

Hydraulic Cage Concept for Waste Chambers and its Technical Implementation for the Underground Richard Repository, Litoměřice, Czech Republic

Funding of work

Phare Project

Solution for the Closure of a Chamber in the Richard Repository

EUROPEAID/113986/D/SV/CZ



**A project funded by the
European Union and the Czech Republic**



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Location of Richard Repository



◆ Richard Repository

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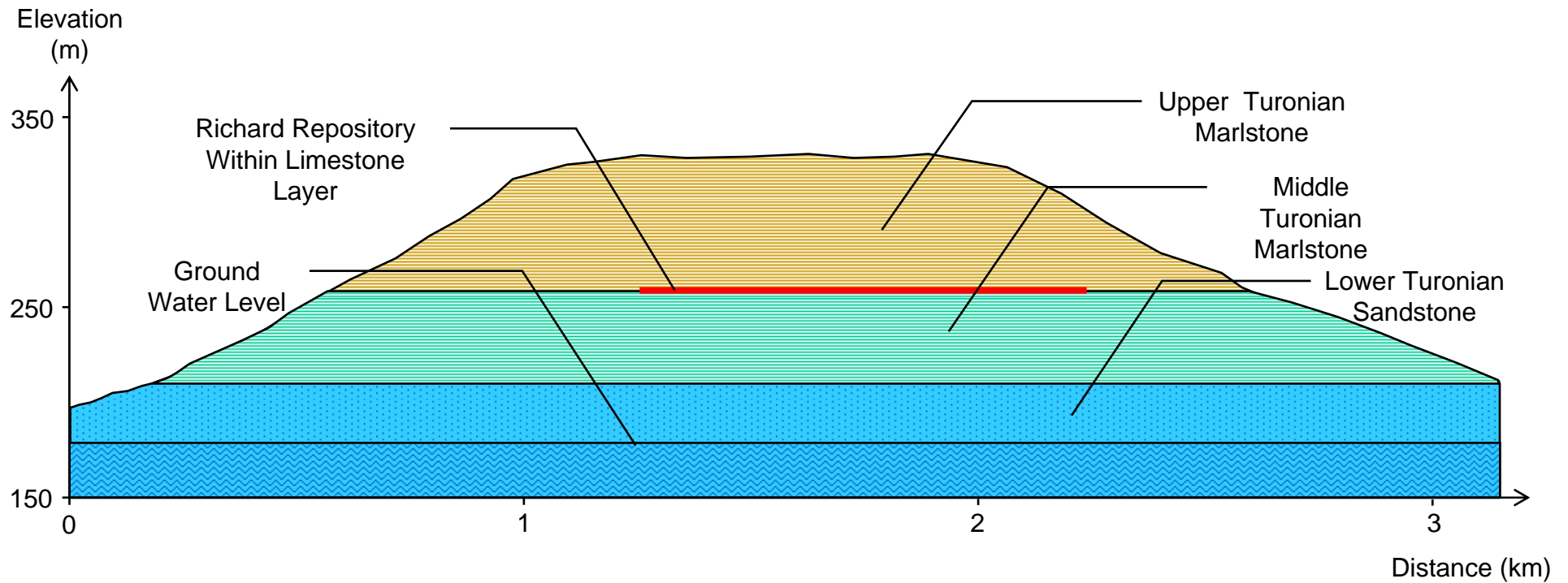
Location of Richard Repository



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Geological Cross Section Richard Repository

Simplified Geological Cross Section



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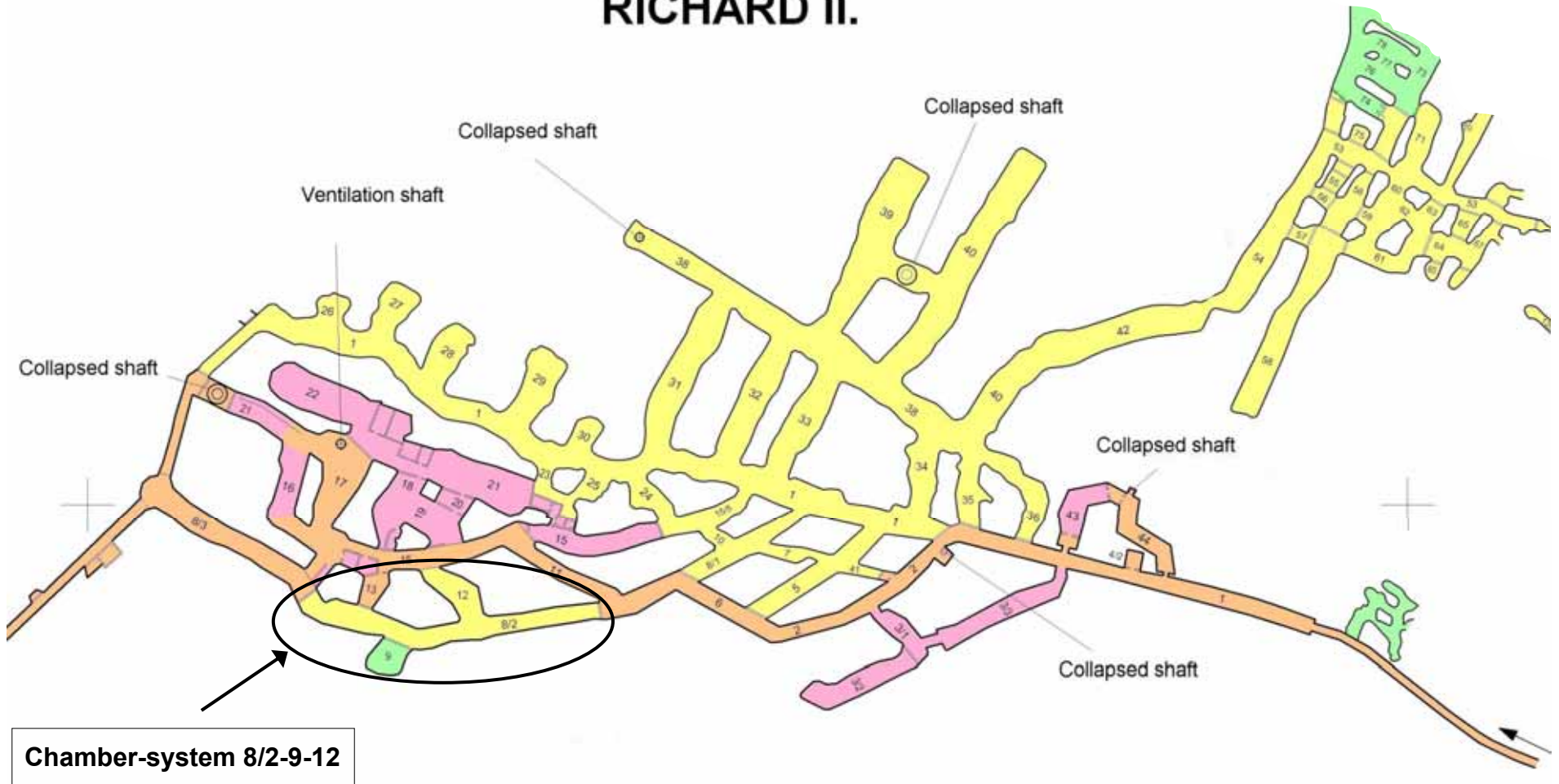
History of Richard Repository

- 1930´s Limestone mine
- 1940´s Military production
- 1960´s Repository
- Inventory ca. 10^{15} Bq
- Approx. 25,000 waste packages disposed of
- 2000 RAWRA takes over RICHARD



Map of Richard Repository

RICHARD II.



Chamber-system 8/2-9-12

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Main Tasks of Phare Project on Richard Repository

- Review of existing closure plan and safety assessment
- Revision of closure plan (if necessary)
- Update of the safety assessment
- Detailed technical planning for specific chamber-system
 - Preparation of a non operated chamber-system
 - Handling and treatment of waste (incl. historical waste)
 - Backfilling of chamber-system
- Preparation of documents for realization of closure concept
 - licensing
 - tender process

Main Topics of Presentation

- Brief description on the reasons for changing the former closure concept
- Principal description of new closure concept and its impact on the long-term safety
- Description of planned technical implementation

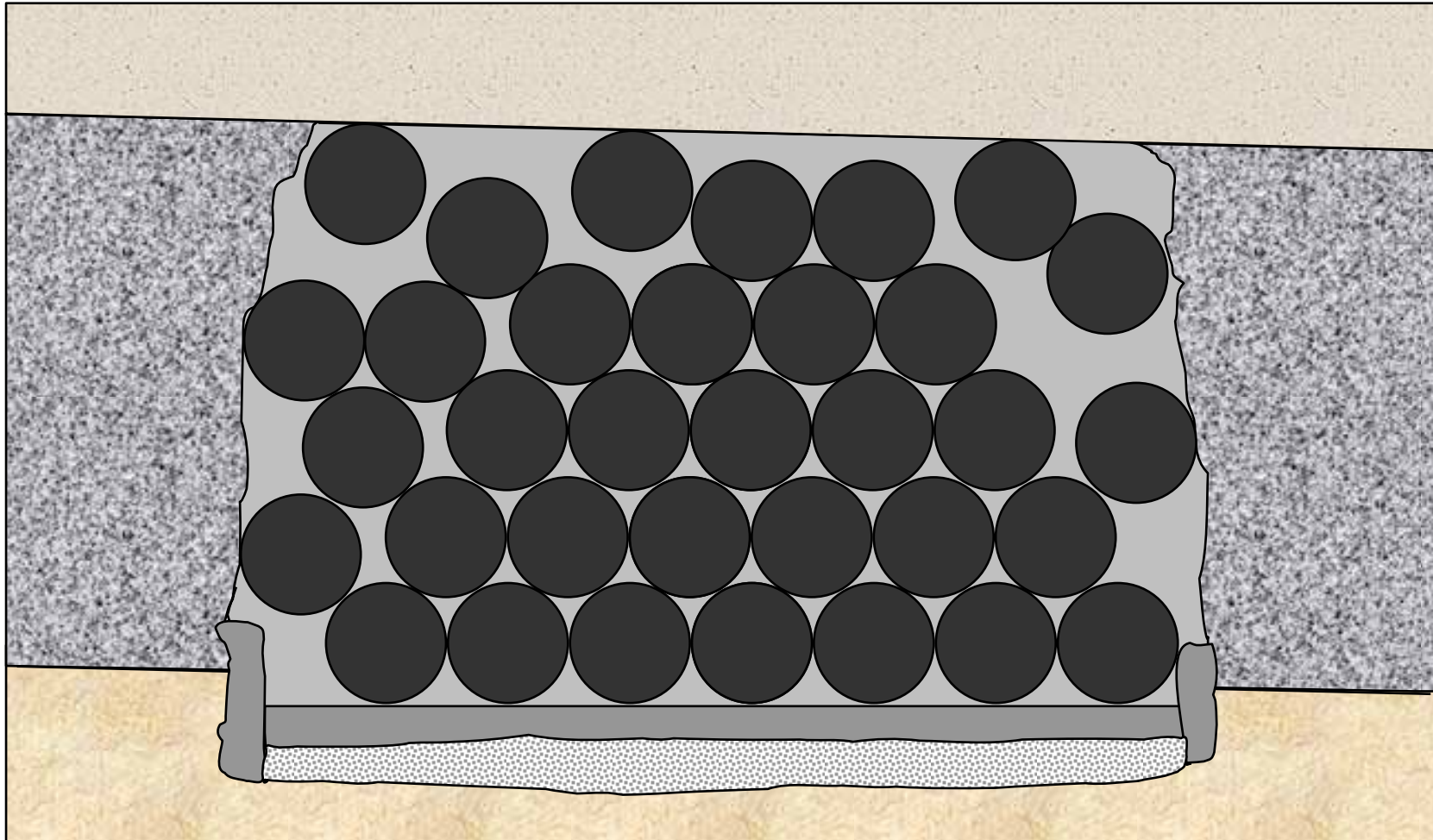
Waste Chamber



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Previous Closure Concept

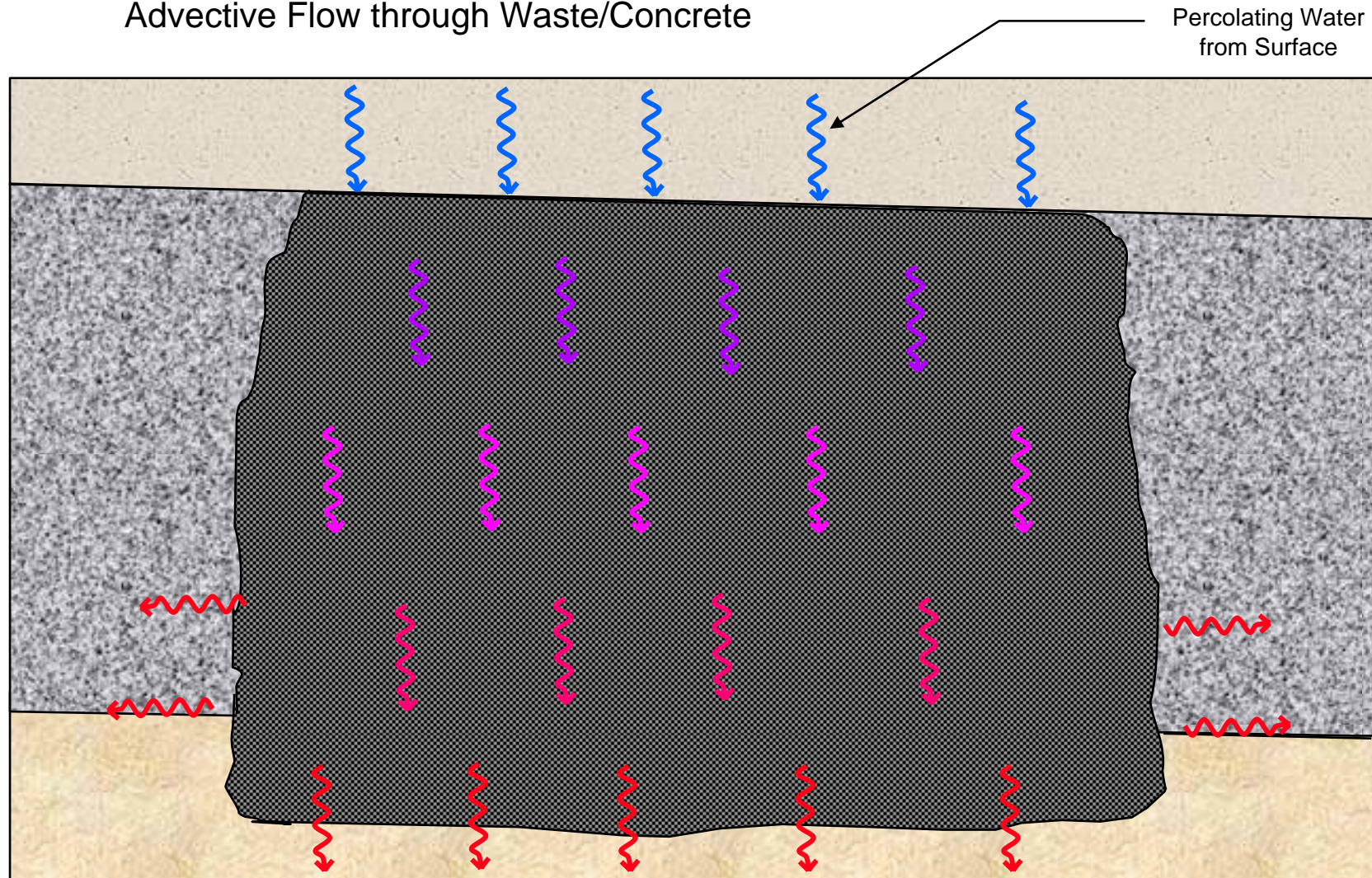
Simplified Chamber Model



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Previous Closure Concept

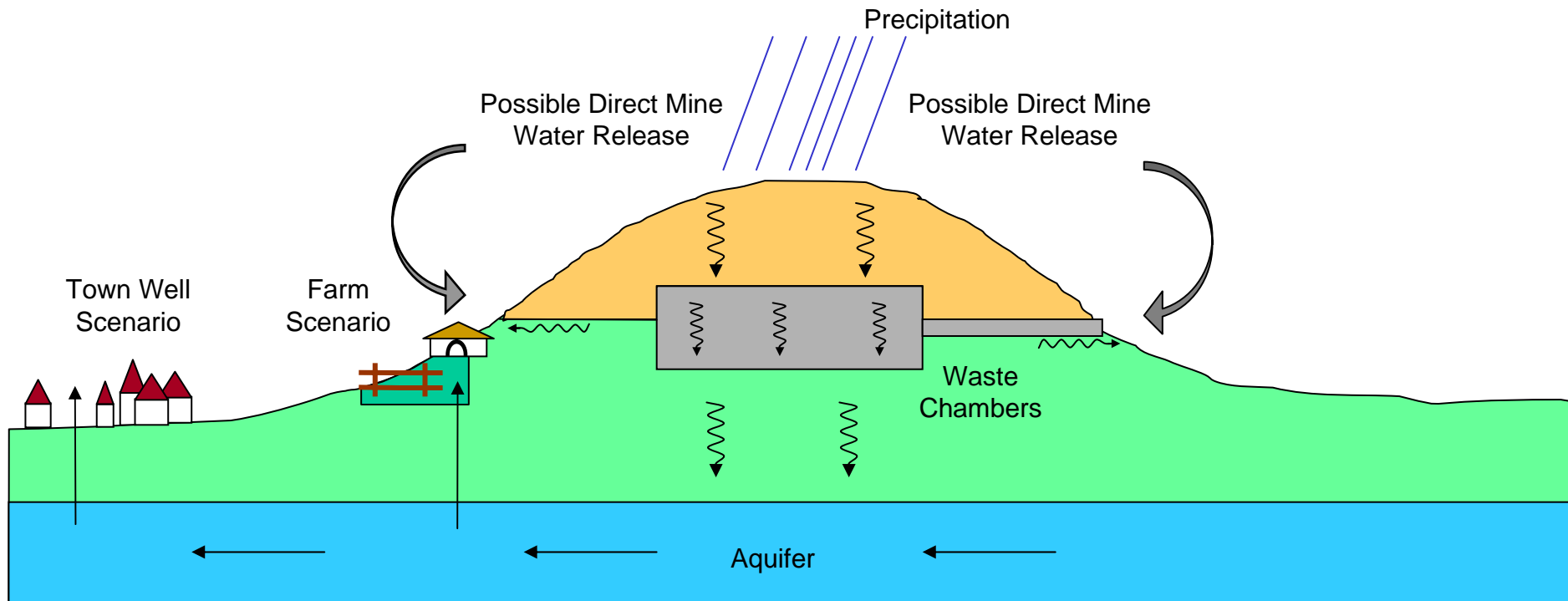
Advective Flow through Waste/Concrete



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Previous Closure Concept

Simplified Model for Scenarios



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Previous Closure Concept

Main Problems

Main Problems of Previous Closure Concept

- Direct contact between water and waste packages not prevented
- Advective transport without delay
- Due to special stratigraphy, scenarios related to direct release of mine water difficult to exclude

Hydraulic Cage Concept

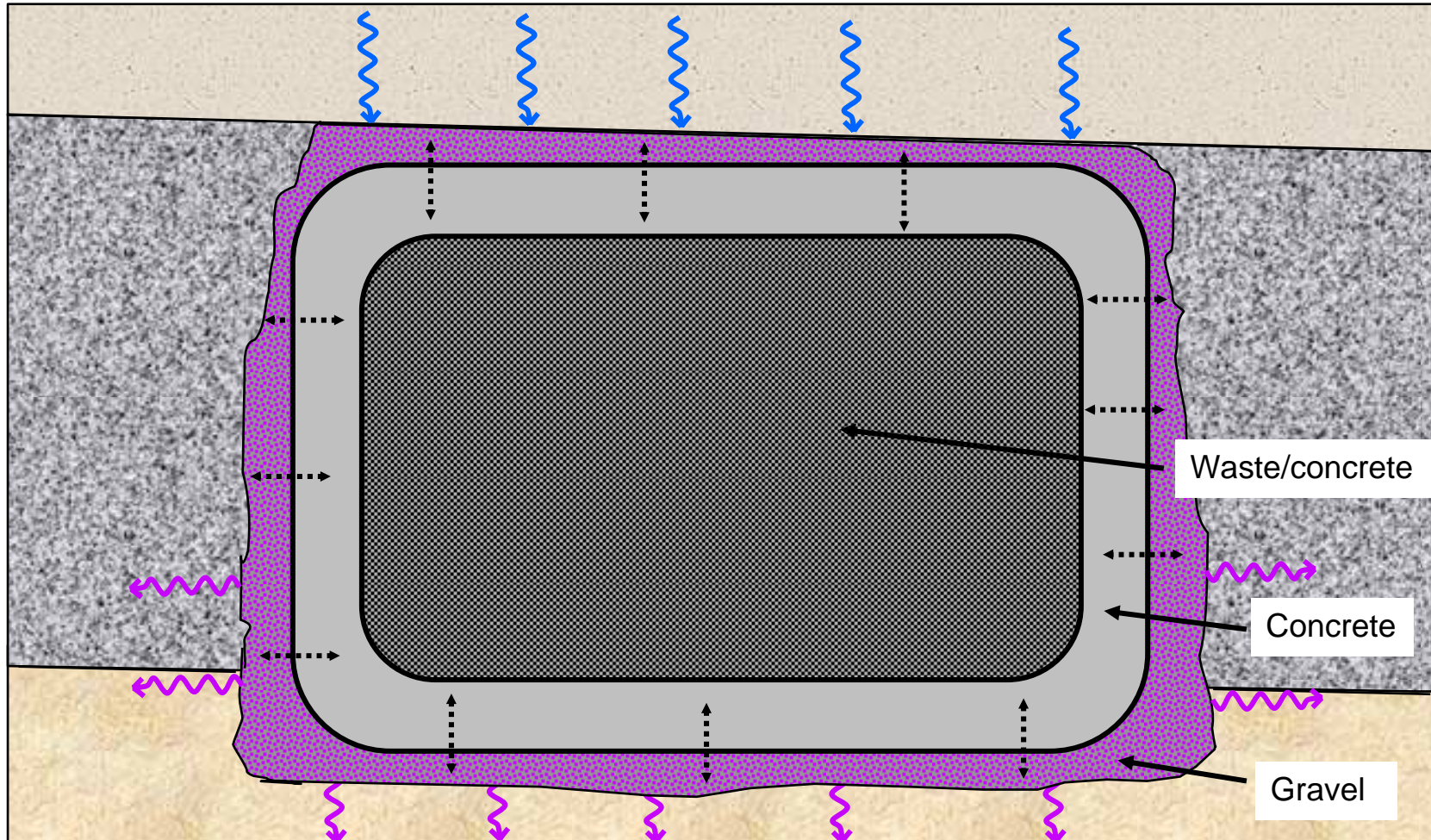
Main Working Principle

Hydraulic Cage Concept

**Elimination of radionuclide transport mechanism
by transport gradient elimination
through implementation of an HYDRAULIC CAGE**

Hydraulic Cage Concept

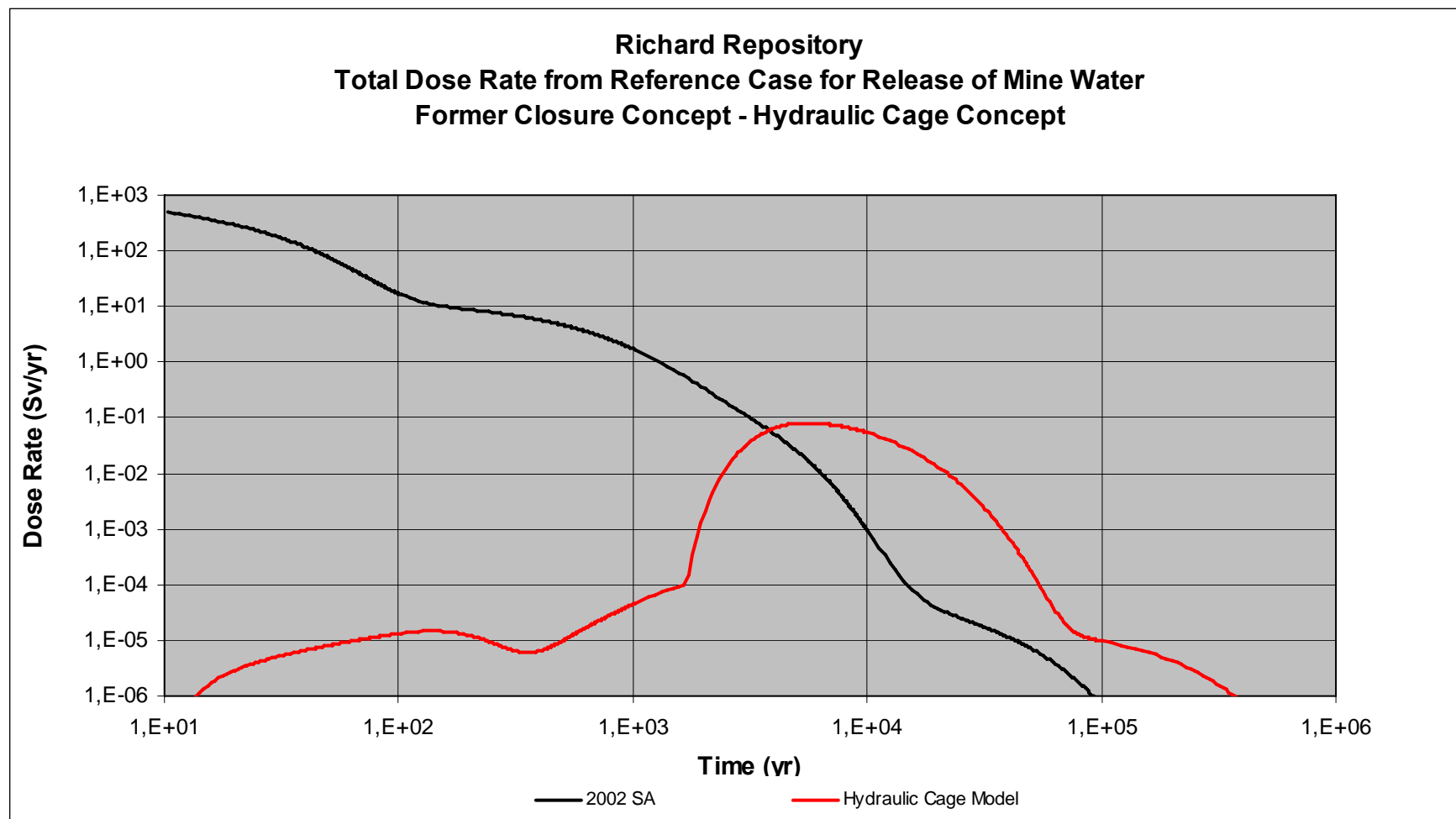
Simplified Radionuclide Transport



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Safety Assessment Richard Repository

Total Dose Rates from Mine Water Release Scenario



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Hydraulic Cage Concept

Technical Implementation

Technical Implementation of

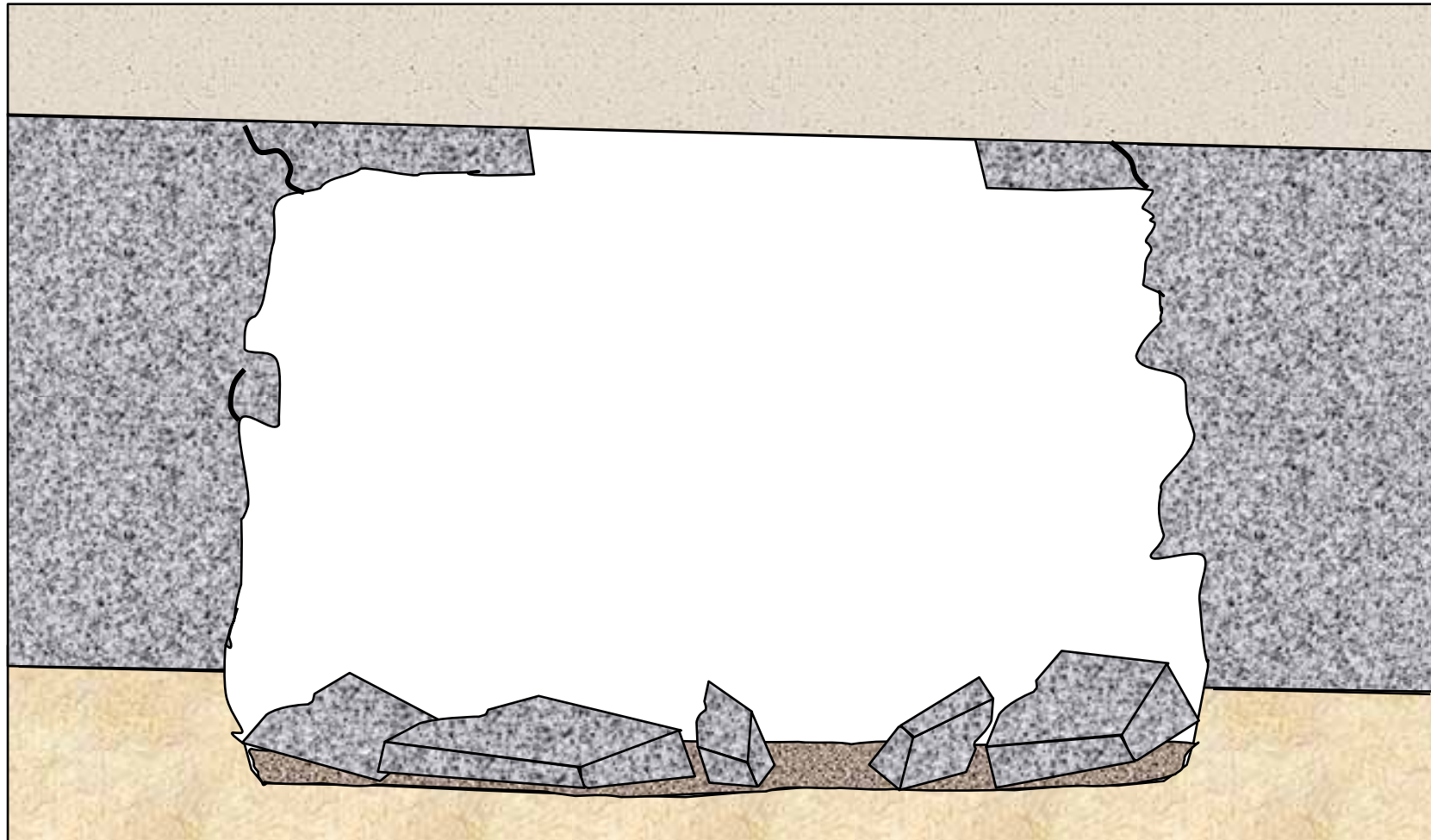
Hydraulic Cage Concept

Main Steps during Technical Implementation of Hydraulic Cage

- Clearing of Chamber
- Construction of Roadway and Hydraulic Cage
- Preparation for Waste Disposal
- Disposal and Backfilling

Chamber Preparation

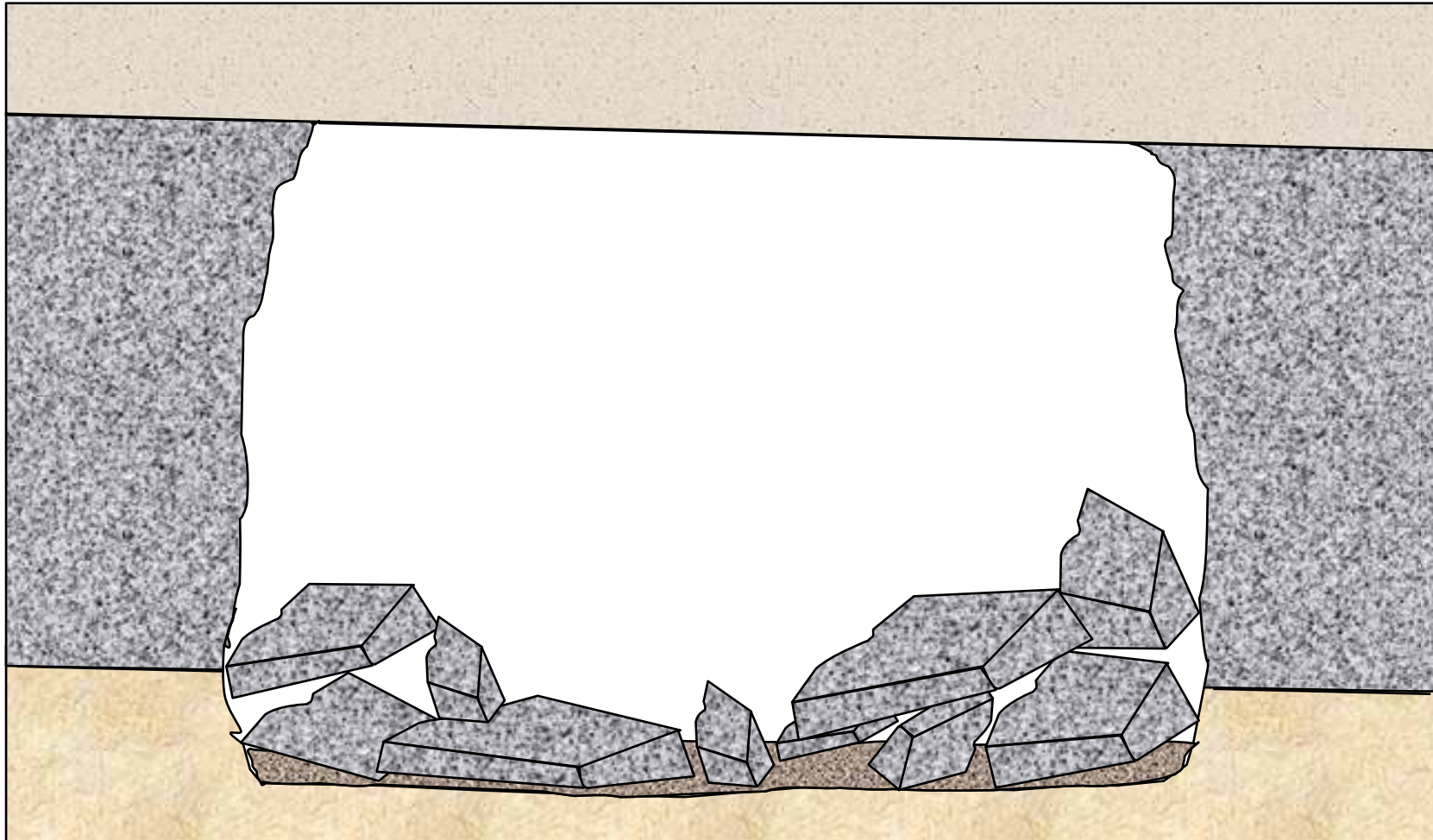
Present Situation



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Chamber Preparation

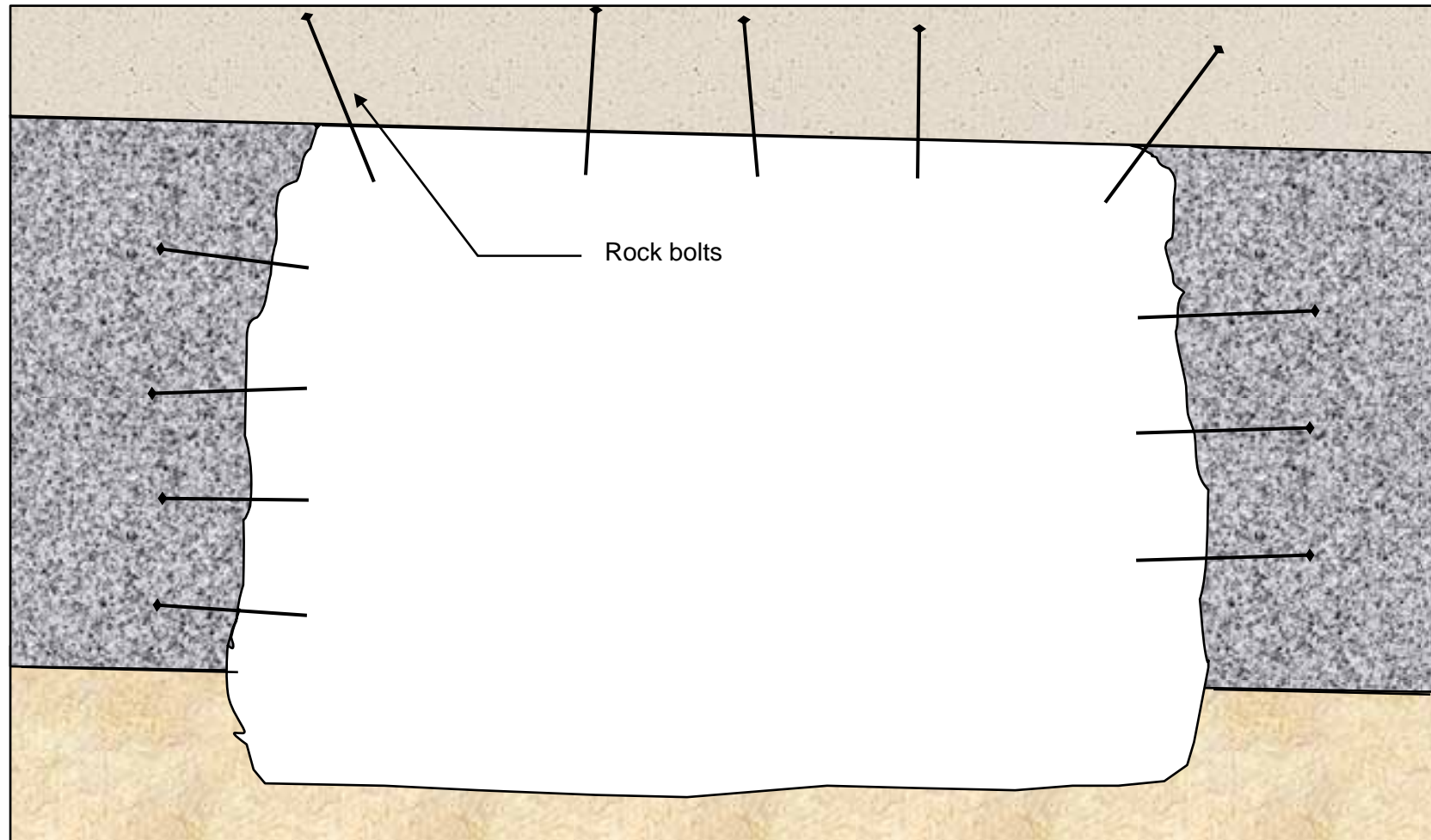
Situation After Clearing of Loosened Rocks



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Chamber Preparation

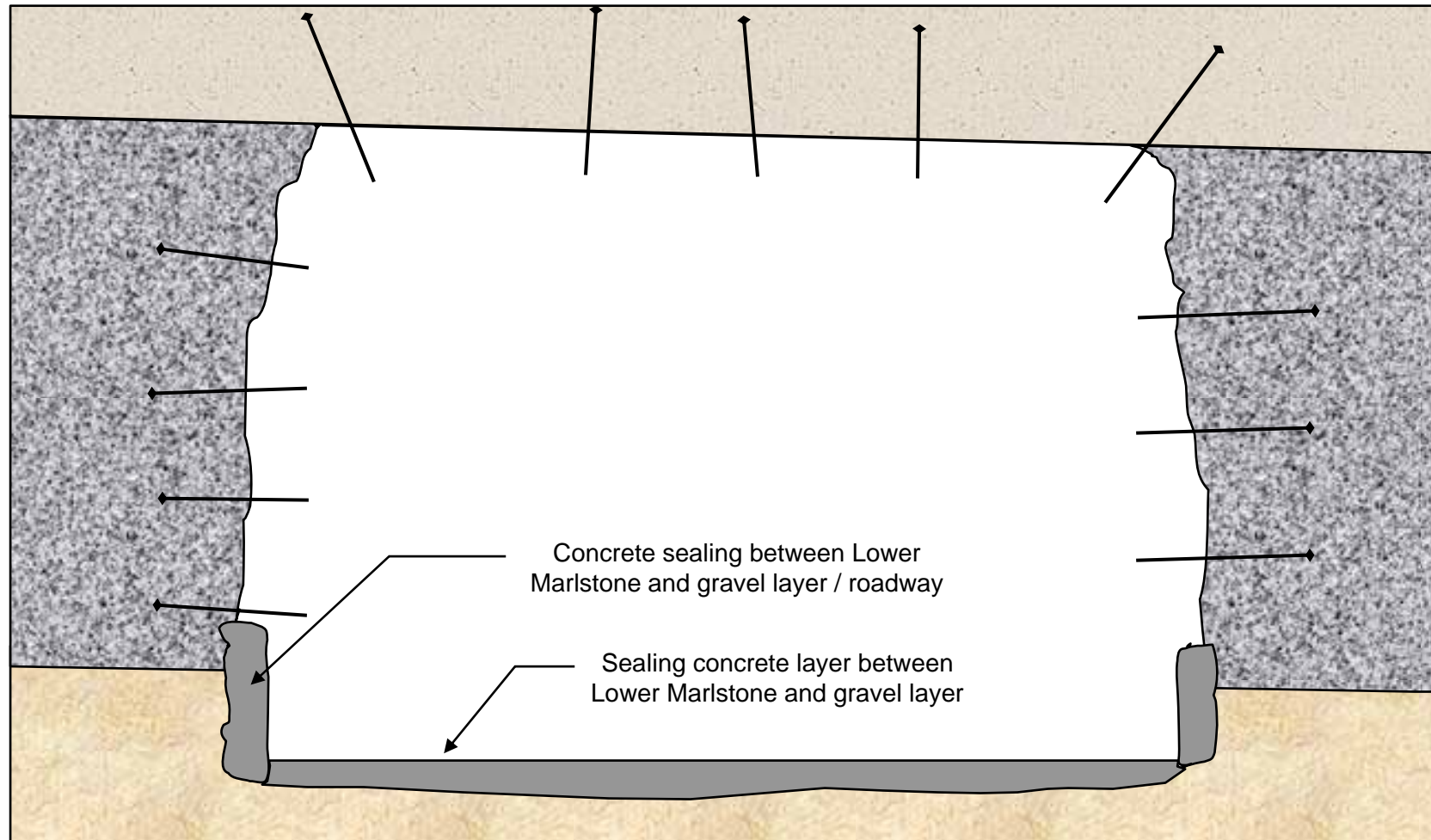
Installation of Rock Bolts



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Chamber Preparation

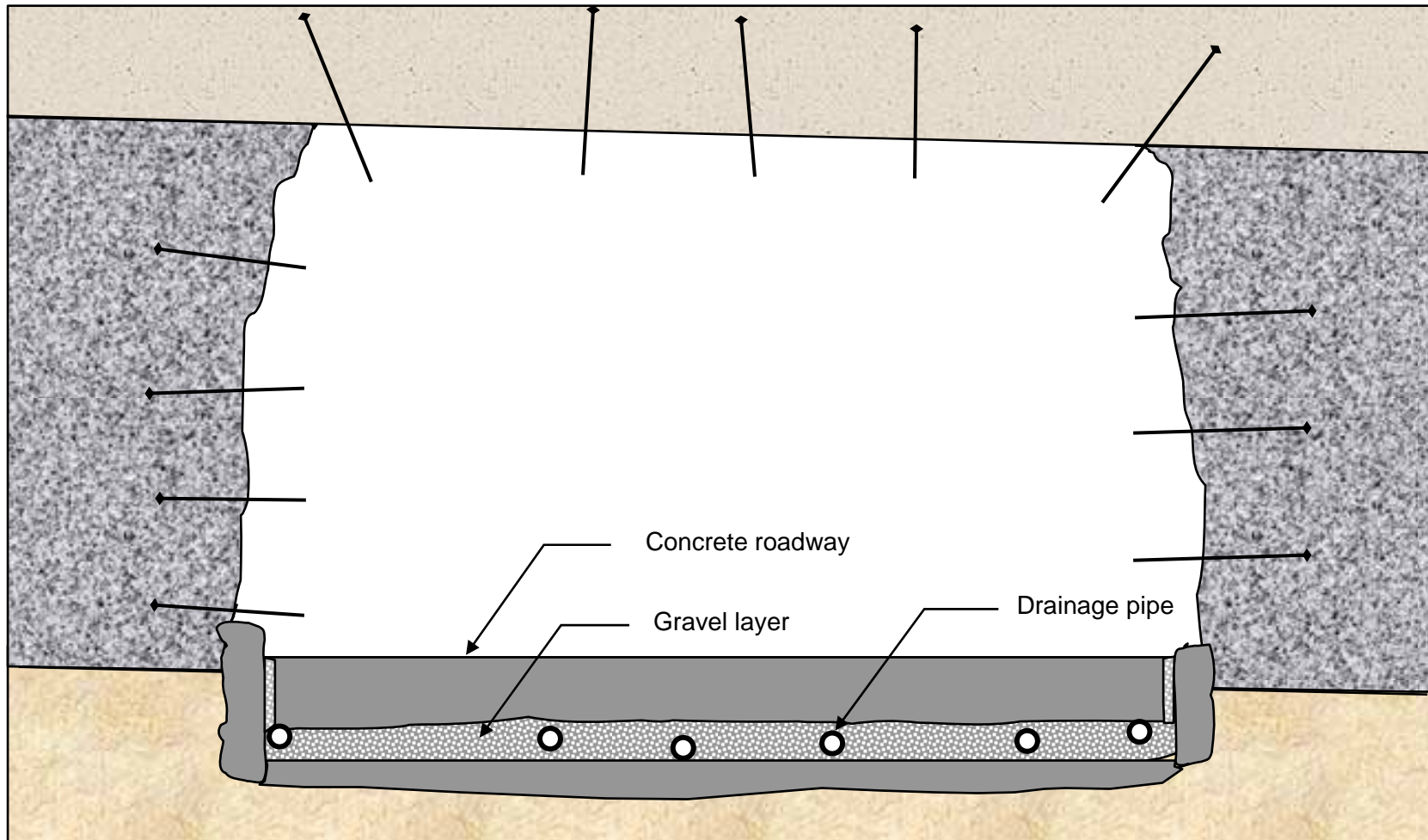
Installation of Separating Layer



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Chamber Preparation

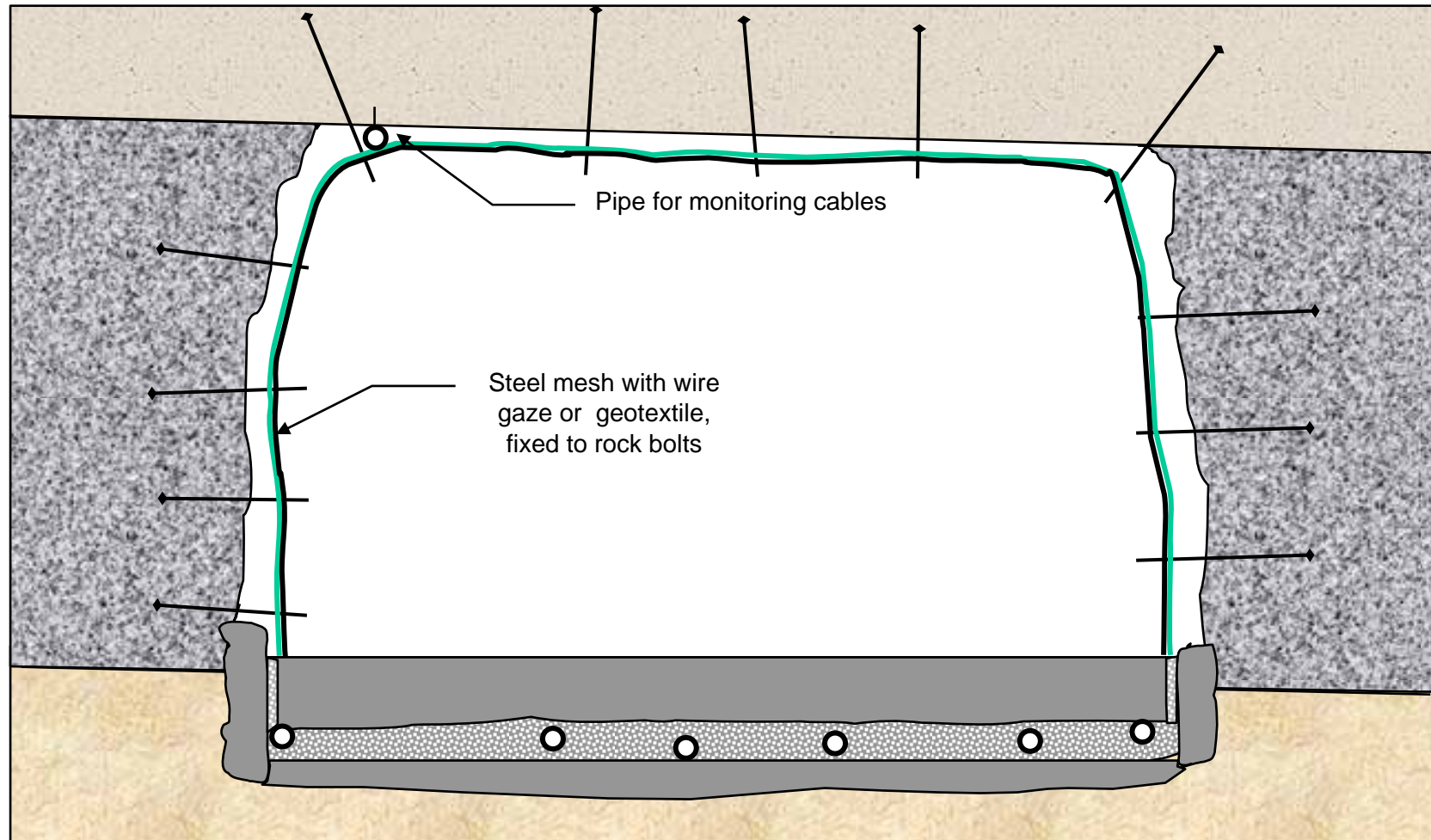
Installation of Concrete Roadway



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Chamber Preparation

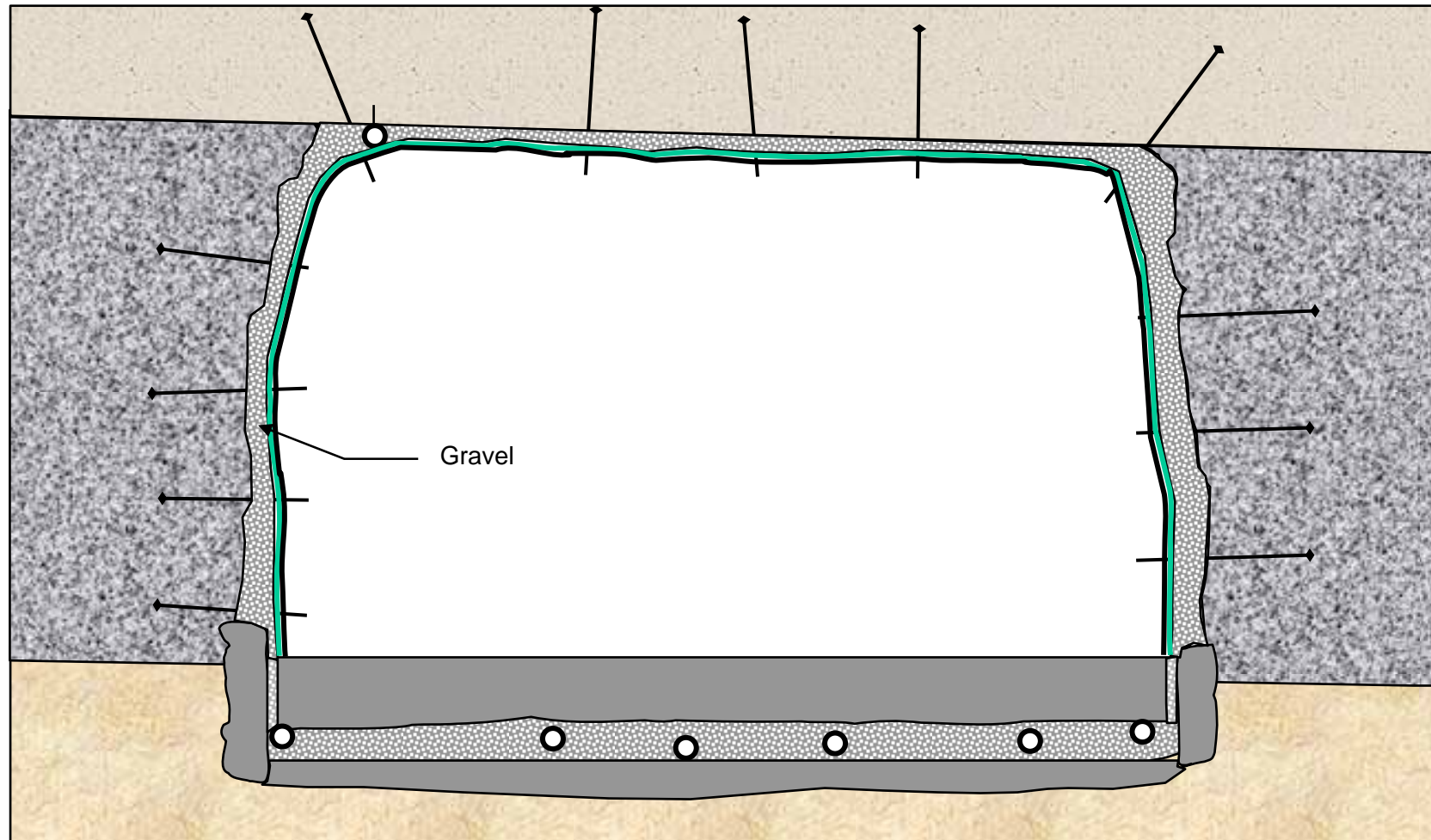
Installation of Hydraulic Cage



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Chamber Preparation

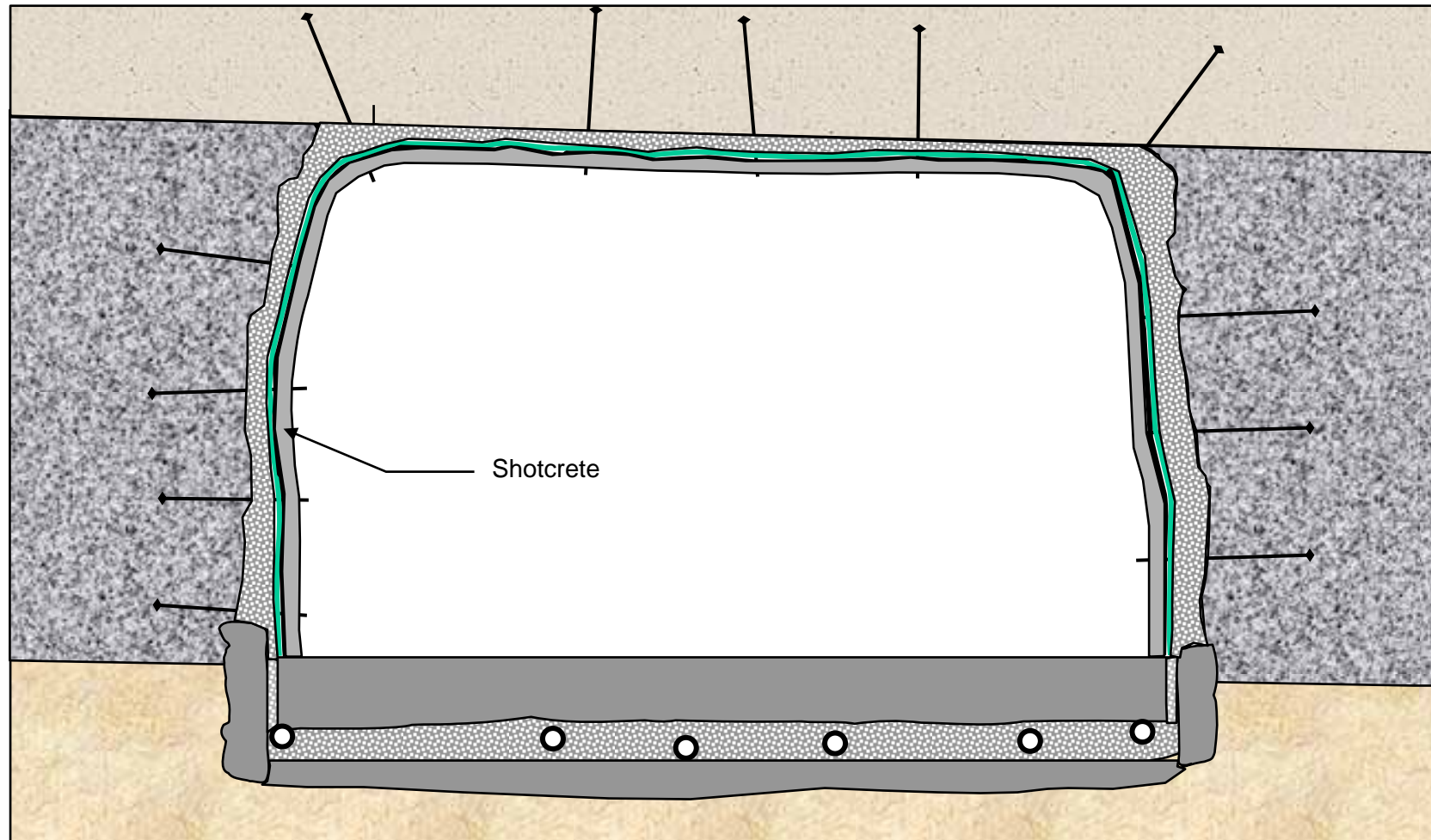
Installation of Gravel Layer



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Chamber Preparation

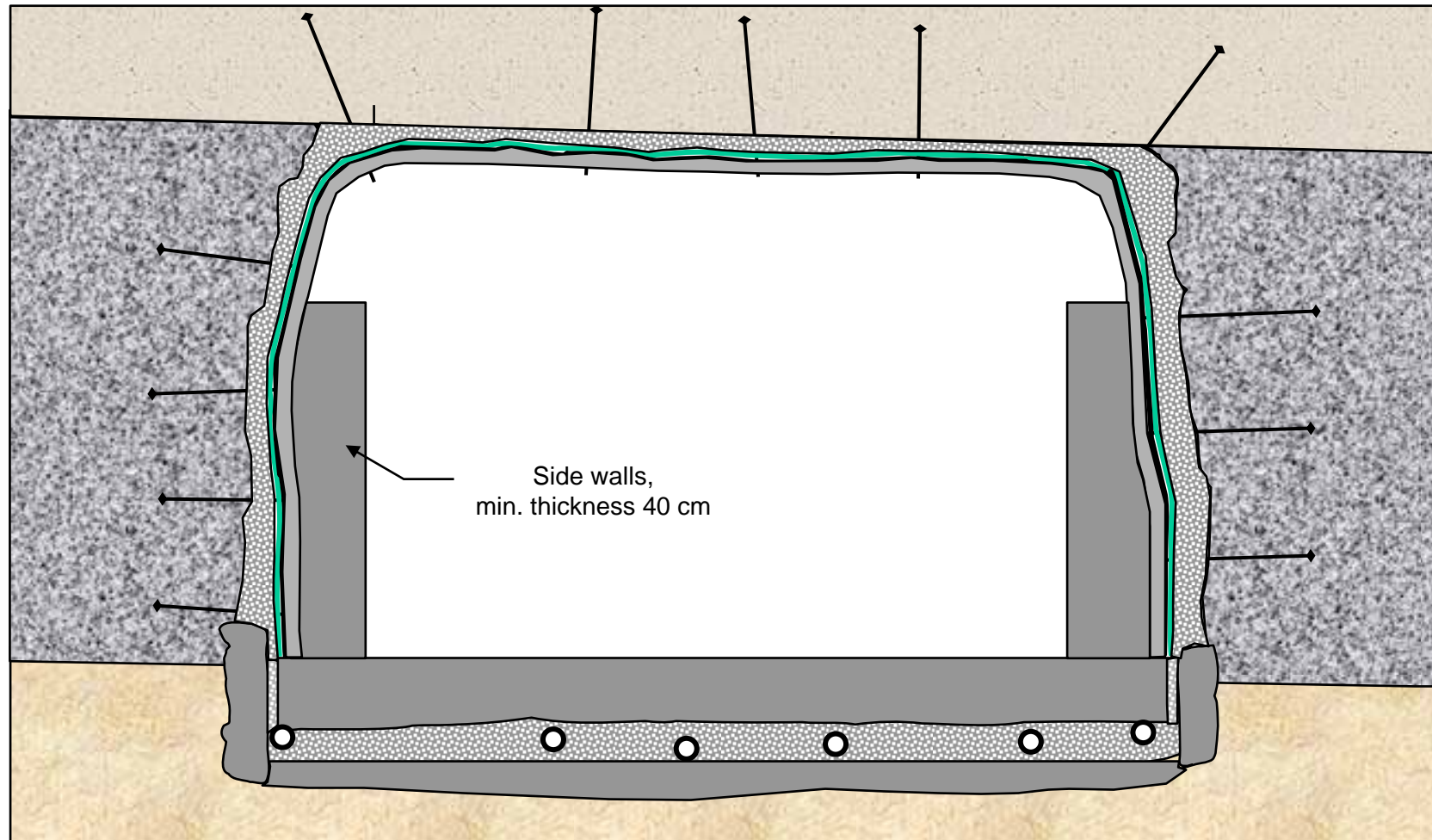
Application of Shotcrete Layer



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Chamber Preparation

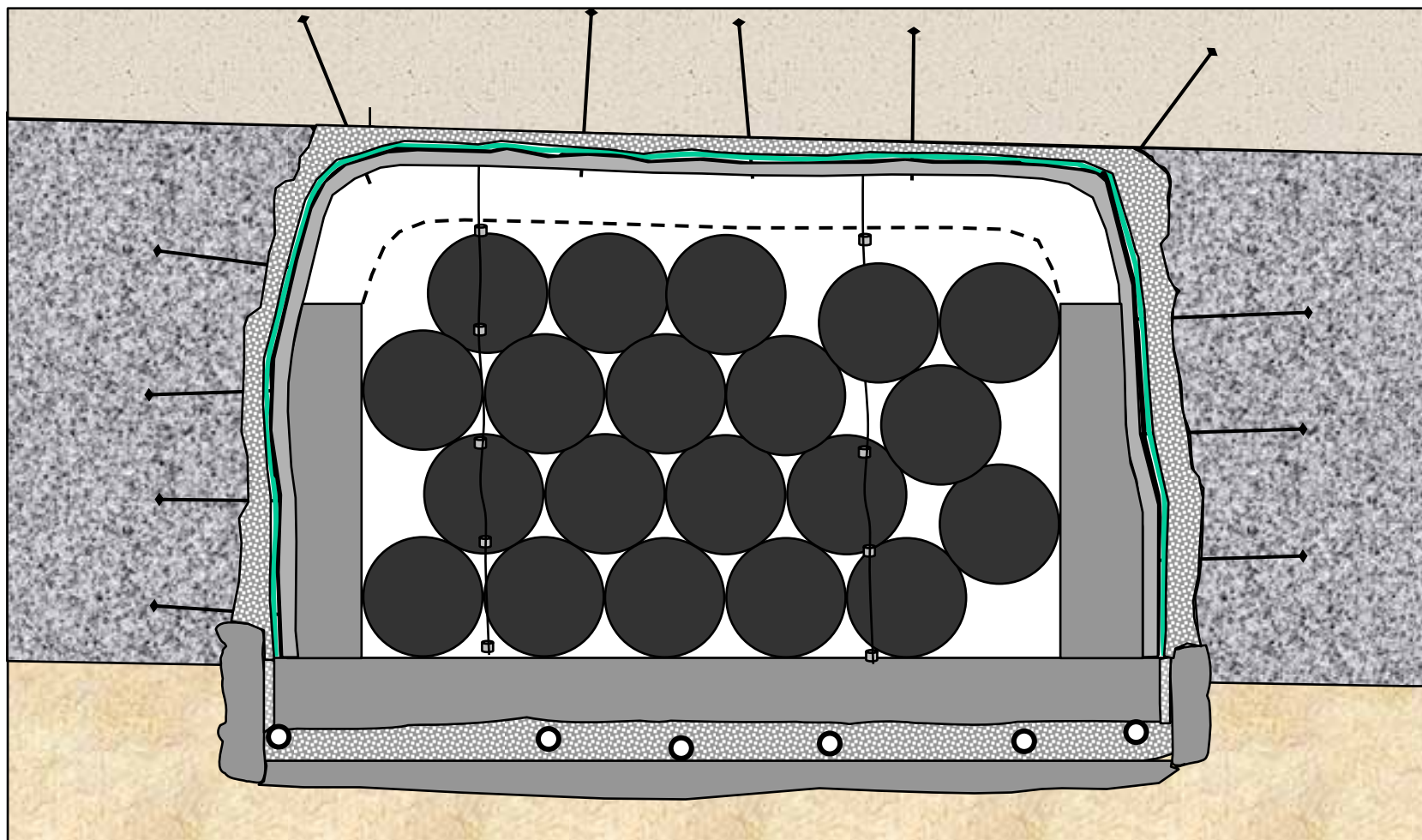
Preparation of Concrete Side Walls



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Disposal of Waste

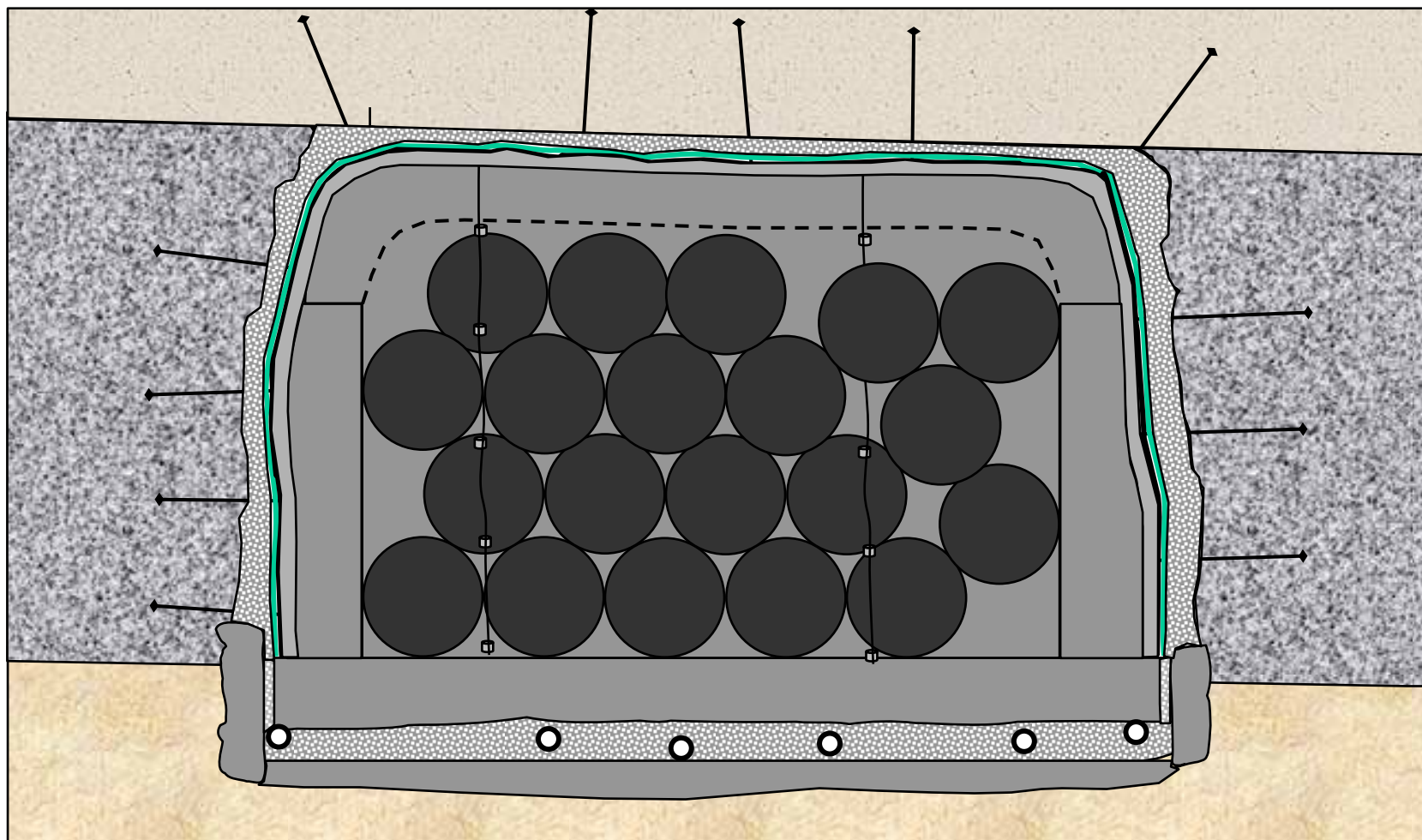
Disposal of Waste Drums



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Closure of Chamber

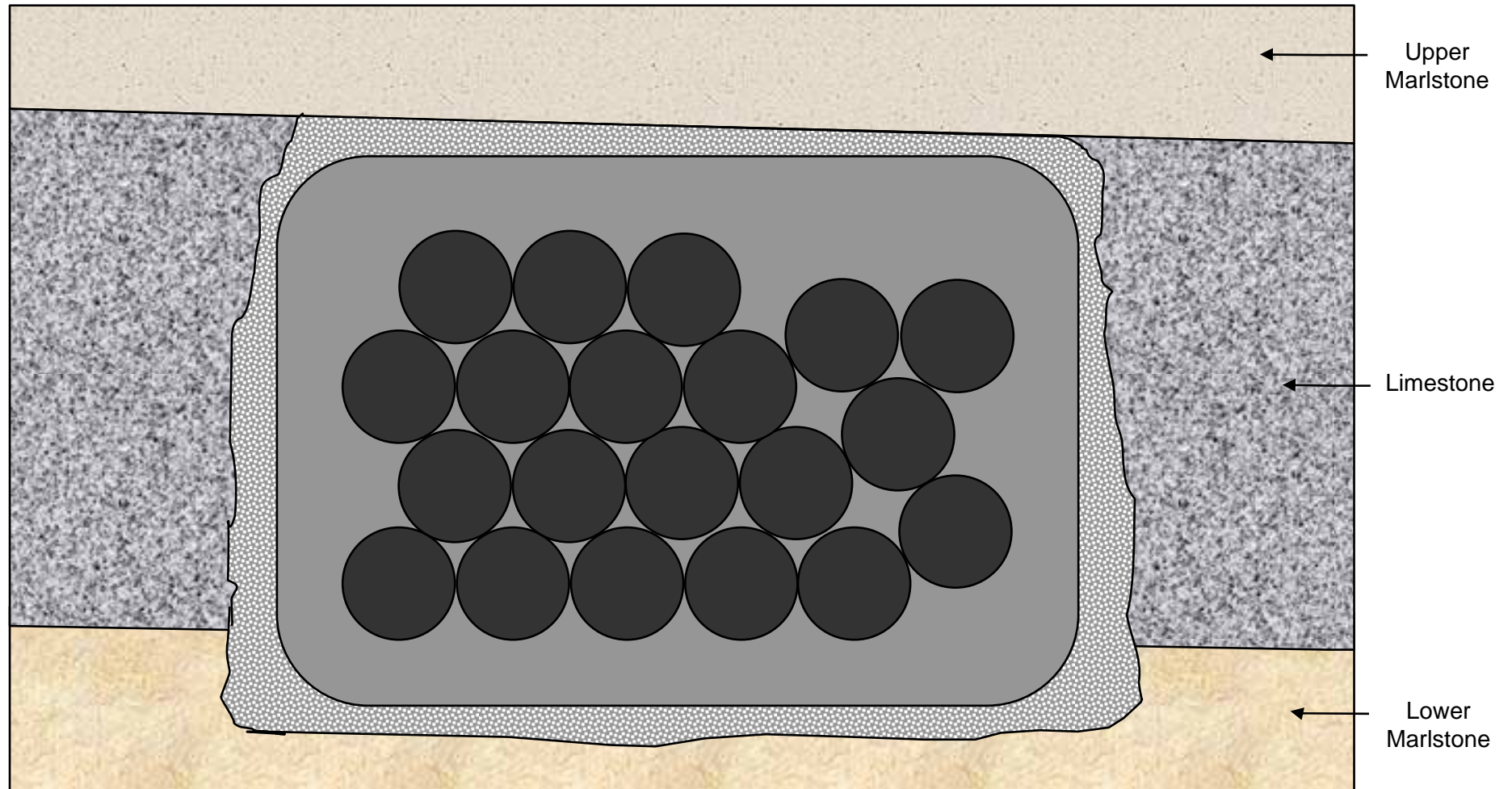
Situation after Backfilling



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Closure of Chamber

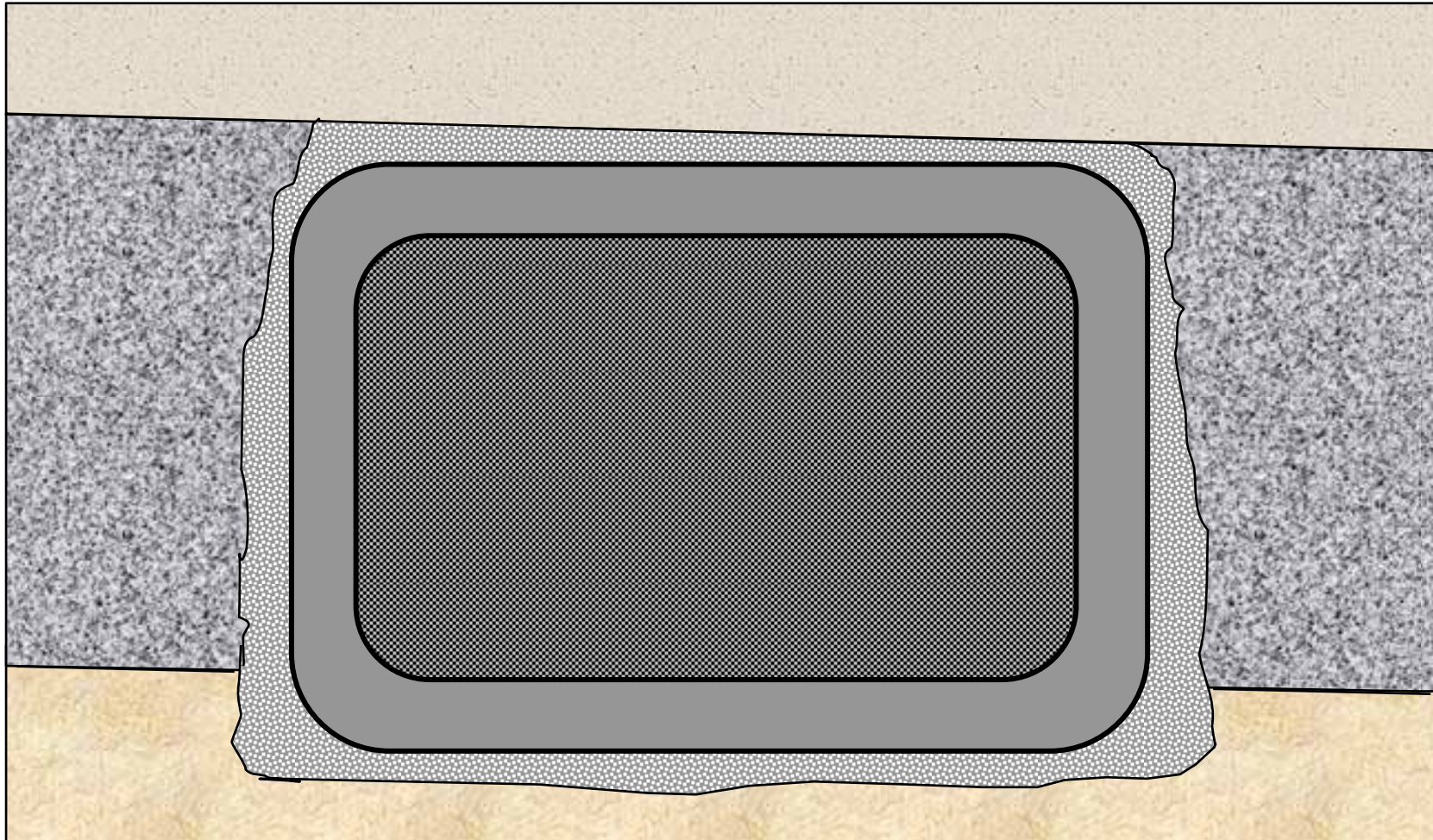
Simplified Model of Situation after Backfilling



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Closure of Chamber

Further Simplified Model of Situation after Backfilling



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Chamber Preparation

Initial Situation



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Presentation TopSeal 2006, Olkiluoto

Thank you very much for your attention