

# PLACEMENT: ZOOM ON THE ARC APPROACH AVOID - REDUCE - COMPENSATE

J. Gutleber (CERN)  
P. Boillon (Cerema)

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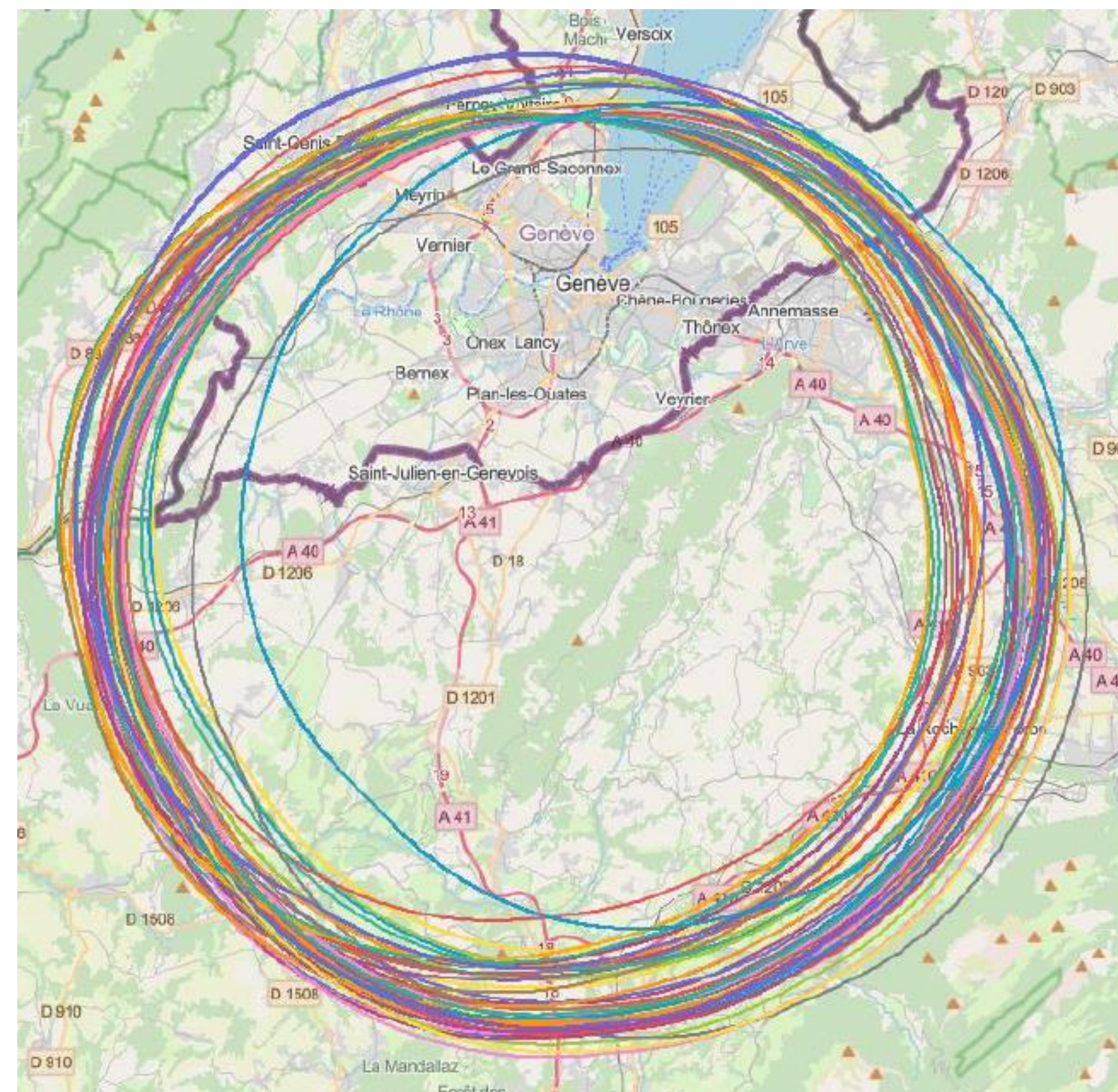
# Content

- **The FCC feasibility study**
- **FCC Placement: principle and method**
  - 3 main criteria
  - Focus on territorial issues : scope of analysis
  - Focus on territorial issues : global approach
  - Focus on territorial issues : plot level approach
- **Avoid Reduce Compensate approach**
  - Hierarchy principle
  - Main targets /definition
  - Classification
- **Avoid Reduce Compensate : a FCC declination**
  - How to avoid main impacts ?
  - How to reduce remaining impacts ?
  - How to anticipate potential compensation needs ?



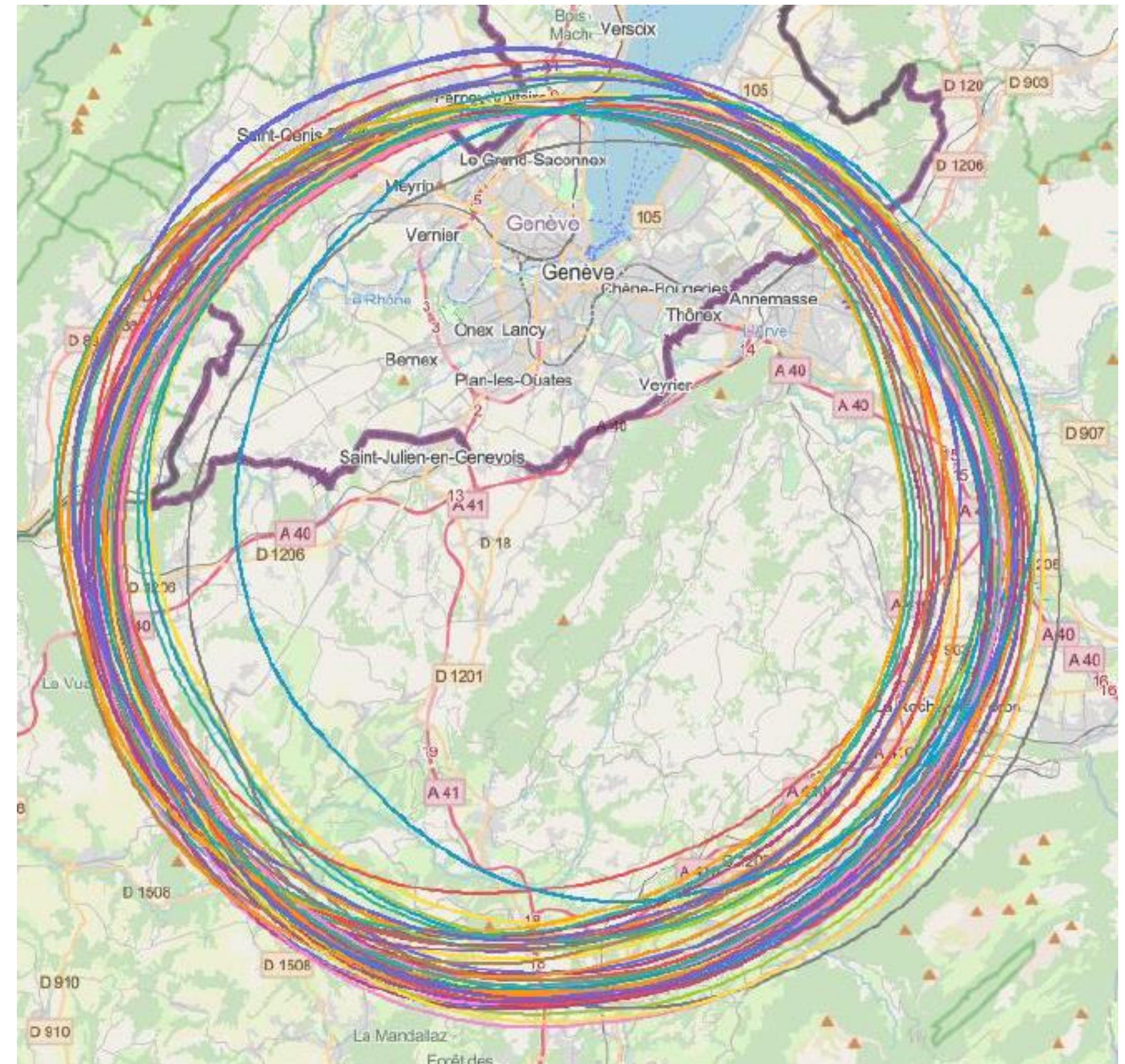
# Cerema

- Cerema is a French public engineering institution.
- Its mission is to bring knowledge, scientific and technical know-how and innovative solutions to territorial projects.
- From upstream to downstream of the project, Cerema has multidisciplinary cross-disciplinary expertise to help meet the challenge of sustainable development of territories.
- In the FCC study, Cerema provides, on a strictly technical level, its expertise and knowledge to the project owner, especially on territorial constraints and placement, and about environmental assessment.



# The FCC feasibility Study 2021 - 2025

- Optimize the **layout**, for the ring and the surface sites
- Prepare the **administrative processes** for a potential project approval with the Host States
- Optimize of the **colliders and theirs injector chains**
- Develop and document of the **technical infrastructure**
- Elaborate a **sustainable operational model** for the collider and experiments (human and financial needs, environmental aspects, energy efficiency)
- Consolidate **costs estimates** and **fundings**



Source: CERN

# Content

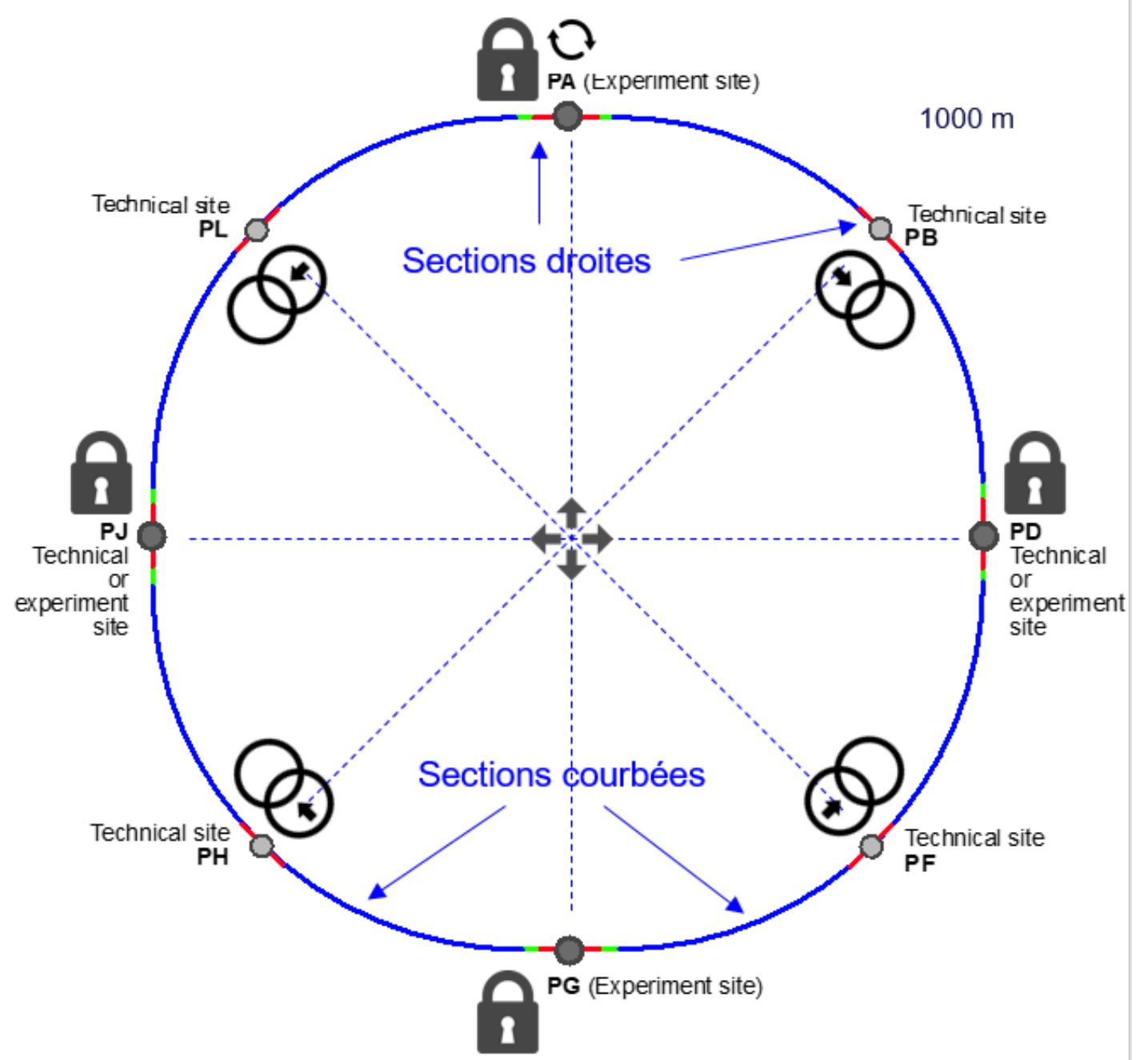
- **FCC Placement : principle and method**
  - 3 main criteria
  - Focus on territorial issues : scope of analysis
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  - Focus on territorial issues : plot level approach



# Placement: principle & method

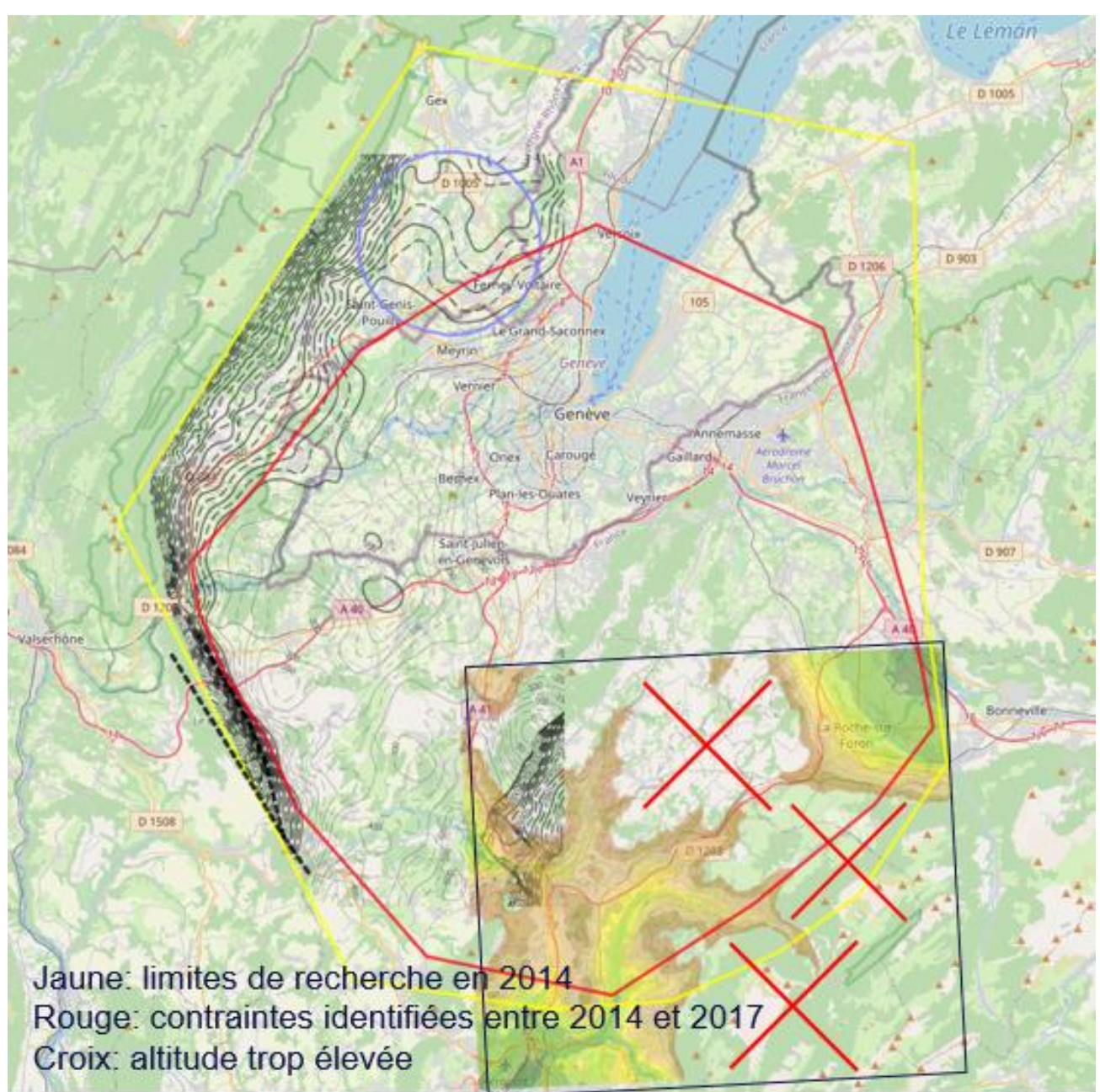
- Choices made according 3 main **criteria/requirements**

## Scientific



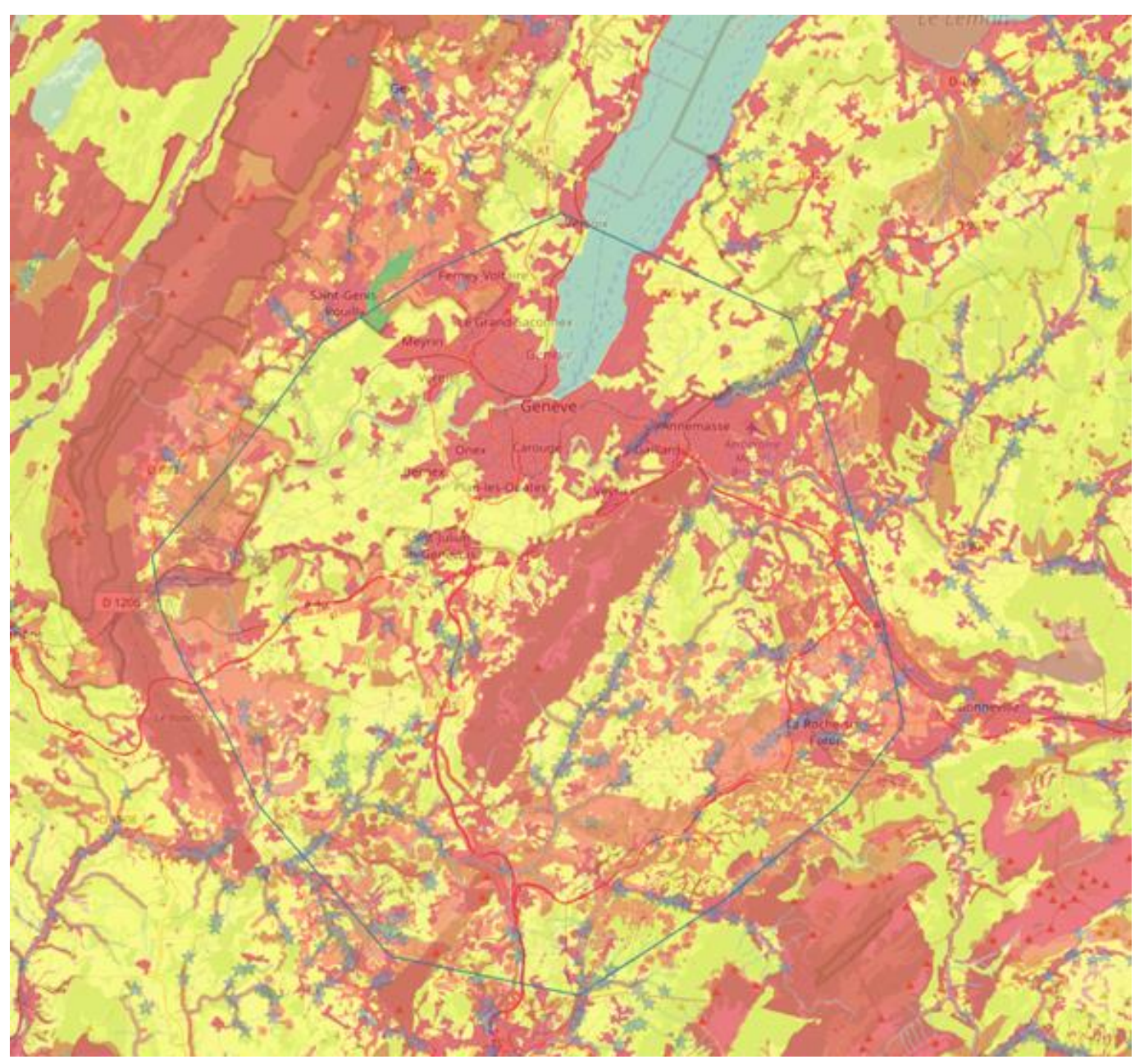
Geometric requirements for scientific performance

## Geological and topographical



Presence of faults, geological risks, too deep shafts, too high altitudes, difficult terrain, depths of the lake, unstable ground, subsurface water layers and many more...

## Territorials constraints known at this stage



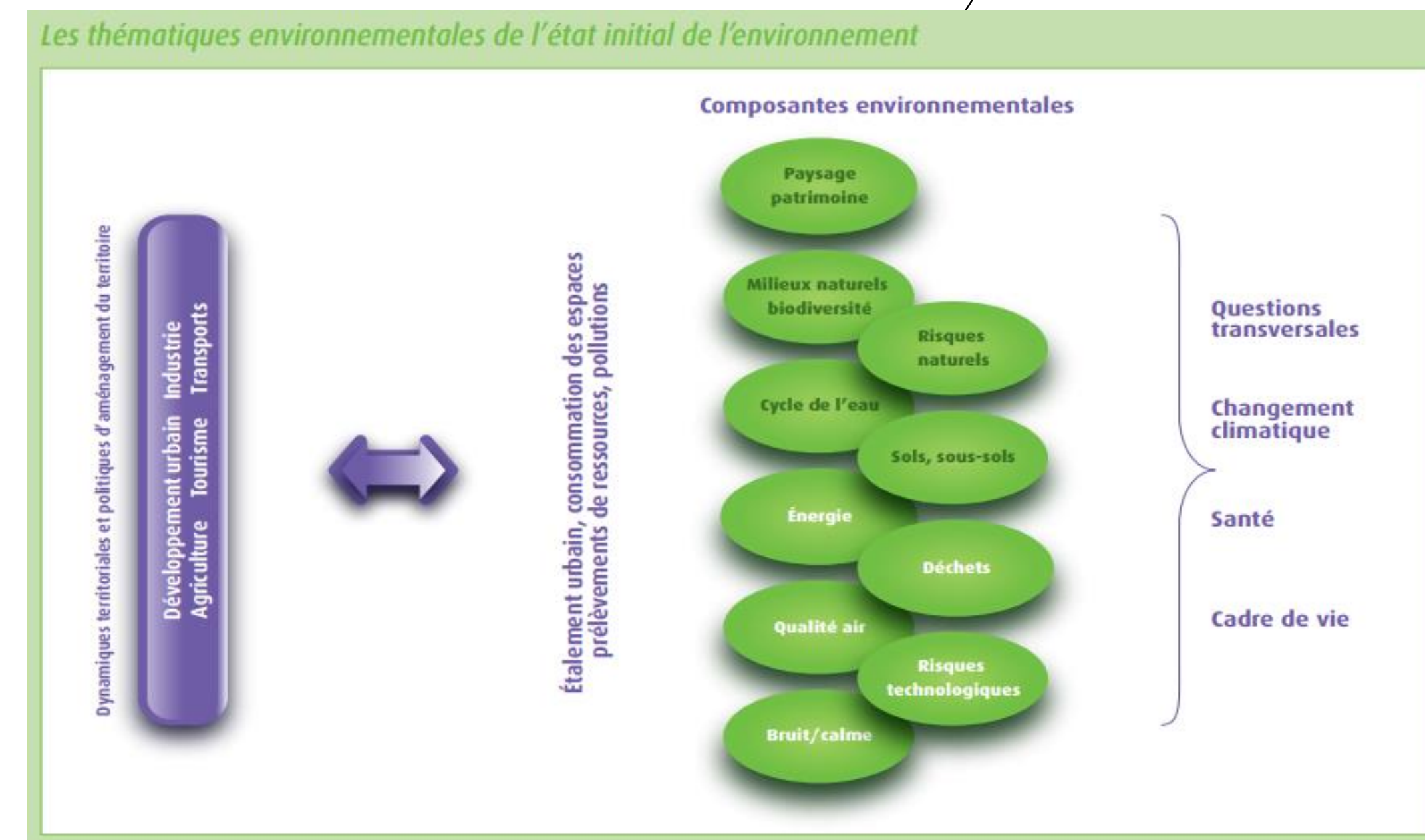
Avoid-Reduce-Compensate approach  
Vigilance on the agricultural aspects, the economic and human dimension...

# Placement: principle & method

## Focus on territorial stakes – Scope of analysis

To identify and characterise the environmental stakes of the territory requires an **in-depth knowledge of the territory**. The analysis covers several « chapters », among them the following high-priority ones :

- **Physical environment** : water, climate or soil and subsoil
- **Natural environment** : threatened or rare biodiversity, ecosystem services
- **Human environment** : health and air, risk and safety, displacement of population and effects on livelihoods or activities (urban planning, agriculture), tangible and intangible cultural heritage, landscape,



Source : CGDD Evaluation environnementale des documents d'urbanisme, édition 2020

### Les champs à étudier dans l'évaluation environnementale concernant les incidences notables directes ou indirectes du projet, plan ou programme sur l'environnement

(Extrait de l'article L. 122-1 du code de l'environnement)

- « 1° La population et la santé humaine ;
- 2° La biodiversité, en accordant une attention particulière aux espèces et aux habitats protégés au titre de la directive 92/43/ CEE du 21 mai 1992 et de la directive 2009/147/ CE du 30 novembre 2009 ;
- 3° Les terres, le sol, l'eau, l'air et le climat ;
- 4° Les biens matériels, le patrimoine culturel et le paysage ;
- 5° L'interaction entre les facteurs mentionnés aux 1° à 4°. »

Source : Code de l'environnement – French environmental Law

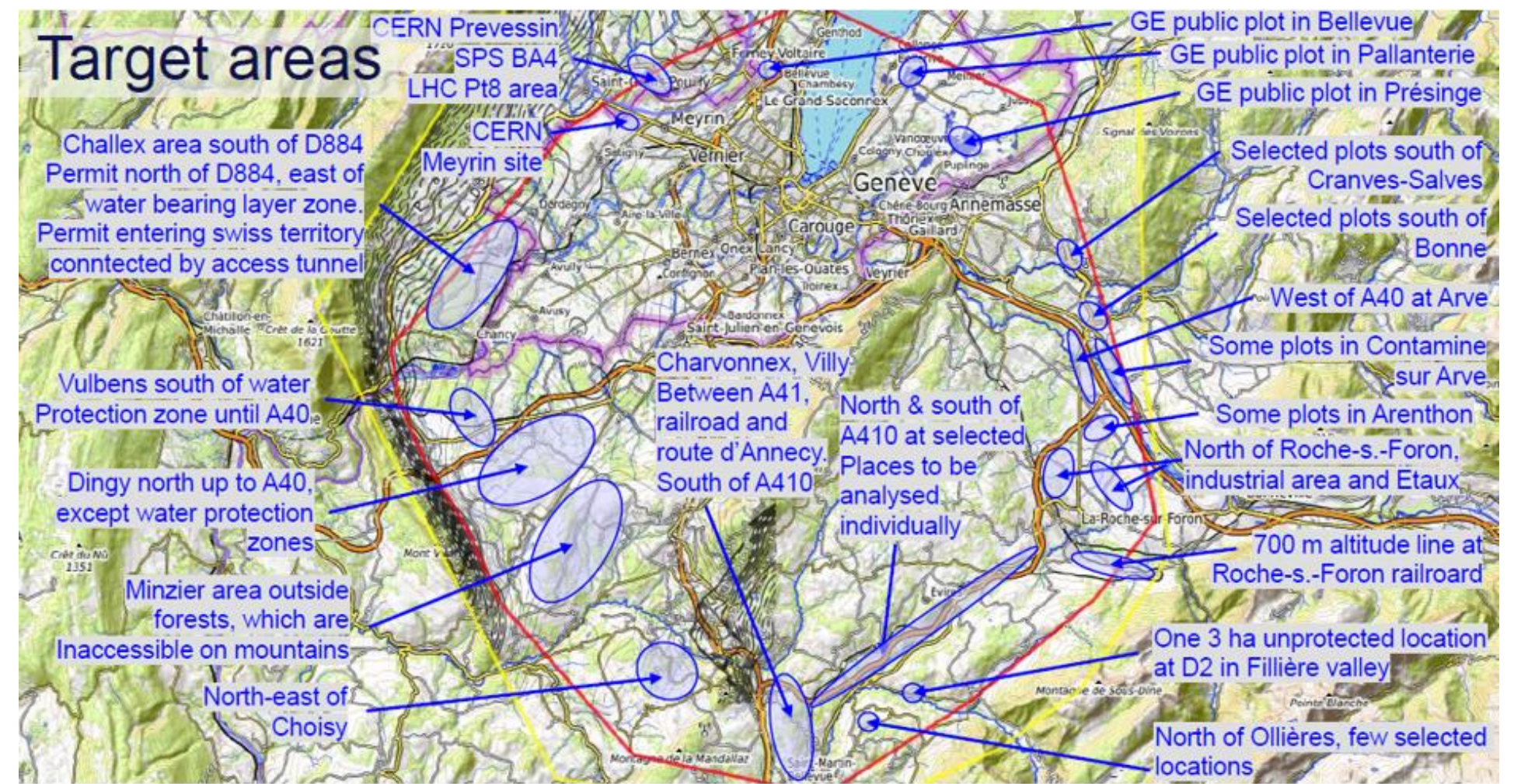
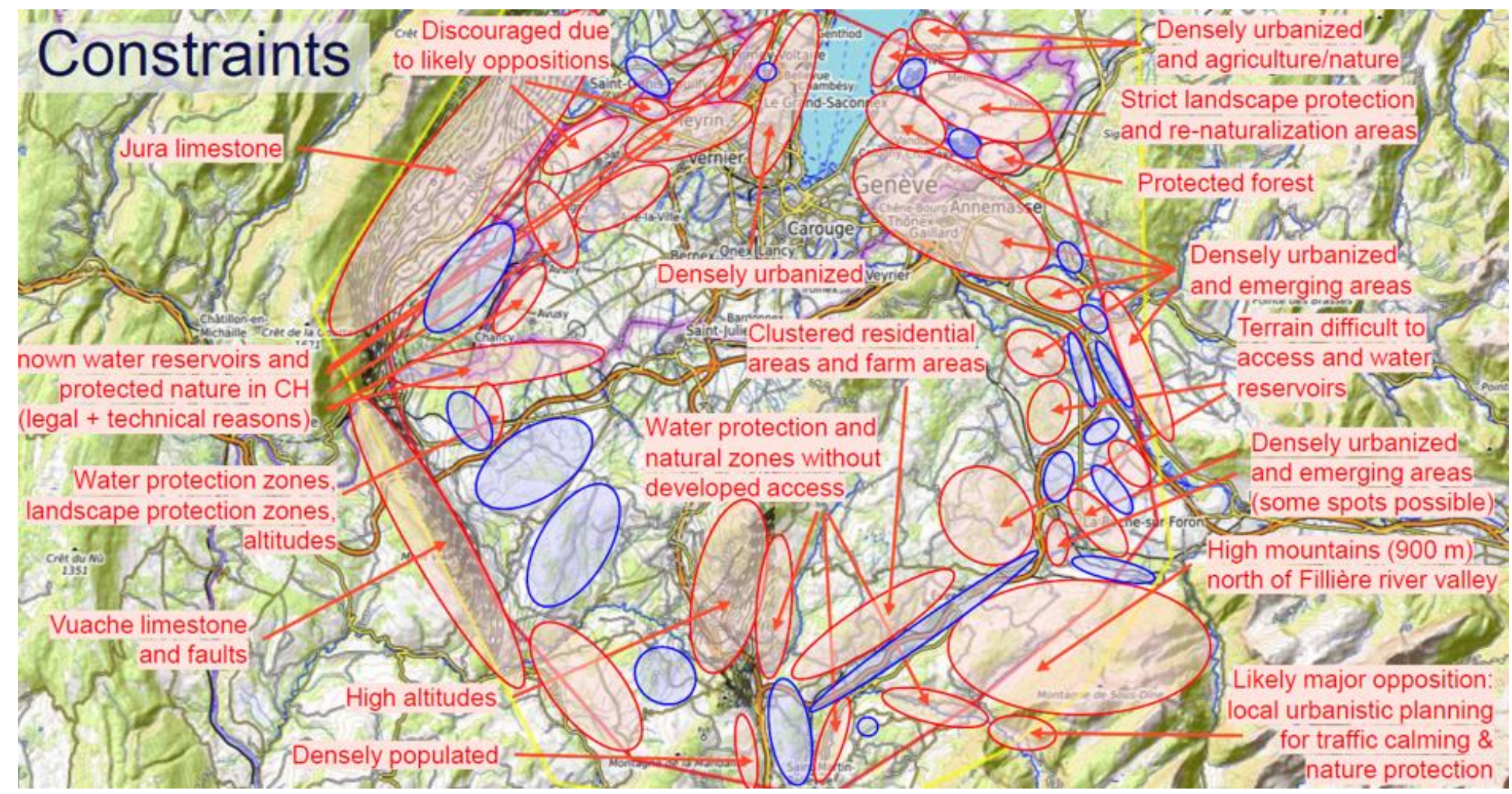
# Placement: principle and method

## 2 scales: global and local

- ✓ Optimise the **layout** for the ring
- ✓ **Global analyses** of environmental stakes and opportunities

urbanization  
protection  
health forest human industries  
risk  
agriculture water  
biodiversity

access railroad road  
unprotected  
ressources  
energy



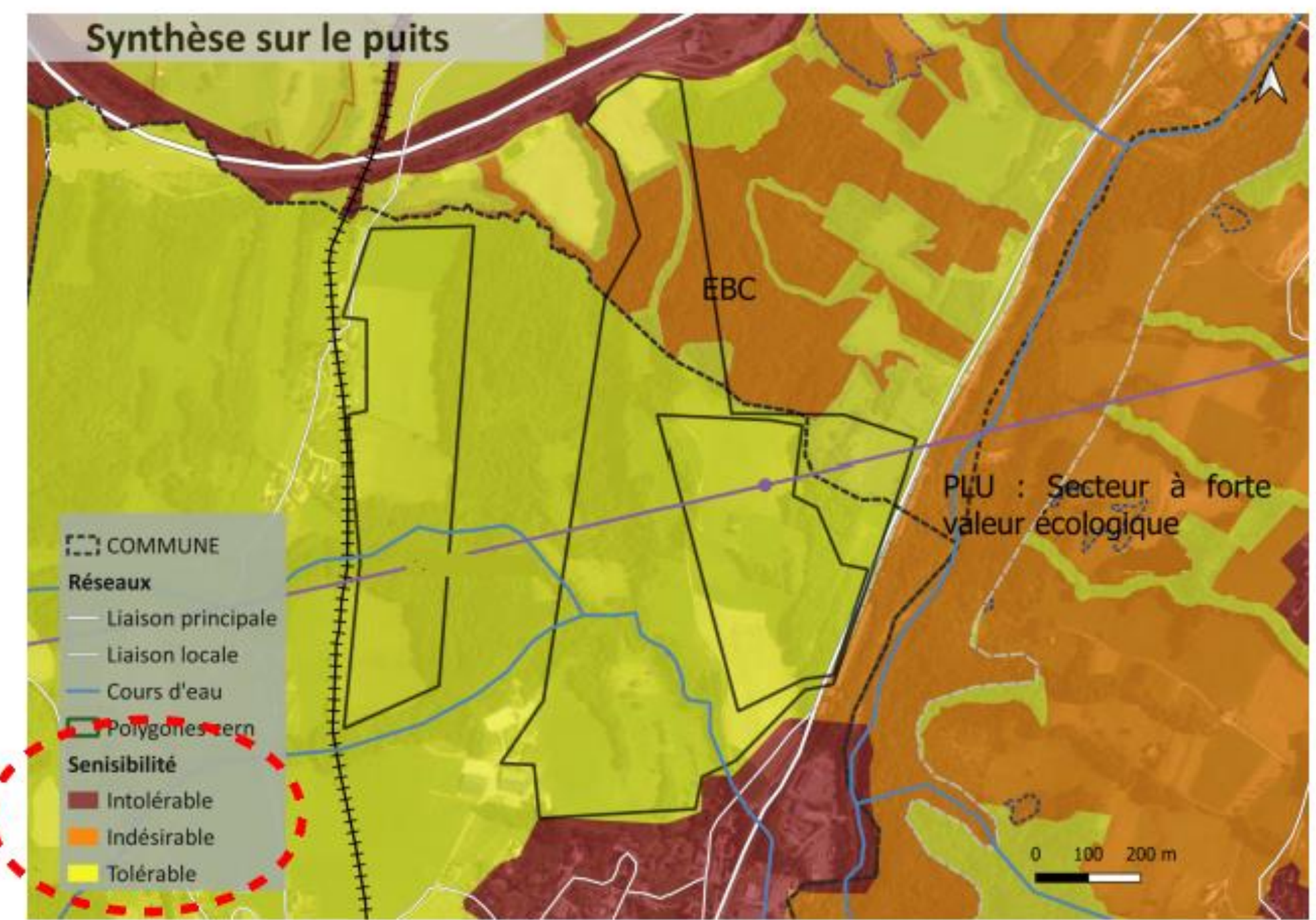


# Placement: principle and method

## 2 scales: global and local

- ✓ Optimise the **layout** for surface sites
- ✓ **Plot analyses** of environmental issues

*Globalised environmental issues at plot scale*



Virtual example from FCC work  
Source : Cerema

# Content

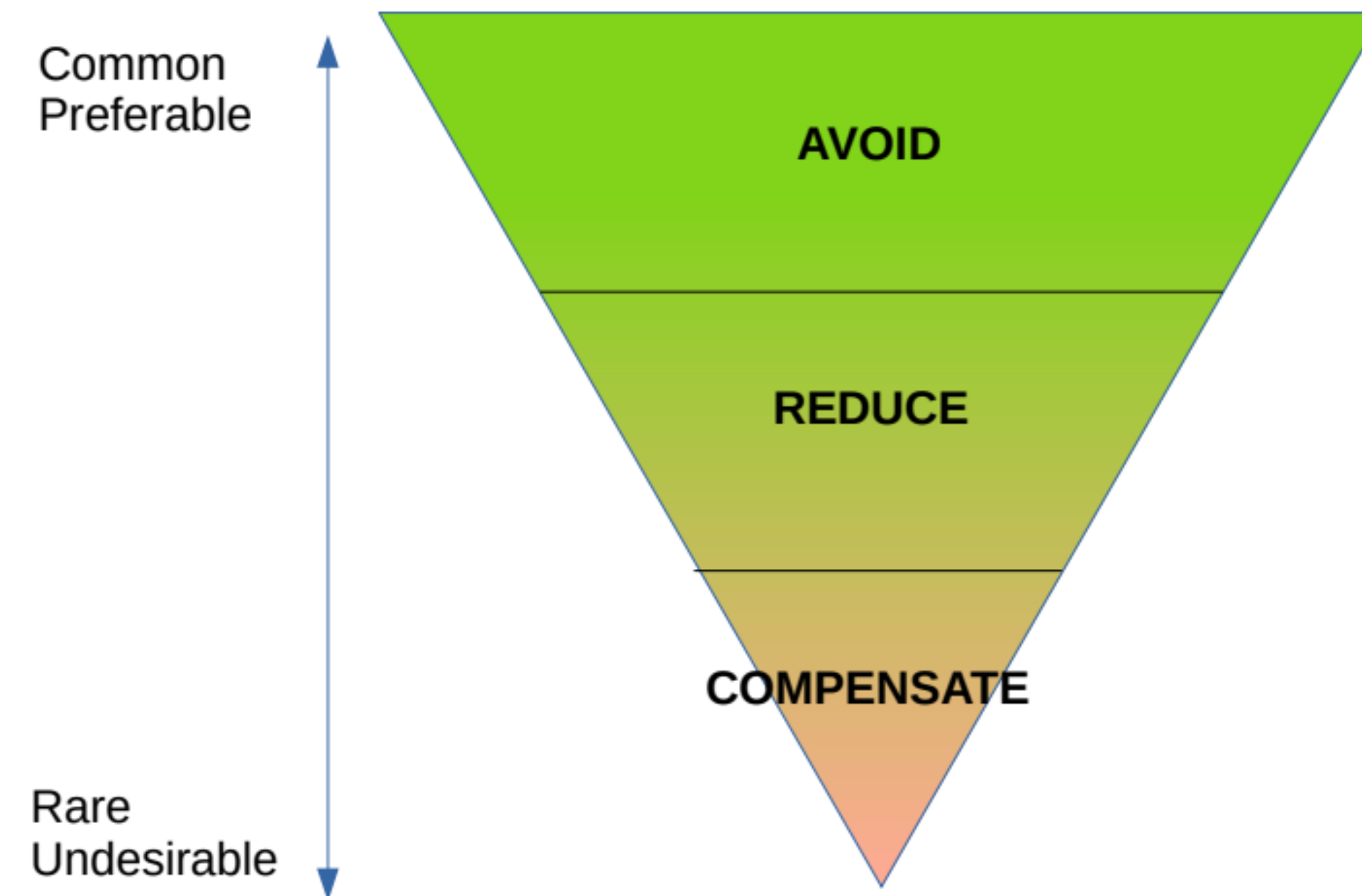
- **Avoid Reduce Compensate approach**
- Hierarchy principle
- Main targets /definition
- Classification



# Avoid Reduce Compensate Approach

## Hierarchy principle

- Approach included in the impact assessment methodology (= principle of the French Law, as an **implementation of a EU directive**)
- As part of the impact assessment : it includes **all project components of the project** (access, related infrastructures, construction phase, water and electricity requirements....) ; it includes **all scope of environmental analysis** (physical, natural and human environment)
- It must respect the **hierachy principle**



*Hierachy Principle for ARC approach*  
 Source : Cerema

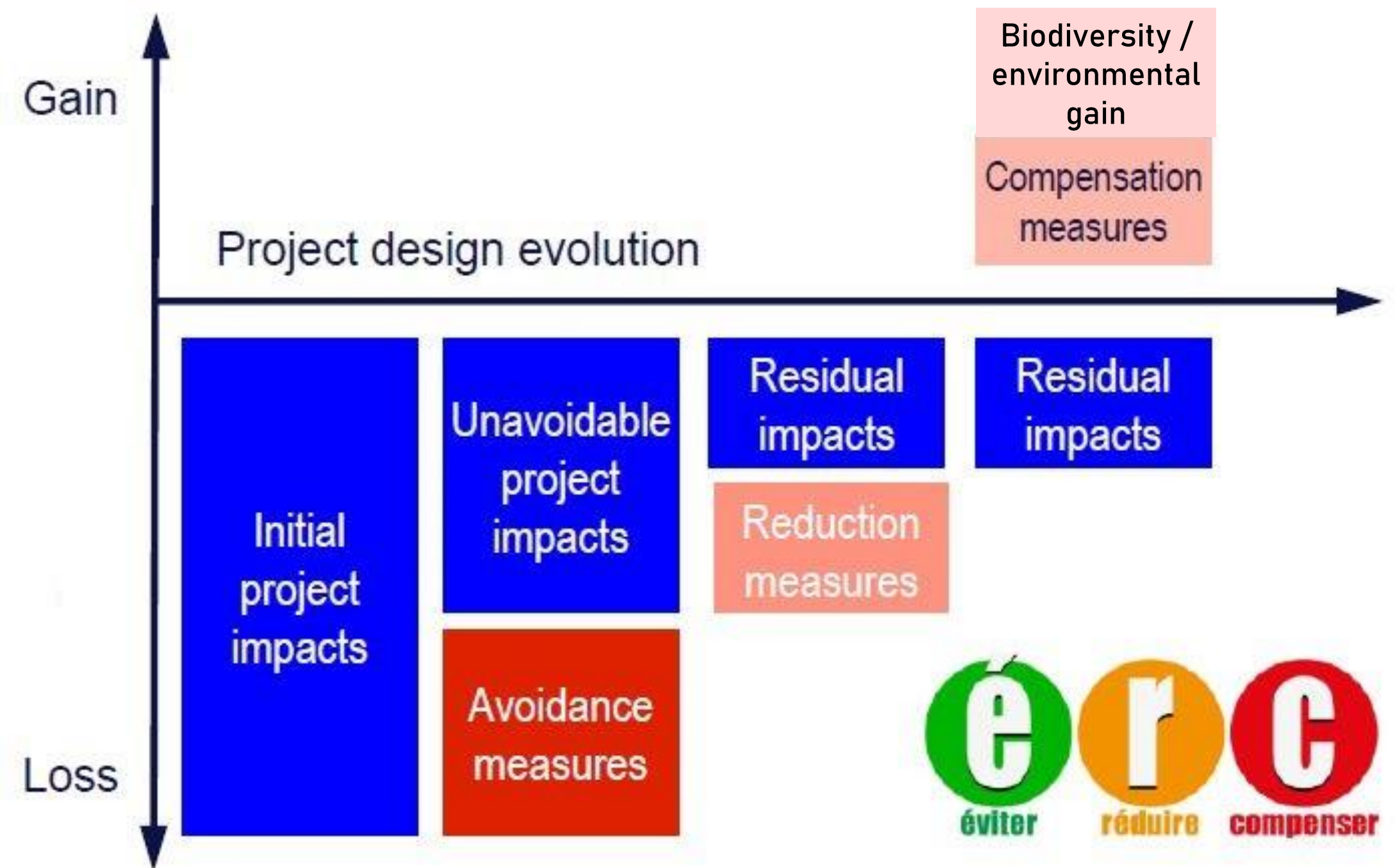
# Avoid Reduce Compensate Approach Definition

## An iterative 3 steps approach

**Avoid:** measures taken to **avoid creating impacts** from the outset or set aside key conservation areas / **delete a potential impact**

**Reduce:** measures taken to **reduce the intensity and/or extent of impacts** that cannot be completely avoided

**Compensate:** measures taken to **compensate for any significant residual, adverse impacts** that cannot be avoided, reduced and/or restored

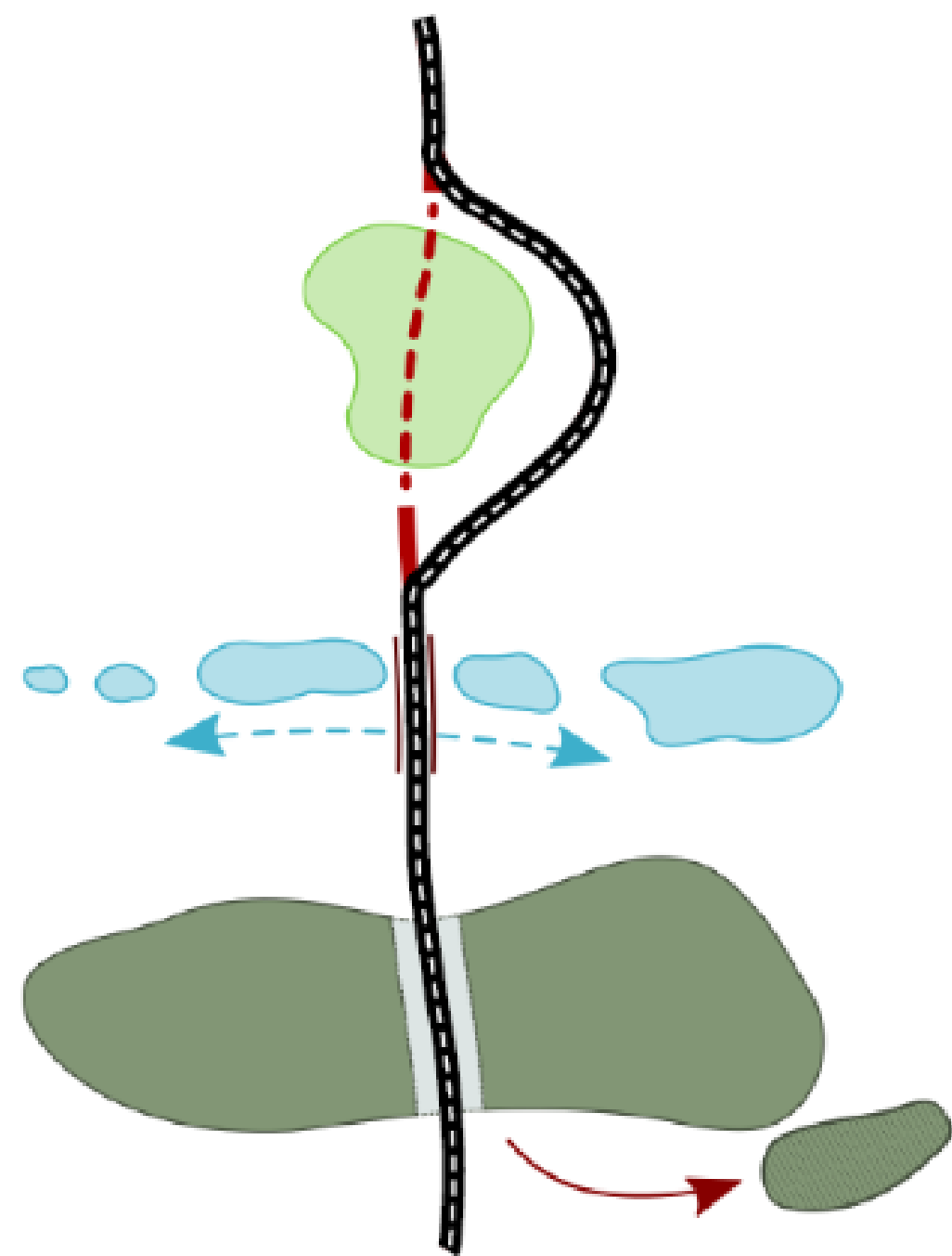


Source: CERN

# Avoid Reduce Compensate Approach Classification

If FCC were a road infrastructure....

1  
2  
3



## Avoid

- opportunity choice (=upstream choice)
  - geographical avoidance
  - technical avoidance
  - temporal avoidance
- To be considered for both construction and operation phases*

## Reduce

- geographical reduction
  - technical reduction
  - temporal reduction
- To be considered for both construction and operation phases*

## Compensate

- Only for any significant residual, adverse impacts that cannot be avoided, and/or reduced.**
- Criteria for valid compensating measures :*
- equivalence
  - faisibility
  - efficiency

Source : Cerema - CTT 18 et 19 novembre 2021 – C.Bigard

# Content

- **Avoid Reduce Compensate: a FCC declination**
- How to avoid main impacts ?
- How to reduce remaining impacts ?
- How to anticipate potential compensation needs ?

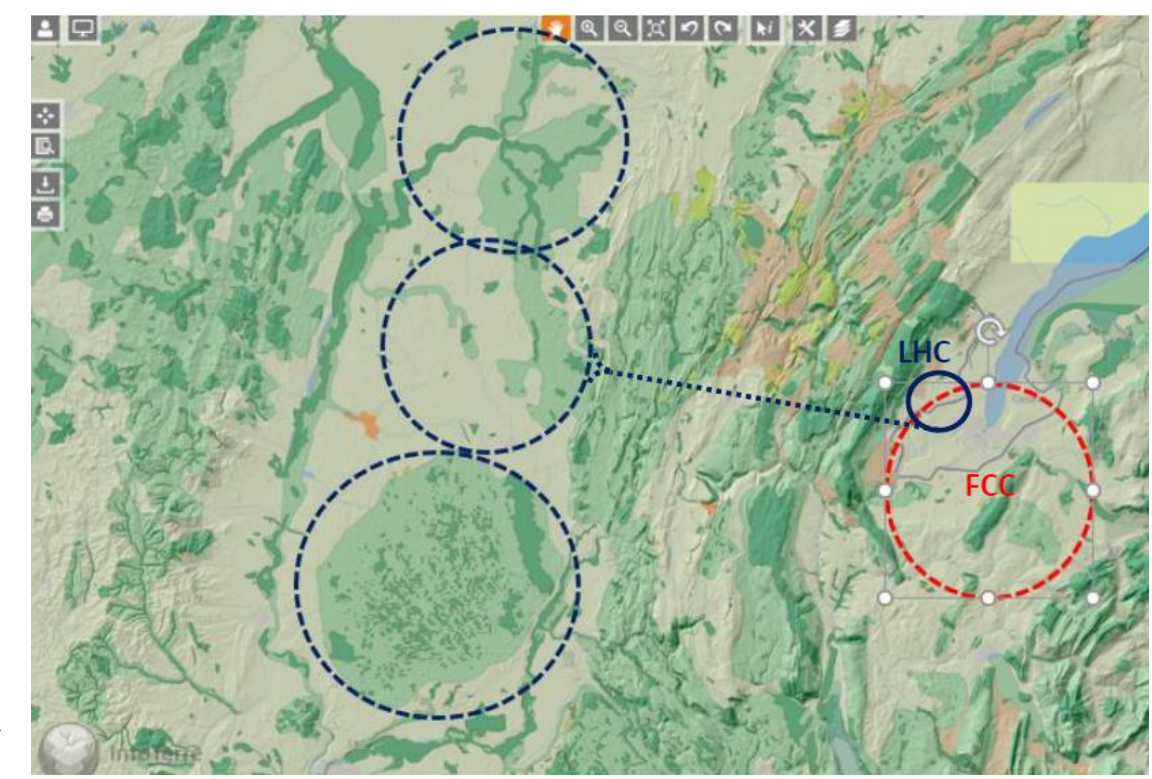


# Avoid – Reduce – Compensate – FCC declination

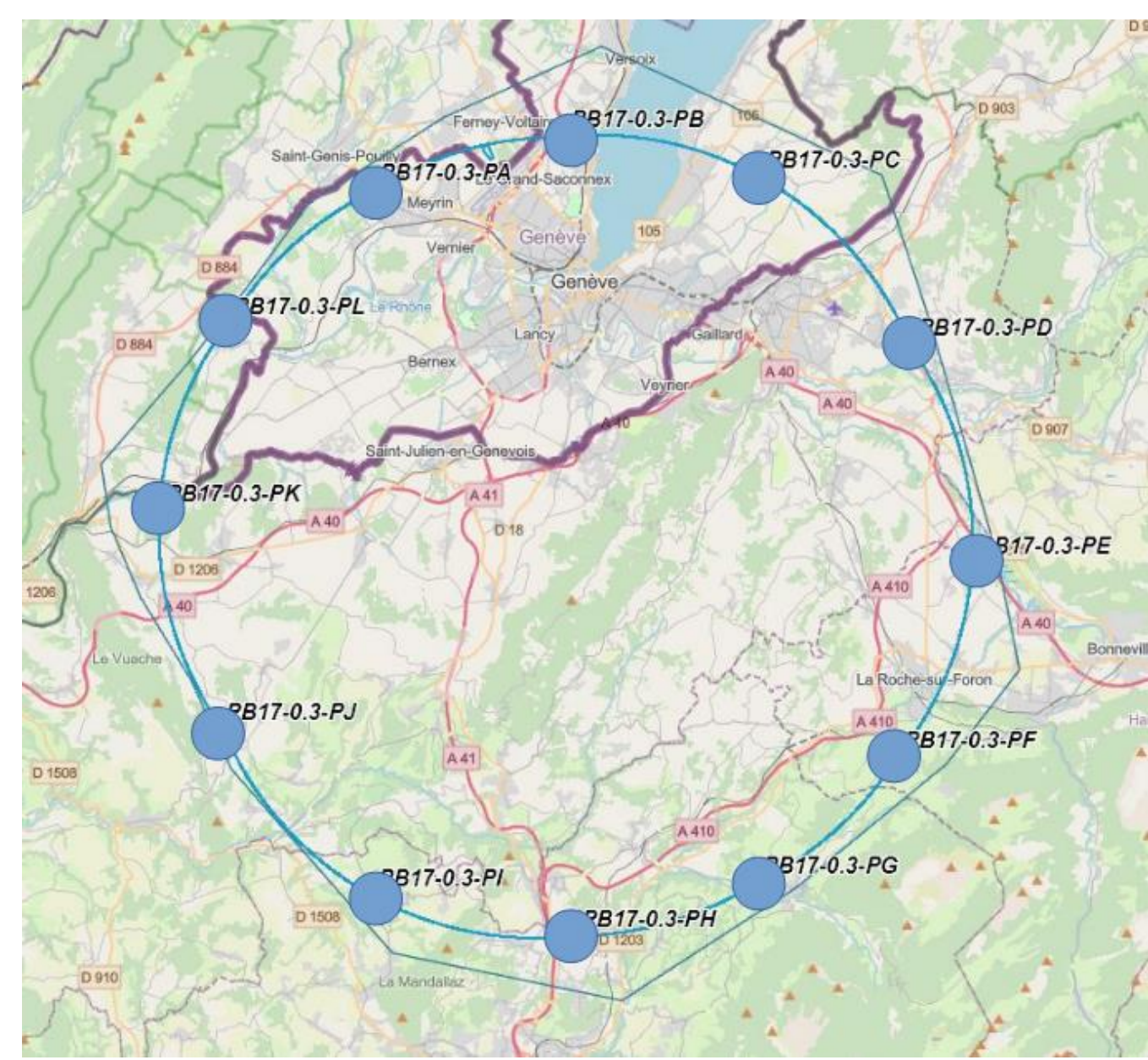
## How to avoid impact ? Upstream choices

Many (several hundreds) scenarios analysed:

- Trans-Jura variants examined,
- Switch from 12 to 8 surface sites for both scientific and ARC reasons:
  - Easier geometry, possibility for up to 4 experiment site for FCC-ee
  - Too difficult to find suitable placement for inflexible 12 site layout
- = Right upstream choices



Placement illustrations only

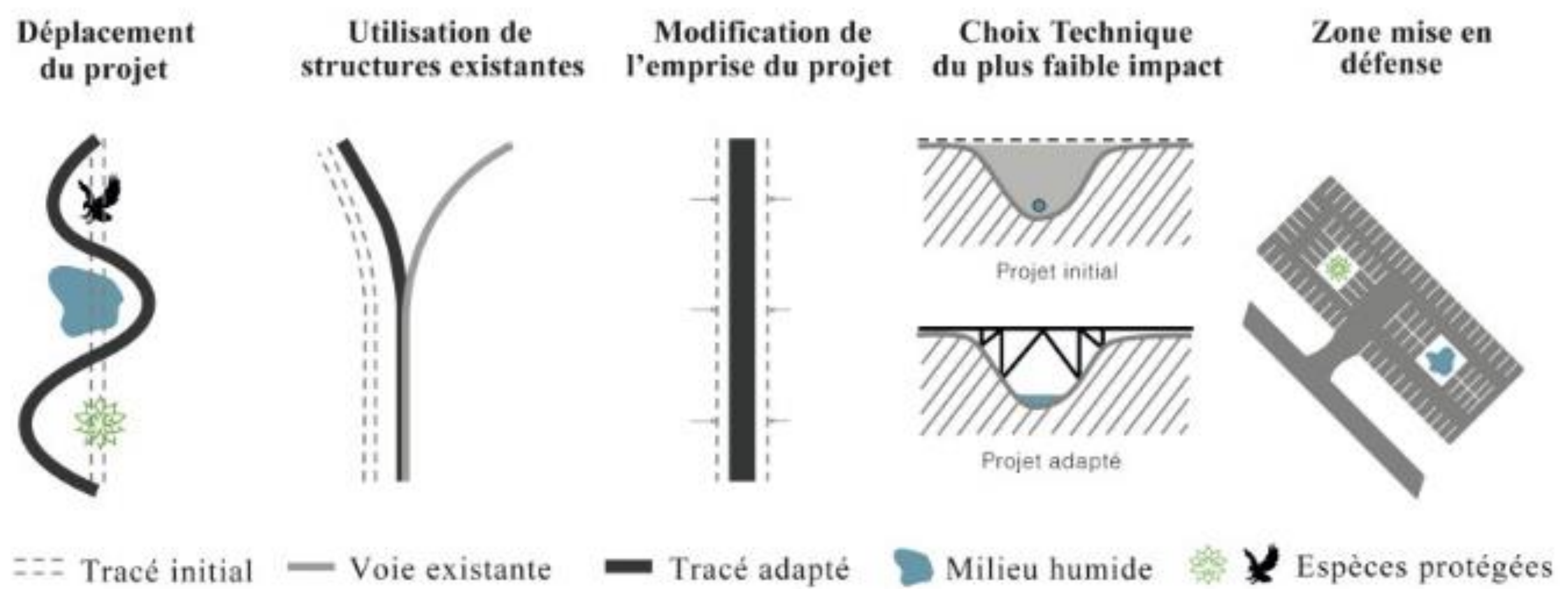


# Avoid – Reduce – Compensate – FCC declination

## How to avoid impact ? Technical choices

If FCC were a road infrastructure.....

Illustration des 5 mesures qualifiées d'évitement utilisées pour l'étude



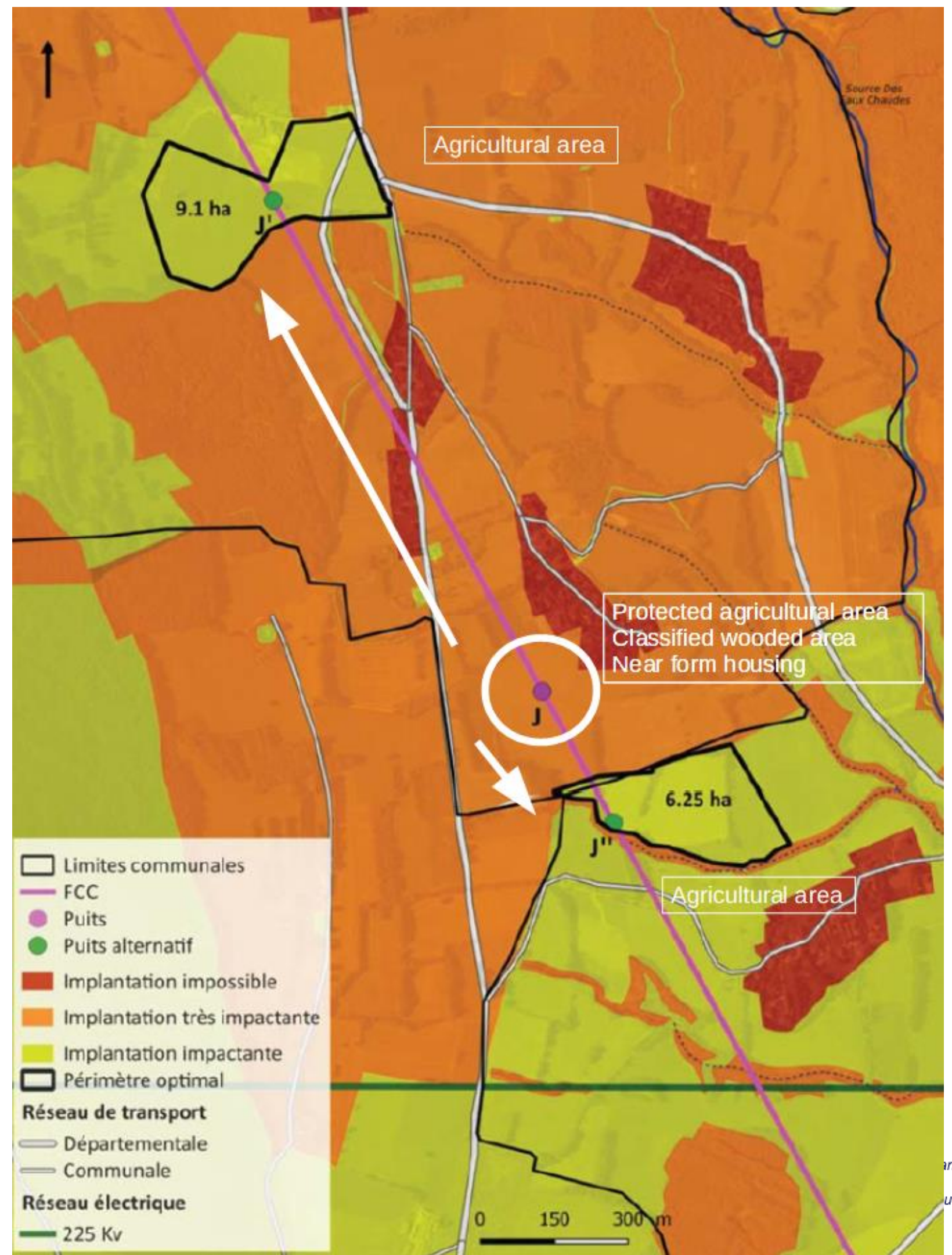
Source : CGDD - Évaluation environnementale  
La phase d'évitement de la séquence ERC  
Actes du séminaire du 19 avril 2017



# Avoid – Reduce – Compensate – FCC declination

## How to avoid impact ? Technical choices

Initial and alternative locations



Iterative improvement on all criteria

	D	D'	E	E'	E''	F	F'	G	H	H'	I	I'	I''	J	J'	J''	K	K'	K''
Captage eau potable : périmètre rapproché																			
Zone rouge PPRN																			
Inventaire régional des tourbières																			
Zone NATURA 2000 : ZSC et ZPS – Habitats ou espèces prioritaires																			
Arrêté de protection de biotope : APPB																			
Confit avec le réseau routier principal et ferroviaire																			
Confit avec ouvrages souterrains existants : Servitude I1 Pipeline d'intérêt général																			
Confit avec zones denses construites avec des logements																			
ZNIEFF de type 1																			
Inventaire Zones humides																			
ZICO																			
Espace boisé classé																			
Zonage agricole protégé au titre de l'intérêt paysager ou écologique																			
Captage d'eau potable : périmètre éloigné																			
Réservoirs de biodiversité du SRCE																			
Monuments historiques protégés au PLU																			
Zones agricoles non protégées																			
Forêts non protégées																			
Corridors écologiques SRCE																			
ZNIEFF de type 2																			
Zone bleu ou blanche PPRN																			
Servitude PT1 : protection																			



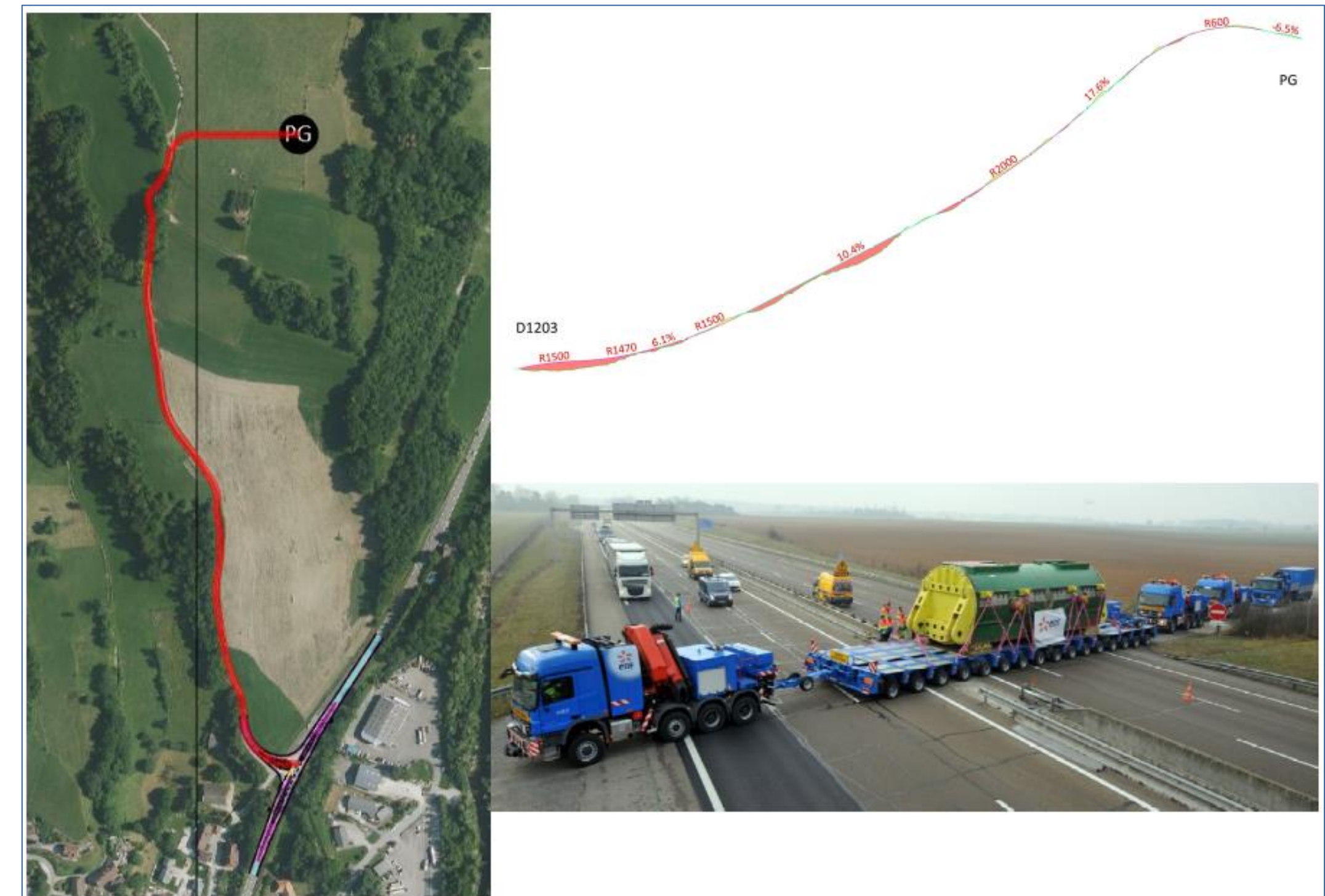
...in Union's Horizon 2020 research and innovation programme under grant No 951754. The information use that may be made of the information.

# Avoid – Reduce – Compensate – FCC declination

## How to avoid impact ? Technical choices

6 % slope, but too much consumption of real-estate is considered a too strong impact

15 % slope, less land-use impact and use of existing path, but requires specific transport devices (tractor/pusher)



# Avoid – Reduce – Compensate – FCC declination

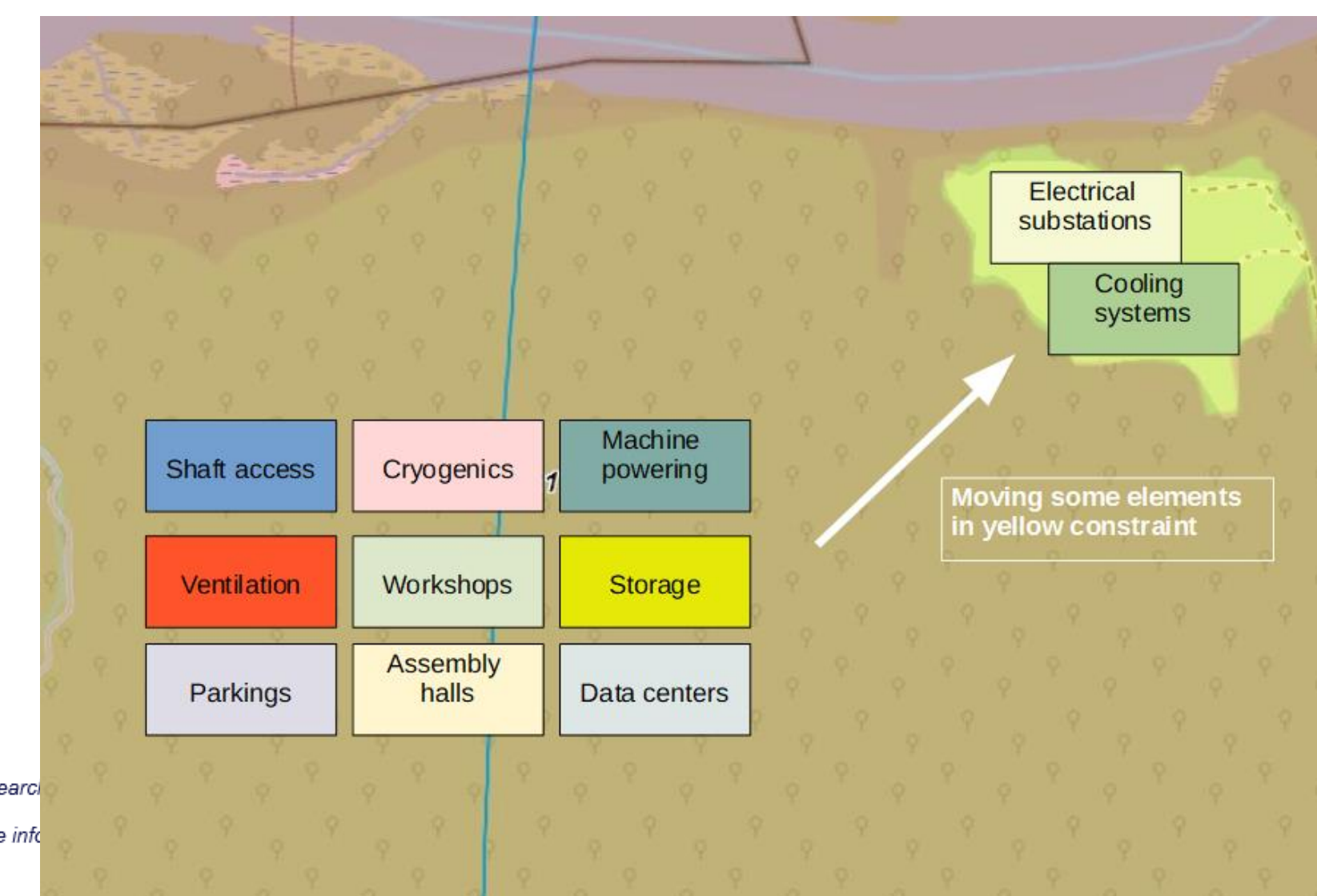
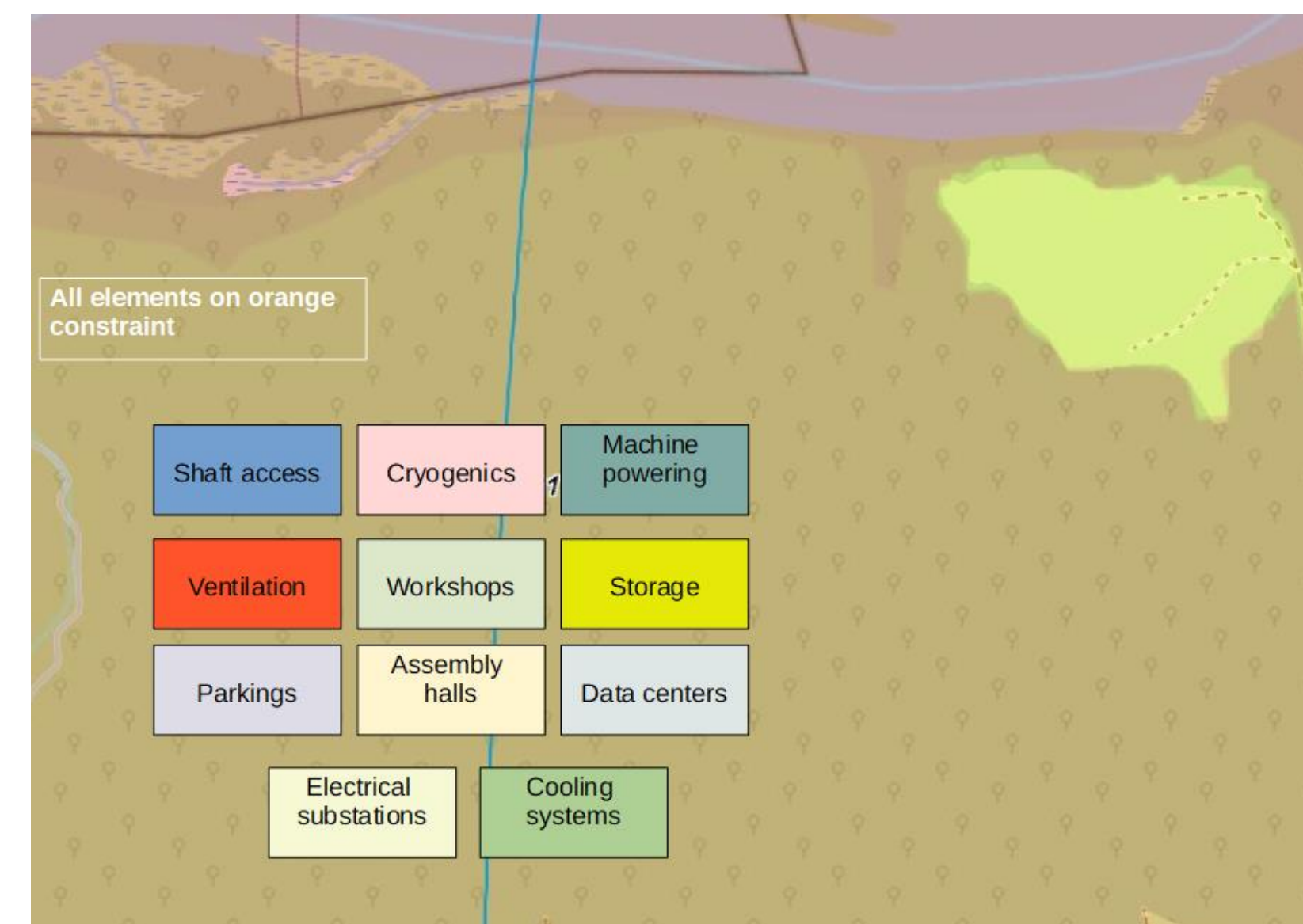
## How to avoid impact ? Surface sites

Upstream choice must **avoid strategic areas** such as :

- High biodiversity areas (Natura 2000 sites, existing protected natural sites,...)
- Strategic resources (ex : drinkable water sector, high valuable agriculture areas...)
- Populated areas (urban sectors)
- ....

**Technical measures** to avoid potential impacts on surface sites :

- **Constant optimisation work** : to reduce size of the technical elements. Example : 3 shafts initially needed reduced to 2 shafts
- **Moving parts of the FCC** : remote electrical transformers, or cooling system to avoid sensitive areas



# Avoid – Reduce – Compensate – FCC declination

## How to reduce impact ? Landscapes

**Landscapes** were in the scope of the analysis (among many other criteria) :

- Avoid great and open landscapes on the hills,
- Prefer placing surface site in the valleys, near other infrastructures



*Significant visual impact on the hill*



*Less impact in the valley*

# Avoid – Reduce – Compensate – FCC declination

## How to reduce remaining impact ?

**Examples** during construction phase :

- Use existing roads and paths
- Optimize **extracted materials management** (re-use extracted materials) & their disposal (by train or waterways)
- Technical reduction during construction phase such as **optimisation of machine traffic, temporary sanitation, preventive scaring** of identified fauna species, **strict protection** of animal and plant species in the work area, **adapt the construction calendar** to the annual life cycle of the species, etc.



*Watering to avoid dust*



*Fences to protect sensitive areas*



*Improved extracted material management*



*Artificial nests near the project*



*Fences to protect sensitive areas*

# Avoid – Reduce – Compensate – FCC declination

## How to anticipate potential compensation needs ?

### Biodiversity compensation mechanisms measures are strictly regulated by French law

Main objective : to guarantee measures that are close to the affected sector, effective and sustainable.

*Examples of potential measures :*

- *Restoration or rehabilitation of natural environments (ecological engineering)*
- *Reseeding of degraded environments, creation/restoration of hedges, restoration of ecological corridors, development of shelters or shelters for wildlife*



*Restoration of environment by removing invasive species*



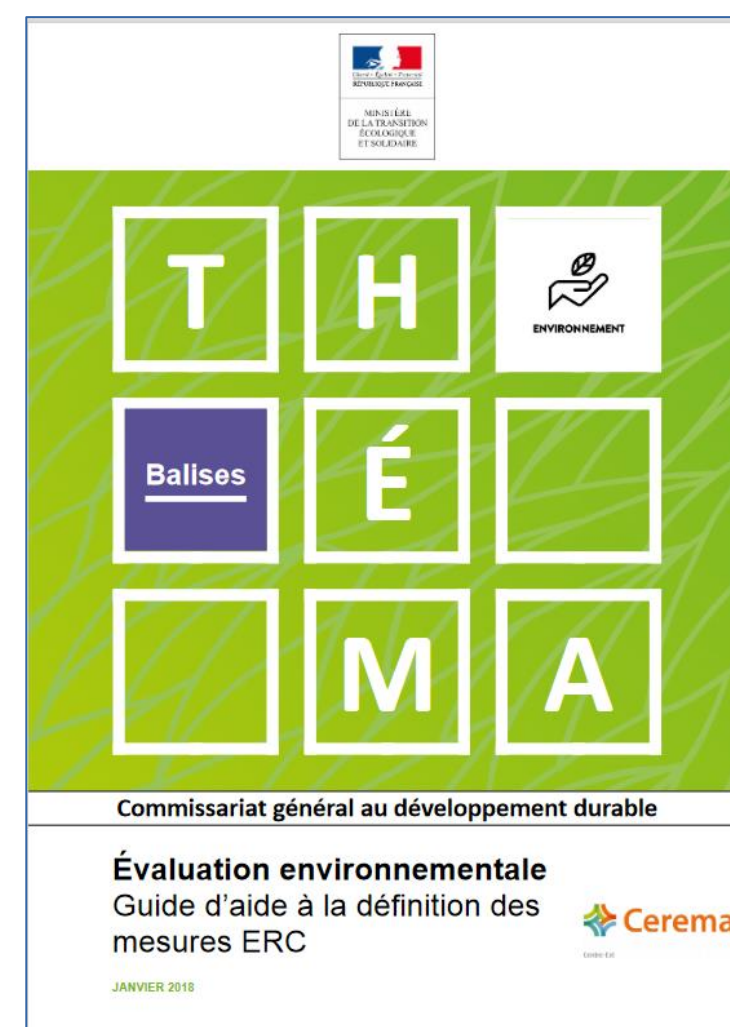
*Rehabilitation of a degraded area*



*Creation of islands for the restoration of a water body*

# Bear in mind

- Relevant measures *to avoid-reduce-compensate environmental impacts* rely on :
  - In-depth territory knowledge
  - Constant legal and technical watch, because *territory evolves without stop...and regulation and technical means always make progress*
- Guidelines help





THANK YOU FOR YOUR ATTENTION