

ONOZ SITE ECOLOGICAL RESTORATION PRESENTATION



A SMaP study



December 10th, RAWFILL FINAL EVENT



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Defining restored habitats and species
Our final proposal

SITE PRESENTATION AND CONTEXT ELEMENTS



Site location

History

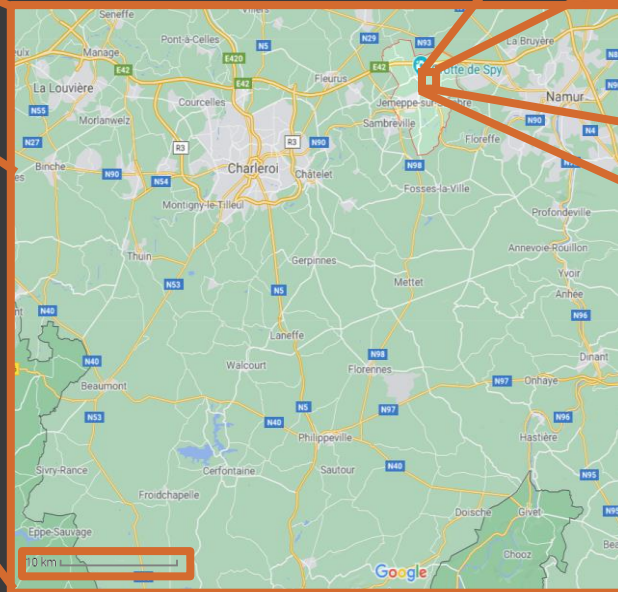
Geological characteristics

Biological context

Natura 2000

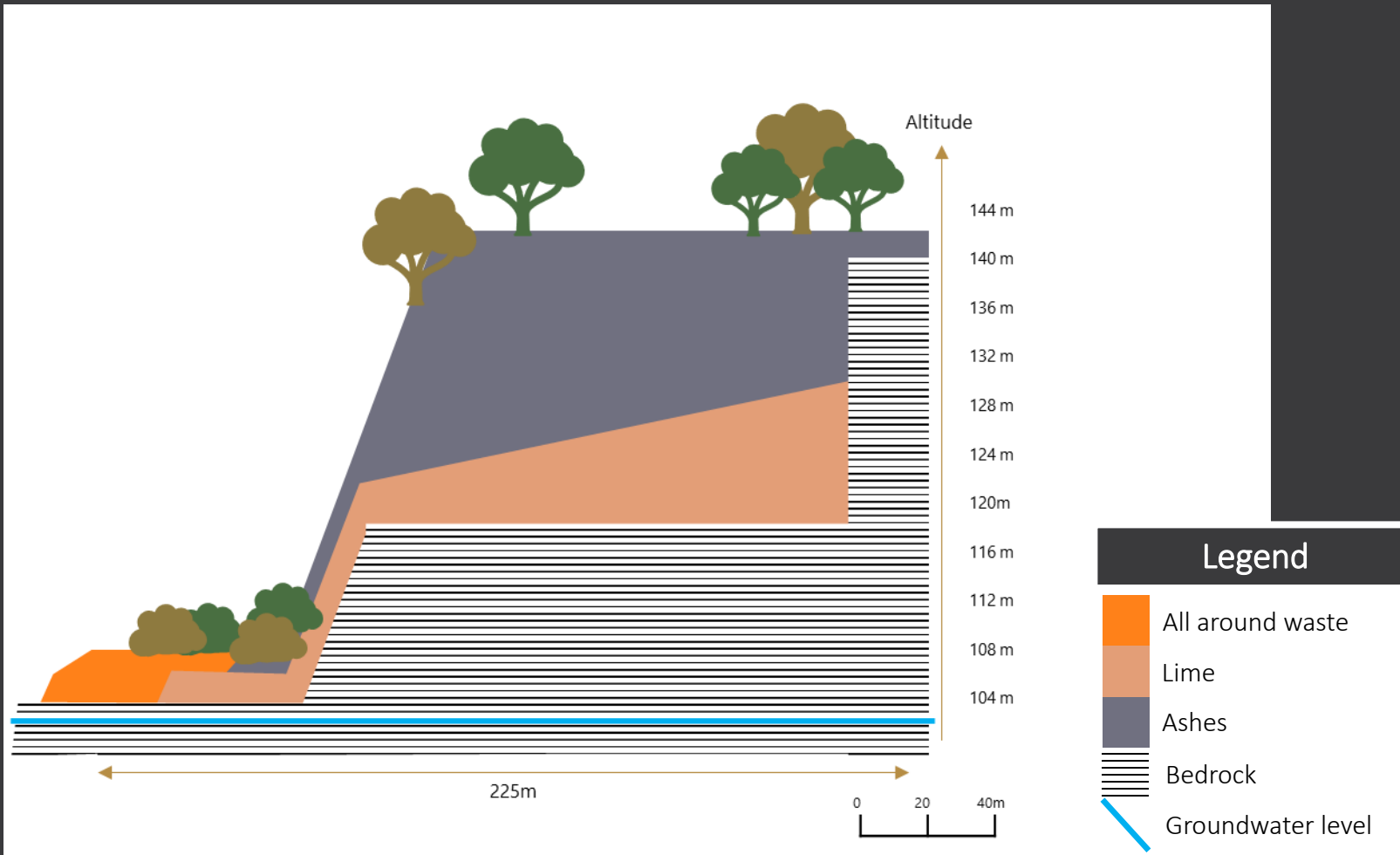
Climate

SITE LOCATION



Total site area: 6.18 ha

SITE HISTORY



19xx-1966: Quarry

1967-1976: Ash and lime deposit

1977-1987: Junkyard and illegal waste deposit in the lower part

1955-2004: Tire storage area

2020: Current situation

CLIMATE AND NATURA 2000

The **climate** scenarios for Flanders $+0.7$ (°C) in the annual average temperature (every 10 years)

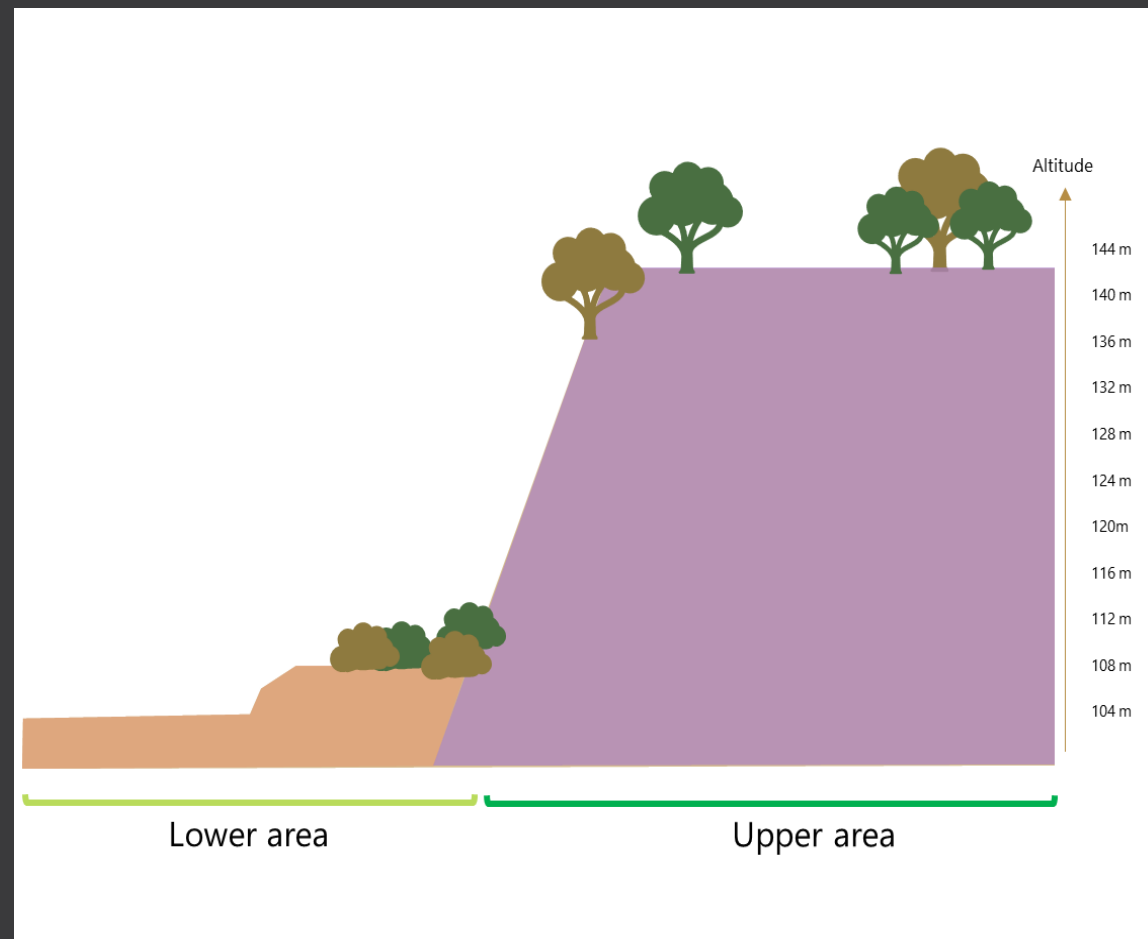
Temperature range nowadays:
-0.9 to +25(°C)
(winter/summer)

Temperature range in 30 years:
-0.2 to +27.1(°C)
(winter/summer)

Two Natura 2000 management units (UG: “unité de gestion”) intersect with the studied area

UG 2
Open environments of biological interest (lower part)

UG 9
Species habitat forests (upper part)



BIOLOGICAL CONTEXT

8 Different natural habitats



1 Fauna species to protect

- 3**
- Eurasian eagle-owl
 - Badger
 - Several species of bats
 - *Anguis fragilis*
 - *Rana temporaria*
 - Birds

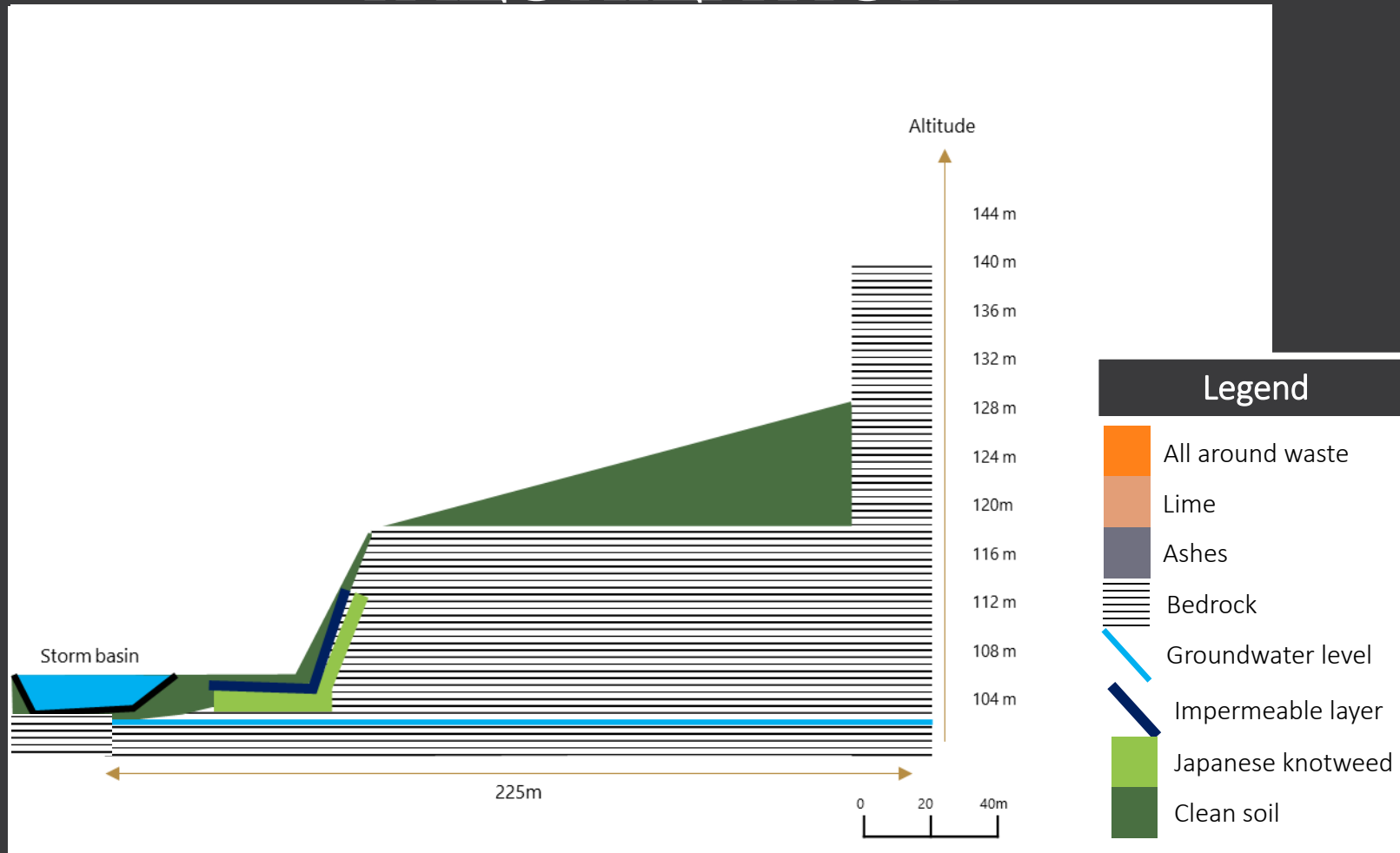
1 Flora species to protect

- 0**
- Oregano
 - *Epipactis helleborine*
 - Rumex
 - *Lithospermum officinale*
 - *Centaurea species*
 - *Echium species*
 - *Leucanthemum vulgare*
 - *Betonica officinalis*
 - *Solidago virgaurea*
 - *Dipsacus fullonum*

5 Invasive species to avoid

- *Reynoutria japonica*
- Buddleja
- *Cotoneaster horizontalis*
- Aster species
- Rhus species

SITE REMEDIATION AND VALORIZATION



98% of waste on site
will be revalorized

Phase 3
(15 months)

- Fill the excavated hole with clean soil
- Create a storm basin (empties in river)

Our objective: building a restoration plan proposal



Definition
Variables
Applied methodology

HOW TO BUILD A RESTORATION PLAN

Guidelines established by the Society for ecological restoration

Engage stakeholders

Native reference ecosystems

Consider climate change

Monitor progress with
measurable indicators

Enrich ecosystems as much as
possible

HOW TO BUILD A RESTORATION FACTORS PLAN

The Society for ecological restoration sets multiple factors that should be considered while creating a restoration plan. These factors can be summarized in three categories. The objective is to meet as many of these factors as possible in the final plan.

Diversity

1. Similar diversity and community structure in comparison w/ reference sites
2. Presence of indigenous species
3. Presence of functional groups necessary for long-term population

Vegetation structure

4. Capacity of the environment to sustain populations
5. Normal functioning
6. Integration in the landscape

Ecological processes

7. Elimination of potential threats
8. Resilience to natural disturbances
9. Self-sustainability

HOW TO BUILD A RESTORATION STRATEGY PLAN

(Based off the European project “Life” and “Restore”, which are similar to the ONOZ quarry.)

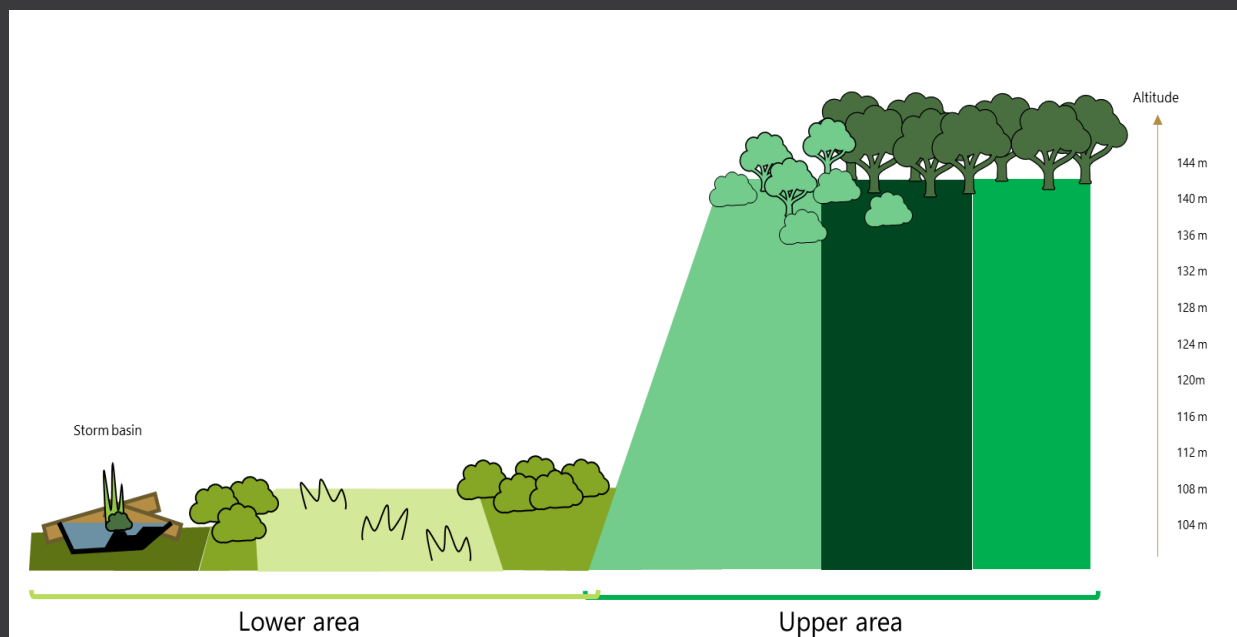
Important to:

- Divide areas by habitat
- Create pioneer habitats



OUR ECOLOGICAL RESTORATION OBJECTIVES

“Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.”-
- Society for ecological restoration



Restore habitats in upper and lower part (excavation site) to be welcoming to species observed on site



Try to incorporate Natura 2000 species to enrich the site's ecology

OUR METHODOLOGY

Determine on-site species

Analyze species repartition on site
Ecological observations report

Determine potentially integrated species

Native species to the area
Natura 2000

Group species

Determine necessary habitats for each species
Group species with same requirement

Create habitats

According to groupings, determine what is necessary on site to accommodate all previously present species and as many new native species

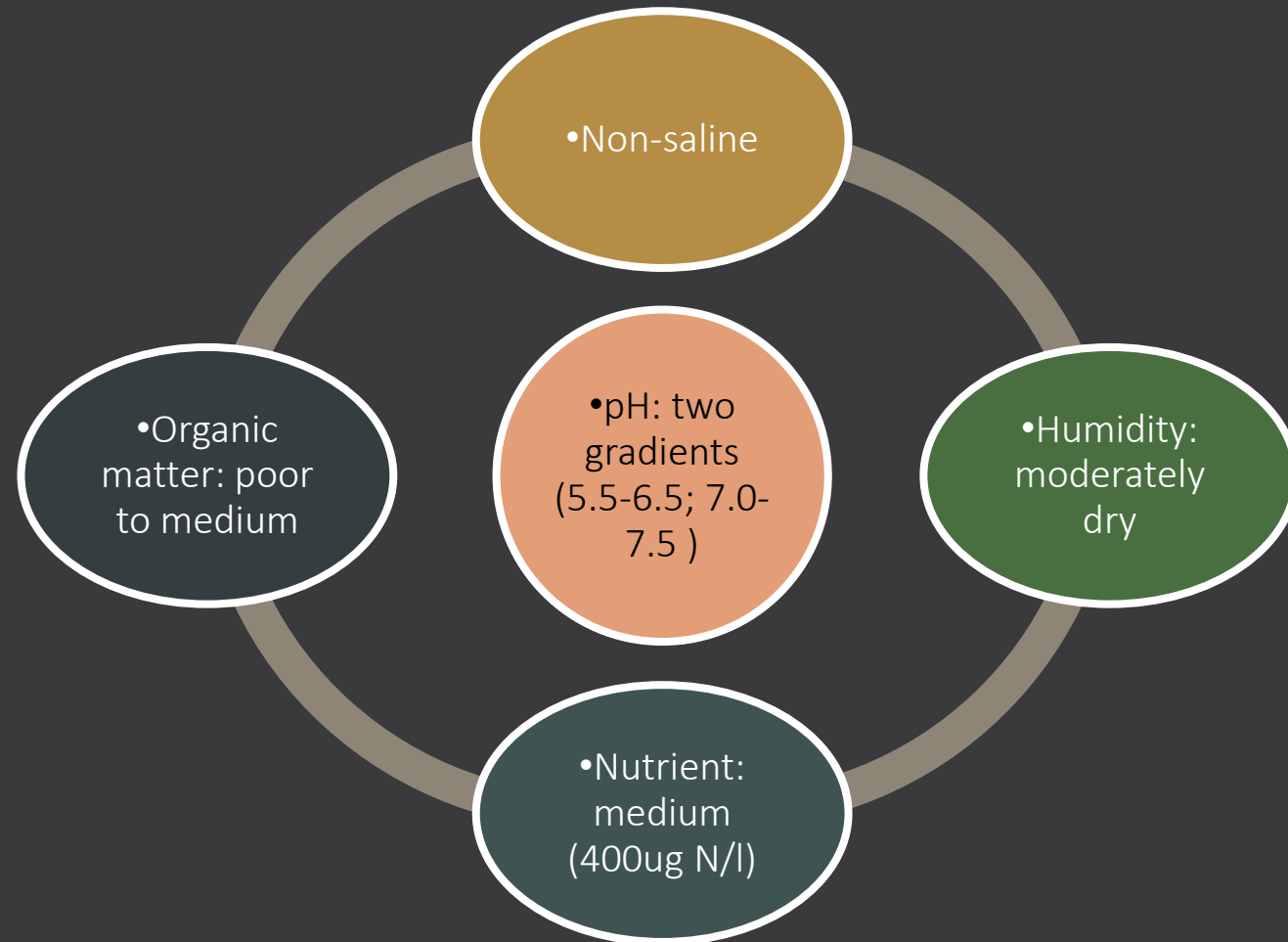
Our ecological restoration plan



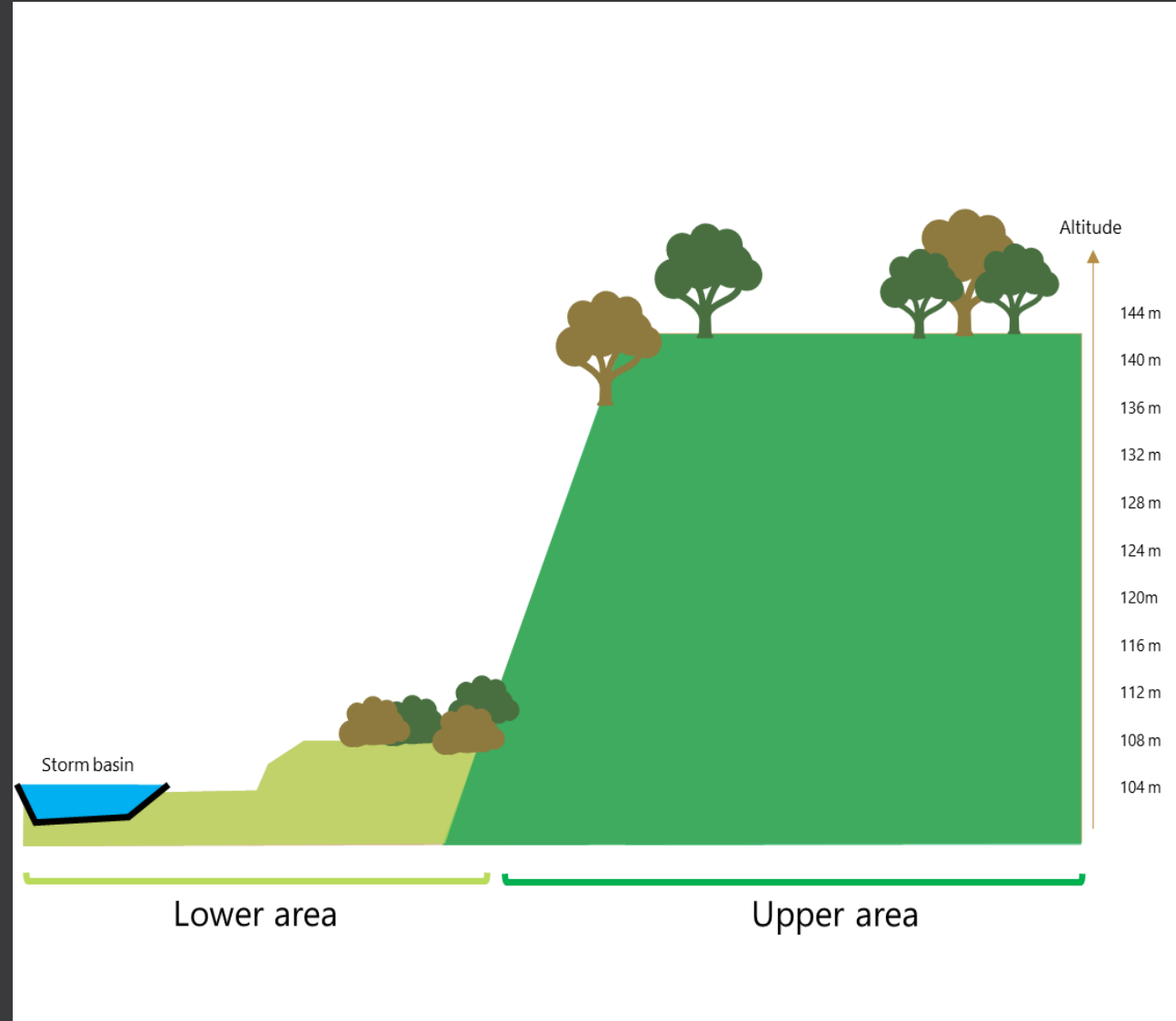
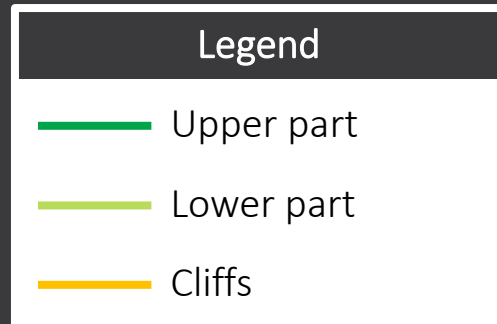
Defining soil type
Defining restored habitats and species
Our final proposal

SOIL

Soil Sample from another limestone quarry could be used for this refill purpose.



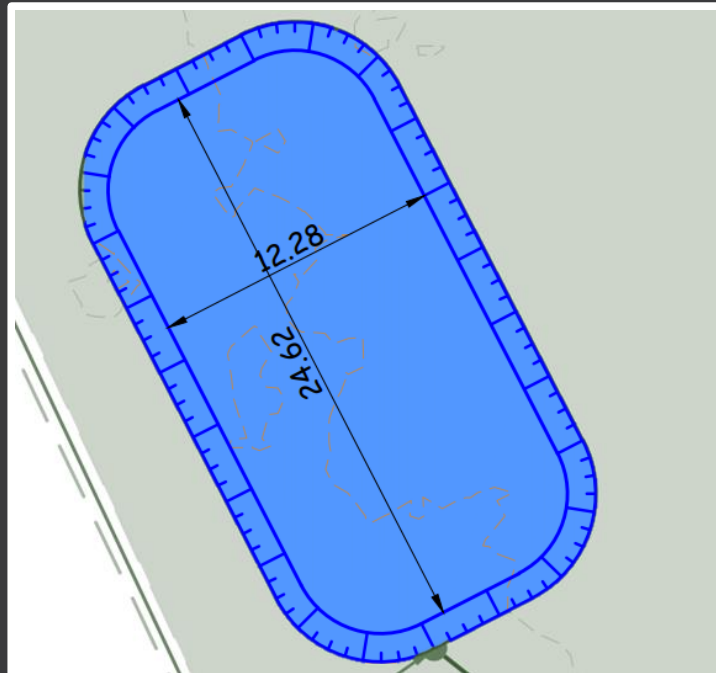
AFFECTED AREAS



#1 Storm basin



RESTORED HABITAT #1: STORM STORM BASIN CHARACTERISTICS



Bottom: 103.96m²
Overflow: 105.00m²

Initial cost: 30 000 €

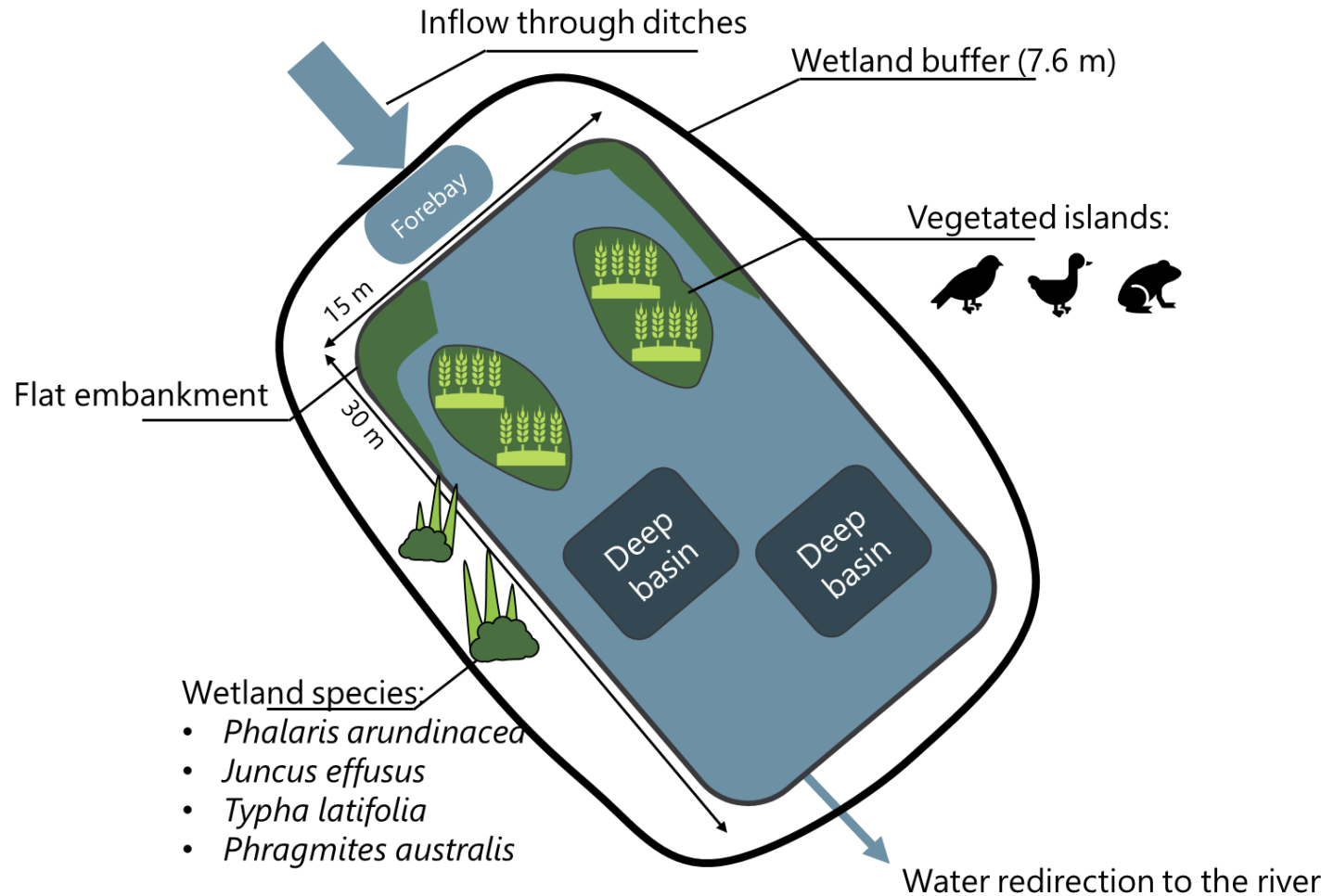
Depth: 66 cm

Volume: about 200 m³

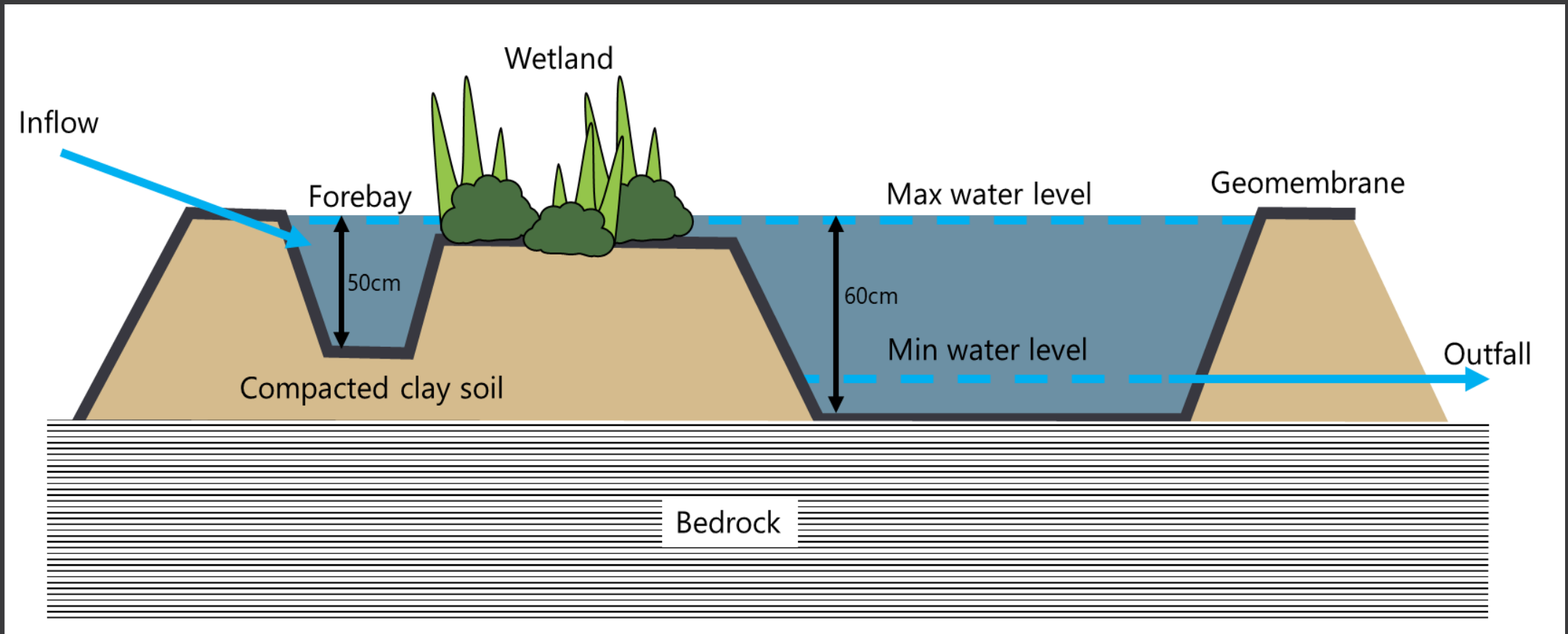
Purpose: prevent potentially polluted water to reach the groundwater by collecting water coming from the slope and redirecting it to the river

To integrate the storm basin in the local ecosystem, the storm basin will take the form of a “constructed wetland/vegetated basin”

RESTORED HABITAT #1: STORM OUR STORM BASIN PROPOSAL TOP VIEW VIEW BASIN



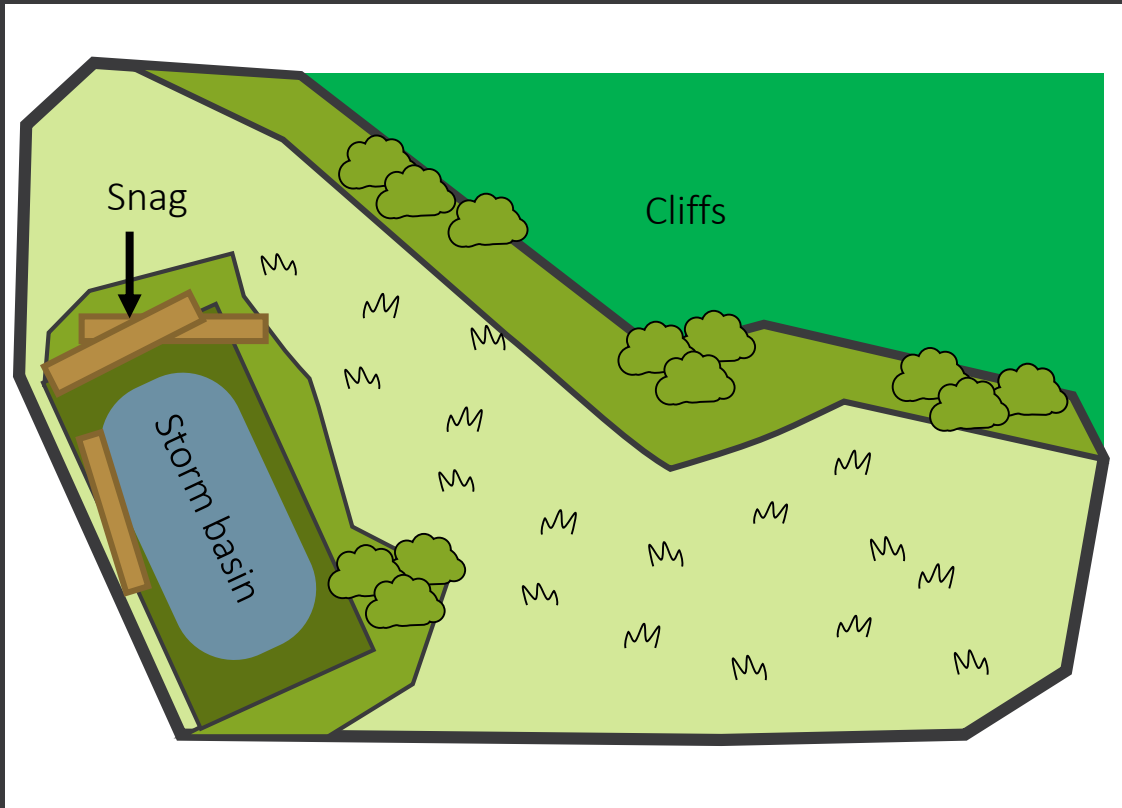
RESTORED HABITAT #1: STORM OUR STORMWATER BASIN PROPOSAL SIDE VIEW



#2 Lower area



RESTORED HABITAT #2: LOWER PERMANENT AREAS (FLORA)



Open area (parc-like)
Low density native lawn / grass

10% *Lolium perenne*, 10% *Poa pratensis*,
80% *Festuca arundinacea*

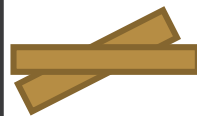


Low to high density of native bushes and fruit
bearing plants

Cornus mas, *Sambucus nigra*, *Berberis vulgaris* and
Viburnum Trilobum, *Ligustrum vulgare*, *Buxus*
sempervirens and *Salix purpurea*



Wetlands

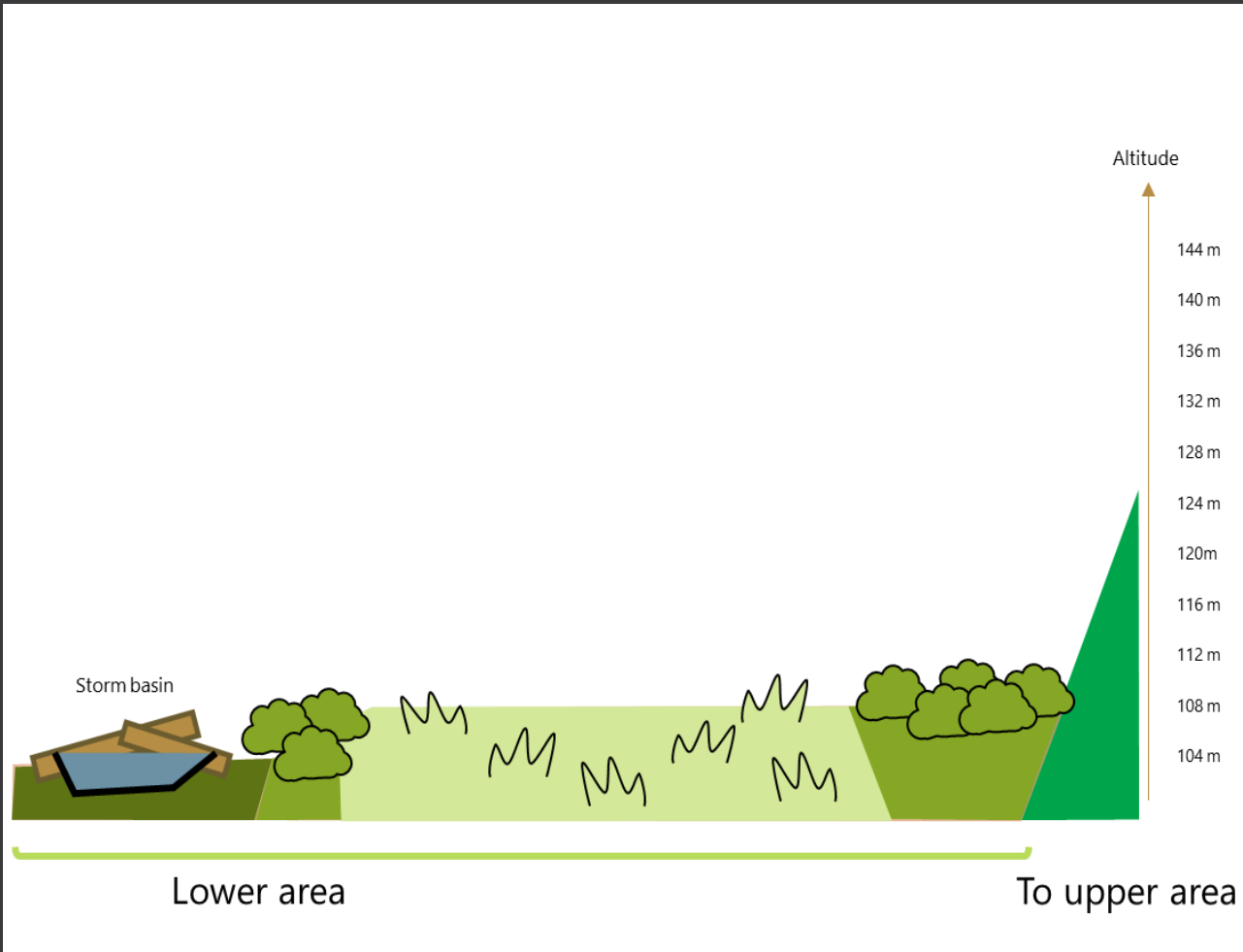


Snag (trees from upper part)

RESTORED HABITAT #1: LOWER

PERMANENT AREA

RELOCATION GOALS (FLORA)



Prairie

- Provide open area for hunting

Bush

- Provide food for birds, hiding places and nesting areas for animals.

Wetlands

- **Attraction for the animals** (ducks, frogs, birds, etc.) to the water body

Snags

- **Shelter** for amphibians (i.e., frogs);
- **Insects habitat**
- **Hunting ground** for animals who eats insects (i.e., bats)

RESTORED HABITAT #2: LOWER FAUNA SPECIES (PREVIOUSLY OBSERVED AND NATURAL 2000) AREA



Anguis fragilis (Lizard)



Rana temporaria (Frog)



Meles meles (Badger)



Parus major (Tits)



Acrocephalus schoenobaenus
(Warbler)



Prunella modularis
(Accenteur)



Fringilla coelebs (Chaffinch)



Picus verdis (European Woodpecker)



Emberiza citronella (Yellowhammer)



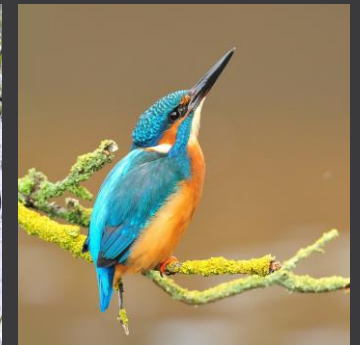
Anas crecca
(Eurassian teal)



Egretta alba
(Great egret)



Anas querquedula
(Garganey)



Alcedo atthis
(Common Kingfisher)

RESTORED HABITAT #2: LOWER PERMANENT AREAS (FAUNA)

Frogs

- Nearby **wetlands** and **low to high dense bushes** nearby the water basin provides enough moisture content for the enrichment

Lizard

- Create **lawns and herbaceous** vegetation near the cliff
- Create condition for lizard's growth

Badgers

- Use the **storm basin** to create a hunting area
- Usage of bushes to give a cover and create **underground burrows** for nesting

Tits, Warbler & Chaffinch

- Grow berry-producing plants** along with the bushes
- Introduce a high density of vegetation and bushes

European green woodpecker, yellowhammer & accentor

- Introduce *a high density of* vegetation and bushes near the wetland (nesting)
- Have **open areas** (hunting)

Eurasian teal, Great egret & Garganey

- Low to high dense bushes nearby **wetlands for nesting areas**

Common kingfisher

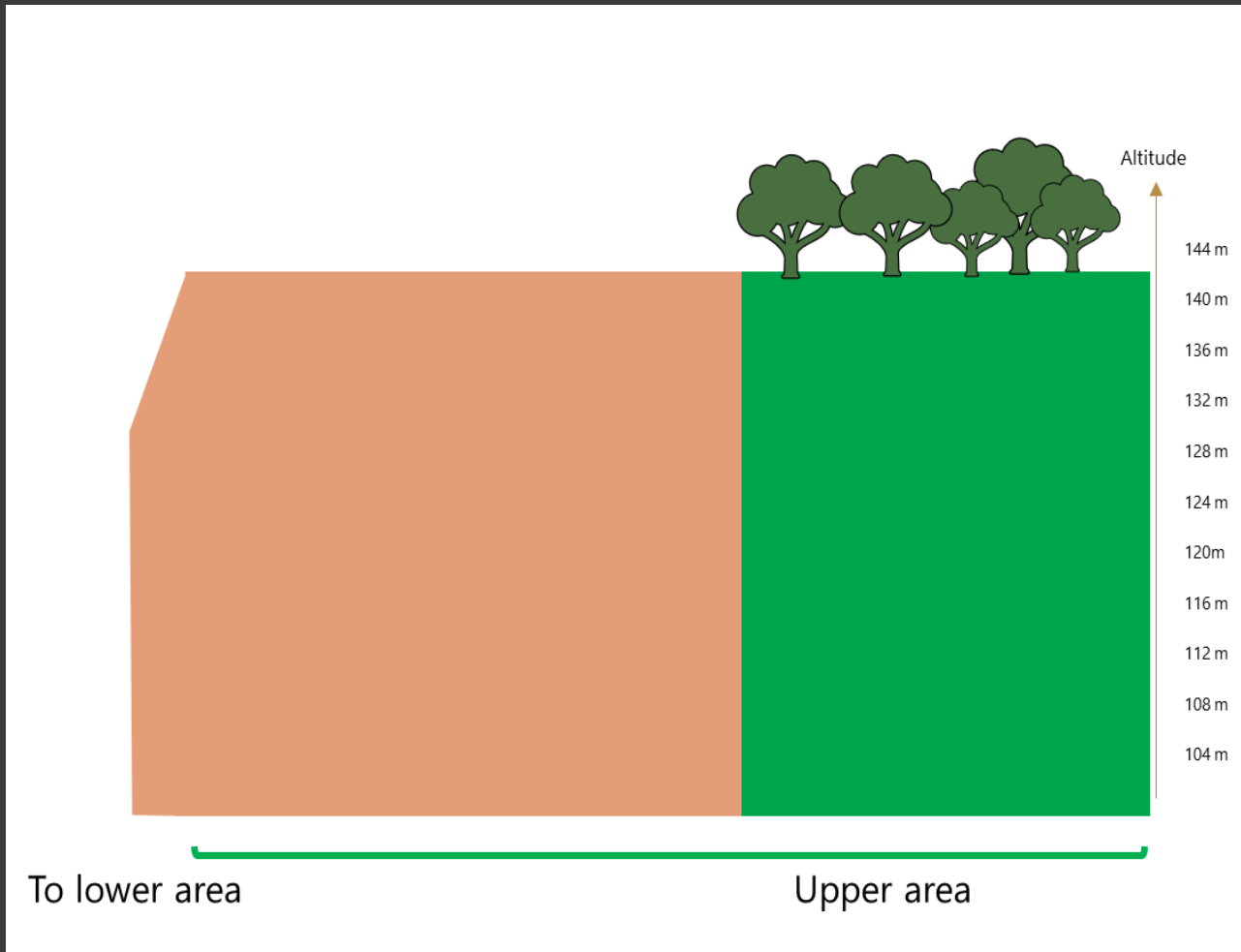
- Create **open area** for hunting, herbaceous layer and bushes for comfort

#3 Upper area



RESTORED HABITAT #3: UPPER

AREA SPECIFICATIONS

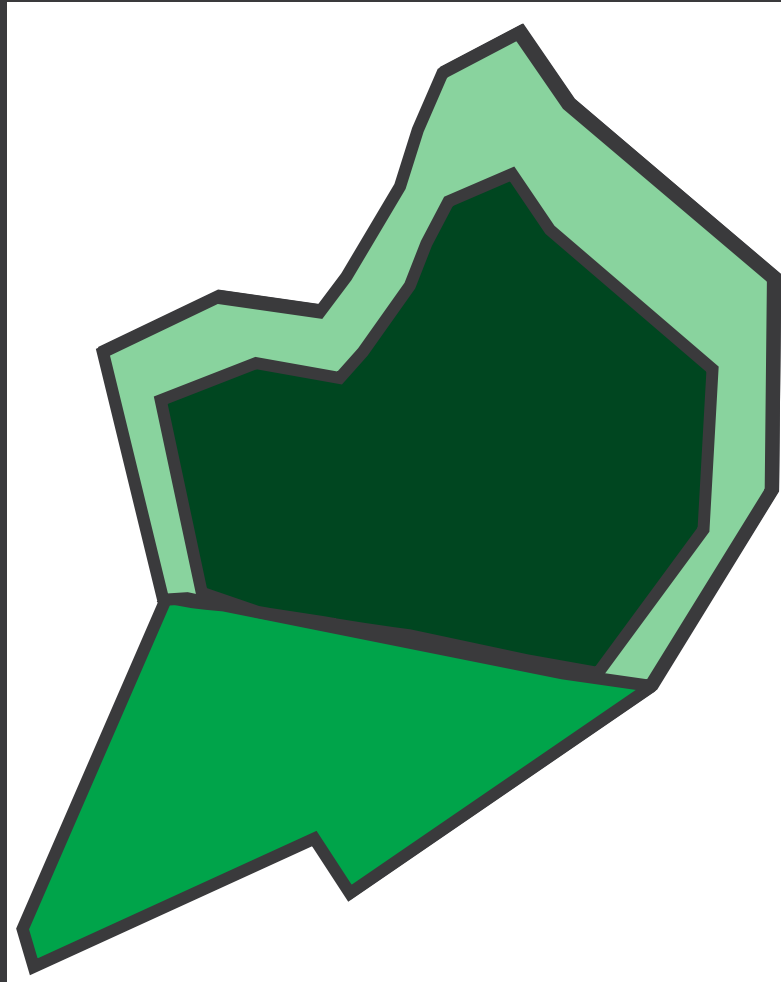


Excavated area

Untouched area

The refiling process while significantly lower the slope of the cliff that was previously there.

RESTORED HABITAT #3: UPPER PERMANENT AREAS (FLORA)



Mixed forest (conifers and hardwoods, medium density)

Quercus, Fagus sylvatica, Carpinus betulus, Alnus glutinosa, ...



Open area (native species as bushes, low density)

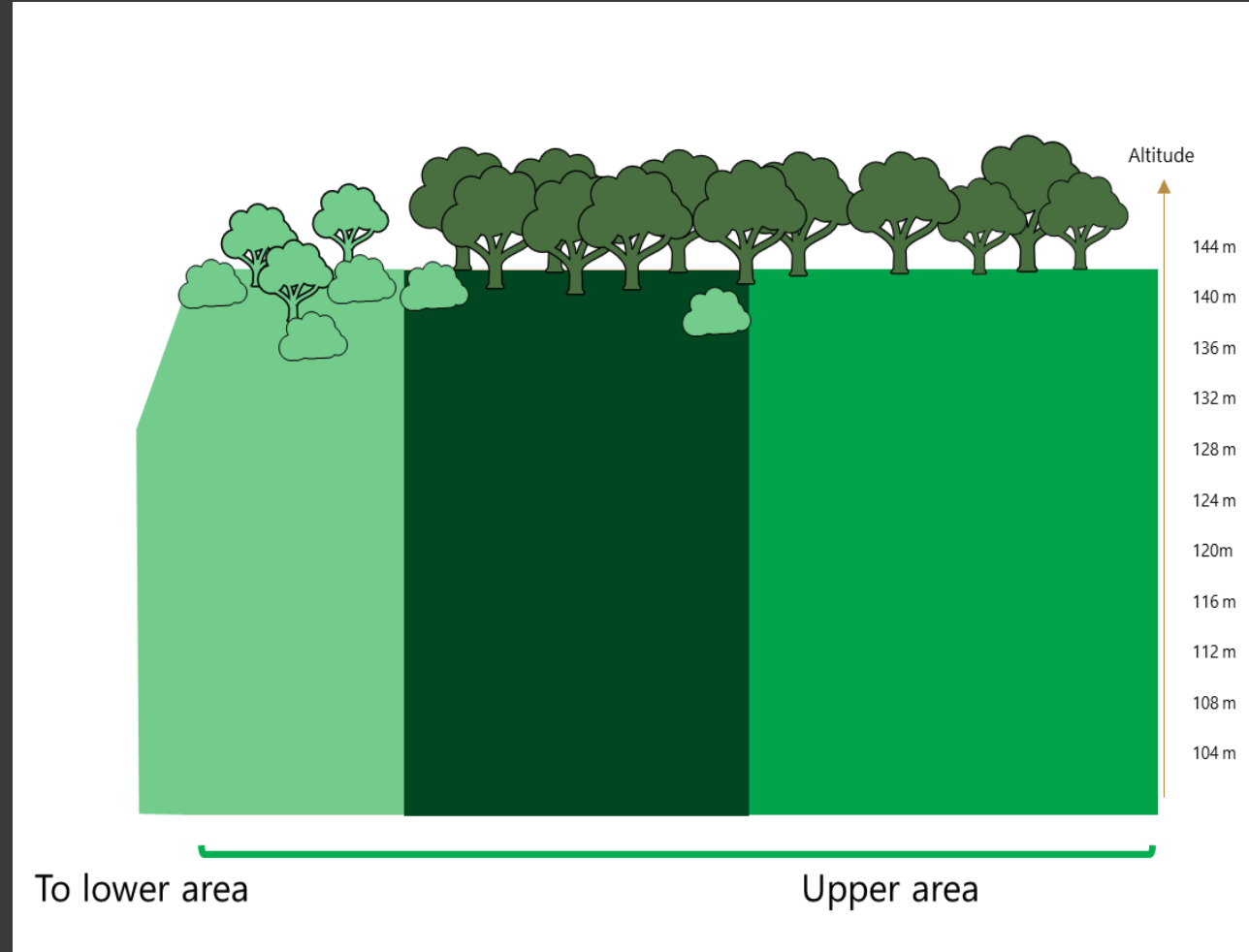
Rocky waste, Viburnum, Pyracantha, Symphoricarpos



Untouched area

RESTORED HABITAT #3: UPPER

PERMANENT AREAS (FLORA)



Mixed forest

- Replicate the prior forest
- Create an undisturbed and isolated area
- Provide a protective area for species and preys

Open forest

- Provide hunting ground and nesting area for flying species
- Allow sun to penetrate deeper in the mixed forest

RESTORED HABITAT #3: UPPER SPECIES (PREVIOUSLY OBSERVED AND NATURAL 2000) AREA



Eurasian eagle-owl (*Bubo bubo*)



Bats species



Yellow hammer (*Emberiza citrinella*)



Accentors (*Prunellidae* family)



Nine-primaried oscine species



Warler (*Passer domesticus*)



Middle spotted woodpecker (*Dendrocopos medius*)



Black woodpecker (*Dryocopus martius*)



European honey buzzard (*Pernis apivorus*)

RESTORED HABITAT #3: UPPER PERMANENT AREAS (FAUNA)

Owl

- Protected nesting areas to give the owl tranquility
- Make sure **the trees are spaced enough** to allow hunting

Birds

- Make sure to that **berries will be available** on the upper part
- Make sure that the forest is a suited habitat for insect multiplication and therefor **provide enough preys** for this specie
- Make sure in some areas the **trees are spaced enough** to allow hunting

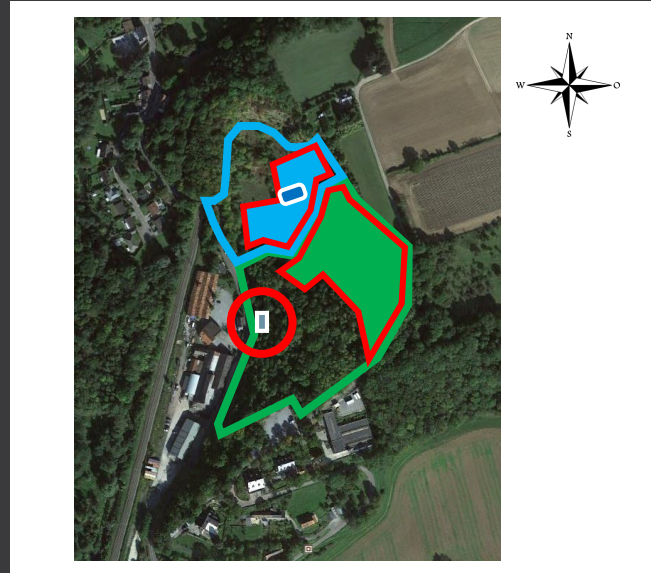
Bats

- Keep the **old lime kiln ruins** as a nesting area
- Be sure in some areas **the trees are spaced enough** to allow hunting

RESTORED HABITAT #3: UPPER LIME KILN AREA

Bats

- Keep the old lime kiln ruins as a nesting area
- Be sure in some areas the trees are spaced enough to allow hunting



Lime kiln ruins

- Current on-site nesting area for bats
- Located in the upper part, near the storm basin

Overall information



TECHNICAL APPROACH



Maintenance of the plantation

Actors

Department of Nature and Forestry in Wallonia

- Forest Resources Branch
- Direction of Nature and Green Spaces

Companies

- Exemples : Tree nursery of the ardennes, Jungers Michel ,Tree nursery Poncin

Actions

Clearing of plantations

- Limit competition from weedy vegetation
- 2 to 5 clearances needed for successful plantation

Forming and pruning

- Add corrections to tree shapes

Means

Manual release operation (Thermal brushcutter)

Mechanical release operation (machines)

Chemical release operation: phytocidal products (not good for environment)

MONITORING AND EVALUATION



Climate

- Sunlight (hour)
- Rainfall (mm)
- Wind (m/s)
- Humidity (%)
- Temperature (C°)



Local meteorological station



Soil

- Erosion intensity (kg/ha*year)
- Soil C, N/P/K and OM (g/kg)
- Soil seed bank (invasive species)
- Slope damage (slope stability analysis)
- Microbial diversity



Field and Laboratory tests;
Slope stability analysis



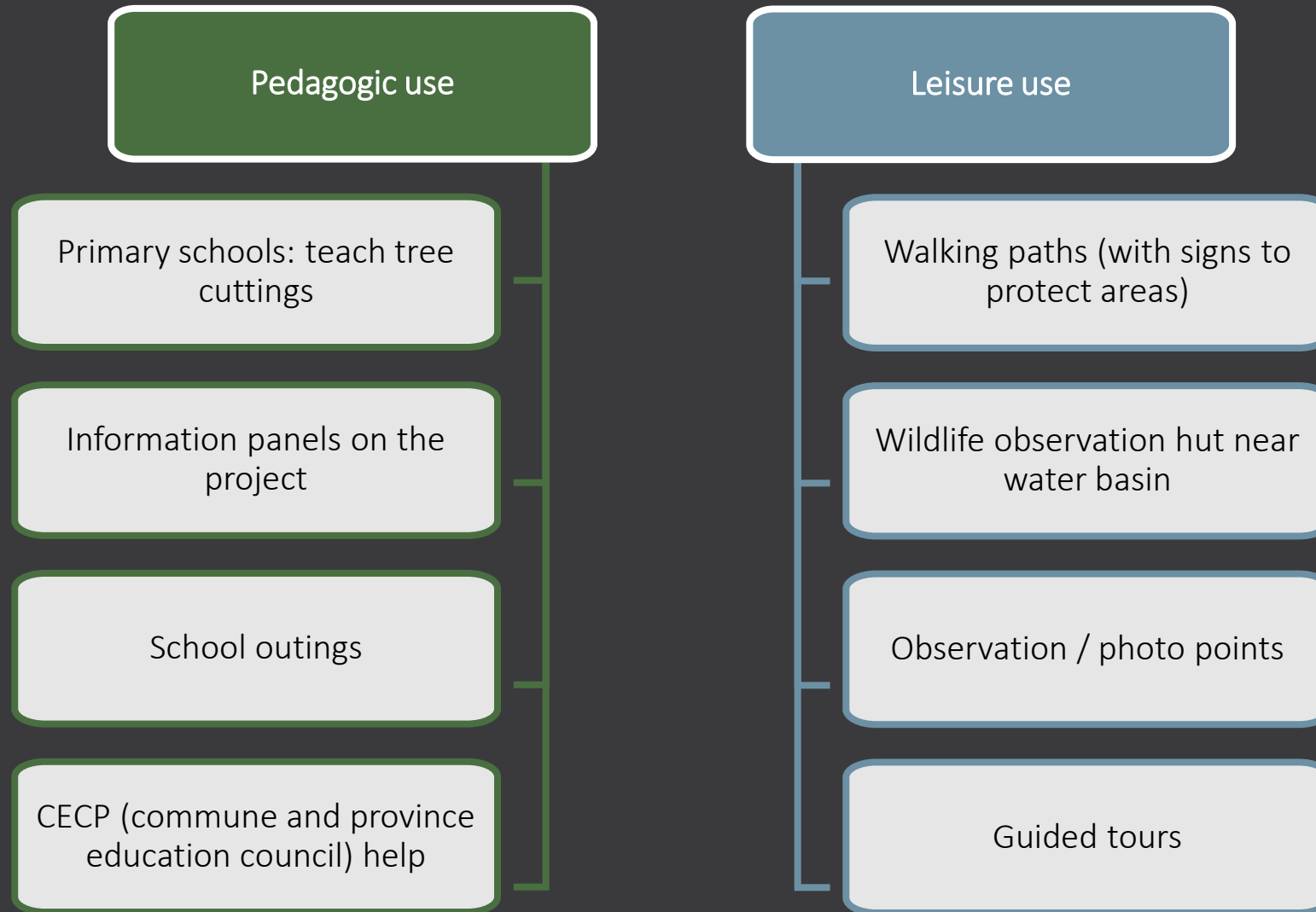
Biodiversity

- Richness
- Evenness
- Distribution
- Productivity (g/m²*d)
- Stability of root-soil system



Field tests;
Shannon–Wiener and Simpson's diversity index

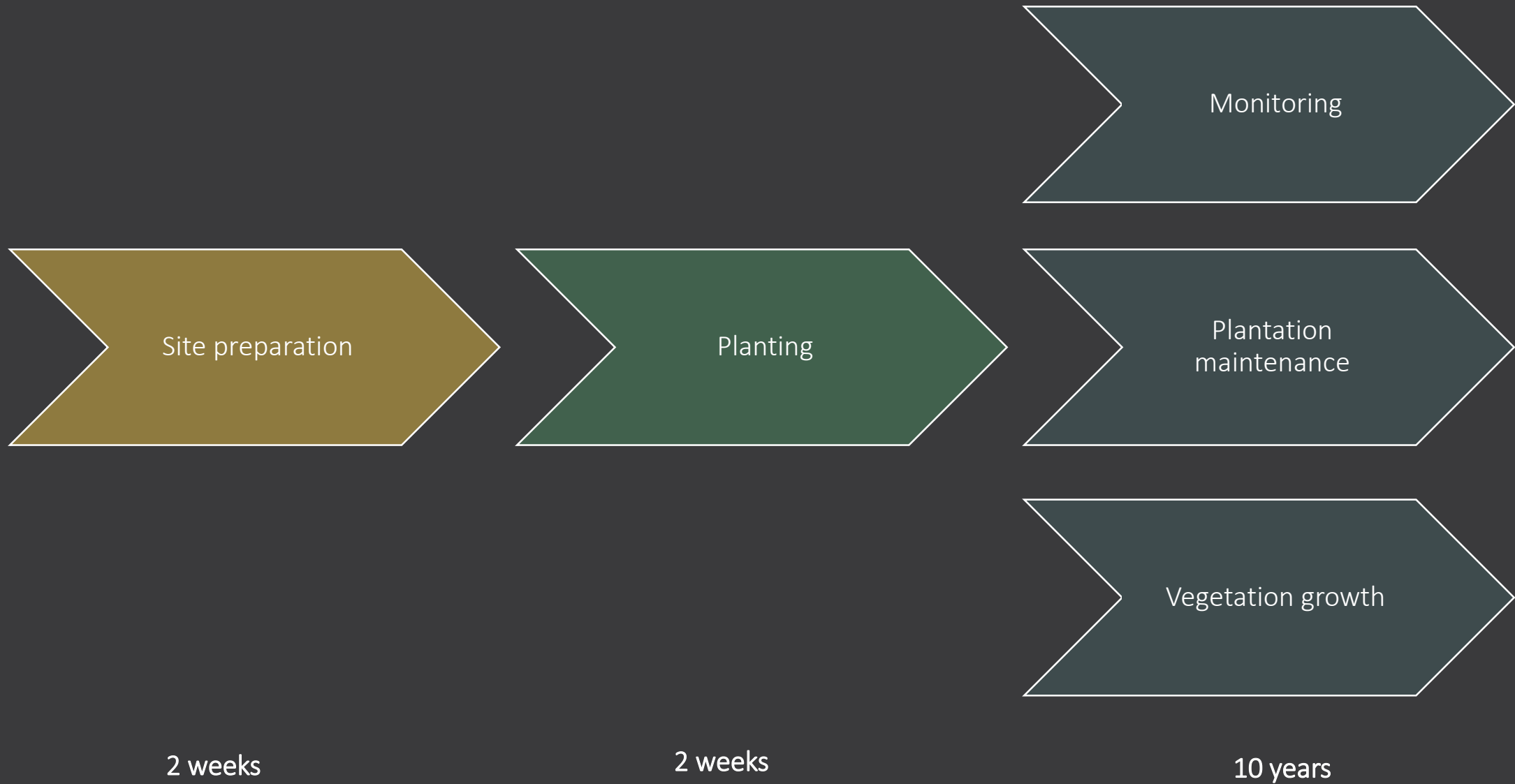
FUTURE SITE USE



RESTORATION COSTS

	Site preparation	Planting	Monitoring	Total per area
Storm basin	Initial budget 30 000€ (original basin)	10 000€ (pond)	(included in the lower part)	40 000€
Lower part	4 900€	5 500€ (material) 4 700€ (labor)	1 850€	16 950€
Upper part	5 100€	19 000€ (material) 89 000€ (labor)	1 850€	114 950€
Total per step	40 000€	128 200€	3 700€	Total cost 171 900€

TIMELINE

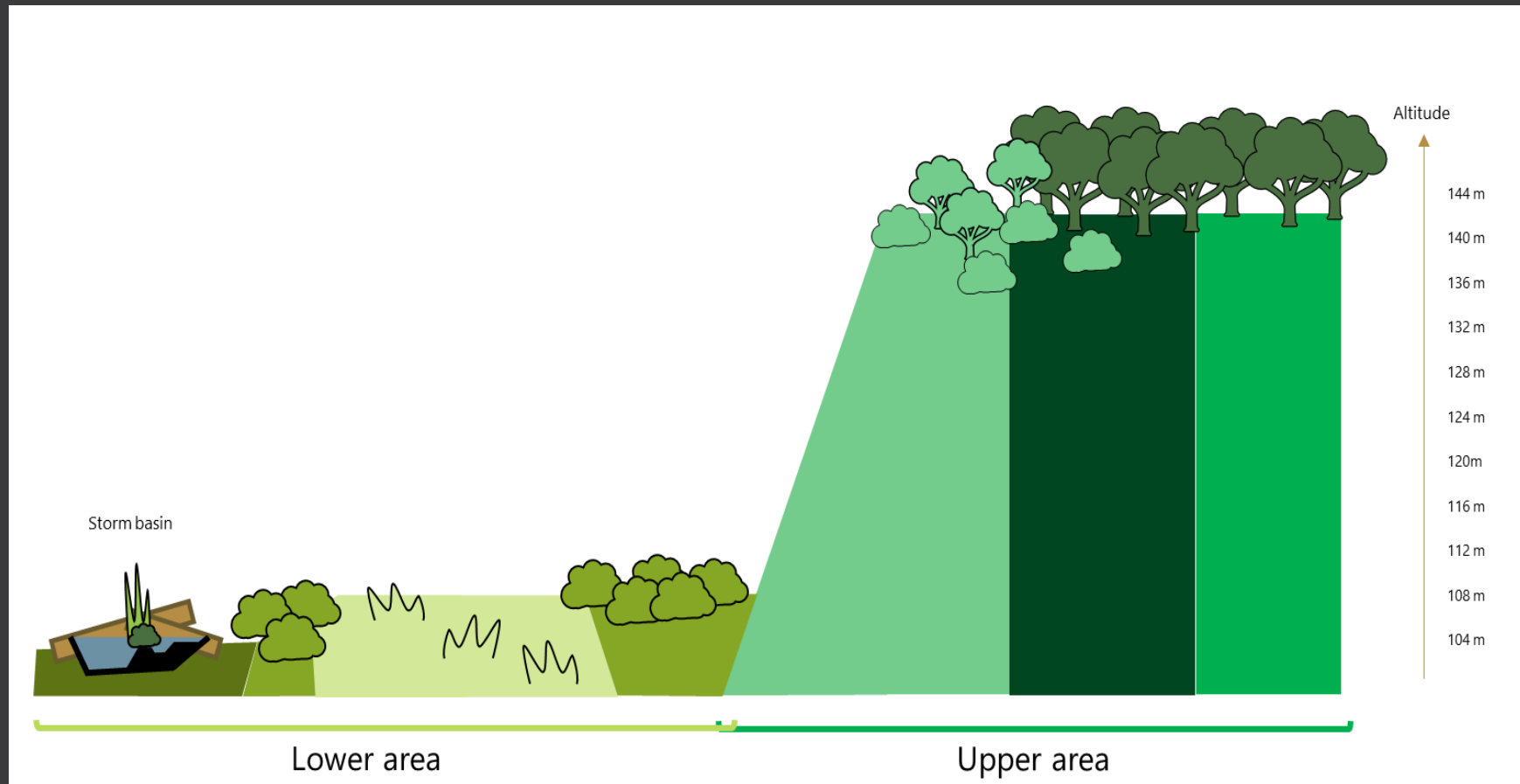


Conclusion



Final overview
Conclusion
Questions

FINAL OVERVIEW



Diversity

- ☒ Similar diversity and community structure in comparison w/ reference sites
- ☒ Presence of indigenous species
- ☐ Presence of functional groups necessary for long-term population

Ecological processes

- ☒ Elimination of potential threats
- ☒ Resilience to natural disturbances
- ☐ Self-sustainability

Vegetation structure

- ☒ Capacity of the environment to sustain populations
- ☒ Normal functioning
- ☒ Integration in the landscape

Thank you for your attention!