Implenia

SUSTAINABLE ENGINEERING IN THE INDUSTRY

GUEST LECTURE
IMPLENIA REAL ESTATE DEVELOPMENT

Benoît Klein
10th december 2024
EPFL

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Implenia

IMPLENIA IN A NUTSHELL

WE DESIGN AND BUILD WITH AND FOR PEOPLE

3'563
mio. CHF, CA 2022

138,9
mio. CHF, EBIT 2022

7'221
mio. CHF, order book

4 divisions

Real Estate

Buildings

Civil Engineering

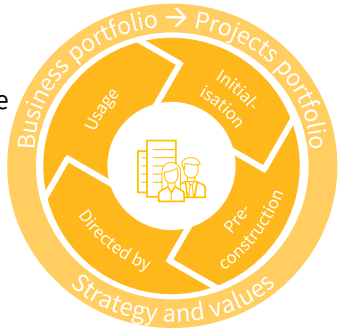
Specialties

1 integrated model

Integrated services throughout the value the value creation chain

4 strategic priorities

- Portfolio
- Profitable growth
- Innovation
- Talent and organisation



~ 9'000
FTE
May 2023

Culture based on
5 values

Excellence Collaboration Agility Integrity Sustainability

GREEN VILLAGE USE CASE OF SUSTAINABLE ENGINEERING


Green Village
Geneva
Montreal
Kyoto
Salève
Rhône
Jura
Lac

SUSTAINABLE ENGINEERING IN THE INDUSTRY - GUEST LECTURE - IMPLENIA REAL ESTATE

PROGRAMME AND DEVELOPMENT HISTORY

62,000 m² SBP

48 flats
1 hotel, 1 crèche, 1 cafeteria
1 school, 1 conference centre
1 chapel, several international missions

200 permanent residents
2,500 workplaces
1 neighbourhood activator
1 open landscaped park

- 2012 — Implenia Winner of the Service development AO
- 2014 — Architectural competition
- 2017 — Classification Obtaining a localised neighbourhood plan
- 2020 — Start of works 1ère stage
- 2023 — Delivery Montreal and Kyoto
- 2024 — Delivery Montreal and Kyoto
- 2027 — Delivery Stockholm and Lima Renovation of the Centre
- 2028 — Delivery Stockholm and Lima Renovation of the Centre
- 2029 — Delivery Rio and Durban
- 2030 — Delivery Rio and Durban

GREEN VILLAGE USE CASE

SEED next generation living · SNBS · THPE

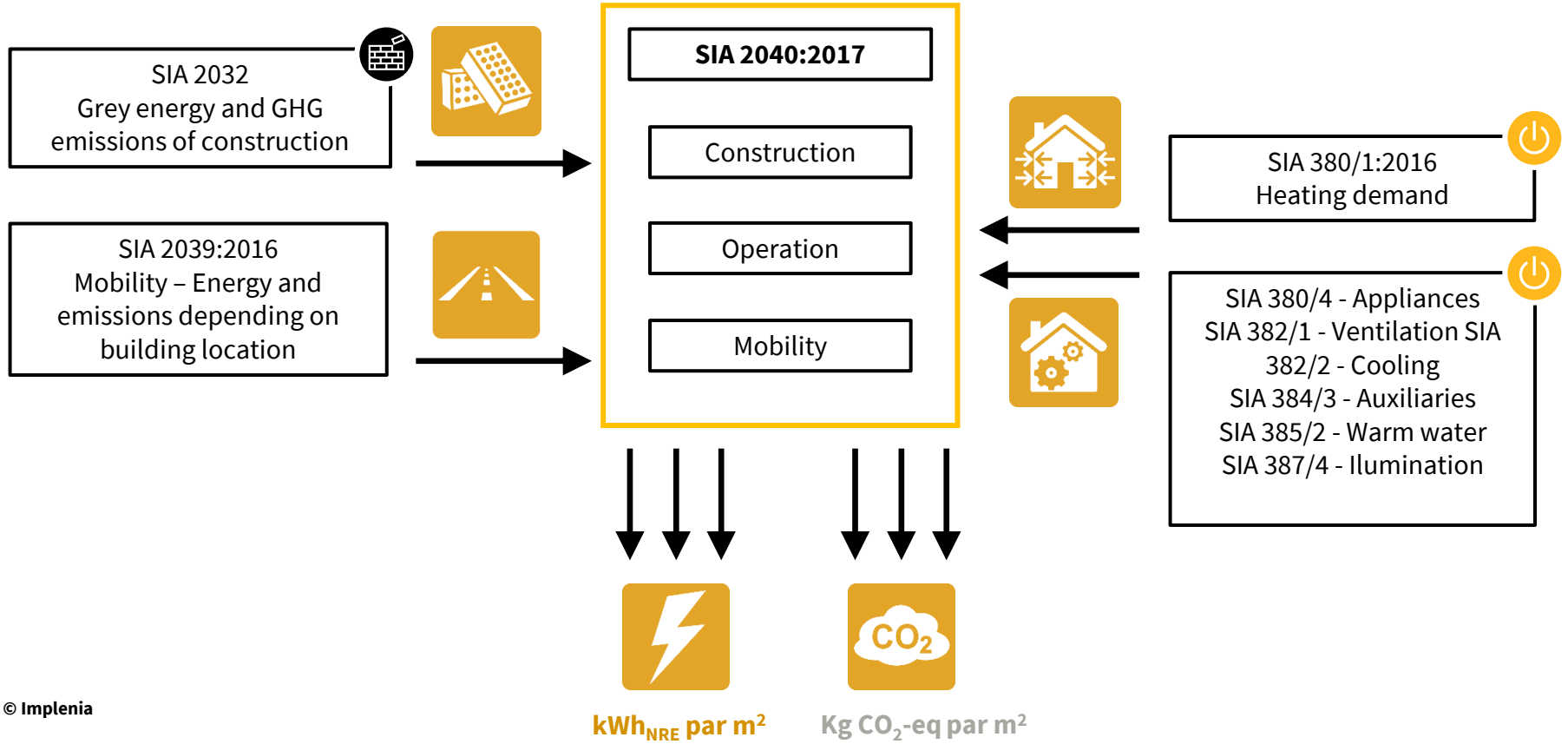
Panel of measures from the Green Village Sustainability Action Plan (tri-party agreement)

Zero carbon energy	Zero waste	Travel and transport	Materials and products	Sustainable water	Land and nature
Minimising the grey energy of construction choices (special work, spans, slabs, distribution, lightening, filling, etc.).	Limiting excavations and promoting open land (maximum target 1.2 m3 excavated per m2 built)	80% of TIM car parks pre-electrified (9 electromobility charging points planned for the driveway)	Low-carbon cement for reinforced building construction (Stockholm)	Rainwater recovery concept for storage and reuse for outdoor watering	Creation of 5 replacement environments to promote biodiversity, in coordination with an ecologist
Architectural charter Limited quantities of glass/aluminium in facades	Reuse of products from the in situ deconstruction inventory	easy access to indoor and outdoor cycle parking (including cargo bikes)	Use of natural, locally-sourced materials, timber framing for Lima	95% open-air rainwater management.	20% of the surface area of the plot reserved exclusively for biodiversity
Zero-carbon source of heat, cooling and hot water production by connecting groundwater to heat pumps	Good integration of 'eco-points' to facilitate use and logistics	Maximum 40% of users using motorised means of transport	Installation of Misapor to drain the land	Reducing the number of impervious road surfaces (surface planted parking, fire access in a mix of earth and stone)	Protecting birds on façades , Swift nest boxes dedicated space for an orchard
Low-intensity exterior lighting (biodiversity) with timer or detector.	Reuse of excavated materials to reshape the land	Facilities to facilitate urban logistics (automatic parcel dispenser, dedicated space for deliveries, removals)	Priority recycling of excavated material	70% of the neighbourhood perimeter is permeable	At least 45% of the plot to be planted in open ground

IMPLEMENTATION OF DECARBONIZATION STRATEGIES

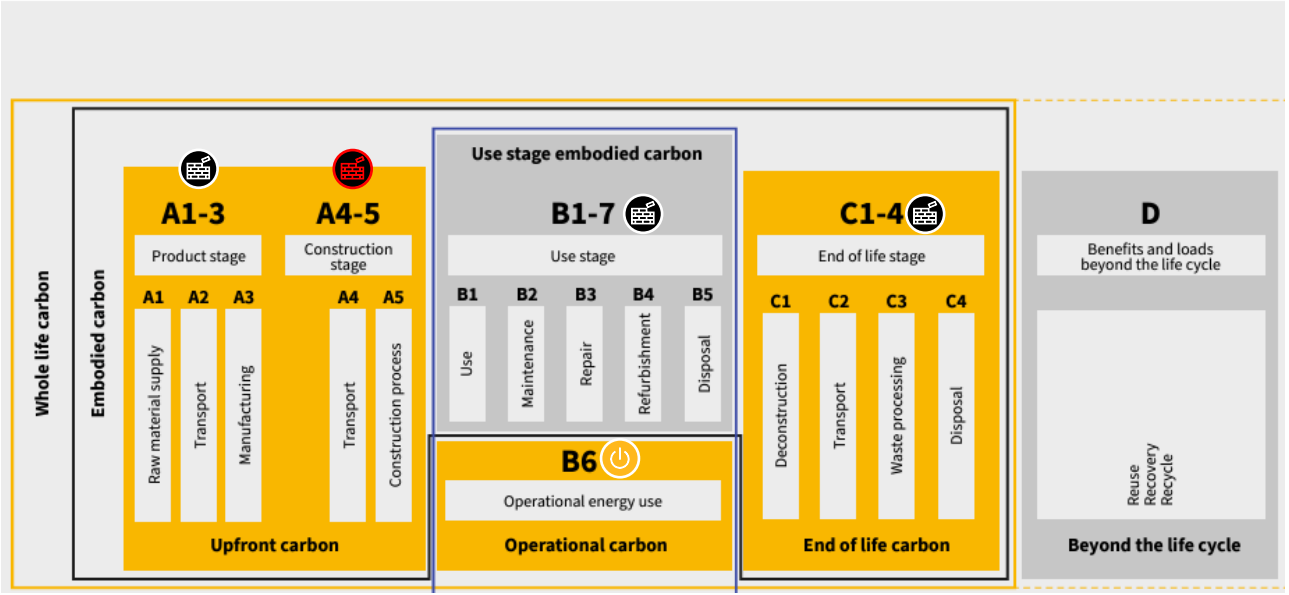
«The fact that CO_2 is transparent and odourless is the greatest tragedy for humankind. »
Sobek 2020

USING EXISTING NORMS TO EVALUATE FOOTPRINT : SIA 2040

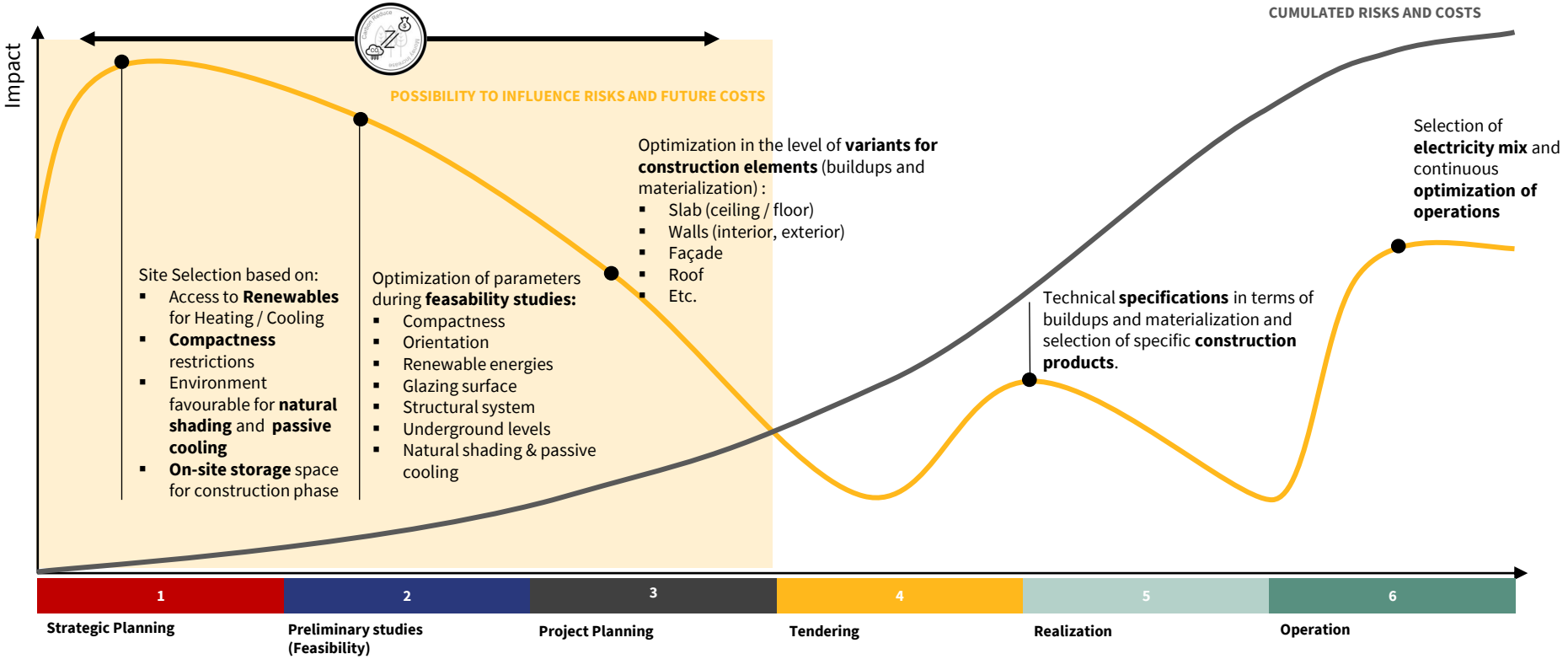


LIFE CYCLE PHASES OF A BUILDING

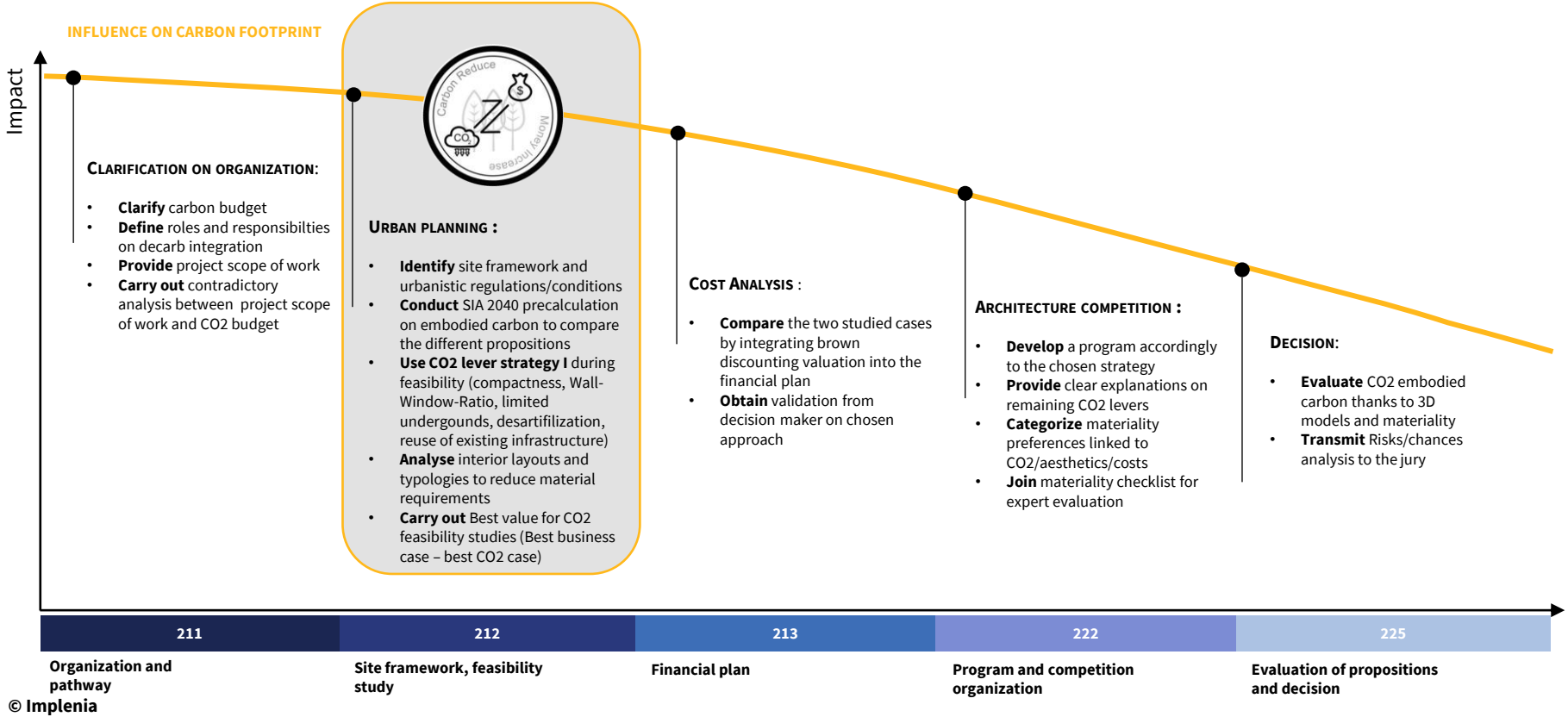
Decarbonising a building requires a perspective that considers the entire life cycle of that building. Starting with site selection, through the development and construction phase, to the operation and end-of-life of a building, all decisions and actions should be assessed for their overall impact. The European EN 15978 standard, to which this study refers, presents a framework for a building's life cycle phases that can be used when analysing its environmental performance in a Life Cycle Assessment (LCA) (Figure 4).



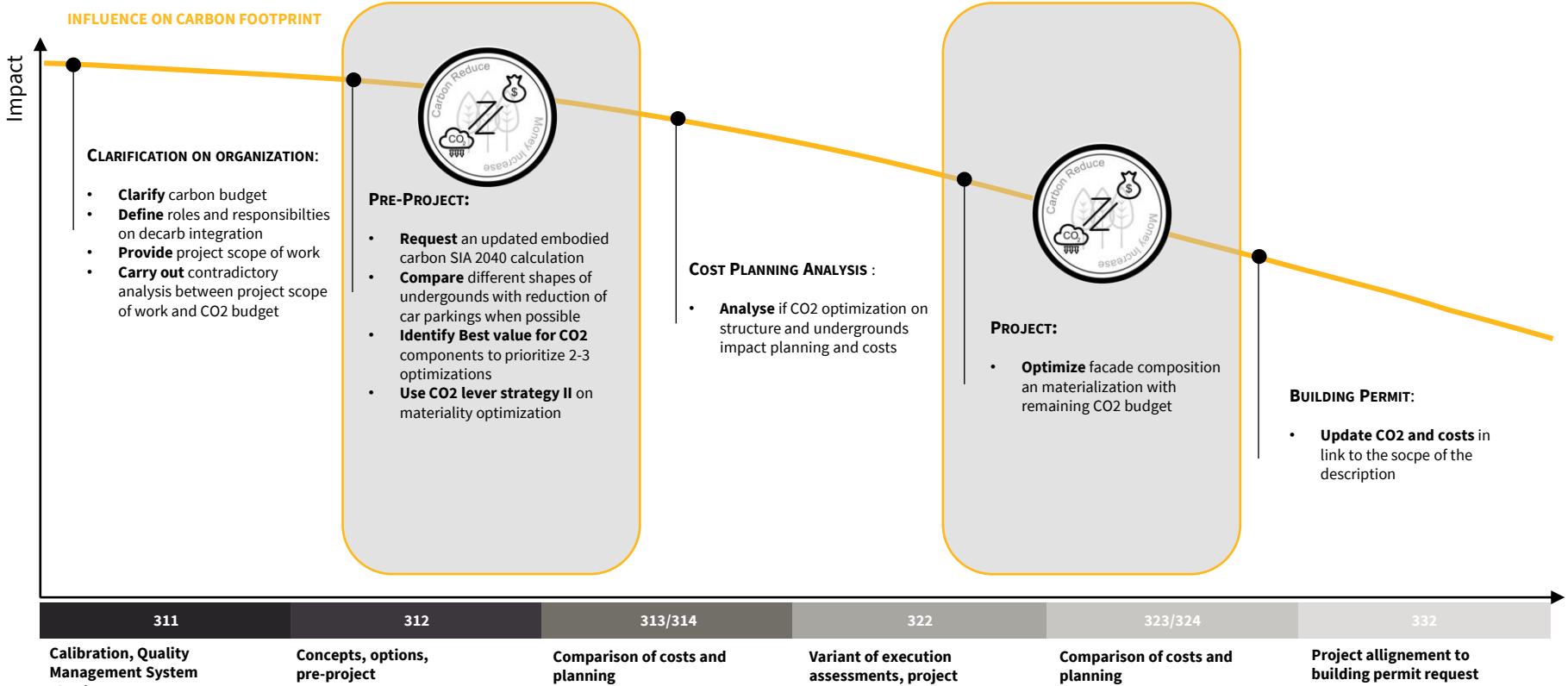
IMPACT CHRONOLOGY OF STRATEGIES AND LEVERS



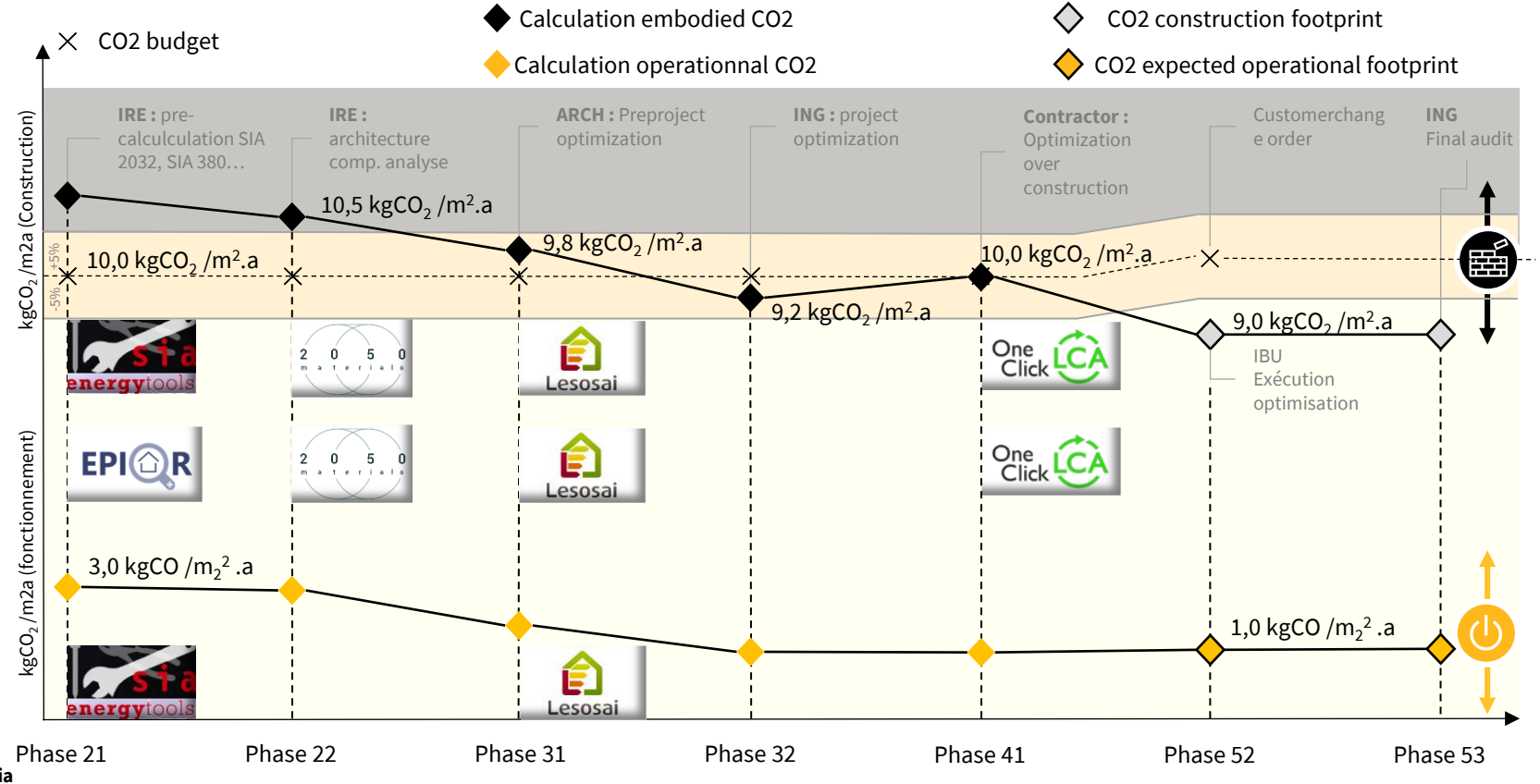
BEST VALUE FOR DECARBONIZATION



BEST VALUE FOR DECARBONIZATION



CARBON BUDGETS AND FOLLOW UP TOOLS



LEVERS AND STRATEGIES BY MEANS OF EMBODIED CARBON

EMBODIED CARBON

- Site selection
- **Underground floors and parking lots**
- **Building Compactness**
- **Wall Windows Ratio**
- Technical installations
- **Building materials/products**
- Storage space on construction sites*.

Urban planning (SIA 1/2)
Strategic feasibility (SIA 2/3)
Planning (SIA 2/3)
Realization (SIA 3/4)

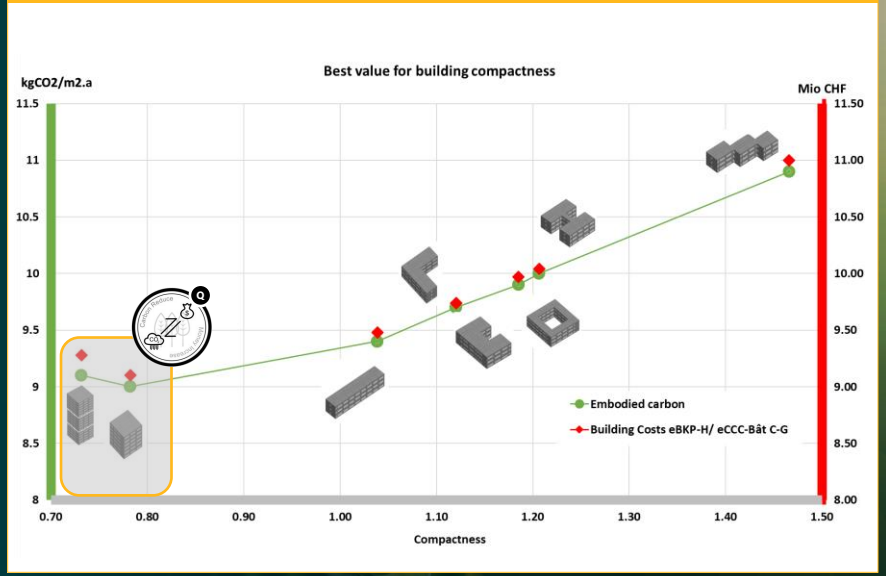
STRATEGY I
Optimization **Quantities**
in phase SIA 2 **(WIN-WIN)**

STRATEGY II
Optimization **Materiality**
in phase SIA 3

*For the reuse of excavated material and existing elements or materials.

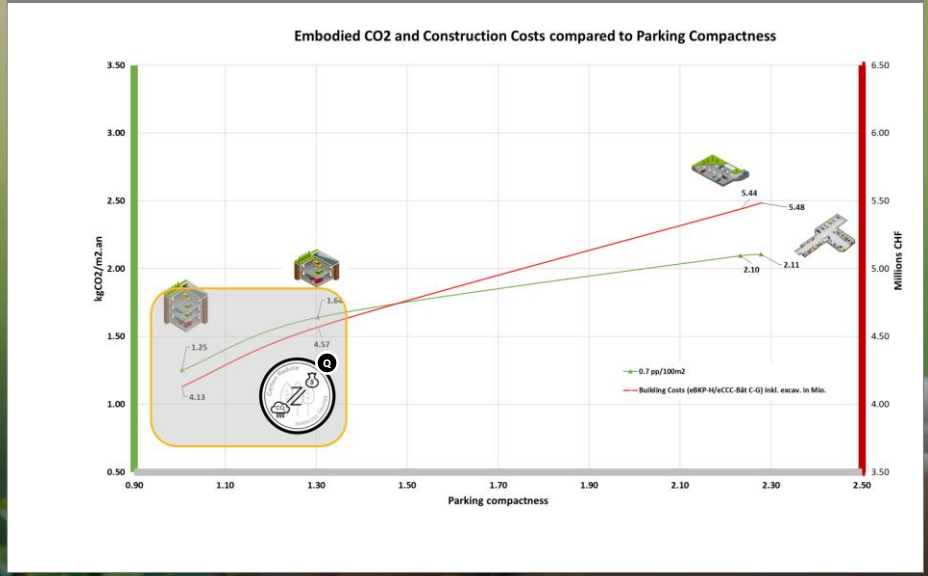
STRATEGY I : PARAMETRIC DESIGN

BUILDING GEOMETRY



- There is a **clear theorethical correlation** of CO2 and costs as a function of compactness, with an optimum around 0.8
- **In Praxis**, compactness is also studied in correlation to zoning plan
- **Take away**: KPI to include in dashboards to steer best value for CO2 efficiency of building geometry

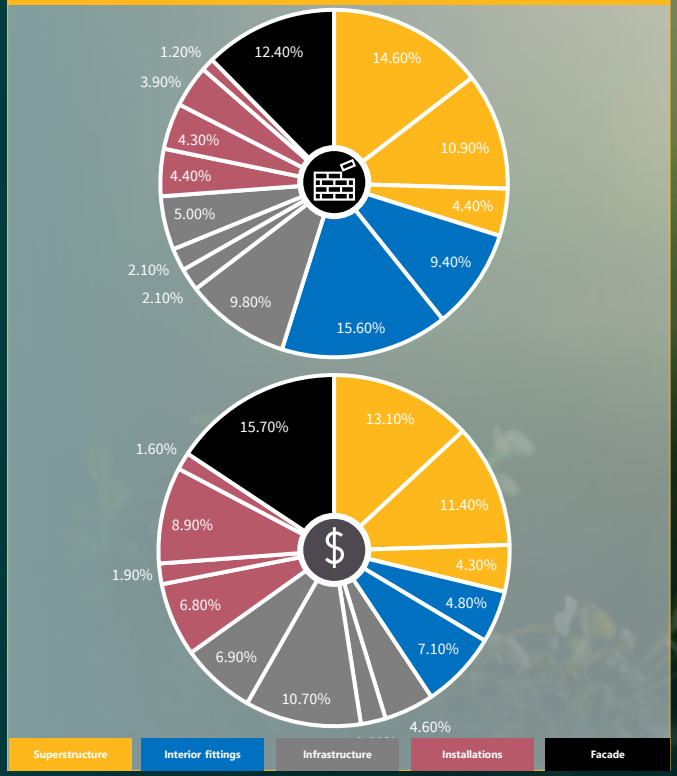
UNDERGROUND GEOMETRY



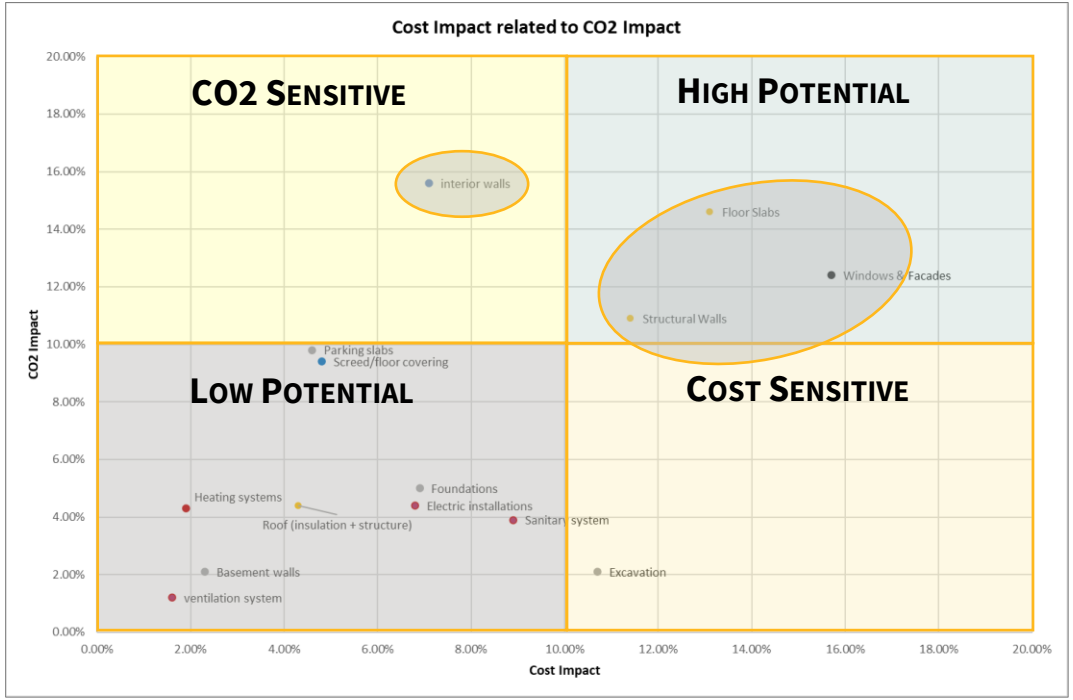
- **In theory,** underground compactness optimum is found below 1.3, above this factor there is no longer «win-win» as far as cost and CO2
- **In Praxis**, # levels, geometry design vs geotechnical, usage & accessibility
- **Take away:** KPI to use as a guidance to steer best value for CO2 efficiency of undergrounds

BEST VALUE FOR CO2 STRATEGIES – DEPENDENCY ANALYSIS

BREAKDOWN OF CO2 AND COSTS PER ELEMENT

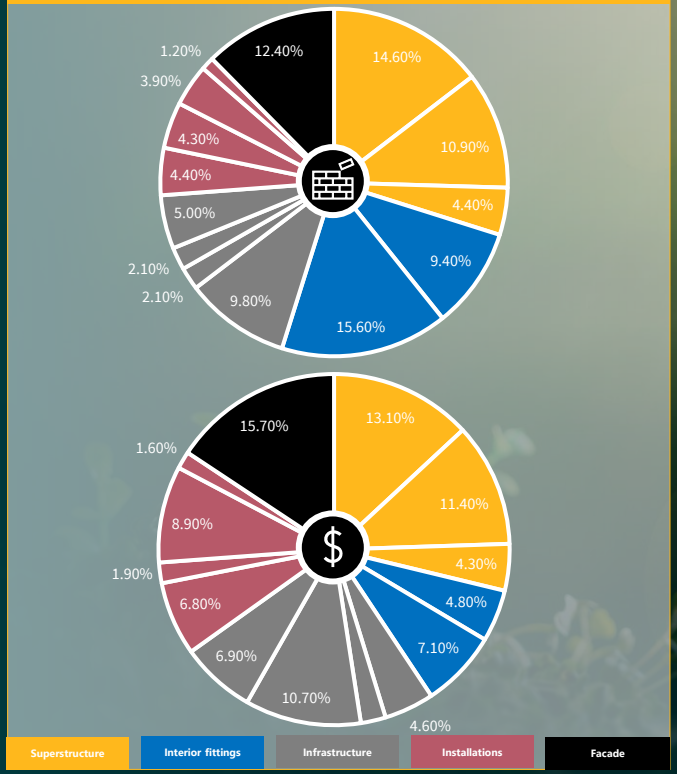


METHODOLOGY TO IDENTIFY FOCUS PRIORITIES

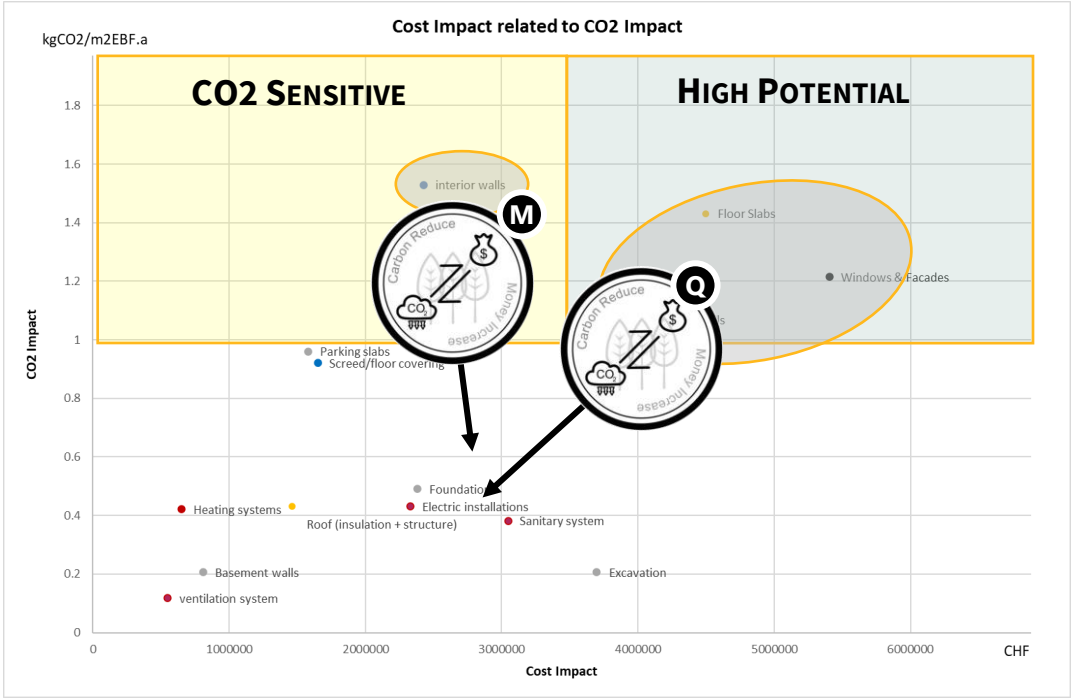


BEST VALUE FOR CO2 STRATEGIES – DEPENDENCY ANALYSIS

BREAKDOWN OF COSTS AND CO2 PER ELEMENT

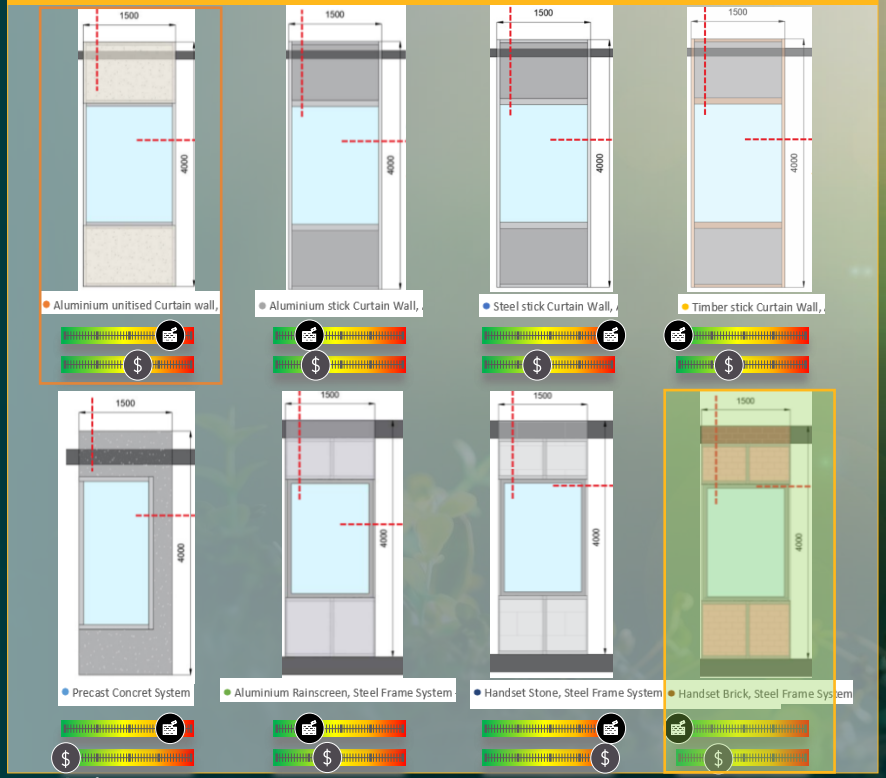


IDENTIFICATION OF APPLIED STRATEGIES

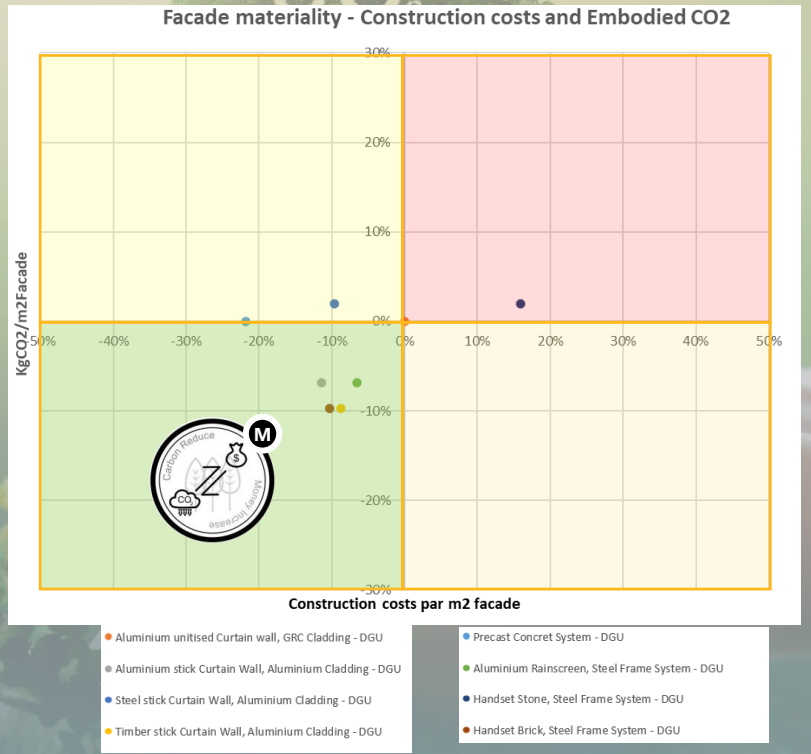


STRATEGY II : OPTIMIZATION BY COMPONENTS

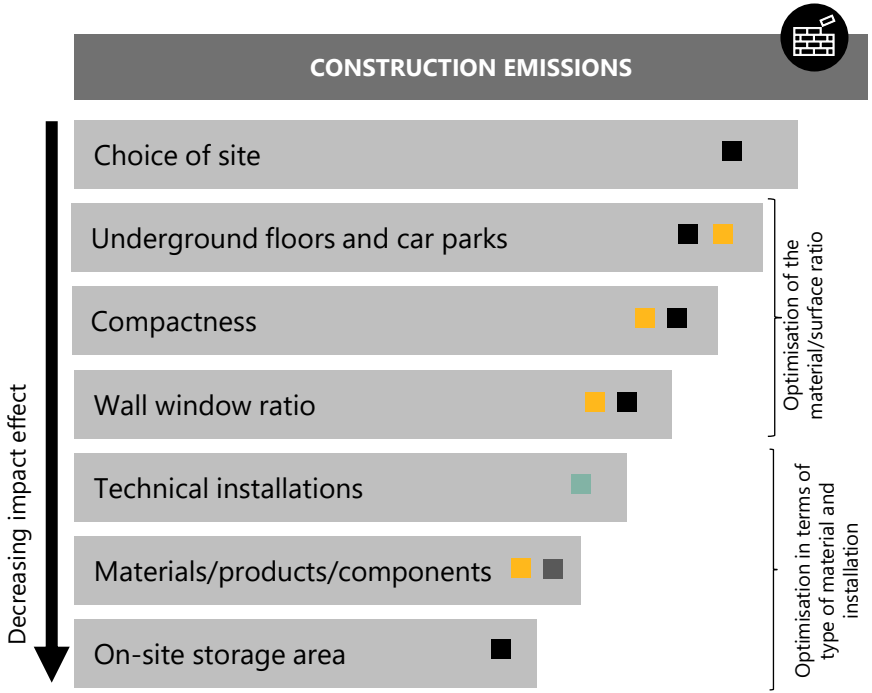
FACADE COMPOSITION



BEST VALUE FOR CO2 COMPARISON



OPTIMIZATION OF EMBODIED CARBON



SIA 2040 study, SIA 2 phase = **10.5 kgCO2/m2.year**

- → Limiting basements
- → Optimising the structure
- → Architecture optimisation
- → Simplification of technical distribution
- → Low-carbon materials

SIA 31 phase= **8.0*** **kgCO2/m2.year** without parking

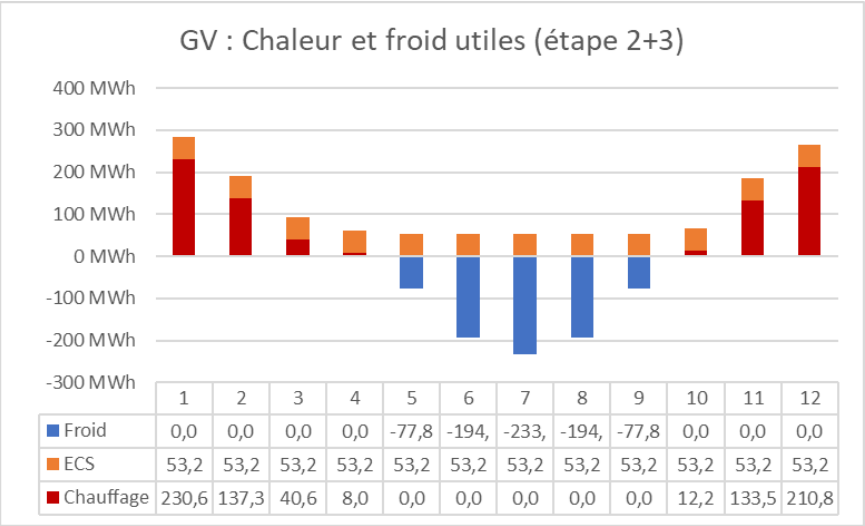
* CO2 impact of the 25 parking spaces allocated to the building not taken into account in the study

ZERO OPERATIONNAL CARBON PLANNING

HYPOTHESES THERMAL REQUIREMENTS

According to Concept Energétique Territorial - Green Village 2023

- Heat for **heating (773,000 kWh/year)**
  - Project values for buildings under construction
  - 70% Qhli of SIA 380/1 2016
  - 40% of heating can be interrupted for DHW production
- Heat for **DHW (638,000 kWh/year)**
  - Based on SIA 380/1 2016
  - Weinmann assessment for hotel building G (Rio)
- **Cooling (512,000 kWh/year)**
  - Administrative areas: in accordance with the STD for administrative building E (Kyoto)
  - Hotel building G (Rio), commercial, catering and assembly areas: CT 2024 2021



	1	2	3	4	5	6	7	8	9	10	11	12
Froid	0,0	0,0	0,0	0,0	-77,8	-194,	-233,	-194,	-77,8	0,0	0,0	0,0
ECS	53,2	53,2	53,2	53,2	53,2	53,2	53,2	53,2	53,2	53,2	53,2	53,2
Chauffage	230,6	137,3	40,6	8,0	0,0	0,0	0,0	0,0	0,0	12,2	133,5	210,8

Annex to the call for tenders . XLS file of monthly consumption data by building

STRATEGIES FOR LOW-CARBON THERMAL SUPPLY

Strategies validated by the OCEN following the coordination meeting on 08.12.2022

Strategy 1: groundwater and GeniLac network, direct for cooling and coupled with pumps for heat production, photovoltaic solar energy via Microgrid Group E

Strategy 2: connection to the GeniLac network, directly for cooling and coupled with heat pumps for heat production, photovoltaic solar energy via Microgrid Group E

Strategy 3: groundwater, direct for cooling and coupled with heat pumps for part of the heat production, GeniTerre for the rest of the production, photovoltaic solar power via Microgrid Group E

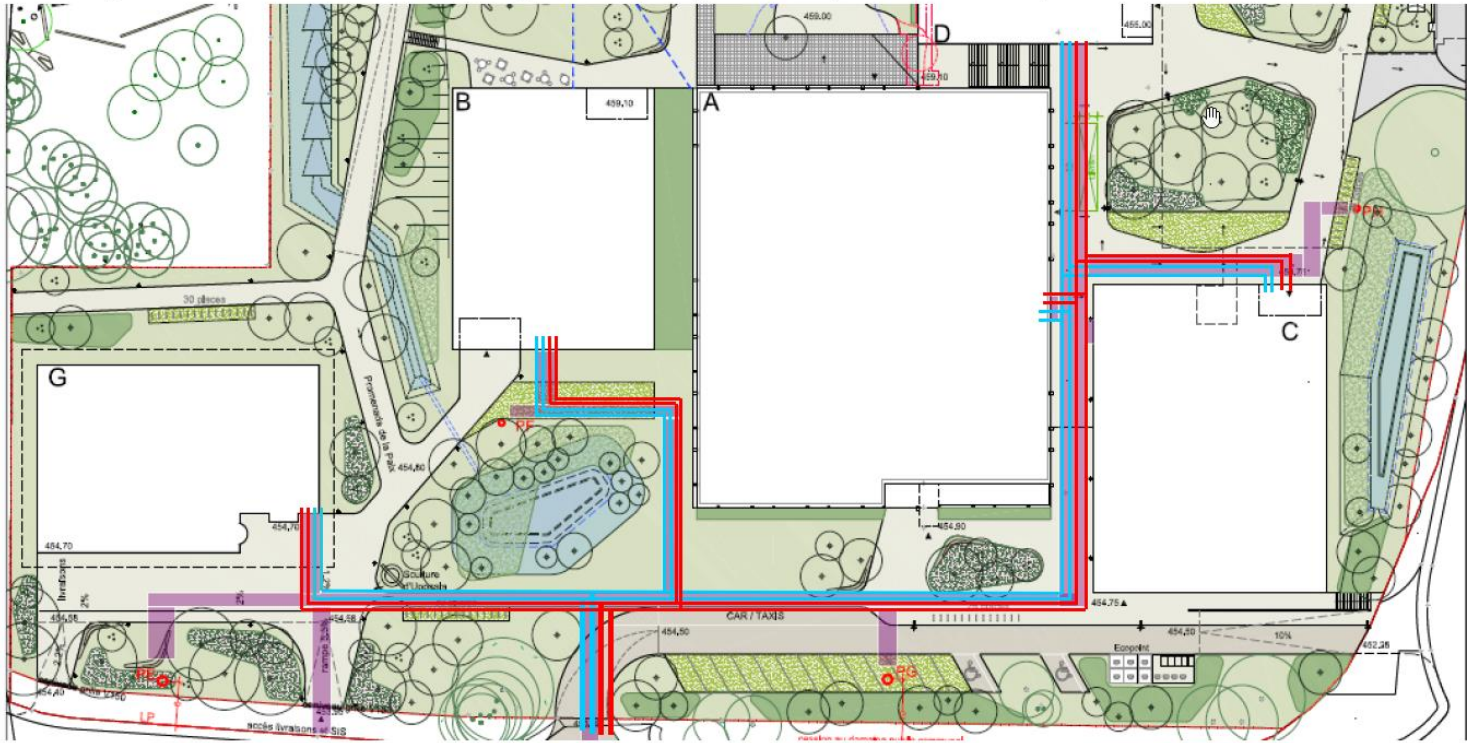
NB1: All strategies must meet the legal requirements and the increased requirements of the client (100% renewable thermal supply).
NB2: The developer would like decentralised production to take place in the technical basements of each building. There are no plans for additional buildings or shared areas in the car parks or on the roof for the thermal contractor.

RESPONSES FROM THERMAL OPERATORS MARCH 2023

SRE (41,469 m2)	Operator A			Operator B	Operator C	
Proposed variant Appro	V1	V2	V3	Did not wish to respond to variants 1 and 3, no contact with SIG on variant 2	XXXX	
					Decentralised	Centralised
Compliance with carbon and AO targets	Legal?	Legal?	Compliant	/	Compliant	Non-compliant
Presta. limits equivalent	Wells, connections, networks, heat pumps and electricity consumption, heat exchangers			/	Connections, networks to buildings, exchangers	Connection, networks to main power station, exchangers
Annual heating costs (CHF/m^2) quotation dated 06.03.23	14,3	21,1	13,9	/	22,4	19,1
Additional services included	**DHW charging and storage, distribution group**			/	/	/
Delta proprietary investment	/			/	+ 700 kCHF	+ 1,000 kCHF
Annual heating costs (CHF/m^2) offer dated 16.03.23	16,1	22,6	15,5	/	22,4	19,1

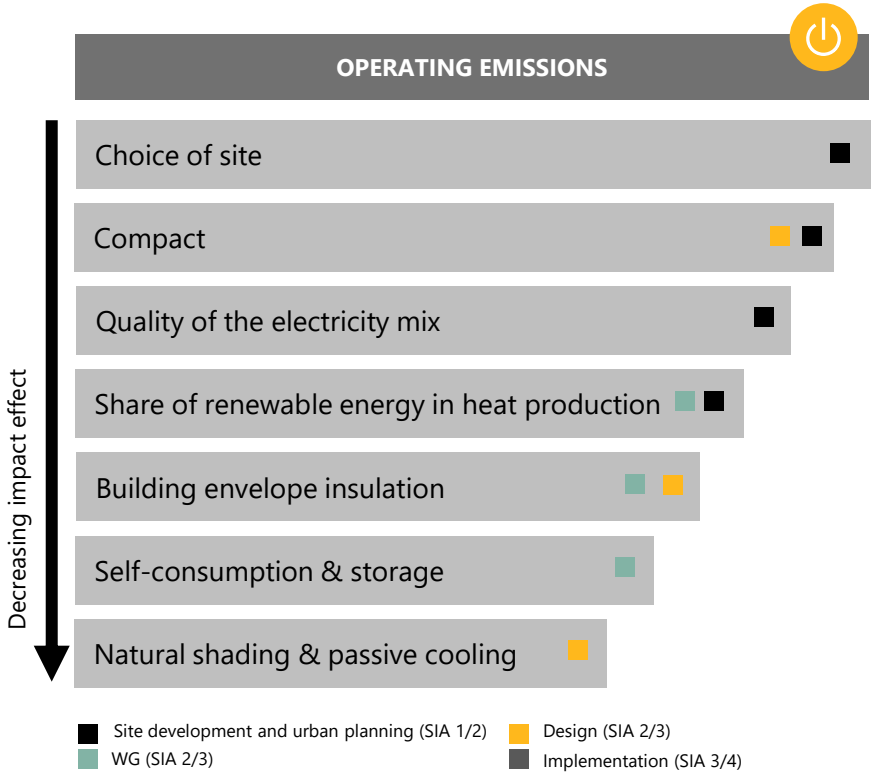
ZERO CARBON THERMAL ENERGY SUPPLY

Vue en plan des réseaux thermiques sur la parcelle



Introduction commune GeniTerre et GeniLac, sous conditions de faisabilité

OPTIMIZING THE CARBON EMITTED BY OPERATIONS



Study SIA 2040 phase SIA 2 = **3.3 kgCO2/m² .an**

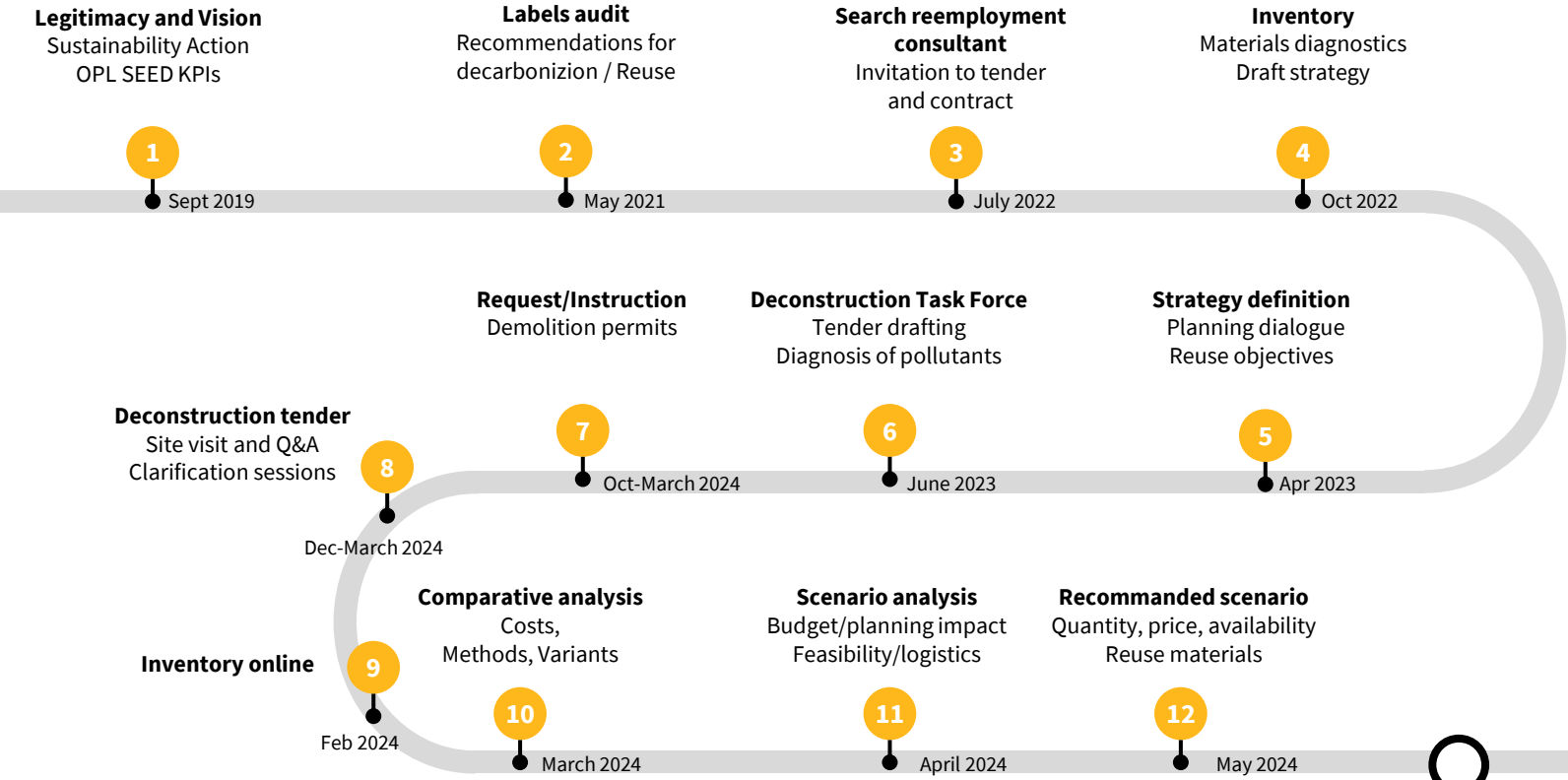
- → Access to major networks + groundwater on private property
- → Envelope factor = 0.78
- → 100% Naturemade star Neighbourhood microgrid contract
- → 100% groundwater Heating / Cooling / DHW
- → THPE 2'000 Watts
- → 30% self-generation of photovoltaic energy

SIA 31 phase = **0.4 kgCO2/m² .an** in 100% Naturemade Star

DECONSTRUCTION PLANNING

CIRCULAR STRATEGIES

IMPLEMENTATION PATHWAY



INVENTORY PHASE – DIAGNOSIS OF EXISTING ELEMENTS

Green Village Geneva

Implenia Suisse SA
M. Rastello, M. Klein
Chemin de l'Echo 1
1213 Onex

Propriétaire : **Centre œcuménique des églises (COE)**

Bâtiment : **Ailes du bâtiment A**
Route de Ferney 150, Grand-Saconnex
N° cadastral : Bât. 395 sur parcelles 2448-2449-2450-2451-2455

Inventaire de réemploi/réutilisation : Diagnostic et stratégie

Responsable : Jenny Rey

Route de Renens 4
CH-1008 Prilly
00 41 21 624 64 94

Rue des Cèdres 12
CH-1203 Genève
00 41 22 345 13 30

www.lebird.ch

Éléments de planning (intentionnels) :

Diagnostic polluants : printemps 2023
Dépôt autorisation de démolition ailes : mai 2023
Travaux de démolition des ailes : mi-2024
Possibilité de stockage sur site (à confirmer) : 2024-2025
Travaux rénovation bâtiment A : 2025-2026
Travaux de construction bâtiment B et D : fin 2024 - 2026
Aménagements extérieurs : 2025-2026

le Bird
Bureau d'ingénieurs en ressources & construction durable

Identification du rapport :
Diagnostic_reemploi_GV_batA_vf_20230306
Version finale pour diffusion
Nombre de pages : 59
Date d'émission du rapport :
6 mars 2023

2. Liste des éléments réutilisables

Le réemploi ou la réutilisation de matériaux de construction permet l'économie de matériaux neufs et évite des frais d'élimination (transport et traitement des déchets). Dans le cadre de la solution C-BAT, ces avantages sont mis en évidence par le calcul d'un poids équivalent CO_2 par unité de matériaux selon méthode de calcul de la base de données INIES. Pour les coûts d'élimination, les coûts sont calculés selon prix moyen au m^3 de transport et traitement des déchets évacués via les déchèteries de chantier gérées par Bird en 2021-2022.

N°	Description	eCCBat	Matériau (eco21, INIES)	Unité f.	Quantité	kg CO2 eq. /	Total kg CO2 eq.	m3 non foisonné	Coûts d'élimination estimés (T+T)*
LBD-2209-0001	Murs en béton armé (abris, pignons)	C.02	Voiles en béton armé (ép. 20-40cm)	par m2	2800	1.09E+02	3.05E+05	840	63000
LBD-2209-0002	Dalles en béton pleine (abris, Salève, radiers)	C.04	Béton plein armé pour dalle (ép. 30-40cm)	par m2	5800	2.36E+01	1.37E+05	2030	152250
LBD-2209-0003	Dalles à caisson (Jura, Rhône, Lac)	C.04	Béton plein armé pour dalle (ép. 35cm dont 12 plein)	par m2	8000	7.26E+01	5.81E+05	1600	120000
LBD-2209-0004	Panneaux de façade métallique	E.02	Bardage en acier	par m2	700	4.29E+01	3.00E+04	14	0
LBD-2209-0005	Panneaux de façade métallique	E.02	Bardage en acier	par m2	255	4.29E+01	1.09E+04	5	0
LBD-2209-0006	Panneaux de façade métallique	E.02	Bardage en acier	par m2	100	4.29E+01	4.29E+03	5	0
LBD-2209-0007	Eléments de façade en béton préfabriqué	E.03	Bardage en béton	par m2	236	2.05E+02	4.84E+04	20	2000
LBD-2209-0008	Eléments de façade en béton préfabriqué	E.04	Bardage en béton	par m2	90	2.05E+02	1.85E+04	8	800
LBD-2209-0009	Escalier de secours en béton	I.05	Escalier droit en béton armé	par ml	50	7.71E+02	3.86E+04	18	2700
LBD-2209-0010	Escalier de secours , structure métallique	I.05	Escalier droit en acier	par ml	50	7.62E+02	3.81E+04	6	0
LBD-2209-0011	Porte de garage	E.03	Porte de garage en acier motorisé	par m2	16	3.60E+02	5.76E+03	2	120
LBD-2209-0012	Divers portes coupe-feu EI30	G.01	Porte acier	par m2	35	1.16E+02	4.06E+03	2	120
LBD-2209-0013	Portes abris anti-atomiques	G.01	Porte blindée béton acier	par m2	25	1.09E+02	2.73E+03	4	400
LBD-2209-0014	Portes métalliques simples	G.01	Porte acier	par m2	3	1.16E+02	3.48E+02	1	60
LBD-2209-0015	Portes EI30	G.01	Porte en bois	par m2	20	9.84E+01	1.97E+03	1	60

N°	Description	eCCBat	Matériau (eco21, INIES)	Unité f.	Quantité	kg CO2 eq.	Total kg CO2 eq.	m3 non foisonné	Coûts d'élimination estimés (T+T)*
LBD-2209-0016	Portes en bois	G.01	Porte en bois	par m2	1000	9.84E+01	9.84E+04	50	3000
LBD-2209-0017	Portes en bois	G.01	Porte en bois (aggloméré)	par m2	250	9.84E+01	2.46E+04	13	780
LBD-2209-0018	Portes vitrées EI30	G.01	Portes vitrées isolantes acier	par m2	225	1.21E+02	2.72E+04	18	3600
LBD-2209-0019	Portes vitrées EI60	E.03	Portes vitrées isolantes acier	par m2	65	1.21E+02	7.87E+03	5	1000
LBD-2209-0020	Escalier en béton préfabriqué	G.05	Escalier droit en béton armé	par ml	100	7.71E+02	7.71E+04	22	2200
LBD-2209-0021	Escalier en béton préfabriqué	G.05	Escalier droit en béton armé	par ml	105	7.71E+02	8.10E+04	23	2300
LBD-2209-0022	Chemin de câbles métalliques	G.05	Chemin de câbles dalle acier	par ml	100	5.34E+01	5.34E+03	2	0
LBD-2209-0023	Faux-plafond métallique	G.04	Plafond suspendu en métal avec suspente métallique	par m2	2000	3.41E+01	6.82E+04	80	0
LBD-2209-0024	Faux-plafond perforé	G.04	Plafond suspendu en plaque de plâtre	par m2	400	1.47E+01	5.88E+03	12	2880
LBD-2209-0025	Parois vitrées	G.01	Cloison démontable en profilés aluminium à remplissage bloc-porte vitré	par m2	35	1.21E+02	4.24E+03	3	600
LBD-2209-0026	Luminaires	G.05	Plafonniers, suspension intérieur linéaire pour éclairage tertiaire ou industriel	par él.	30	1.19E+02	3.57E+03	1	60
LBD-2209-0027	Luminaires	G.05	Plafonniers, suspension intérieur linéaire pour éclairage tertiaire ou industriel	par él.	250	1.19E+02	2.98E+04	5	300
LBD-2209-0028	Luminaires	G.05	Plafonniers, suspension intérieur linéaire pour éclairage tertiaire ou industriel	par él.	1000	1.19E+02	1.19E+05	20	1200
LBD-2209-0029	Luminaires	G.05	Encastrés intérieurs non linéraires pour éclairage tertiaire	par él.	9	1.33E+02	1.20E+03	1	60
LBD-2209-0030	Luminaires	G.05	Encastrés intérieurs linéraires pour éclairage tertiaire	par él.	40	1.51E+02	6.04E+03	1	60
LBD-2209-0031	Signalétique protection incendie	G.05	BAES	par él.	200	5.97E+00	1.19E+03	1	60
LBD-2209-0032	Radiateurs	G.05	Radiateur à eau chaude statique	par él.	580	1.75E+02	1.02E+05	63	0
LBD-2209-0033	Sanitaires (WC+lavabos)	G.05	Céramique	par él.	98	6.11E+03	5.99E+04	7	1400
LBD-2209-0034	Sanitaires (WC+lavabos)	G.05	Céramique	par él.	26	4.47E+02	1.16E+04	2	600
LBD-2209-0035	Verrières motorisées	E.03	Verrière	par m2	12	6.14E+02	7.37E+03	1	200
LBD-2209-0036	Gravier	F.01	Gravier	par m3	110	3.05E+01	3.36E+03	110	11000

INITIAL INVENTORY – CATALOG OF ELEMENTS

LBD-2209-0001 Murs en béton armés (abris, porteurs)

Localisation	Abris anti-atomiques, murs porteurs (piliers non considérés)		
Etat d'usure	Evaluation à faire par spécialiste (carbonatation, RAG)		
Quantité	Env. 2'800 m2		
Catégorisation selon eCCbat	C.02		
Matériau	INIES : Voile en béton armé		
Dimensions	Epaisseur entre 20 et 40 cm (30 cm en moyenne).		
Poids (masse)	2'500kg/m³		
Accessibilité, démontabilité, modularité	Sciage ou concassage		
Réemploi/réutilisation	**In situ**	**Ex situ**	**Filières de traitement**
	OUI	OUI	17 01 01 Béton
Remarques/ compléments d'information :	Priorités de réemploi : 1) Réemploi comme éléments pleins (sciages - voir exemple en annexe 2) ; 2) Réemploi comme granulats dans des bétons classés/de structure ; 3) Réemploi comme granulats dans bétons maigres ou de propreté (limiter le décyclage).		

LBD-2209-0005 Panneaux de façade métallique (petites dimensions)

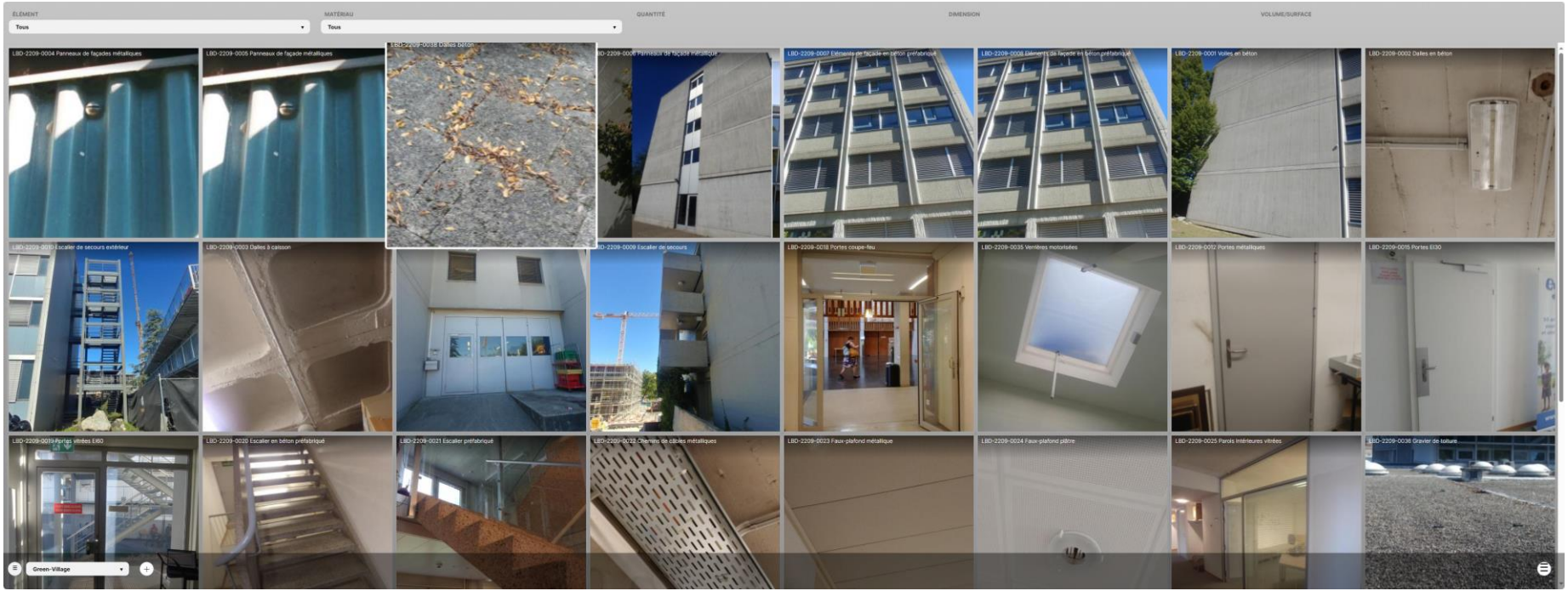
Localisation	Façade, ailes Jura, Lac, Rhône		
Etat d'usure	Usagé		
Quantité	255 éléments (env. 385m²)		
Catégorisation selon eCCbat	E.02		
Matériau	INIES : Bardage en acier		
Dimensions	L 110 cm P <1 cm H 135 cm		
Poids (masse)	Env. 6 kg		
Accessibilité, démontabilité, modularité	Vis apparentes		
Réemploi/réutilisation	**In situ**	**Ex situ**	**Filières de traitement**
	NON	OUI	17 04 05 Acier
Remarques/ compléments d'information :	A mettre sur le marché du réemploi, par exemple pour des constructions industrielles, constructions temporaires, aussi pour des particuliers.		

LBD-2209-0018 Portes vitrées EI 30

Localisation	Ensemble des ailes, tous les étages sauf sous-sols		
Etat d'usure	Bon état		
Quantité	30 éléments		
Catégorisation selon eCCbat	G.01		
Matériau	Porte vitrée isolante acier		
Dimensions	Environ L 300 cm P 8 cm H 250 cm		
Poids (masse)	300 kg		
Accessibilité, démontabilité, modularité	Pose ultérieure en rénovation, facilement déposable		
Réemploi/réutilisation	**In situ**	**Ex situ**	**Filières de traitement**
	OUI	OUI	Séparation verre, aluminium
Remarques/ compléments d'information :	Voir exigences AEAI : Même fonction dans la partie du bâtiment à transformer ? Réutilisation dans d'autres bâtiments neufs ou à mettre en conformité ?		

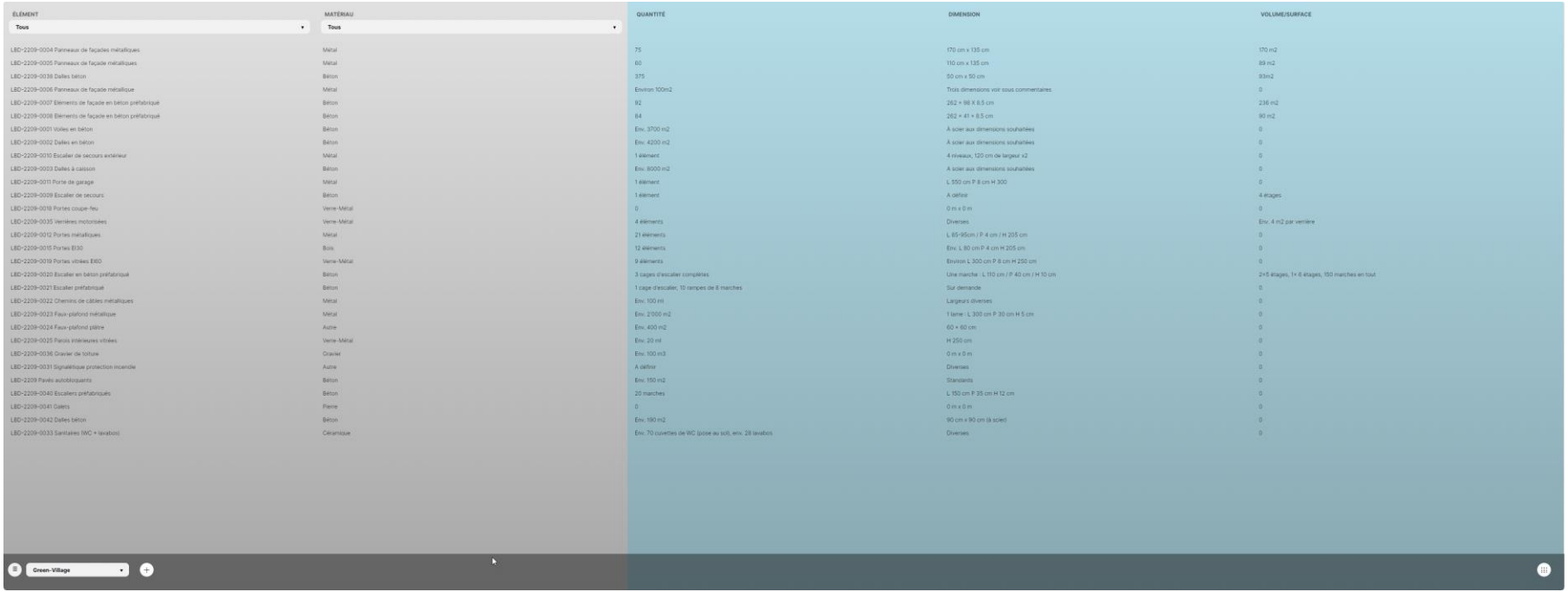
DIALOGUE WITH ARCHITECTS AND ENGINEERS

GREEN VILLAGE INVENTORY POSTED ON REUZI



Accès :	REUZI | Inventaire
Nom d'utilisateur :	INVENTAIRE REEMPOI GREEN-VILLAGE
Mot de passe :	GreenVillage

GREEN VILLAGE INVENTORY POSTED ON REUZI



Accès :	REUZI | Inventaire
Nom d'utilisateur :	INVENTAIRE REEMPOI GREEN-VILLAGE
Mot de passe :	GreenVillage

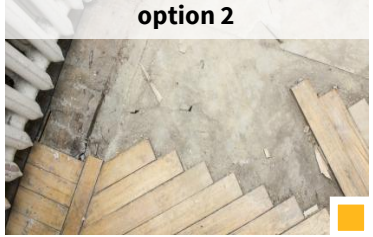
TENDERING WITH OPTIONS

Chapter CAN 117 demolition and dismantling is organised as follows:

option 1

Demolition
Demolition-evacuation-transport-landfill **Articles 117.** 124, 125, 215, 223, 228, 311, 333, 453, 461, 513, 631

option 2



Dismantling
Dismantling-transport-storage on site 117.223.001

option 3

Dismantling + demolition variant
Dismantling-transport-storage on site 117.225.001

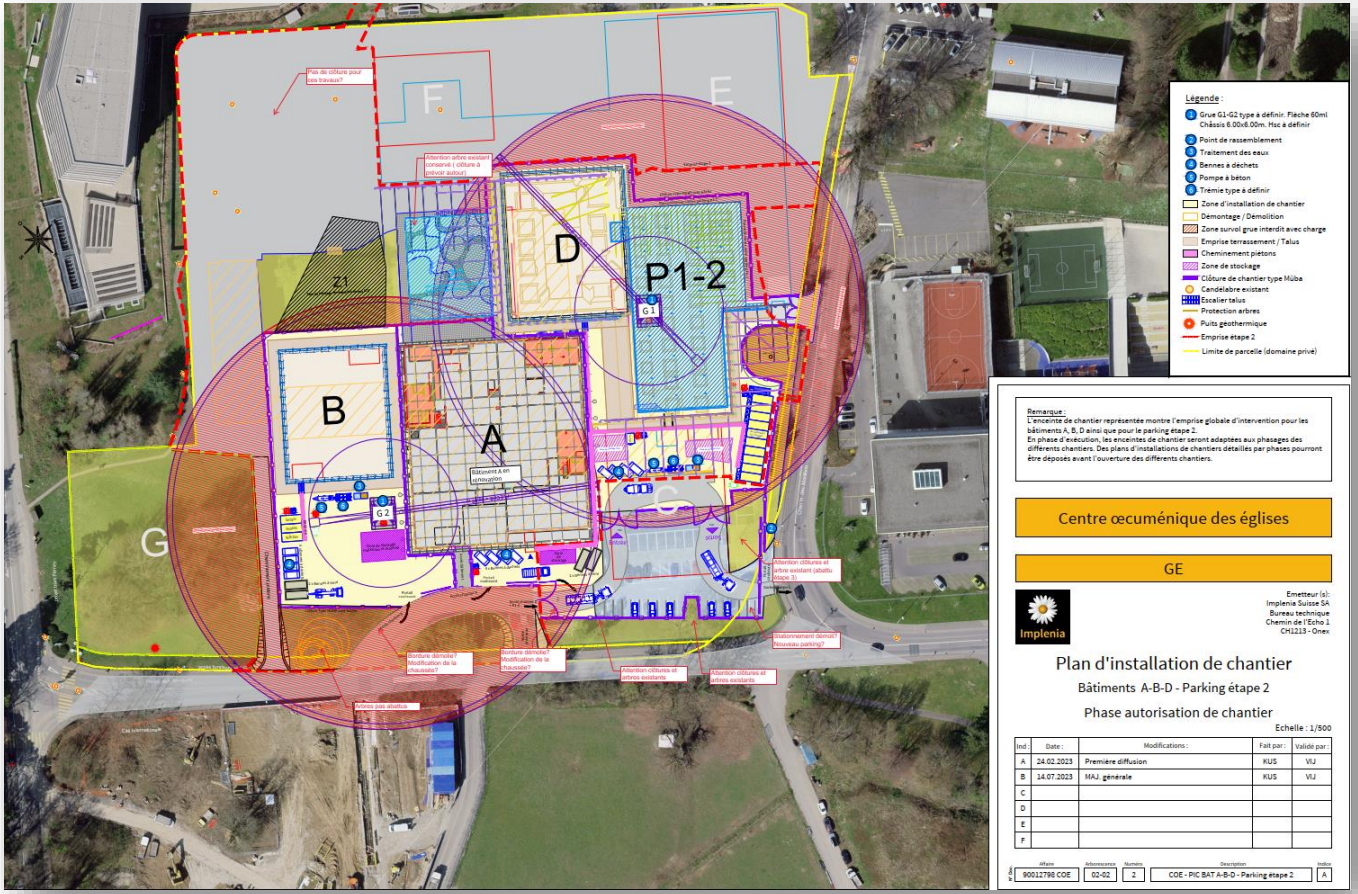
- **Non-added variant Demolition** cost 117(224.001) Disposal cost 117(725.001) Landfill cost 117(734.001)
- **Articles** 225 (224) - 322 (323) - 336 (335) - 342 (341) - 352 (351) - 412 (412.003) - 556 (555)

option 4

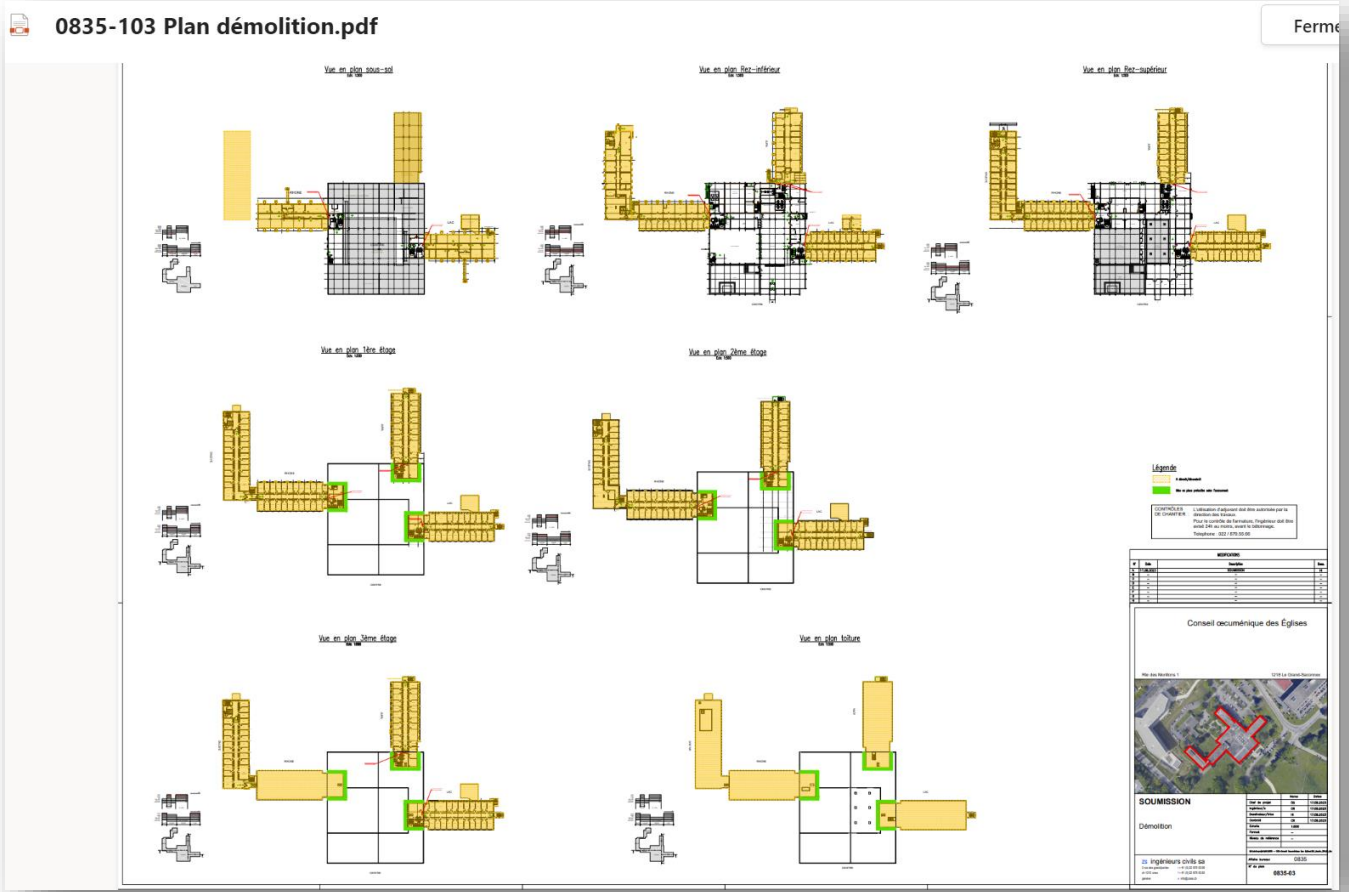
Demolition + dismantling variant
Single demolition 117.233.011

- Cost of **dismantling** services 117(234.001) Cost of removal 117(728.001) Cost of landfill 117(731.001)
- **Articles** 233 (234) - 411 (411.003) - 423 (424) - 445 (446) - 531 (532)

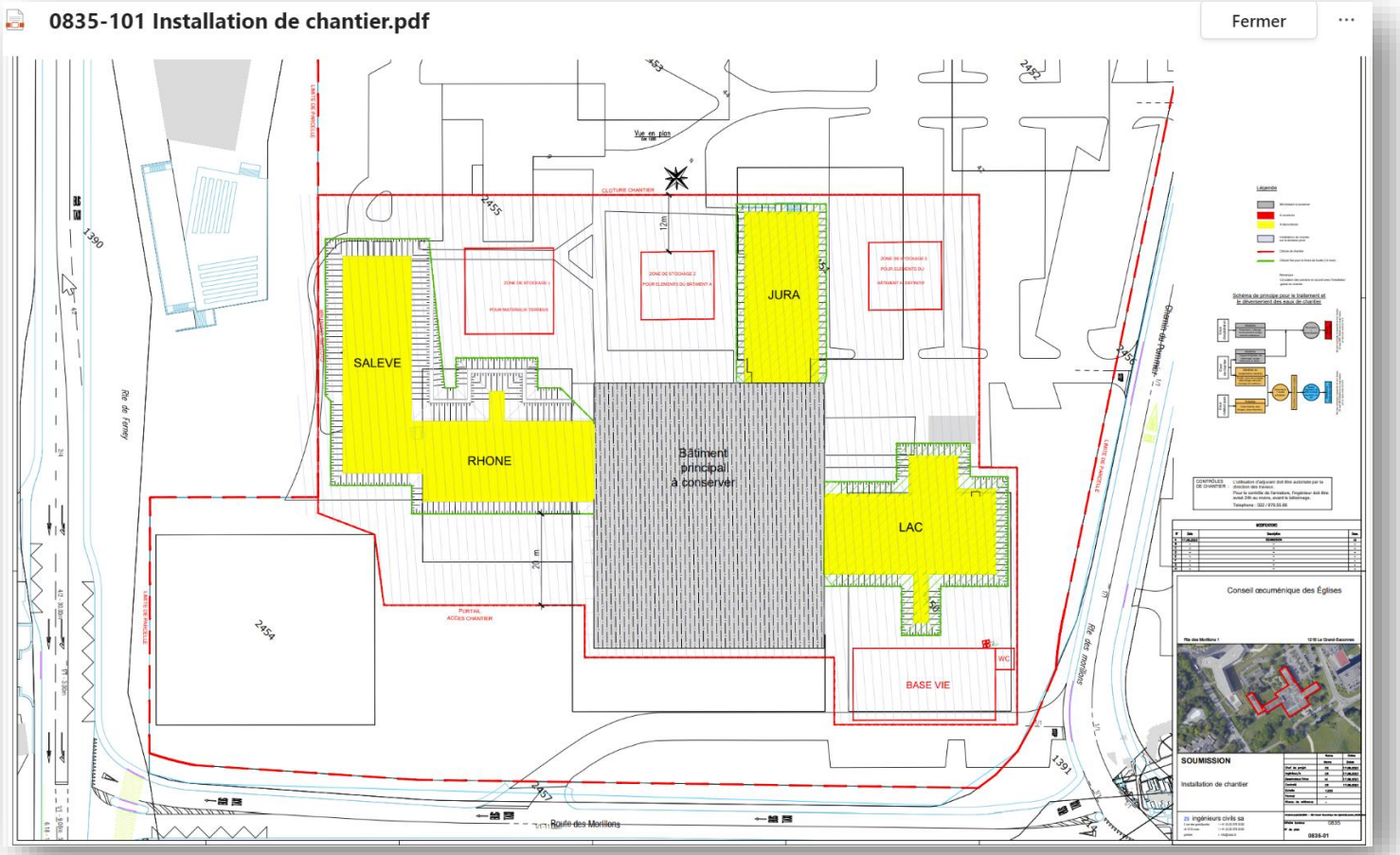
SITE INSTALLATION BY IMPLENIA BUILDINGS



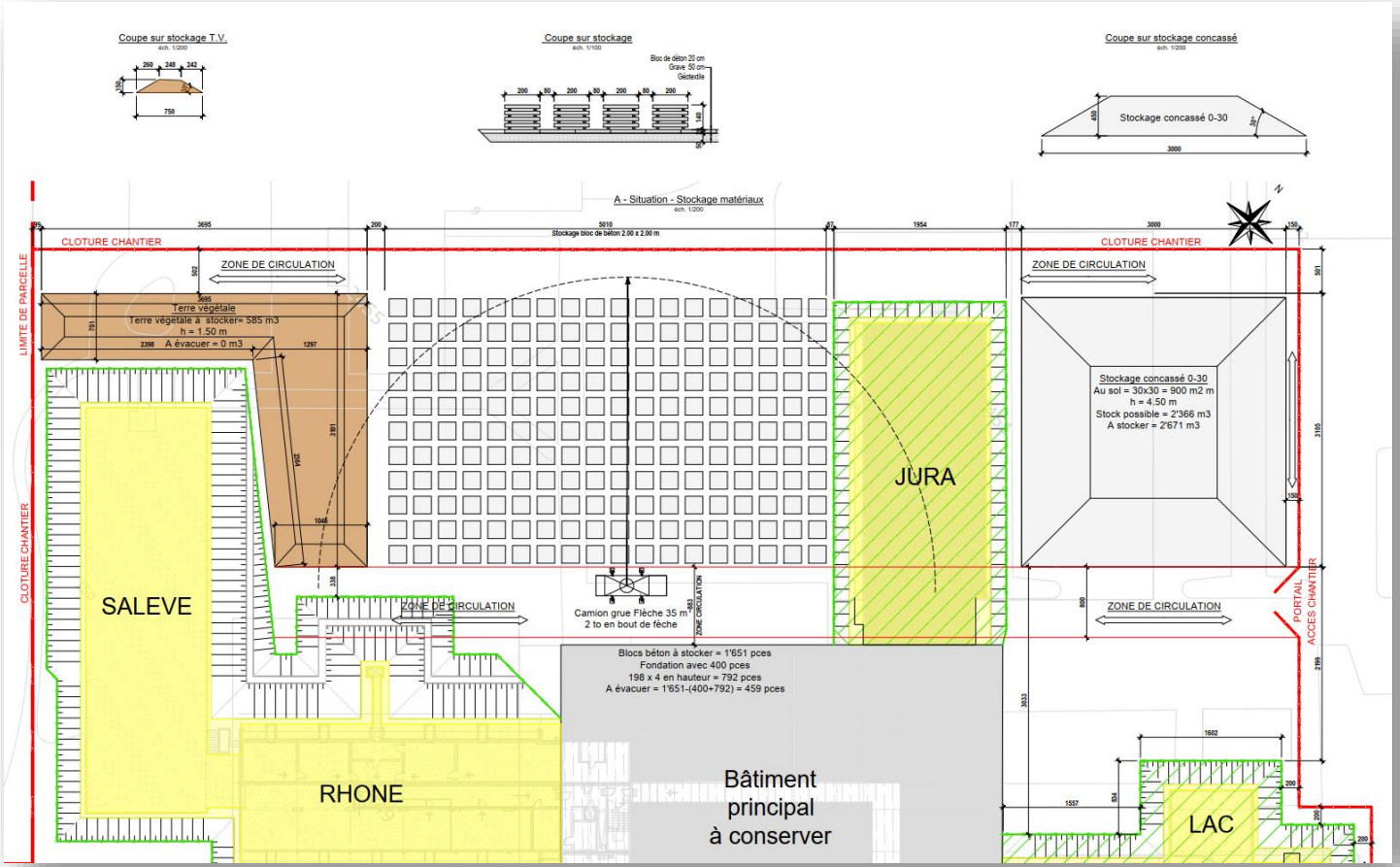
DISMANTLEMENT DRAWINGS – SEQUENCE OF WORKS



SITE INSTALLATION BY CIVIL ENGINEER



STORAGE AREA SUITABLE FOR REUSE - RECYCLING



SUPPLY AND DEMAND ANALYSIS

SUPPLY QUANTITIES

Aile Rhône

Surfaces m2	murs en BA ép:20cm	murs en BA ép:25cm	murs en BA ép: 40cm	Dalles pleines ép: 20cm	Dalles caissons (ép: 22cm)
sous-sol (hauteur d'étage 2.41m)		117	236		
rez-inf (hauteur d'étage 3.10m)	164			183	342
rez-sup (hauteur d'étage 2.60m)	52				525
2ème étage (hauteur d'étage 2.60m)	52				525
3ème étage (hauteur d'étage 2.60m)	52				525
toiture					525
Total. bât Rhône (m2)=	320	117	236	183	2'442

Aile Salève

Surfaces m2	murs en BA ép:20cm	murs en BA ép:25cm	murs en BA ép: 40cm	Dalles pleines ép: 20cm	Dalles caissons (ép: 22cm)
rez-inf (hauteur d'étage 3.10m)	474				
rez-sup (hauteur d'étage 2.60m)	187			705	
2ème étage (hauteur d'étage 2.60m)	198			705	
3ème étage (hauteur d'étage 2.60m)	198			705	
4ème étage (hauteur d'étage 2.60m)	213			705	
toiture				705	
Total. bât salève (m2)=	1'270	-	-	3'525	-

Aile Lac

Surfaces m2	murs en BA ép:20cm	murs en BA ép:25cm	murs en BA ép: 40cm	Dalles pleines ép: 20cm	Dalles caissons (ép: 22cm)
sous-sol (hauteur d'étage 2.41m)		199	231		
rez-inf (hauteur d'étage 3.10m)	113			183	368
rez-sup (hauteur d'étage 2.60m)	49				550
2ème étage (hauteur d'étage 2.60m)	49				550
3ème étage (hauteur d'étage 2.60m)	49				550
4ème étage (hauteur d'étage 2.60m)	49				550
toiture					550
Total. bât lac (m2)=	311	199	231	183	3'118

Aile Jura

Surfaces m2	murs en BA ép:20cm	murs en BA ép:25cm	murs en BA ép: 40cm	Dalles pleines ép: 20cm	Dalles caissons (ép: 22cm)
sous-sol (hauteur d'étage 1.10m)		95			
rez-inf (hauteur d'étage 3.10m)	166				600
rez-sup (hauteur d'étage 2.60m)	57				600
2ème étage (hauteur d'étage 2.60m)	57				600
3ème étage (hauteur d'étage 2.60m)	57				600
4ème étage (hauteur d'étage 2.60m)	57				600
toiture					600
Total. bât jura (m2)=	395	95	-	-	3'600

Syntèse	murs en BA ép:20cm	murs en BA ép:25cm	murs en BA ép: 40cm	Dalles pleines ép: 20cm	Dalles caissons (ép: 22cm)
Surface total (m2)	2'296	410	468	3'891	9'160

Hors démolition/démonta

TOTAL CAN

683 K

Démolition démontage

CAN 117

Mieux disant 2'162K

TOTAL surface d'éléments BA 16'225 m2

4'007 éléments

TOTAL gisement béton recyclé 8'596 Tonnes

COSTS PER SURFACE

117 119.001	Consignation des réseaux	1 up	1'299	1'299	
119.002	Dérialisation	1 up	1'856	1'856	
124.001	Spécification	1 up	10'023	10'023	
125.001	Spécification	1 up	6'091	6'091	
125.002	Spécification	50 up	95	4'740	
125.003	Spécification	1 up	4'254	4'254	
215.301	Spécification	80 m3	95	7'584	
223.123	Couche d mm 101-150	65 m	7	436	
223.213	Couche d mm 101-150	2200 m2	5	11'440	
224.111	1 rangée	36 m			
224.231	Sur lit sable/gravillon	175 m2			
224.301	Divers	200 up			
225.111	1 rangée	36 m	7	245	
225.231	Sur lit sable/gravillon	180 m2	10	1'867	
225.241	Spécification	400 up	10	3'920	
225.242	Spécification	175 up	10	1'715	
225.243	Spécification	200 up	10	1'960	
228.101	Spécification	3 p	192	577	
233.122	h m 1,21-2,00	24 m	12	293	
233.222	h m 1,01-1,50	28 m	9	246	
234.122	h m 1,21 2,00	24 m			
234.222	h m 1,01-1,50	28 m			
234.501	Divers	5 up	65	325	
311.001	Spécification	470 up	22	10'434	
311.002	Spécification	26 up	29	751	
311.003	Spécification	395 up	24	9'401	
311.004	Spécification	2105 up	21	43'153	
322.001	Déconstruction murs BA	450 up	45	20'160	
322.002	Déconstruction murs BA h=2.60	1902 up	45	85'210	
322.003	Déconstruction murs BA h=3.10	919 up	45	41'171	
322.004	Déconstruction murs BA ép.40cm	668 up	49	27'342	
322.005	Déconstruction	7268 up		0	
322.006	Déconstruction	1858 up		0	
323.113	Démolition murs BA h=2.60	1902 m2		0	
323.118	Démolition murs BA h=3.10	919 m2		0	
323.117	Démolition murs BA ép.40cm	668 m2		0	
323.212	Démolition murs Maçonnerie	7268 m2	17	119'922	
323.216	Démolition murs Maçonnerie	1858 m2	20	36'788	
333.112	Démolition piliers	629 p	57	35'979	
335.121	Démolition escalier BA	9.5 m3		0	
335.122	Démolition escalier BA	8.5 m3		0	
335.123	Démolition escalier BA	28 m3		0	
335.201	Démolition escalier acier	4.7 t		0	
336.121	Déconstruction escalier BA	9.5 m3	36	338	
336.122	Déconstruction escalier BA	8.5 m3	36	303	
336.123	Déconstruction escalier BA	28 m3	36	997	
336.201	Déconstruction escalier acier	4.7 t	1'809	8'504	
341.001	Démolition dalle BA	6255 up		0	
341.002	Démolition dalle BA	395 up		0	
341.003	Démolition dalle BA	2820 up		0	
342.001	Déconstruction dalles BA	6255 up	42	259'583	
342.002	Déconstruction dalles BA	625 up	38	23'813	
342.003	Déconstruction dalles BA	2820 up	38	107'442	
351.001	Démolition dalle BA	1675 up		0	
351.002	Démolition dalle BA	825 up		0	
352.001	Déconstruction dalles BA	1675 up	38	63'818	
352.002	Déconstruction dalles BA	825 up	38	31'433	
411.001	Enveloppe bâtiment	360 up	13	4'824	
411.002	Enveloppe bâtiment	2100 up	17	35'280	
411.003	Démolition enveloppe façade	400 up		0	
412.001	Spécification	360 up		0	
412.002	Spécification	2100 up		0	
412.003	Spécification	400 up	44	17'560	
423.101	Spécification	4544 up	20	92'698	
424.101	Spécification	4544 up		0	
445.101	Spécification	4544 up	8	36'806	

STORAGE & STRATEGY

Scénario	Ailes	Résultat
		Total Net HT Sous-Traitan
Déconstruction	Jura	Déconstruction Jura
Déconstruction	Lac	Déconstruction Lac
Déconstruction	Salève	Déconstruction Salève
Déconstruction	Rhône	Déconstruction Rhône
Nombre de dalles à Ecouler		4007 Dalles de 4m2
Stockage Max à un Instant T		792 Dalles de 4m2

DEMAND

Windows for Ukraine

Green Village Needs 450 m2 AMEX

SOREVA Needs 500 to 800 m2 MEYRIN

DRIZE Needs 2'005 m2

Interest Implenia
- Bike rack
- Kitchen

HELP TO DECISION

Budget : xx Mio	Scenario I	Scenario II	Scenario III
DESCRIPTION	**Demolition + Evacuation** (Lake, Jura, Rhône, Salève) **Deconstruction** 450 m2 for reuse in situ	**Demolition + Crushing** (Rhône) **Demolition + Evacuation** (Lac, Jura, Salève) **Deconstruction** 450 m2 for reuse in situ	**Demolition Crushing** (Rhône) Salève **deconstruction** **Demolition Evacuation** (Lac, Jura, Salève)
TOTAL COSTS (BKP 1-6) BEST BIDDER AVERAGE COST (4 BIDS)	 xx CHF EXCL. TAX xx CHF EXCL. TAX	 xx CHF EXCL. TAX xx CHF EXCL. TAX	 xx CHF EXCL. TAX xx CHF EXCL. TAX
PLANNING	6 months - 25 weeks	7 months - 30 weeks	8 ½ months - 36 weeks
BENEFITS	Budget and planning under control Low storage impact on stage 2 GV	Allignment to (authorities) demand : concrete recycling in GV	Increased visibility, demonstrator
RISKS	Missallignment to (authorities) demand : concrete recycling in GV	Management of the insitu crushing process	1st experience, reuse costs, planning
PREREQUISITES	N/A	Storage area (350 m2) for recycled aggregates	Recycled storage (350 m2) Reuse storage (1750 m2)
CRUSHING REVENUES	N/A	CHF 47,825 EXCL.	CHF 47,825 EXCL.
RE-EMPLOYMENT INCOME	N/A	N/A	CHF 71,940 EXCL. (1199 Slabs (4m2) at 15 CHF

SUSTAINABLE ENGINEERING IN THE INDUSTRY – GUEST LECTURE – IMPLENIA REAL ESTATE

WATER SYSTEMS

WATER CYCLES

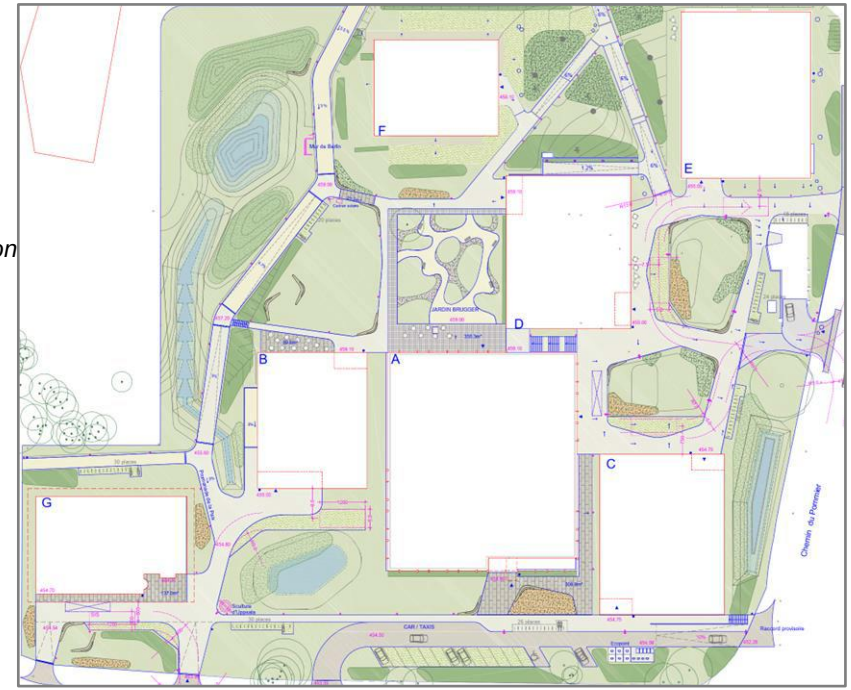
Implenia commissioned an engineer to carry out a study the hydraulic **potential of rainwater reclamation for watering** according to the established rainwater management concept
⇔ vision of reducing the need for drinking water

Objectives:

- *assess the potential for rainwater harvesting without compromising the concept initial integrated water management system favourable to biodiversity and irrigation of the soil;*
- *calculation of possible autonomy rates for watering*
- *proposed layout and water storage volume*

Study carried out on the basis of **hydrodynamic modelling** of the historical rainfall (last 30 years), taking into account the network the infiltration and evapotranspiration of water from the site. according to the configuration of the landscape project

Autonomous watering rates calculated on the basis of **water requirements for watering** supplied by landscapers depending on number and species planned planting



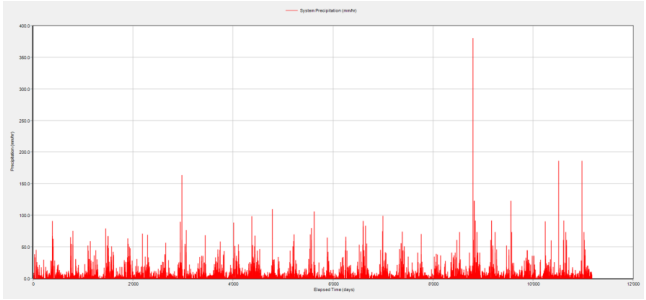
Landscaping plan, ADR architects, version of 21.03.2023

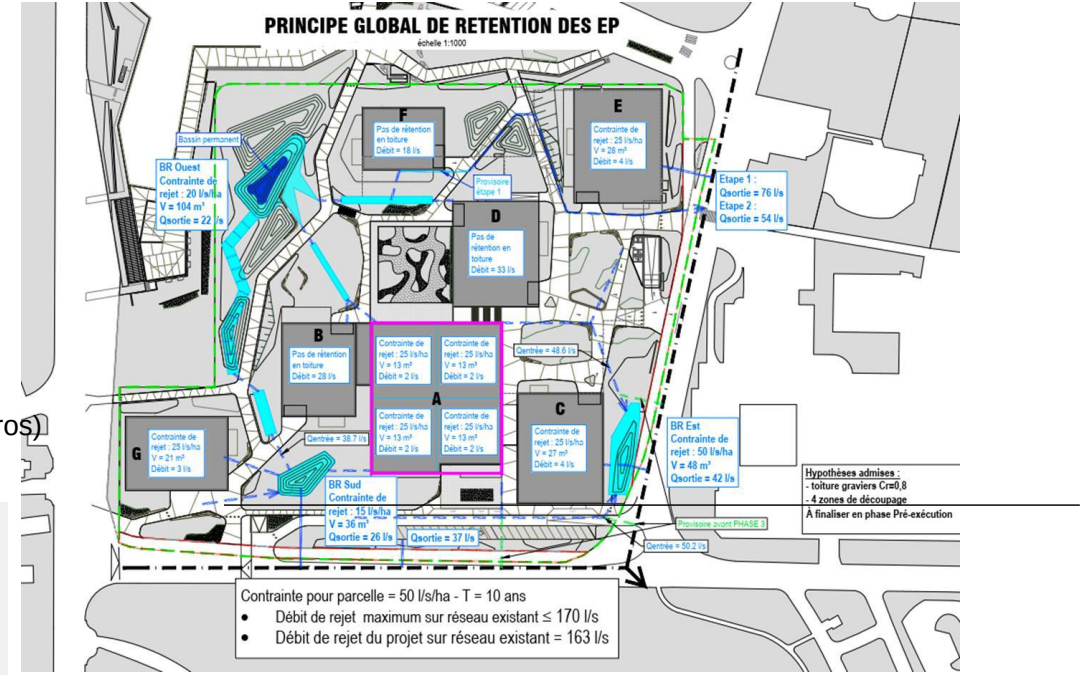
WATER CYCLES

Sizing of hydraulic structures (reservoir permanent, ditch, open ditch) based on the water management concept drawn up by civil engineers and landscape architects

Climatic data :

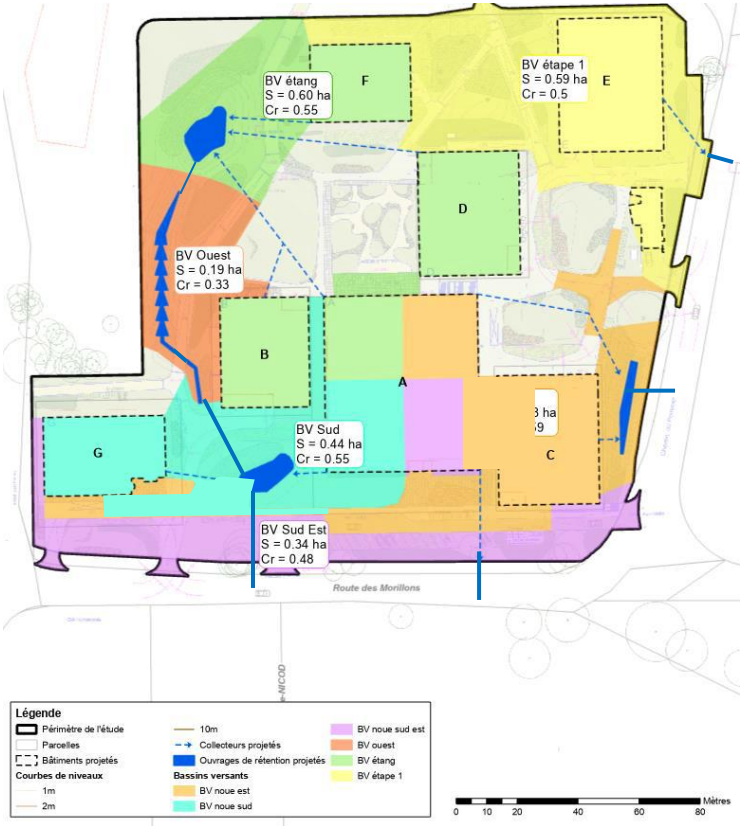
- Precipitation: continuous rainfall series measured at the Bachet-de-Pesay station (Plan-les-Ouates) over a 30-year period (1989 - 2019)
- Evapotranspiration: defined according to temperature daily rates (max / min) over the last 3 years - (in euros) data from Cointrin station

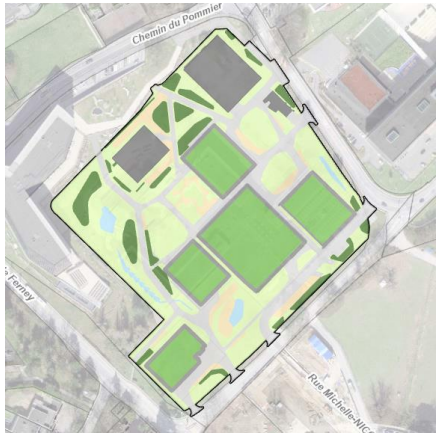


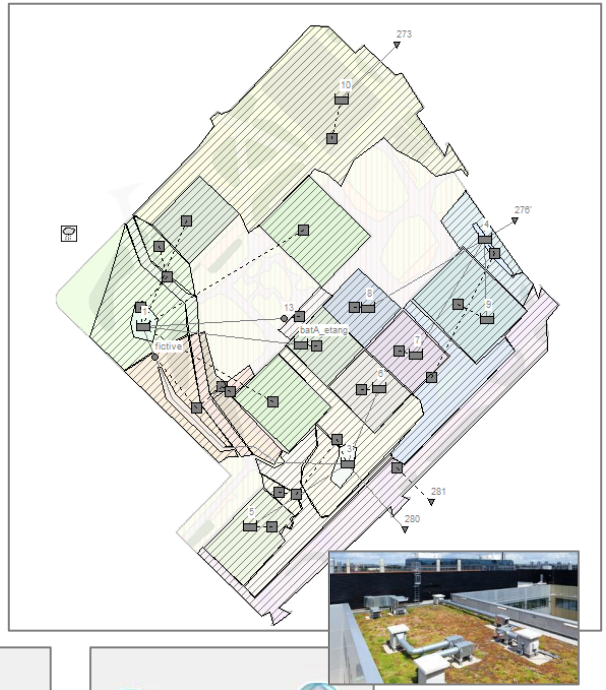


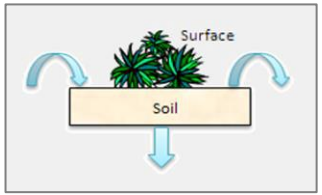
Plan of the overall water retention principle, EDMS Ingénieurs, version of 10.12.2019

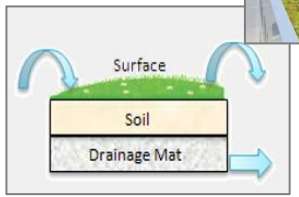
WATER CYCLES











WATER CYCLES

Results for all the areas concerned (BV West, South and East):

26.1 m of rainfall over 30 years, i.e. ~ 900 mm / year

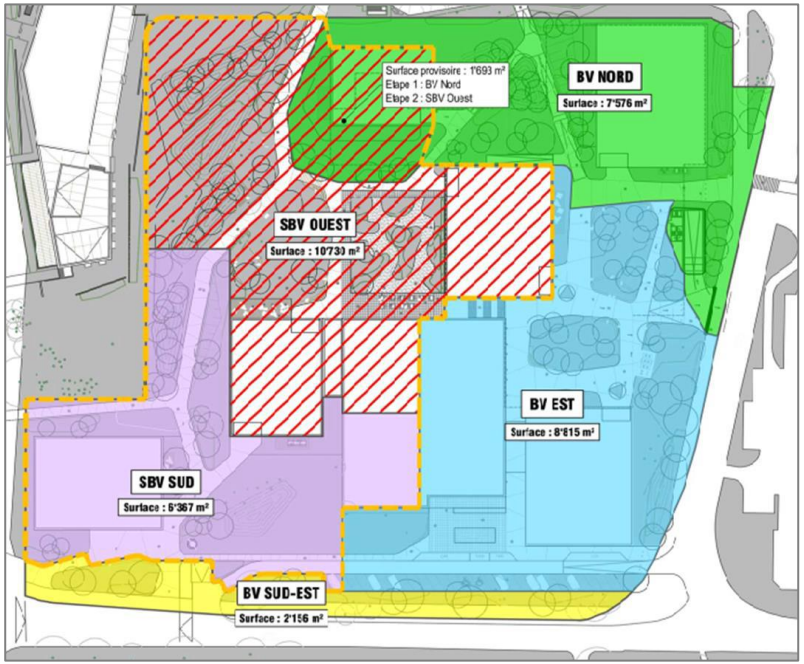
Average rainfall ~ 15,400 m3 / year

Volumes available at outlet ~ 3,500 m3 / year

On the scale of the project perimeter**, around 80% of rainwater is**

discharged into the ground.

are evaporated or naturally infiltrated into the spaces greens / pond



Catchment plan, EDMS Ingénieurs, version of 19.01.2018

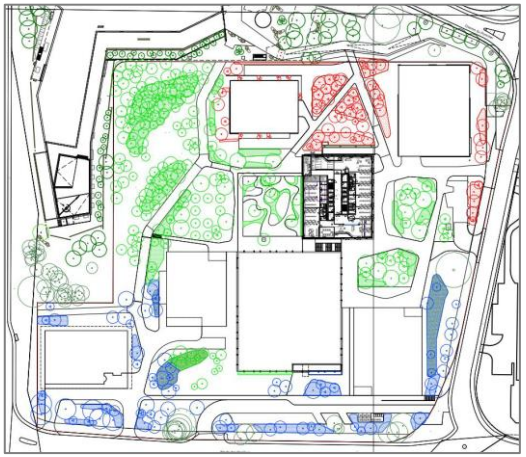
WATER CYCLES

Watering requirements: Estimated requirements for the 2 construction stages combined

The estimated watering requirements for the two stages of construction combined must take into account the evolution of needs over time, which will tend to decrease over the years (growth and the trees' natural water autonomy).

A reduction of 20% per year allowed, i.e. ~10m^3 /year for stage 2 and ~4m^3 /year for stage 3

The table below assumes that stage 3 will be completed 2 years after stage 2.

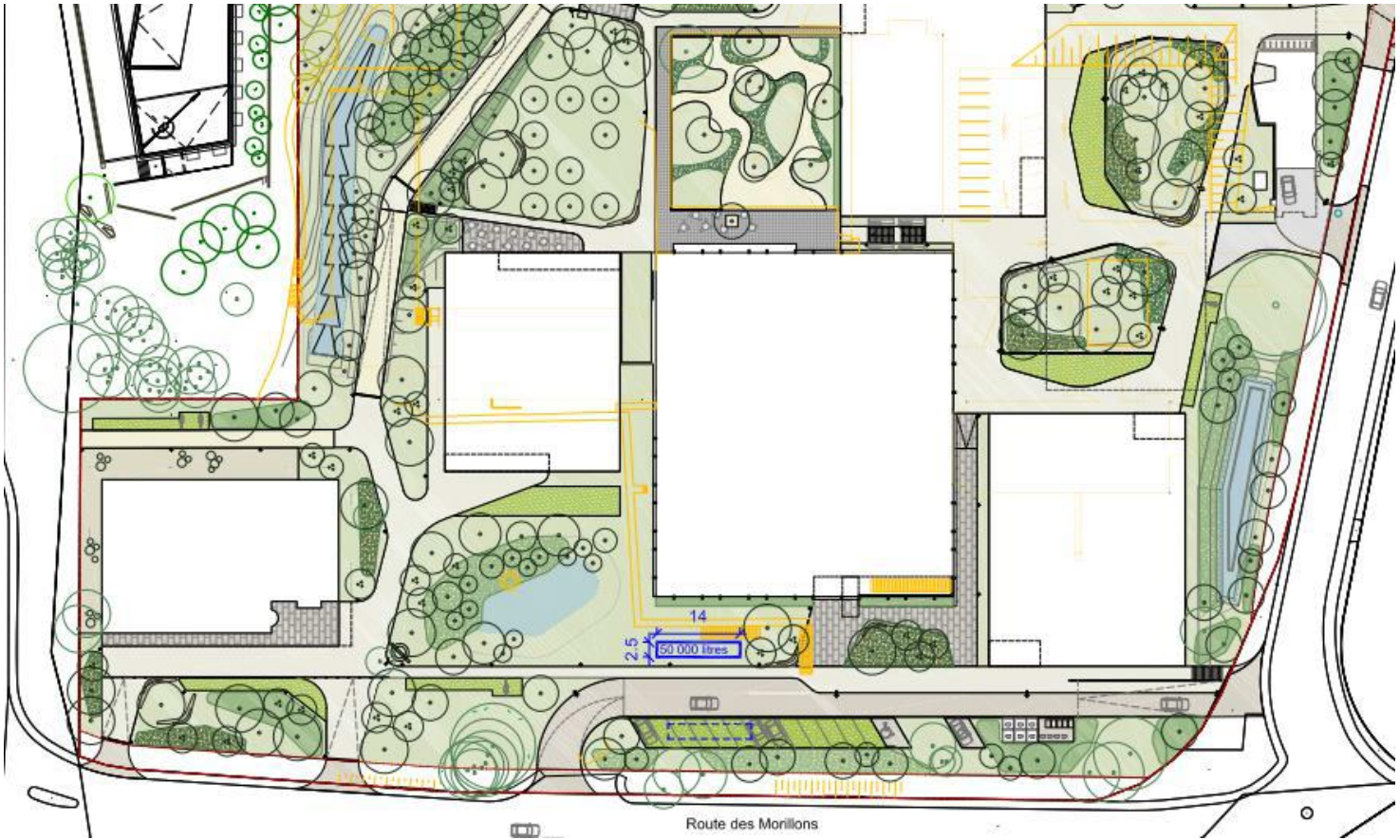


Plan of planting stages, ADR, version of 25.04.2023

Phase of project	***Watering needs per year***							
	année 1	année 2	année 3	année 4	année 5	année 6	année 7	année 8
Étape 2	**50**	**40**	**30**	**20**	**10**	-	-	-
Étape 3	*non réalisée*		**20**	**16**	**14**	**10**	**6**	**4**
Étape 2 + 3	**50**	**40**	**50**	**36**	**24**	**10**	**6**	**4**

We can therefore define a maximum overall watering requirement (stages 2+3) of approximately 50m^3 per intervention (10/year).

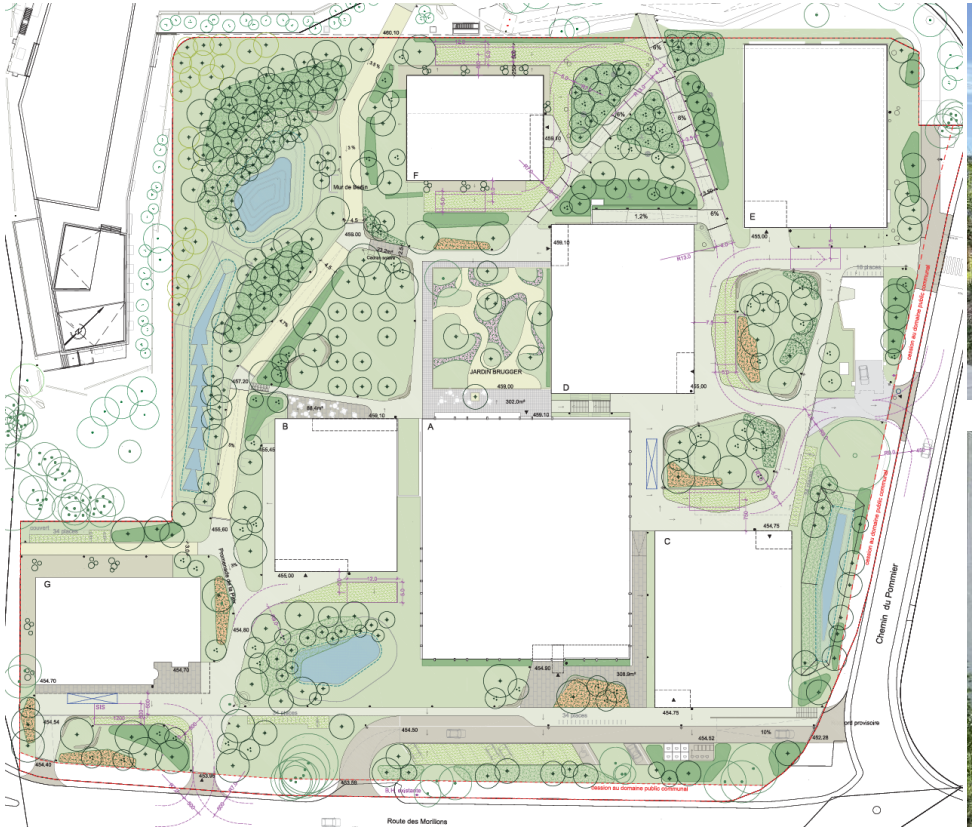
WATER CYCLES



SUSTAINABLE ENGINEERING IN THE INDUSTRY – GUEST LECTURE – IMPLENIA REAL ESTATE

URBAN PLANNING, LANDSCAPING & BIODIVERSITY

LANDSCAPING DESIGN



BIODIVERSITY INTEGRATION

1 Identification of areas suitable for conversion into substitute medium (minimum of 5 media)

Create biological connections for the transit of small wildlife.

Qualité des connexions biologiques entre les principaux milieux aménagés

Bonne à très bonne

Moyenne

Médiocre

SEED **6 environments identified, several of which are represented several times on the site**

- Prairial
- Pioneer
- Bocage
- Wooded
- Wet

SEED Overall, the environments are well connected.
Concrete pathways, particularly between wooded knolls, remain a weak point in the project.

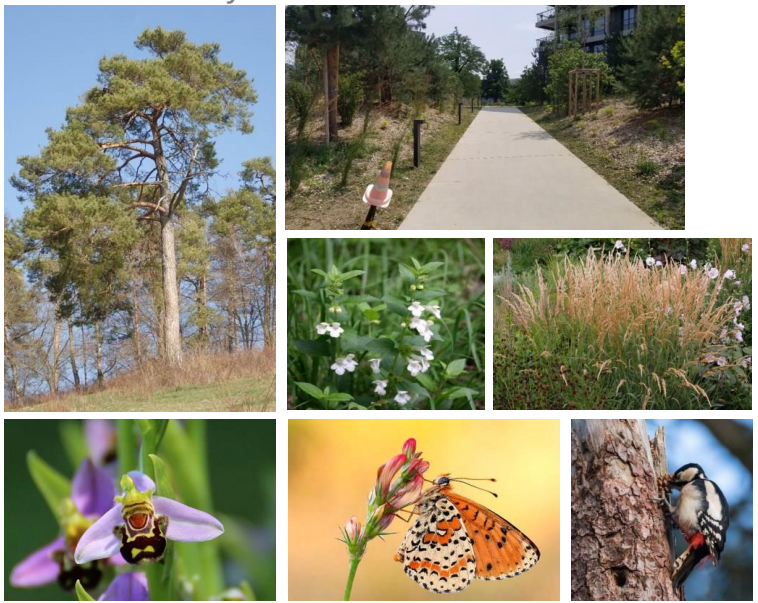
BIODIVERSITY INTEGRATION

2

Drawing up lists of plants to recreate environments that correspond to a target pool of animal and plant species.

Converging biodiversity, landscape and technicality (sustainability (climate), maintenance, economic aspects, etc.)

Pine forest on mesobromion hillock



BIODIVERSITY INTEGRATION

3

Choice of ground features for small fauna to be placed in the green spaces created.

- Creating a neighbourhood-wide network of micro-habitats.
  Establish a sufficient density of networked structures in the environments created.

Assessed under theme 1 "environmental structure".

This criterion reaches the OPL level.

Wooded hills of
Stage 1

Sand-stone niche within wooded knolls (stage 1)

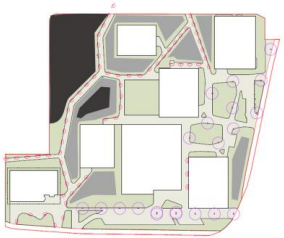
Other developments under study (stage 2)

BIODIVERSITY INTEGRATION

4 Minimising the impact of buildings on flora and fauna (theme 2)

Wildlife-friendly lighting plan

low markers (1 m) aligned with the aisles, on one side of the linear layout only



+ Large surfaces in unlit substitution (low residual brightness)
+ "night in the western sector preserved

Facades that pose little danger to the birds

+ Choice of low-reflective glazing
- Large areas of glazing on ground floor
- Glazing surfaces on upper floors at the recommended 4 m ^{2}
+ Metal railings (Montréal)
+ Blinds

Stage 1 (Montreal)

Permeable coatings small invertebrate fauna

- The paths are exclusively in concrete which offers no possibility of passage for some of the small fauna land. The use of grass grids is only available on SIS lanes.

This criterion is rated at an average level at this stage

BIODIVERSITY INTEGRATION

5

Including facilities in construction (theme 2)

Installation of nesting boxes for small colonies of swifts on buildings in Lima and Stockholm

Length of open-air water management system open vegetation (majority)

N o u e s e t basins (stage 2 project underway)

High proportion of trees honey and fruit trees

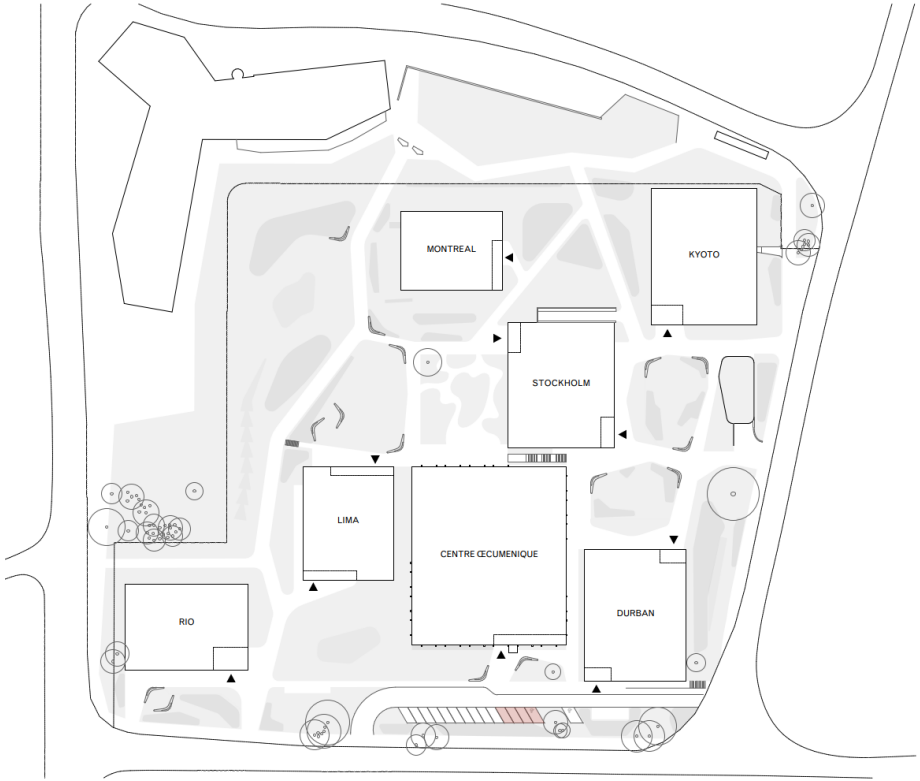
This criterion is rated as good at this stage.

SUSTAINABLE ENGINEERING IN THE INDUSTRY – GUEST LECTURE – IMPLENIA REAL ESTATE

MOBILITY, WASTE MANAGEMENT

MOBILITY ASPECTS – LOGISTICS
ACCESS TO PUBLIC TRANSPORTS

MOBILITY ASPECTS – PARKINGS & ELECTRIFICATION



DECOMPTE PLACES TIM : SS01 + SS02 + AMEX

PLACES TOTALES

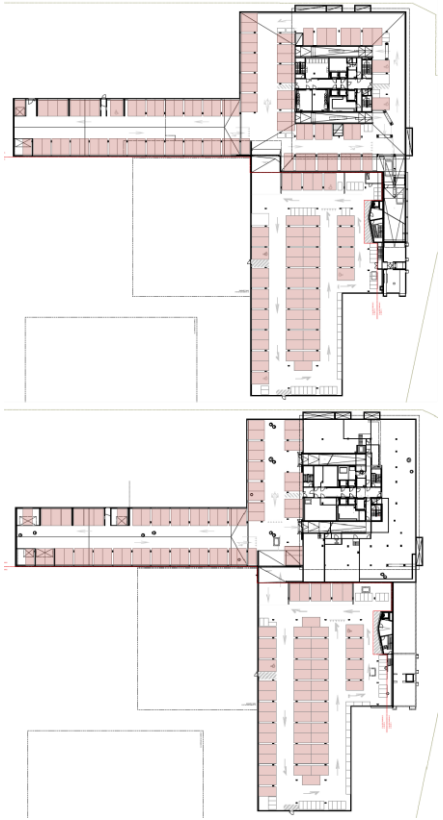
Places voitures	275
Places moto	102

PLACES ELECTRIFIES

Places voitures raccordés	264

LEGENDE :

- Places TIM Standard
- Places TIM Electrifiés



MOBILITY ASPECTS AND URBAN PLANNING

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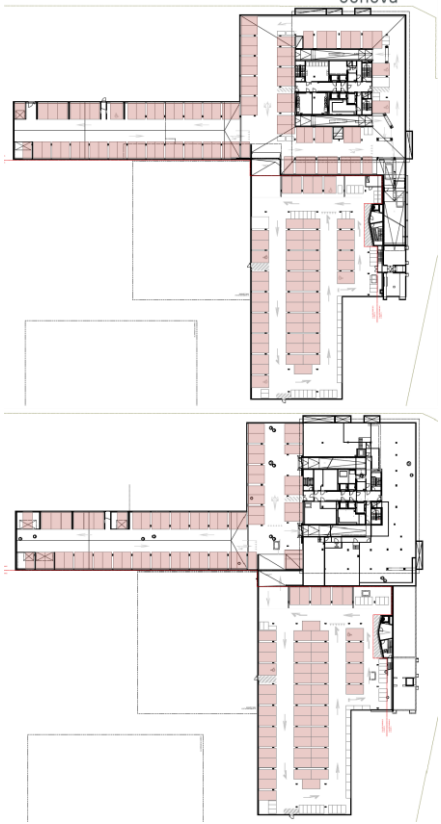
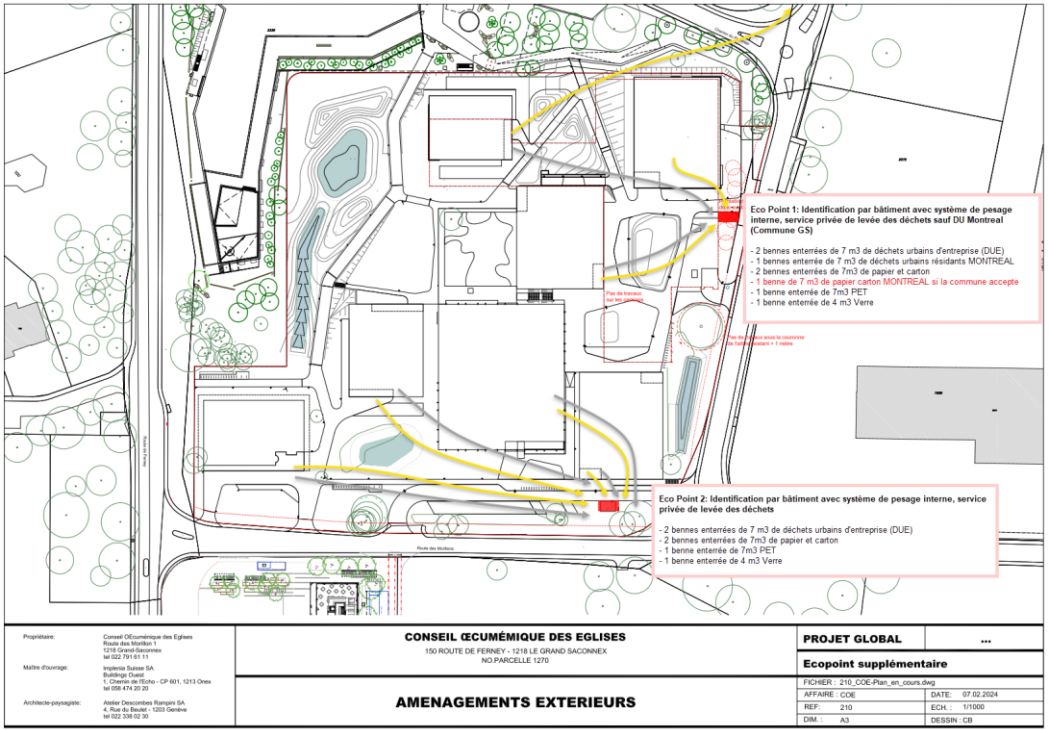
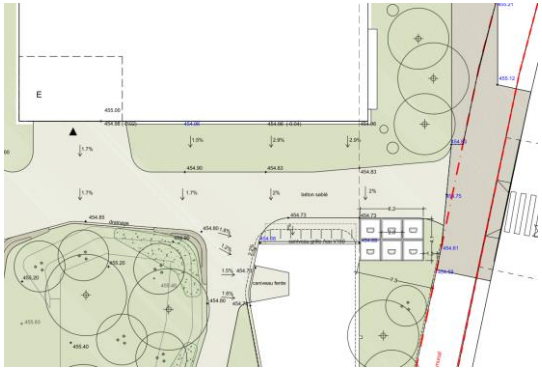
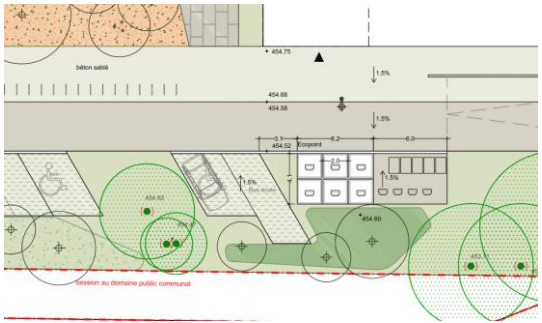


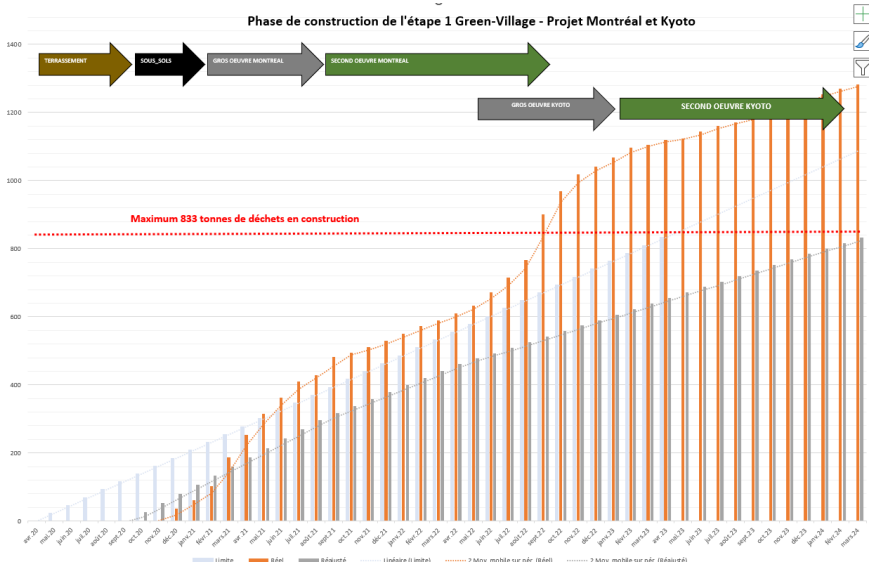
WASTE MANAGEMENT IN OPERATION

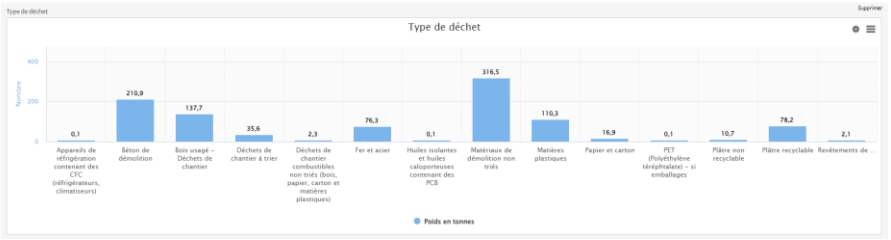


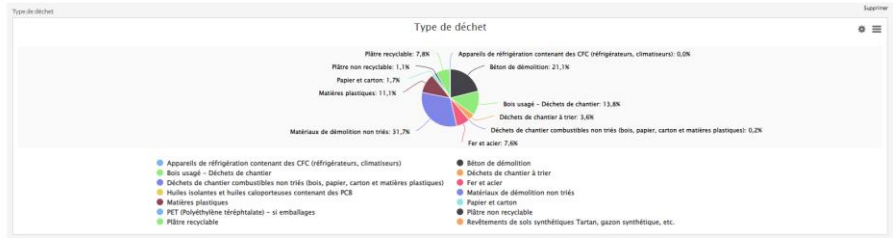




WASTE MANAGEMENT DURING CONSTRUCTION








«It’s better to try and fail, than not to try at all»
John McEnroe

IMPLENIA REAL ESTATE – BEST VALUE FOR CO2 – HOW TO OPTIMIZE COSTS AND EMBODIED CARBON?

LET'S TRY ALL TOGETHER

Benoît KLEIN
Senior Sustainability Manager
Implenia Real Estate Development
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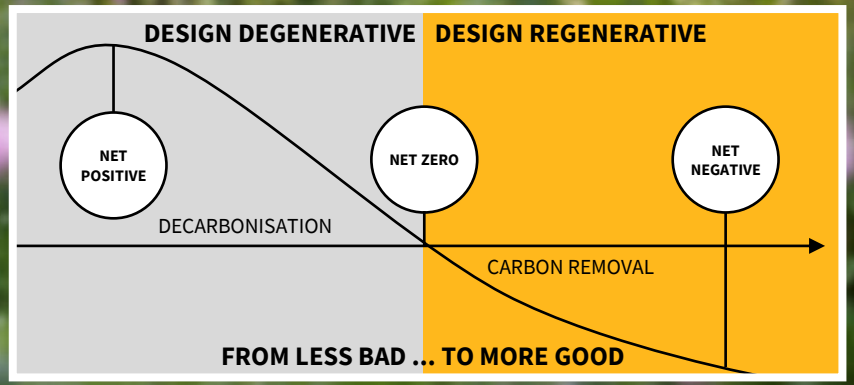
Upload our white paper:
implenia.com/en/net-zero



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Real Estate Development

NET ZERO

Comment s'engager sur la voie des bâtiments à zéro émission de carbone ?

Livre Blanc

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L'IMMOBILIER, VECTEUR DE DYNAMIQUE SOCIALE

Une approche pour améliorer la valeur sociale au sein des communautés

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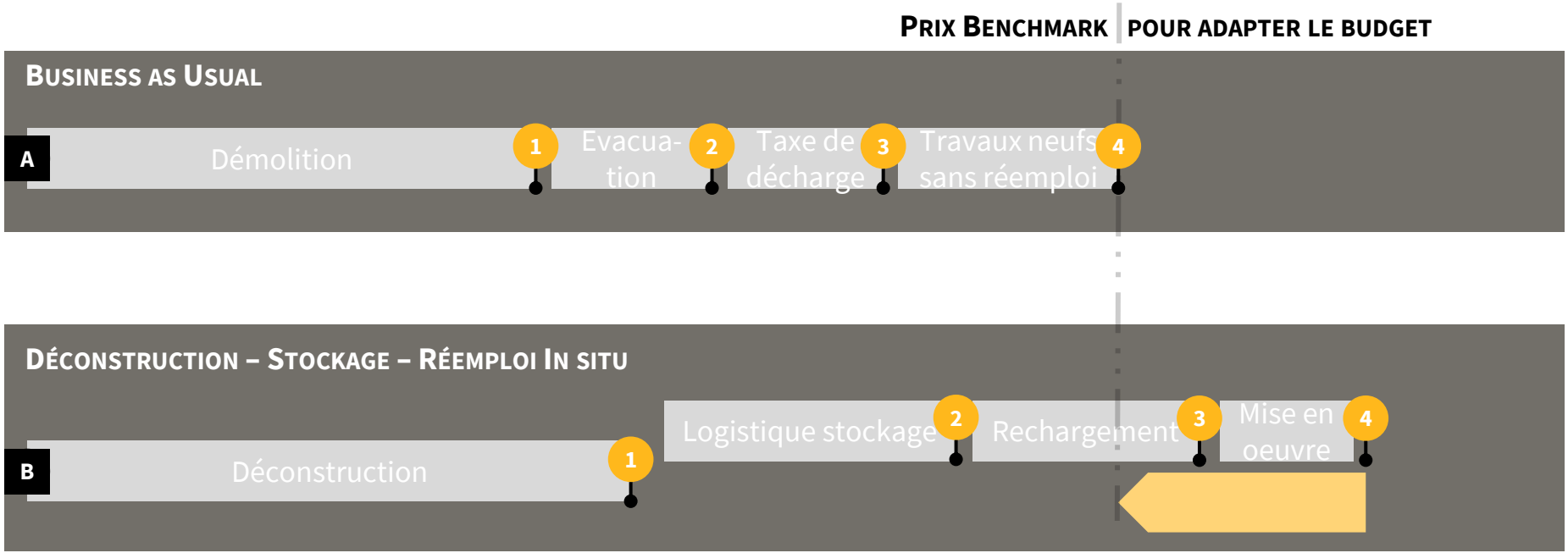

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