

Translation from Lithuanian

**STATE ENTERPRISE IGNALINA NUCLEAR POWER PLANT  
PROJECT MANAGEMENT DEPARTMENT  
INFRASTRUCTURE DEVELOPMENT PROJECTS DIVISION**

APPROVED BY

*(certified by advanced electronic  
signature)*

**TECHNICAL SPECIFICATION FOR THE PROCUREMENT OF SERVICES FOR THE  
GEOLOGICAL SETTING INVESTIGATIONS BY DEEP BOREHOLE DRILLING FOR  
THE POTENTIAL DEEP GEOLOGICAL REPOSITORY**

\_\_\_\_\_ 2026 No. \_\_\_\_\_  
Visaginas

**I. SECTION  
TYPE OF PROCUREMENT**

1. Procurement of services.

**II. SECTION  
PURPOSE**

2. As stated in Lithuania's '*Development Programme for Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030*' approved by the resolution No.76 of the Government of the Republic of Lithuania on 3 February 2021 (hereinafter the 'Program'), the only currently considered sustainable final method for the disposal of spent nuclear fuel and other long-lived radioactive waste is their placement into a deep geological repository (hereafter the 'DGR') for radioactive waste. The DGR is a nuclear facility (hereafter the 'NF'), and its location must comply with the nuclear safety requirements applicable to NFs. More information about the DGR project is provided in Annex 1 to this Technical Specification (hereafter the 'TS').

In implementing the Program and planning the construction of the DGR, it is necessary to select the final site for its construction from all available alternatives. The specificity and uniqueness of the DGR require that the specific territory must be selected for this facility considering the totality of geological, social, economic, environmental protection and other conditions that determine the safety and suitability/acceptability of the DGR at the selected site. Following initial geological suitability assessments of Lithuania's territory for the construction of the DGR, three potentially suitable geological formations have been identified, within which 77 potential DGR sites are located. To prioritise the identified potential sites, the most suitable geological formation for the

construction of the DGR must be selected. In the absence of sufficient factual data on Lithuania's deep geology and the suitability of the properties and conditions of potential geological formations for the construction of the DGR, the geological setting investigations must be carried out using boreholes at this stage of the DGR project implementation. Three locations were selected for the investigations using boreholes, where potentially suitable Lower Cambrian Baltic Series clay and crystalline basement formations for the construction of the DGR are present. Information on the borehole locations is provided in Annex 2 to this TS, information about the geological structure of the Ignalina District is provided in Annex No. 4 to this TS.

All three (3) borehole plots specified in Annex No. 2 of the TS are state-owned and managed by the Lithuanian State Forest Enterprise (hereinafter – State Forest Enterprise). SE Ignalina Nuclear Power Plant (hereafter the 'INPP' or the 'Contracting Authority') will sign a contract for borehole investigations with State Forest Enterprise, under which the Supplier will be granted permission to conduct borehole investigations at the designated locations. Forest felling, timber removal, and post-borehole forest restoration will be carried out by State Forest Enterprise.

The objective of the services is to determine the geological structure of the investigated sites and the suitability of the potential formations for the construction of the DGR by conducting comprehensive investigations using boreholes (hereafter the 'Boreholes') at the three plots specified by INPP) to the extent outlined in Section 4 of this TS. Information on the required investigations to be conducted during drilling is provided in Annex 3 to this TS.

3. The procured services are classified as a product important to safety.

### **III. SECTION DEFINITIONS AND ABBREVIATIONS**

4. Abbreviations and terms used in the TS:

**Boreholes** – Deep investigation boreholes;

**CDP methodology** – common depth point methodology;

**DGR** – Deep geological repository (for radioactive waste);

**EIA** – Environmental Impact Assessment of proposed economic activity;

**EnMin** – Ministry of Energy of the Republic of Lithuania;

**Geophysical (seismic) surveys** - are studies based on the investigation of artificially generated seismic waves propagating through rock layers, aimed at determining the geological and tectonic structure of an area (hereinafter referred to as 2D surveys).

**IAEA** – International Atomic Energy Agency;

**INPP or the Contracting Authority** – SE Ignalina Nuclear Power Plant;

**LGS** – Lithuanian Geological Survey under the Ministry of Environment;

**Lithuanian State Forest Enterprise** - State Forest Enterprise (*VĮ Valstybinių miškų urėdija*);

**NF** – Nuclear facility;

**Potential formation** – a geological formation potentially suitable for the construction of the DGR. Potential formations in Lithuania are crystalline basement, Lower Cambrian Baltic series and Lower Triassic clay formations;

**Potential sites** – sites potentially suitable for the construction of the DGR;

**Program** – Nuclear Facilities Development Program for Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030;

**RQD** – Rock Quality Designation;

**RSC** – Radiation protection centre (*Radiacinės saugos centras*);

**Screening** – Screening of proposed economic activities for Environmental Impact Assessment;

**TS** – Technical Specification;

**VATESI** – State Nuclear Power Safety Inspectorate (*Valstybinė atominės energetikos saugos inspekcija*);

**2D** – two-dimensional;

#### **IV. SECTION DESCRIPTION AND SCOPE OF SERVICES**

5. The Supplier must perform the following when providing the services:

5.1 Prepare a detailed Service Provision Schedule<sup>1</sup> in accordance with the requirements set out in Clause 17 of this TS and agree upon it with the Contracting Authority.

5.2 Prepare a Quality Assurance Plan in accordance with the requirements [17] established by the INPP, agree upon it with the INPP and adhere it throughout the service provision period.

5.3 Collect and analyse archival and funds' information according to TS Appendix No. 3, Clause 3.14.4, regarding the plots selected by the Contracting Authority for investigation boreholes. Review and familiarize with any other information at the Supplier's discretion, necessary for providing the services. Conduct a review of the plots for investigation boreholes.

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<sup>1</sup> Following the completion of the screening procedures for the environmental impact assessment or the environmental impact assessment and upon receipt of the conclusion from the competent authority, the Supplier shall update the detailed Service Provision Schedule for each of the investigation borehole based on the most current information. The time limits specified in the updated Service Provision Schedule must not exceed the overall time limit for the provision of the Services as set out in Clause 24 of the TS.

5.4. The screening of each investigation borehole for the environmental impact assessment must be carried out in accordance with the provisions of the Law on Environmental Impact Assessment of the Proposed Economic Activities. During the screening process for each investigation borehole, the following must be done:

5.4.1. Before submitting the screening information to the competent authority, the Supplier must obtain accept from the INPP for the prepared screening documents.

5.4.2. If a negative conclusion regarding the screening is provided, the Supplier shall conduct the environmental impact assessment for the proposed economic activity.

5.5. Conduct 2D surveys at each plot for investigation boreholes. The 2D surveys must be coordinated with the INPP and LGS in accordance with the procedure established by law. Based on the results of the 2D surveys, select the precise locations of the boreholes. The Supplier is required to conclude an agreement with the State Forest Enterprise regarding geophysical (seismic) exploration surveys carried out in the territory managed by it. If there is a need to carry out 2D surveys not on state-owned land managed by the State Forest Enterprise but on neighboring plots owned by other natural or legal persons, the Supplier shall also assume responsibility for coordinating these surveys with the landowners, concluding agreements with them, and carrying out any other related activities

5.6 For each investigation borehole, prepare a borehole design and, in accordance with the requirements specified in TS Appendix No. 3, a program for the investigation borehole. The borehole design and the investigation borehole program must be coordinated with the INPP and LGS in accordance with the procedure established by law. Each program must, among other things, include:

5.6.1. The specific location of the investigation borehole selected by the Supplier within the plot boundaries;

5.6.2. The procedure applied by the Supplier and its timeline for obtaining written approvals from owners or agreements with them for plots where investigations will be conducted and through which equipment/technology for the investigations will be transported (procedure for establishing road easements);

5.6.3. The Supplier is obliged to obtain written consents from the owners or conclude agreements (regarding the establishment of road easements) with the owners of the plots through which the equipment/technical machinery intended for the investigations will be transported.

5.7 Upon receiving a positive conclusion from the responsible authority regarding the environmental impact assessment, submit the final designs of three investigation boreholes, as well as investigation programs to the LGS for registration in accordance with the established procedure.

*Note. Each borehole design must include a borehole liquidation scheme.*

5.8. In accordance with the approved borehole designs and registered investigation programs, and after the State Forest Enterprise has carried out clearing activities, prepare the sites for conducting the investigations, i.e., as needed, including but not limited to: organizing access road construction, electricity supply, water supply, and setting up the investigation site, etc.

5.9 In accordance with the registered Borehole investigation program, install the boreholes and conduct investigations, including sampling and laboratory analysis of the samples. During the provision of services, LGS will selectively supervise the investigations. The Supplier must ensure that authorised INPP and LGS personnel have the possibility to assure that the investigations are being conducted properly at the service locations and to familiarize themselves with relevant service-related documents.

*Note. Samples taken during the installation of boreholes must be properly stored and delivered for laboratory testing in a timely manner.*

5.10. Upon completion of installation (drilling) of the boreholes, prepare and submit a passport for each borehole to LGS for registration.

5.11. Upon completion of all investigations specified in the programs, liquidate each borehole, restore the investigation sites, and return the affected environment to its original condition, compensating third parties for any damages, if incurred.

*Note. If circumstances of borehole installation change, submit revised borehole liquidation schemes to LGS.*

5.12. Upon completion of the investigations, perform analysis of data, interpret the investigation results, summarise them, and submit the investigation reports for all three boreholes to both INPP and LGS, as well as register them in the Subsurface Register. The content of the borehole investigation report is provided in Annex 3.

5.13. Present the investigation results at a meeting organised by the Contracting Authority with Lithuanian institutions and other stakeholders involved in the DGR construction project.

5.14 The Supplier must prepare the investigation reports in both Lithuanian and English. The Supplier may include in the investigation reports other data/information not mentioned in Clause 5 of this TS, which, in its opinion, is important for the service results. The investigation reports must be submitted to the Contracting Authority in digital form as original/editable files and in \*.pdf format, approved by the electronic signature of the Supplier's director (or its authorised person).

## **V. SECTION RULES AND STANDARDS**

6. When providing services to INPP, the Supplier must comply with the following regulatory documents.

No	Title of the regulatory document
<b>Laws of the Republic of Lithuania</b>	
1.	Underground Law of the Republic of Lithuania
2.	Law on the Environmental Impact Assessment of Planned Economic Activities of the Republic of Lithuania
3.	The Law on Forestry of the Republic of Lithuania
4.	Law on Environmental Protection of the Republic of Lithuania
5.	Law on Land of the Republic of Lithuania
6.	Law on Special Land Use Conditions of the Republic of Lithuania
<b>Other legal acts</b>	
7.	Description of the Procedure for Selection of the Proposed Economic Activity for Environmental Impact Assessment approved by order No. D1-845 of the Minister of Environment of the Republic of Lithuania on 16 October 2017
8.	Description of the Procedure for Designing, Installing, Conserving, and Decommissioning of Hydrocarbon boreholes approved by Order No. D1-227 of Minister of Environment of the Republic of Lithuania on 10 July 2023
9.	Rules for the Handling, Storage, and Use of Drill Core Samples at the Subsurface Information Centre of the Lithuanian Geological Survey under the Ministry of Environment.
10.	Order of the Director of the Lithuanian Geological Survey under the Ministry of Environment on the Approval of the Stratigraphic Classification of the Silurian, Ordovician, Cambrian and Ediacaran Systems of Lithuania.
11.	Order of the Director of the Lithuanian Geological Survey under the Ministry of Environment on the Approval of the Stratigraphic Classifications of the Neogene, Paleogene, Cretaceous, Jurassic, Triassic, Permian, Carboniferous and Devonian Systems of Lithuania.
12.	Description of the Quaternary Stratigraphic Scheme of Lithuania approved by Order No 1-86 of the Director of the Lithuanian Geological Survey on 17 June 2009 Order of the Director of the Lithuanian Geological Survey under the Ministry of Environment on the Approval of the Description of the Quaternary Stratigraphy Scheme of Lithuania.
13.	Resolution of the Government of the Republic of Lithuania on the Implementation of the Law on the Subsoil of the Republic of Lithuania, 10 March 2020, No. 198.

14.	Order of the Minister of Environment of the Republic of Lithuania on the Approval of the Description of Procedures for Designing, Installing, Conserving, and Decommissioning Groundwater Wells, 23 December 1999, No. 417.
15.	International Association of Drilling Contractors – <i>IADC Drilling Lexicon</i> , <a href="https://www.iadclexicon.org/">Drilling Lexicon   Oil and Gas Drilling Glossary   IADC Lexicon.org</a> .
16.	Eurocode 7. Geotechnical Design. Part 2: Ground Investigation and Testing.
<b>INPP documents</b>	
17.	Description of the procedure for the assessment of Suppliers and Sub-suppliers providing products important to Safety and the control of their activities at the State Enterprise Ignalina Nuclear Power Plant DVSta-1708-4V <a href="https://alitra.lt/wp-content/uploads/2025/09/dvsta-1708-4v6_lt52021.docx">dvsta-1708-4v6_lt52021.docx</a>

7. This section provides a minimum list of regulatory documents. The Supplier, when providing its services, must comply with regulatory documents governing legal relations related to the subject matter of the services, as well as with national and international court precedents.

8. The Supplier must adhere to the latest versions of the regulatory documents.

## **VI. SECTION REQUIREMENTS FOR THE PROCUREMENT OF SERVICES IMPORTANT TO SAFETY**

9. The Supplier must comply with the following documents (the latest revisions):

9.1. Procedure for safety related products suppliers and sub-suppliers assessment and their activities control at State Enterprise Ignalina Nuclear Power Plant , DVSta-1708-4 ([https://alitra.lt/wp-content/uploads/2025/09/dvsta-1708-4v6\\_lt52021.docx](https://alitra.lt/wp-content/uploads/2025/09/dvsta-1708-4v6_lt52021.docx) ).

10. The Supplier must ensure that authorised INPP personnel and/or authorised VATESI personnel have the opportunity to verify, at the service provision site, the compliance with the procurement document requirements, review documents related to service provision and monitor the Supplier's (and all levels of subcontractors) activities through independent inspections (such as audits and inspections). Any non-conformities identified during these inspections must be rectified in a timely manner, but no later than the contract completion date.

11. The Supplier shall prepare a Quality Assurance Plan in accordance with INPP established requirements [17]. The prepared Quality Assurance Plan must be submitted to the INPP no later than within 30 calendar days from the effective date of the contract. The template/form of the Quality Assurance Plan is available at:

[https://alitra.lt/wp-content/uploads/2025/09/dvsta-1708-4v6\\_lt\\_kup.docx](https://alitra.lt/wp-content/uploads/2025/09/dvsta-1708-4v6_lt_kup.docx).

## **VII. SECTION**

## **GENERAL REQUIREMENTS FOR SERVICES**

12. When providing the services, the Supplier shall provide advice to the Contracting Authority. The requirement for the Supplier to advise the Contracting Authority shall be understood as providing explanations and responses to the Contracting Authority's inquiries, amending prepared documents and participating in meetings organised by the Contracting Authority with Lithuanian institutions and other entities. Consultations shall be carried out verbally or in writing. Responses and explanations must be prepared in writing unless the Contracting Authority specifies otherwise when submitting a request for clarification.

13. The Supplier must amend documents prepared during the implementation of the contract in accordance with comments received from the Contracting Authority and/or authorised institutions and resubmit the revised documents to the Contracting Authority and/or authorised institutions for further approval.

14. Document approval refers to the submission of a document prepared by the Supplier to the Contracting Authority and/or authorised institutions for review, comments, feedback, instructions or recommendations. The Contracting Authority shall have the right to require the Supplier to additionally or separately obtain approval from Lithuanian institutions or other relevant approval entities if such approval becomes necessary during the service provision.

*Note. Lithuanian institutions shall be understood as the Ministry of Finance, the Ministry of Energy, the Ministry of Environment, VATESI, RSC, LGS, the Environmental Protection Agency and/or other competent state institutions.*

15. The Supplier is responsible for the proper execution of the service provision schedule and must plan the submission of documents to the Contracting Authority and/or authorised institutions for approval accordingly, considering the possibility of rejection or non-approval.

16. Document approval refers to the Contracting Authority's written confirmation that the document is acceptable to the Contracting Authority and meets the requirements of the contract.

## **VIII. SECTION SERVICE PROVISION SCHEDULE**

17. Services must be planned in stages according to the following service provision schedule 2 (see the note below).

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<sup>2</sup> This service provision schedule is preliminary. During Stage 1 – Initial – the Service Provider must prepare a detailed service provision schedule, which may differ from the preliminary version. It should be noted that, to maximise the overall service provision period efficiently, the Supplier may commence work on the next stage before the final approval of the document/report from the previous stage. It should also be noted that the Supplier may organize and carry out work at



Stage No	Service Provision Stage / Brief Description of Key Activities	Time Limit			Report
		Borehole 1	Borehole 2	Borehole 3	
-	<b>Commencement of Contract Performance</b>	of entry into force of the contract			-
1	<b>Initial:</b> Preparation of a detailed service provision schedule (TS 5.1); Preparation of the Quality Assurance Plan (TS 5.2); Familiarisation with information and applicable regulatory framework (TS 5.3); Data collection and interpretation (TS 5.3); Overview of the Borehole sites investigations (TS 5.3); Environmental impact screening (TS 5.4); 2D geophysical (seismic) surveys (TS 5.5); Preparation and approval of investigations in the Borehole project plans and Borehole investigations programmes (TS 5.6).	120 calendar days from the date of entry into force of the contract	120 calendar days from the date of entry into force of the contract	120 calendar days from the date of entry into force of the contract	Initial
2	<i>Contracting Authority's approval/endorsement.</i>	<i>15 calendar days from the completion of Stage 1</i>	<i>15 calendar days from the completion of Stage 1</i>	<i>15 calendar days from the completion of Stage 1</i>	-
3	<b>EIA Conduct:</b> EIA conduct (TS 5.4.2).	120 calendar days from the completion of Stage 2 and the Contracting Authority's letter ordering the EIA services	120 calendar days from the completion of Stage 2 and the Contracting Authority's letter ordering the EIA services	120 calendar days from the completion of Stage 2 and the Contracting Authority's letter ordering the EIA services	Stage*
4	<i>Contracting Authority's approval/endorsement</i>	10 calendar days from the completion of Stage 3	10 calendar days from the completion of Stage 3	10 calendar days from the completion of Stage 3	-

different borehole locations at their discretion—either sequentially or in parallel—while ensuring compliance with the deadlines and requirements specified in the TS and the Contract.

Stage No	Service Provision Stage / Brief Description of Key Activities	Time Limit			Report
		Borehole 1	Borehole 2	Borehole 3	
5	<b>Approval of Borehole documentation:</b> Update of the detailed service provision schedule (TS 5.1); Preparation and coordination of the final investigation Borehole designs project and investigations in the Borehole programmes (TS 5.7).	30 calendar days from the end of Stage 2 and sending of the Contracting Authority's letter for the commencement of Stage 5, or from the end of Stage 4 and sending of the Contracting Authority's letter for the commencement of Stage 5	30 calendar days from the end of Stage 2 and sending of the Contracting Authority's letter for the commencement of Stage 5, or from the end of Stage 4 and sending of the Contracting Authority's letter for the commencement of Stage 5	30 calendar days from the end of Stage 2 and sending of the Contracting Authority's letter for the commencement of Stage 5, or from the end of Stage 4 and sending of the Contracting Authority's letter for the commencement of Stage 5	Stage*
6	<i>Contracting Authority's approval/endorsement</i>	<i>10 calendar days from the completion of Stage 5</i>	<i>10 calendar days from the completion of Stage 5</i>	<i>10 calendar days from the completion of Stage 5</i>	-
7	<b>Establishment of the investigation site:</b> Establishment of the investigation site (TS 5.8)	60 calendar days from the completion of Stage 6	60 calendar days from the completion of Stage 6	60 calendar days from the completion of Stage 6	Stage*
8	<i>Contracting Authority's approval/endorsement.</i>	<i>20 calendar days from the Stage 7</i>	<i>20 calendar days from the Stage 7</i>	<i>20 calendar days from the Stage 7</i>	-
9	<b>Borehole installation and investigations in the borehole:</b> Installation of 3 boreholes, preparation and registration of borehole logs, investigations in the boreholes, and sampling (TS 5.9, 5.10, TS Appendix No. 3); Sampling and submission to laboratories (TS 5.9 p., TS Appendix No. 3).	360 calendar days from the completion of Stage 8	360 calendar days from the completion of Stage 8	360 calendar days from the completion of Stage 8	Stage*

Stage No	Service Provision Stage / Brief Description of Key Activities	Time Limit			Report
		Borehole 1	Borehole 2	Borehole 3	
10	<i>Contracting Authority's approval/endorsement.</i>	30 calendar days from the completion of Stage 9	30 calendar days from the completion of Stage 9	30 calendar days from the completion of Stage 9	-
11	<b>Liquidation of the investigation site:</b> Borehole liquidation and restoration of the environment (TS 5.11 p.).	45 calendar days from the completion of Stage 10	45 calendar days from the completion of Stage 10	45 calendar days from the completion of Stage 10	Stage*
12	<i>Contracting Authority's approval/endorsement.</i>	15 calendar days from the completion of Stage 11	15 calendar days from the completion of Stage 11	15 calendar days from the completion of Stage 11	
13	<b>Laboratory tests:</b> Analysis of samples in laboratories (TS 5.9 p., TS Appendix No. 3).	180 calendar days from the completion of Stage 10	180 calendar days from the completion of Stage 10	180 calendar days from the completion of Stage 10	Stage*
14	<i>Contracting Authority's approval/endorsement.</i>	30 calendar days from the completion of Stage 13	30 calendar days from the completion of Stage 13	30 calendar days from the completion of Stage 13	
15	<b>Preparation of investigation reports:</b> Data analysis and interpretation of investigation results, summarization (TS 5.12 p.); Preparation of investigation reports for 3 boreholes (TS 5.12 p., TS Appendix No. 3); Presentation of results (institutional <sup>3</sup> ) (TS 5.13 p.).	240 calendar days from the completion of Stage 10	240 calendar days from the completion of Stage 10	240 calendar days from the completion of Stage 10	Stage*
16	<i>Contracting Authority's approval/endorsement.</i>	30 calendar days from the completion of Stage 15	30 calendar days from the completion of Stage 15	30 calendar days from the completion of Stage 15	
17	<b>Final:</b> Preparation and submission of final reports on investigations in the three	30 calendar days from the	30 calendar days from the	30 calendar days from the	Final

<sup>3</sup> 'Institutional' presentation should be understood as a presentation to the State Enterprise Ignalina Nuclear Power Plant, the Ministry of Finance of Lithuania, the Ministry of Energy of the Republic of Lithuania, the Ministry of Environment of the Republic of Lithuania, VATESI, RSC, LGS and/or other competent state institutions.

Stage No	Service Provision Stage / Brief Description of Key Activities	Time Limit			Report
		Borehole 1	Borehole 2	Borehole 3	
	Boreholes to the Lithuanian Geological; Investigation Subsurface Register (TS 5.12 p., TS Annex 3).	completion of Stage 16	completion of Stage 16	completion of Stage 16	
18	<i>Contracting Authority's approval/endorsement</i>	<i>10 calendar days from the completion of Stage 17</i>	<i>10 calendar days from the completion of Stage 17</i>	<i>10 calendar days from the completion of Stage 17</i>	-

*Note. \*The stage report includes the activities/results of the stage; it is not a progress report.*

## IX. SECTION REQUIREMENTS FOR THE SERVICE PROVIDER'S PERSONNEL AND ORGANISATION OF SERVICE PROVISION

18. The Supplier must independently assess the competencies of the personnel required for the quality and timely provision of services and accordingly determine the number of employees needed. The qualifications, number and level of involvement in the project of the personnel carrying out the services and supporting staff (including, but not limited to: administrator, translator, assistant, financial officer, lawyer, health and safety specialist and etc.) must correspond to the specific nature, purpose and scope of the services being procured.

19. Authorised persons appointed by the Contracting Authority will cooperate with the Supplier and their team during the provision of services. They will be responsible for contract management from the Contracting Authority's side and the provision of all necessary information and data related to, for example, the service provision, offering comments and suggestions and participating in meetings.

20. All personnel providing services and supporting staff employed by the Supplier must be independent and free from any conflicts of interest<sup>4</sup> that may arise while performing their assigned duties. The Supplier must sign a separate confidentiality commitment in relation to the public procurement-sale contract (the form is attached to the PD (Procurement documents)). A separate penalty for violations of confidentiality obligations will be stipulated in the contract.

21. During the provision of services, the Contracting Authority shall have the right to require the Supplier to replace any member of the Supplier's team or supporting personnel with an

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<sup>4</sup> A conflict of interest is a situation where the services provided by the Supplier violate the obligations of confidentiality, loyalty and acting exclusively in the interest of the Contracting Authority.

equivalent, if a specific person is performing their duties inadequately (poorly or untimely), failing to cooperate properly with the authorised persons of the Contracting Authority and/or not adhering to the highest standards of business/professional ethics. The Contracting Authority must notify the Supplier of such a request at least 15 calendar days in advance.

22. The Supplier, in accordance with Article 7, Paragraph 1 of the Underground Law of the Republic of Lithuania, must have/obtain a permit to explore the subsurface. The procedure for issuing permits is regulated by [13]. A foreign Supplier may obtain a permit for geological investigations in accordance with the procedure established by Article 7, Paragraph 1 of the Underground Law of the Republic of Lithuania.

#### **X. SECTION PLACE OF PERFORMANCE**

23. The Supplier's headquarters and the Republic of Lithuania.

#### **XI. SECTION SERVICE PERIOD**

24. The service provision deadline:

24.1. No more than 955 calendar days from the contract effective date if the Contracting Authority does not order the service specified in TS Clause 5.4.2 (Stage No. 3 "EIA implementation");

24.2. No more than 1085 calendar days from the contract effective date if the Client orders the service specified in TS Clause 5.4.2 (Stage No. 3 "EIA implementation").

25. The Contract execution start date is the date of entry into force of the Contract.

#### **XII. SECTION OFFICE PREMISES**

26. The Supplier shall provide suitable office premises for the personnel working under the contract.

27. The costs of the office premises shall be included in the total contract price.

#### **XIII. SECTION EQUIPMENT**

28. The Service Supplier must ensure that they have sufficient materials, equipment, and certified drilling machinery necessary for the contract implementation. Before installing the boreholes, the Supplier must provide the equipment certificates.

29. Under this service contract, no technical equipment required for the contract implementation may be purchased on behalf of the Contracting Authority or transferred to the Contracting Authority upon the completion of the contract.

#### **XIV. SECTION COSTS**

30. The Supplier must include all direct and indirect costs related to the provision of services, taxes, fees and other reasonably foreseeable expenses in the price of the service contract.

31. No other additional expenses not included in the contract price will be reimbursed.

#### **XV. SECTION REPORTING**

32. During the contract implementation, the Supplier must prepare and submit to the INPP the following reports on the fulfilment of contractual obligations: i) monthly progress and ii) (each) stage report. Monthly progress reports in either Lithuanian or English. Each stage report must be drawn up in both Lithuanian and English.

#### **XVI. SECTION MONITORING AND EVALUATION**

33. The Initial report, each Stage report and the Final report prepared by the service Supplier, along with other documents/information submitted by the Supplier, will be evaluated based on compliance with the requirements set out in this TS, the Quality Assurance Plan and the contract. Stage reports and other documents/information will be considered properly prepared if they comply with all the requirements established in these documents.

#### **XVII. SECTION QUALITY CONTROL**

34. The Supplier must comply with the requirements set out in Sections IV, VI, VII and VIII and ensure their implementation.

#### **XVIII. SECTION OTHER REQUIREMENTS**

35. In gathering information, communicating with authorised institutions, communities and interest groups, and providing services, the Supplier must follow the highest business ethics standards and, in all cases, act in such a way as not to harm the interests of the Contracting Authority and/or the Contracting Authority's positive professional reputation.

#### **XIX. SECTION OBLIGATIONS OF THE CONTRACTING AUTHORITY**

36. The Supplier must submit written requests to the Contracting Authority for any information related to the services being purchased (justifying the need for such data) in advance, to ensure the Contracting Authority has sufficient time to prepare such information.

**ENCLOSURES:**

Annex No 1 information about the DGR project.

Annex No 2 Information about the drilling sites.

Annex No 3 Information about the required research to be conducted during drilling.

Annex No 4 Information about the geological structure of the Ignalina District.

## INFORMATION ABOUT DEEP GEOLOGICAL REPOSITORY PROJECT

Pursuant to BSR-3.1.2-2017 classification the Spent Nuclear Fuel shall be attributed to the highly radioactive waste, it will be transferred in special containers along with other long-lived radioactive waste to special storage facilities at Ignalina NPP by 2022 and by 2038 respectively (two storage facilities for highly radioactive waste (*already constructed and operated*) and two storage facilities for long-lived radioactive waste (*one already constructed and operated, the other one will be constructed to store radioactive waste generated during the dismantling of reactors*)).

At the end of the safe, design operation period of containers and storage facilities for highly radioactive waste it will be required to get ready for final disposal of highly radioactive waste and long-lived radioactive waste.

In accordance with the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management of 05 September 1997*, the Law on Radioactive Waste Management of the Republic of Lithuania was adopted in 1999 (hereinafter referred to as the Law), this law was amended in 2014 considering the provisions of *Council Directive 2011/70/Euratom of 19 July 2011*. The law establishes the national principles of radioactive waste management.

According to the Law, highly radioactive waste and long-lived radioactive waste generated in Lithuania must be disposed of in a repository installed in the territory of Lithuania.

The head of the State Nuclear Power Safety Inspectorate, establishing nuclear safety requirements in Lithuania and pursuing state regulation and supervision of radioactive waste management safety approved nuclear safety requirements BSR-3.1.2-2017 “Pre-Disposal Management of Radioactive Waste at Nuclear Installations” on 31 December 2010, the annex 1 hereof stipulates that High-level radioactive waste (of G class) and Long-lived radioactive waste (of D and E classes) must be placed into the Deep geological radioactive waste repository based on the established criteria.

Accordingly, Lithuania, in fulfilling its obligation under the Directive, **must dispose high-level radioactive waste and long-lived radioactive waste generated in the country to the Deep geological radioactive waste repository constructed in the territory of Lithuania.**

In accordance with international practice and IAEA recommendations (No. SSG-14 „*Geological Disposal Facilities for Radioactive Waste*“, Vienna, 2011; Introduction, (1.2.), it is considered, that the term ‘geological disposal’ refers to the disposal of solid radioactive waste in a disposal facility located *underground* in a stable geological formation so as to *provide long term containment of the waste and isolation of the waste* from the accessible biosphere. From a technical point of view: radioactive waste in special containers will be pushed into special shafts (tunnels), which, when filled with containers, will be sealed with special materials – ensuring long-term protection against potential radiological hazards, without leaving the opportunity for future radioactive waste removal. During the operation of the repository on the ground, there will be constructed administrative premises for the preparation of radioactive waste containers for transfer to the deep radioactive waste repository, an information centre, etc. The whole other territory (above deep geological radioactive waste repository) can be safely used for its intended purpose (agriculture, etc.). Following the closure of the geological radioactive waste repository, the requirement to leave the mentioned buildings will be decided in accordance with current global practice.

Based on the evaluations of the deep geological repository programmes of the more advanced countries, a preliminary schedule for the implementation of the Lithuanian deep geological radioactive waste repository project has been prepared.

The preliminary schedule provides for the following stages / deadlines:

*Identification and selection of the Site(s) for the deep geological radioactive waste repository (including planning, selection of host sites, concepts / assessment, geological / and other investigations): 2019-2035;*

*The detailed deep geological radioactive waste repository site(s) survey and licensing (including preliminary/conceptual design, description of site conditions, safety analysis, DGR site approval, ELA, licensing): 2036-2049;*

*Construction of the deep geological radioactive waste repository: 2050-2070;*

*Operation of the deep geological radioactive waste repository: 2071-2084;*

*Closure of the deep geological radioactive waste repository: 2085-2093;*

*Time period after the closure of the deep geological radioactive waste repository: from 2094.*



**Note.** *The schedule is preliminary, it must be periodically revised / updated (after changes in important circumstances, new ones, after each stage, etc.).*

## Translation from Lithuanian

## INFORMATION ON THE BOREHOLE SITES

**Borehole Site 1**

Borehole Site 1., (see Figure 1, blue) is located in the territory of Kalviškės village, Vidiškės eldership, Ignalina district municipality..

Borehole Site 1 consists of a land plot owned by the state, with the unique number: 4400-1844-5479. The specific location of the borehole on the site will be chosen (*based on practical possibilities and applicable technology*) by the Supplier carrying out the borehole installation.

In this potential deep geological repository (DGR) investigation area, there are two potential formations: 1) the Baltic Series Formation of the Cambrian System, and 2) the Crystalline basement formation. The potential formations are distinguished based on stratigraphic and lithological parameters.

The indicative data for the possible depth of the occurrence of the potential formations, determined based on the actual existing boreholes nearest to the DGR investigation areas, are provided below.

At this location, the top of the Lower Cambrian Baltic Series formation lies at (-310) meters above sea level (at a depth of 567 meters). The thickness of the Baltic Series in the area is about 94 meters and consists of clay layers interbedded with sandstone layers, which make up approximately 20–30% of the Baltic Series profile. The crystalline basement rock formation in this location lies at (-530) meters above sea level (at a depth of 787 meters). The upper part of the crystalline basement consists of migmatites. There are no boreholes in the nearest area that have penetrated or intersected either of the two potentially suitable formations, and the area has not been studied using seismic survey methods—i.e., there is no actual geological data on the area's geological structure. The nearest boreholes are Tverėčius–336, located 23,4 km from this location, and Visaginas–5, located 33,45 km away from the location.

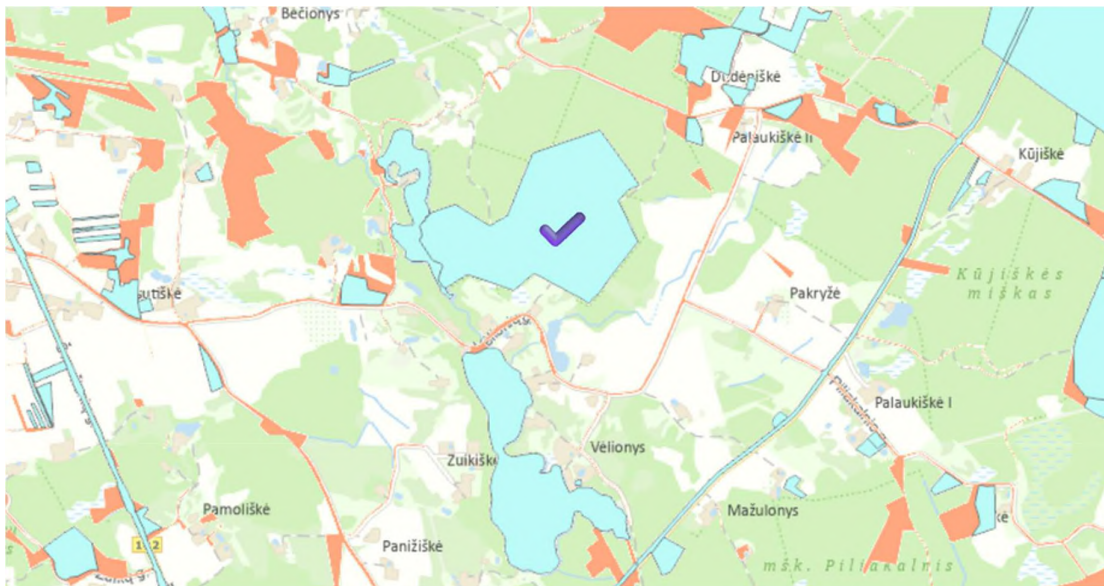


Figure 1. Example: Site of borehole No 1

### Borehole Site 2

Borehole Site No 2 (see Figure 2, blue) is located in the territory of Džiaugsminė village, Vidiškės eldership, Ignalina district municipality.

The site of borehole 2 consists of a land plot owned by the state, with the unique number: 4400-1612-6753. The specific location of the borehole on the site will be chosen (*based on practical possibilities and applicable technology*) by the Supplier carrying out the borehole installation.

In this DGR investigation area, there are two potential formations: 2) The Cambrian Baltic Series Formation and 2) the Crystalline Basement Formation. The potential formations are distinguished based on stratigraphic and lithological parameters.

The indicative data for the possible depth of the occurrence of the potential formations, determined based on the actual borehole data nearest to the DGR investigation areas, are provided below.

The Lower Cambrian Baltic Series clayey rock Formation at this location lies at (-333) meters above sea level (at a depth of 533 m). The thickness of the Baltic Series in the area varies between 77 and 87 m and consists of clay layers interbedded with sandstone layers. The sandstone interbeds possibly make up about 39% of the Baltic Series' total thickness.

The crystalline basement rock Formation in the area lies at (-570) meters above sea level (at a depth of 770 m). The upper part of the crystalline basement is composed of migmatites, while amphibolites are present in the northwestern part of the area.

There are no boreholes in the area that have penetrated or intersected either of the potentially suitable formations, and the area has not been studied using seismic survey methods —i.e., there are no actual geological data on the structure of the area. The nearest borehole that has penetrated these rock formations is Visaginas -5, located 27,3 km away from this location.

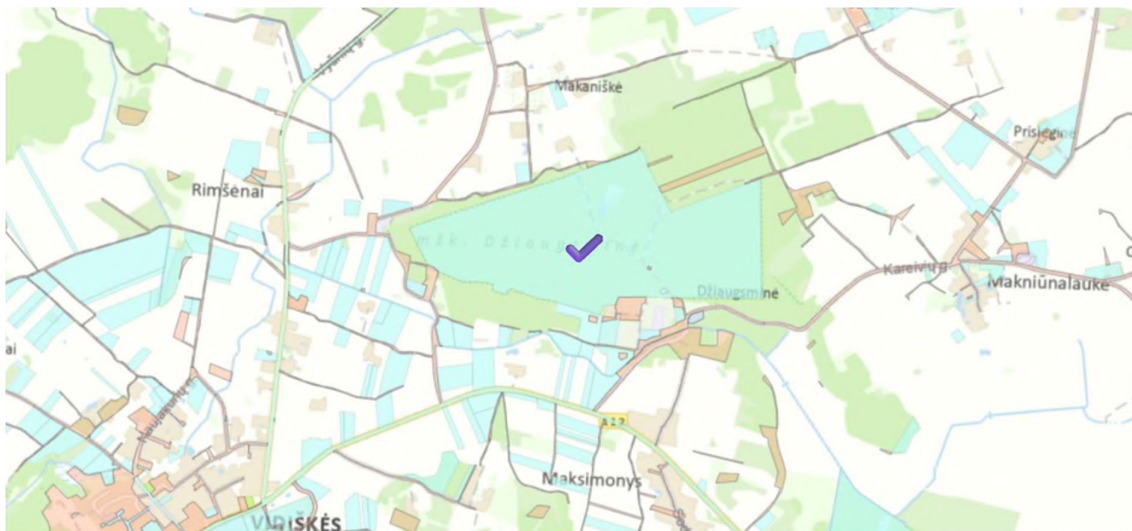


Figure 2. Example: Borehole Site No 2

### Borehole Site 3

Borehole Site No 3 (see Figure 3, blue) is located in the territory of Rubelninkai village, Ceikiniai eldership, Ignalina district municipality..

The Borehole Site 3 consists of a land plot owned by the state, with the unique number: 4400-2462-0895. The specific location of the borehole on the site will be chosen (*based on practical possibilities and applicable technology*) by the Supplier carrying out the borehole installation.

In this DGR investigation area there are 1) Cambrian Baltic Series Formation and 2) Crystalline basement Formation. The potential formations are distinguished based on stratigraphic and lithological parameters.

Indicative data on the possible depth of the potential formations, determined based on the actual borehole data closest to the DGR investigation areas, are provided below.

The Lower Cambrian Baltic Series clayey rock formation at this location lies at (-233) meters above sea level (at a depth of 533 m). The Baltic Series, which is 102 thick at this location, consists of clay layers interbedded with sandstone interlayers. The sandstone interlayers constitute approximately 20% of the Baltic Series.

The crystalline basement rock formation at this location lies at (-490) meters above sea level (at a depth of 690 m). The upper part of the crystalline basement consists of migmatites.

There are no boreholes in the area that have penetrated or reached either of the potentially suitable formations. The area has not been studied using seismic survey methods – i.e there are no actual geological data on the geological structure of the area. The nearest borehole that has drilled through these rock formations is Tverečius-336, located 16,2 km away from this location.

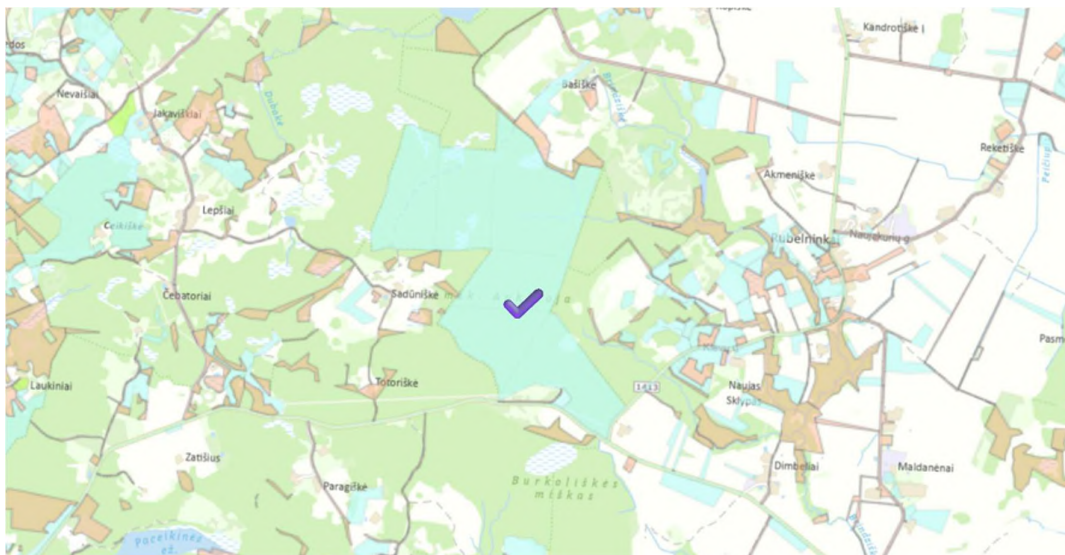


Figure 3. Example: Borehole Site No 3

**Translation from Lithuanian****INFORMATION ON THE INVESTIGATIONS TO BE CARRIED OUT DURING DRILLING****1. Under the contract, the following must be carried out:****1.1. 2D geophysical (seismic) surveys at all investigation sites:**

1.1.1 Prepare a 2D survey program and conduct studies of the deep geological and tectonic structure of the borehole plots using the 2D seismic exploration Common Depth Point (CDP) method (hereinafter referred to as CPD).

1.1.2. At all three borehole plots, investigate the tectonic structure, determining the following elements of the deep structure:

1.1.2.1. The upper boundary (surface) of the crystalline basement formation, its depth, tectonic faults and their amplitudes, strikes, and dip angles; if technically feasible, determine fracture zones and the thickness of the weathered crust of the crystalline basement.

1.1.2.2. Tectonic faults of the Lower Cambrian formation and their distribution across the site, determining fault amplitudes, strikes, and dip angles; the crest and base of the formation, their depth, and structural configuration.

1.1.2.3. Tectonic faults that cut through the entire sedimentary sequence, determining fault amplitudes, strikes, and dip angles; identify geological layers where tectonic faults are no longer recognizable.

1.1.2.4. Isolate the crest of the Lower Silurian and Lower Llandovery layers, which, in the interpretation of seismic survey data under Lithuanian conditions, is used as a reference reflection horizon.

1.2. Three vertical<sup>1</sup> boreholes must be drilled in the three areas as specified in TS Annex No. 2. The approximate depth of the planned boreholes from the ground surface is ~800 meters.

1.3. During drilling of boreholes, the Supplier must drill into the crystalline basement 50 m deeper than the physical weathering crust at the borehole sites..

1.4. More detailed information about the identification of potential formations in the planned boreholes and the conditions of the depth of the occurrence of formation is provided in Annex 2 of this TS.

1.5. A vertical borehole drilling is planned, but a deviation (not exceeding 10 degrees) is permissible when drilling the borehole if it is necessary for recovery of the oriented core, acoustic geophysical surveys in boreholes (ATV), optical geophysical surveys in boreholes (OTV), borehole televiewer, or for determining tectonic deformations in the crystalline basement and/or other rocks.

1.6. During drilling, borehole monitoring must be carried out using methods available to the Supplier (measurements while drilling – MWD or LWD methods).

Throughout the entire borehole wellbore section, through the sedimentary rocks and the physical weathering crust of the crystalline basement rocks, a casing string must be installed in the borehole. The casing string may be installed after the necessary geophysical well logging have been performed in the open borehole.

1.7. When preparing borehole's drilling project and borehole's liquidation project and liquidation scheme, it is recommended to follow the requirements set out in Sections III and VI of the document specified in Clause 6, item 8 of this TS.

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<sup>1</sup> Vertical borehole – a borehole that is designed vertically from the ground surface (according to [15]).

1.8. When drilling the boreholes, a minimally polluting drilling mud should be used for geological layers, if possible, prepared on a clay basis with a minimum amount of chemical additives, or another fluid that complies with environmental requirements [14] the drilling mud must be effectively cleaned in the surface drilling mud system.

1.9. Upon completion of the investigations in the boreholes, the boreholes must be permanently plugged and abandoned in accordance with the borehole abandonment project decisions and abandonment scheme, so that the abandonment method and measures ensure long-term protection of the subsurface and other environmental components (according to the document specified in Clause 6, Item 8 of this TS).

2. In each of the drilled boreholes must be fulfilled<sup>2</sup>:

2.1. Detailed and comprehensive borehole's sidewalls' investigations must be carried out using optical and/or acoustic, and/or electrical imaging methods.

2.2. The entire borehole core, which can be recovered, must be recovered<sup>3</sup> (up to 100 m depth, at least 50% of the total core length must be recovered, in greater depths – 80–100% recovery). The core diameter must be selected so as to fully meet the requirements of the investigations specified in this TS Appendix, but not less than 61.1 mm for sedimentary cover and 50 mm for the crystalline basement, provided that a 50 mm sample diameter is ensured in accordance with [16]. 2.3. Core photofixation with orientation markers<sup>4</sup> must be carried out, the entire core must be oriented, and formation integrity measurements (RQD determination) must be performed. 30% of the recovered core length is preserved in a cylindrical shape by vacuum method<sup>5</sup>, the remaining 70% of the recovered core length is cut lengthwise into two parts, and one of the cut parts is preserved by vacuum method. The recovered core, after conducting the investigations specified in this Annex of the technical specification, and after abandoning all the investigations in the boreholes (at the latest), must be submitted for storage to the LGS Subsurface Information Centre core repository [9] in accordance with the established procedure.

2.4. The thickness of the physical weathering crust, fracturing (and microfracturing), orientation and geometry of the cracks must be determined for the crystalline basement formation.

2.5. A complex of well logging has to be carried out throughout the entire borehole profile (from the wellhead to the well bottom) using the methods selected by the Supplier from five mandatory groups of methods: acoustic, cementometry, thermometry, radioactive (nuclear)<sup>6</sup>, and electrical. From each of the aforementioned methods' groups, the Supplier selects, at their discretion, one or several of the most suitable methods for determining the parameters and characteristics specified in sections 2.1–2.4, 2.9–2.10, 2.11.1–2.11.2, 2.11.5–2.11.9 of this TS.

2.6. The natural stresses<sup>7</sup> of the potential formations and the geological layers covering them (up to the wellhead) and those underlying them in the boreholes has to be determined using methods selected by the Supplier and the temperature has to be determined (temperature must be measured at the wellhead and well bottom).

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<sup>2</sup> The Supplier is responsible for ensuring that the selected investigation methods are sufficient to guarantee the quality of the investigations. The investigation methods must be selected and justified in the borehole designs and investigation programs prepared by the Supplier.

<sup>3</sup> In the case of unconsolidated (loose) rocks, core recovery must be no less than 50% of the total core length.

<sup>4</sup> In the case of loose rocks, photofixation may not be performed in full. All deviations from the borehole design must be documented and clearly justified.

<sup>5</sup> It means vacuum packing in aluminium foil with a plastic cover.

<sup>6</sup> Radioactive (nuclear) methods are a group of geophysical borehole investigation (GBI) methods that measure the natural gamma radiation of rocks. No radioactive materials may be used during the investigations.

<sup>7</sup> Only in the case of consolidated rocks.

2.7. The presence of any natural gas or gaseous material<sup>8</sup>, if they will occur in the subsurface formations and/or ground water, should be determined.

2.8. Surveys of the aquifers located above and below the potential formation in the borehole must be carried out:

- 2.8.1. Pressure measurements;
- 2.8.2. Hydrogeological parameters (permeability coefficient) of the identified aquifers "in situ"<sup>9</sup>;
- 2.8.3. Physical properties of the groundwater (Eh, temperature).
- 2.8.4. Groundwater samples have been taken for hydrogeochemical parameter determination.

2.9. After fieldwork, a lithological description of each borehole's profile (with a precision of 1 centimetre according to the requirements of standards EN ISO 14688-1 and ISO EN 14689-1) and a stratigraphic subdivision (classification) with accuracy of stratigraphic units up to the formations units according to international and approved local stratigraphic schemes [10-12] must be prepared.

2.10. Undisturbed core samples of categories A and B from sedimentary rocks (no later than 24 hours after lifting) have been taken (according to standard EN ISO22475) must be taken and sent to laboratories, as specified in items 2.11.3 and 2.12.3 of this Appendix. Samples for other investigations mentioned in this Appendix may be taken and sent to laboratories depending on the circumstances. Samples are taken: up to a depth of 200 m, every 5 m; from 200 m to the crest of potential formations distinguished according to stratigraphic and lithological<sup>10</sup> parameters\* – every 2 m; within the potential formation bedding interval – every 1 m. In the potential crystalline basement formation, samples are taken every 1 m up to a depth of 50 m from the of the physical weathered crust of the crystalline basement.

2.11. The following parameters (and their values) must be determined from core samples:

- 2.11.1. Permeability of fractures to solutions, self-healing of fractures; brittle and plastic (shear) deformations, mylonitisation and cataclastic zones, brecciation zones;
- 2.11.2. Geometrical parameters of potential formations and the layers covering them and underlying them: depth of occurrence and thickness;
- 2.11.3. Chemical composition of pore solutions, natural moisture<sup>11</sup> and density of rocks, moisture at the limit of ductility and plasticity, density of solid particles;
- 2.11.4. For sedimentary rocks – granulometric composition, for crystalline basement rocks – petrographic composition;
- 2.11.5. Total organic matter content and maturity;
- 2.11.6. Mineralogical composition (including the amount of clay and water-soluble minerals in the total rock matrix and separately in the clay fraction) and chemical composition;
- 2.11.7. Adsorptive properties (Kd); cation exchange rate, solubility; diffusion coefficient;
- 2.11.8. Reservoir properties (porosity, effective porosity, permeability, magnetic susceptibility);
- 2.11.9. Swelling and brittleness of clay rocks;
- 2.11.10. Permeability coefficient of the potential formation and covering rock samples.

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<sup>8</sup> It refers to any natural gas (or substance in gaseous phase) occurring in the subsurface formations and/or formation water.

<sup>9</sup> It is recommended to perform borehole tests **in-situ** using the Packer method. However, if this is not possible, the tests may be conducted using other methods. The Service Supplier is responsible for the proper preparation and execution of the borehole investigations.

<sup>10</sup> Information on the identification of potential formations in boreholes and their laying conditions is provided in Annex 2 of this TS.

<sup>11</sup> For determining the natural moisture, natural density, and chemical composition of pore solutions of rocks, samples must be examined no later than 24 hours from the core lifting. For other tests, undisturbed category A and B samples are taken according to standard EN ISO 22475 and submitted to accredited laboratories.



2.12. Groundwater samples are taken from all identified aquifers. The following parameters must be determined in groundwater samples:

2.12.1. Groundwater, total mineralisation, macrocomponent composition; ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ );

2.12.2. Concentration of important components for safety (sulphur, nitrogen, iron compounds, microorganism content) in the water;

2.12.3. Amount of dissolved gases in the water (oxygen,  $\text{CO}_2$ ,  $\text{H}_2$ ,  $\text{CH}_4$ );

2.12.4. Water aggressiveness to construction materials (metal, concrete);

2.12.5. Isotopic composition of the water (tritium, radiocarbon, radon, stable oxygen, sulfur, and carbon isotopes);

2.12.6. Content of colloids and dissolved organic matter (humic and fulvic acids);

2.12.7. Water pH.

3. Requirements for the survey report:

3.1. The completed survey report is the final result of the survey;

3.2. The composition and scope of the processed and systematised data presented in the survey report must comply with the requirements of the technical specification and its annexes;

3.3. The survey report must use the indicator letter symbols and indices, other signs, and measurement units of physical quantities as specified in Lithuanian standards, and approved geological indices;

3.4. The survey report consists of an explanatory note, textual and graphical annexes;

3.5. The title page of the survey report must include the report title, the first letter of the survey manager's full name, signature, and the survey registration number in the Earth's Subsoil Register. After the title page – the table of contents, listing all the sections of the explanatory note, textual and graphical annexes;

3.6. The explanatory note of the survey report must include the following sections: Introduction, general data; Geological structure; Hydrogeological conditions, rock composition and properties; Geological processes and phenomena; Conclusions and recommendations;

3.7. In the "Introduction" section, the following must be indicated: Name of the survey customer, the survey manager's first name and surname, the dates and numbers of the permits to conduct survey on the Earth's Subsurface; Survey location, address, LKS-94 coordinates; purpose of the survey; Information about the types of survey work, methods, equipment, metrological checks, survey methodology, and applied normative documents; The dates and duration of the survey work; The names of the fieldwork, laboratory tests, and data processing performers; Work performed by subcontractors; Explanations for changes in the survey work, descriptions of additional work (if any); Geological mapping information, explanations of conventional symbols, signs, concepts, and abbreviations of specific terms;

Section 3.8 "General data" includes information about the survey location (plot, area):

3.8.1. Relief of the land surface, altitudes, slope steepness, other morphometric and morphological features;

3.8.2. Administrative affiliation of the plot;

3.8.3. Technogenic situation of the plot (excavations, embankments, existing buildings);

3.8.4. Data about protected areas (if any); Information about immovable cultural heritage (if any).

3.9. Section "Geological structure" must include the following survey data

3.9.1. Description of the borehole profile (from the ground surface) with an accuracy of 1 centimetre according to the requirements of the EN ISO 14688-1 and ISO EN 14689-1 standards;

3.9.2. The geological age, genesis, and composition of geological layers;

3.9.3. The geometry of the layers and stratigraphic classification with an accuracy of suite, according to international and approved local stratigraphic schemes;

3.9.4. Lithological features of the layers, petrographic composition, structural and texture elements.

3.10. In the "Hydrogeological conditions" section, the following must be described:

3.10.1. Detected aquifers, identified types of groundwater;

3.10.2. Conditions of aquifer bedding, the filtration (hydraulic conductivity) properties of the layers;

3.10.3. Groundwater level, level regime, depth forecast, flow direction;



- 3.10.4. Height of the piezometric level of groundwater, hydraulic connections;
- 3.10.5. Potential for technogenic groundwater formation;
- 3.10.6. Hydrochemical composition of groundwater and evaluation of its aggressiveness.
- 3.11. In the "Rock composition and properties" section, the following are provided:
  - 3.11.1. Data on the identified geological layers, their geometric parameters;
  - 3.11.2. Data on the composition of the rocks forming the layers and indicators describing their physical state, permeability, nature of property changes;
  - 3.11.3. For each identified geological layer, results of fieldwork, laboratory tests, and data processing must be provided.
- 3.12. In the "Geological processes and phenomena" section, the following must be described:
  - 3.12.1. Geological processes and phenomena (if any);
  - 3.12.2. Deformations in the studied and neighbouring plots (if any);
  - 3.12.3. Evaluation of seismic activity.
- 3.13. In the "Conclusions and recommendations" section, the data on the impact of geological and hydrogeological structure on construction works must be provided, as well as recommendations for geological surveys in other stages of the GA project implementation.
- 3.14. Textual and graphical annexes of the survey report:
  - 3.14.1. Copy of the technical specification;
  - 3.14.2. Schematic of the borehole location, geodetic coordinates of the borehole in LKS-94 and altitude in the LAS 07 elevation system;
  - 3.14.3. Borehole passport with an identification number in the Earth's Subsoil Register;
  - 3.14.4. Data from archival and foundation materials on previously drilled boreholes in the vicinity, plan of other survey locations (if any);
  - 3.14.5. A geological column of the survey borehole at a scale no smaller than 1: 200 (geological section compiled during investigations, with geological layers' boundaries and hydrogeological data);
  - 3.14.6. Well logs, graphs and diagrams from other instrumental tests in the borehole (raw data in editable format);
  - 3.14.7. Laboratory test protocols for rock properties;
  - 3.14.8. Protocols for groundwater testing;
  - 3.14.9. Summary table of rock parameters, with the characteristic values determined for each geological layer.
- 3.15. The survey manager is responsible for the validity of the conclusions presented in the survey report and the quality of the data from the conducted surveys.
- 3.16. The survey manager must sign the report.
- 3.17. The survey report must be submitted to the Geological Service of Lithuania under the Ministry of the Environment within 10 working days after the completion of the survey by one of the following methods:
  - 3.17.1. Through electronic communication tools using the electronic services of the Service website;
  - 3.17.2. By other electronic communication tools (email, creating access for the Service to the data server, etc.);
  - 3.17.3. On electronic media.
- 3.18. The survey report, submitted via electronic communication tools or electronic data media, must be signed with a qualified electronic signature.

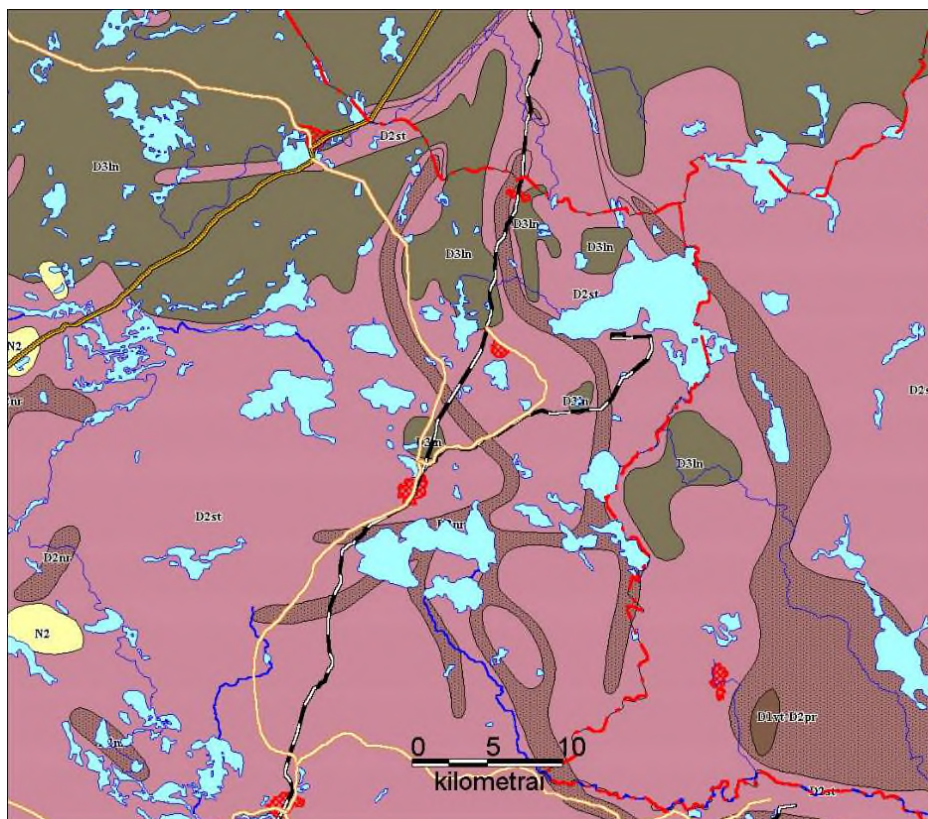
*Translation from Lithuanian*

## INFORMATION ABOUT THE GEOLOGICAL STRUCTURE OF THE IGNALINA DISTRICT

The geological section of the Ignalina district is divided into two parts – the crystalline basement and the overlying sedimentary cover. The thickness of the sedimentary cover varies from 700 to 800 meters. The thickness of the sedimentary rocks increases towards the northwest.

The upper part of the sedimentary cover consists of Quaternary deposits, whose geological structure is particularly complex due to the active influence of glaciers and their meltwater. This layer reaches a thickness of 60–80 meters and is intensively exploited for drinking water supply. In some places, deep paleoincisions have been identified, exceeding depths of 200 meters (Figure 1).

Beneath the Quaternary layer lies the sandy deposits of the Upninkai Formation of **Middle Devonian**, with a thickness of about 100 meters (Figure 2). In the northern part of the Ignalina district, younger rocks of **Upper Devonian** Šventoji Formation are widespread. The sandy deposits of the Upninkai and Šventoji Formations form a one complex, dominated by fine-grained sand with interlayers of siltstone and clay (Figure 2). The sandstones and sands are highly porous – about 30 percent, with a permeability coefficient exceeding 1 Darcy.



*Figure 1. Excerpt from the Pre-Quaternary Map, Scale 1:200,000*

In deep paleoincisions beneath the Quaternary cover, rocks of the Narva Regional Stage of the **Middle Devonian** are exposed in some areas. This layer is about 80 meters thick. It is dominated by dolomitic marl, with frequent dolomite interlayers in the lower part and rare sandstone interlayers up

to 2 meters thick. The depth of the Narva top varies from 95 meters (in the south) to 190 meters (in the north).

In the lower part of the **Middle Devonian** lies a sandstone layer 9–16 meters thick, attributed to the Pärnu Formation, which contains interlayers of marl and dolomite (at the base).

Devonian rocks overlay on the clayey-carbonate deposits of the **Silurian system**. The section consists of **Lower Silurian** rocks. At the base is a clayey marl about 30 meters thick, attributed to the Švenčionys Formation (Llandovery), overlain by the Paprieniai Formation (25–30 m) composed of clayey marl that transitions upward into dolomitic marl. The total thickness of the clayey sequence reaches 37–40 meters. The depth of the Silurian rock top ranges from 166 meters (Tverečius area) to 316 meters (Zarasai step).

The **Ordovician** carbonate and clayey rock complex is 140 meters thick. The section is dominated by limestone, with interlayers of marl. The reservoir properties of these rocks are relatively low.

The **Cambrian** deposit consists of two distinct parts – the upper part is composed of quartz sandstone from the Lakajai Formation, with a thickness of up to 15 meters. Its reservoir properties are good – porosity is 20–25 percent, and the permeability coefficient exceeds 1 Darcy. Beneath the Lakajai sandstones lie the blue clays of the Baltic Series, with a thickness of 70–110 meters. The top lies at a depth of 340–520 meters. In addition to clays, there are interlayers of sandstone and siltstone, which are more common in the lower part of the section.

Beneath the Cambrian clays lie **Ediacaran** (formerly **Vendian**) sandstones and greywackes. Their thickness is about 130–150 meters. The sandstones have poor reservoir properties due to clay–iron cementation.

Ediacaran rocks rest on the **crystalline basement**. All boreholes drilled in the Ignalina district have penetrated cataclastic and mylonitized rocks of crystalline basement that are crushed within the Drūkšiai and Polotsk tectonic zones. The depth of the crystalline basement ranges from 700 to 800 meters.

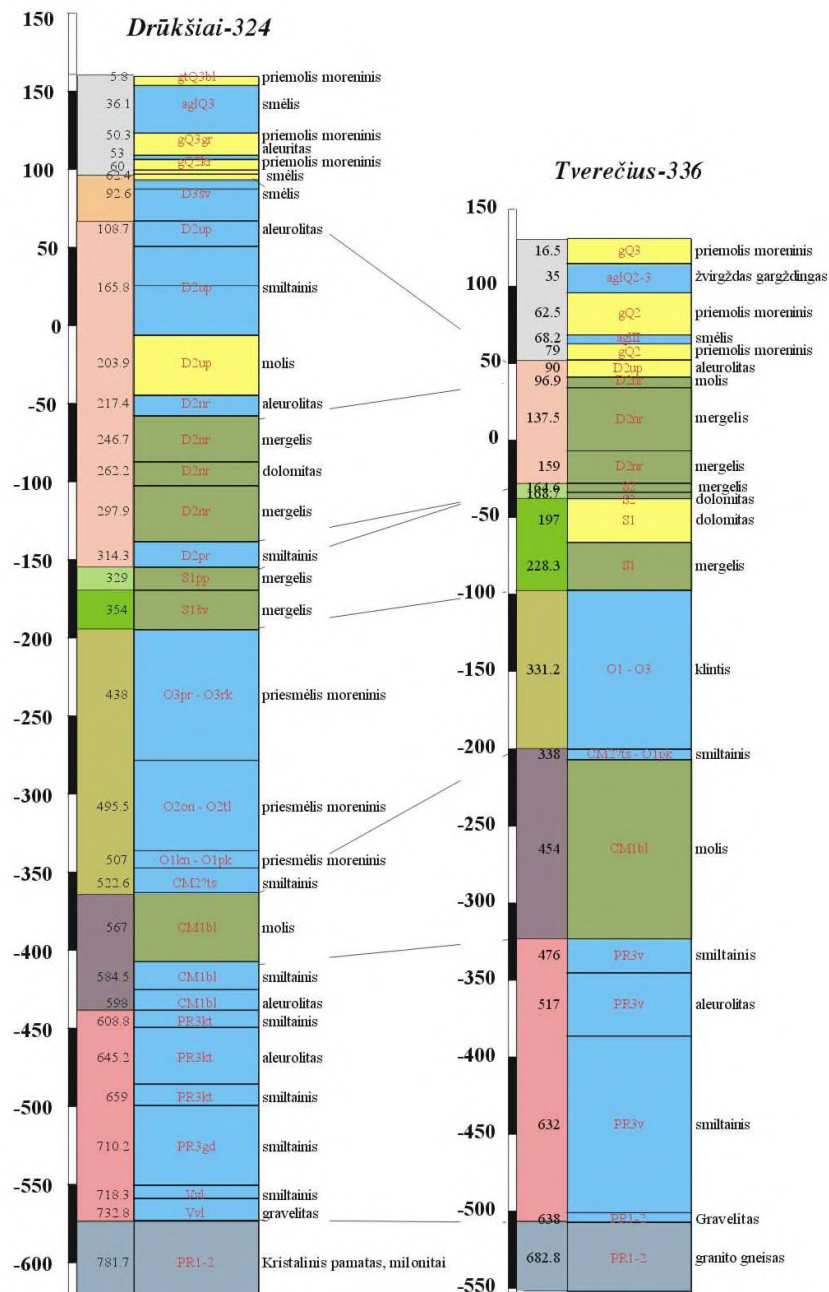


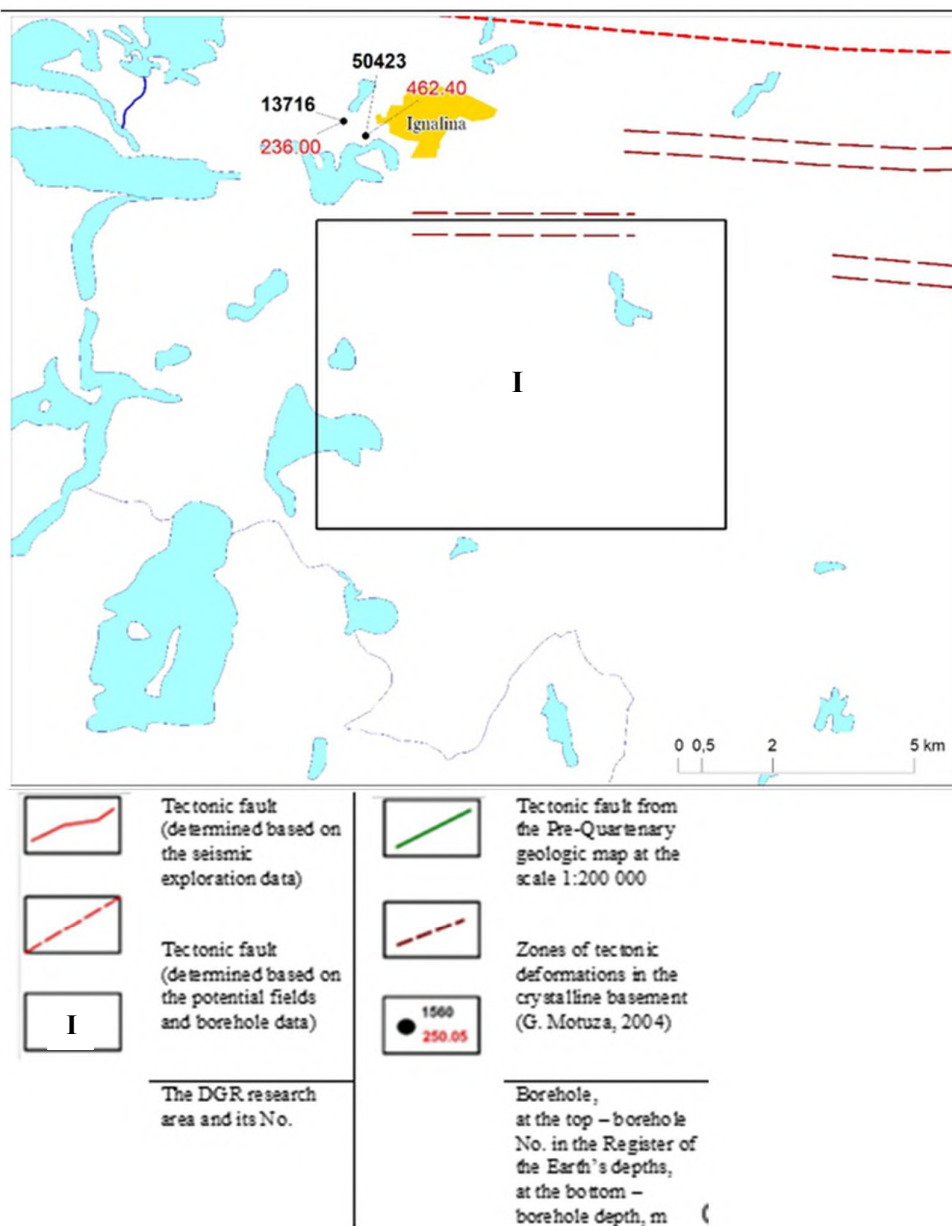
Figure 2. Geological Columns of Tverečius-336 and Drūkšiai-324 boreholes. Blue colour indicates aquifers, yellow – aquitards, green – regional aquitards. The depth of the base of each layer and the age of the rocks are indicated. Other notes: priemolis, moreninis – glaciolacustrine clay; smėlis – sand; aleuritas – silt; aleurolitas – siltstone; smiltainis – sandstone; molis – clay; mergelis – marlstone; dolomitas – dolomite; priesmėlis, moreninis – glacial till; gravelitas – gravel/ gravelite; kristalinis pamatas – crystalline basement; milonitai – mylonite; žvirgždas – gravel; klintis – limestone; granito gneisas – granitic gneiss

The Drūkšiai area, located near the potential Deep geological repository (DGR) study sites, has been thoroughly investigated. The geological investigations report titled “Report on the 1:50 000 scale complex geological–hydrogeological and engineering geological mapping in the Ignalina NPP region within the territories of Lithuania, Belarus, and Latvia (Drūkšiai site) by V. Marcinkevičius

(lead executor) et al., Vilnius, 1995”, is archived at the Lithuanian Geological Survey under the Ministry of Environment. The report is stored in the Geological Fund – report number No. 4384.

## Geological and Hydrogeological Conditions of the Study Sites

### DGR research Area No. I – Characteristics



Address	Švenčionėliai eldership, Švenčionys district municipality; Ignalina eldership, Vidiškiai eldership, Ignalina district municipality	
Angle Coordinates	X	Y
NW	6 133 999,25	635 163,66
NE	6 133 999,25	643 253,33
SE	6 127 905,95	643 253,33
SW	6 127 905,95	635 163,66

Area, km <sup>2</sup>	49,063
Formation	Clayey Rocks of the Baltic Series, Lower Cambrian (Cm)
The formation top, (abs. alt. m.)	<u>-250 - -330</u>
Occurrence depth, m	390 - 450
Formation	Crystalline Rocks (KP)
The formation top, (abs. alt. m.)	<u>-490 - -520</u>
Occurrence depth, m	680 - 710

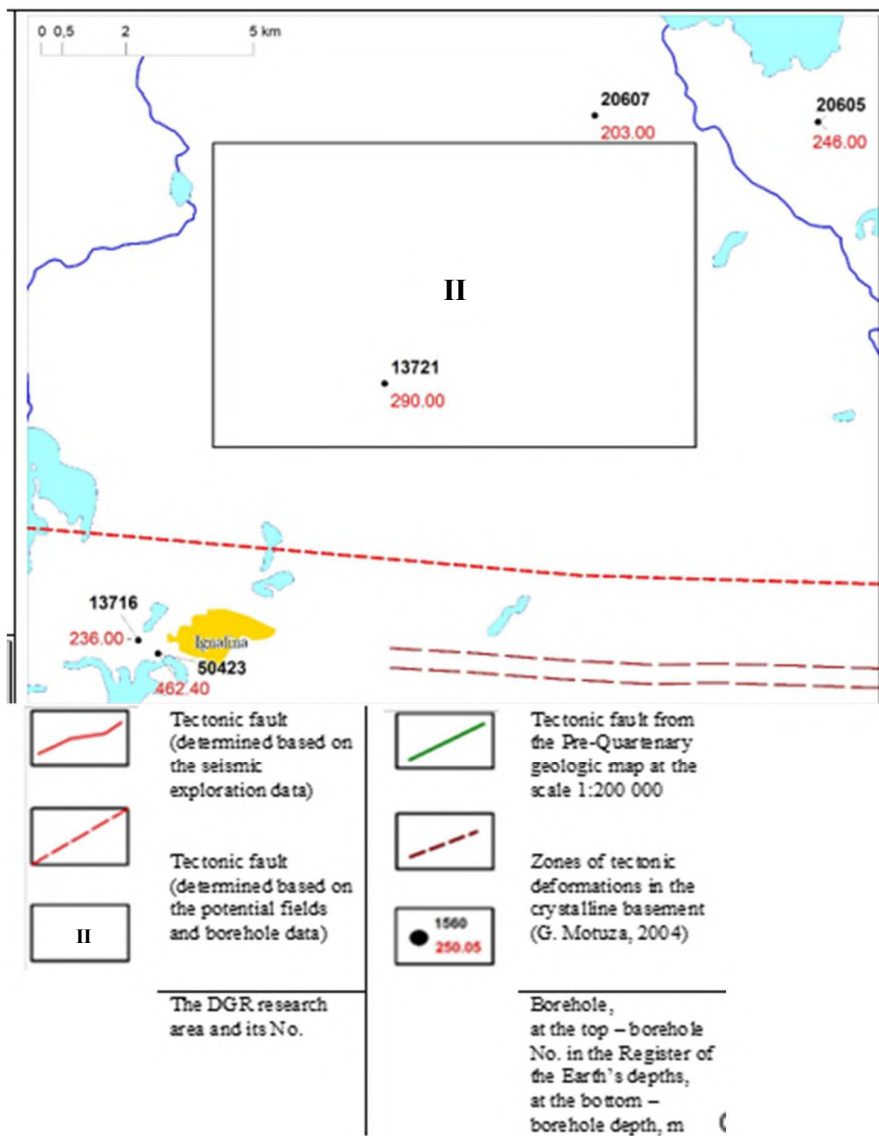
<b>DGR Research Area No. I – Summarised stratigraphic cross-section</b>
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ERATHEM	SYSTEM	SERIES	STAGE	SUBSTAGE	REGIONAL STAGE	GROUP	FORMATION	GEOLOGICAL INDEKS	COLUMN	THICKNESS, m	LITOLOGICAL CHARACTERIZATION OF STRATIGRAPHICAL UNITS	PERMIABILITY
P A L E O Z O I C	CENOZOIC	QUATERNARY	MIDDLE DEVONIAN			Arukiula - Burtneki	Upinkai	D <sub>9</sub> up		0 - 30	Sandstone, sand, siltstone with rare clay interlayers	
						Narva	Ledai	D <sub>9</sub> k		0 - 7	Siltstone, sandstone, clay	
						Neris	Nevezis	S <sub>1</sub> nr		6	Dolomite	
						Paprienai	Sven-ionys	S <sub>1</sub> pp		28	Dolomite	
						Lakajai	Cm .bl			90 - 97	Clay with fine interlayers of sandstone	
P A L E O Z O I C	DEVONIAN	MIDDLE	EIFELIAN	GIVETIAN	Arukiula - Burtneki	Upinkai		D <sub>9</sub> up		0 - 30	Sandstone, sand, siltstone with rare clay interlayers	
P A L E O Z O I C	SILURIAN	WENLOCK - LUDLOW	GORSTIAN - LUDFORDIAN	TELYCHIAN	JAAANI	ADA - VERE - RE	Sven-ionys	S <sub>1</sub> sv		31	Marlstone clayey, dolomitic with interlayers of clay	
P A L E O Z O I C	ORDOVICIAN	UPPER	KATIAN - HIRNANTIAN	VOLCHOV - NABALA	VORMSI - PORKUNI		O <sub>3</sub> vr-pr			62	Limestone	
P A L E O Z O I C	CAMBRIAN	TERRENEUVIAN	VERGALE - RAUSVE	Lakajai	Cm .j		Cm .bl			90 - 97	Clay with fine interlayers of sandstone	
P A L E O Z O I C	PROTEROZOIC	EDIA - CARAN								130 - 145	Interbedding of sandstone and siltstone with rare interlayers of conglomerate	

## LEGEND

	GOOD PERMIABILITY
	MIDDLE PERMIABILITY
	INPERMIABILITY



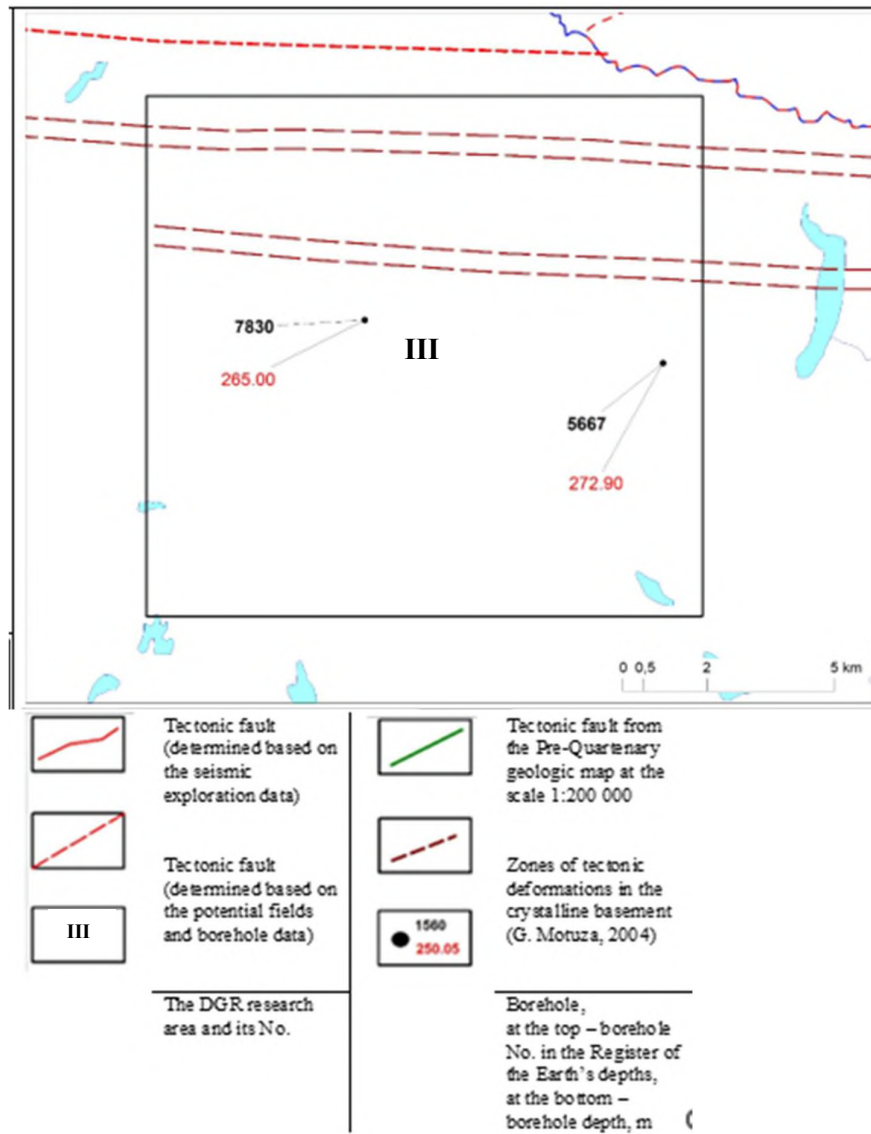
Address	<u>Kazitiškis eldership, Ignalina eldership, Vidiškiai eldership, Naujoji Daugėliškis eldership, Ignalina district municipality</u>	
Angle Coordinates	X	Y
NW	<u>6 146 893,24</u>	<u>637 351,00</u>
NE	<u>6 146 893,24</u>	<u>647 975,20</u>
SE	<u>6 140 192,37</u>	<u>647 975,20</u>
SW	<u>6 140 192,37</u>	<u>637 351,00</u>
Area, km <sup>2</sup>	70,856	
Formation	Clayey Rocks of the Baltic Series, Lower Cambrian (Cm)	
The formation top, (abs. alt. m.)	<u>-305 - -365</u>	
Occurrence depth, m	425 - 500	
Formation	Crystalline Rocks (KP)	
The formation top, (abs. alt. m.)	<u>-560 - -580</u>	
Occurrence depth, m	740 - 760	



## DGR Research Area No. II – Summarised stratigraphic cross-section

PROTEROZOIC	PALAEOZOIC										THICKNESS, m	LITOLOGICAL CHARACTERIZATION OF STRATIGRAPHICAL UNITS	PERMIABILITY		
	CAMBRIAN	ORDOVICIAN		SILURIAN		DEVONIAN		GROUP	FORMATION	GEOLOGICAL INDEX					
	TERRENEUVIAN	Series-2	LOWER	MIDDLE	UPPER	LLANDOVY	WENLOCK-LUDLOW				MIDDLE		REGIONAL STAGE	SUBSTAGE	STAGE

### DGR Research Area No. III – Characteristics



Address	Naujoji Daugėliškis eldership, Tverėčius eldership, Ceikiniai eldership, Mielagėnai eldership, Ignalina district municipality	
AngleCoordinates	X	Y
NW	6 136 173,57	645 180,27
NE	6 136 173,57	657 436,31
SE	6 124 729,11	657 436,31
SW	6 124 729,11	645 180,27
Area, km <sup>2</sup>	139,599	
Formation	Clayey Rocks of the Baltic Series, Lower Cambrian (Cm)	
The formation top, (abs. alt. m.)	-200 - -300	
Occurrence depth, m	330 - 420	
Formation	Crystalline Rocks (KP)	

The formation top, (abs. alt. m.)	<u>-460 - -520</u>
Occurrence depth, m	640 - 700

**DGR Research Area No. III – Summarised stratigraphic cross-section**

PROTEROZOIC	PALAEOZOIC										THICKNESS, m	LITOLOGICAL CHARACTERIZATION OF STRATIGRAPHICAL UNITS	PERMIABILITY
	CAMBRIAN	ORDOVICIAN		SILURIAN		DEVONIAN		CENOZOIC	ERATHEM				
EDIA-CARAN	TERRENEUVIAN	Series-2	LOWER	MIDDLE	UPPER	LLANDO-VERY	WENLOCK-LUDLOW			MIDDLE		QUATERNARY	SYSTEM
			FERMOOSCHN	FLOJIAN - SANDBIAN	KATIAN - HIRMANNTIAN	TELYCHIAN	COBLENZ-LUDFORDIAN	EIFELIAN		GIVETIAN	SERIES		
							PALEGIAI	Narva		Arukula - Burtnieki	STAGE		
							JAANI	Narva		Upinkai	SUBSTAGE		
							ADAVE-RE	Ledai			REGIONAL STAGE		
								Kernave			GROUP		
								D <sub>3</sub> k			FORMATION		
								D <sub>3</sub> ld			GEOLOGICAL INDEX		
											COLUMN		
										90 - 150	THICKNESS, m		
										Interbedding of glacial till, glaciolacustrine clay (comprising 45 - 90% of section) interbedding of sand, silt and gravel (comprising 10 - 55% of section)			
										Sandstone, sand, siltstone with rare clay interlayers			
										Siltstone and sandstone			
										Dolomitic marlstone with interlayers of dolomite (20 - 30 %) and clay			
										Dolomite			
										Dolomite			
										Dolomite			
										Marlstone clayey, dolomitic with interlayers of clay			
										Limestone			
										Limestone with interlayers of marlstone			
										Sandstone			
										Sandstone			
										Clay with fine interlayers of sandstone			
										Interbedding of sandstone and siltstone with rare interlayers of conglomerate			
										Crystalline basement: composition - dominating gneiss, at the top of CB - weathered crust			

## LEGEND

	GOOD PERMIABILITY
	MIDDLE PERMIABILITY
	IMPERMIABILITY