during the warm summer months.

The design for four floating dwellings is worked out in this thesis, but more could be added to calm waters around Suomenlinna on demand.
6.1 Site Plan Länsi-Mustasaari

- Floating Home
- Community Building
- Floating Home
- Floating Home
- Floating Home
- Floating Home

E14
E12
E11
E9
E7
E5
Pikku Mustasaari
Arrow
The building site on Länsi-Mustasaari lies between the grassy hill of E14 and the pier. Respectively two floating homes frame the community building - half on land, half on the water - which is the heart of the project. The bay of Länsi-Mustasaari faces Pikku Mustasaari and opens up towards the city of Helsinki, protected from the forces of the open sea. The artificial hill of the fortification behind buildings E7 and E12 refracts the strong wind blowing from the open sea and makes the building site a calm place with only a minor breeze and hardly any waves. The floating homes can be copied and anchored
to other calm places around the island if there is the need for more living space. This gives the possibility for the community to grow and expand. Building A and B are possible extensions of the project. Their location on land between the existing building structure and the new buildings allows the community another way to grow. In between these buildings lies a greenhouse for the community of Suomenlinna to maintain their green thumb during the long months of winter.
6.2. FLOATING HOMES

THE SYSTEM

The floor plans of the floating homes are divided into four units of 6.5x7m. The units are designed to be flexible homes which grow or even shrink with their owners. Only the bathrooms and the kitchen have a fixed spot in the layout, due to piping. The rest of the layout is open to the inhabitants. In every unit there are two stocks of foldable walls. They can either be left closed for an open layout or opened for room divisions to make the units adaptable. The flexibility of the homes has an economic aspect, as well as a social one. People do not have to fit into homes, but homes have to fit the people!

EXAMPLE

A single man moves in, rents one unit of 45,5 m². He meets a woman, gets married and they start building a family. So instead of moving out, they expand their home by another available unit and rent now two units of 91m². Their family grows by another member and they rent a third unit. Their home is now 136,5m². The couple gets older and their children move out. Instead of moving into a smaller apartment, the couple leaves two units behind and keeps one 45,5m² unit in which to grow old.

Beneath the floating homes are two water tanks. One tank stores rain water, which is collected by drip moldings at the roof. This water is used for watering the green house. The other tank stores grey water, which comes from the pipes of the washing appliances and will be further used for flushing the toilets.

GREEN HOUSE

Connected to the south facade of the floating home is a green house. It not only allows the inhabitants to plant vegetables and fruits for the community, but also functions as a social room. The green house is accessible from all units of the floating home and a staircase allows people to meet within. The floor of the first storey is a perforated metal screen, which does not only allow light to enthrone the lower floor, but is also a visual connection of the units.
+3.00
FIRST FLOOR
2x SINGLE OPTION
1 UNIT
45.5m²
GROUND FLOOR

2X COUPLE/SMALL FAMILY OPTION

2 UNITS ON 2 LEVELS

01 m²

2x couple/small family option

2 units on 2 levels

91 m²
+3.00
FIRST FLOOR
2x COUPLE/SMALL FAMILY OPTION
2 UNITS ON 2 LEVELS
91m²
GROUND FLOOR

2x couple/small family option
2 units on 1 levels
91m²
FIRST FLOOR
2x COUPLE/SMALL FAMILY OPTION
2 UNITS ON 1 LEVELS
91m²
GROUND FLOOR

1x FAMILY OPTION

3 UNITS ON 2 LEVELS

136.5m²
FIRST FLOOR
1X FAMILY OPTION
3 UNITS ON 2 LEVELS
136.5m²

1X SINGLE OPTION
1 UNIT ON 1 LEVEL
45.5m²
6.2.2 Section

The construction of the floating dwelling consists of a hollow concrete slab. Due to its massiveness, it is steady and sturdy, which makes it a very stable structure. The concrete pontoon is fixed in place with an anchoring system. The floating platform has a thickness of approximately 0.4m. An access pontoon is connected separately to the platform, which makes it easier to assemble and the whole construction more durable.

A water depth of a minimum of 1.5m fulfills the requirements for a floating dwelling during lowest tide. The structure can resist a wave height of a maximum of 0.4m, which is not likely to occur in the calm bay of Länsi-Mustasaari.

The reference company Marinetek\textsuperscript{107} has tested their floating dwellings for several years in Finnish winters and the frozen sea and harsh weather conditions are no problem for the pontoons. If very strong winds occur, the structure might move slightly, but these are in general no problem.
TAKE A CLOSER LOOK AND FLIP THE BOOK AROUND!
INTERIOR VIEW LIVING ROOM GROUND FLOOR
6.3 COMMUNITY BUILDING

The community center is the heart of the project. It does not only extend the private living space of the floating homes, but gives the community a place to meet and socialize. The community building consists of three parts:

1. The common part features with a play area and the common room. Children have their own room to play and socialize with other children while their parents are at work, at home or participating in a festivity in the common room. The room is away from the water and children can be seen through the glass door for their safety.

2. The private part features with two guest rooms, a quiet room with a library, a laundry room and a bicycle workshop. Instead of having an extra room in each flat for guests, the community building provides this extra space and can be rented if needed. The bicycle workshop will be of interest for many people in Suomenlinna. The majority of people owns a bicycle and instead of owning the repair tools by themselves, the community can share them and has therefore more for owning less. The quiet room is accessible from the common room and is a recreation area for people who like to socialize, but also need their time out. The community can share their books in this library.

3. The sauna part includes a social room (which can be entered by a separate entrance or from the common room), changing rooms for men and women and the sauna, which whose division between men and women can be opened if more sauna space is needed. The sauna can be directly exited towards the ocean for a cool shower (in summer as well as in winter) after a the hot temperature of the sauna visit.
1* information board: information for laoning community goods
2* book sharing: community can share books and create a library
3* sauna partition: can be opened if necessary
6.3.2 Sections
6.3.3 Elevations
“Sustainability takes forever. And that’s the point.”
William Mc Donough
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LIST OF FIGURES

If not mentioned otherwise, all photos and illustrations by Isabella Pollak.

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Valmet Oy used to built ships as war reparations to the Soviet Union


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All information about the floating construction was kindly provided by the company MARINETEK (www.marinetek.fi)