Reykjavíkurborg

Reykjavík, 28. apríl 2022
MSS22040238

Borgarráð

Ártúnshöfði - Lóðarvilyrði - Re-Inventing Cities C40 - Lifandi Landslag ehf.

Óskað er eftir að borgarráð samþykki hjálagt lóðarvilyrði til Lifandi landslags ehf., kt. 490413-2000 til uppbyggingar á umhverfisvænu húsnæði á lóð að Ártúnshöfða, sjá afmörkun á fylgiskjali 1, með fyrirvara um breytingu á deiliskipulagi sem afmarki ný lóðarmörk með byggingarrétti fyrir uppbyggingu á umhverfisvænu húsnæði.

Greinagerð:

Á fundi borgarráðs þann 9. nóvember 2017 var samþykkt tillaga borgarstjóra þess efnis að Reykjavíkurborg tæki þátt í verkefninu Re-Inventing Cities á vegum C40, samtaka yfir 90 stórborga sem vinna saman í baráttunni gegn loftslagsbreytingum. Markmiðið með verkefninu er kalla fram lausnir og leita til uppbyggingar á umhverfisvænum byggingum/ verkefnum sem sýna bestu lausnir á sviði sjálfbærni, umhverfisgæða og minna kolefnisfótspors, ásamt því að styðja við góða borgarþróun. Lóðin á Ártúnshöfða var ein þriggja lóða sem Reykjavíkurborg lagði fram í fyrsta áfanga verkefnisins.

Á fundi borgarráðs þann 20. júní 2019 var greinargerð dómnefndar kynnt. Að mati dómnefndar var tillaga Lifandi landslags hlutskörpust á Ártúnshöfða. Samkvæmt tillögunni á að nota lágkolefnabyggingarefni, þ.m.t. timbur, til þess að draga úr kolefnisspori og stuðla að hringrásarhagkerfi þannig að úrgangur verði minni en annars. Ein helsta sérstaða lóðarinnar er jarðhitinn undir henni og verður hann nýttur í verkefninu.

Á fundi borgarráðs þann 20. júní 2019 var veitt heimild til að bjóða verðlaunuðum tillögum til viðræðna um lóðarvilyrði á viðkomandi reitum. Lóðarvilyrðið er háð því skilyrði að bygging húsnæðis á lóðinni á Ártúnshöfða verði unnin í samræmi við þá tillögu sem teymið Lifandi landslag sendi inn í samkeppnina Re-Inventing Cities og lág til grundvallar niðurstöðu dómnefndar sem gerð var opinber 22. maí 2019.

Lifandi landslag teymið er samþykkt því að meðfylgjandi lóðarvilyrði verði veitt til félagsins Lifandi landslags ehf., kt. 490413-2000. Komi til úthlutunar greiðist gatnagerðargjald í samræmi við samþykkt um gatnagerðargjald í Reykjavík nr. 725/2007, með síðari breytingu. Standist byggingar á lóðinni markmið um umhverfisgæði skal greiða 45.000 kr. fyrir heimilaða íbúðafermetra ofanjarðar og 20.000 kr. fyrir heimilaða atvinnufermetra ofanjarðar. Greiðsla byggingarréttar og gatnagerðagjalda er bundin byggingarvísitölu desembermánaðar 2020 (149,2 stig) skal fara fram innan 45 daga frá úthlutun lóðarinnar. Standist byggingar ekki markmið um umhverfisgæði greiðist viðbótargreiðsla fyrir byggingarrétt í samræmi við grein 5.3. í lóðarvilyrði.

Verði nýtt deiliskipulag ekki samþykkt innan tveggja ára frá samþykkt borgarráðs á vilyrði þessu fellur það niður. Sama gildir ef ekki er óskað eftir úthlutun lóðarinnar innan eins árs frá gildistöku nýs deiliskipulags fyrir lóðina.

Ívar Örn Ívarsson
Skrifstofa borgarstjóra og borgarritara

Reykjavíkurborg

Hjálagt:

1. Lóðarvilyrði – Lifandi Landslag ehf.
2. Kröfulýsing hönnunar
3. Sigurtillaga Lifandi Landslags ehf. í samkeppninni Re-Inventing Cities

Reykjavíkurborg, kt. 530269-7609, vegna Reykjavíkurborgar eignasjóðs, kt. 570480-0149, Ráðhúsi Reykjavíkur, 101 Reykjavík (hér eftir „Reykjavíkurborg“) veitir Lifandi landslagi ehf., kt. 490413-2000, (hér eftir „Lifandi landslag”) eftirfarandi:

-LÓÐARVILYRÐI-

1. Lóðin

1.1. Um er að ræða vilyrði fyrir úthlutun lóðar á Ártúnshöfða ásamt byggingarrétti, með fyrirvara um samþykki deiliskipulags sem afmarkar ný lóðarmörk með byggingarrétti fyrir uppbyggingu á umhverfisvænu húsnæði. Gert er ráð fyrir að á lóðinni verði verslunar- og skrifstofuhúsnæði, þjónustuhúsnæði og íbúðir (bæði hefðbundnar íbúðir og stúdentaíbúðir með deililausnum).

1.2. Afmörkun nýrrar lóðar má finna í fylgiskjali I en hún er til viðmiðunar og er ekki bindandi fyrir endanlega útfærslu á stærð lóðar ásamt byggingarrétti í samþykktu deiliskipulagi. Stærð og staðsetning nýrrar lóðar, byggingarmagn o.fl. verður nánar ákveðin í deiliskipulagi. Í drögum að deiliskipulagi sem nú er í vinnslu er gert ráð fyrir 26.510 fermetra byggingarmagni ofanjarðar. Endanleg mörk lóðar geta færst til lítillega eftir samþykkt deiliskipulags, t.d. vegna göngustíga eða lagna.

1.3. Lóðarvilyrði þetta er háð því skilyrði að við byggingu húsnæðis á lóðinni verði unnið í samræmi við skilmála samkeppninnar Re-inventing Cities og þá tillögu sem teymið Lifandi landslag sendi inn í samkeppnina og lágu til grundvallar úrskurði dómnefndar sem var gerður opinber 22. maí 2019. Kynning á sigurtillögu Lifandi landslags er að finna í fylgiskjali III.

1.4. Hægt verður að óska eftir úthlutun lóðarinnar þegar deiliskipulag fyrir lóðina hefur verið auglýst í B-deild Stjórnartíðinda.

2. Niðurfelling lóðarvilyrðis

2.1 Hafi nýtt deiliskipulag fyrir viðkomandi lóð við Ártúnshöfða ekki tekið gildi innan tveggja ára frá samþykkt þessa lóðarvilyrðis í borgarráði fellur lóðarvilyrðið niður.

2.2 Malbikunarstöðin Höfði er nú með starfsemi á því svæði sem lóðarvilyrði þetta tekur til. Fyrirhugað er að sú starfsemi verði flutt í burtu þannig að lóðin verði byggingarhæf. Vegna burðarþols og annarra tæknilegra atriða er varða uppbyggingu á lóðinni er ákjósanlegt að húsnæðið verði byggt upp samhliða framkvæmdum við það göturými borgarlínu sem liggur frá Krossamýrartorgi að lóðinni, sem veitt er vilyrði fyrir samkvæmt lóðavilyrði þessu. Áætlað er að framkvæmdir við göturými borgarlínu á framangreindu svæði hefjist undir lok árs 2023.

2.3 Reykjavíkurborg mun senda Lifandi landslagi tilkynningu þegar Malbikunarstöðin Höfði hefur flutt starfsemi sína af því svæði sem lóðarvilyrði þetta nær til.

2.4 Lóðarvilyrði þetta fellur niður ef ekki er óskað eftir úthlutun lóðarinnar innan 12 mánaða frá gildistöku deiliskipulags skv. gr. 2.1. Hafi Malbikunarstöðin Höfði ekki flutt starfsemi sína af því svæði sem lóðarvilyrði þetta nær til framlengist lóðarvilyrðið sjálfkrafa í allt að 6 mánuði frá tilkynningu Reykjavíkurborgar skv. gr. 2.3.

3. Greiðslur vegna lóðarúthlutunar

3.1. Lifandi landslag mun greiða gatnagerðargjald skv. samþykkt um gatnagerðargjald í Reykjavík nr. 725/2007, með síðari breytingum.

3.2. Lifandi landslag mun greiða fyrir byggingarréttinn 45.000 kr. fyrir hvern heimilaðan fermetra af íbúðarhúsnæði ofanjarðar (A+B) og 20.000 kr. fyrir hvern heimilaðan fermetra af atvinnuhúsnæði ofanjarðar (A+B), enda standist byggingar á lóðinni markmið um umhverfisgæði, sbr. gr. 5.

Framangreint fermetraverð er bundið byggingarvísitölu desembermánaðar 2020 (149,2 stig) og skal það uppreiknað í samræmi við þróun vísitölunnar til greiðsludags.

3.3. Greiðsla gatnagerðargjalda og byggingarréttar skal fara fram innan 45 daga frá samþykki borgarráðs á úthlutun lóðar samkvæmt lóðarvilyrði þessu.

3.4. Þegar sótt er um byggingarleyfi verður gerð úttekt á umhverfisgæðum bygginga á lóðinni, sbr. gr. 5. Ef Lifandi landslag nær ekki þeim markmiðum sem sett eru upp í gr. 5. skal félagið greiða viðbótargreiðslu fyrir byggingarréttinn. Nánari lýsing á skilyrðum vegna viðbótargreiðslunnar er lýst í gr. 5.4. Niðurstaða úttektar á umhverfisgæðum og ákvörðun um viðbótargreiðslu samkvæmt henni skal liggja fyrir áður en byggingarleyfi er gefið út.

3.5. Komi til viðbótargreiðslu skal hún greidd innan þriggja mánaða frá því að niðurstaða liggur fyrir varðandi umhverfisgæði verkefnisins. Lifandi landslag skuldbindur sig til að fá ekki útgefið bygginga- eða framkvæmdaleyfi, þ.m.t. takmarkað byggingarleyfi, fyrr en framangreind viðbótargreiðsla hefur verið greidd.

3.6. Lóðarleigusamningur verður gefinn út innan 10 virkra daga eftir að greiðsla samkvæmt gr. 3.1.-3.3. og eftir atvikum viðbótargreiðsla, sbr. 3.4. hafa verið greiddar að fullu. Í lóðarleigusamningnum munu koma fram kvaðirnar sem eru taldar upp í gr. 4. auk almennra kvaða (s.s. vegna lagna, bílastæða o.fl.)

4. Kvaðir lóðarinnar

4.1. Auk almennra kvaða gilda eftirfarandi kvaðir um úthlutun lóðarinnar við Ártúnshöfða og sölu byggingarréttar hennar. Kvöðunum skal þinglýst á lóðina. Auk þess skulu þær tilgreindar í eignaskiptayfirlýsingu og þeirra skal getið í kaupsamningum, afsölum og lóðarleigusamningum sem gerðir verða við Lifandi landslag.

4.1.1. Óheimilt er að þinglýsa aðilaskiptum á lóð og/eða íbúðareiningum fram að því tímamarki þegar greiðsla byggingarréttar hefur borist Reykjavíkurborg, nema að fengnu leyfi borgarráðs. Þó er Lifandi landslag heimilt að færa lóðina í dótturfélag sem er 100% í eigu félagsins með því skilyrði að dótturfélag samþykki alla þá skilmála sem fram koma í lóðarvilyrði þessu.

4.1.2. Hafi Lifandi landslag ekki hafið framkvæmdir tveimur árum eftir úthlutun lóðarinnar áskilur Reykjavíkurborg sér rétt til að afturkalla úthlutunina nema félagið geti sýnt fram á málefnalegar ástæður fyrir töfum.

5. Umhverfisgæði bygginga

5.1. Stefnt er að því að fyrirhuguð bygging á lóðinni verði í sérflokki hvað varðar umhverfisgæði.

5.2. Reykjavíkurborg gerir þá kröfu að til þess að verð skv. gr. 3.2. haldist sé eftirfarandi krafa ófrávíkjanleg:

5.2.1. Burðarvirki byggingarinnar samanstendur af krosslímdum timburgrindum, stífaðar af með gegnheilum krosslímdum timbureiningum (e. CLT) og stálvirki eftir þörfum og í samræmi við kröfur byggingarreglugerðar en hluti byggingar, t.a.m. kjarnar, verður úr umhverfisvænni steypu, allt eins og fram kemur í sigurtillögu Lifandi landslags, sjá fylgiskjal III.

5.3. Til þess að mæla árangur í umhverfisgæðum verkefnisins að öðru leyti hefur verið tekin saman kröfugerð sem verður nýtt til þess að meta endanlega greiðslu fyrir byggingarrétt í verkefninu.

5.4. Í kröfulýsingunni eru tilgreind 32 atriði sem stuðla að auknum gæðum í verkefninu. Þegar sótt verður um byggingarleyfi mun Reykjavíkurborg fá óháðan ráðgjafa til þess að fara yfir kröfugerðina og gefa þessum 32 atriðum einkunn á bilinu 0-2 stig. Þegar aðili hefur vel náð sínum markmiðum fást tvö stig. Þegar hluta markmiða hafa náðst fæst eitt stig og þegar ljóst er að markmið nást ekki er gefið núll fyrir það atriði. Mest er hægt að fá 64 stig.

5.4.1. Ef Lifandi landslag nær 51 stigi eða meira greiðir félagið samkvæmt gr. 3.2.

5.4.2. Ef Lifandi landslag nær á 38-50 stigum greiðir félagið viðbótargreiðslu fyrir byggingarréttinn sem nemur mismun á gr. 3.2. og reiknuðu meðaltali af fjárhæðum skv. gr. 3.2 og markaðsverði

byggingarréttarins eins og hann er metin af tveimur fasteignasölum og velja samningsaðilar hvor sinn fasteignasalann. Hvor aðili um sig, Reykjavíkurborg og Lifandi landslag, greiðir kostnað af verðmati þess fasteignasala sem aðilinn tilnefnir. Verðmat skal taka mið af verðmæti byggingarréttar á lóðinni samkvæmt samþykktu deiliskipulagi og kvöðum.

5.4.3. Ef Lifandi landslag nær 37 stigum eða minna greiðir félagið viðbótargreiðslu fyrir byggingarréttinn sem nemur mismun á fjárhæðum skv. gr. 3.2 og markaðsverði byggingarréttarins eins og hann er metin af tveimur fasteignasölum og velja samningsaðilar hvor sinn fasteignasalann. Hvor aðili um sig, Reykjavíkurborg og Lifandi landslag, greiðir kostnað af verðmati þess fasteignasala sem aðilinn tilnefnir. Verðmat skal taka mið af verðmæti byggingarréttar á lóðinni samkvæmt samþykktu deiliskipulagi og kvöðum.

5.4.4. Ef mat fasteignasala á markaðsverði byggingarréttar reynist lægri en fjárhæð skv. gr. 3.2. mun ekki koma til viðbótargreiðslu. Við þær aðstæður á Lifandi landslag ekki kröfu um endurgreiðslu mismun á matsverði byggingarréttarins og fjárhæðum skv. gr. 3.2.

6. Samþykki fyrir veðsetningu og framsali

6.1. Lifandi landslag skal heimilt að veðsetja lóðarréttindi sín til að fjármagna þróun verkefnisins og framkvæmd enda séu gatnagerðargjöld og greiðsla vegna byggingarréttar að fullu greidd. Ef það er ekki raunin getur veðleyfi aðeins komið til greina hafi það að geyma skilyrði um að gatnagerðargjald og greiðsla vegna byggingarréttar séu að fullu greidd með andvirði láns.

6.2. Kvaðir sem þinglýstar verða í lóðarleigusamningi, kaupsamningi eða afsölum um einstaka eignarhluta halda gildi sínu þó að til komi nauðungarsala á veðandlaginu að hluta til eða öllu leyti.

Reykjavík xx. apríl 2022.

_____	_____
f.h. Reykjavíkurborgar með fyrirvara um samþykki borgarráðs	f.h. Lifandi landslags ehf.
Vottar að réttri dagsetningu og undirritun:	
_____	_____
Nafn og kt.	Nafn og kt.

Fylgiskjöl:

I. Afmörkun reitsins sem lóðarvilyrðið tekur til
II. Kröfulýsing hönnunar
III. Sigurtillaga Lifandi landslags í samkeppninni Re-Inventing Cities

Fylgiskjal I

Afmörkun reitsins sem lóðarvilyrði Reykjavíkurborgar til Lifandi landslags ehf., tekur til er á Ártúnshöfða og var lýst í gögnum (e. site specific requirements) sem lágu til grundvallar samkeppninnar Re-Inventing Cities. Teymið Lifandi Landslag var sigurvegari keppninnar og fær félagið Lifandi Landslag ehf. lóðinni úthlutað á þeim grundvelli fyrir hönd teymisins. Staðsetningin hér að neðan er til viðmiðunar og getur færst til við gerð deiliskipulags svæðisins.

Efni: Kröfulýsing hönnunar

Kröfulýsing þessi er unnin upp úr vinningstillögu hönnunarteymisins JAKOB+MACFARLANE - T. ARK – LANDSLAG – EFLA – KLASI – HEILD/UPPHAF - ARNARHVOLL fyrir Reinventing Cities, Ártún Reykjavík, Iceland. Phase 2, 7. mars 2019.
Í vinningstillögunni er því lýst með hvaða hætti leysa á þær 10 áskoranir sem settar voru um gerð og tilhögun byggingarinnar í hönnunarsamkeppninni.

Í skjali þessu hafa verið dregnar saman þær aðgerðir sem vinningstillagan lýsir og þær settar fram í styttu formi og á íslensku. Vísað er til ofannefndrar vinningstillögu fyrir nánari útskýringar.

Í upptalningu kröfulýsingarinnar er notast við sömu númeraröð og uppröðun og kemur fram í vinningstillögunni þar sem kröfulýsing nr. 1 vísar til áskorunar nr. 1 o.s.frv. Aftan við hvern kröfulið er óútfylltur reitur sem notaður verður til þess að skrá hvort og með hvaða hætti kröfunum hefur verið mætt. Við yfirferð á aðaluppdráttum verður fyllt í reitinn með viðeigandi lit samkvæmt eftirfarandi matslykli:

Grænt: Byggingin mætir öllum kröfum sem gerðar eru með fullnægjandi hætti.
Gult : Byggingin mætir að hluta þeim kröfum sem gerðar eru.
Rautt : Byggingin stenst ekki þær kröfur sem gerðar eru.
Kröfulýsingunni er ætlað að vera fylgiskjal með lóðarvilyrði.

1. Orkunýting

1.1. Orkunotkun

Markmið hönnunarinnar er að orkunotkun fyrir húshitun, loftræsingu, heitt neysluvatn, dælubúnað, lýsingu og hústæknibúnað á hvern byggðan fermetra verði að jafnaði 150 kWh/m².

Hönnun byggingarinnar mun miða að því að hámarka nýtingu á dagsljósi.

1.2. Loftræsing fyrir íbúðir

Í hverri íbúð verður sjálfstætt loftræsikerfi búið varmaendurvinnslu. Varmaendurvinnslan fer fram annaðhvort með varmaskiptahjóli eða plötuvarmanýti til að endurvinna varma úr útblásturslofti loftræsikerfisins. Íbúar eiga að geta stjórnað hitastigi innblásturslofts íbúðar í gegnum loftræsikerfið.
Mögulega má nota sömu aðferð í rýmum fyrir viðskiptavini.

1.3. Húshitun og nýting á hitaveitu

Byggingin verður upphituð með hitaveitu. Til þess að hámarka nýtingu varmans í hitaveitunni verður affall frá húshitun notað til þess að hita upp gróðurhús á þaki byggingarinnar.
Frá gróðurhúsum verður affall hitaveitu leitt í gegnum tjörnina í húsagarði byggingarinnar til að halda henni frostfrírri.

1.4. Gólfhiti í íbúðum

Íbúðir verða upphitaðar með gólfhita. Íbúar geta stjórnað hitastigi í íbúðum í gegnum hitanemana.

1.5. Aukin einangrun

Við hönnun byggingarinnar verður gengið lengra í einangrun hjúpflata en gerð er krafa um í byggingarreglugerð. Til dæmis verða útveggir byggðir upp með háeinangrandi krosslímdum timbureiningum (e. CLTi panels) sem draga verulega úr varmatapi og er miðað við að U-gildi útveggja verði á bilinu 0,25-0,30 W/ m²K í stað 0,40 W/m²K kröfu reglugerðarinnar.

1.6. Betri orkunýting

Við hönnun hússins verða lagðir fram útreikningar sem sýna orkusparnað miðað við hefðbundna byggingu í Reykjavík. Á seinni stigum hönnunar verður lagt mat á orkunotkun byggingarinnar m.t.t. kostnaðar og endurheimtutíma fjármagns af þeim orkusparnaði sem af hönnuninni hlýst.

1.7. Lyftur og annar búnaður

Lyftur verða settar upp í byggingunni til þess að mæta kröfum um aðgengi milli hæða. Gerð verður samanburðarkönnun á mögulegum lyftum þar sem lyftukerfið sem þarf minnstu orkunotkunina verður valið. Lyftukerfi sem endurvinna orku verða skoðuð sérstaklega í þessu sambandi.
Hvatt verður til að velja orkusparandi rafbúnað þar sem þörf er á s.s. skrifstofutæki, heimilistæki, eldhús og veitingaþjónustutæki.
Sett verða upp sameiginleg þurrkrými fyrir þurrkun á þvotti bæði innanhúss og utan.

1.8. Hreinn orkugjafi

Byggingin mun eingöngu notast við rafmagn og hita sem unnin er úr endurnýjanlegum orkugjöfum.
Í verksamningum verður gerð sérstök krafa til verktaka um að þeir noti eins mikið af rafdrifnum tækjabúnaði á byggingartímanum eins og mögulegt er.
Við hönnun byggingarinnar verða kostir þess að nýta sólarorku metnir m.t.t. umhverfisþátta og hagkvæmni.
Markmið hönnunarinnar er að orkunotkun fyrir húshitun, loftræsingu heitt neysluvatn, dælubúnað, lýsingu og hústæknibúnað á hvern byggðan fermetra verði að jafnaði 150 kWh, sbr. gr. 1.1.

1.9. Stýribúnaður fyrir orkunotkun

Íbúar geta stjórnað hitastigi innblásturslofts í íbúð með loftræsikerfi hverrar íbúðar eftir þörfum.
Íbúar geta valið sér hitastig á gólfhita á tilteknu hitastigsbili (s.s. 18-25°C).
Gólfhitakerfið verður stýranlegt með hitanema á vegg og innblásturshitastigi loftræsikerfis verður stýrt til þess að draga úr heildarorkunotkun.
Útilýsing verður sjálfstýrð til þess að koma í veg fyrir ljósanotkun í björtu (birtustýring).
Lýsing verður tengd hreyfiskynjurum í umferðarrýmum (umferðastýring).
Fylgst verður með orkunotkun byggingarinnar með aðgengilegum orkumælum og henni miðlað til notenda og íbúa. Yfirlit yfir orkunotkun verður birt á aðgengilegum skjáum sem sýna orkunotkun, kostnað orkunotkunar og áætlaða CO_2 losun.
Útbúin verður handbók fyrir notendur byggingarinnar og heimilishandbók fyrir íbúa sem dreift verður til notenda og íbúa sem útskýrir hvernig eigi að umgangast tækjabúnað byggingarinnar.

1.10. Kolefnisfótspor

Kolefnisfótsporið sem bundið er í byggingarefnum byggingarinnar (krosslímt timbur, steinsteypa og bendistál) verður kolefnisjafnað með endurheimt votlendis og/eða skógrækt.

2. Sjálfbærni byggingarefna, hringrásarhagkerfi og meðferð sorps

2.1. Líftímakostnaður

Beitt verður útreikningi á líftímakostnaði (e. LCC) byggingarefna til þess að velja það byggingarefni sem er fjárhagslega sjálfbærast hverju sinni. Í þessum tilgangi verða gerðar greiningar á hjúpfleti byggingar, tæknibúnaði (veitur, lagnir, loftræsing, lýsing, lyftur, hússtjórnunarkerfi og öryggis-, bruna- og þjófavarnarkerfi), yfirborðsefnum og lóðarfrágangi.
Til að lágmarka sóun á hráefnum verður hugað sérstaklega að því að byggingarefnin séu endurnýtanleg eftir líftíma sinn og búi þannig yfir verðmætum sem unnt er að leysa út.

2.2. Sjálfbærni mannvirkis

Burðarvirki byggingarinnar samanstendur af krosslímdum timbureiningum (e. CLT) sem dregur verulega úr kolefnisfótspori byggingarinnar og steyptu virki þar sem kappkostað verður að nota vistvæna steypu (e. Low Carbon Concrete) eins og mögulegt er.
Í einangrun verður notuð íslensk steinull.
Til að draga úr sóun í jarðvinna verður enginn kjallari undir byggingunni.

2.3. Meðferð úrgangs á byggingartíma

Markmiðið er að með markvissri stjórnun á meðferð byggingarúrgangs megi draga úr sóun. Umhverfissérfræðingur hönnunarteymisins mun útfæra sérstakt úrgangsstjórnunarkerfi sem á að lágmarka urðun byggingarúrgangs á byggingartíma og draga úr úrgangsmyndun á skaðlegum úrgangi. Byggingarúrgangur verður flokkaður í minnst 5 flokka, allt frá úrgangi sem fer til spilliefnamóttöku yfir í byggingarefni til endurnotkunar.
Stefnt er að því að 95% af öllum byggingarúrgangi verði endurunnin/endurnýttur og þá aðeins 5% fari í urðun. Allur byggingarúrgangur verður mældur og skrásettur í rúmmetrum eða tonnum á hvern brúttófermetra. Skráningin mun einnig ná til þess hvert skaðlaus byggingarúrgangur hefur verið fluttur og hversu stórt hlutfall af úrgangi fer til urðunar.
Áður en byggingarframkvæmdir hefjast, verða öll mannvirki á lóðinni (s.s. malbik o.fl.) sem þarf að fjarlægja, skráð og athugað hvort það sé unnt að nýta það byggingarefni út frá umhverfis-, tæknilegum eða fjarhagslegum sjónarmiðum.
Til þess að veita fullvissu um trygga stjórnun á meðferð á byggingarúrgangi, verður sérstökum óháðum aðila falið að hafa eftirlit með framkvæmd og framvindu meðferðarinnar á úrgangi.
Uppgröfur af lóðinni verður endurnýttur í landmótun lóðarinnar.

2.4. Sorphirða

Komið verður fyrir sorpgerði á lóð þar sem unnt verður að flokka frá endurvinnanlegt sorp. Stærð sorpgerðisins verður ákvarðað í samvinnu við Reykjavíkurborg.
Komið verður fyrir sérstöku rými innanhúss fyrir endurvinnanlegt sorp. Gert er ráð fyrir 6 sorpflokkum. 5 flokkar á endurvinnanlegu sorpi (plast, pappír, gler, málmar, lífrænt) og loks óflokkað sorp. Sorpílát verða með skýrum endurvinnslumerkingum og stærðir þeirra verða ákvarðaðar eftir fjölda íbúa og samkvæmt leiðbeiningum Reykjavíkurborgar. Sorpílátin verða staðsett nærri eldhúsi hverrar íbúðar.
Komið verður fyrir aðstöðu til moltugerðar á lóðinni með vatnspósti til þrifa á aðstöðunni og umhverfis hana.
Leiðbeiningabæklingur um sorphirðu verður útbúinn og afhentur íbúum byggingarinnar.

Í hverju eldhúsi íbúða verður afmarkað svæði fyrir geymslu á lífrænum úrgangi. Úrgangurinn verður notaður í gróðurhúsum á þaki byggingarinnar.

3. Kolefnislitlar samgöngur

3.1. Lágmörkun á CO2 losun farartækja

Verkefnið mun hvetja til notkunar á reiðhjólum með því að hafa sérstaka hjólreiðarstíga og veita hjólreiðaumferð forgang á gatnamótum.
Verkefnið mun einnig hvetja til notkunar á fjölvirkum samgöngum með því að útbúa aðstöðu fyrir reiðhjólaleigur og samnýtingu á reiðhjólum í sérstökum skýlum sem staðsett eru í nánd við strætóstöðvar þar sem unnt er að geyma og gera við reiðhjól og hlaða rafmagnsreiðhjól. Samnýting á reiðhjólum verður auðvelduð með aðgengilegu greiðslukerfi á staðnum, á netinu og í appi.
Verkefnið mun hvetja til notkunar á fjölþættum samgöngum (e. MaaS) með því að bjóða upp á valmöguleika á að deila og leigja hjól, hlaupahjól og umhverfisvænar bifreiðar.
Á hönnunarstigi verður íhugað að gera kröfur um að flutningabifreiðar og byggingartæki sem notuð eru á byggingartíma verði án kolefnislosunar að norskri fyrirmynd (Energy Norway, the Norwegian District Heating Organization, ENOVA, the Federation of Norwegian Constuction Industries (BNL), the Norwegian Contractors Association Oslo, Akershus and Ostfold (EBAO), Climate Agency, City of Oslo and Nelfo (2018), Guide to arranging fossil- and emmission-free solutions on building sites).

3.2. Umferð gangandi

Í hönnun á umhverfi gangandi umferðar verður gætt sérstaklega að því að tryggja öryggi gangandi vegfarenda með því að hafa göngustíga án þrepa og með lágum kanti, aðgreina gönguleiðir frá reiðhjólaumferð, tryggja örugga þverun á umferðarleiðum og koma fyrir bekkjum/sætum og stöðum þar sem hægt er að stoppa á leið sinni.

3.3. Almenningssamgöngur

Hönnun byggingarinnar mun taka mið af aðgengi að Borgarlínustöð og gert er ráð fyrir að á almenningssvæðum (við Borgarlínustöð) verði komið fyrir upplýsingaskjá sem sýna tímaáætlanir almenningsvagna í nágreninu.

3.4. Samnýting bílastæða

Í tillögunni er ekki gert ráð fyrir bílastæðum fyrir íbúa byggingarinnar en hönnun lóðarinnar gerir ráð fyrir möguleika á aðlögun á bílastæðum fyrir íbúa í samræmi við sameiginlega svæðaskiptingu almenningsbílastæða skipulagsheildarinnar við Ártún. Í þeirri lausn verða a.m.k. helmingur bílastæða útbúin með rafhleðslustöðvum fyrir rafknúin farartæki og lágkolefnisfarartæki munu hafa forgang að bílastæðum.

4. Seigla og aðlögunarhæfni

4.1. Aðlögun að umhverfi og náttúruöflum

Meginhætta á náttúruhamförum stafar frá flóðum. Lóðin er staðsett á landfyllingu við árós Elliðaáa og er flóðahættan því bæði frá sjávarföllum og vatnavöxtum í ánni. Til þess að mæta þessari hættu er

tjörn komið fyrir á lóðinni sem getur tekið við vatni úr flóðum sem síðan seytlar aftur til sjávar eftir flóðið.
Til þess að efla mótstöðu byggingarinnar gegn flóðum verður neðsta hæð hennar byggð úr steinsteypu. Af þessum sömu sökum er verslunar- og þjónusturými staðsett á neðstu hæð byggingarinnar til að verja íbúa hennar á efri hæðum fyrir skakkaföllum.

4.2. Sveigjanleiki í notkun

Húshitun og loftræsing verður hönnuð á þann veg að mögulegt verði að bæta loftkælingu við kerfið síðar ef þörf verður á.

5. Umhverfisvæn þjónusta á lóð, í húsi og í nágrenni

5.1. Hlutverk inngarðs

Í inngarði byggingarinnar verður fléttað saman samfélagslegu hlutverki hans fyrir íbúa og gesti og aðstaða fyrir lífríki plantna og dýra. Markmiðið er að inngarðurinn myndi staðbundið lífríki plantna, fugla og skordýra þar sem fyrirætluð tjörn gegnir lykilhlutverki m.a. í tengslum við blágrænar ofanvatnslausnir. Með affalli hitaveitu verður gengið úr skugga um að tjörnin haldist íslaus allt árið. Inngarðurinn verður tengdur náttúrulegu nærumhverfi með grænum göngustígum.

5.2. Ylrækt.

Ylræktun í gróðurhúsunum fimm, hvert um sig 150 fermetrar að stærð, á þaki byggingarinnar, verður skipt upp á milli íbúa, veitingastaðar og barnaheimilis. Íbúum verður úrhlutað sérstök gróðurhússvæði þar sem þeir geta ræktað grænmeti og kryddjurtir fyrir sig. Veitingastaðurinn á jarðhæð mun fá aðgang að gróðurhúsi til matjurtaræktunar og barnaheimilið fær einnig skika í gróðurhúsi til þess að kenna börnum ræktun.

5.3. Græn þök

Hönnun grænna þaka byggingarinnar miðar að því að skapa þar aðstöðu, bæði innan- og utandyra, fyrir íbúa byggingarinnar til að stunda matjurtaræktun og njóta útivistar og útsýnis yfir nærliggjandi umhverfi.
Gróðurþekja þakanna mun binda verulegt vatnsmagn úr regni í jarðvegi sínum og draga þannig úr þörfinni á umfangsmiklu fráveitukerfi regnvatns. Gróðurþekjan bindur einnig CO_2.

5.4. Félagsleg arðsemi fjárfestingar

Við fullnaðarhönnun byggingarinnar og á notkunartíma hennar veðrur félagsleg arðsemi fjárfestingar metinn með reglubundnum hætti. (e. Social Return on Investment) Matið verður órjúfanlegur hluti af upphaflegri kostnaðar- og fjárfestingaráætlun fyrir framkvæmdina og verður kynnt væntanlegum hagsmuna- og fjárfestingaraðilum sem hluti af samningum þar um.
Matið verður einnig notað til þess að setja viðmið fyrir hagsmunaaðila t.d. að velja eingöngu samstarfsaðila sem hafa sett sér samfélagsleg markmið og umhverfisstefnu.
Niðurstaðan úr matinu verður notuð til þess að velja samstarfsaðila sem skara fram úr á þessum sviðum.
Matið fer fram á tvo vegu. Fyrst verður gerð spá um frammistöðu byggingarinnar á þessu sviði sem byggir á markmiðum verkefnisins og félagslega arðsemin verður útreiknuð út frá því. Síðan verður

útreikningurinn uppfærður árlega með raungildum og metin raunáhrif allra aðgerða á verkefnið í heild. Matið fer fram í eftirfarandi skrefum:

1. Skilgreina umfang og hagsmunaaðila.
2. Skilgreina niðurstöður.
3. Færa sönnur á niðurstöður og gefa þeim vægi í matinu.
4. Staðfesta áhrif aðgerða á heildarniðurstöðu.
5. Reikna út félagslega arðsemi.
6. Skýrslugjöf til hagsmunaaðila, móttaka á endurgjöf þeirra og viðbrögð við þeim.

Eftirfarandi eru hagsmunaaðilar:

Hagsmunaaðilar	**Ástæða**
Rekstrartengdir leigjendur	Mikilvægir fyrir heildarhugmyndina
Íbúar	Sá hópur sem byggingin mun þjóna mest
- Aldraðir og hreyfihamlaðir	Sérstök áhersla er lögð á þennan hóp vegna breytinga í aldurssamsetningu þjóðarinnar
- Námsfólk	Félagsleg fjölbreytni
Leikskóli	Stuðningur við íbúa
Náttúruminjasafn barna	Almenn þjónusta
Reykjavíkurborg	Veitir ýmsa þjónustu

6. Sjálfbær þróun í snjallborgum

6.1. Snjallborgir

Við hönnun byggingarinnar verður byggt á hugmyndafræði BIM um samþjöppun upplýsinga um bygginguna bæði á hönnunarskeiði og á notkunarskeiði.
Við þrívíddarmódel byggingarinnar verða tengdar upplýsingar um kolefnisfótspor byggingarhluta sem fengnar eru úr lífsferilsgreiningu (e. LCA) byggingarinnar sem hluti af BREEAM vottun byggingarinnar.
Með notkun á þrívíddamódeli gefst kostur á að herma mismunandi lausnir varðandi burðarþol, einangrun, kostnað o.s.frv. til þess að auðvelda ákvörðunartöku á hönnunarstigi. Upplýsingar í módelinu verð uppfærðar á rekstrartíma byggingarinnar í tengslum við viðhaldsverkefni í framtíðinni.
Reykjavíkurborg mun geta nýtt sér módelið til almennra kynninga á verkefninu.

6.2. Upplýsingaveita

Sett verður á laggirnar vefsvæði þar sem unnt verður að veita íbúum og notendum byggingarinnar upplýsingar um starfsemi líðandi stundar í byggingunni.

Netnotendur byggingarinnar munu fá aðgang að IFTTT appveitunni.

Í byggingunni verður fjöldi skynjara, mæla og nema sem fylgjast með hitastigi, ljósmagni, rakastigi o.s.frv. Unnið verður að því að veita íbúum aðgang að upplýsingum frá þessum nemum. T.d. að tengja reykskynjara við lýsingu þ.a. birtustig verði aukið í brunatilfellum.

Íbúar munu geta fylgst með daglegri orkunotkun í gegnum hússtjórnarkerfi byggingarinnar.

6.3. Sprotastarfsemi

Skrifstofurými á 2. hæð byggingarinnar verða hönnuð með sjálfbæra sprotastarfsemi í huga. Slíkir aðilar sem hafa áhuga á að koma sér fyrir í byggingunni munu þurfa að lúta siðareglum sem settar verða á seinni stigum hönnunarinnar.

7. Sjálfbær vatnsnotkun

7.1. Regnvatn og yfirborðsvatn

Regnvatni verður safnað frá þökum og af lóðinni til þess að nota við vökvun á gróðri. Þannig verður gengið frá regnvatnslögnum að unnt verði að tengja hreinsistöð við lagnirnar til þess að auka nýtingarmöguleika á regnvatni í framtíðinni.
Á skjáum í almenningsrýmum og í upplýsingaveitu byggingarinnar verður hægt að fylgjast með vatnsnotkun einstaklinga og byggingarinnar í heild og bera hana saman við almenna notkun á landinu.
Gróður á þökum mun ekki þarfnast vökvunar.
Mengað yfirborðsvatn á lóð verður hreinsað með náttúrulegum aðferðum með því að veita því í gegnum gróðurþekju, tjarnir, sand, möl og jarðveg sem sía vatnið.
Við hönnun verður áhersla lögð á að meðhöndla allt yfirborðsvatn með blágrænum ofanvatnslausnum sbr. ákvæði deiliskipulags. Með þessu verður yfirborðsvatn á lóð hreinsað með náttúrulegum aðferðum með því að veita því í gegnum gróðurþekju, tjarnir, sand, möl og jarðveg sem sía vatnið.

7.2. Vatnsnotkun

Búnaður fyrir vatnsnotkun verður valin með það fyrir augum að vatnsnotkun verði ekki meiri en lýst er í hefðbundinni notkun (e. baseline) samkvæmt BREEAM.

8. Líffræðilegur fjölbreytileiki, jarðyrkja og endurheimt á gróðri í þéttbýli

8.1 Varðveisla líffræðilegs fjölbreytileika

Lögð verður sérstök áhersla á að framkvæmdir á lóðinni hafi ekki neikvæð áhrif á náttúru-, vatna-, og fuglalíf Elliðaáa. Gerðar verða sérstakar ráðstafanir til þess að koma í veg fyrir mengun af völdum byggingarefna og hvernig skuli meðhöndla úrgang og eiturefni.
Yfirborðsvatn verður síað og hreinsað á byggingartímanum áður en því er veitt út í ána.
Beitt verður aðgerðum til þess að koma í vef fyrir truflun á náttúru- og dýralífi, t.a.m. á varp- og vaxtartíma fugla og að ekki verði hindrun á göngu fiska í ánum.
Gerðar verða greiningar til að meta áhrif ljóss sem stafar frá veitingastað, íbúðum, leikskóla og sérstaklega gróðurhúsum til að færa ekki núverandi birtuskilyrði úr jafnvægi.
Í samningum við hagsmunaðila verða sett skilyrði til að tryggja vöktun á náttúru og skilgreina ábyrgð aðila á því sviði í rekstri byggingarinnar.
Við hönnun lóðar verður miðað að því að endurskapa staðbundið náttúrufar og dýralíf.
Í hönnun er gert ráð fyrir því að gróður þeki a.m.k. 75% af heildarstærð lóðarinnar.

8.2 Fjölbreytt nýting gróðurhúsa

Rými í gróðurhúsum verða útbúin þannig að unnt sé að nota þau á fjölbreyttan hátt, s.s. fyrir yoga-kennslu, námskeið í listmálun, útleigu fyrir brúðkaup og fleiri atburði af slíkum toga.
Tekjur af slíkri starfsemi verða notaðar til þess að greiða niður viðhaldskostnað sameignar.
Garður, græn þök og gróðurhús verða höfð í umsjá aðila sem hefur garðyrkjumenntun.
Á lokastigum byggingarframkvæmda verður útbúin ítarleg handbók fyrir viðhald og umsjá gróðurs og gróðurmannvirkja í samráði við framtíðareigendur byggingarinnar.

9. Samfélagslegur ávinningur

9.1. Samtenging aldurshópa

Öll almenningssvæði eru hönnuð með það í huga að eðlileg blöndun á aldurshópum íbúa eigi sér stað í notkun svæðanna.

10. 10 Framsækin hönnun í þéttbýli

10.1. Markmið vottunar

Gert er ráð fyrir að byggingin fái „Very good“ einkunn úr BREEAM vottun eða sambærilega einkunn úr öðru sambærilegu matskerfi á sjálfbærni.

C40 REINVENTING CITIES
ÁRTÚN, REYKJAVIK ICELAND
LIVING LANDSCAPE
LIFANDI LANDSLAG

2. THE PROJECT

T E A M

HEILD Upphaf JAKOB+ MACFARLANE T.ark EFLA EOC LANDSLAG CNRS KLASI FRAMKVÆMDAFÉLAGIÐ ARNARHVOLL

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FOREWORD

Living Landscape, a new ecosystemic typology for living.

Living Landscape is an innovative mixed-use building with a minimum carbon footprint, a positive impact on its environment and sheltering a condensed local ecosystem. Living Landscape will be the largest wooden building in Iceland.

The project which will represent Iceland's the largest wooden structure is situated alongside the City Line, the new bus line crossing Reykjavik from West to East. It takes full advantage of this privileged location connecting to the public transportation route through a bus stop located on the North-East corner, opening to a large public square.
Programmatic elements are organised around and under a rich **ecosystemic landscape** which creates an 'O' shaped building. This center core is designed as a sample piece of the **local ecosystem**. Indigenous plants, local rocks, a topographic surface mimicking the nearby wetlands, a rainwater management inspired by stratovolcanoes, all contributing to a rich shared ecosystem epicenter for the project, the city and the planet.

A prototype typology

Our project sets on a forthcoming urban context: Elliðaárvogur-Ártúnshöfði development consists on displacing a polluting industrial zone in order to create **urban continuity** by weaving a new neighborhood in between Vogar-Gerði and Harmar-Foldir.

As the first project of far east Reykjavik's new urban extension we ambition that our Living Landscape **ecosystemic typology** proposes a precedent for Iceland's numerous upcoming developments.

All together, they will compose a **new ecosystem fabric**, an extremely rich environment where the differences between an urban condition and a natural condition are blurred.
This ecosystemic methodology of growing urban cities was designed by our team of local and international experts to be seen **as an example for the global community.**

2019-03-07

Mixed-use building teeming with life

Various activities animates its ground floor. The second floor is made of offices. The upper floors are a compostion of different types of housings (students, elderly and family). Finally its evolutive roof welcomes five shared glass houses and is ready to welcome all sorts of activites, all connected by an accessible circular pathway.
The central landscape is porous, walkers, bicycles and all sorts of soft mobilities can cross it.

The first thing you see riding the bus towards the new extension of Reykjavik, right after the small island, is the most active corner of our building: at the crossing between a street alongside the Elliðaá river (West) and the busiest street (South), you find a 300 sqm restaurant.

4 100 sqm of commercial spaces fill the ground floor on the South side facing the main street and on the East side facing the public square.

The offices (included within the 4 100 sqm) are located on the first floor, above the shops.

On the a peaceful angle (North-West) a 400 sqm kindergarten with 250 sqm of protected courtyard inside the central landscape.

The rest of the courtyard space is **shared** with the kindergarten and all the inhabitants of the housings above. A careful topographic work enables **soft mobilities** to cross the project from all directions. In the middle of the central landscape the volcanic geothermal water, after it has heaten the housings and the glass houses, runs through a pond enabling it never to freeze and thus adding to the richness of the central landscape : water, air, earth, plants, rocks, animals, insects, together forming a concentrated local and protected ecosystem. The central landscape is porous, walkers, bicycles and all sorts of soft mobilities can cross it.
Inhabitants access the central core of the building through four entrances each located on a cardinal point. When in the central space, the landscape distributes the accesses to eight vertical circulations leading to the apartments.

The first level of apartments sits on the North part of the ground floor which benefits of private gardens within the central space. All five floors above the ground floor are filled with housings adding up 17 000 sqm of floor area.
Apartments include various typologies from single bedroom apartments to 4 bedrooms apartments, all including an outdoor balcony / winter garden. On the South part of the building, facing the busiest street, we find mostly student housings, some of them designed as big shared apartments. In the most protected areas, you'll find more apartments for the elderly and the rest of the building is made of family dwellings.

On the rooftop, a promenade for the inhabitants made of a wood decking and tundra vegetation connects the five greenhouses, each around 150 sqm. They are dedicated to shared communal spaces for the inhabitants with shared outdoor spaces.
A part of the greenhouses area will be dedicated to the restaurant (local agriculture) and another one for the kindergarten (educational purpose).

All elevator shafts bring access to electricity and water to large decks on the roof enabling them to be colonised by future activities like sports rooms, tea bars, artist workshops etc.

Innovative design

However we use traditional and Icelandic elements such as green tundra roofs, and natural features of the local ecosystem, our building is **indisputably contemporary** and its arctic nature inspired **undulating form** is quite **disruptive** in the Icelandic context.
Our project will be the **largest wooden building** in Iceland. It will trigger **new uses** through **innovative programming** such as the central ecosystem, it fosters social bonds by offering quality spaces like the communal greenhouses to families, students and the elderly.

Such a vibrating project will initiate a new energy in the Icelandic urban context and act as a signifier for future development throughout the world.

Nature-Based Solution

To harness the power and sophistication of nature to turn environmental, social and economic challenges into **innovation opportunities**, our team worked hard to incorporate Nature-Based Solutions (NBS) in our project.

NBS can address a variety of **societal challenges** in sustainable ways, with the potential to contribute to **green growth** and **'future-proofing'** society, fostering citizen well-being and providing **business opportunities**.

Nature-based solutions are actions which are inspired by, supported by or duplicated from nature. They have tremendous potential to be energy and resource-efficient and resilient to change, but to be successful they must be adapted to local conditions.

Many nature-based solutions result in multiple **co-benefits** for **health**, the **economy**, **society** and the **environment**, and thus they can represent more efficient and cost-effective solutions than more traditional approaches.

Four principal goals are addressed by nature-based solutions in Living Landscape:

Trigger a new type of **sustainable urbanisation** through nature-based solutions like implementing stores selling locally grown or made products, to stimulate **economic growth** as well as improving the environment, making the city more attractive, and Icelanders happier.

Restoring a degraded and polluted ecosystem victim of violent man made changes like landfills and petroleum related industry using nature-based solutions such as **re-implementing local plants** and rocks, working **a porous city** and **sheltering animals** can improve the **resilience of ecosystems**, enabling them to deliver vital **ecosystem services** and also to meet other societal challenges.

Developing climate change adaptation and mitigation using nature-based solutions such as a **water management** through landscape, re-implementing a degraded flora and **wood construction** can provide more **resilient responses** and enhance **Carbon Capture and Storage** (CSS).

Improving **risk management** and **resilience** using nature-based solutions which proved their efficiency for hundreds of years on a nearby environment can lead to greater benefits than conventional methods and offer synergies in reducing multiple climate related risks.

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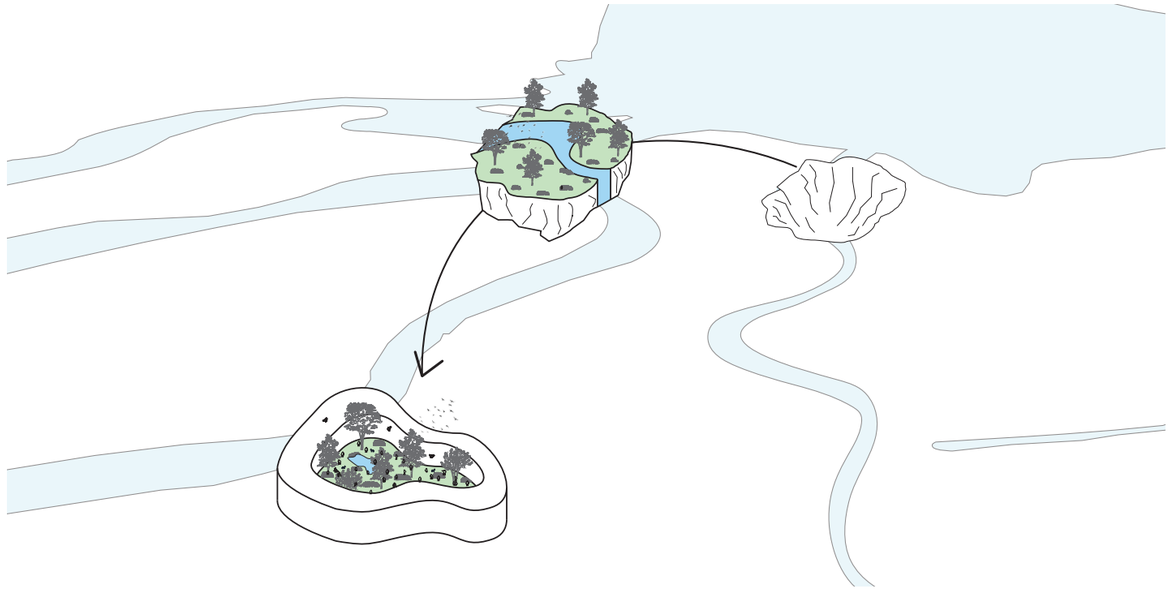
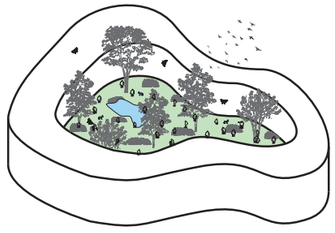
Certification

Living Landscape uses **common sense** to stand as an extremely sustainable building. However it is a wooden building, it uses sustainable concrete when beter in the global impact of the structure. It's energy solutions have been chosen considering local needs and an insular reality which, sometimes doesn't fit with a mainland point of view. The project will aim to reach a "Very good" rating with the BREEAM scheme or a similar level of ambition with other methods for assessing sustainability. This ensures good performance with regards to sustainability.





Sustainable structural principles

Living Landscape will be the largest wood building in Iceland.

In order to satisfy the mixed-use, adhere to sustainable building practice and be innovative – the final scheme for the structure is based on a **hybrid sustainable concrete base and structural timber superstructure**.

The commercial spaces at ground floor structure that require a large open floor plan are based on a 9m spaced grid with columns set back 11 to 14m. These spans and the transfer structure at 1st floor level require a reinforced concrete solution. The remaining ground floor spaces used for kindergarten and residential are based on a Cross Laminated Timber (CLT) structure with a 3m grid that continues up to roof level.

The reinforced concrete base structure is designed to create the four 12m wide span bridge openings that provide access to the internal landscaped areas.
Over the commercial spaces, from 1st floor to roof level – the 4 to 5 storey structure is based on a 3m modular Cross Laminated Timber (CLT) construction for housing. The modular panel CLT construction provides flexibility using wall and floor **prefabricated timber** panels with the necessary built-in acoustic and thermal requirements.
The building is divided into 4 blocks – each block containing 2 to 3 concrete cores that provide lateral structural stability. In total 9 core and elevator shafts.
The roof is based on a more flexible grid arrangement for use as communal spaces with glazed pavilions for shared use by residents – dining, relaxation, exercise, etc.

The south facing glazed façade benefits from a 2m setback from the street and a 1m setback for the internal courtyard areas.
There is no basement so RC columns and core structures are founded directly on the site's ground.
For the optimal use of sustainable concrete, **recycled lightweight plastic structural formers**, such as Cobaix, can save up to 35% in concrete.

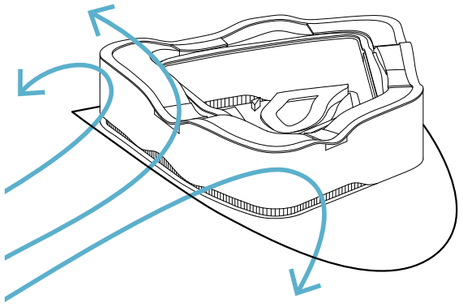
The facades are comprised of a **new generation** of Cross Laminated Timber (CLT) with Insulation panels: Panobloc, an innovative cross fold panel composed of several layers of timber crossed at 90° and shifted then filled in with sustainable and **locally sourced insulation** materials under an industrial process according to the expected performances (thermal fire and structural resistance, acoustics...). To the outer skin is applied Kerto panels of 27mm thickness treated for class 3 or 4 to EN 335:2013.

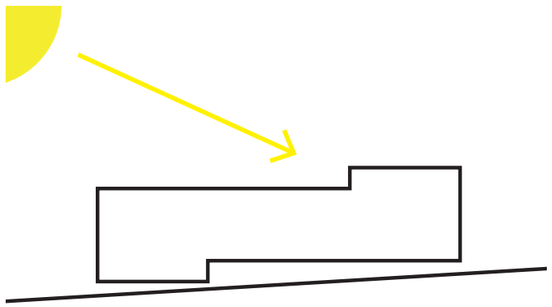
Hard surfaces of outdoor environments will partly be **built by waste**. An example of this would be to use concrete blocks and/or asphalt blended with recycled and broken glass bottles. This material creates an interesting pattern on the ground with various colors of the recycled bottles that also reflect light from the surface, resulting in a “sparkly” floor which is especially interesting in the winter when the natural light is scarce.
Landscaping will reuse materials from the site as much as possible. Materials from the former industry on the site can be used to create sculptures in public spaces, resulting in a site specific design that can enhance the identity for the site.

1. SITE ENERGY EFFICIENCY AND SUPPLY OF CLEAN ENERGY

Taking advantage of the landscape

In Nordic climates, shelter from wind and wind chill factor as well as the creation of sheltered exterior spaces are critical. This is one of the reasons of our circular shaped building. Winds are redirected around its façades sheltering life at its core around a landscaped courtyard.
On the urban scale, the 'O' shape stretches slightly to the East protecting the public square from the predominant winds





Lighting

Living Landscape also takes advantage of the natural topography to limit maximize direct sunlight exposure for users comfort and limitation artificial lighting.
Our design aims also to offer the inhabitants the most of the stunning Icelandic Landscape has to offer: all views where carefully worked to be directed toward the surrounding nature.

We have maximized the number of double exposure apartments. When single sided, apartments are shallow and wide enough to allow good daylighting into the back of the apartment. All living rooms have generous outdoor space in direct continuation and most of them are facing South and West.
Stairwells and communal spaces are daylit, with movement and daylight sensor control, ensuring 25-50 lux lighting level at all times, while reducing electrical usage.
By having greenhouses on top of the building, we ensure that all the sunlight available to the building is used to full extent.

Internal and external lighting will be provided with specification of energy efficient light fittings and appropriate controls. Within the building the controls will take account of absence or occupancy by sensors and externally lighting will be automatically controlled through a time switch or a daylight sensor to prevent use during daylight hours or when not needed. For residential areas, the prospective residents will be encouraged to buy and install energy efficient lamps and equipment.

An energy efficient project

Icelandic building regulation does not include requirements regarding energy consumption but we have set our own goals. The energy demand of a BAU building in Iceland uses around 250 kWh/m² (space heating, ventilation, hot water, fans, pumps, lighting and technical equipment) [6], but our target is to reduce the energy demand by 40% form 250 to 150 kWh/m².*

We attempt to reach this goal by maximizing energy efficiency at all stages. Regarding lighting, as mentioned above, we have adjusted the form of the building to maximize the use of daylight.

There are several ways in which we will increase energy efficiency regarding heating like hot water and ventilation:
Waste heat recovery ventilation. A cascade of waste heat utilization, underfloor heating with thermostats, and better insulation of the building.

École de la chambre syndicale de la couture parisienne, Paris

* Based on EFLA's experience with energy calculations in BREEAM certifications.

Innovative HVAC

Individual ventilation system will be used for each apartment, giving occupants the flexibility of customizing indoor temperature to their comfort, which lower heating costs down and yields more valuable apartments. The installation includes either a rotary heat exchanger or a cross-flow heat exchanger to recover waste heat energy from the exhaust air, greatly increasing the energy efficiency.
This heat recovery solution has been demonstrated in Iceland a few times and is gaining foothold in the Nordic countries. The initial costs of this system would be more expensive than the BAU case but it will pay off in the long run through thermal energy savings. This solution will be implemented in all apartments and possibly also in the commercial spaces.
The HVAC system will be located at the balcony ceiling of each apartment. From there, the air will be distributed within the apartment. The BAU case, however, would be to ventilate exhaust air from bathrooms and kitchens while taking in cold air through grills located in windows or external walls. The BAU case does not capture any waste heat from exhaust air.

Also, this system frees the project from ventilation ducts and massive shafts offering a better yield regarding the floor surfaces.

Cascade of waste heat utilization

The Capital Region of Iceland has a district hot water heating system which gets renewable heat from the geothermal heat/ electricity power plants at Nesjavellir and Hellisheiði. This renewable source of heat will be used to heat the building. In our we strive to maximise the use of the heat contained in this hot water of geothermal origin. After its main use of heating up apartments, the hot water is still at approximately 30-40°C.
This water will be lead to the rooftop greenhouses to keep them out of frost using the heat still contained in the water.
Currently in the neighborhood there is a single-pipe hot water district system but according to Reykjavík Utilities (Veitur) there will be a double-pipe system built up in the near future. This requires the water to be returned to the district return pipe in the street after its use in the greenhouses.
Nevertheless, the remaining warmth is used a last time by running the pipes through the pond in the courtyard to maintain it out of frost and enriching the central arctic landscape.
These solutions are lead by our long term vision of the project. There will be more installation cost regarding utilizing waste heat for heating the rooftop greenhouses due to pipework but there will be savings in the thermal energy costs.
The building is a mixed structure. Most of it is wood but the first floor is made out of sustainable concrete which offers great thermal mass contributing to heating and cooling spaces.

Underfloor heating with thermostats

Underfloor heating will be controlled with thermostats to minimize thermal energy use. There are co-benefits of using the abovementioned ventilation system along with a floor heating system because the heated air from the floors circulates better and is distributed more evenly, yielding a more stable temperature across the apartments.

Better insulation

In the detailed design of the project, the aim will be to go further in insulation than the Icelandic Building Regulation requires. Taking external walls as an example, the Building Regulation requires that external walls should not have a higher thermal transmittance (U-value) than U = 0,40 W/m²K but in our design the aim will be to reach a U-value of 0,25-0,30 W/ m²K for external walls.
To reach these high standards we set to ourselves, we had to take advantage of the international knowledge of our team.
External wall will be filled with a French Industry subproduct. New generation of very high and exceptional performance Cross Laminated Timber with Insulation (CLTi) panels, Panobloc is a cross fold panel composed of several layers of timber crossed at 90° and shifted, filled in with locally sourced insulation materials totally configurable (gaps between the wooden lattices, width of insulating strips...) under an industrial process according to the expected performances (thermal fire and structural resistance, acoustics...).

Reduced consumption

These energy efficiency improvements are expected to reduce the energy consumption by around 20-30% compared to a ‘regular’ Reykjavik housing project . In the later design phases, calculations for energy consumption with regard to cost and payback period will submitted, to show the value in energy savings.

Equipment

Lifts will be installed to meet the expected transport demand and use pattern in the building. The energy efficiency of available lifts will be analysed and different systems compared where the transport system with the lowest energy consumption will be specified within the building. The lifts shall fulfill specific criteria regarding energy efficient features, e.g. the lifts shall operate in standby mode during off-peak periods.
In continuation to our global vision on the energy efficiency of the project, elevators with power generation system (creating energy with turbines activated by their motion) wil be studied for the project.

In order to ensure optimum performance and energy savings in the developments operation, the procurement of energy efficient equipment will be encouraged for all areas within the building. This applies to the following equipment, but is not limited to: Office equipment, domestic scale white goods and kitchen and catering facilities. In addition, for residential areas, an internal or external space will be provided for drying of clothes thus reducing the need for energy means of dryers.

* See Appendix: Geothermal district heating in Iceland explanation from the HB09 project. Energy study from the HB09 project.

Clean Energy

Our project will only use renewable electricity and renewable heat energy. Electricity in Iceland is by far from renewable sources and is produced mainly in hydropower plants (approx. 73%) and geothermal power plants (approx. 27%). There would therefore not be any gains from producing renewable electricity on-site as that would most likely not be nearly as efficient as the power plants already in place, due to the difference in scale. The same story is to say about district heat in Reykjavík, it is entirely renewable. The hot water is produced at the geothermal power plants and supplied by a distribution pipeline network.*

Regarding the construction itself, the BAU would be to use machinery that runs on diesel only. But in our project, we will set strict requirements in the tender documents that will require contractors to use as much electricity-powered machinery as possible.
The project will also maximize the use of sunlight to reduce its energy purchases.

As mentioned above, the electricity supplied by the Icelandic grid is almost entirely renewable produced by hydropower plants and geothermal power plants, so there is no need to buy Guarantees of Origin or similar certificates to prove that renewable electricity was used. All small-scale users of electricity in Iceland, such as in this project, automatically run on renewable electricity and heat.

Our goal is to reduce the yearly energy demand of the building down to 150 kWh/m² (space heating, ventilation, hot water, fans, pumps, lighting and technical equipment). The aim is therefore to keep the energy demand of the building below 3.400 MWh/year. Since the grid-supplied electricity and heat in Reykjavík is 100% renewable, the total expected renewable energy consumption is 100% of the total energy consumption, i.e. 3.400 MWh/year.

As stated above, the energy demand of a BAU building in Iceland is around 250 kWh/m² but our target is to reduce the energy demand down to 150 kWh/m², saving 100 kWh/m². In terms of greenhouse gas emissions, this means reducing the emissions from 107 tonnes CO_2-eq./year down to 64 tonnes CO_2-eq./year, saving 43 tonnes CO_2-eq./year. *

On-site energy control and monitoring:

The individual ventilation system for each apartment gives occupants the flexibility of customizing indoor temperature to their comfort.
Floor heating will be controlled with thermostats where occupants could choose a temperature within a given range (i.e. 18-25ºC). The floor heating system will be synchronized with the ventilation system to reduce the total thermal energy consumption.
External light fittings will be automatically controlled for prevention of operation during daylight hours and presence detection in areas of intermittent pedestrian traffic. Within the building in non-residential areas and common areas (circulation areas, corridors and stairwells) the switching controls will take account of absence or occupancy

Energy consumption will be monitored using connected energy meters accessible and visible by users. The control system could either be monitored directly or via an energy monitoring and management system. For residential areas, the energy consumption will be made available to the building users through the use of energy display devices. The purpose of the energy display device is to transmit energy consumption, cost and CO2 emission data to a visual display unit in an accessible location in order for building occupants to make meaningful energy reduction decisions. Users will receive alerts including previous month comparisons to bring awareness to users.

Our project is targeting a very wide range of residents from students to elderly and families and is thought to be inclusive of all kinds of impairments. This is why all user interfaces will be carefully selected in order to facilitate access to technologies to everyone. A non-technical building user guide and home user guide will be developed and distributed to the building users as appropriate to ensure proper use and control of systems within the building.

Energy storage

Always driven by a global overview of all our solutions a great expertise of the local scene by our team we will not implement on-site energy storage in our project.
Energy storage is mainly required where there is on-site energy production or where the electricity grid contains mostly wind or solar power, which can be variable in production and would need buffering. The Icelandic electricity grid, however, only contains hydropower and geothermal electricity, which are very stable forms of renewable electricity production so energy storage is not needed. On-site electricity production would be impractical in Reykjavík where there is enough grid-supplied renewable electricity and heat available. As discussed above, it is more environmentally friendly to use the grid-supplied renewable energy than producing it on-site.

Societal benefits

The project aims to be as low-carbon as possible but there might be some emissions left to reach carbon-neutrality. There are two main opportunities for offsetting carbon emissions in Iceland, either by rewetting drained wetlands (peatlands) or through forestry. These incur social and environmental benefits through supporting local action to reduce carbon emissions while at the same time increase the biodiversity of barren areas.
The carbon footprint for the embodied emissions from the main building materials (Cross Laminated Timber (CLT), concrete, reinforcement steel) will be compensated for by buying either wetland recovery or forestry carbon offset credits, making the building effectively carbon neutral.

* The Icelandic electricity grid is 73.3% hydropower, 26.6% geothermal and 0.06% wind power and the carbon intensity is broken down accordingly [4].Thinkstep (2019). GaBi Professional Database.

2. SUSTAINABLE MATERIALS MANAGEMENT, CIRCULAR ECONOMY AND WASTE

Ecobalance

Driven by Edgar Morin's Mainstream Utopia (Penser Global - Think Global) when choosing a construction element, the impact on the environment of all its stages were studied from the production of the raw material to its degradation. Described as Life Cycle Assessment, evaluation methods were used to ensure a low-carbon impact of the building.

First of all, the life cycle impacts for Cross Laminated Timber (CLT) construction were compared to a BAU concrete construction on the basis of 1 sqm of external wall with a thermal transmittance of U = 0,275 m²K/W. The BAU structure would be a 180 mm thick reinforced concrete but our design proposes a 120 mm thick CLT structure instead. For the sake of comparison, all other layers of the external wall were kept the same but the stone wool insulation is thinner in our design because CLT provides better thermal insulation compared to concrete.

The layers in the comparison were as follows:
Concrete wall would have been:

- 30 mm wooden cladding
- 135 mm stone wool insulation
- 180 mm concrete + rebar (BAU)

When our CLT project is:

- 30 mm wooden cladding
- 100 mm stone wool insulation
- 120 mm CLT

The carbon footprint of the CLT wall turns out to be 19 kg CO_2-eq. per sqm of external wall whereas the carbon footprint of the concrete wall is 93 kg CO_2-eq. per m² of external wall. Therefore by choosing a CLT external wall instead of the BAU concrete wall, 74 kg of CO_2-eq. are saved per sqm of external wall. In this comparison, the CLT option **reduces the carbon footprint by almost 80%**.

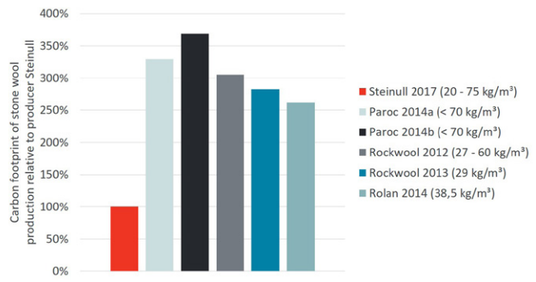
Secondly, we propose to use Low-Carbon Concrete (LCC) or Green Concrete where possible. LCC is a concrete which uses waste material as at least one of its components and/or its production process does not lead to environmental destruction, and/or has high performance and life cycle sustainability.
Standard concrete contains usually 400 kg CO2/m³ of concrete but we aim to use concrete with lower carbon intensity, e.g. LCC300 with 300 kg CO_2 /m³. As design of the building continues, low-carbon concrete options will be further assessed.
Another way of reducing emissions from concrete is to reduce the amount of concrete where possible and to avoid using high-strength concrete where it is not needed, e.g. by using C25/30 concrete instead of C30/37 where possible.

Thirdly, the building will exclusively use Icelandic stone wool as an insulation material. Through an Life Cycle Assessment (LCA) carried out by our environmental engineer (EFLA), it has been shown that Icelandic stone wool has much less carbon emissions than the alternatives and also less than stone wool produced abroad. Stone wool is a low-carbon, heat resistant insulation material and an Environmental Product Declaration (EPD) is now being developed by ourselves (EFLA). The carbon footprint of Icelandic stone wool produced by Steinull hf. is up to three times lower than the carbon footprint of their competitors in Norway, see image no. 1[1].

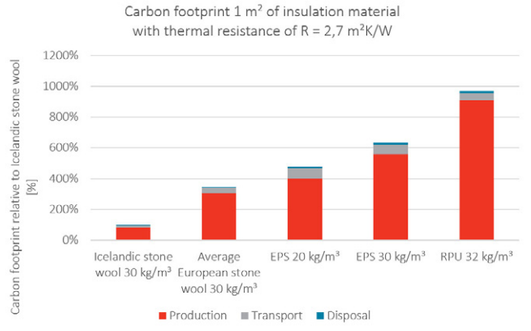
The Icelandic stone wool also outperforms other types of insulation in terms of being low-carbon, see image no. 2 [2].
The carbon footprint of the main building materials in the building (CLT, concrete) has been assessed. CLT is the structural material for most of the building and will be used in upper floors, external walls, roof and underside cladding of the 1st floor slab.
The estimated volume of CLT needed for upper floors and external walls is around 9.800 m³. The amount of reinforced concrete needed for foundations, bottom floor slab and the second floor slab is around 3.700 m³. Considering the most relevant Life Cycle stages, i.e. the material production and the waste treatment, the carbon footprint is 3.160 tons CO_2-equivalents, or 140 kg CO_2-equivalents per m² of gross floor area.

Cost Assessment with Life Cycle Approach

In order to deliver whole life value, Life Cycle Costing (LCC) will be used to improve the design and promote economic sustainability. The LCC will incorporate building envelope, services, finishes and external spaces and the results used to influence building and systems design to minimize life cycle costs and maximise critical value. This approach guarantees robust material selection and promotes lifetime extension of materials through maintenance, repairs, upgrades and renovation.



EFLA (2019). Life Cycle Assessment of Icelandic stone wool. Steinull hf



EFLA (2019). Kolefnisspor einangrunarefna

Transportation

The most relevant Life Cycle stages were included in the comparison, i.e. the material production and the waste treatment. Transport was not included at this stage. Iceland insular condition needs to be taken into consideration. Almost all building material needs to be imported by sea.
With lack of trees in Iceland, CLT structures for external walls is unfortunately not produced in Iceland. But it's clear competence with regards to low CO_2 emissions during its life cycle makes it a material of choice when lowering the carbon footprint. We have already engaged discussion with Norwegian, Finish and Austrian manufacturers which all work with sustainable wood and have experience in providing Iceland.

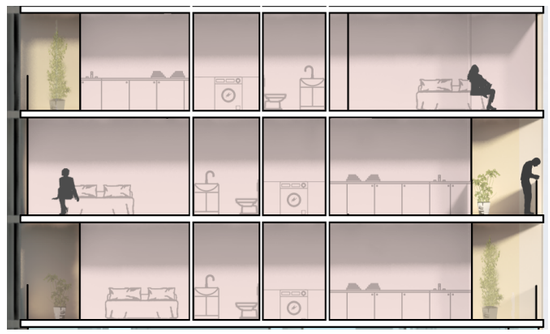
The building will, however, exclusively use Icelandic stone wool as an insulation material. It is a low-carbon, heat resistant insulation material that is transported much shorter distances than other insulation materials. By choosing Icelandic stone wool exclusively, we lower the transport emissions.

For the reinforced concrete made base of our building we plan to use Green Concrete (or Low Carbon Concrete (LCC)). Subsequently, a careful study of all the building wastes we could use will be made prior to the construction, such as remains left by the asphalt industry currently on site, wastes from former street demolitions or digs in the existing landscape for the future City Line route etc.
During the construction phase, transportation emissions will be minimized during the construction phase by optimizing procurement and minimizing the need of deliveries to the site. Heavy machinery and other construction equipments will be electrically charged on site.

By eliminating basement construction and general soil relocation, the project limits the requirement for intense trucking of earth to and from the site. By the use of prefabricated Cross laminated timber panels and other off-site fabrication, waste is minimized and efficient transport of materials to the site is maximized.

A flexible building

Societal needs constantly evolve. Our philosophy is not to make precise prevision but to offer an **adaptive design** resilient to changes. This is why we have designed a **flexible** project capable of **absorbing changes** within the years, but also during the design phase of the project.
Through careful delineation between structural elements of the CLT, space dividing elements and floor to ceiling height, the structural principles of the project facilitate modifications of uses and changes such as transforming the offices into more housings or changing some typologies of apartments.
The outdoor spaces next to the greenhouses have been thought as multi-purpose spaces. By only bringing access to electricity and water through the vertical circulations and calculating the structure on which they stand strong enough to welcome a new plugged activity, like a yoga class or artist workshops.
Collective spaces around circulation and on rooftop can adapt to different user expectations as they evolve over time.
As well, HVAC systems wil be designed with the possibility to integrate cooling if needed later on.



Material efficiency

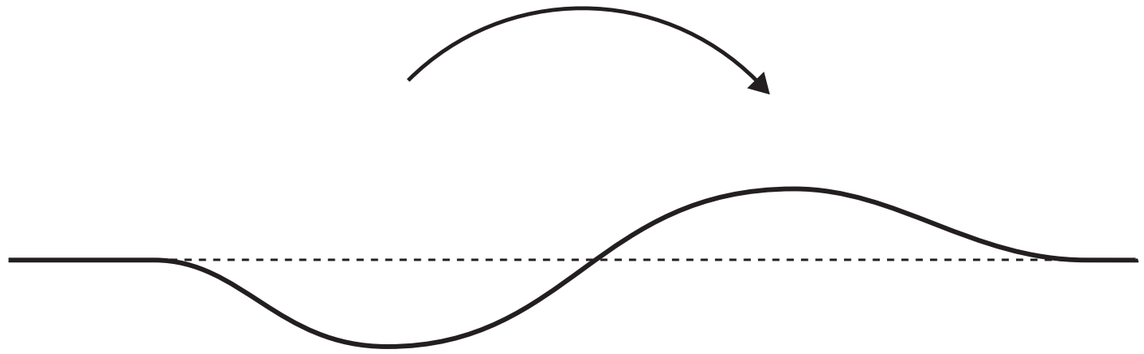
Our design does not lead to useless material use in the building. Far from being a modernist project, our building has something in common with the functionalist movement: the richness of our design is obtain through a careful choice in raw, sustainable and beautiful materials. No superflux ornamentation leads to unnecessary quantities of building materials.

Construction waste management

Living Landscape aims to reduce construction waste and divert resources from landfill through effective management of construction waste.
Targets will be set for the amount of non-hazardous and hazardous waste generated on-site and protocole will be developed by our environmental specialists to minimize waste during the construction phase. Construction waste will be sorted into at least five categories (from directly reusable to hazardous waste) and procedures will be developed for reusing and recycling construction waste. The aim will be to reroute from landfill 95% of total construction waste generated. The data collected from monitoring will be reported as m^3 or tonnes of waste generated per 100 m^2 of gross internal floor area. The report will also include the destination of non-hazardous waste leaving the site and the percentage of waste diverted from landfill.
Before demolition starts, the existing structures and on-site hard surfaces will be audited to determine if reuse of materials is feasible and to maximise the recovery/recycling of materials.
To make sure the amount of waste will be carefully monitored throughout construction phases, a legal person (specialist) will be designated by our team and made accountable for implementing these actions.
Digs from foundations and the pond will be used as fillings for landscape and modeling the site.

Domestic waste management

To avoid waste being sent to landfill, dedicated storage facilities will be provided for operational-related household waste streams. An adequate external space will be allocated to the storage of recyclable and non-recyclable household waste. The size of the space will be decided according to the recommendations of the Reykjavík City. It will be located on a hard surface and be accessible to all occupants of the building. An adequate internal space will also be provided for recyclable household waste. The waste will be sorted into the six categories that the municipality plans to implement. Five recyclable categories, plastic, paper, organic, glass and metal waste, and one category for the residual mixed waste. The bins will be clearly labelled. Sizing of the bins will be according to the number of occupants and will follow the latest guidelines provided by Reykjavík City. The internal recycling bins will be located in a dedicated non-obstructive position in or close to the kitchen of each apartment.
Adequate external facilities will be provided for composting of household compostable waste. It will be a dedicated position accessible to all occupants and will include a water outlet for cleaning in and around the facility. To ensure correct participation of occupants, an information leaflet will be delivered to each dwelling.
Internal container space will be provided in each dwelling kitchen for the storage of compostable organic waste. The compost produced will be used in the rooftop greenhouses.



3. LOW-CARBON MOBILITY

Attractive outdoor spaces

Because of its pioneer condition (first project of a broader new development) we have a great urban ambition for our answer to the Artun site of the C40 Reinventing Cities competition. In our proposal we go further the fixed limits to stimulate innovative urban development for Reykjavik.
We want people outdoor! By ‘people’ we mean inhabitants, users of the restaurant, commercial spaces, neighbors, but also visitors, fishermen and woman walking along the salmon fishing river (Elliðaá), kids with skateboards, roller-skates and bikes. We want this new neighborhood enjoyable and safe place, but not only, we want to make it a destination.
Through our proposal for a landscaped treatment of all surfaces, collective courtyard and rooftops but also sidewalks, river boardwalks and roads as well, we generate a safe collective space where all sorts of mobilities coexist peacefully.
Through the general focus of the project away from fossil based transport modes, through limited parking and a direct access to the BRT, high quality bike facilities, the project pushes the residents and users towards alternative transport, but also through the program focus on students and elderly as critical part of the housing mix, the users themselves are more likely to harvest the benefits of alternative transport.

Reykjavik

Fostering outdoor activity

Even though Iceland is world famous for its hiking trips and wild nature, Icelanders would jump in their cars to buy their groceries. Why is that ? Is it because the city lacks local stores ? Is it because Icelanders love their cars ?

If you want people enjoying the streets you need to give them a good reason to be outside and offer them a safe environment! You need to trigger their appetite for social interactions. The sense of community through social integration can be promoted using urban gardens, public spaces enabling collective activities and inclusive collective spaces: playful for the youth, safe considered safe by parents and accessible for all (slopes, benches etc.).

An increasingly strong evidence base shows the positive effects of access to green spaces and good-quality landscape on health, well-being, social cohesion and community support. Using Nature-Based Solutions (NBS) to enhance neighborhood spaces can stimulate healthy physical activity and promote the development of social ties, as citizens are attracted outdoors to utilise public spaces together and in greater numbers feel safer to move around freely.

Brighton, United Kingdom

As the first project of the new urban extension of Reykjavik we show the way to this new development towards a **joyful**, **safe** and **animated** street which will attract people using their feets (or else if they can’t)!

Our **Mixed-use** building provides the city with an **animated ground floor**. On the first angle you see when arriving to the new neighborhood, a **large restaurant** spreading out on its outdoor spaces towards the salmon fishing river (Elliðaá). On the main street and the public square inhabitants will find double height commercial spaces intended to welcome **activities** such as a **local grocery**, a **bicycle shop**, **community center** etc...

Because we design and build with local knowledge, all outdoor, public and collective spaces are adapted to Icelandic climate conditions: the restaurant terrace is previewed to be occupied just few months a year, rooftops are protected from predominant winds and built-in solutions are implemented to prevent from icy surfaces, commercial spaces are largely glassed and well orientated for better natural lighting.

Livign Landscape

Living Landscape also offers a safe environment to the public. The shape of our project, at the macroscale (neighborhood) as well as at the microscale (the block) protects from winds, opens large visibility to is outside spaces and offers sheltered space at its core. It protects the public square and back streets from predominant winds. The extensive absorbance capacity of its ground and the retaining pond avoids flooded and slippery walking paths during rainy and icy days. Its soft rounded plan doesn’t creates any dark recess in the façade, and its double height shops adds on the public light which makes it a very safe building to walk around.

In conclusion, by creating an interesting urban fabric walking is encouraged. This is achieved by using buildings, vegetation, water and other details to create an attractive and climate friendly environment. Efforts are made to make sure that main walking routes are protected from wind and other harsh weather conditions. Studies show that interesting environment encourages* inhabitants to do their errands on foot. Connections through the site are furthermore made easy, safe and accessible, making it easy to cross and walk by, which is extremely important regarding the location of the site being only a few meters from an important Bus Rapid Transit (BRT) station. Commercial space is offered on ground level facing the main street which supports walking as the inhabitants on the site will be able to make many of their daily errands on foot as they will have some service and retail close to their homes. Attractive seating and resting areas are offered on various locations to support walking and encourage inhabitants to spend time in the public spaces.

* See: Walkability: Creating great cities by putting pedestrians first, from 880cities.com

Soft and e-mobilities

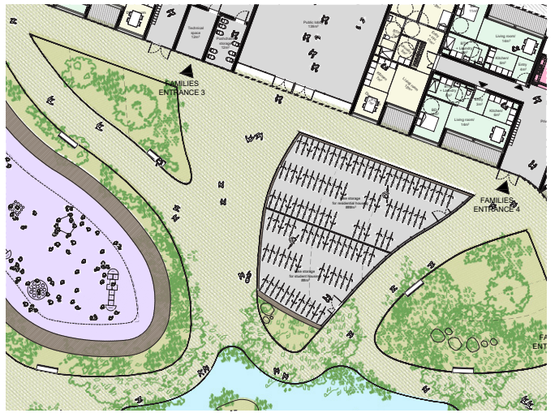
The project will encourage cycling by limiting surface recess and, when necessary, by introducing direct cycle paths, priority for cyclists at intersections and a safe cycling infrastructure.
A very generous, secured and easily accessible bike shelter is previewed in the central landscape, under an earthen bump. Inside some services will be provided like built-in air pumps and maintenance poles

The project will minimize the use of diesel and petrol vehicles by introducing digitalized mobility solutions, both multimodal and separate services (i.e. bicycle sharing). Such solutions provide people with the opportunity to avoid private ownership of a car.
The multimodal mobility services (MaaS) enables a more seamless journey connecting different modes of transportation by offering sharing and renting possibilities of bicycles, scooters and cars.
Based on the most recent information on the zoning development; the option of independent parking structures around the area is being investigated. Due to this urban parking management, the project does not include a large parking for all the inhabitants. However, the project will develop it´s parking strategy according to the finalized zoning, the project was designed in such a way that a large enough parking could be incorporated in the project. Therefore quantitative parking strategy is hard to come by, and are here described in general terms.
Future requirements for parking spots around the site will be respected and a minimum of 50% of them will be equipped of charging outlets for electric vehicles. Other incentives are no or limited parking for diesel and petrol vehicles and/or priority parking for electric and low-carbon vehicles and priority for cyclists at intersections.

Car sharing schemes will be introduced in the area. Also, bike sharing and our high quality bicycle parking situated nearby local transport stops will encourage multimodal and ease the integration of public transportation and cycling.

Bike sharing facilities and other bicycle parking places will be provided with a roof and facilities to repair the bikes. Bike sharing schemes will be provided with a user friendly and easily accessible on-site, on-line and in-app payment system. In the area there will be charging capabilities for e-bikes and e-scooters who are becoming increasingly popular. Public parking houses will also be provided with a secure bicycle parking for residents and visitors to hire.

The project will encourage the use of electric or low carbon vehicles by introducing charging points in the area and in residential buildings. Additionally, car hire schemes will be introduced which will only include low-carbon or electric vehicles.
Residents or visitors to the area owning an electric or low-carbon vehicles will have priority parking spaces.



Loving Landslag bike shelter

A n urban furniture pump in Rennes, France


Fixing poles


Foldable scooter renting

Encouraging an extensive use of public transport

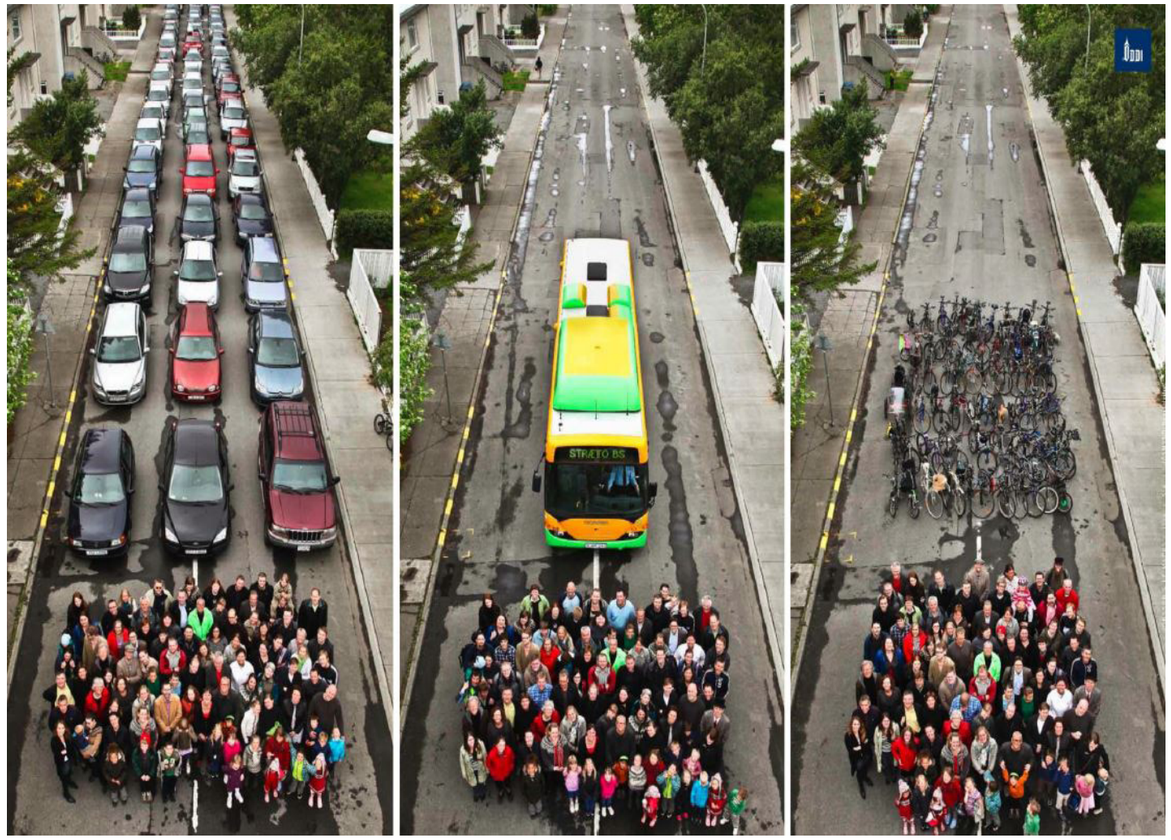
It stroke our foreign team members how bus stops in Reykjavik are invisible to newcomers. Sometime neither a piece of urban furniture nor a simple sign indicates the presence of a stop. People wait in the cold in an informed line and nothing tells them how long they have to remain waiting. The absence of seats is indeed a repulsive aspect for the elderly persons with reduced mobility.
The new City Line bus stop itselves initiate the project for which we designed Living Landscape with a collaborative team including local users, international traffic experts, planners, landscapists and architects. Its urban volume celebrates the first bus stop of the new development of Reykjavik. Its circular shape stretches towards the bus stop on the South-West corner expressing the presence of a public square hosting the bus stop. this sheltering shape was obtained through a careful study of the local weather conditions and together by the architects and the local landscapists and environmental engineers.
Creating an interesting and vibrant site close to an important Bus Rapid Transit stop (BRT) will support the use of both the planned and existing bus lanes within the neighborhood.
Our proposal is to initiate a collaborative work with the authorities in charge of the implementation of the new City Line (BRT) to provide our users with data visualisation abstracted from the City Line public inputs. Our collective spaces will be provided with screens displaying real time public transport informations, such as schedules, remaining times, delays, weather conditions etc.

Limit commute distances

Designing our project we imagined our plot and its neighboring blocks as villages all together forming an ensemble similar to a country or a region.
This leads to picture our users as a community and to imagine rich mixed-use program. Being a village, our block needs to provide homes, food, communal spaces, culture and work. This is why we previewed a Kindergarten, a restaurant, shops, and offices in addition to the housing project. We imagined the rest of the development built on the same model with complementary services to form a rich and complete community.
All of this aiming to a new city with reduced distances, a city where an elderly person can easily walk to a local grocery store, where leisure is found downstairs your apartment, where people leave their homes without their car keys.
As mentioned above all sorts of non-carbon emitting modes of transportation are extensively prioritized and facilitated. Thus transportation emissions will be minimized during occupancy.

Fossil-free construction site

During the detailed design phase, the eventuality to require an electricity driven carbon-free construction site following the Oslo example* will be considered . Then, heavy machinery and other construction equipment would be electrically charged at site. We would follow the Norwegian Guidelines for fossil- and emission free solutions on building sites.*]



Source: Reykjavik 2030

* Energy Norway, the Norwegian District Heating Organization, ENOVA, the Federation of Norwegian Construction Industries (BNL), the Norwegian Contractors Association Oslo, Akershus and Østfold (EBAO), Climate Agency, City of Oslo and Nelfo (2018). Guide to arranging fossil- and emission-free solutions on building sites. Accessed on 6th March 2019: https://www.klimaoslo.no/wp-content/uploads/sites/88/2018/06/Veileder-Utslippsfrie-byggeplasser-ENG.pdf

4. RESILIENCE AND ADAPTATION

Site specific analysis

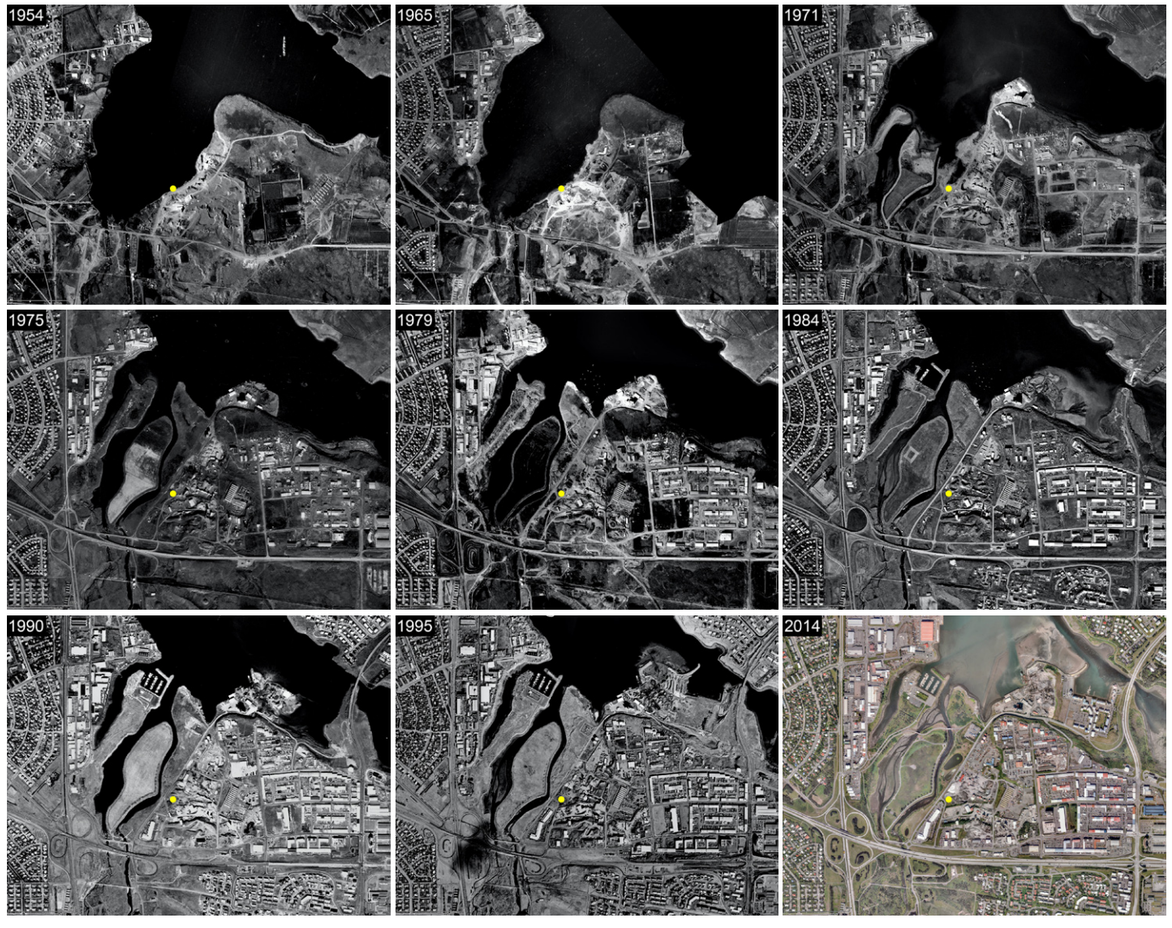
If global emissions continue to rise, we will face the RCP8.5 scenario in the IPCC models which predicts a 3.7°C global temperature increase before 2100 compared to preindustrial levels. The temperature increase itself (i.e. heat waves and droughts) is not seen as the main immediate risk in Iceland. Rather, increased flooding and more extreme rainfall and wind events are considered the main climate hazards in Iceland: Increase in rainfall intensity is expected and a increase in rainfall amount.*

Sea level rise in certain parts of Iceland will be less than globally due to the gravitational effects of melting glaciers.** However, Reykjavík is far from glaciers and the buffering effect of their disappearance will probably not be observed in Reykjavík. On the contrary, historically the land in Reykjavík has been sinking. Sea level rise therefore poses a threat to buildings and structures close to the coast in Reykjavík.

Prioritizing possible climate threats, sea floods and rain floods are seen as the main risks that this particular building will face.

Sea floods: In Reykjavík the coastal flood with a return period of 100 years is currently 3.34 m high according to the Reykjavik City level system [3]. Climate change will aggravate the risk by heightening the 100-year-flood. For the RCP8.5 scenario in the IPCC reports (representing 3.7°C global warming before 2100 compared to preindustrial levels), the 100-year-flood in Iceland will rise to 3.93 m. If the land sinking trend in Reykjavík continues as before, the 100-year-flood could rise by additional 0,2-0,4 m before the end of the century, raising the 100-year-flood to 4,33 m [3].

River floods: The river Elliðaá meets the sea very close to the site. The 100-year-river-flood has been assessed to be a discharge of 212 m³/s [5]. Upstream, where the river channel is narrower, that translates into a flood of 4,5 m height above the normal river surface [5]. The river channel is much wider next to our site, yielding a lower height during flood, but river floods are still a threat to be considered.



* Veðurstofa Íslands (2018). Loftslagsbreytingar og áhrif þeirra á Íslandi. ** EFLA Consulting Engineers (2013). Evaluation of flood risk in Reykjavik according to BREEAM International Bespoke 2010.

Resilient design

After our site specific analysis, we concluded that floods were the most significative climatic threat to our project. Our project stands on a polder, a man made extension of Reykjavik shore towards the sea. Standing like this on a low landfill makes the building very sensitive to floods. The height of the site and the surroundings is in the range of 3,3 - 5 m so parts of the site are at risk for the 100-year-flood.

Our first answer addressed to this threat is our sustainable urban surface treatment with a local nature-based solutions: to recreate a **natural condition**, by essence adapted to local conditions and **resilient**.
Thanks to its strong knowledge of the local nature our team worked to recompose around and within our project a sample of the local ecosystem, combining earth and rocks, water and plants, insects and birds.
The porous ground will limit floods, gutters carved out from the earthen ground surfaces will guide rainwaters to the retaining pond and gently pour the water back after the weather crisis. The pond and the mass of the earthen ground will contribute to limit risks of heatwaves.
This Nature-Based Solution has a positive environmental impact. It provides opportunities for adaptation to climate change, thus increasing urban resilience to risks, such as droughts, floods and heatwaves, as well as opportunities for small-scale climate mitigation through increased carbon storage (for a detailed justification, please, see challenge 7 and 10).

On a structural level, our answer addressed to this threat is to build the first floor in concrete, as opposed to wood for the rest of the project. Concrete is a highly rot-resistant material which will stand still during and after floods, even long or ever-lasting ones.

On a programmatic level, we addressed this threat in placing almost only commercial spaces on the ground floors. This way, if floods happen, casualties would be limited to material loss and inhabitants would be safe in their homes. One could say the whole building should have been lifted up, but this option would have been in contradiction with our strong intention of creating an active street.
On a very pessimistic future, if the floods lingers and maintain themselves into a much higher sea level, the commercial spaces could relocate somewhere else and the building would still function.

Another proposition which will be made to the City is that the lowest parts of the neighborhood could be raised to 4 to 5 m higher to protect the building against these climate threats. This will be discussed and decided with Reykjavík City in later phases.

Bio façade and roof

As mentioned above, our façade complex is formed by Panobloc insulated wall fillings and wood cladding. Prefabricated pieces are delivered to building sites and installed on the supporting structure to form the curtain wall.

Completely dismountable, our façades are totally upgradable with time and can be adapted to climate change or new insulation specifications.
Because it is made of raw wood cladding, therefore light colored, the general aspect of our façades prevent the building from overheating when the sun hits is directly.

A very significant part of our roof is made of a tundra landscape (copied from local conditions, another Natur-Based Solution, this one used by Icelander for hundreds of years helping us with insulation of the building.

Heating and cooling needs

The RCP8.5 scenario in the IPCC reports represents 3.7°C global warming before 2100 compared to preindustrial levels. Due to conditions in Reykjavík, the models predict that only 3% of summer days (June-August) go above 20°C at the end of the century in RCP8.5 scenario.*

HVAC systems will not need a cooling element up until outside temperatures go above 20-24°C, which is the average range preferred temperature of occupants. The HVAC will therefore handle most of the projected forecast of warming. The variability in the climate prediction models is very high, however, and the HVAC systems will therefore be designed with the possibility to integrate cooling if needed later on.

Currently, HVAC systems in Iceland are only used for heating, not cooling. The first decades of warming climate will reduce the need for heating and thus save energy used by HVAC and heating systems. According to the above discussion, cooling would not be applicable until towards the end of the century.

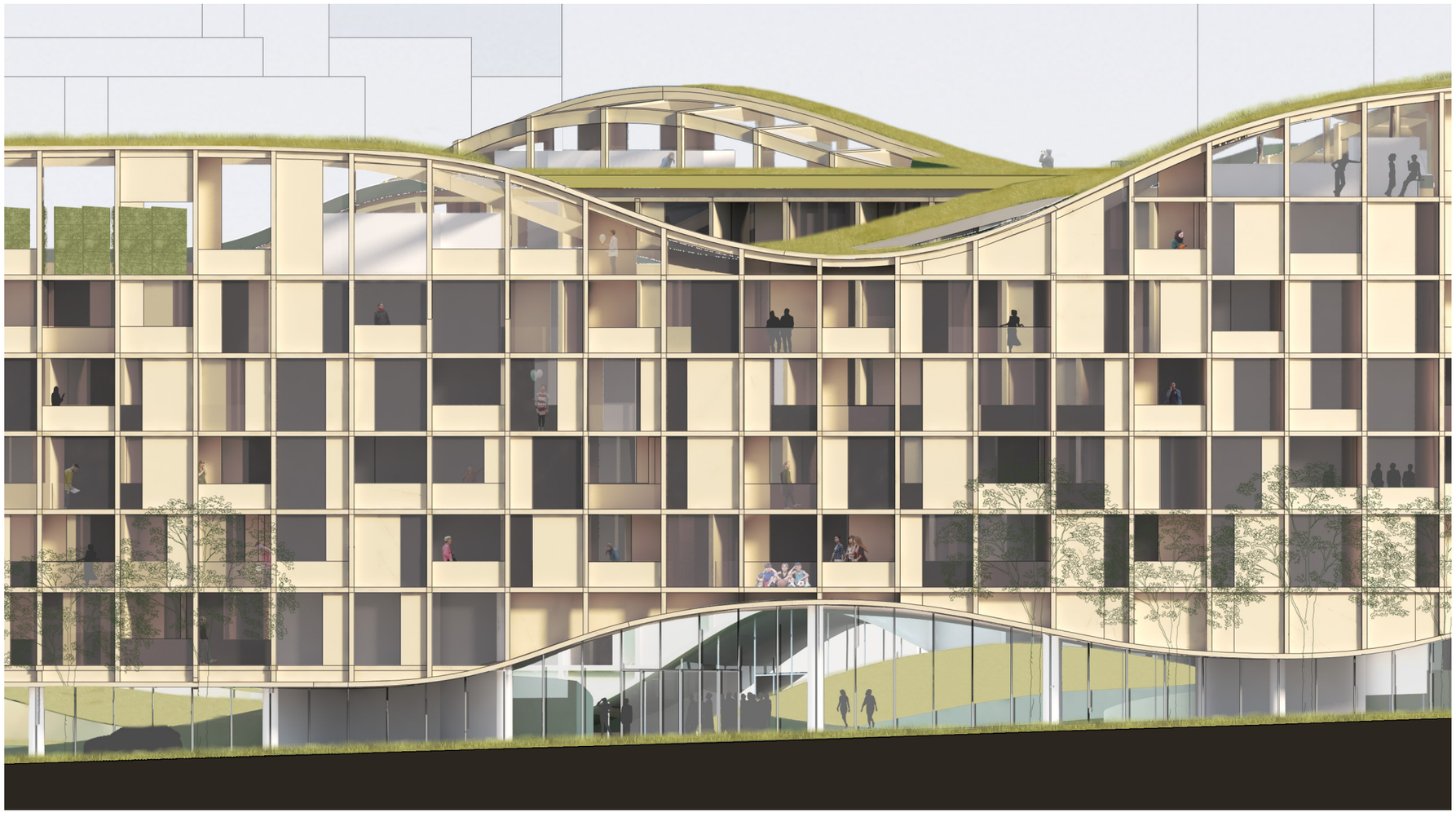
Traditional vernacular habitat in Iceland

Panobloc from Techniwood

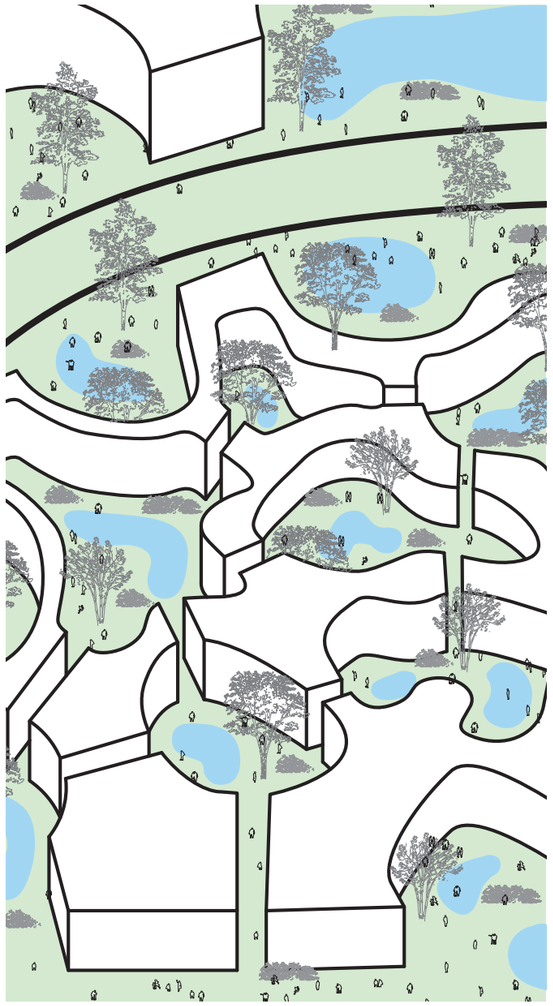
* Veðurstofa Íslands (2018). Loftslagsbreytingar og áhrif þeirra á Íslandi.

Knowledgeable people

All the above mentioned aspects of our building addresses extreme weather events. For the future users know how to react to these kinds of events we will make sure they are well informed when moving to the building.
Within the owners handbook a chapter will be dedicated, to responsible energy usage and a how-to about the building systems to that end
A second chapter will explain how the building is expected to work in extreme weather conditions which might arise in the future. (i.e. block direct sunlight during heatwaves, leave goods and climb floors in case of floods, prefer certain paths during icy days etc.).
Also communication between the building manager and the inhabitants will be facilitated by creating an app or a simple pager group (facebook or equivalent). Therefore building managers will be able to share direct information to the whole community of inhabitants and they will also be able to chat between each others directly to organise community events or share useful informations. The final platform will be chosen after a survey aiming to determine which solution would be the most inclusive in a community including students not able to buy the latest technology, the elderly, or middle class families equipped with the latest smartphones...



5. NEW GREEN SERVICES FOR THE SITE AND NEIGHBORHOOD



Green services - eco-systemic answer

The main green service in the proposal is the unique central garden inside the courtyard which is intended to have various ambitious functions both for biodiversity and social purposes. The aim is to create a fully functioning local ecosystem, combining earth and rocks, water and plants, insects and birds. Thanks to the geothermal heat, the pond will be maintained out of frost all year therefore creating a green oasis, a slightly warmer condition creating a microclimate at the center of our building. By doing this, a unique place is created and hopefully a new **generator of life** imposing our project as a new place of interest for people to visit.
This central garden is furthermore connected with green pedestrian links to the East and West of the plot, linking the site with the bigger framework of green infrastructure in the neighborhood.

Our proposal is for the rest of the new development of Reykjavik to use our Living Landscape as an example. All main plots could have a central landscape like ours but each bringing a different hint to the map. When ours uses warmth & water, some could use extensive light, others play with certain types of natural colors, smells, textures. All together will compose an extremely rich environment where the difference between an urban condition and a natural condition is blurred.

The green roof dedicated to urban agriculture, an outdoor promenade, collective activities and educational programs, is conceived as a major biodiversity attractor (for a detailed justification, please see challenge 8 ‘Biodiversity, urban re-vegetation and agriculture’).

Green services - supply and export of clean energy

Our project will only use renewable electricity and renewable heat energy. Electricity in Iceland is by far from renewable sources and is produced mainly in hydropower plants (approx. 73%) and geothermal power plants (approx. 27%). There would therefore not be any gains from producing renewable electricity on-site as that would most likely not be nearly as efficient as the power plants already in place, due to the difference in scale. The same way district heat in Reykjavík is 100% renewable. The hot water is produced at the geothermal power plants and supplied by a distribution pipeline network.

Green services - waste management services

To avoid waste being sent to landfill, dedicated storage facilities will be provided for operational-related household waste streams. An adequate external space will be allocated to the storage of recyclable and non-recyclable household waste. The size of the space will be decided according to the recommendations of the Reykjavík City. It will be located on a hard surface and be accessible to all occupants of the building. An adequate internal space will also be provided for recyclable household waste. The waste will be sorted into the six categories that the municipality plans to implement. Five recyclable categories, plastic, paper, organic, glass and metal waste, and one category for the residual mixed waste. The bins will be clearly labelled. Sizing of the bins will be according to the number of occupants and will follow the latest guidelines provided by Reykjavík City. The internal recycling bins will be located in a dedicated non-obstructive position in or close to the kitchen of each apartment.
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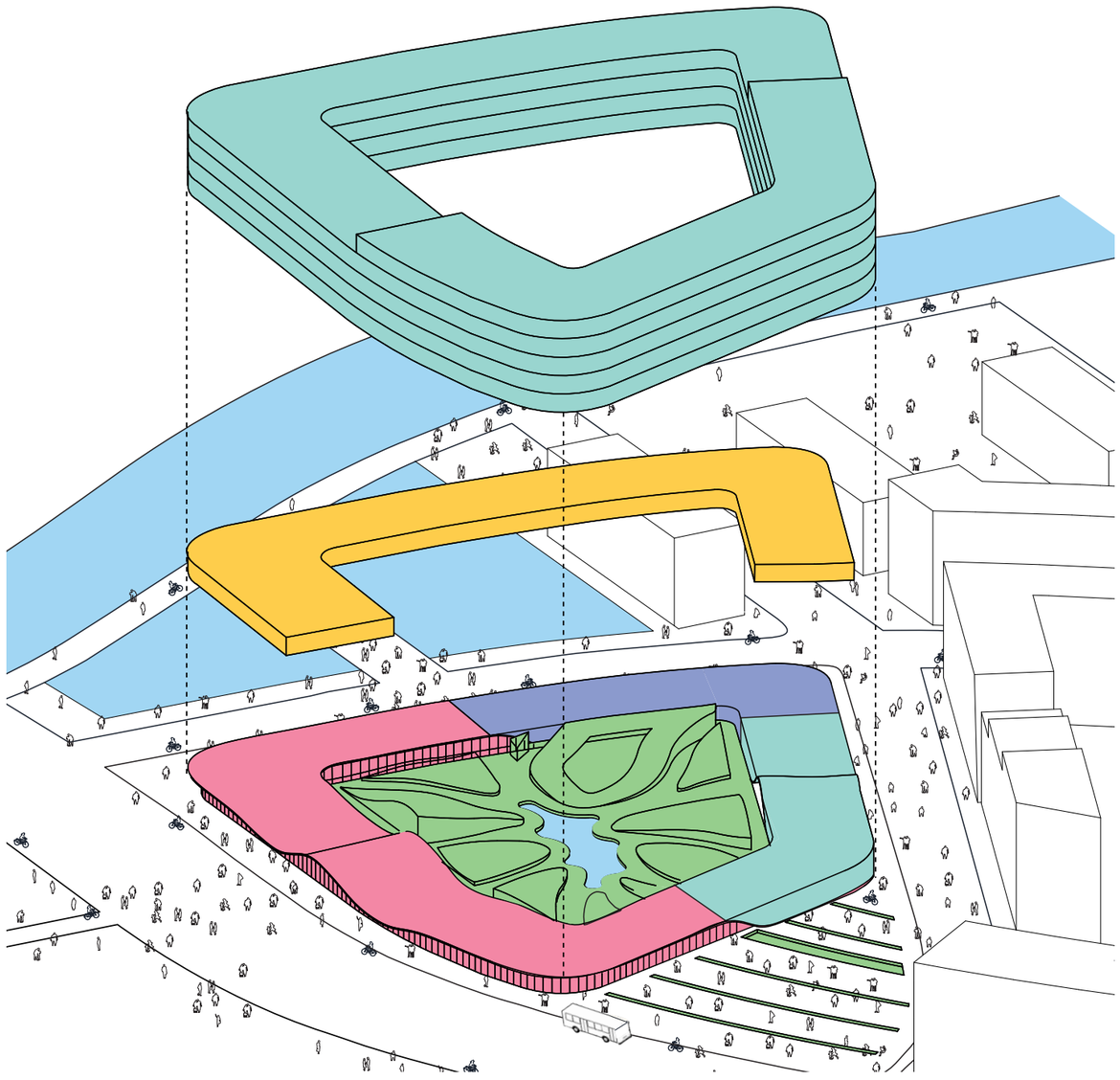


Green services - public space

Our project has a plethora of public spaces. Its urban shape which stretches to the east help defining the public square previewed by the city and contributes to its quality.
Stores, shops and a large restaurant are designed In continuation of the street for them to be in direct continuation of the city, inviting the public inside.

At the core of our project the sheltered landscape is imagined to be colonized by light, water, vegetation, animals but also the users. It is somehow another degree of public space. It is a communal place for all inhabitants.

Green services - green transport shared economy services

The project will minimize the use of diesel and petrol vehicles by introducing digitalized mobility solutions, both multimodal and separate services (i.e. bicycle sharing). Such solutions provide people with the opportunity to avoid private ownership of a car.
The multimodal mobility services (MaaS) enables a more seamless journey connecting different modes of transportation by offering sharing and renting possibilities of bicycles, scooters and cars.
Based on the most recent information on the zoning development; the option of independent parking structures around the area is being investigated. Due to this urban parking management, the project does not include a large parking for all the inhabitants. However, the project will develop it´s parking strategy according to the finalized zoning, the project was designed in such a way that a large enough parking could be incorporated in the project. Therefore quantitative parking strategy is hard to come by, and are here described in general terms.
Future requirements for parking spots around the site will be respected and a minimum of 50% of them will be equipped of charging outlets for electric vehicles. Other incentives are no or limited parking for diesel and petrol vehicles and/or priority parking for electric and low-carbon vehicles and priority for cyclists at intersections.
Car sharing schemes will be introduced in the area. Also, bike sharing and our high quality bicycle parking situated nearby local transport stops will encourage multimodal transportation and ease the integration of public transportation and cycling.

Bike sharing facilities and other bicycle parking places will be provided with a roof and facilities to repair the bikes. Built-in pumps will be provided in the bicycle shelter. Bike sharing schemes will be provided with a user friendly and easily accessible on-site, on-line and in-app payment system. In the area there will be charging capabilities for e-bikes and e-scooters which are becoming increasingly popular and not in a sufficient number in Iceland.

The project will encourage the use of electric or low carbon vehicles by introducing charging points in the area and in residential buildings. As previously mentioned, additionally, car hire schemes will be introduced which will only include low-carbon or electric vehicles. Residents or visitors to the area owning an electric or low-carbon vehicles will have priority parking spaces.

Green services - urban agriculture

Living Landscape has five greenhouses on its multi-purpose rooftop. **Urban Agriculture** inside the greenhouses provides fresh food, reducing transportation costs, and strengthening **social cohesion** for the inhabitants, the kindergarten and the restaurant.
As a leading **prototype project** for Iceland we ambition that visitors coming to the greenhouses with the inhabitants will acquire knowledge and desire towards urban agriculture.
Most of the greenhouses will be dedicated to inhabitants and will be exploited as communal growing spaces on a **'Family Garden'** model adapted to Iceland climate and culture.
English 'allotments' or French 'jardins familiaux' are ideas developed in the late XIXth century: small plots dedicated to vegetable gardening are attributed to inhabitants by municipalities with the ambitions to increase **quality of life, social cohesion and to food expenses**.
Some greenhouses or part of greenhouses will be dedicated to the restaurant. Vegetables and aromatic herbs grown on-site will be incorporated in their recipes and served in the public restaurant on the ground floor. Courses including **locally-grown** products will be advertised as so and foster desire and knowledge.
A greenhouse (or a space in a greenhouse), will be dedicated to the kindergarten for **educational purpose**. Children will learn where plants come from, how to grow them and will be able to bring some at home.

Green services - sustainability education

Living Landscape sits on the threshold between the revitalization of an industrial precinct and the fantastic natural conditions of the Elliðaár natural surroundings. It embraces the city-nature dialogue and seeks out to highlight the rich tapestry of potentials that are to be found in the symbiosis of the two to the benefits of the citizens.

The same way the tiny City Nature Museum (CNM) of Reykjavik, offers groups of kids from 5 to 9 years old activities and workshops about the relationship of the city to its natural surroundings; where the city gets the water from, how energy is made and where does the food reaching our homes comes from, the kindergarten and youth groups on the rooftop, would benefit of our Natur-Based Solution to learn about all those subjects directly on-site. Vegetable gardens in greenhouses on the roof, views towards the natural landscapes of the valley and the rivers, all aspects of our project which will help **teach children** and **increase awareness** of parents about urban farming, hydro-electricity, salmon fishing, pollution, recycling etc.
More precisely, teachers from the kindergarten will take advantage of the social-ecological context to **teach kids** about the factors necessary to maintain balance in an ecosystem, fostering sustainable human-nature integrations.

The goal of the restaurant has the same philosophy. It will **focus and advertise** locally grown and locally (Iceland) produced food .

Green services - water management

Through the above mentioned tools, water consumption will be **monitored** and schemes will be proposed to users for them to reduce their regular consumption. The user manual and the building management group (app or facebook) will provide general **information** as well as collective consumption **alerts**.
In some European Cities (Paris for example) 20% of the water is lost in leaks before it reaches the buildings. We will provide effective building solutions to **monitor** water loss and actively maintain the system.*
High performance taps will be installed in the housings. Our team of experts will design a clever water management system: **grey water reuse** in the toilets and/or to clean collective spaces. Grey water filtering and storage for watering the landscape or storage in the central pond etc...

Green services - social value

A unique garden will be created in the courtyard with favorable microclimate for people, vegetation and wildlife. The space will be open but sheltered from winds, creating a space for people to **meet and interact**.

The green roof design will include a variety of indoor and outdoor spaces. This variety of areas consists of user-friendly spaces protected from the local weather conditions allowing inhabitants and visitors to enjoy the roof top and city view. The social value objective of the green roofs are to raise **community livability** and strengthen **community ties**, foster **collaboration**, Improve habitat and encourage public **education opportunities**.
The green roofs role is to boost **recreational opportunities** by providing outdoor areas for people to use and take enjoy **activities** such as sport activities or coffee shops. They also have the potential to foster improved community **interactions** that help **build social capital**.

The rooftop will also welcomes opportunities for urban agriculture in the greenhouses allowing people to **connect** socially through gardening thus strengthening **community ties**. Students will be able to profit from the **knowledge** of the elderly and give back in exchange the strength from their arms.

Soil and vegetation help decreasing sound transmission, thus reducing local noise pollution levels and **improving the quality** of the new public and private roof spaces.
Increased vegetation on the green roof contributes to **support biodiversity** and adds beneficial habitat for a rich of flora and fauna.

Managing future economic and environmental constraints will crave full community participation and **partnerships**. The green roof and educational programs give an opportunity to establish shared **consciousness** and **consideration** for all ages about significance of sustainability. They increase interest in green infrastructure through their new functions and atmosphere, which provides a considerable opportunity for **public education**.

* 1 300 milliards de litres d'eau potable perdus dans des fuites - Le Monde, 2014 March the 23rd

New environmental values

Habitat is created in the central garden and on the rooftop for various types of species in a favorable microclimate by utilizing both water and vegetation.

The green and vegetated roof system benefits to a wide range of private and public entities: **Reduces Stormwater** Runoff, **Decreases Energy Use**, Increases **Air Quality** and Decreases Atmospheric CO2.

Reduces Stormwater Runoff: The green roof can **stock** important quantity of water in their growing media. This water is ultimately evaporated from the soil or transpired by the plants on the roof, thus decreasing quantity of runoffs entering the sewer systems and waterways, which can help alleviate the risk of Combined Sewer Overflows (CSO). The **porous ground** will limit floods, **gutters** carved out from the earthen ground surfaces will guide rainwaters to the **retaining pond** and gently pour the water back after the weather crisis. The pond and the **thermal mass** of the earthen ground will contribute to limit risks of heatwaves.

Decreases Energy Use: Supplementary **insulation** provided by the growing media of the green roof can decrease the building's energy utilization by providing greater insulation in comparison to ordinary roofing materials.

Increases Air Quality: Locally, the vegetation cultivated on the green roofs takes up air pollutants and **intercepts pollution** (heavy and fine particles).
The cooling effect of vegetation **reduces smog** formation by delaying the reaction rate of nitrogen oxides and volatile organic compounds.

By **decreasing energy use**, the green roofs lessen the air pollution provoked by electricity generation.

Decreases Atmospheric CO2: The green roof vegetation directly **sequesters carbon**.
By lowering energy use and the urban Heat Island (UHI) consequence, the green roofs reduce CO2 emissions from regional electricity generation.

Sustainable business plan

Heild/Upphaf acknowledges that there is increased recognition for developers and investors to account social, economic, and environmental value that results from our developments. By using a Social Return on Investment (SROI) evaluation scheme, the long term social and environmental benefits of Living Landscape will be consistently monitored, evaluated and improved. The idea is to apply of a set of principles within a framework that is designed to help bring about consistent qualitative and quantitative results, whilst at the same time recognizing that what is of value will be different for different people in different situations. This process is included the initial cost planning process and will be introduced to potential buyers and tenants as part of all agreements and contracts made between them and Heild/Upphaf.
Furthermore, the SROI evaluation scheme will be used to create benchmarks for potential stakeholders in the area, for example by choosing commercial tenants that have CSR and environmental policies in place. Finally, the outcomes of the evaluation processes will be used to determine stakeholders that create exceptional social and environmental value for the project. These stakeholders will be awarded, creating an incentive for all parties to achieve the overall goals of the Living Landscape project.
For this project two types of SROI will be carried out. First a forecast has will be conducted and once the project is completed an evaluation process will take place annually. The forecast will predict how much social and environmental value will be created if Living Landscape meets its intended outcomes. The evaluation will be based on actual outcomes that have already taken place.
The analysis will take place is in six stages:
1. Establishing scope and identifying key stakeholders (who will be involved in the process, how and why).
2. Mapping outcomes (exploring the relationships between inputs, outputs and incomes).
3. Evidencing outcomes and giving them value (finding data to show whether outcomes have happened and valuing them)
4. Establishing impact (would the aspects of change have happened anyway or are they a result of factors which have been eliminated from consideration)
5. Calculating the SROI (adding up all the benefits, subtracting any negatives and comparing the result to the investment)
6. Reporting, using and embedding (last step involves sharing findings with stakeholders and responding to them)
The following key stakeholders have been identified for the following reasons.

Key stakeholders	Reason for inclusion
Commercial tenants	Important for the concept
Résidents	Group that is expected to gain the most benefits from the project
- Older and disabled residents	Specific attention will be aimed towards this group due to aging population
- Students	Social diversity
Kindergarten	Support for residents
City Nature children's museum	Public amenity
City of Reykjavik	Provides services

6. CLEAN GROWTH AND SMART CITIES

Smart city - BIM

To design our project we use **Building Information Modeling** (BIM), a 3D modeling process that connects architects, engineers and building solution professionals in a **real time workflow** even when team members are in different parts of the globe. This connection allows better insights on the project, **improves efficiency** during the design phases and brings more **resilience to changes** throughout the whole study and construction phases. The BIM model is delivered at the same time as the physical building and is updated with changes during maintenance phases.

A project specific protocol will be defined and endorsed by all team members before the next phase of the project.

The digital model including a great amount of precise **data** such as U values for insulations, masses, load bearing capacities and so on, will be a support for a plethora of simulations and tests therefore assisting our team in the choices we'll made regarding to material refinements and performance and price **optimizations**.

A **collaborative work** with the city will be initiated by our team to communicate the final 3D model. It could be used in different presentations and downloaded into Reykjavik broader 2D and 3D model and made available to everyone (i.e. in borgarvefsja.reykjavik.is)

Also, a BIM model facilitates **BREEAM certification** by supporting the integral part of conducting an LCA

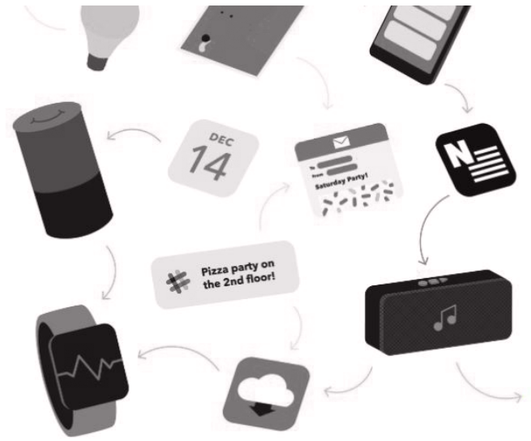
Smart city - information and community ties

Communication between the building manager and the inhabitants will be facilitated by creating an **app** or a simple pager group (facebook or equivalent). Therefore building managers will be able to **share direct information** to the whole community of inhabitants and they will also be able to chat between each others directly to organize community events or share useful informations. The final platform will be chosen after a survey aiming to determine which one would be the most **inclusive**, from students not able to buy the latest technology, the elderly, or middle class families equipped with the latest smartphones...

User support

A portfolio of carefully selected apps will be proposed to inhabitants.
For example GrowVeg one of the apps which could be recommended to the Greenhouse users. It would help them manage their vegetable gardens in a **collaborative** way.

Users will be initiated to If This Then That (IFTTT) an free way to get all your apps and devices talking to each other. Basically it is a user friendly way to create **scripts** to trigger individualized responses to collective stimulus.
For example, when someone would write #PizzaPartyNow on the Facebook group an individually selected signals would be ignited to notify all users such as your light blinking, a voice message from you home assistant or a simple email.



IFTT principal diagram

Smart city - smart building

Our building is already previewed with a plethora of **sensors** (humidity, temperature, fire etc...). All this **data** will be collected and a dedicated team will determinate how to use them and **connect** them to building equipments. For example, in addition to mandatory alert signs, fire detectors could be linked to individual lighting fixtures in order to maximize alert perceptions by visually impaired people.

Also, in a country with days as short as 5 hours in winter and as long as 24 hours in summer, lighting is a crucial subject. lighting fixture as well as connected blinds and **day cycle simulation** scenarios will be selected in order boost well being.

Smart Building Management System (BMS)

will also be including in the requirement specifications of the building. Apartments will be equipped with performant energy consumption monitoring tools.

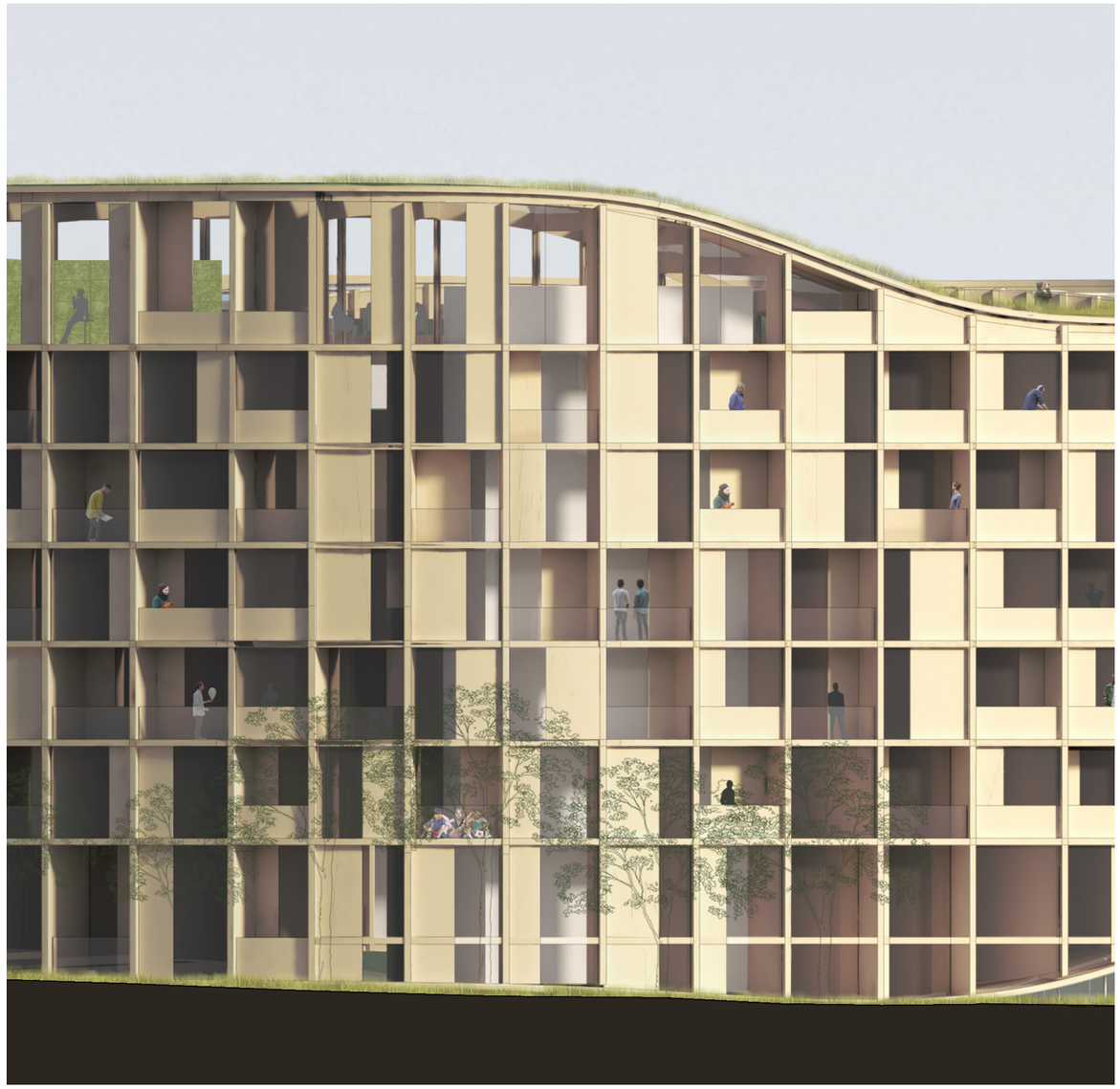
Smart cities - startups

Our generous open plan office spaces on the second floor of the building were designed with local **green Start-Ups** in mind. They will have access both to the courtyard and green roof creating a dynamic atmosphere. Being close to the city-line gives them a perfect opportunity to access quickly other places in Reykjavík.
Green Start-Ups and micro companies moving into the building will have to respect an **ethical charter** which will be established in a later phase.

Green Growth Innovation

Our infrastructure offers a context for innovative interventions for **green growth**. The planned nature-based solutions, the shared green space, the transformative roof-top infrastructures have an important role to play, for instance, through supporting the implementation and optimisation of green and grey infrastructure. Our shared green space will contribute to cutting energy and resource demands and costs. Co-benefits include reduced air pollution, flood control, and recreation.
New uses in initially underused and unused grey infrastructure will be fostered. The new cycling paths and associated infrastructure are good examples. These **new uses** will provide openings for businesses to innovate in the revitalisation of the initially discarded urban areas. This shall **drive innovation** in business models that will be driven by sustainability concerns. Our new infrastructure shall foster innovation, with a view to maximizing a range of environmental, social and economic **co-benefits** for all. The presence of the bus stop and connection to the broader city will facilitate the **replication** of our project and up-scale our co-benefits.

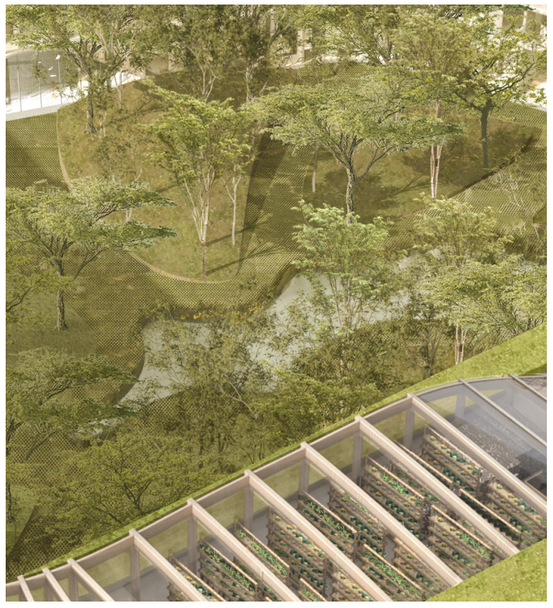
For the reinforced concrete made base of our building we plan to use **Green Concrete** (or Low Carbon Concrete). Subsequently, a careful study of all the building wastes we could use will be made prior to the construction, such as remains left by the asphalt industry currently on site, wastes from former street demolitions or digs in the existing landscape for the future City Line route etc.



7. SUSTAINABLE WATER MANAGEMENT

Stormwater and rainwater

Stormwater is **collected** on the site (on the rooftop and central landscape) as well as from nearby streets and building plots (gutters carved on the landscape). This water will be used for watering vegetation on the site which lowers the need of water in that regard.
Today, the site doesn't need an additional intake of potable water than the one from the city Rey kjavik. Nevertheless, a challenge of our project is to prepare ourselves to an ever changing future. This is why we imagine our stormwater management system to be potentially updated with a **purifying facility**.



A natural pond

By collecting stormwater and making it visible in ponds and rain gardens on the site, **awareness is raised** among inhabitants of the importance of responsible water treatment and the importance of allowing stormwater on the site to sink into the groundwater. The level of the water in our central pond will fluctuate throughout the year in relation to rainfalls, melting of glaciers etc.
Duly aware of this relation between their living environment and a broader sense of nature, inhabitants will feel connected to their homeland, **a bond between humans and nature** is cultivated.
Particular attention is paid in our project to the involvement of society and individuals in the development of Nature-Based Solutions (NBS) to enrich adaptation strategies. Our aim is to **re-connect people with nature**, raising awareness of **societal benefits** and creating a public demand for green infrastructures and restoration actions. The stormwater solutions can easily be seen by inhabitants and therefore have an **educational value**. Inhabitants will be able to see water level rise or sink in stormwater ponds, as a consequence of rain or drought.

As mentioned above digital tools such as screens installed in common spaces and information displayed on the project's app (or pager group i.e. Facebook) will **inform** inhabitants with global and individual water consumption **monitoring** and compared to national surveys.

Benefits include protection from flood damage, improved living conditions for wild species, re-flooding of carbon-rich soils, reduction of nutrient loads and landscape improvements.

Excess water management

Our whole project develops around a natural landscape incorporating a pond designed as a retaining pool at its center. By carving earthen gutters in the landscape we use the natural slope to pour excess water to the Elliðaá river which pours in the sea during extraordinary climatic events. However, the excess water is not directly poured in the river. All our stormwater solutions have overflow pipes. Those pipes will take the excess water safely to the river mouth only in case of extreme excesses.

Duplicating our excess water management from the local natural landscape we are, again, answering a climatic threat by a Natur-Based Solution (NBS), ensuring ourselves to **fit in the local natural** environment and cope with local climatic events.

The traditional way to handle stormwater would be to lead the stormwater into the sewers all at once without slowing it down on site which often results in an overload on sewers, resulting in floods.The stormwater system is designed to slow down the stormwater from the site which minimizes the pressure on the existing water system of the city. This way the stormwater does not flow all at once into the sewer system.

Water usage

Water is an abundant resource in Iceland and according to data from the National Energy Authority less than 1% of the countries' freshwater resource is being utilised. Reykjavík Energy puts great emphasis on this valuable resource and the focus is on protection and provision of clean and clear water now and in to the future.

Although water is abundant, the resource shall be treated with respect and care and thus water-consuming components specified for the building will be selected carefully and efficient domestic scale equipment selected. The performance of the water-consuming components shall be beyond the defined baseline levels according to BREEAM issue Water 01.

Open air vegetation on roofs will rely solely on **precipitations**, there will therefore be **limited maintenance** and no need for irrigation equipment. *

* See appendix for Rainwater management calculations

Polluted water treatment

Stormwater is depolluted using sustainable Natur-Based Solution (NBS) Duplicating in a smaller scale the different layers of a stratovolcano*, the ones offering the purest mineral water springs:
Before entering the groundwater table, the journey of a rainwater drop passes through vegetation, runs through different retaining ponds and is filter by a succession of layers of earth and sand of various densities.

* Conic volcano made from different layers of lava

8. BIODIVERSITY, URBAN RE-VEGETATION AND AGRICULTURE

Local biodiversity protection and preservation

Our whole project has been developed in respect with the **local ecosystemic landscape**. The watershed is maintained, **restored** green spaces and habitats will be developed only with native species. The ecological value of our infrastructure and surrounding green, blue and grey infrastructures is clearly considered as an added value to the whole project.

One of the main aims of the project is to protect and maintain habitats and ecological species. The site is close to a river that is a habitat for many species, including various species of birds, trouts and salmons. It is therefore especially important to **maintain** the **balance** in this riche ecosystem. To do so, we will preserve the river and riverbanks free of any pollution that could possibly harm its biology throughout the entire development of the project, from construction to general use. Strict terms will be set on the building plot, special terms and directions will be set on ways to handle all polluting and toxic material both during and after the construction time.
Stormwater from the site will be **cleared** from all harmful ingredients before it is supplied to the river. Sustainable stormwater solutions will be utilised to meet these standards. It is also essential to **eliminate disturbance** of wildlife during important breeding seasons, such as for birdlife as well as the time period when the sea salmon migrates from sea up into the river to spawn. The the construction schedule will be amended to address this point.
Lighting **impact studies** for the restaurant, the housing, the kindergarden and specially the greenhouses will be done in order to ensure that our building will not be disruptive for an existing balance.
Furthermore, terms will be set to ensure **responsible monitoring** both during and after construction time, and the different responsibilities specified for each stakeholder involved in the project (such as developer on one hand and the city on the other).

Foster biodiversity

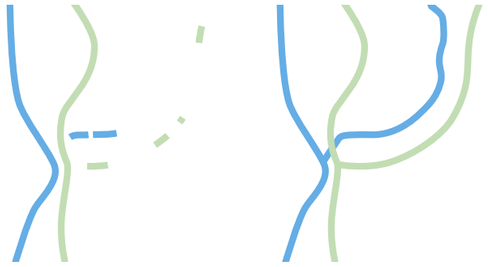
Once again using a Nature Base Solution (NBS) we will answer a major issue of our site:
By implementing **a sample of the local ecosystem** at the center of our project will both foster and support wildlife and flora in its great diversity. All elements composing the local ecosystem are there: water, air, light, earth, rocks, vegetation, wetlands...
This will as well contribute to **increase wildlife** in the nearby areas and **create habitat** for various species

As the first project of Reykjavik new urban extension, Living Landscape is designed to **set precedents** meant to be **replicated** by future projects which will surround it and to be seen as **an example for the global community**.
We ambition that our Living Landscape nature management methodology will be continued throughout rest of the new development of Reykjavik. All main plots could have a central landscape like ours but each bringing a different hint to the map. When ours uses warmth & water, some could use extensive light, others play with certain types of natural colors, smells, textures.
All liked between each others like pearls on a string necklace, the ecosystem landscapes will compose an extremely rich environment where the difference between an urban condition and a natural condition is blurred.

Our creative team is ready to collaborate with the city and the urban planners in charge of the new development of Reykjavik to produce an updated protocole or regulation.

Atlantic Puffins in Iceland. Source: Natural Geographic

Our natural spaces are designed considering the large urban scale. We include our project in an existing fabric by continuing green and blue corridors for nature never to be blocked by man made structures. Nature will be able to spread and progress again.
Maintaining and increasing biodiversity will allow a sustainable delivery of ecosystem services.



Green and blue corridor

Visitors awareness on nature and biodiversity

The restaurant will share its philosophy with its customers. It will **bring awareness** to urban agriculture as it will be represented into the customers' plates. Products grown on-site in the greenhouses will convey the diversity of vegetable which could be cultivated on site.

The kindergarten has dedicated to **educational exhibitions** and spaces allocated in the greenhouses. These will act as a **children and parents awareness center** to local biodiversity and nature concentrated on site.

Citizen education and awareness on themes of nature and biodiversity will be fostered through the practice of three different, but connected, spaces:
The green, blue and grey infrastructure inside and surrounding the building. They will favor a **connection** to wild species through coexisting spaces (paths next to the pond, in the garden, views from the shops toward the central landscape), and offer the **sound** of wild nature in an urban condition (rain on the pond, birds, frogs etc.).
The multi-use shared transformative spaces on the rooftop, will foster a large amount of collective **activities linked to nature** and biodiversity accessible to inhabitants' visitors, such as shared urban agriculture, shared local products cooking practices or exhibitions informing on biodiversity and nature-based solutions.
The shared green space within the building. as a shelter for local biodiversity will act as **a life sized catalog** of local life.

Re-vegetation & urban agriculture

The site is currently a brownfield, with very limited green space. Our project includes a very generous and diverse central landscape, a green roof with large tundra areas and five greenhouses. The cumulative area of grass, trees, shrubs, rain gardens and greenhouses of Living Landscape is around **75%** of the total area of the plot.

The entire green spaces are **accessible** to residents. Some will be dedicated to the Kindergarten, some to the restaurant and the roof, as a collective space, will welcome guests and visitors.

On-site agriculture in the greenhouses has some major advantages such as providing fresh food, reducing transportation costs, and strengthening social cohesion.
Most of the greenhouses will be dedicated to inhabitants and will be exploited as communal growing spaces on a similar yet Iceland adapted idea as English 'family gardens' or French 'jardins ouvriers', small plots attributed to inhabitants by municipalities dedicated to vegetable gardening and aiming to **increase quality of life** and social cohesion and to food expenses.
Some greenhouses or part of greenhouses will be dedicated to the restaurant for them to grow vegetables and aromatic herbs on-site to be incorporated in their recipes and served in the public restaurant on the ground floor. Courses including locally grown products will be advertised as so and **foster desire and knowledge**.
A greenhouse (or a space in a greenhouse), will be dedicated to the kindergarten for **educational purpose**. Children will learn where plants come from, how to grow them and will be able to bring some at home.

Spaces in the greenhouses will be attributed to other **activities** such as a yoga school, a painting class, rented for weddings and other types of events.
Financial models will be studied to allocate a significant part of the funds collected through those activities to help reduce collective charges on maintenance.

The central landscape and the green roofs will be **maintained** by a dedicated professional gardener paid by the the resident association of the project in relation to their attributed ratio of green surface. A precise protocole for maintenance and attribution of the green spaces and greenhouses will be completed in a later phase of development. Public consultations with future owners will be organized.

9. INCLUSIVE ACTIONS AND COMMUNITY BENEFITS

Our project settles in a brownfield, a land inhabited only by wild life forms. We take advantage of this context to foster a new king **communal living** for Iceland Capital City.

It is now recognized that integrating **Nature-Based Solutions** (NBS) into urban design and planning can improve human **health and well-being**, while offering ecological and economic **co-benefits**. Our multifunctional green spaces will provide such benefits. An increasing strong scientific base shows the positive effects of green and blue spaces and good quality landscapes on health, well-being, **social cohesion** and **community support**.

All of our shared spaces have been thought, designed and developed to maximise **social integration** across genders, age and social background. For instance the green and blue shared spaces will favor **recreational activities** for kids, walking paths for adults and the benches will help elderly people to **integrate** these spaces in their new habits. The multifunctional rooftop spaces will favor **knowledge sharing** across genders and ages through the growing of plants and crops and through cooking activities. Those multi-purpose place are designed to **anticipate** the arrival of new activities like yoga classes, artists workshops...

Communication between inhabitants will be facilitated by creating an app or a simple pager group (facebook or equivalent). Therefore inhabitants will be able to **share information** directly with to the whole community and they will also be able to chat between each other to organise community events or **share useful informations**. The final platform will be chosen after a survey aiming to determine which solution would be the most **inclusive** in a community including students not able to buy the latest technology, the elderly, or middle class families equipped with the latest smartphones...

For a detailed description, please see Challenge 6 ‘Clean growth and smart cities’.

10. INNOVATIVE ARCHITECTURE AND URBAN DESIGN

Living Landscape, a new ecosystemic typology for living.

Living Landscape is an innovative mixed-use building with a minimum carbon footprint, a positive impact on its environment and sheltering a condensed local ecosystem. Living Landscape will be the largest wooden building in Iceland.

The project which will represent Iceland's the largest wooden structure is situated alongside the City Line, the new bus line crossing Reykjavik from West to East. It takes full advantage of this privileged location connecting to the public transportation route through a bus stop located on the North-East corner, opening to a large public square.
Programmatic elements are organised around and under a rich **ecosystemic landscape** which creates an 'O' shaped building. This center core is designed as a sample piece of the **local ecosystem**. Indigenous plants, local rocks, a topographic surface mimicking the nearby wetlands, a rainwater management inspired by stratovolcanoes, all contributing to a rich shared ecosystem epicenter for the project, the city and the planet.

A prototype typology

Our project sets on a forthcoming urban context: Elliðaárvogur-Ártúnshöfði development consists on displacing a polluting industrial zone in order to create **urban continuity** by weaving a new neighborhood in between Vogar-Gerði and Harmar-Foldir.

As the first project of far east Reykjavik's new urban extension we ambition that our Living Landscape **ecosystemic typology** proposes a precedent for Iceland's numerous upcoming developments.

All together, they will compose a **new ecosystem fabric**, an extremely rich environment where the differences between an urban condition and a natural condition are blurred.
This ecosystemic methodology of growing urban cities was designed by our team of local and international experts to be seen **as an example for the global community.**

Mixed-use building teeming with life

Various activities animates its ground floor. The second floor is made of offices. The upper floors are a compostion of different types of housings (students, elderly and family). Finally its evolutive roof welcomes five shared glass houses and is ready to welcome all sorts of activites, all connected by an accessible circular pathway.
The central landscape is porous, walkers, bicycles and all sorts of soft mobilities can cross it.

The first thing you see riding the bus towards the new extension of Reykjavik, right after the small island, is the most active corner of our building: at the crossing between a street alongside the Elliðaá river (West) and the busiest street (South), you find a 300 sqm restaurant.

4 100 sqm of commercial spaces fill the ground floor on the South side facing the main street and on the East side facing the public square.

The offices (included within the 4 100 sqm) are located on the first floor, above the shops.

On the a peaceful angle (North-West) a 400 sqm kindergarten with 250 sqm of protected courtyard inside the central landscape.

The rest of the courtyard space is **shared** with the kindergarten and all the inhabitants of the housings above. A careful topographic work enables **soft mobilities** to cross the project from all directions. In the middle of the central landscape the volcanic geothermal water, after it has heaten the housings and the glass houses, runs through a pond enabling it never to freeze and thus adding to the richness of the central landscape : water, air, earth, plants, rocks, animals, insects, together forming a concentrated local and protected ecosystem. The central landscape is porous, walkers, bicycles and all sorts of soft mobilities can cross it.
Inhabitants access the central core of the building through four entrances each located on a cardinal point. When in the central space, the landscape distributes the accesses to eight vertical circulations leading to the apartments.

The first level of apartments sits on the North part of the ground floor which benefits of private gardens within the central space. All five floors above the ground floor are filled with housings adding up 17 000 sqm of floor area.
Apartments include various typologies from single bedroom apartments to 4 bedrooms apartments, all including an outdoor balcony / winter garden. On the South part of the building, facing the busiest street, we find mostly student housings, some of them designed as big shared apartments. In the most protected areas, you'll find more apartments for the elderly and the rest of the building is made of family dwellings.

On the rooftop, a promenade for the inhabitants made of a wood decking and tundra vegetation connects the five greenhouses, each around 150 sqm. They are dedicated to shared communal spaces for the inhabitants with shared outdoor spaces.
A part of the greenhouses area will be dedicated to the restaurant (local agriculture) and another one for the kindergarten (educational purpose).

All elevator shafts bring access to electricity and water to large decks on the roof enabling them to be colonised by future activities like sports rooms, tea bars, artist workshops etc.

Innovative design

However we use traditional and Icelandic elements such as green tundra roofs, and natural features of the local ecosystem, our building is **indisputably contemporary** and its arctic nature inspired **undulating form** is quite **disruptive** in the Icelandic context.
Our project will be the **largest wooden building** in Iceland. It will trigger **new uses** through **innovative programming** such as the central ecosystem, it fosters social bonds by offering quality spaces like the communal greenhouses to families, students and the elderly.

Such a vibrating project will initiate a new energy in the Icelandic urban context and act as a signifier for future development throughout the world.

Nature-Based Solution

To harness the power and sophistication of nature to turn environmental, social and economic challenges into **innovation opportunities**, our team worked hard to incorporate Nature-Based Solutions (NBS) in our project.

NBS can address a variety of **societal challenges** in sustainable ways, with the potential to contribute to **green growth** and **'future-proofing'** society, fostering citizen well-being and providing **business opportunities**.

Nature-based solutions are actions which are inspired by, supported by or duplicated from nature. They have tremendous potential to be energy and resource-efficient and resilient to change, but to be successful they must be adapted to local conditions.

Many nature-based solutions result in multiple **co-benefits** for **health**, the **economy**, **society** and the **environment**, and thus they can represent more efficient and cost-effective solutions than more traditional approaches.

Four principal goals are addressed by nature-based solutions in Living Landscape:

Trigger a new type of **sustainable urbanisation** through nature-based solutions like implementing stores selling locally grown or made products, to stimulate **economic growth** as well as improving the environment, making the city more attractive, and Icelanders happier.

Restoring a degraded and polluted ecosystem victim of violent man made changes like landfills and petroleum related industry using nature-based solutions such as **re-implementing local plants** and rocks, working **a porous city** and **sheltering animals** can improve the **resilience of ecosystems**, enabling them to deliver vital **ecosystem services** and also to meet other societal challenges.

Developing climate change adaptation and mitigation using nature-based solutions such as a **water management** through landscape, re-implementing a degraded flora and **wood construction** can provide more **resilient responses** and enhance **Carbon Capture and Storage** (CSS).

Improving **risk management** and **resilience** using nature-based solutions which proved their efficiency for hundreds of years on a nearby environment can lead to greater benefits than conventional methods and offer synergies in reducing multiple climate related risks.

Certification

The project will aim to reach a "Very good" rating with the BREEAM scheme or a similar level of ambition with other methods for assessing sustainability. This ensures good performance with regards to sustainability.

Natural ground in Iceland

Man made concrete porous ground . Source: Landslag

Living Landscape porous ground

Sustainable structural principles

Living Landscape will be the largest wood building in Iceland.

In order to satisfy the mixed-use, adhere to sustainable building practice and be innovative – the final scheme for the structure is based on a **hybrid sustainable concrete base and structural timber superstructure**.

The commercial spaces at ground floor structure that require a large open floor plan are based on a 9m spaced grid with columns set back 11 to 14m. These spans and the transfer structure at 1st floor level require a reinforced concrete solution. The remaining ground floor spaces used for kindergarten and residential are based on a Cross Laminated Timber (CLT) structure with a 3m grid that continues up to roof level.

The reinforced concrete base structure is designed to create the four 12m wide span bridge openings that provide access to the internal landscaped areas.
Over the commercial spaces, from 1st floor to roof level – the 4 to 5 storey structure is based on a 3m modular Cross Laminated Timber (CLT) construction for housing. The modular panel CLT construction provides flexibility using wall and floor **prefabricated timber** panels with the necessary built-in acoustic and thermal requirements.
The building is divided into 4 blocks – each block containing 2 to 3 concrete cores that provide lateral structural stability. In total 9 core and elevator shafts.
The roof is based on a more flexible grid arrangement for use as communal spaces with glazed pavilions for shared use by residents – dining, relaxation, exercise, etc.

The south facing glazed façade benefits from a 2m setback from the street and a 1m setback for the internal courtyard areas.
There is no basement so RC columns and core structures are founded directly on the site's ground.
For the optimal use of sustainable concrete, **recycled lightweight plastic structural formers**, such as Cobaix, can save up to 35% in concrete.

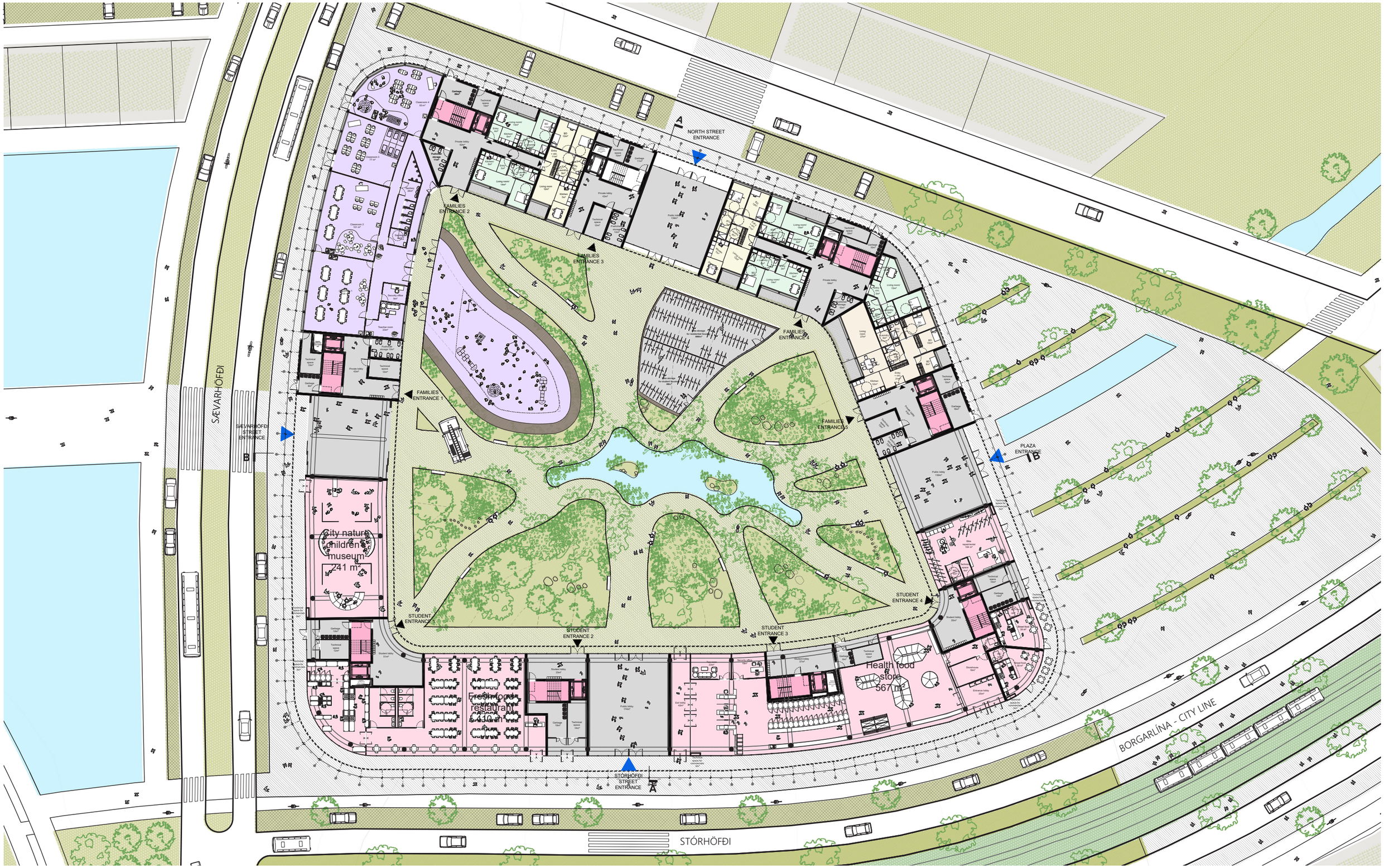
The facades are comprised of a **new generation** of Cross Laminated Timber (CLT) with Insulation panels: Panobloc, an innovative cross fold panel composed of several layers of timber crossed at 90° and shifted then filled in with sustainable and **locally sourced insulation** materials under an industrial process according to the expected performances (thermal fire and structural resistance, acoustics...). To the outer skin is applied Kerto panels of 27mm thickness treated for class 3 or 4 to EN 335:2013.

Hard surfaces of outdoor environments will partly be **built by waste**. An example of this would be to use concrete blocks and/or asphalt blended with recycled and broken glass bottles. This material creates an interesting pattern on the ground with various colors of the recycled bottles that also reflect light from the surface, resulting in a “sparkly” floor which is especially interesting in the winter when the natural light is scarce.
Landscaping will reuse materials from the site as much as possible. Materials from the former industry on the site can be used to create sculptures in public spaces, resulting in a site specific design that can enhance the identity for the site.

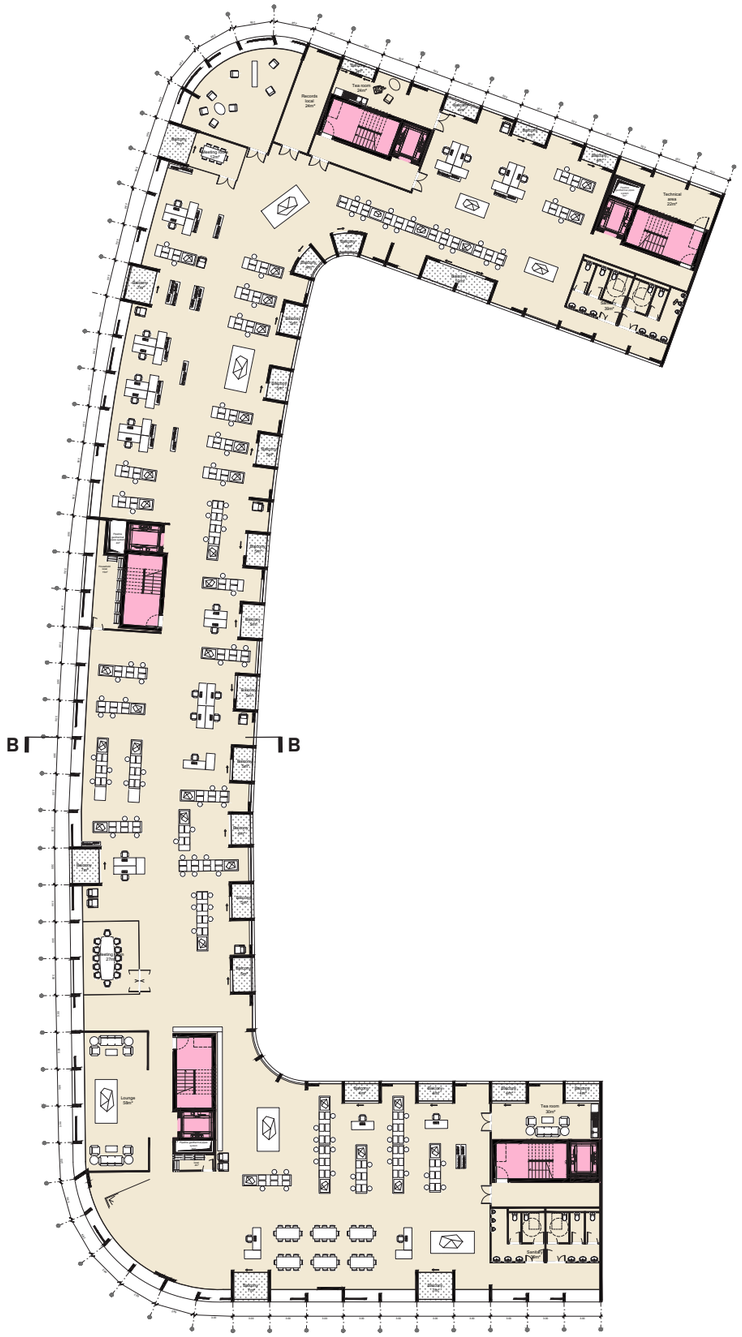
GROUND VIEW PERSPECTIVE

BIRD EYE VIEW PERSPECTIVE

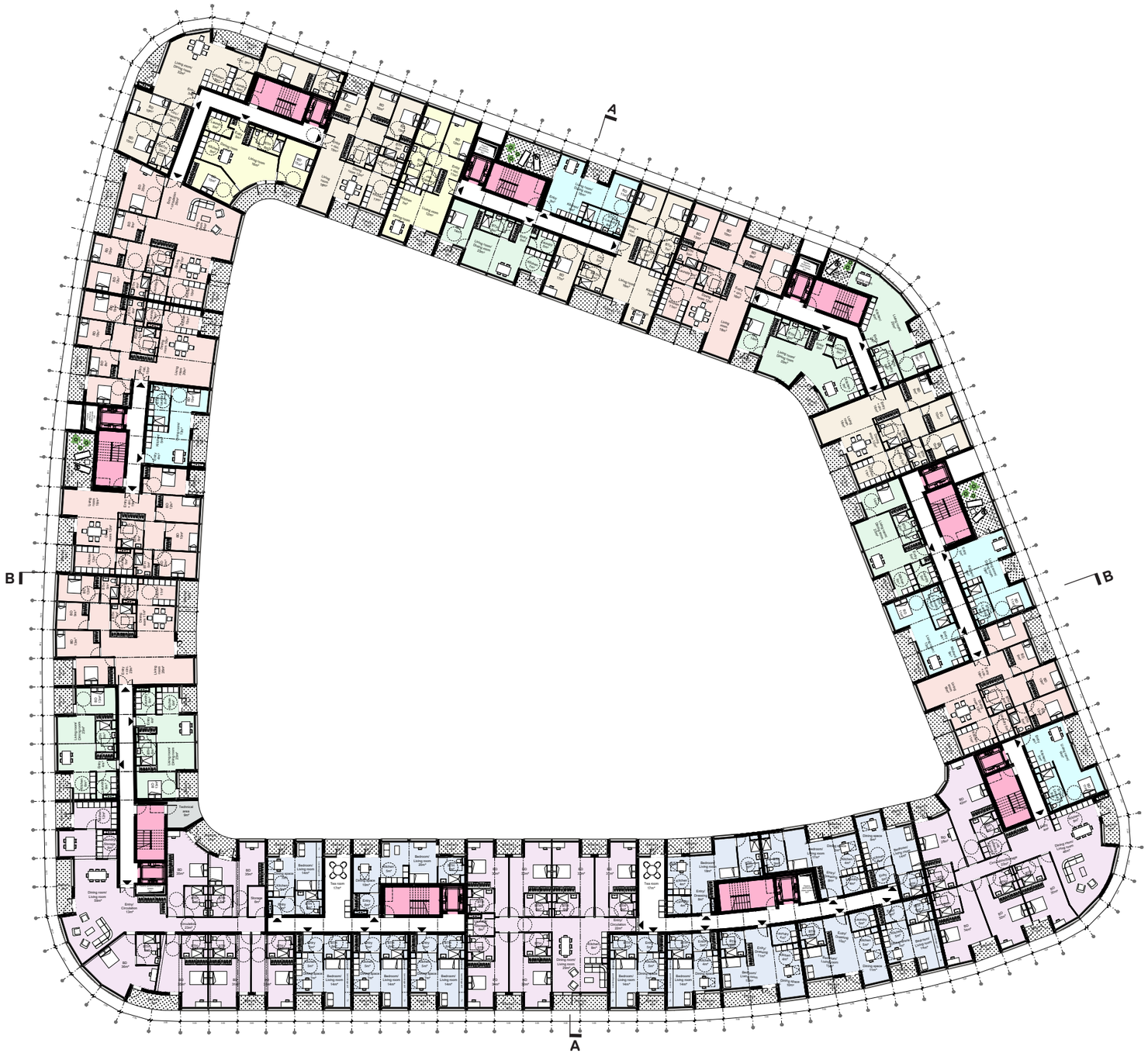
ROOFTOP PERSPECTIVE



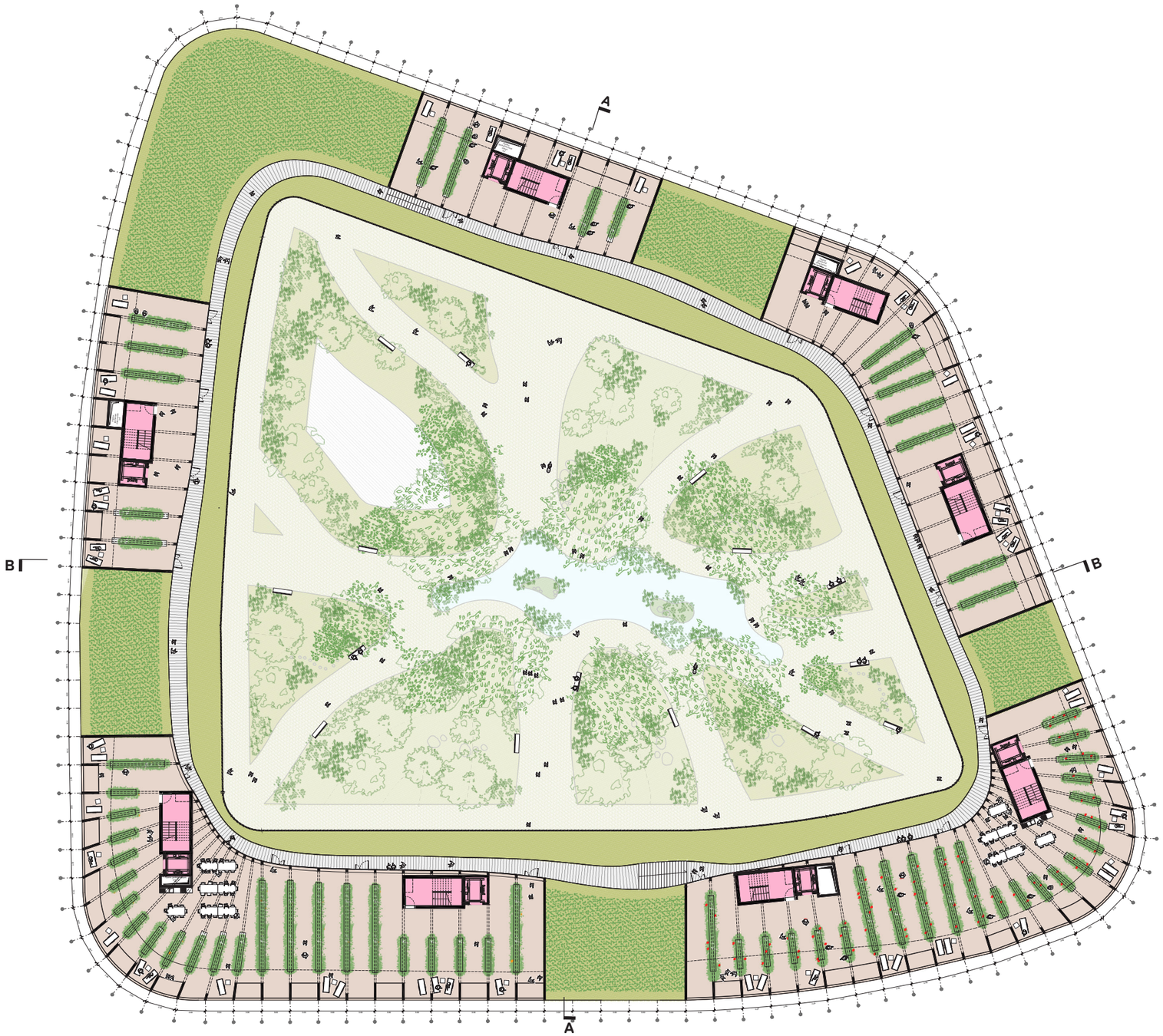
FIRST FLOOR - GROUND FLOOR 1:500



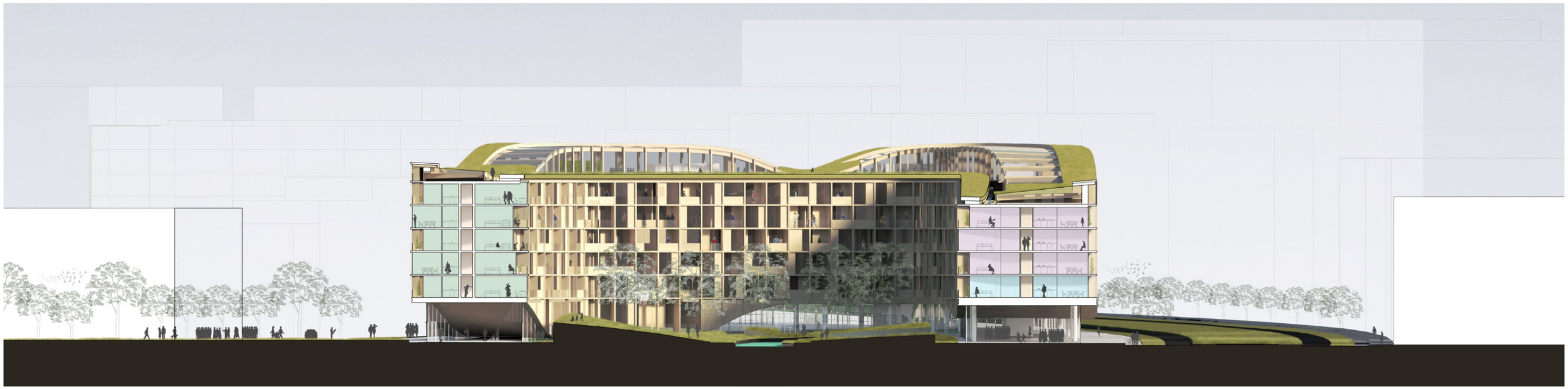
SECOND FLOOR - OFFICE 1:500



GENERAL FLOOR 1:500

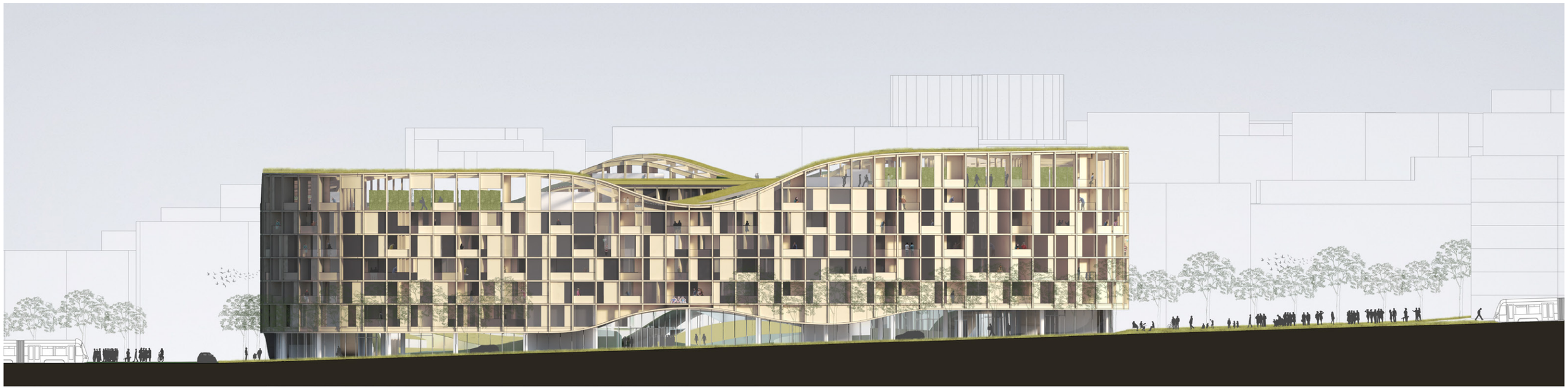


ROOFTOP 1:500



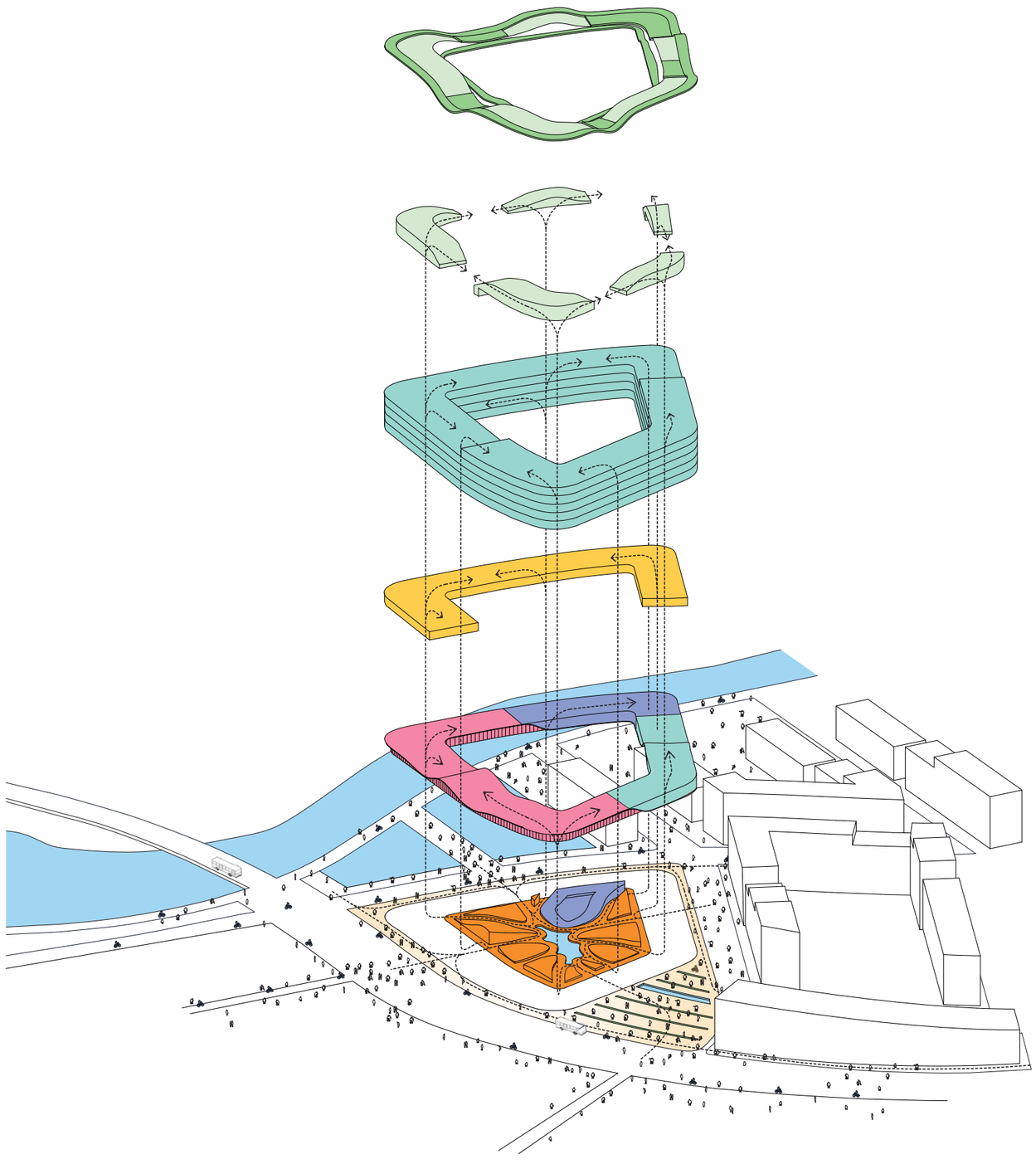
NORTH-SOUTH SECTION A 1:500

EAST-WEST SECTION B 1:500



SOUTH ELEVATION 1:500

NORD-EAST ELEVATION 1:500



AXONOMETRIC: PROGRAMMATIC DIAGRAM

ACTIVITIES DEVELOPED IN THE PROJECT & SURFACE CHART

Ground floor: Housing entrances, bike storage, two street food, one health food store, two small specialty store, one fresh food restaurant, kindergarden with an igloo, city nature children's museum, housing with private garden and a collective central landscape

Second floor: Start-up offices

Third to seventh floor: housing from studio to four bedrooms and coliving (student, elderly and famil)

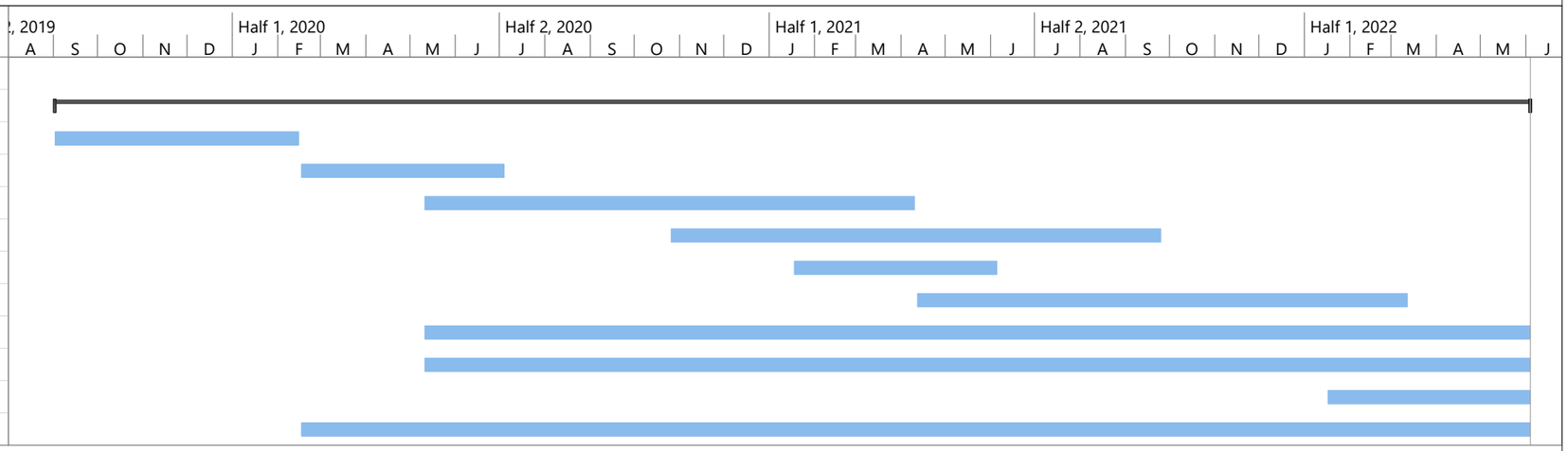
Rooftop: greenhouses and multi purpose decks

C40 ÁRTÚN	interior	exterior	Location	
COMMERCIAL				
Street food 1	35		Nxt to RTS stop	Quick off-beat street food while catching the RTS
Street food 2	35		Nxt to RTS stop	Quick off-beat street food while catching the RTS
Health food store	600		Nxt to RTS stop	Local market to grab something on the way home after picking up the kids.
Small specialty store 1	100			Fresh Fish, meet, cheese or other specialty store
Small specialty store 2	80			Fresh Fish, meet, cheese or other specialty store
Fresh-food restaurant	350			Neighbourhood resturant focusing on fresh produce and fish? Potentally also runs the street food stand.
Start-up offices	900			Offices in an off-center location for flexible cheap rental spaces for start ups.
Service company	100		Ground floor	Bike repair/rental, Laundromat or other services
Technical spaces	100		Ground fl/basem.	Here I believe JMF has already an estimate from Efla concerning sizes. Use that.
TOTAL COMMERCIAL	**2300**			
EDUCATION				
Kindergarten	575		Ground floor	4 classrooms, 95m2 each w/bathrooms and foyer. Small assembly hall and 15% support spaces.
Kindergarten igloo		250	Ground floor	roofed outdoor space for kindergarten
City nature children´s museum	450		Ground floor	Center for late kindergarten/early elementary school groups to learn about city/nature co-existance: urban farming, parks, nature systems in cities such as hydroelectic (elliðaár), floodwater systems, why certain geology is good location for starting cities (why is Reykjavík here) etc. Includes indoor classrooms w/ exhibitions, greenhouse on the roof and hiking around the area.
City nature children´s museum - greenhouse	250		Roof top	Rooftop greenhouse
Technical spaces	100		Ground fl/basem.	Here I believe JMF has already an estimate from Efla concerning sizes. Use that.
TOTAL EDCUATION	**1375**	**250**		
TOTAL NON-RESIDENTIAL	5875	250		

RESIDENTIAL				
Studio	1224			
1 Room	2343			
2 Rooms	504			
3 Rooms	3120			
4 Rooms	2565			
Circulation space	1220			
Bike storage	100		Ground fl/basem.	Heated enclosed bike storage on ground floor or in basement.
Storage	400		Ground fl/basem.	
Communal greenhouse	250		Roof top	
Technical spaces	400		Ground fl/basem.	Here I believe JMF has already an estimate from Efla concerning sizes. Use that.
TOTAL RESIDENTIAL HOUSING	**12126**			
STUDENT HOUSING				
Student T1	1848			
Student T1 +	1083			
Student Co-locations	3848			
Circulation space	781			
Bike storage	100		Ground floor	Heated enclosed bike storage on ground floor or in basement.
Bike shelter		100	Ground fl/basem.	50-100 exterior bike storage.
Communal greenhouse	250		Roof top	
TOTAL STUDENT HOUSING	**7910**			
TOTAL RESIDENTIAL+STUD.	20037	100		
TOTAL	25912	475		

PLANNING

ID	Task Name	Duration	Start	Finish
1				
2	**C - 40**	**36 mons**	**Mon 2.9.19**	**Fri 3.6.22**
3	Design	6 mons	Mon 2.9.19	Fri 14.2.20
4	Earthworks	5 mons	Mon 17.2.20	Fri 3.7.20
5	Structural frame	12 mons	Mon 11.5.20	Fri 9.4.21
6	Interior finishing	12 mons	Mon 26.10.2(	Fri 24.9.21
7	Ventilation	5 mons	Mon 18.1.21	Fri 4.6.21
8	Outdoor finishing	12 mons	Mon 12.4.21	Fri 11.3.22
9	Pipework	27 mons	Mon 11.5.20	Fri 3.6.22
10	Electrical work	27 mons	Mon 11.5.20	Fri 3.6.22
11	Landscaping and site cleanup	5 mons	Mon 17.1.22	Fri 3.6.22
12	Site Cost	30 mons	Mon 17.2.20	Fri 3.6.22



2019-03-07

APPENDICES

The data and calculation for the comparison of different wall structures is shown in tables 1 and 2. The most relevant Life Cycle phases were considered: Material production (embodied carbon) and end of life treatment.

Table 1. Carbon footprint per m² of BAU wall with a concrete structure.

External wall section: BAU					
Material	**Thickness [mm]**	**R [W/m²K]**	**λ [W/mK]**	**Volume [m³]**	**Carbon footprint of production and waste treatment [kgCO_2-eq.]**
Timber cladding	20			0,02	Source: GaBi Professional Database (Thinkstep)
Stone wool insulation	135	3,6	0,037	0,135	Source: LCA for Icelandic Stone wool (EFLA)
Concrete C25/30 + rebar 70 kg/m³	180			0,18	Source: GaBi Professional Database (Thinkstep)
Total		3,6			93,4
Thermal transmittance (U-value)	0,274	m²K/W			

Table 2. Carbon footprint per m² of a wall with a CLT structure.

External wall section: Cross-laminated Timber (CLT)					
Material	**Thickness [mm]**	**R [W/m²K]**	**λ [W/mK]**	**Volume [m³]**	**Carbon footprint of production and waste treatment [kgCO_2-eq.]**
Timber cladding	20			0,02	Source: GaBi Professional Database (Thinkstep)
Stone wool insulation	100	2,7	0,037	0,1	Source: LCA for Icelandic Stone wool (EFLA)
CLT	120	0,9	0,13	0,12	Source: EPDs of several glulam producers.
Total		3,6			18,5
Thermal transmittance (U-value)	0,276	m²K/W			

Carbon footprint calculation for the main building elements is shown in Table 3.

Table 3. Overall carbon footprint of the production and waste treatment of the main building materials.

Whole building	**Mass [tonnes]**	**Volume [m³]**	**Carbon footprint of production and waste treatment [kgCO_2-eq.]**
CLT	4318	9814	Source: EPDs of several glulam producers.
Concrete	8751	3700	Source: GaBi Professional Database (ts)
Rebar	370	48	Source: GaBi Professional Database (ts)
Total			3.160.000

Baseline water consumption levels for water-consuming components.
Components specified within the building shall go beyond the baseline level

Component	Baseline	Unit
WC	6	Effective flush volume (litres)
Wash hand basin taps	12	litres/min
Showers	14	litres/min
Baths	200	litres
Urinal (2 or more urinals)	7.5	litres/bowl/hour
Urinal (1 urinal only)	10	litres/bowl/hour
Kitchen tap: kitchenette	12	litres/min
Kitchen taps: restaurant (pre-rinse nozzles only)	10.3	litres/min
Domestic sized dishwashers	17	litres/cycle
Domestic sized washing machines	90	litres/use
Waste disposal unit	17	litres/min
Commercial-sized dishwashers	8	litres/rack
Commercial or industrial sized washing machines	14	litres/kg

EFLA CONSULTING ENGINEERS

MEMO		
Project number 2933-031	**Customer** Reitir II	**Date** March 2011
Project **Höfðabakki 9, Office building**		
Subject **BREEAM - ENE 1 - Heat Generator Efficiency**		
Sender EFLA Consulting Engineers		
Receiver BRE		

Iceland is a country rich in geothermal resources. Situated on the mid-Atlantic ridge, there is constant volcanic activity beneath the surface in various parts of Iceland. As a result, there are large amounts of underground hot water reservoirs (Figure 1). In the Capital Area, Reykjavík Energy pumps hot water from the ground in various parts of Reykjavík, which is a low – temperature area. The water is generally at a temperature of 70-80°C.

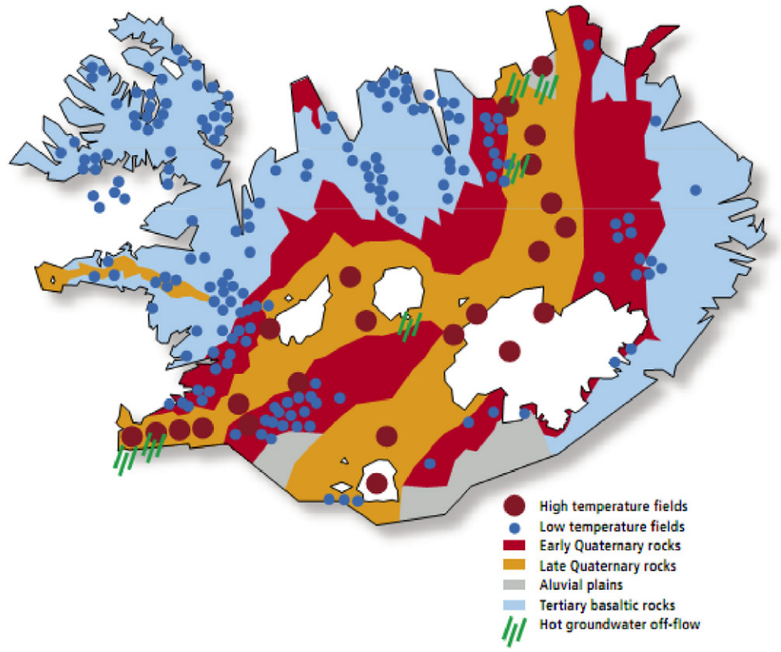


Figure 1: Location of high- and low temperature fields in Iceland (Reykjavík Energy, 2011a).

One of Reykjavik Energy's key emphasis is environmental responsibility, which is embodied in respect for the environment and responsible utilization of resources. Reykjavik Energy's environmental goals include e.g. the following (Reykjavík Energy, 2011b):

- Setting measurable goals in environmental affairs.
- Sustainably utilizing resources in water conservation areas and geothermal areas.

EFLA hf. | Höfðabakki 9 | 110 Reykjavík | Iceland | Tel: (+354) 412 6000 | Fax: (+354) 412 6001 | www.efla-engineers.com | efla@efla.is

- Being a market leader in sales of environmentally sound products.
- Working toward continuous improvements in accordance with Environmental Management Standard ISO 14001 and “EarthCheck”.

Hot water is harnessed from low-temperature fields in Reykjavík and Mosfellsbær and distributed for space-heating, which reaches 99% of housing in the Reykjavík metro area. Hot water for space heating is also generated at the Nesjavellir plant by heating cold, groundwater. Figure 2 explains the geothermal activity at Nesjavellir.

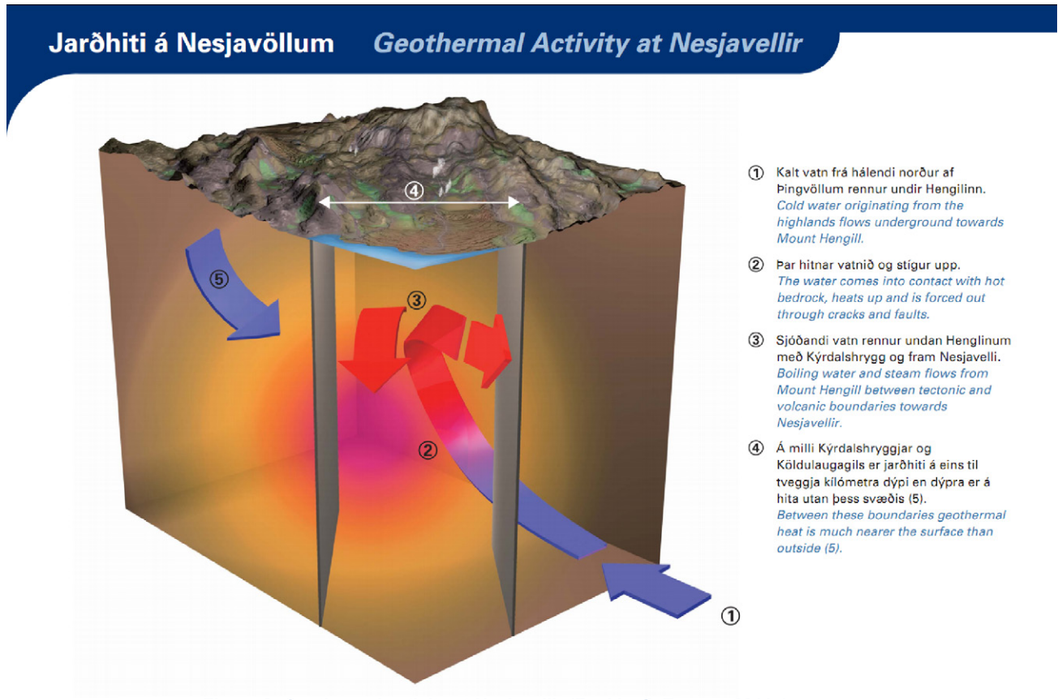
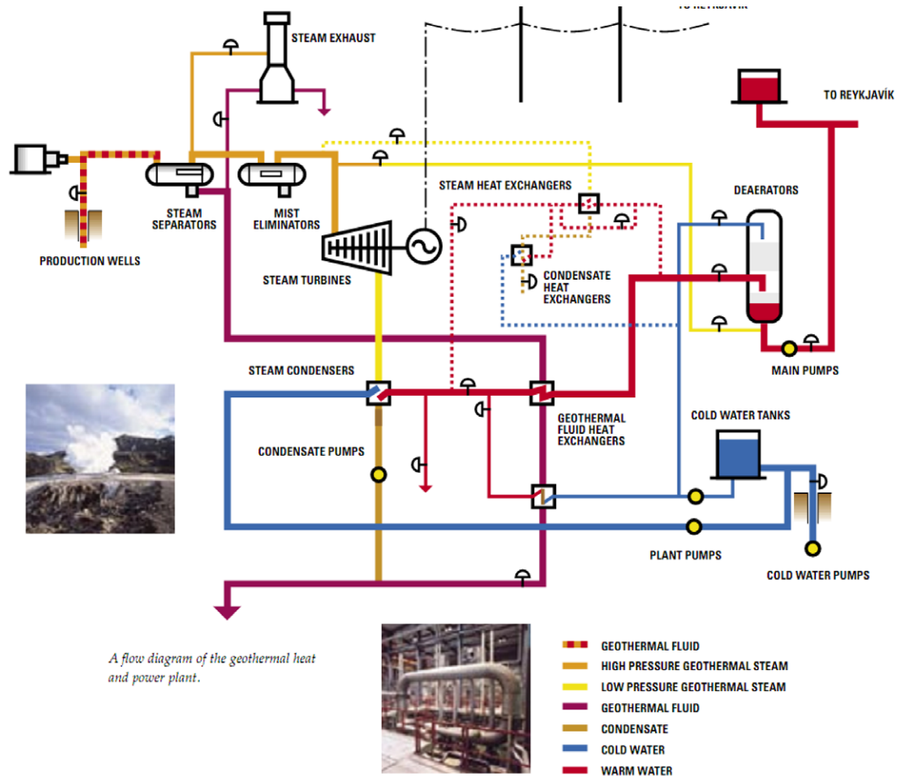


Figure 2: Geothermal activity at Nesjavellir (Reykjavík Energy, 2011a).



A flow diagram of the geothermal heat and power plant.

Figure 3: A flow diagram of Nesjavellir geothermal heat and power plant (Reykjavík Engergy, 2011a).

In the geothermal active area surrounding the Nesjavellir plant, production wells have been drilled to catch the steam generated from precipitation/ground water reaching the lava. The steam is guided through steam turbines to generate electricity. When the steam exits the turbines it is utilized to heat up the cold ground water. The heated water is then distributed to the capital area for heating of houses and supplying sanitary hot water (see Figure 3).

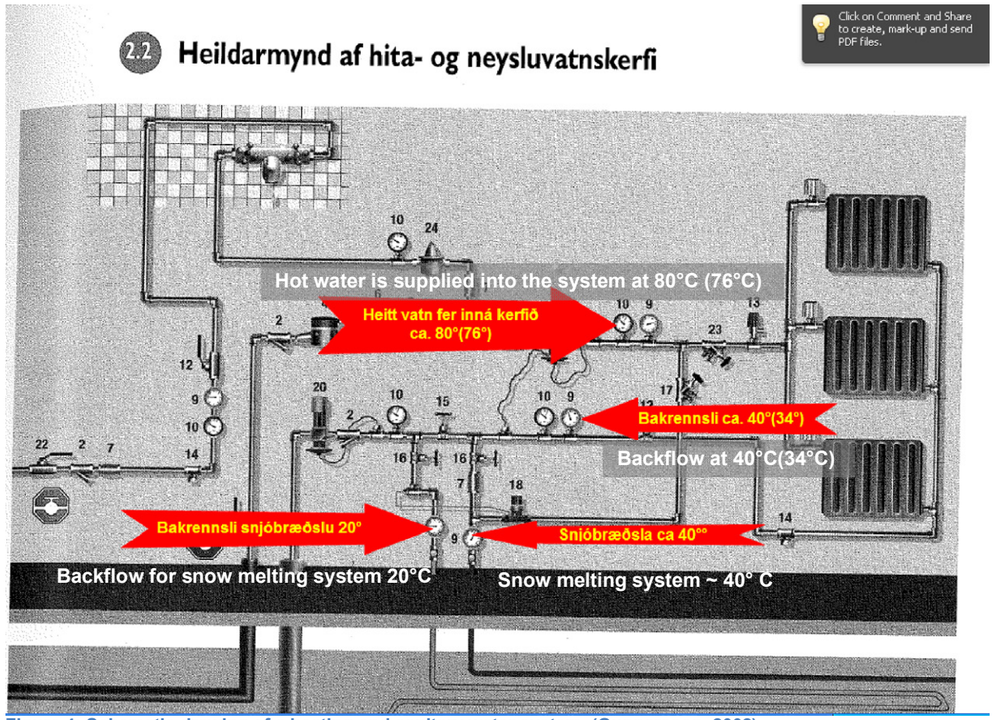


Figure 4: Schematic drawing of a heating and sanitary water system, (Gunnarsson, 2002) .

Figure 4 above shows a typical intake room of a residence in Iceland. Hot water is supplied at a temperature of approximately 75°C into the heating and sanitary system. When the hot water leaves the heating system (radiators) it still has a temperature of approximately 35°C. The return water can then be used for snow melting systems, reducing the water temperature further by 20°. The return water is then approximately 15°C and can be released into the drainage system. However,nowadays, a closed system is often used, where the return water is circulated and heated up with the geothermal hot water.

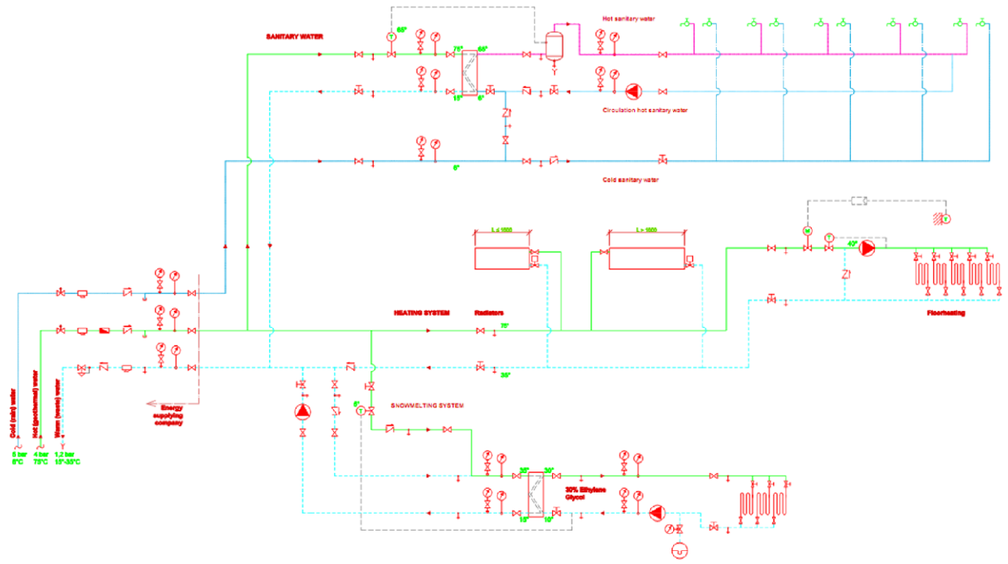


Figure 5: Schematic drawing of heating, sanitary water and snow melting system for an office building in Iceland.

A schematic drawing of a heating, sanitary water and snow melting system for an office building in Iceland, can be seen in Figure 5. The same principles can be seen as in the simple case, illustrated in Figure 4, i.e. temperatures and utilization of the geothermal water.

The main goal in the design of a geothermal plumbing system is to get as much heat out of the water as possible. In the example above the temperature is decreased from app.75°C down to 15°C.

From the above it is clear that space heating in the Reykjavík Area is provided from high efficient energy sources, either from the geothermal low temperature fields located in the Capital Area or from the Nesjavellir cogenerating power plant that generates both electricity and heated water for space heating.

Therefore one credit is awarded for heat generator efficiency.

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Nature-based Solutions: New Influence for Environmental Management and Research in Europe

Greening roofs or walls to cool down city areas during summer, to capture storm water, to abate pollution, and to increase human well-being while enhancing biodiversity: nature-based solutions (NBS) refer to the sustainable management and use of nature for tackling societal challenges. Building on and complementing traditional biodiversity conservation and management strategies, NBS integrate science, policy, and practice and create biodiversity benefits in terms of diverse, well-managed ecosystems.

Hilde Eggermont, Estelle Balian, José Manuel N. Azevedo, Victor Beumer, Tomas Brodin, Joachim Claudet, Bruno Fady, Martin Grube, Hans Keune, Penelope Lamarque, Katrin Reuter, Matt Smith, Chantal van Ham, Wolfgang W. Weisser, Xavier Le Roux

Nature-based Solutions: New Influence for Environmental Management and Research in Europe | *GAIA* 24/4 (2015): 243 – 248
Keywords: biodiversity, ecosystem services, research programming, social-ecological systems, societal challenges, sustainable management

Nature-based Solutions, an Emerging Term

It is now widely recognized that human activities have reached a level that could result in abrupt and, in some cases, irreversible environmental changes detrimental to human development (Steffen et al. 2015). Societies face increasing challenges such as climate change, jeopardized food security and water resource provision, and an enhanced disaster risk.

One approach to answer these challenges is to increasingly rely on technological strategies, which are designed and managed to be as simple, replicable and predictable as possible (Hoffert et al. 2002). For instance, physico-chemical biofiltration processes are used to purify air and water at large scales in most countries, in particular in the northern hemisphere. An alternative approach is to manage the (socio-)ecological systems in a comprehensive approach in order to sustain and potentially increase the delivery of the ecosystem services (ES) to humans.[1]

The second approach recognizes the complexity of socio-ecological systems and the fact that they are dynamic, leaving room for self-reorganization and mutability and associated resistance and resilience capacities (Garmestani and Benson 2013). In this context, nature-based solutions (NBS) have recently been put forward by practitioners (in particular the International Union for Nature Conservation, IUCN) and quickly thereafter by policy (European Commission), referring to the sustainable use of nature in solving societal challenges.

While ES are often valued in terms of immediate benefits to human well-being and economy, NBS focus on the benefits to people and the environment itself, to allow for sustainable solutions that are able to respond to environmental change and hazards in the long-term. NBS go beyond the traditional biodiversity conservation and management principles by "re-focusing" the debate on humans and specifically integrating societal factors such as human well-being and poverty alleviation, socio-economic development, and governance principles.

In this sense, NBS are strongly connected to ideas such as natural systems agriculture (Jackson 2002), natural solutions (Dudley et al. 2010), ecosystem-based approaches (Cowan et al. 2010), green infrastructures (Benedict and McMahon 2006), and ecological engineering (Borsje et al. 2011).[2] >

1 In this paper, we refer to ES as the direct and indirect contributions of ecosystems to human well-being (Costanza et al. 1997, Millennium Ecosystem Assessment 2005).

2 For instance, ecosystem-based approaches are increasingly promoted for climate change adaptation and mitigation (Cowan et al. 2010, Naumann et al. 2011, Burch et al. 2014) by organisations like United Nations Environment Programme (UNEP) and non-governmental organisations such as The Nature Conservancy. Similarly, green infrastructure refers to an "interconnected network of green spaces that conserves natural systems and provides assorted benefits to human populations" (Benedict and McMahon 2006).

Contact: *Dr. Hilde Eggermont* | Belgian Biodiversity Platform | Royal Belgian Institute for Natural Sciences | Vautierstraat 29 | 1000 Brussels | Belgium | Tel.: +32 2 6274318 | E-Mail: h.eggermont@biodiversity.be

http://dx.doi.org/10.14512/gaia.24.4.9

The concept of ecological engineering may be closest to NBS (at least types 2 and 3 below), though it has different definitions (Mitsch 2012). In particular, Barot et al. (2012) indicate that the goal of ecological engineering is to develop more sustainable practices informed by ecological knowledge with the aim of 1. protecting and 2. restoring ecological systems, 3. modifying ecological systems to increase the quantity, quality and sustainability of particular services they provide, or 4. building new ecological systems that provide services that would otherwise be provided through more conventional engineering based on non-renewable resources.[3]

The term "nature-based solutions" was first used in the late 2000s (MacKinnon et al. 2008, Mittermeier et al. 2008) in the context of finding new solutions to mitigate and to adapt to climate change effects whilst simultaneously protecting biodiversity and improving sustainable livelihoods. The IUCN referred to NBS in a position paper for the *United Nations Framework Convention on Climate Change* (IUCN 2009), after which the term has been quickly taken up by policy, viewing NBS as an innovative mean to create jobs and growth part of a green economy. Currently, the European Commission is developing a EU research and innovation policy on NBS in the context of its *Horizon 2020 Framework Programme* (European Commission 2015), with the aim to position Europe as a world leader in this field.

Many Voices, One Term

The NBS idea has barely been evaluated by the scientific community (but see MacKinnon and Hickey 2009, MacKinnon et al. 2011), and different stakeholders view NBS from different perspectives. For instance, IUCN (2012) stresses that they "can deliver effective solutions to major global challenges, such as climate regulation, using nature while providing biodiversity benefits in terms of diverse, well-managed ecosystems and respecting and reinforcing communities' rights over natural resources". This framing puts biodiversity and local human communities at the heart of NBS. In the context of the on-going political debate on jobs and growth (main drivers of the current EU policy agenda), the European Commission underlines that NBS can transform environmental and societal challenges into innovation opportunities, by turning natural capital into a source for green growth and sustainable development. For the commission, NBS are sustainable measures that aim to simultaneously meet environmental, societal and economic objectives, which should help maintain and enhance natural capital (European Commission 2015). This framing puts economy and social assets at the heart of NBS while sustaining environmental conditions. In any case, NBS are often seen as a concept, and more likely a flagship term, that can provide incentives for governments, institutions, business and citizens to develop innovative ways to integrate natural capital in policies and planning, and to maintain or increase biodiversity and human well-being (European Commission 2015).

With this paper, we do not intend to provide an in-depth review of all concepts related to NBS, nor to nail down a strict definition. Rather, we aim to sharpen the term, in particular by proposing a typology of NBS, and reflect on its added value with respect to existing terms and concepts, its possible drawbacks in case of misuse, and perceived future challenges for research and management. As such, we hope to spur further discussion, and contribute to sharpening the term allowing for a better evaluation of its true potential.

A Proposed Typology

We propose a typology characterizing NBS along two gradients (figure 1): 1. "How much engineering of biodiversity and ecosystems is involved in NBS?", 2. "How many ecosystem services and stakeholder groups are targeted by a given NBS?". Due to the ES trade-offs that likely exist (Howe et al. 2014), we hypothesize that most often, the higher the number of services and stakeholder groups is targeted, the lower the capacity to maximize the delivery of each service and simultaneously fulfill the specific needs of all stakeholder groups will be. As such, there are three types of NBS:

- ***Type 1*** consists of no or minimal intervention in ecosystems, with the objectives of maintaining or improving the delivery of a range of ES both inside and outside of these preserved ecosystems. Examples include the protection of mangroves in coastal areas to limit risks associated to extreme weather conditions and to provide benefits and opportunities to local populations; and the establishment of marine protected areas to conserve biodiversity within these areas while exporting biomass into fishing grounds (Grorud-Colvert et al. 2014). This type of NBS is connected to, e.g., the concept of biosphere reserves incorporating core protected areas for nature conservation and buffer and transition areas where people live and work in a sustainable way.
- ***Type 2*** corresponds to the definition and implementation of management approaches that develop sustainable and multifunctional ecosystems and landscapes (extensively or intensively managed), which improves the delivery of selected ES compared to what would be obtained with a more conventional intervention. Examples include innovative planning of agricultural landscapes to increase their multifunctionality; and approaches for enhancing tree species and genetic diversity to increase forest resilience to extreme events. This type of NBS is strongly connected to concepts like natural systems agriculture (Jackson 2002), agro-ecology (Altieri 1989), and evolutionary-orientated forestry (Lefèvre et al. 2014).
- ***Type 3*** consists of managing ecosystems in very intrusive ways or even creating new ecosystems (e.g., artificial ecosystems with new assemblages of organisms for green roofs and walls to mitigate city warming and clean polluted air). Type 3 is linked to concepts like green and blue infrastructures[4] (Benedict and McMahon 2006) and objectives like restoration of heavily degraded or polluted areas. Within this type, novel approaches such as animal-aided design (Hauck and Weisser 2015) are currently being explored to bridge the gap between biodiversity conservation and landscape architecture.

3 Terms such as "ecosystem restoration" (return of an ecosystem to a close approximation of its condition prior to a disturbance or period of specific management) are often seen as part of ecological engineering (National Research Council 1992). The same applies for "agro-ecology" which delineates the ecological principles necessary to develop sustainable agricultural production systems (Altieri 1989).

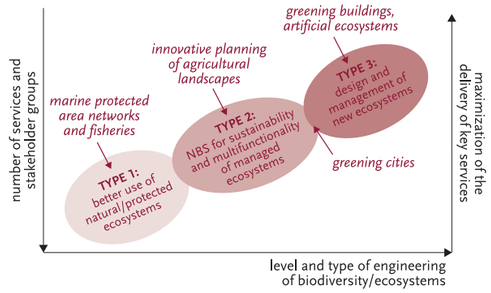

FIGURE 1: Schematic representation of the range of nature-based solution (NBS) approaches. Three main types of NBS are defined, differing in the level of engineering or management applied to biodiversity and ecosystems (x-axis), and in the number of services to be delivered, the number of stakeholder groups targeted, and the likely level of maximization of the delivery of targeted services (y-axis). Some examples of NBS are located in this schematic representation. Note that the y-axes could be shifted, and that type 3 cannot be viewed as "better" than type 1, the three types being complementary.

Type 1 fully fits with the way IUCN frames NBS. Types 2 and 3 would also fit with this definition providing that they should contribute to preserving biodiversity and managing or restoring ecosystems sustainably while delivering a range of ES. In the case of agro-ecosystems or inner city green spaces, e.g., it would be important to consider ecological complexity and connection with surrounding ecosystems to provide biodiversity benefits. Type 2 and moreover type 3 are often exemplified by the European Commission for turning natural capital into a source for green growth and sustainable development.

The boundary between these three types is obviously not clear-cut. Hybrid solutions exist along this gradient both in space and time. For instance, at landscape scale, mixing protected and managed areas could be needed to fulfill multifunctionality and sustainability goals. Similarly, a constructed wetland can be developed as a type 3 but, when well established, may subsequently be preserved and surveyed as a type 1.

Outlier examples (that would plot upper-left and bottom-right) are likely rare. Pristine ecosystems, like taiga, have many roles at local and global scale (like water and climate regulation, support to livelihoods of local populations, etc.), and may therefore not be restricted to a narrow range of stakeholders. Similarly, although abilities to manage complex ecosystems will continue to increase over the coming decades, the design of artificial ecosystems will likely target only a few ES and have to tackle ES trade-off.

Opportunities and Risks Associated to NBS

What NBS Are, or Are Not

While we advocate that the open nature of the term NBS can favor its success, we contend that it is important to specify which solutions should and should not be considered as NBS. We illustrate this with the development of green roofs and walls in cities. Having in mind the sole objective of developing green surfaces in urban areas to mitigate the effects of global warming, green roofs or walls could be created using, e.g., clones from one or very few plant species, regardless of their biogeographical distribution. Such new structures would hardly contribute to increase biodiversity and the delivery of other ES. This may also lead to a poor resistance and resilience to future extreme events, increased management costs, and risk of biological invasions. Furthermore, without a coordinated approach at the city scale, firms would likely design green buildings in a case-by-case approach with a very uncertain effectiveness at city scale. Such an approach, which largely misses out on the objectives of sustainability, increased biodiversity, and effectiveness at relevant scale (here the city), would not fit the NBS framing. Similarly, rain gardens designed to manage storm water runoff that pay little reference to what plants are used and to other ES, fall short of NBS. In contrast, within an urban planning approach at the city scale, a range of species could be selected for green roofs or walls based on their biogeography and key functional traits (Lundholm et al. 2015), which would address multiple goals such as cooling during summer, storm water capture, pollution abatement, increased human well-being, biodiversity enhancement, and better resilience to future hazards, while adopting adequate governance to properly tackle the issue at city scale (figure 2, p. 247). Such approaches would fit the NBS term. NBS thus broadens the ES framework, promoting and better relying on biological diversity to increase the resistance and resilience of social-ecological systems to global changes and extreme or unexpected events and the delivery of a range of ES.

Calling for Innovative NBS Should Not Imply Losing Track of Existing Ones

NBS are often referred to as innovative, but they should not include exclusively "new" solutions. Whilst the NBS concept offers new opportunities and brings added-value, it also encompasses existing ideas and requires inclusion of lessons from the past. Local and traditional knowledge should also be considered when exploring NBS. Traditional management systems (e.g., for agriculture, forestry, aquaculture, fishing) and their principles should be re-assessed in light of NBS criteria, as they often include sustainable, locally-adapted and biodiversity-enhancing practices. For example, engineered biodiverse pastures developed in Portugal in the 1960s and 1970s provide higher yields of better quality forage, significantly increase sustainable stocking rates, and have mul- >

4 Green or blue infrastructures should solve urban and climatic challenges by building with nature.

tiple environmental co-benefits (Teixeira et al. 2015). This could be a typical NBS unrecognized as such so far.

NBS Should Exploit Win-win Situations but Will Have to Cope with Trade-offs and Uncertainties

NBS should account for multiple interests (in particular environmental, societal, and economic ones) and promote sustainability. Yet, there will be few win-win situations where all goals are simultaneously met. Documenting and analyzing the possible synergies and trade-offs between ES and stakeholders' expectations will therefore be at the heart of identifying and implementing NBS. In addition, stakeholders and policy makers must remain aware of the complexities and uncertainties that surround NBS. Assessing the risks associated with a given NBS should be compulsory and alternative solutions should be envisaged, looking at the potential impacts through time and space, and accounting for future environmental changes. Otherwise, NBS could generate problems instead of solutions (e. g., species introduced for pest control can become invasive, if corresponding controls are lacking).

NBS Could Help Meet Various Ethical, Intellectual, and Relational Challenges

NBS clearly build on, and share aspects with other concepts, approaches and tools, but might be more holistic and have more potential to support environmental sustainability. More specifically, the NBS approach may help meet three types of challenges – ethical, intellectual, relational – that other concepts have not completely addressed so far (Jones 2011; but see Hauck et al. 2013).

Ethical challenges arise at two different levels: NBS are 1. a human-centered utilitarian concept, and 2. include other knowledge systems beyond modern science (i. e., indigenous and local knowledge). As the NBS term clearly refers to societal challenges (ontological dimension), problems defined by humans (epistemic dimension), and the sustainable use of nature (practical dimension), there is no doubt that the concept is anthropocentric as are other current concepts such as ES. The debate on anthropocentric and bio- or ecocentric (assuming an intrinsic value of living beings, entire ecosystems, or the biosphere) views has been at the heart of the discussions on the *Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES)* conceptual framework (Diaz et al. 2015) and the discussion on "the new conservation" (Kareiva 2014); we will not start it again here. We advocate that NBS might help to demonstrate that these two views can be complementary, leading to successful approaches to promote biodiversity. The second ethical challenge relates to the plurality of value and knowledge systems that exist among different cultures regarding human-nature interactions. This plurality of views has to be acknowledged and integrated while developing and assessing NBS, and stakeholder participation has to be ensured. NBS have the potential to solve or avoid conflicts here, because they aim at dealing with concrete problems often at a local level. Moreover, research has shown that a mismatch exists between ES approaches and governance needs (Primmer and Furman 2012) and that transdisciplinary approaches are more likely to achieve effective change on the ground (BIOMOT 2014).

The intellectual challenge requires those coming from various scholastic traditions (ecosystem science and ecology, conservation and restoration, forestry and agronomy, sociology, economics, architecture, etc.) to respectively identify and fuse their key principles into a coherent, useful set that is comprehensible and accessible to all. The nature of NBS could help with providing the critical intellectual mass and rapid cross-fertilization of ideas needed for reaching this ambition. Moreover, there is a need to promote research models where applied and fundamental sciences are not opposed, thereby facilitating transdisciplinarity (Barot et al. 2015).

The relational challenge is strategic. Being promoted by practitioners and policy makers rather than scientists (unlike, e. g., ES: Gómez-Baggethun et al. 2009), one added-value of the NBS term could be that it is easier to grasp by non-technical audiences and key societal partners (business, policy, education, and practitioners), and hence could promote the stakeholder model of research (Barot et al. 2015), receive wider support, and result in systemic solutions rather than sectorial ones. Although many practitioners and scientists working in traditional fields such as agriculture, forestry and aquaculture are genuinely concerned by sustainability issues, they often have difficulties integrating scientific ecological knowledge and turning towards drastically new practices (Neßhöver et al. 2013, Lewinsohn et al. 2015). Work on NBS could mobilize a great number of people towards achieving environmental sustainability in all kinds of socio-ecosystems. However, while social scientists and various groups of stakeholders may receive the idea of NBS well, its acceptance among natural scientists, in particular those involved in species and habitat conservation, remains a challenge as there is some distrust in "yet another buzz word" and concern that at the end these NBS may address biodiversity conservation only in a cosmetic manner, possibly generating even more pressure on natural systems.

For their successful deployment, we believe that NBS should not be considered as "the one and only" possible way, but need to be embedded in a wider, coherent strategy at research and policy level. Otherwise, NBS run the risk of misinterpretation, misapplication and non-acceptance. One of the risks is that it might channel all research and management efforts towards an approach that is useful in some but not all conditions, whereas nature preservation – and associated research – should be supported also.

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FIGURE 2: Nature-based solution approaches can promote the development and management of urban ecosystems to offer sustainable and cost-effective solutions to societal challenges like global warming, water regulation and human health, while enhancing biodiversity. Here, the Green Park in London.

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CONTRIBUTING AUTHORS

Dr. Hilde Eggermont, Estelle Balian, MSc
Belgian Biodiversity Platform, Royal Belgian Institute of Natural Sciences, Brussels, Belgium

Dr. José Manuel N. Azevedo
Fundo Regional para a Ciência e Tecnologia, Açores, Portugal

Dr. Victor Beumer
Deltares, Delft, The Netherlands

Prof. Dr. Tomas Brodin
Umeå University, Department of Ecology and Environmental Science, Umeå, Sweden

Dr. Joachim Claudet
National Center for Scientific Research, CRIOBE, Perpignan, France

Dr. Bruno Fady
French Institute of Agronomic Research, Ecology of Mediterranean Forests, Avignon, France

Prof. Dr. Martin Grube
Institute of Plant Sciences, University of Graz, Austria

Dr. Hans Keune
Belgian Biodiversity Platform, Research Institute for Nature and Forest, Brussels, Belgium

Dr. Penelope Lamarque
International Union for Conservation of Nature (IUCN), Gland, Switzerland

Dr. Katrin Reuter
Museum für Naturkunde Berlin – Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany

Matt Smith, MSc
Joint Nature Conservation Committee, Peterborough, United Kingdom

Chantal van Ham, MSc
International Union for Conservation of Nature (IUCN), European Union Representative Office, Brussels, Belgium

Prof. Dr. Wolfgang W. Weisser
Technische Universität München, Terrestrial Ecology Research Group, School of Life Sciences Weihenstephan, Freising, Germany

Dr. Xavier Le Roux
Microbial Ecology Center, French Institute of Agronomic Research, University Lyon 1, Lyon, France, and French Foundation for Research on Biodiversity, Paris, France

Hilde Eggermont

Born 1977 in Waregem, Belgium. MSc in biology, PhD in freshwater biology/paleolimnology. Scientific coordinator of the *Belgian Biodiversity Platform* and Vice-Chair of *BiodivERsA ERA-NET.* Research interests: science-policy and science-society interfacing, biodiversity, research strategies, horizon scanning.

Estelle Balian

Born 1971 in Saint-Etienne, France. BA in genetics and molecular biology, MSc in fisheries and aquatic sciences. Biodiversity expert for the *Belgian Biodiversity Platform.* Competences in science-policy interfaces on biodiversity and ecosystem services at European and international levels, participatory processes, stakeholder engagement in scientific projects, facilitation and conflict resolution.

Xavier Le Roux

Born 1967 in Coutances, France. PhD in ecosystem ecology. Research team leader at the Microbial Ecology Centre of Lyon-Villeurbanne, Université Lyon. 2008 to 2012 director of the Foundation for Research on Biodiversity. Since 2008 coordinator and Chief Executive Officer of *BiodivERsA ERA-NET.* Research interests: biodiversity, microbial ecology, research programming and promotion, science-society interfacing.