

# Topographical Survey and Soil Characterization of a Candidate Site for Radioactive Waste Repository

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# Introduction

- CNEN tasked at establishing a near-surface repository for LILW;
- Need to select a proper site meeting the diverse technical and socio-economic criteria to host such a facility:
  - Minimization of risk of human exposure to radiation and environment contamination;
  - Meet suitable physiographic, meteorological, geotechnical, hydrogeological and tectonic requirements;
  - Compatible socio-economical characteristics:
    - low population density
    - no agricultural activities
    - absence of mineral deposits of interest
    - proximity to the paved road mesh.

# Candidate site

- Initial strategy: voluntary offer by municipalities inside Region of Interest;
- Change of scenario, one area at a federal land appointed due to:
  - Government owned status;
  - Sufficient area;
  - Appropriate topographic features;
  - Proximity to waste generators;
  - Connection to the paved road grid;
  - Lack of legal impediments.

# Site characterization studies

- Topographical survey
- Boring (SPT and rotary)
- Groundwater analysis



# Site characterization studies

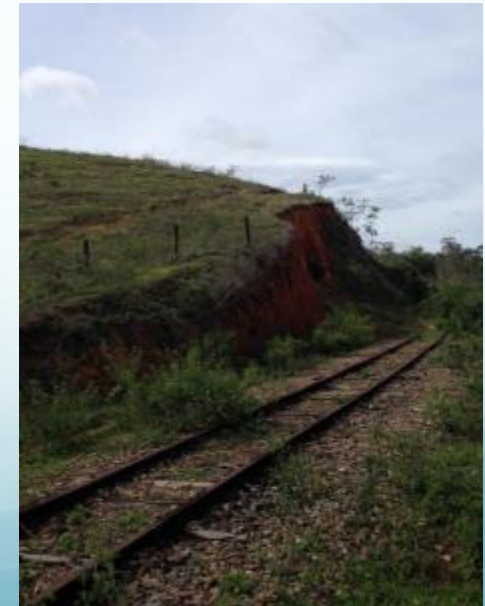
- Conducted at the site and its immediate vicinity to gather preliminary technical information on:
  - The candidate site terrain and landscape;
  - Hydrogeological and geophysical features;
  - Basic data of its constituent layers – depth, nature and strength;
  - Groundwater quality.





# Topographical survey

- Determination and recording of the site perimeter, surface and declivity;
- Characterization of its natural features and man-made buildings and elements.



# Boring

- Twelve boreholes executed;
- Initially SPT boring, subsequently rotary;
- 3 meters penetration in rock;
- Four boreholes changed to groundwater monitoring wells.

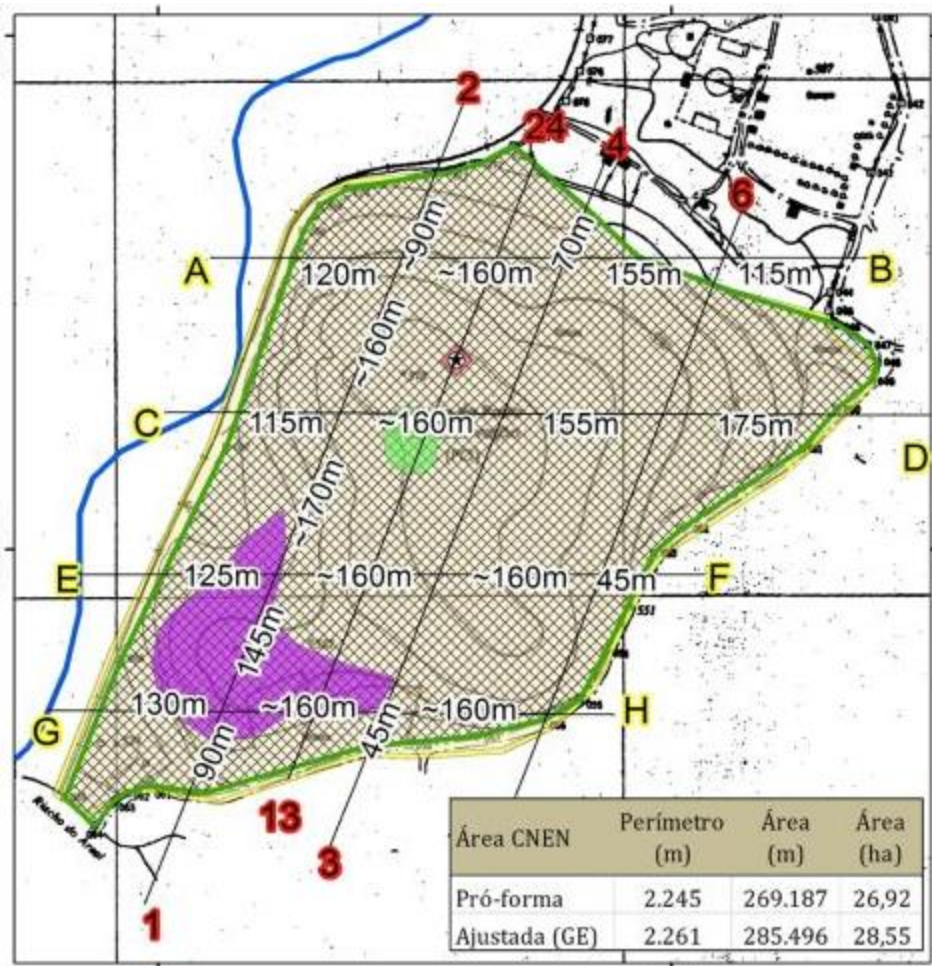
# Results

- Space availability – measured surface – 28 ha – larger than the minimum necessary for the enterprise – 20 ha;
- Distances from paved road grid and to basic infrastructure – water, electricity, data & voice services – within manageable economic and logistic limits;
- Transport safety and security – near the largest waste generator, Angra NPP;
- Absence of mineral deposits of interest;
- Maximum altitude (565 a.m.s.l.) below limit (1,800 m);
- Moderate declivity

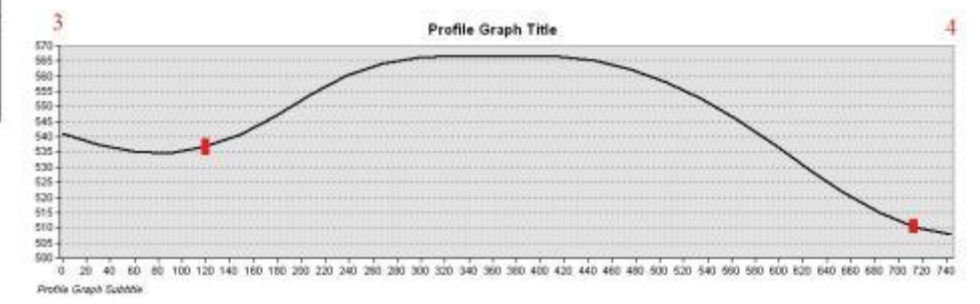
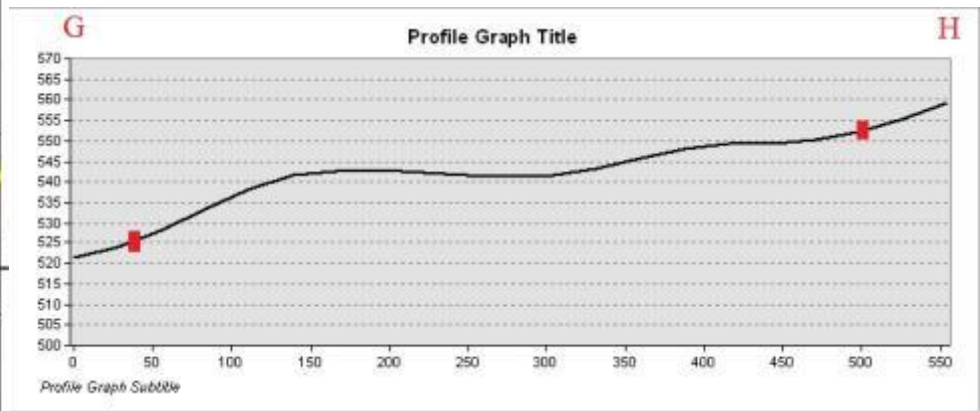
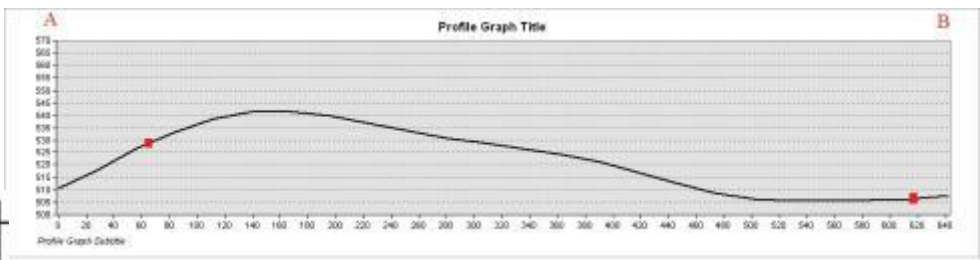


# Results

- Soil consists of successive layers of sandy and silt-sandy clay, gneissic saprolite and gneiss;
- Ground water was detected only in the lowest portion of the terrain.



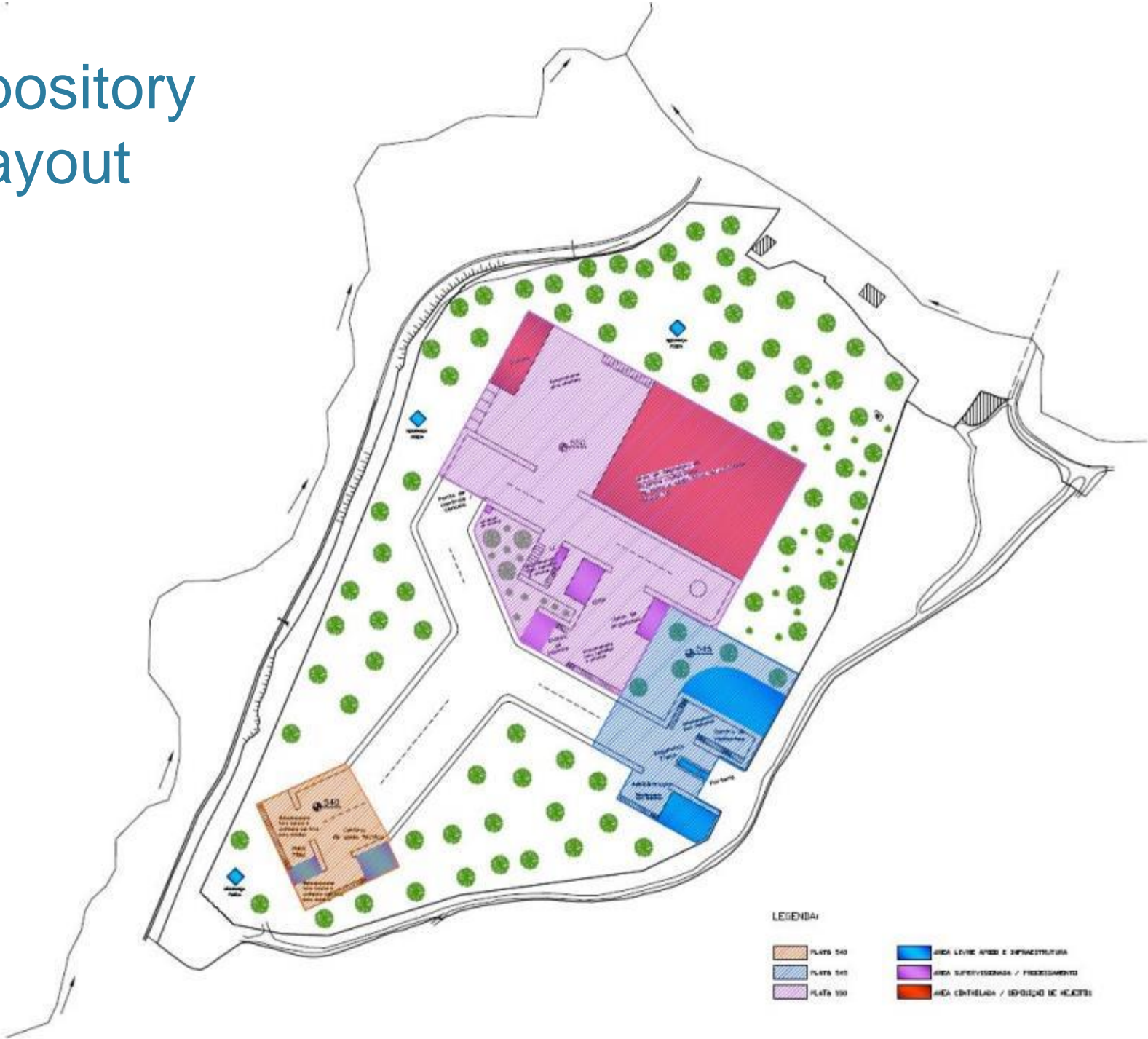
Área CNEN	Perímetro (m)	Área (m)	Área (ha)
Pró-forma	2.245	269.187	26,92
Ajustada (GE)	2.261	285.496	28,55



# Results

- Hilly terrain profile allows the distribution of the three planned leveling plateaus and repository buildings without interference in the surface water flows, either from rainwater runoff and the nearby creek. No increase in erosion or flooding risks;
- Practically no vegetation suppression (pasture fields, features widely spaced, scattered bushes);
- Anthropogenic factors: no facilities, settlements or economical activities of importance within 5 km from the site;
- Soil volume to be excavated for the plateaus' and buildings' construction disposed of inside the site's boundary: minimum environmental impact due to earth movement and particulate dispersion in the air;
- Soil geological structure and properties: well-defined and relatively simple soil structure (consecutive layers of sandy and silt-sandy clay, gneissic saprolite and gneiss): positive perspective for the future safety analysis of the facility.

# Repository layout





# Repository buildings

Building	Purpose	Area (m <sup>2</sup> )
Visitor Centre	Public information	1,500
Gatehouse	Access control	200
Administration	General administration and logistic support	1,000
Technical Support	Auxiliary services support	2,000
Suppliers Shed	Supplies and products storage	600
EMRP and RD&I Laboratory	Implementation of the EMRP and RD&I activities	1,200
Waste Processing	Waste packages reception, temporary storage and conditioning in overpack	378

# Repository buildings

Building	Purpose	Area (m <sup>2</sup> )
Waste Characterization	Waste package contents verification, radiochemical and physical testing	190
Concrete Plant	Mortar manufacture, raw materials (cement, sand and additives) and empty containers storage	525
Disposal Module	Disposal of low and intermediate level wastes	11,165
Disposal Trench	Disposal of very low level wastes	1,875
Ecological Preservation Unit	Nursery seedlings, native species preservation and public visitation	N/A
Meteorological Tower	Record of Atmospheric data	N/A
Fences	Delineation of the perimeter and internal areas	N/A



# Conclusions

- No impediments so far to the establishment of the repository;
- Need of further studies to verify obedience to regulatory requirements and to complete characterize the soil and regional aquifers;
  - Boring mesh refinement;
  - Erosion vulnerability;
  - Acquisition of more detailed input data for the flow conceptual model;
  - Investigation of the origin of the monitoring wells water contamination.
- Site technically pre-selected.

# Next site studies: hydro-geophysical methods

- Magnetometric survey: identification of the site main geological structures;
- Gamma-spectrometric survey: differentiation of the site lithologies;
- Electro-resistivity: detection of structures prone to water catchment, passage and storage.

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