



TERRITORIAL PLACEMENT ANALYSIS AND PROGRESS

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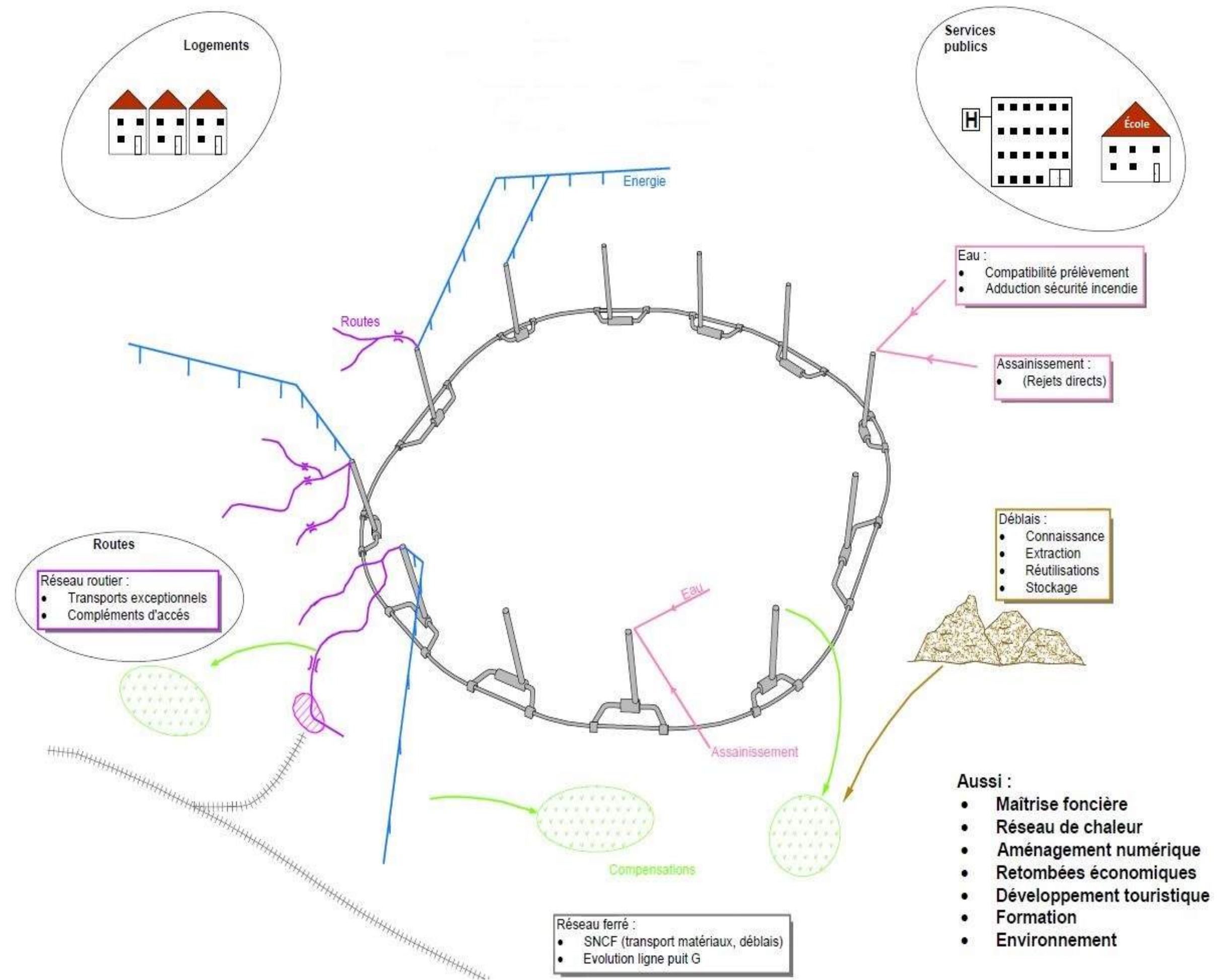
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- **Iterative work**
- **A work in progress WP3**



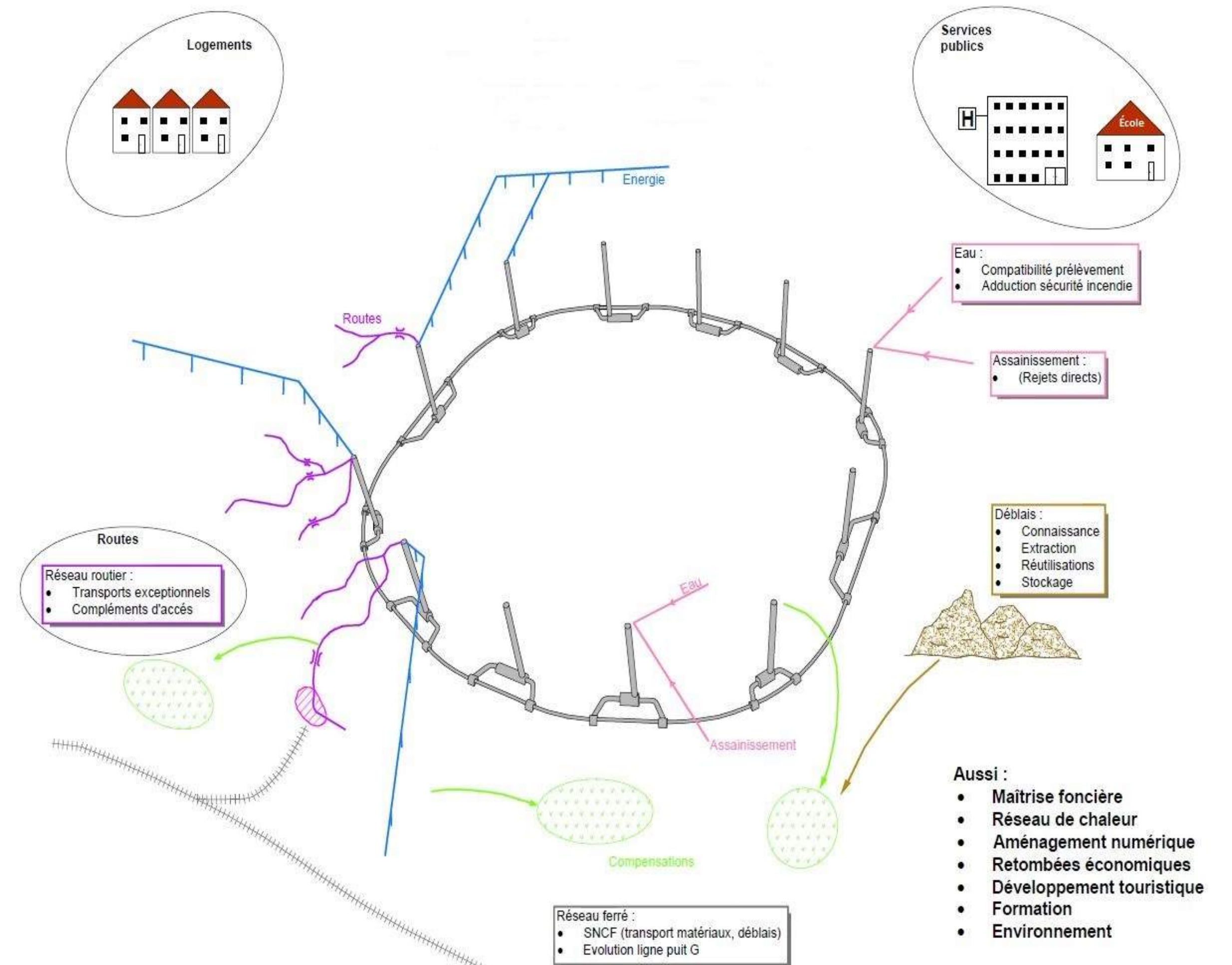
The project and associated impacts

- The legal frame in Europe and France requires a definition of the project scope with a global approach
- 3 main actors are involved :
 - ◆ CERN
 - ◆ The French and the Swiss States
- 3 main components of the project are therefore identified
- A research infrastructure project (surface sites, ring, sub-surfaces structures, injectors, particle collider...)
- 2 development projects in France and Switzerland to support the research infrastructure



The project and associated impacts

- The consideration of impacts must therefore also include a set of objects necessary for the research project, such as:
 - ◆ Roads and accesses
 - ◆ Electric networks
 - ◆ Water needs
 - ◆ Accommodation for staff
 - ◆ Public services (schools, hospitals...)
- Excavated materials (very large volumes) must also be taken into account.



Studies already carried out

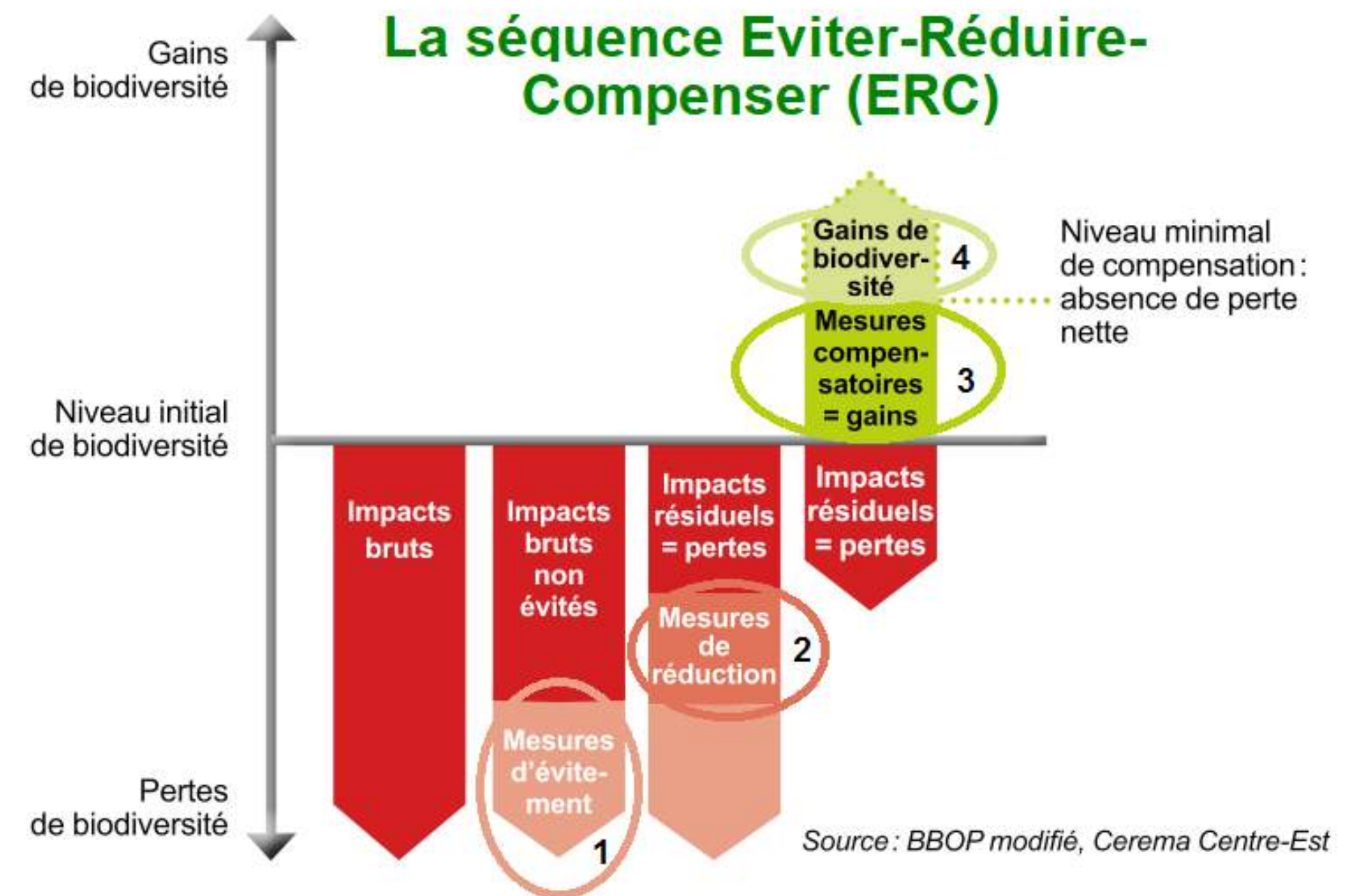
- Several studies have been conducted since 2016
- For CERN
- Also involving the Prefecture (which is the representative of the French State)
- On different themes: procedures, schedules...
- And especially on a central topic:
- The analysis of the territorial placement of the ring
- The Conceptual Design Report proposed a layout with strong constraint points that needed to be improved
- It also provided a working method for the necessary optimization of the layout



ÉTUDE DE SENSIBILITÉ DU SCÉNARIO D'IMPLANTATION DU PROJET FCC EN FRANCE ET DE SES OPPORTUNITÉS	
FCC	
Future Circular Collider Study	
RAPPORT LIVRABLE	
ÉTUDE DE SENSIBILITÉ DU SCÉNARIO D'IMPLANTATION DU PROJET FCC EN FRANCE ET DE SES OPPORTUNITÉS	
Document identifier:	FCC-INF-RPT-0040
Due date:	01/05/2018
Report release date:	26/04/2018
Work package:	International Host Site Relations Working Group
Lead beneficiary:	CERN
Document status:	V 2.0
Domain:	Health, Safety, Environment
Keywords:	Civil engineering, project implementation, environmental impacts, community health and safety
Abstract:	This project defines an initial contribution on potential environmental and socio-economic implications of these FCC surface sites, which lie on French territory. Where required and deemed relevant, the work may extend to underground volumes (collider ring, conversion tunnels, shafts and caverns) and non-project related infrastructures (e.g. electricity and water supplies, roads, railway and air transportation) and should consider socio-economic opportunity potentials (e.g. energy efficiency, waste best recovery and use, public engagement, benefits for regional industries and population).
Language:	French

Make the right upstream choices

- Applying the Avoid - Reduce - Compensate approach
- The avoid-reduce-compensate method is a principle of sustainable development
- It aims at ensuring that developments do not have a negative impact on their environment, and in particular no loss of biodiversity in space and time
- It is a principle of French law (Environmental Code)
- This principle is based on 3 steps:
 - ◆ Avoidance of impacts upstream of the project
 - ◆ Reduction of impacts that couldn't be avoided
 - ◆ Compensation for residual impacts. This means that if the project destroys a certain area of natural environment, you have to reconstitute it elsewhere.



Definition of the constraint grid

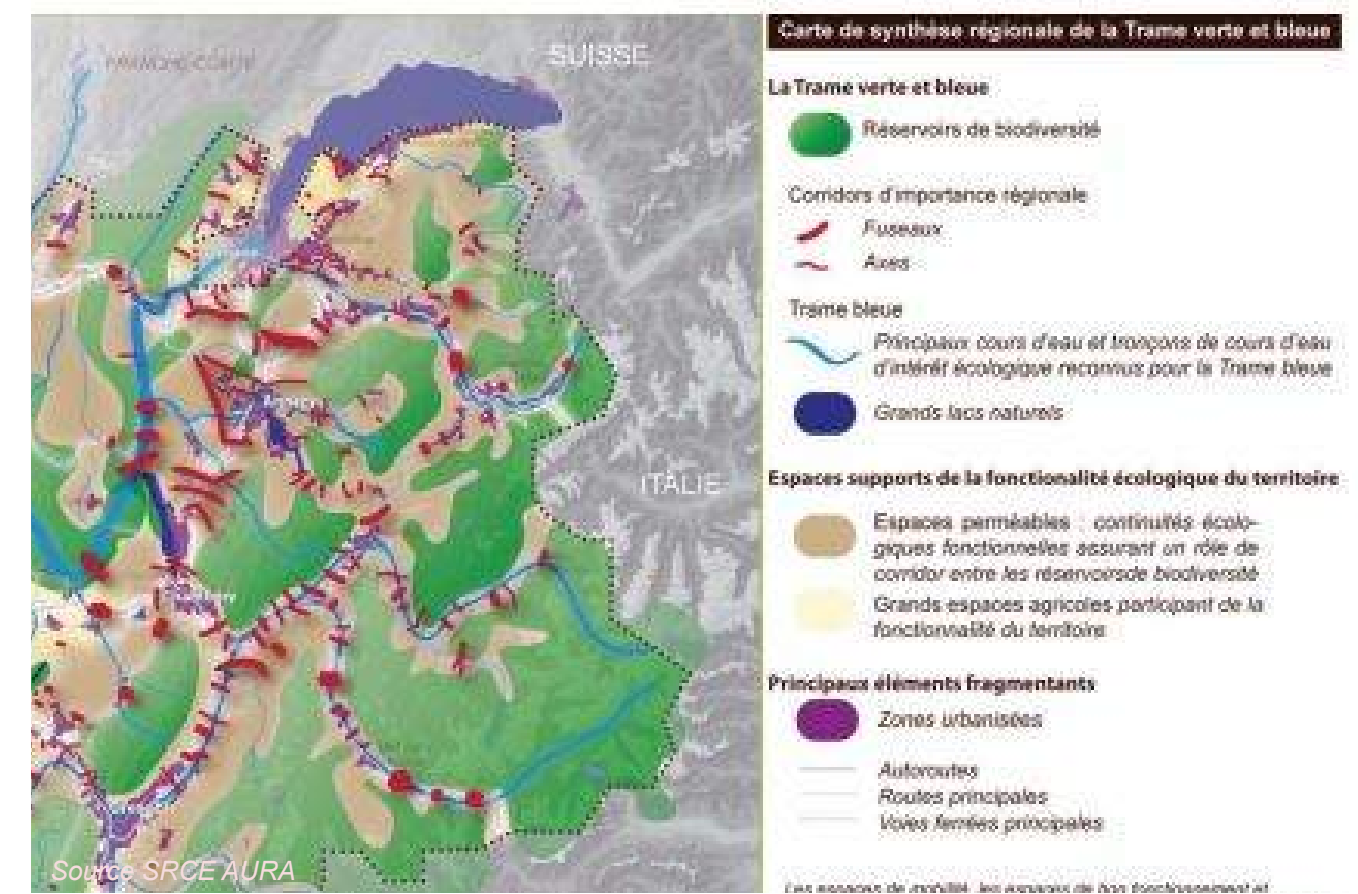
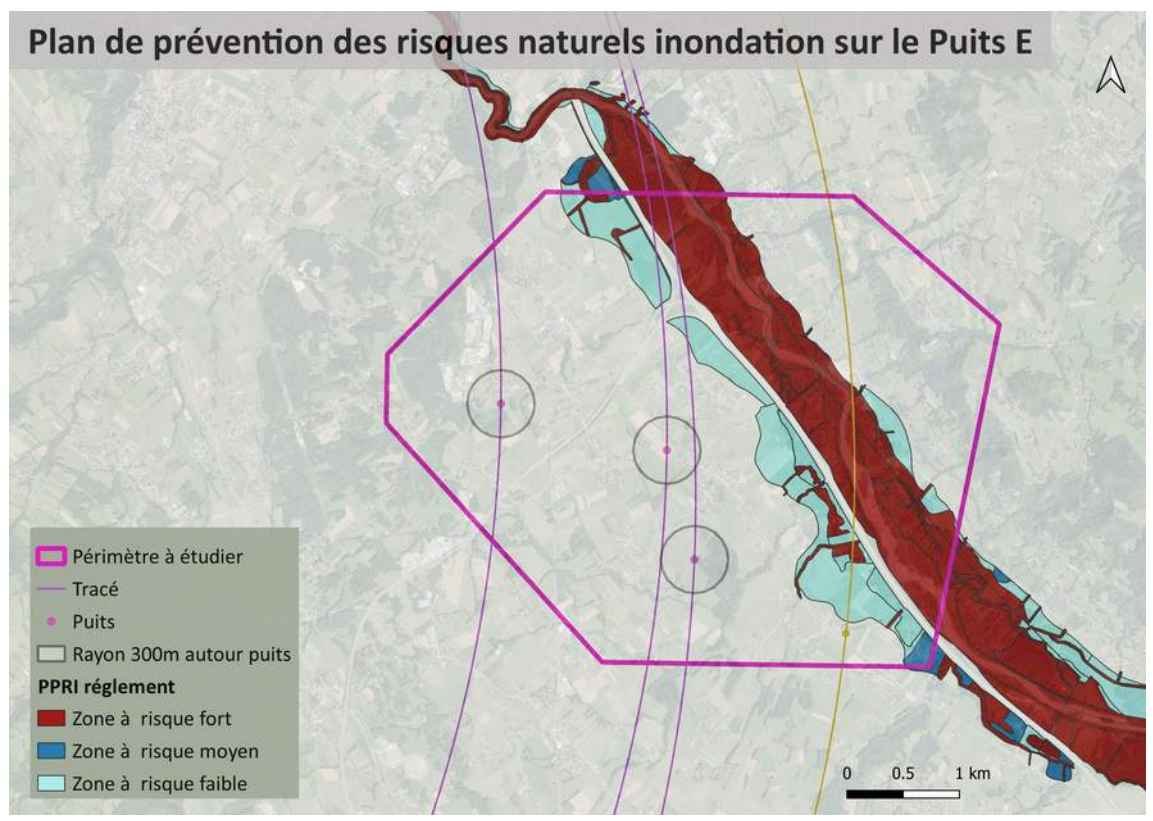
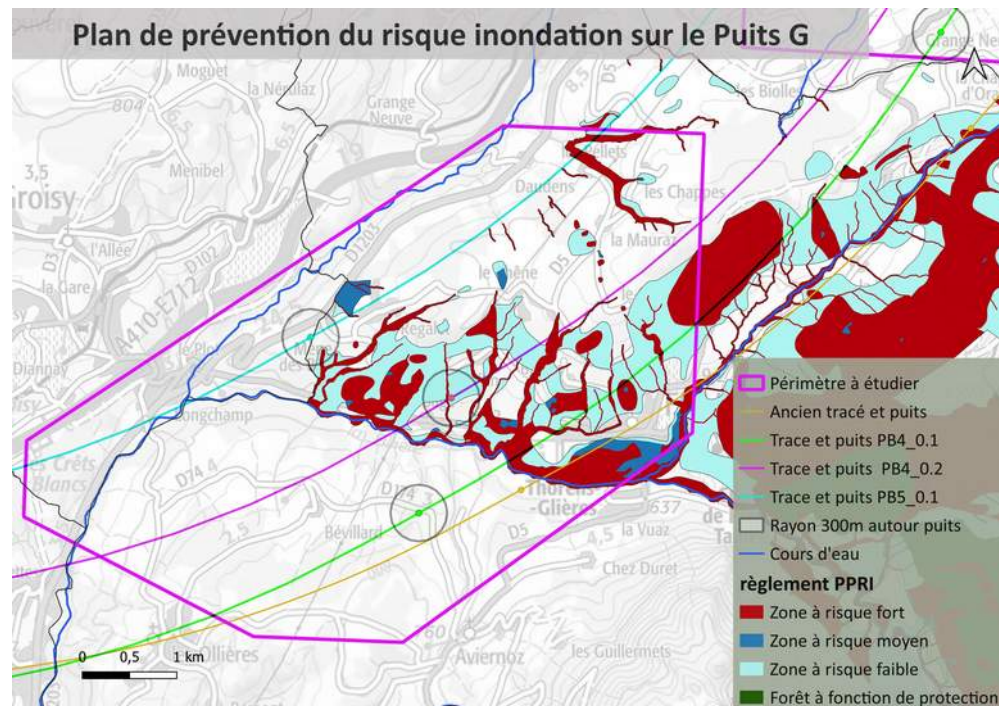
- To start a layout optimization, it is necessary to identify all regulatory constraints
- Then, it is necessary to :
- To document them (texts, references...)
- To mobilize very diverse databases
- To allow them to be taken into account from the upstream stages
- And define a hierarchy of these constraints to allow a hierarchy of avoidances

Moyenne Tolerable	Tous les autres secteurs et objets à protéger d'importance communale
	Corridors à faune d'importance régionale et suprarégionale.
	Sites prioritaires flore
	Inventaire des voies de communication historiques de la Suisse (IVS)
	Degré de sensibilité II de protection contre le bruit.
	Zones de mouvements permanents
	OPAM moyennant des mesures constructives
Faible Negligible	Terrain à usage agricole.
	Degré de sensibilité au bruit correspondant aux zones mixtes.
	Zones instables
	Secteur inscrit au plan directeur des gravières (si exploité avant projet)
	Secteur archéologique

Topics covered

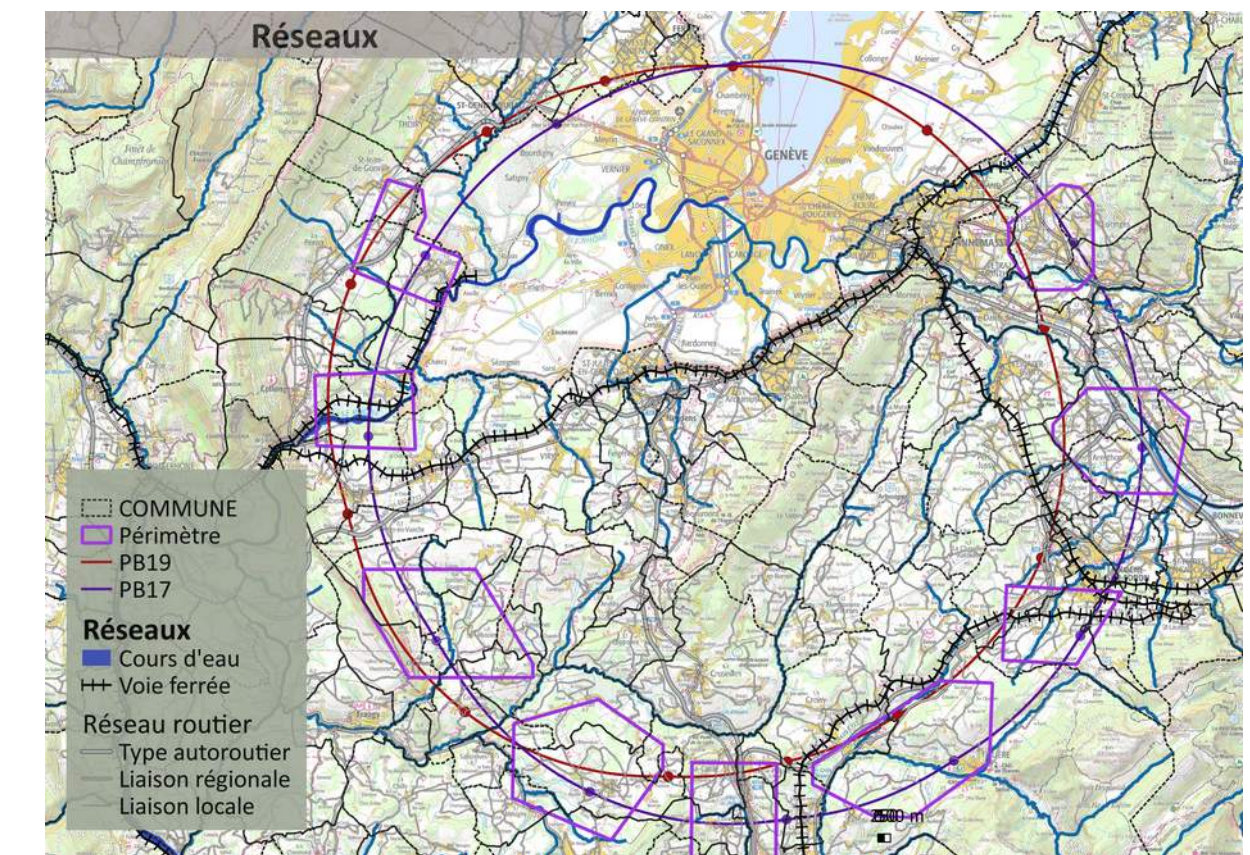
Here are a few illustrations of the topics covered and the associated constraints :

- Drinking water catchments (protection)
- Unconstructible surfaces related to watercourses
- Natural risks (flooding, ground movements...)
- Technological risks
- Protection of natural environments
 - ◆ Wildlife, flora and habitats
 - ◆ Wetlands and wooded areas
- Planning documents constraints



Topics covered

- Some other topics :
- Conflicts with road or rail networks
- Other conflicts :
 - ◆ Constructed areas
 - ◆ Existing underground structures
 - ◆ Projects planned in planning documents
- Protected historical monuments
- Archaeological sites, landscapes
- Agricultural areas



Ring locations are only examples



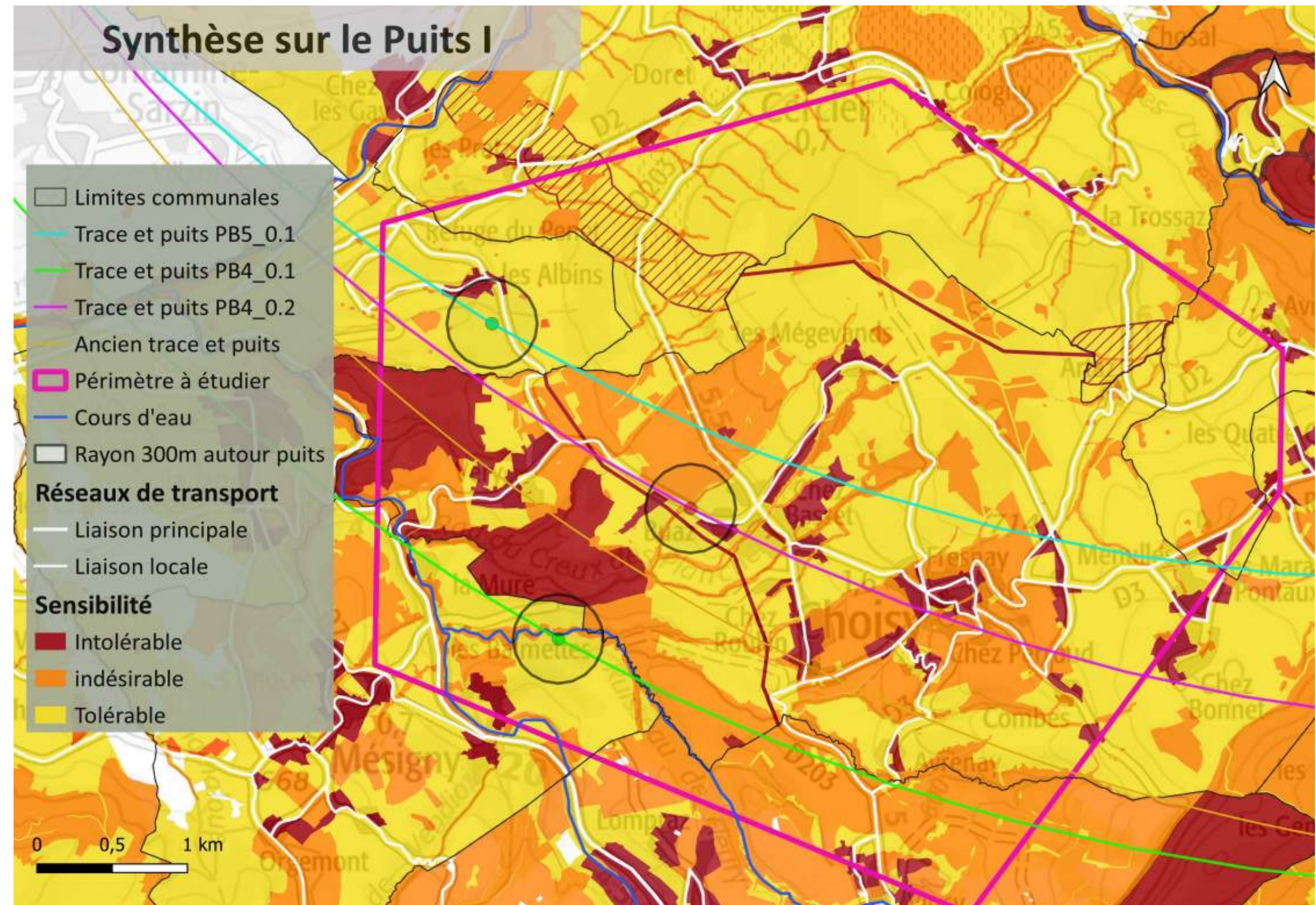
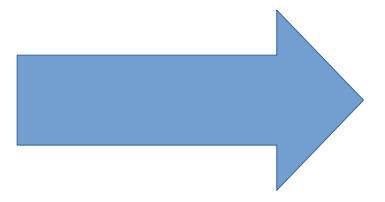
Par A.D. — Travail personnel, Domaine public, <https://commons.wikimedia.org/w/index.php?curid=2637047>

Prioritize constraints

- As there are many constraints are taken into account, they have to be prioritized
- A color code is associated with the level of constraint :

- ◆Red : intolerable
- ◆Orange : strong constraint
- ◆Yellow: tolerable constraint

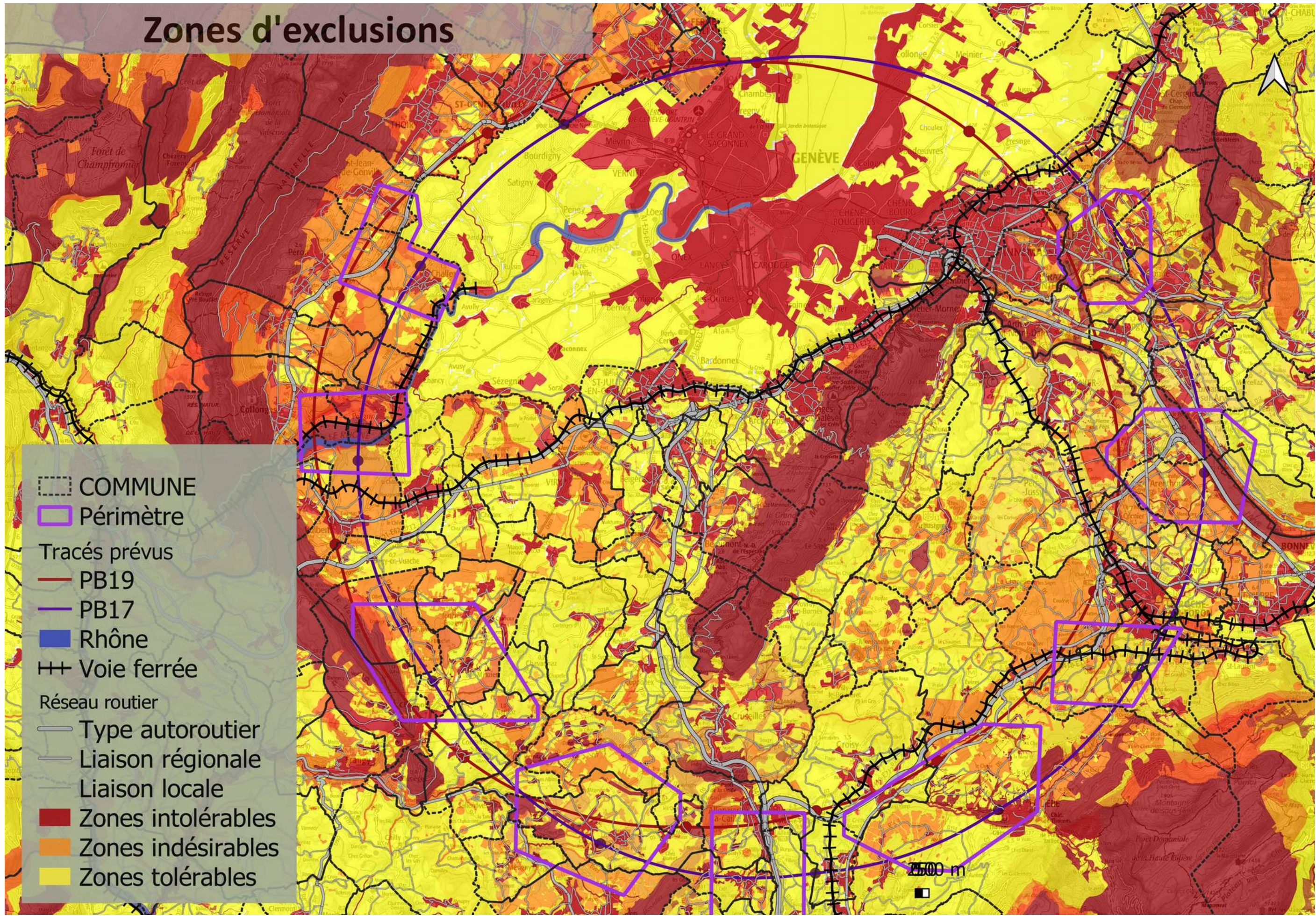
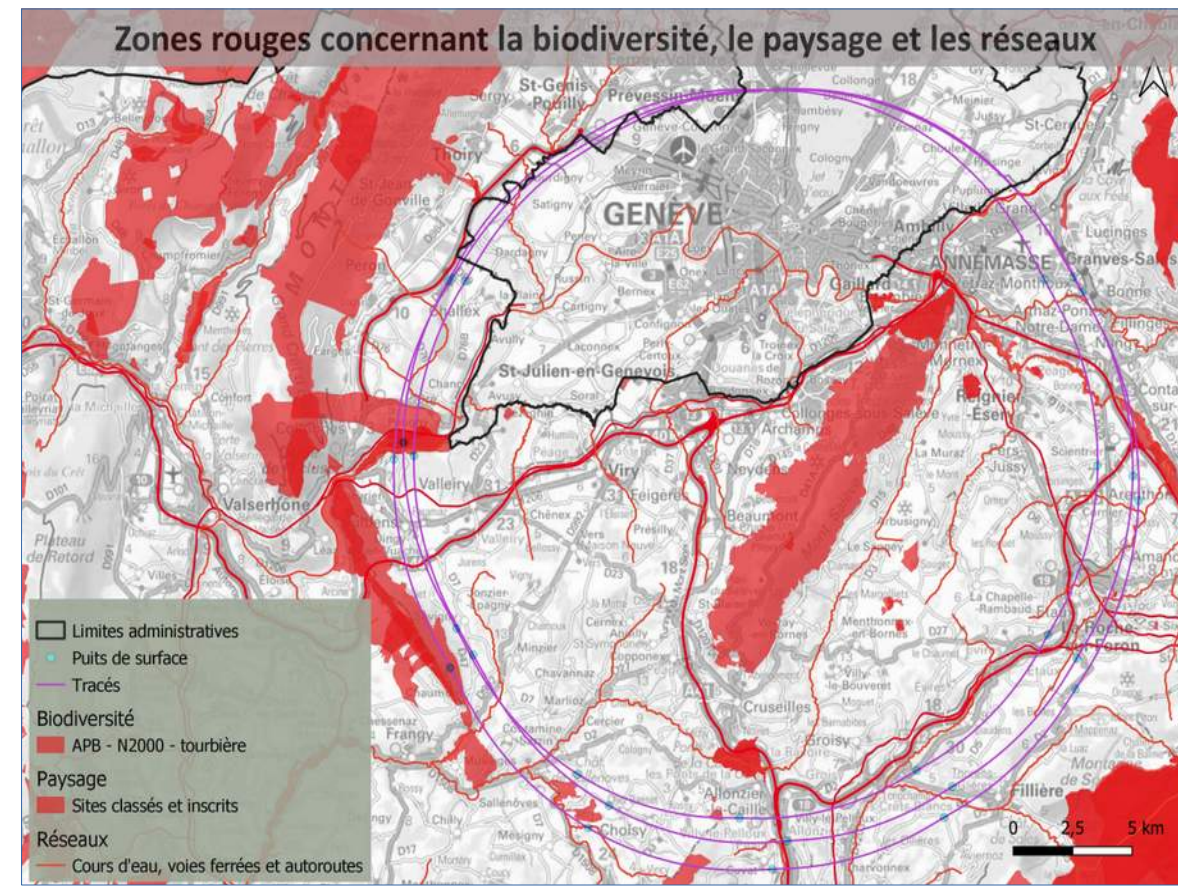
- It led to the development of synthesis maps



Ring locations are only examples

Site analysis

- Synthesis maps allows to :
- Identify exclusion zones
- Target favorable sites
- On both French and Swiss territories



A multi-criteria analysis

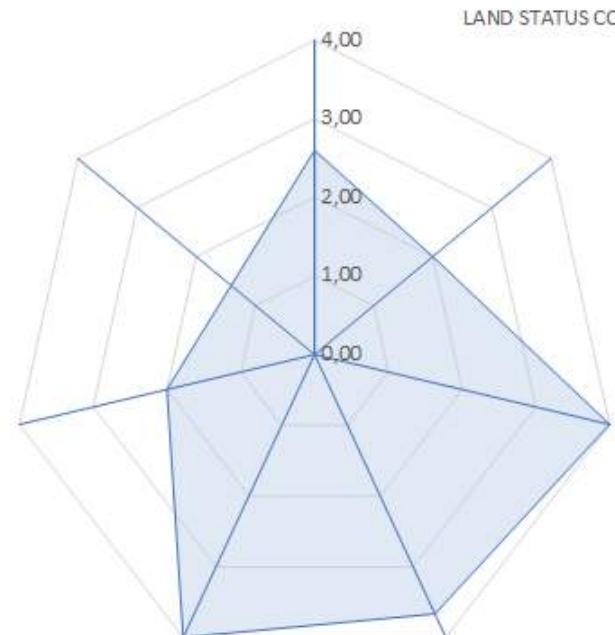
- Synthesis maps provide an initial contribution, but a more detailed analysis is then necessary.

Multi-criteria analyses has been carried out :

- For each surface site
- For an entire layout

In order to identify favorable scenarios

Site Multi Criteria Analysis



LAND STATUS CONNECTIVITY RAW MATERIALS AND SERVICES PHYSICAL FEATURES INFRASTRUCTURE ENVIRONMENTAL AND SOCIAL FACTORS

LAND STATUS CONNECTIVITY RAW MATERIALS AND SERVICES PHYSICAL FEATURES INFRASTRUCTURE

Sum of values and scores:

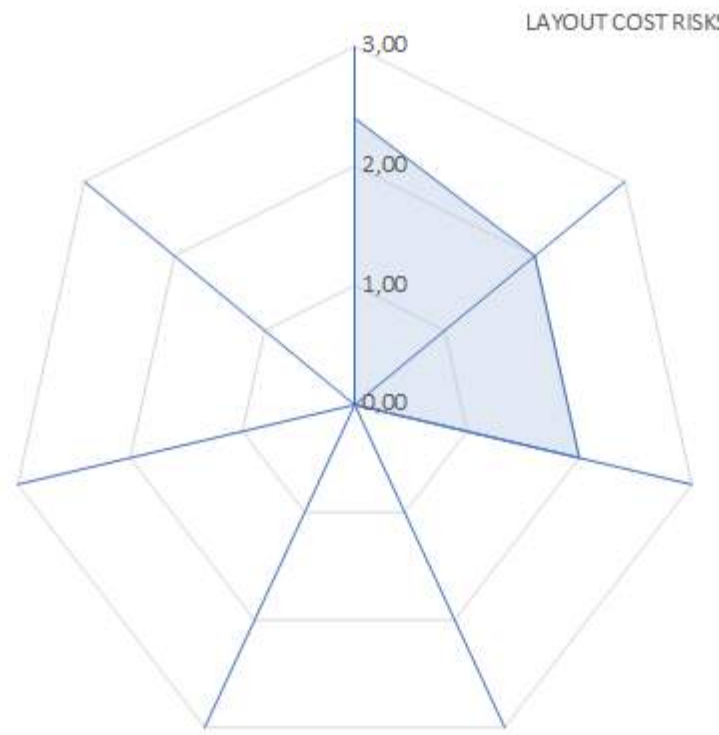
Overall trace		
Value	Score	Score %
10	20	100,00

Criteria	Sum values	Sum scores	Scores %	Scores [0-4]	Comments
LAYOUT	6	12	60,00	2,40	
Geometry (physics performance)	2	4	20,00		
Size (physics performance vs. technological challenges)	2	4	20,00		
Transfer lines to SPS and LHC (technical feasibility and additional costs)	2	4	20,00		
COST	2	4	20,00	2,00	
Total cost (overall budget efficiency)	2	4	20,00		
RISKS	2	4	20,00	2,00	
Project implementation risk (geology)	2	4	20,00		
	0	0	0,00	0,00	

Site identifier	PA		
Site name:			
Country and location:			
Sum of values and scores:	Value	Score	Score %
	36	100	100,00

Criteria	Sum values	Sum scores	Scores %	Scores [0-4]
LAND STATUS	3	13	100,00	2,60
1 Plot availability	1	3	100,00	
2 Clean and clear title	2	4	100,00	
3 Plot price	0	2	100,00	
4 Time for acquisition and expected challenges during acquisition	1	3	100,00	
5 Cost of development	-1	1	100,00	
CONNECTIVITY	0	4	100,00	2,00
6 Distance from transport, industrial and other relevant infrastructures	2	4	100,00	
7 Distance from populated areas	-2	0	100,00	
RAW MATERIALS AND SERVICES	4	8	100,00	4,00
8 Availability of raw materials	2	4	100,00	
9 Proximity to service providers	2	4	100,00	
PHYSICAL FEATURES	15	33	100,00	3,67
10 Plot size and shape	2	4	100,00	
11 Topography	2	4	100,00	
12 Shaft depth	1	3	100,00	
13 Drainage conditions	2	4	100,00	
14 Surface (soil) conditions (from sensibility sheet)	1	3	100,00	
15 Water resources	2	4	100,00	
16 Accessibility	2	4	100,00	
17 Subsurface conditions (physical)	1	3	100,00	
18 Subsurface conditions (regulatory)	2	4	100,00	
INFRASTRUCTURE	12	24	100,00	4,00
19 Accessibility of electrical power	2	4	100,00	
20 Communication network	2	4	100,00	
21 Water for industrial use	2	4	100,00	
22 Drinking water	2	4	100,00	
23 Sewerage disposal, storm water collection, disposal and treatment points	2	4	100,00	
24 Temporary storage and treatment area during construction	2	4	100,00	
ENVIRONMENTAL AND SOCIAL FACTORS	2	18	100,00	2,00
25 Existing territorial constraints (from territorial constraint grid)	-1	1	100,00	
26 Fauna and flora (from sensibility grid)	1	3	100,00	
27 Existing construction constraints	-1	1	100,00	
28 Adjacent surrounding constraints (landscape from sensibility grid)	0	2	100,00	
29 Nuisances (from sensibility grid)	0	2	100,00	
30 Workforce availability and accessibility	2	4	100,00	
31 Local government commitment	2	4	100,00	
32 Civil society support	-1	1	100,00	

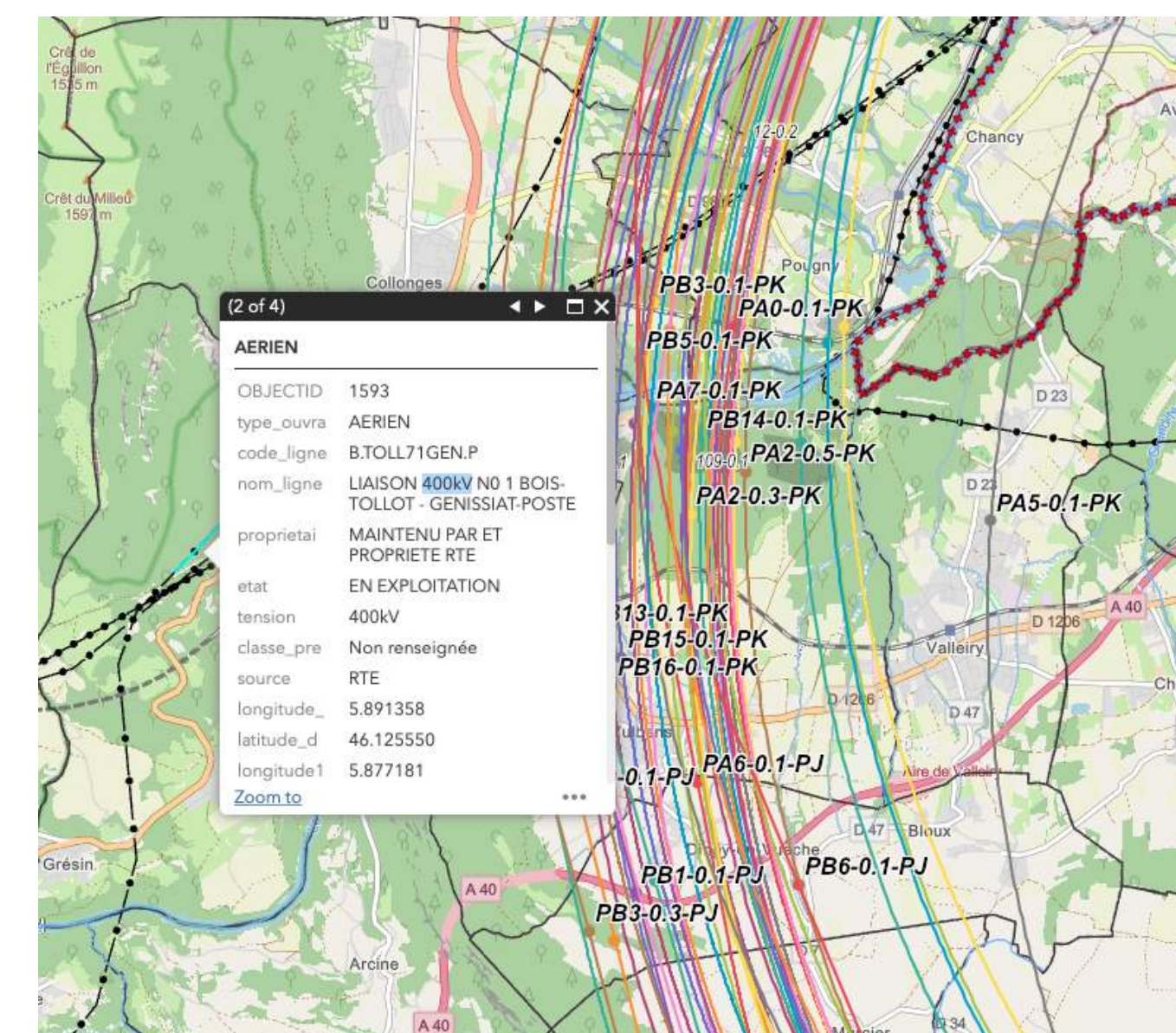
Site Multi Criteria Analysis



LAYOUT COST RISKS

An iterative work

- It is indeed an iterative work that is carried out and which takes place as follows :
- A layout that seems to lower constraints is tested (identification of constraints, maps, mutli-criteria analysis...)
- Stress points are identified and expertised (what regulations ? Are there alternatives?)
- Then more suitable sites nearby are searched
- This leads to a new optimized layout designed with the colleagues in charge of the machine
- This work as been made possible by very efficient placement tools

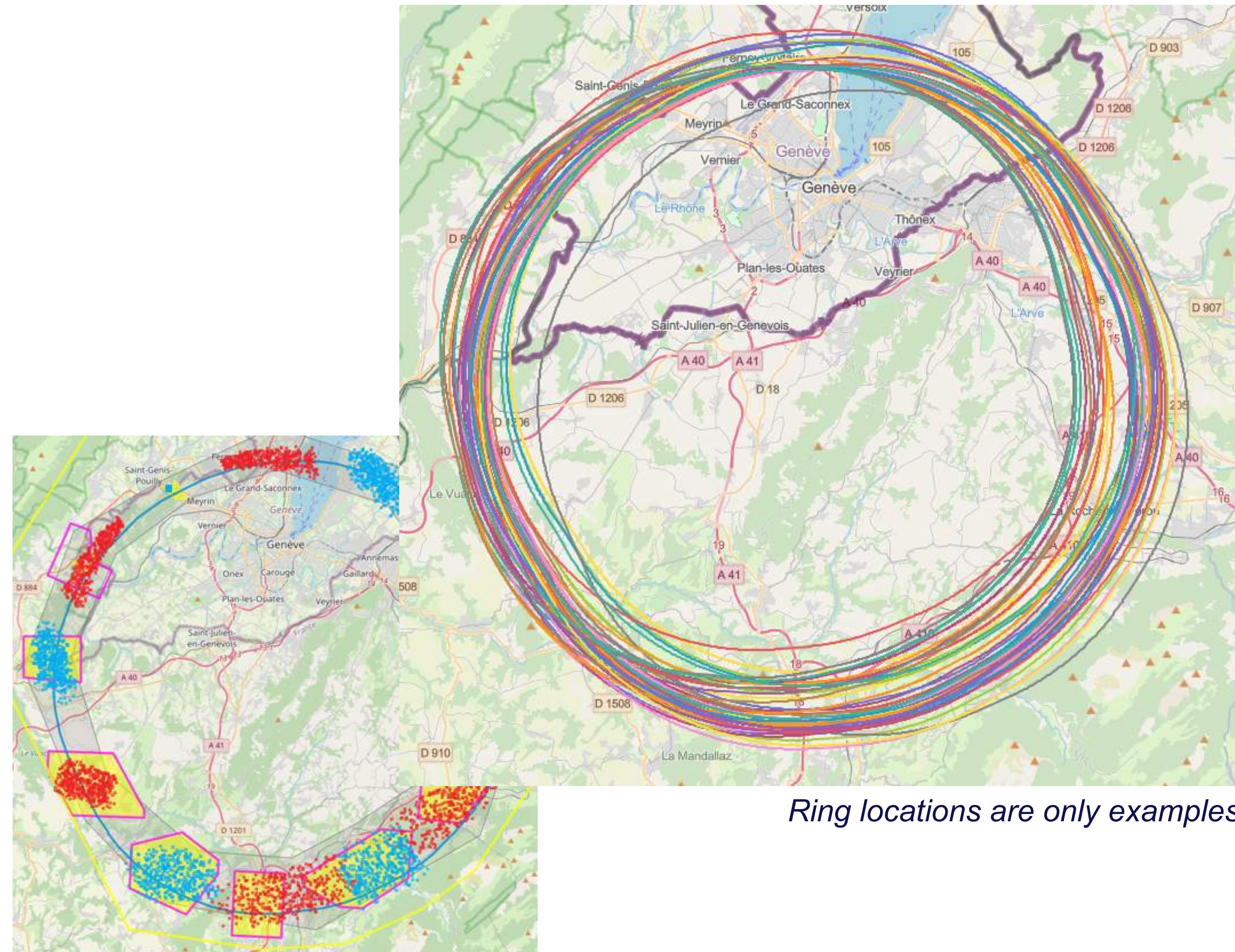


Ring locations are only examples



The Avoid Reduce approach Implementation

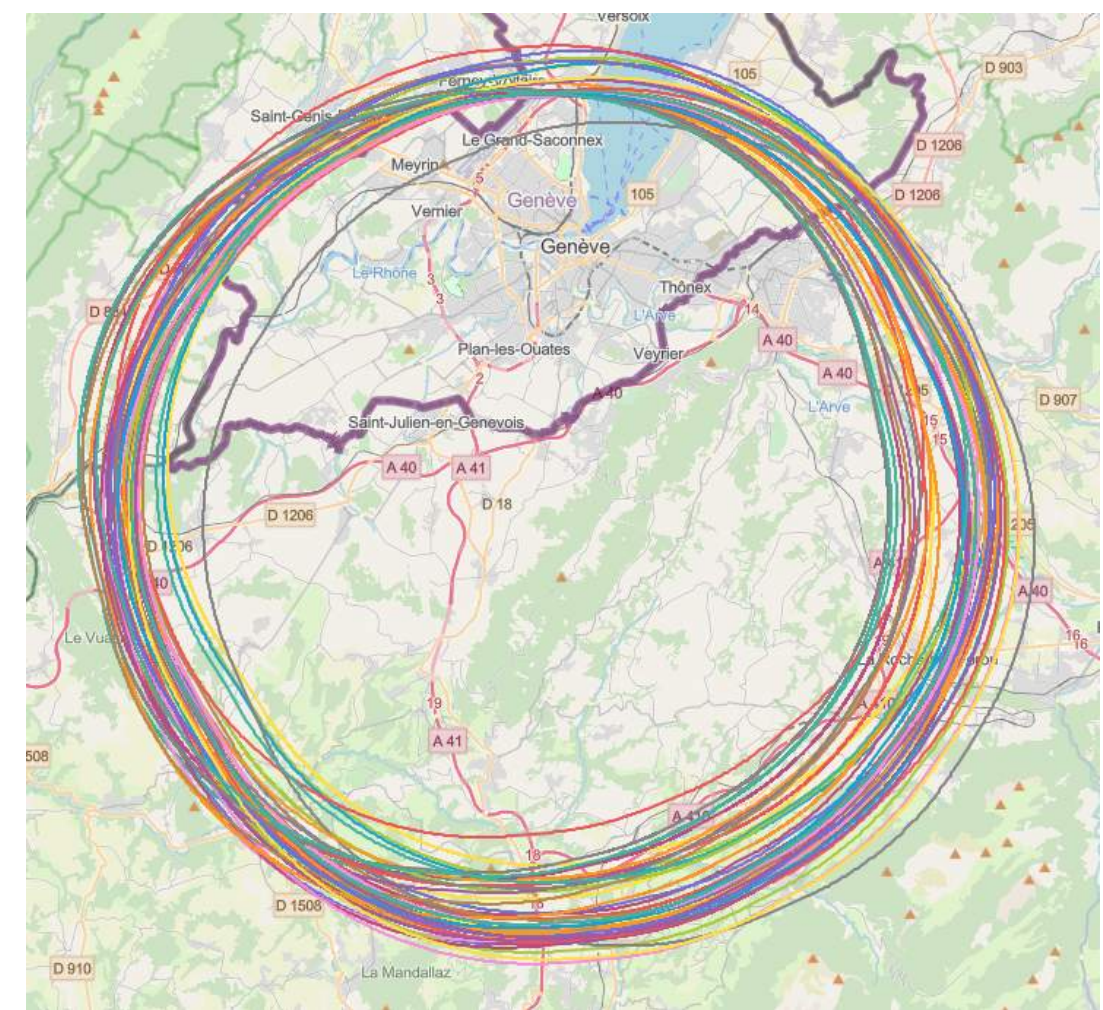
- More than 45 layouts examined
- Numerous possible site implantations considered
- Each of these steps interfacing with the machine geometry
- The compensate step will come in a second phase



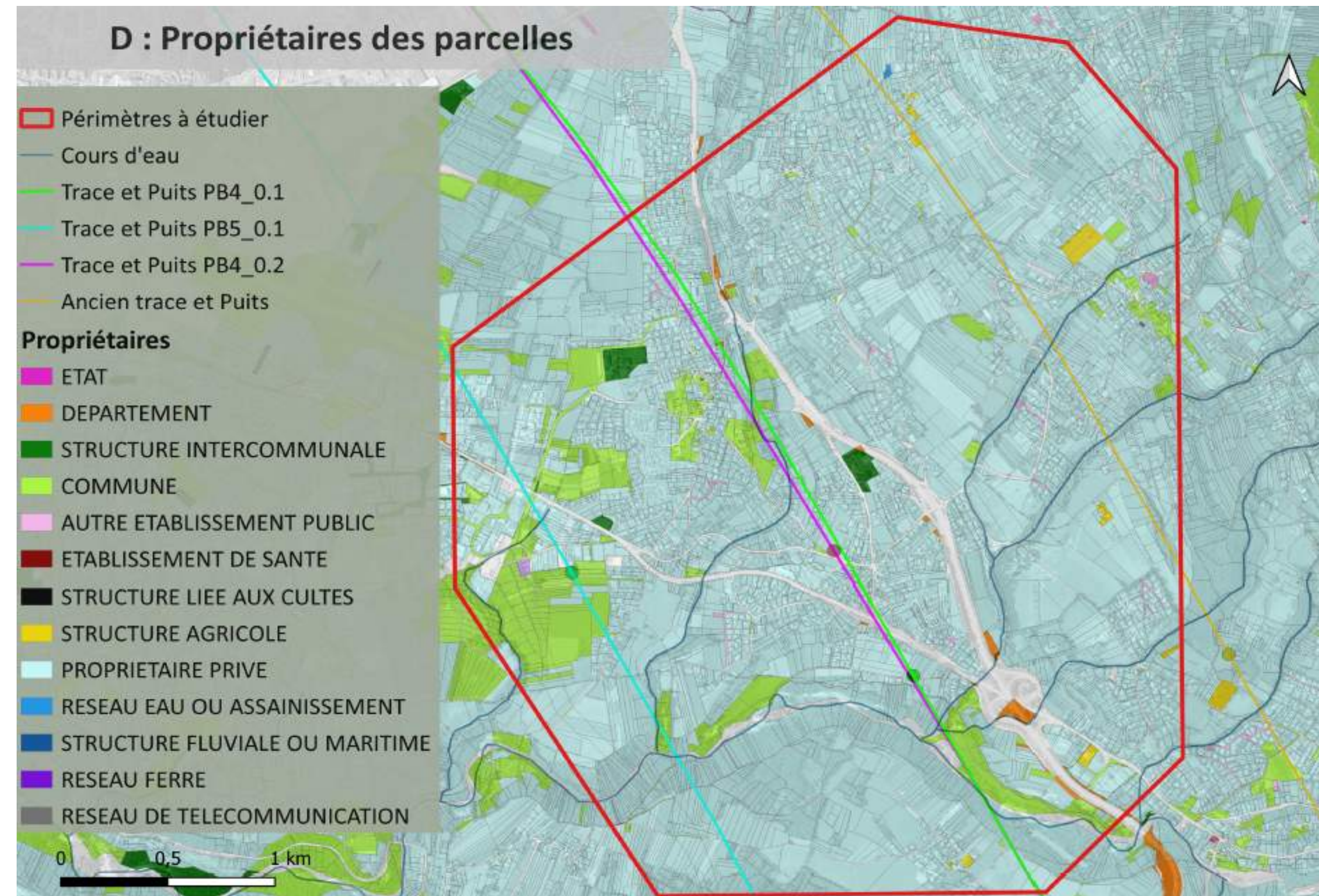
Ring locations are only examples

Use of all known data

- Mobilize all useful information to guide the choices
- Example : the landowner Analysis



Ring locations are only examples



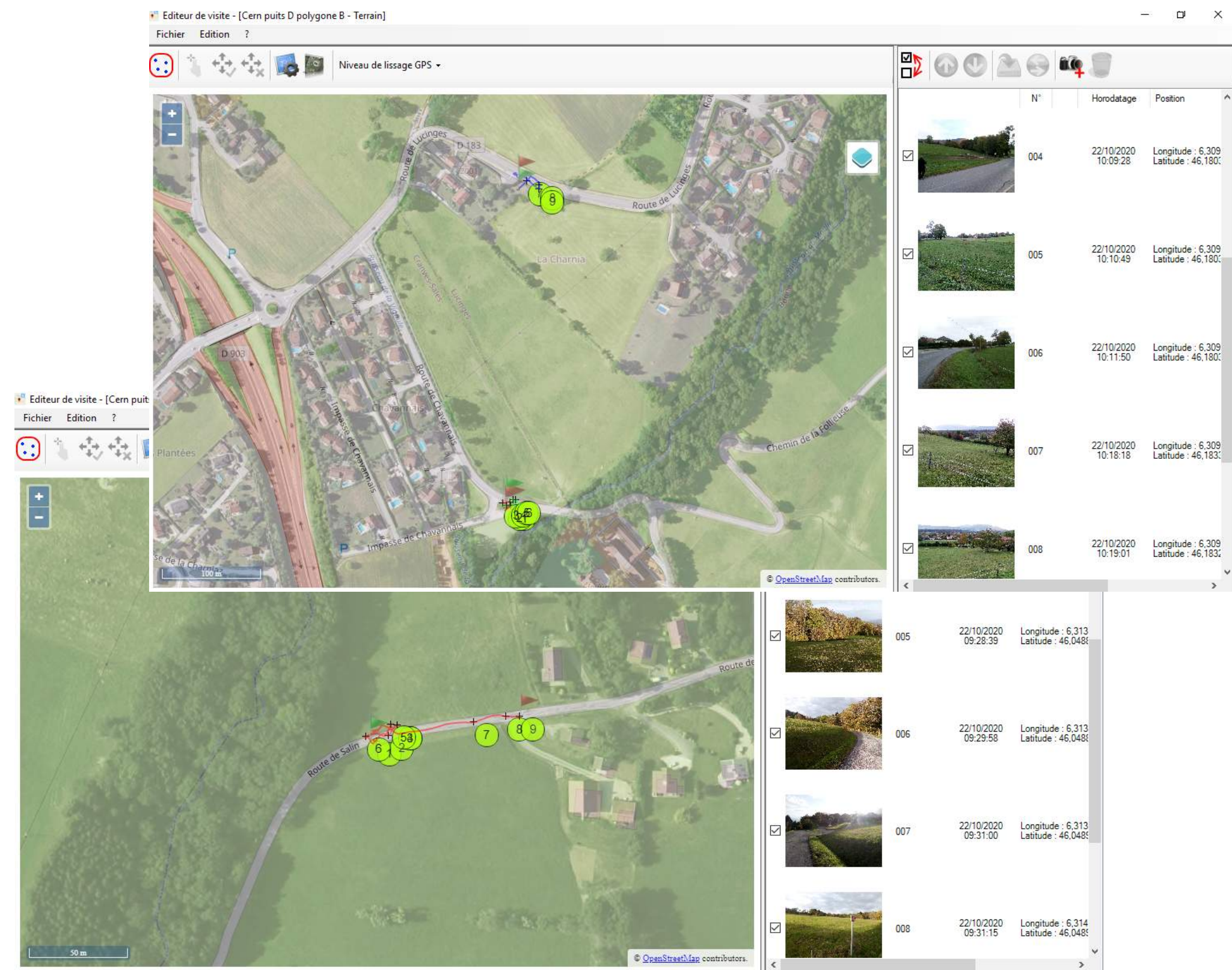
Clarifying procedures

- Often complex procedures
- Need to describe processes and timelines
- Can guide the choice of sites
- Two examples
- Procedure "water autorisation" for boreholes
 - ◆ Conventional drilling (< 100 m),
 - ◆ Deep drilling (> 100 m),

Procedure to authorize to enter private property (that is necessary to carry out site investigations).

Specify particular sites

- Field visits
- Mobilize all attainable knowledge
- SCOUT tool (geolocation)



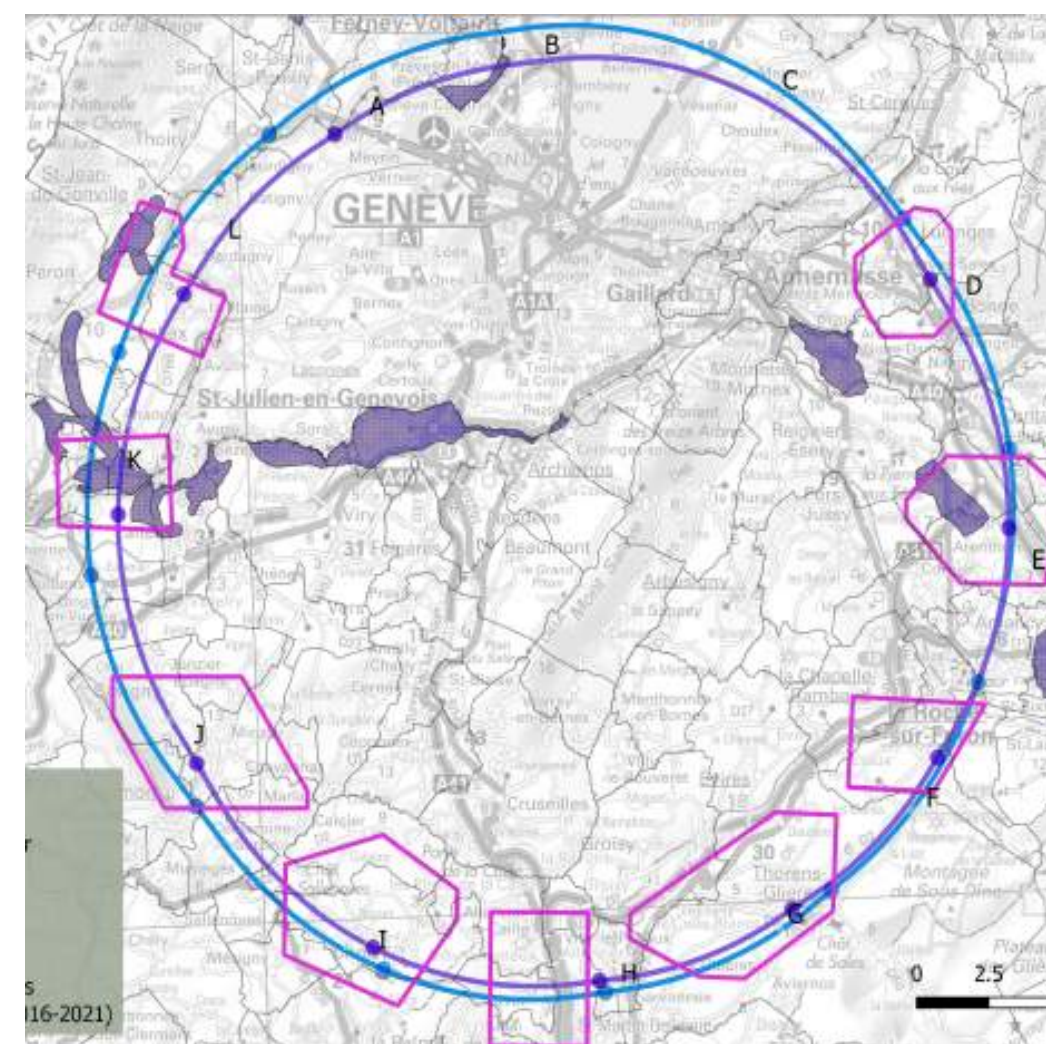
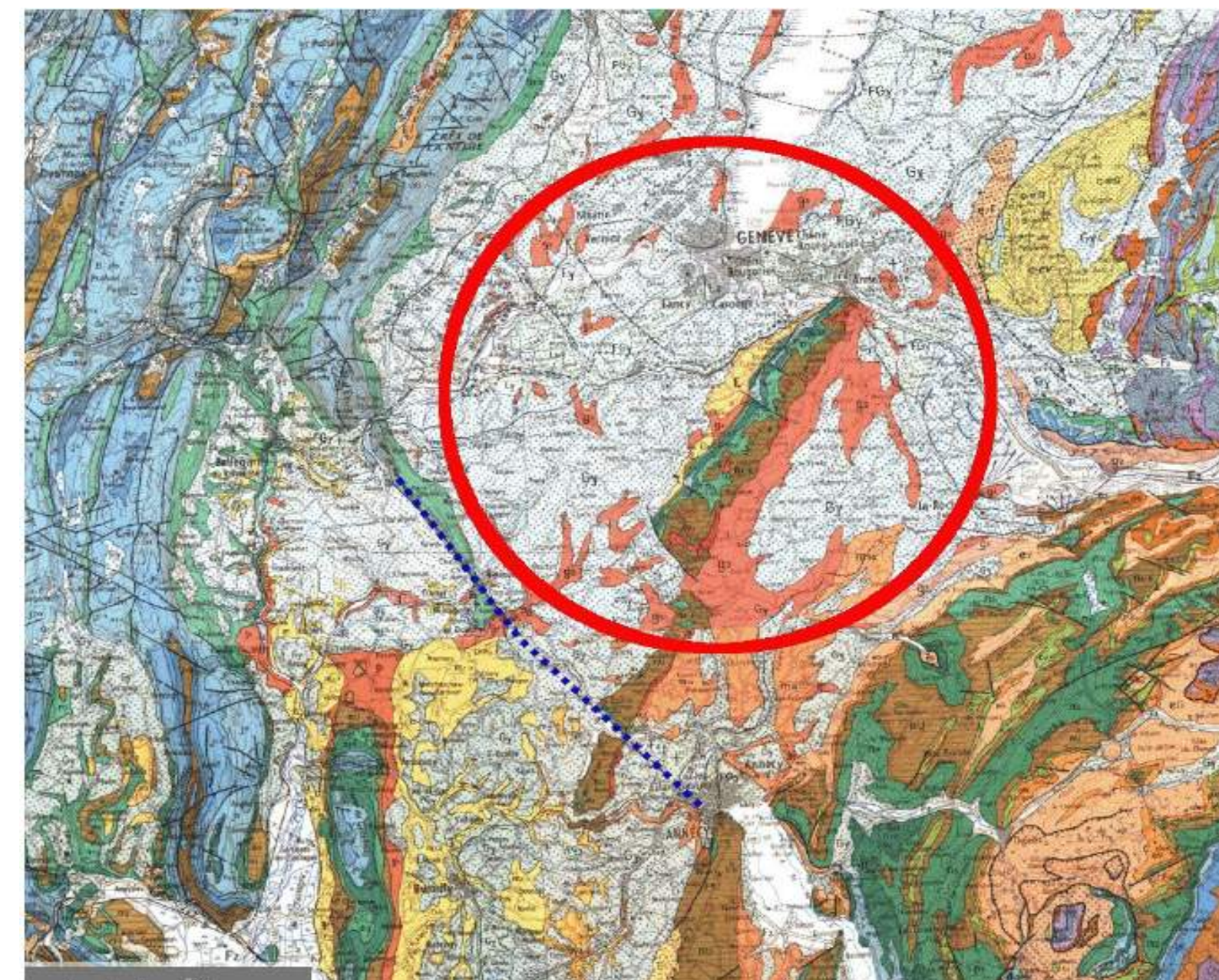
Site-Description-Information-Sheet		Site-Name:	PG	Version:	Pxx-x.x-PG-Target6
Document-identifier:	FCC_2008050900_AVE_... SiteDescriptionInformationSheet_... Pxx-x.x-PG-Target6	Land-Surface-Name:	117-0.1	Doc-Version:	0.1
Date:	2020-08-05	Approval-status:	IN-WORK	Approval-date:	YYYY-MM-DD
Approved-by:	Last-name, first-name, organization	Created-by:	Verdier, Anne-Laure, CERN	E-mail:	anne-laure.verdier@cern.ch
Geographic-location:	Lambert 93 Easting: 949899.25m Northing: 6549556.76m	WGS84 Lat: 46.0029234 Long: 6.2342386	LV95 Easting: Northing:	Canton or Department:	Haute-Savoie
	Town: Filière	Country:	France	Parcels, owners, classification (PLU, PD):	Approximate Size: 7 ha
Map:					

Nom de l'opérateur: Cern puits G
 Objet de la visite: 114.01
 Tableau des relevés:

N°	Commentaires	Photo miniature	Latitude (DD)	Longitude (DD)	Azimut (°)	Heure (hh:mm:ss)	Date (jj/mm/aa)
001	Site très pentu avec la présence d'habitations au Nord et de bâtiments agricoles à mi-pente. Il est difficilement constructible avec des difficultés d'accès. Les prairies, récemment fauchées, présentent un intérêt écologique très modéré. Aucune espèce patrimoniale n'a été observée.		46,002855	6,248907	NaN	12:43:08	11/08/20
002			46,002337	6,247912	NaN	12:45:11	11/08/20
003			46,002338	6,247910	NaN	12:45:27	11/08/20

Specify particular topics

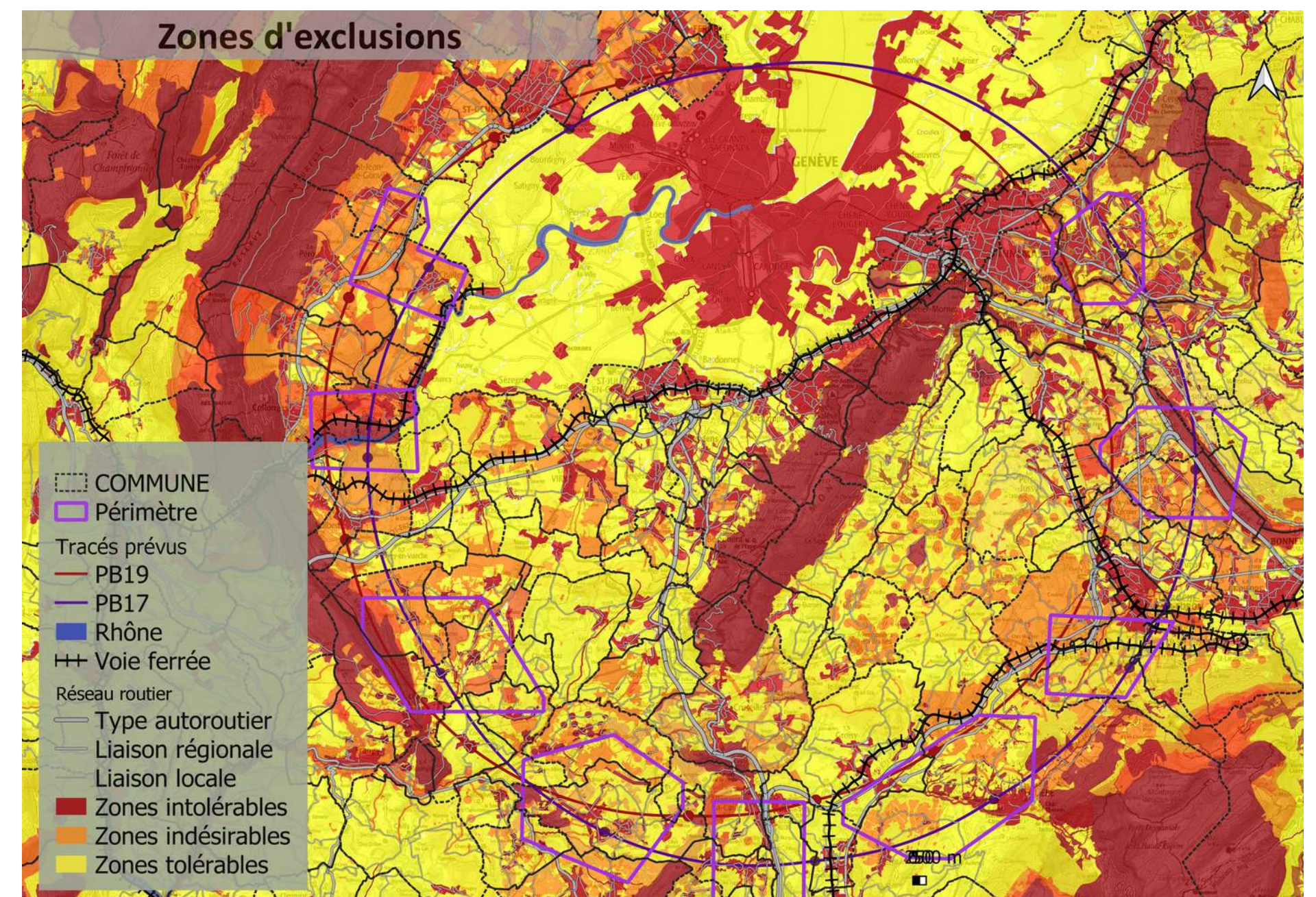
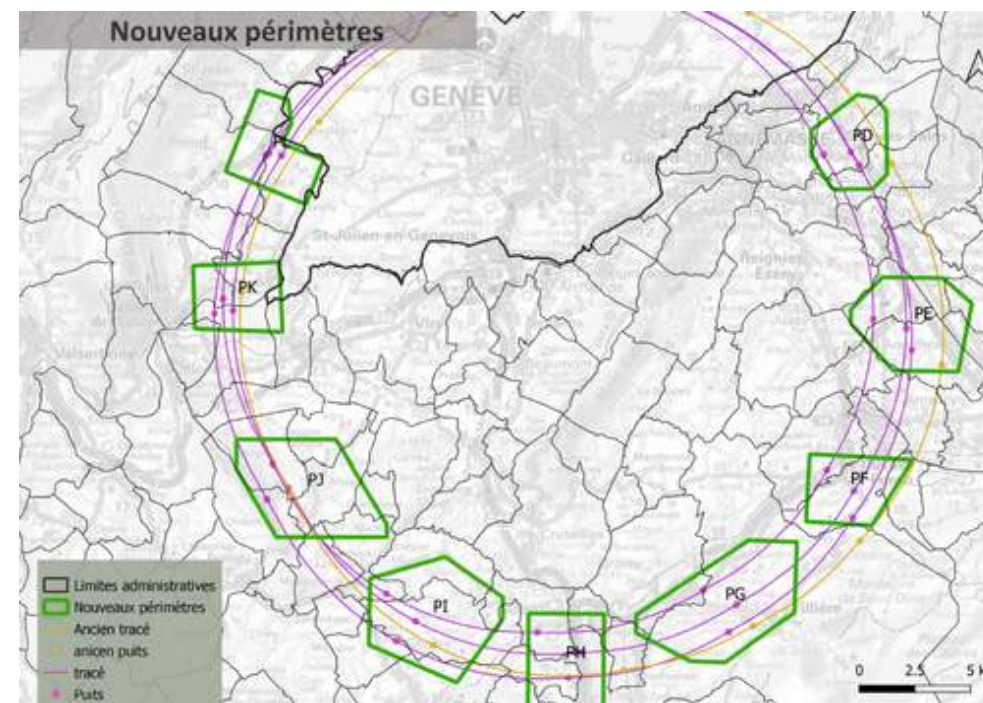
- **Pre-feasibility reports on 2 sensitive themes**
 - **Geology and geotechnics,**
 - **Hydrogeology**
- **In addition to CERN studies**



Ring locations are only examples

A work in progress

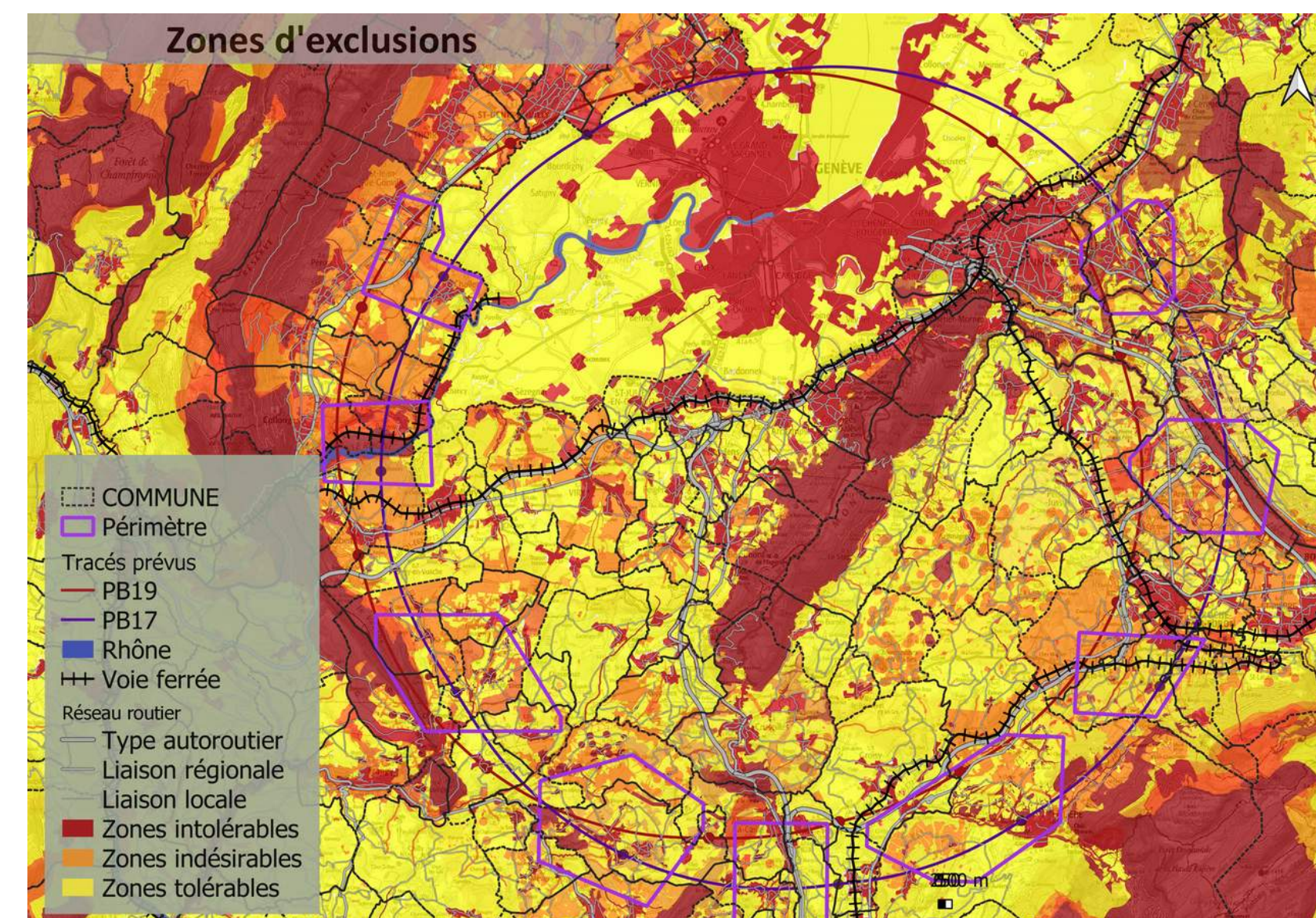
- Many components have been studied for the ring placement
- The work will go on within the WP3 Integrating Europe
- Task 3.2: Optimization of infrastructure placement in relation to territorial requirements
- Closely related to tasks 3.3 and 3.4
- Task 3.3: Transnational environmental assessment framework
- Task 3.4: Management of excavated materials



Ring locations are only examples

A work in progress

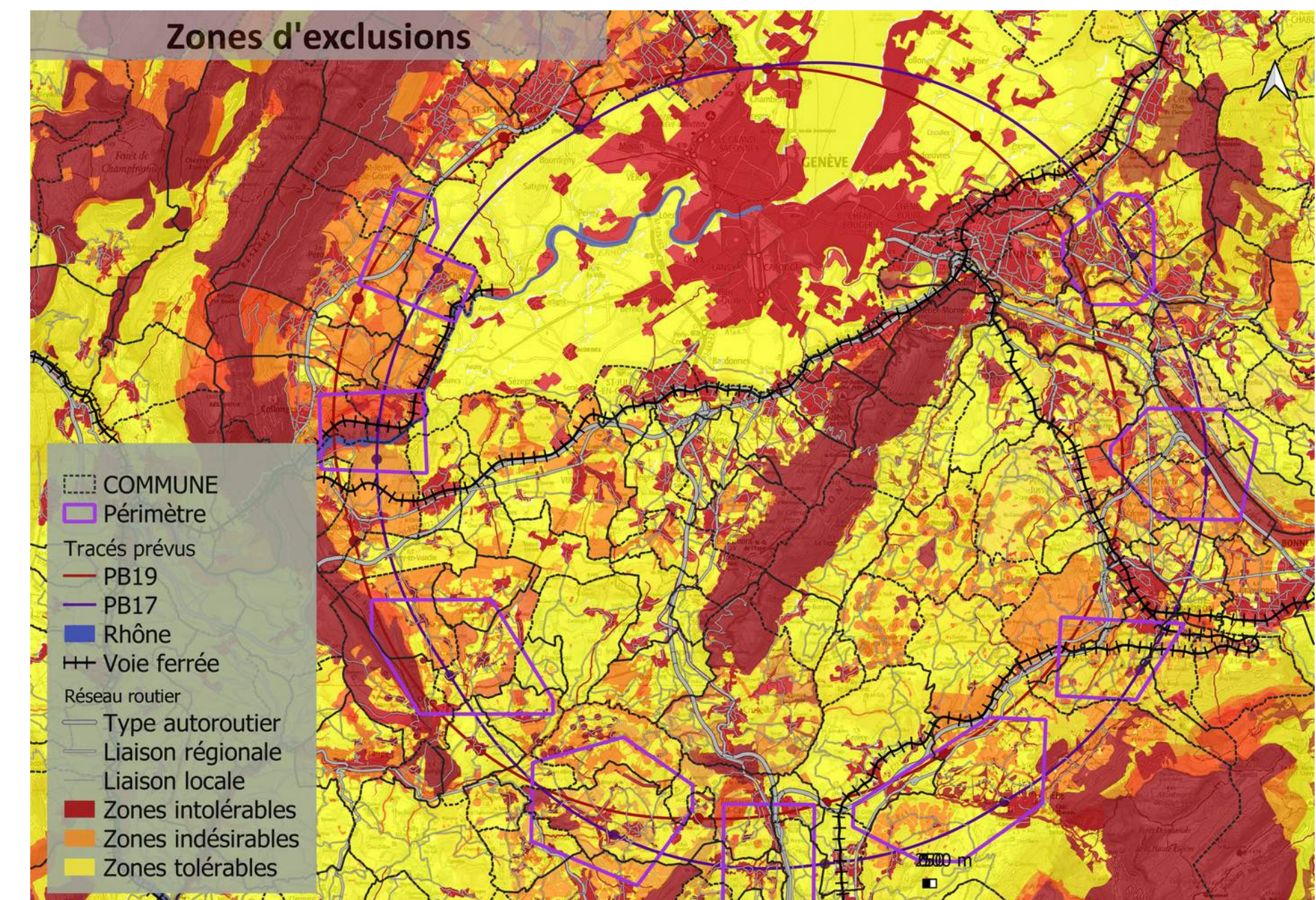
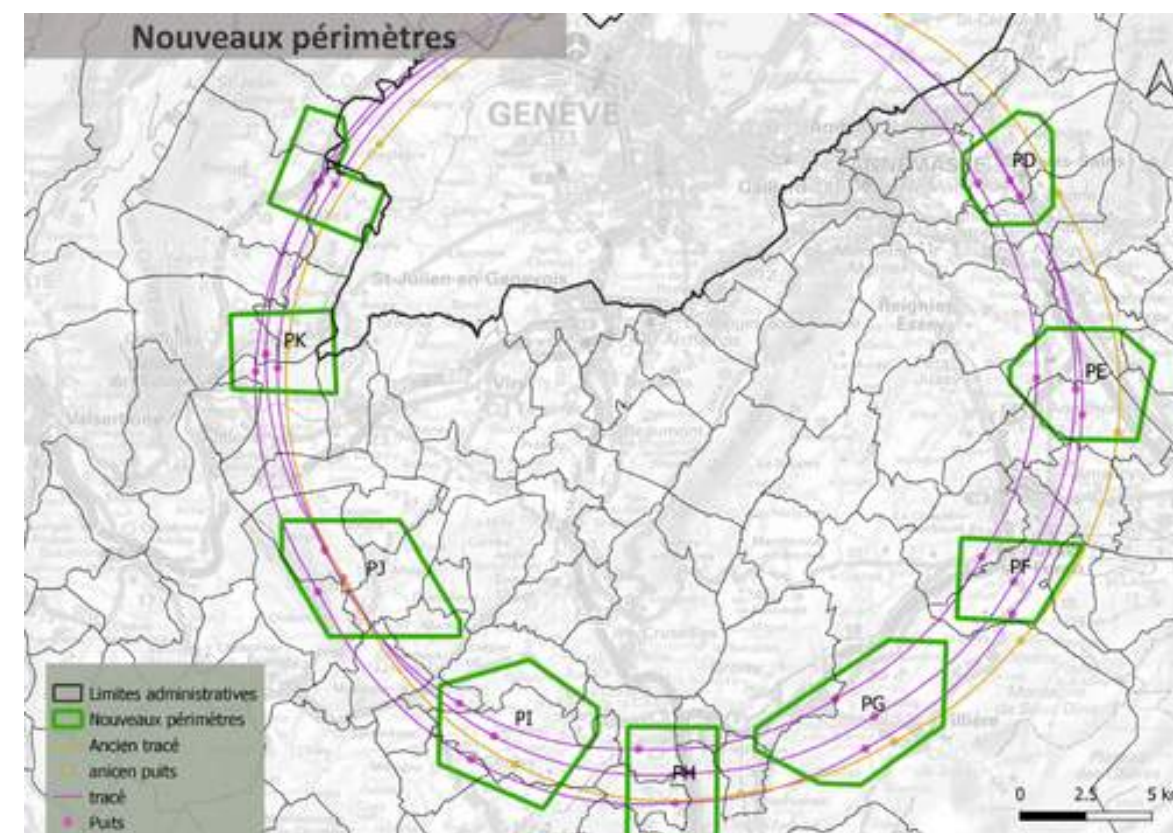
- Still many datas to be collected such as:
- Elements of local knowledge in consultation with host States
- Additional information from of specific services of the States
- Information from local elected officials
- Elements from other studies to be integrated as you go along:
 - ◆ Geology, geotechnics,
 - ◆ A 3D modeling project of the underground,
 - ◆ Hydrogeology,
 - ◆ Excavated materials...



Ring locations are only examples

Conclusion

- A large scale work
- On broad themes
- On 2 territories
- In constant interaction with the physics of the research machine
- To be continued and refined in WP3



Ring locations are only examples



THANK YOU FOR YOUR ATTENTION