

# EXCAVATION MATERIALS MANAGEMENT STRATEGY

Luisa ULRICI, CERN, on behalf of the MATEX working group

WG3 – Integrate Europe

Task 3.4 - Management of excavated materials

D3.4: Preliminary excavation materials management plan (CETU)

# Management of excavated materials: rationale

**Goal:** identify credible concepts for the management of the molasse materials

**Excavated material seen as “resource” rather than waste**

**8.1 Mm<sup>3</sup> of excavation material** (bulk volume after excavation)

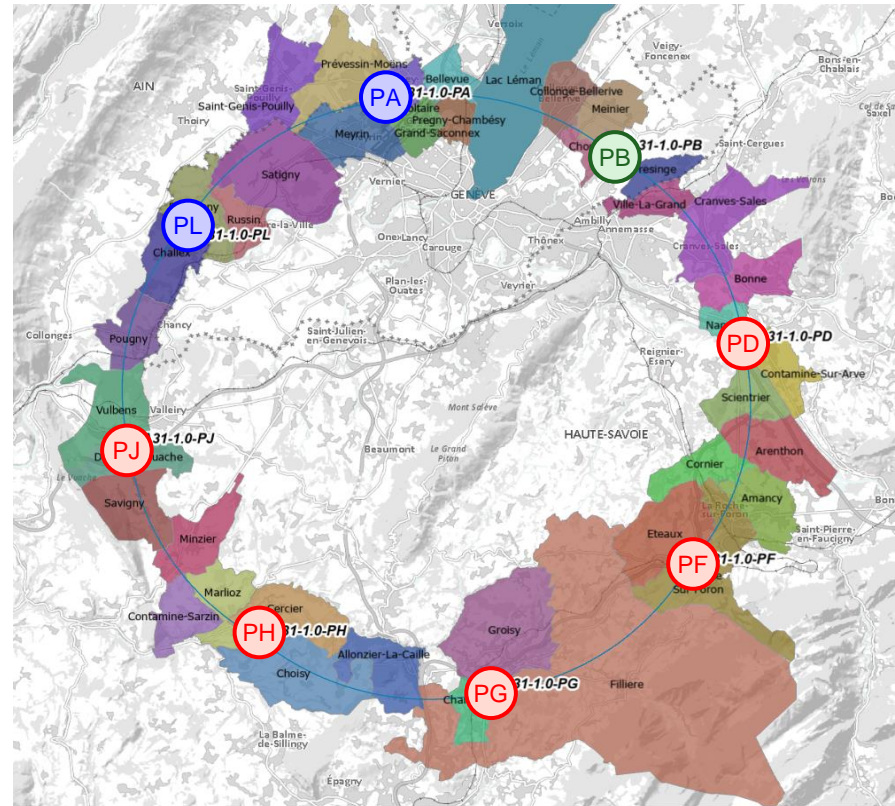
**96%** heterogeneous sedimentary **molasse**, 3% limestone, 1% moraine

Today **no known industrial-scale re-use** for the molasse

**Credible plan** for the management of the materials is a key ingredient of the feasibility

**Leverage** different sectors to develop solutions for a future science project with benefits for the entire society

The excavation material management plan played a role in the **acceptance** of the major infrastructure projects (TELT, Grand Paris etc.).



# Participants on the work for deliverable D3.4:

FR:



Center for studies and  
expertise on Risk,  
environment, mobility and  
urban planning

CH:



REPUBLIQUE  
ET CANTON  
DE GENEVE

Geology, soil and waste  
department (GESDEC)

POST TENEBRAS LUX

A:



Department of  
Subsurface Engineering,  
Leoben, Austria

In addition to



## Collaborations with external experts:

- *Regulatory framework*: University of Lyon 3,
- *3D subsurface modelling*: University of Geneva, GESDEC, University of Grenoble, University "La Sorbonne" (Paris)

## Support by external consultants:

- Inventory of regional opportunities: SETEC/Lerm, BG engineers
- Feasibility study for railroad connection: EGIS-rail

# Description of deliverable D3.4 Preliminary excavation materials **management plan**

**strategy**

**As mentioned in the FCCIS Grant Agreement**

*“A technical/managerial report that summarises the approach for managing the approximately **9\* million cubic meters of excavation materials** in a resource- and cost-effective way, pointing to innovation potentials with economic benefits for companies and environmental advantages for the European society.*

*The plan is considered to be preliminary, since specific management processes, the economic viability and the environmental benefits of the envisaged excavation materials use cases depend strongly on the precise sub-surface investigations, the evolution of legal frameworks in the EU and Switzerland and the response of companies to market surveys, all of which are expected to evolve after this H2020 project ends.”*

\* **outdated**, based on the 12 sites scenario

## **Objectives:**

- To demonstrate the FCC feasibility from the point of view of the management of excavated materials.
- To show that the project owner takes into account all aspects (technical, regulatory, timing...).
- **To define a strategy** and to communicate commitments of the project owner.

# The re-use of excavated materials

The degree of actual reuse depends largely on the **geochemical, mineralogical and geotechnical properties** of the excavated materials.

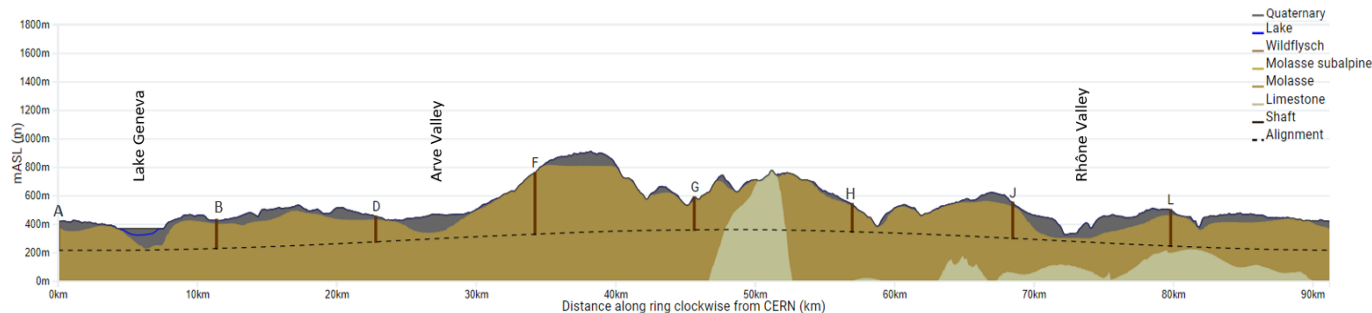
The **choice of the tunnelling method** is of particular importance. It influences the particle size distribution and on anthropogenic contamination.

Possible presence of **geogenic pollution** (hydrocarbons and heavy metals) also impacts the re-use possibilities.

Depending on the quality, typical areas of application for excavated material are the **production of aggregates for concrete and shotcrete**, street and other public infrastructure supports as well as filler material.

Risk management: **subsurface investigations at regular intervals** along the tunnel path and with increased frequency at geotechnically unknown regions **are compulsory**.

To **avoid the creation of temporary surface storage**, the results of geochemical, mineralogical and geotechnical analysis should be available as soon as possible - **preferably via online-analyses in the underground during tunneling**.



# Challenges for the re-use

The **negative impacts created by landfilling** include degradation of the countryside, potential impacts on nature and potential degrade of the quality of life of surrounding residents.

According to the current regulation in France **excavation material is classified as waste** as soon as it exits the project site. This is why it is important that FCC is considered an **undividable, single project in a transnational context**. Discussion with the authorities of the Host States is ongoing.

In this respect, the five-step “waste hierarchy”, established in the EU Waste Framework Directive is applied. It establishes an order of preference for managing and disposing of waste.



# Opportunities for the re-use

Application of **Avoid-Reduce-Compensate** approach (french: “ERC: Éviter-Réduire-Compenser”)

Principle	Examples
<b>Éviter</b> (Avoid)	Adjust the project (tunnel length, number of shafts, depths)
	Avoid waste by introducing innovative re-use and re-use on site.
	Avoid introduction of pollutants due to excavation methods
<b>Réduire</b> (Reduce)	Treatment of polluted materials
	Reduce transport, nuisances and pollution by local re-use
	Regional reuse offsite for agricultural and re-naturation purposes
<b>Compenser</b> (Compensate)	Create or improve agricultural spaces Reforestation with transformed materials Create economic benefits through innovative approaches for industry Develop approaches for the profit of other projects

# Re-use scenarios for socio-economic studies

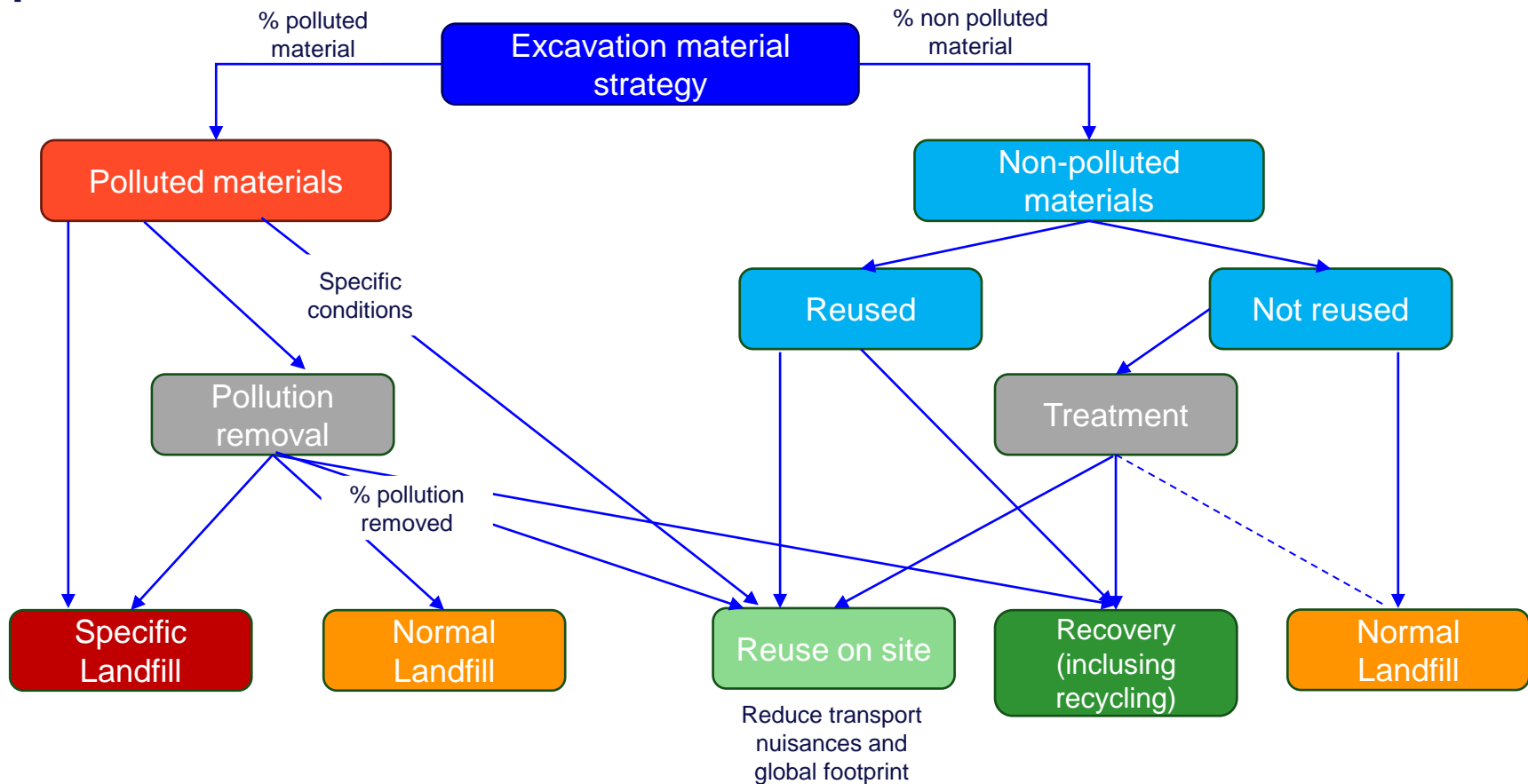
Based on previous CERN projects (LHC and, more recently, HL-LHC).

	Optimistic Scenario	Realistic Scenario	Pessimistic Scenario	Destination
<b>Polluted material</b> Geogenic pollution: Treatment and partial reuse or landfilling	30%	30%	30%	% pollution removed % reuse % recovery % Disposed % special landfilling % landfilling
<b>Non-polluted material / Used</b> reuse (with or without treatment) on site or offsite and/or recovery	60%	35%	10%	% treated % reuse % recovery
<b>Non-polluted material / Not Used</b> Material not suited for reuse because of lack of adapted treatment or regional opportunities	10%	35%	60%	Standard landfilling

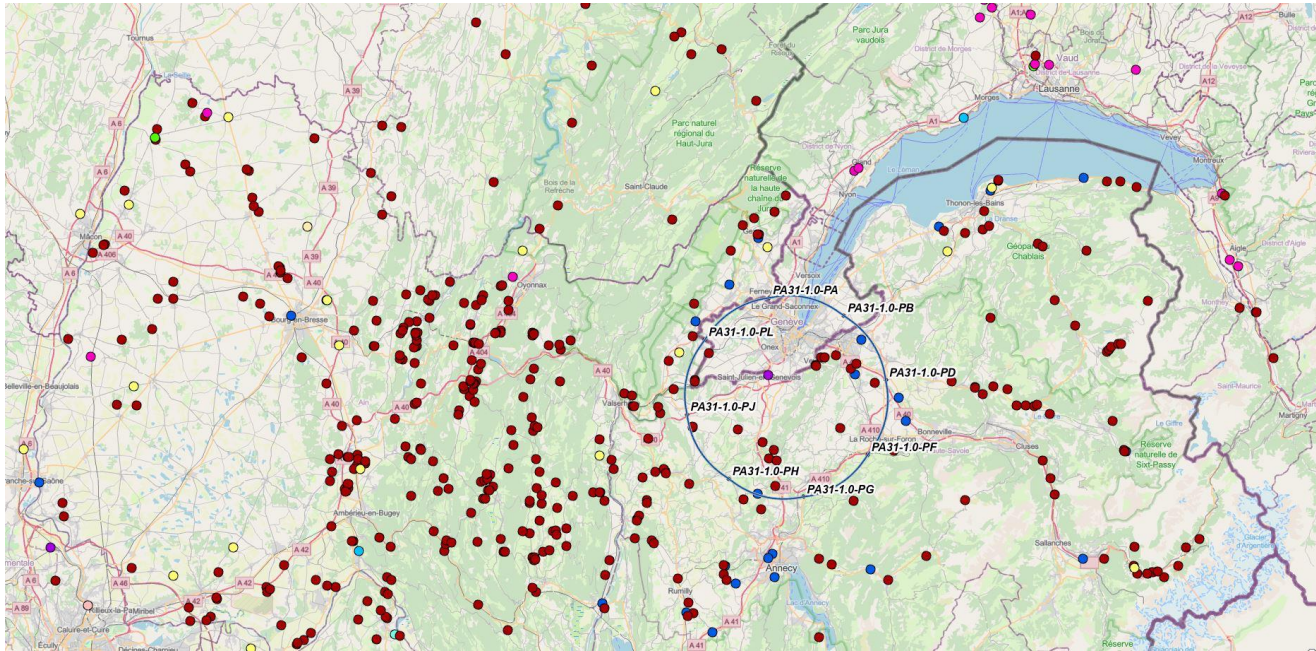
The scenarios will be refined taking into consideration the transport constraints / nuisances.



# Approach



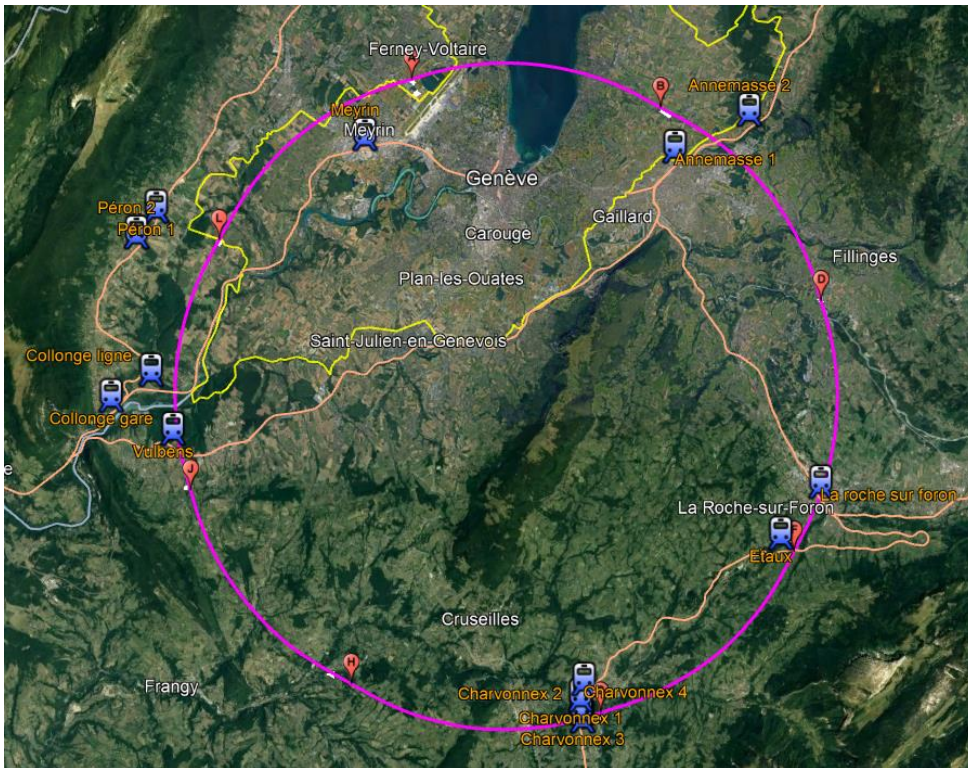
# Regional opportunities



The collected data will be used to:

- build a **preliminary cost analysis** for the excavation material reuse and disposal.
- develop **scenarios for a LCA study** for the potential construction of railroad connections.

# Feasibility study for railroad connections



## Criteria retained:

- Possibility to install a connection
- Modifications needed on the railroad lines
- Maximum allowable load
- Number of wagons / train length
- Capacity of traction /n. of train engines
- Number of trains vs. quantity of material
- Train slots available on the line

Connection installation feasibility

Capacity to evacuate the excavated material

See also presentation by Ch. Barre and T. Halle,  
**«Railway access study preliminary results»**,

Tuesday 6th June, 9:30.

# Railroad connection opportunities

Analyse multicritère débranchabilité site ferroviaire																				
Critère de sélection	Site d'extraction		PA		PB			PD	PF		PG				PH	PJ			PL	
	Site d'exploitation ferroviaire	Meyrin	CEVA (Gare de Genève-Cornavin)	CEVA (Gare de la Praille)	Annemasse 1 (Gare)	Annemasse 2	Aucun site identifié	Étaux	La Roche sur Foron	Chavronnex 1	Chavronnex 2	Chavronnex 3	Chavronnex 4	Aucun site identifié	Collonges Gare	Collonges ligne	Vulbens	Chalex	Collonges Gare	Collonges ligne
La proximité du site potentiel avec une voie ferrée existante	2	2	2	2	2	-2	2	2	2	2	2	2	2	-2	2	2	2	-1	2	2
La débranchabilité avec le Réseau Ferré National (RFN) français ou suisse	2	2	2	2	2	-2	1	2	1	1	1	1	1	-2	2	2	1	-1	2	2
La présence de voie de service ou d'installation embranchée ferroviaire existante à proximité	1	1	1	1	0	-2	0	1	0	0	0	0	0	-2	2	0	0	-1	2	0
La méthode de connexion entre le site ferroviaires et le site d'extraction	-2	-2	-1	-1	-1	-2	1	-1	-1	-1	-1	-1	-1	-2	-2	-1	1	0	-1	-1
Les contraintes d'environnement urbain (poussière/bruit) pour le chargement	-2	-2	-2	-2	0	-2	1	-2	-1	0	-1	-1	-1	-2	0	2	2	-1	0	2
L'espace disponible sur chaque site	2	1	2	2	1	-2	2	1	2	0	1	2	2	-2	1	2	2	0	1	2
Les contraintes environnementales associées	NA	NA	NA	-2	0	-2	2	-2	2	2	2	2	2	-2	-2	-2	-2	0	-2	-2
Le nombre de convoi nécessaire pour transporter la totalité des déblais	2	2	2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	2	2	-2	NA	2	2
La capacité de circulation de la ligne	0	-2	-2	-1	0	-2	1	-2	1	1	1	1	1	-2	0	0	1	0	0	0
<b>Moyenne des scores obtenus</b> Numérotation EGIS (-2 à 2)	1	0	1	0	0	-2	1	0	0	0	0	0	0	-2	1	1	1	-1	1	1
<b>Moyenne des scores obtenus</b> Numérotation CERN (1 à 5)	4	3	4	3	3	1	4	3	3	3	3	3	3	1	4	4	4	2	4	4
<b>Note par site d'extraction</b> Numérotation CERN (1 à 5)	3		3			1	3		3				1	4			3			

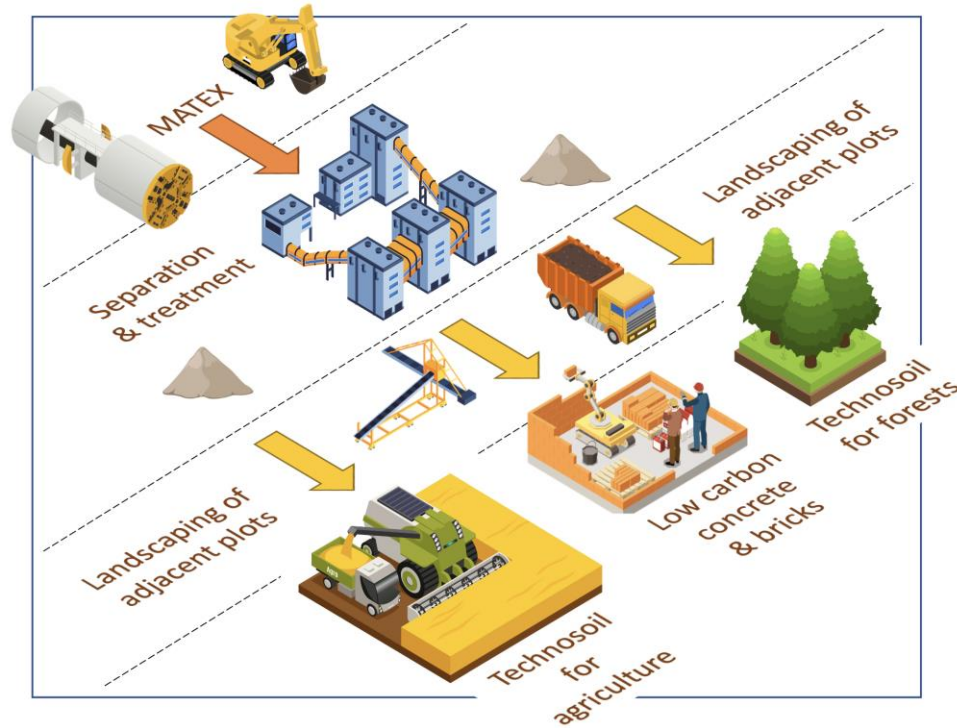
# “Mining the Future®”

- **Publication** of the competition on 1st May 2021
- **First phase** ended in October 2021: **12 proposals, 4 selected by the international jury (9 members)**
- Proposed applications focus on **different phases of the excavated material treatment and reuse.**
- Type of participants: **Key players in excavation projects** as well as new startup and research institutes
- **Second phase:** 4 selected are progressing with the feasibility study to **bring the proposal to at least TRL4\*** . Submission by end of June 2022.
- **Final event** with announcement of the winner: 27 September 2022.



\*TRL: Technology readiness level. Level 4: Technology validated in laboratory

# A "locally innovative" approach



The priority for FCC is to **propose a large-scale re-use of excavated materials** including carbon capture potentials (follow up of Mining the Future<sup>®</sup>, which was seen by the EC as an excellent initiative).

The aim is to re-use the material locally as much as possible, keeping transport nuisances low and providing fertile soil for agriculture and re-forestation.

Work is ongoing since December 2022 to establish the framework for a **real-scale demonstration** of the innovative solutions.

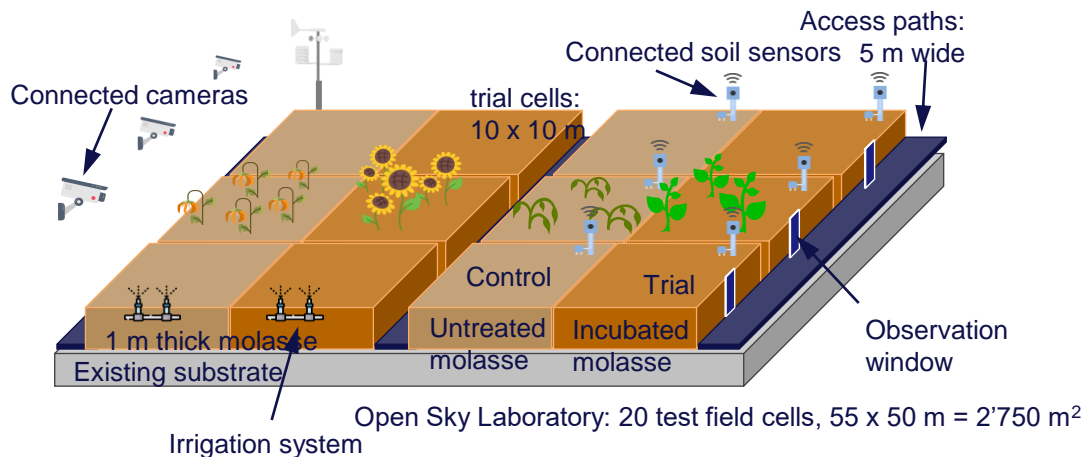
# Next steps

Proposals need to be

- **demonstrated at real scale level**
- **developed jointly** with the host state technical public administration services (e.g. DT, DDT, DREAL) and local actors
- **validated and accepted** by the host state authorities accompanying CERN.

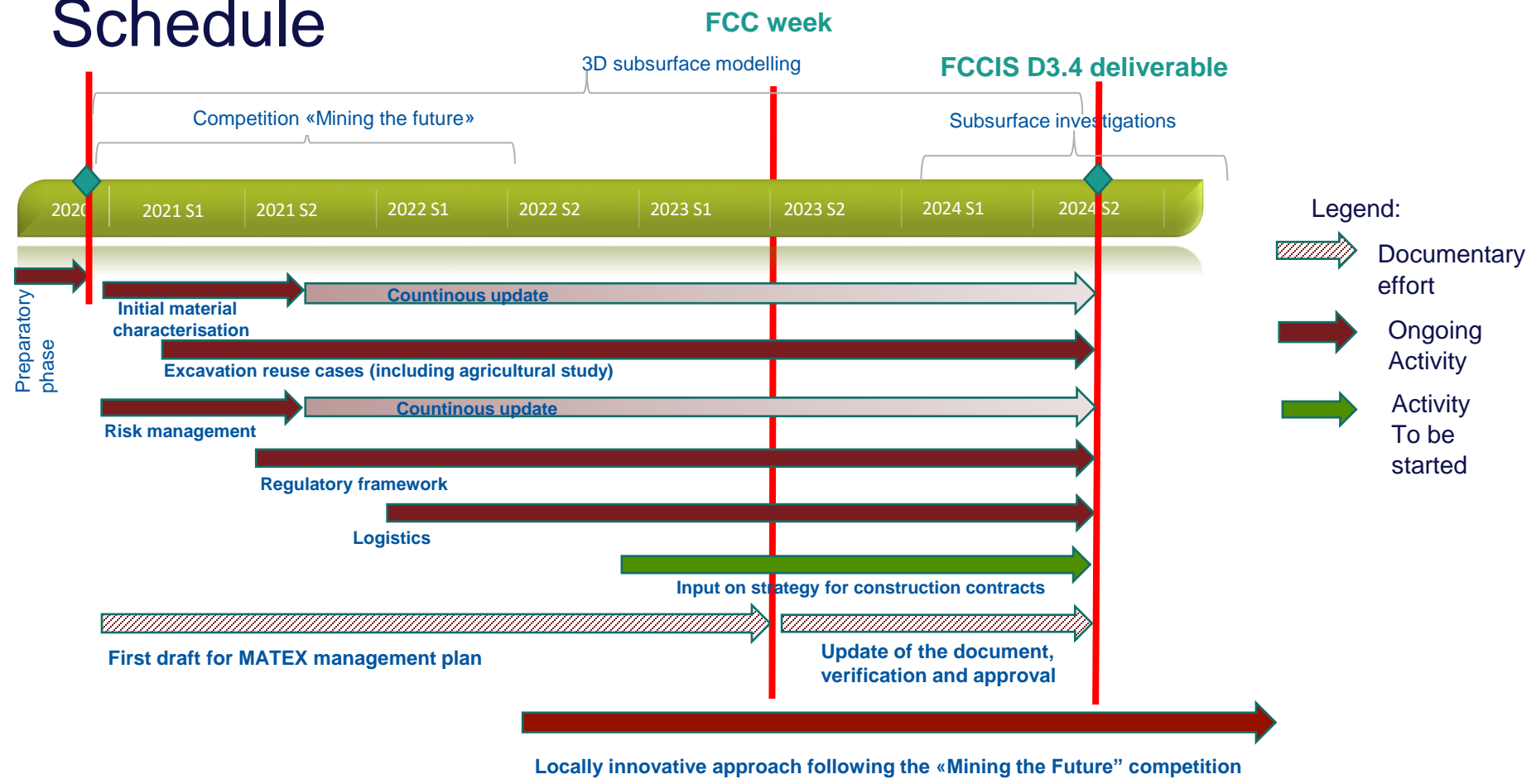
Phases:

- **Identification of demonstration land plots**
- Definition of **type of culture (crops, trees, etc.)** and **parameters to be monitored**
- **Study of tolerance to pollution**



Courtesy of J. Gutleber

# Schedule





# Conclusions

**First draft** of FCCIS deliverable D 3.4.

**First draft** of cost estimate for the excavation material management is being used as basis for cost estimates including re-use.

**Continuous update** will be performed when more information on layout and technical solutions become available.

**Draft of mid-term review deliverable 3.8**  
*“Molasse re-use potentials, based on the outcome of the ”Mining the Future<sup>®</sup>”* is being finalized.

Large scale reuse of excavation material depend on:

- Availability of **precise geotechnical and geomechanical data**
- **Detailed geological investigations are needed well in advance of the tendering for a construction project** (management of risks)
- **Excavation methods** are important to reduce pollutants

Territory and regional regulations are evolving continuously. Agreement with regional and local authorities for a joint effort in making the innovative local reuse a valid and rentable solution



# Thank you for your attention.

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