



European Union Network for the Implementation
and Enforcement of Environmental Law



Tackling Illegal Groundwater Drilling and Abstraction Project

Survey Report

Date of report: 28 September 2022

Report number: 202108 WG4



Funded by the
European Union

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Commission DIRECTORATE-GENERAL FOR ENVIRONMENT - LIFE PROGRAMME
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Introduction to IMPEL

The European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) is an international non-profit association of the environmental authorities of the EU Member States, acceding and candidate countries of the European Union and EEA countries. The association is registered in Belgium and its legal seat is in Brussels, Belgium.

IMPEL was set up in 1992 as an informal Network of European regulators and authorities concerned with the implementation and enforcement of environmental law. The Network's objective is to create the necessary impetus in the European Community to make progress on ensuring a more effective application of environmental legislation. The core of the IMPEL activities concerns awareness raising, capacity building and exchange of information and experiences on implementation, enforcement and international enforcement collaboration as well as promoting and supporting the practicability and enforceability of European environmental legislation.

During the previous years IMPEL has developed into a considerable, widely known organisation, being mentioned in a number of EU legislative and policy documents, e.g. the 7th Environment Action Programme and the Recommendation on Minimum Criteria for Environmental Inspections, and more recently in the General Union Environment Action Programme to 2030 and EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'.

The expertise and experience of the participants within IMPEL make the network uniquely qualified to work on both technical and regulatory aspects of EU environmental legislation.

Information on the IMPEL Network is also available through its website at: www.impel.eu



<p>Title of the report:</p> <p>Survey Report - Results from the TIGDA questionnaire</p>	<p>Number report:</p> <p>202108 WG4</p>
<p>Project Manager/Authors:</p> <p>Monica Crisan</p> <p>Bart Pannemans</p> <p>David Seccombe</p>	<p>Report adopted at IMPEL General Assembly Meeting:</p> <p>7-9/06/2023 Stockholm</p>
	<p>Total number of pages: 97</p> <p>Report: 8</p> <p>Annexes: 89</p>
<p>Executive Summary</p> <p>Within the IMPEL network (https://www.impel.eu) a project was launched in 2021 titled 'Tackling illegal groundwater drilling and abstractions (TIGDA)'. Background to the project and terms of reference can be found at www.impel.eu/en/projects/tackling-illegal-groundwater-drilling-and-abstractions-tigda</p> <p>Sharing knowledge and good practices on how to manage groundwater drilling and abstractions are the main goals of the TIGDA-project. This would include specific permitting conditions, accreditations as well as enforcement tools and methods in place in different member states to reduce illegal drilling and groundwater (over)abstraction. Lessons learned in the member states (good ones as well as bad ones) are useful to share and collect.</p> <p>In order to fine-tune the project objectives to needs of enforcers in each member country, the TIGDA-project group developed a questionnaire within the network to gain valuable input with a topic focus on:</p> <ul style="list-style-type: none"> • Illegal drilling activities, • Illegal groundwater abstractions, • How permitting is organized for both drilling and abstraction, • Whether legislation on these topics is sufficiently supporting enforcement, • How inspections and enforcement can be successfully organized. <p>We are also encouraged respondents to list any novel techniques, pilot projects, tools or best practices that may be applied in their country or region and may be useful to share with the other network members. The gathered information will inform the direction of the next project phase</p>	
<p>Disclaimer</p> <p>This report is the result of a project within the IMPEL network. The content does not necessarily represent the view of the national administrations or the Commission.</p>	



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1. Objectives

Within the IMPEL network (<https://www.impel.eu>) a project was launched in 2021 titled 'Tackling illegal groundwater drilling and abstractions (TIGDA)'. Background to the project and terms of reference can be found at www.impel.eu/en/projects/tackling-illegal-groundwater-drilling-and-abstractions-tigda

Sharing knowledge and good practices on how to manage groundwater drilling and abstractions are the main goals of the TIGDA-project. This would include specific permitting conditions, accreditations as well as enforcement tools and methods in place in different member states to reduce illegal drilling and groundwater (over)abstraction. Lessons learned in the member states (good ones as well as bad ones) are useful to share and collect.

In order to fine-tune the project objectives to needs of enforcers in each member country, the TIGDA-project group developed a questionnaire within the network to gain valuable input with a topic focus on:

- Illegal drilling activities,
- Illegal groundwater abstractions,
- How permitting is organized for both drilling and abstraction,
- Whether legislation on these topics is sufficiently supporting enforcement,
- How inspections and enforcement can be successfully organized.

We are also encouraged respondents to list any novel techniques, pilot projects, tools or best practices that may be applied in their country or region and may be useful to share with the other network members.

This report documents the methodology of the questionnaire, and the synthesis of the answers into a longlist.

2. Methodology

The questionnaire was compiled by the project core team, and sent around to the project team for comment. It was agreed and finalized during the TIGDA-meeting in October 2021.

The questionnaire was sent around to all IMPEL members. In December 2021 nine answers were received. This low outcome was discussed during the TIGDA project meeting, and it was decided to extend the deadline and make another announcement to the TIGDA members. No additional answers were received.

In April 2022, the questionnaire was revised in an effort to make it easier to compile for respondents. A number of questions within the first questionnaire asking for too information were taken out, and some vague questions or answer options were rephrased. The revised questionnaire was again sent out to the TIGDA members, and another nine answers were received. Two respondents answered both questionnaires, so in total sixteen unique respondents returned an answer (covering ten countries). Given the rather lengthy questionnaire (20 minutes to complete), this can be considered a reasonable response. Still, many member states are not represented in the answers, which may result in blind spots on interesting enforcement or inspection techniques.

The responses to both questionnaires can be found in appendix I and II of this report. Figure 1 shows the ten countries for which a questionnaire was received: Belgium (Flanders), Croatia, Greece, Italy, Malta, Norway, Portugal, Romania, Slovenia, UK (Wales & England).



Figure 1: countries for which a questionnaire was returned are indicated in orange.

3. Compiling a longlist of TIGDA-techniques

The completed questionnaires were scanned for any existing methods used for enforcement on detection, monitoring and enforcement of groundwater drilling and extraction. All methods were synthesized in a longlist of TIGDA-methods. This longlist forms the landscape of methods that are used throughout Europe, some may be well-established and generally adopted, others are quite novel and only pioneered in some countries. The longlist was mainly inventoried from responses to the questionnaire, but supplemented with answers from a similar questionnaire in 2015 (VMM, BE) and experiences of the project team.

Table 1 lists the longlisted methods. A more detailed information can be found in Appendix III of this report. For each method a brief description is given, as to how this method is currently understood by the project team. Also a list of countries is given where the method is possibly already applied (in one way or another).

From the questionnaire evidence of illegal drilling exists in following installations: irrigation and growing crops, livestock (dairy, poultry), parks & recreation (golf courses, campsites), smaller quarries, discharges, temporary dewatering of construction sites, domestic water supply.



Table 1: longlist of TIGDA-methods

<p>Building a proper legislative framework</p> <ul style="list-style-type: none"> • Drilling contractors need a license, • Legal obligation to pre-register drilling activities, • Legal obligation to (post-)register drilling activities, • Legal obligation to register new groundwater abstractions + exemptions, • Legal obligation to register effective parameters of the well, • Efficient penalty principles are foreseen
<p>Legislative instruments</p> <ul style="list-style-type: none"> • Regulation campaign for existing illegal groundwater abstractions
<p>Compliance Promotion</p> <ul style="list-style-type: none"> • Raising public awareness, • Information for well operators, • Publication of best-practices for drilling operations, • Publication of best-practices for flow measurement, • Evaluation report for drilling contractor, • Benefits for contractors who perform well
<p>Inspection tools:</p> <ul style="list-style-type: none"> • Inspection checklists, • Detection with helicopters, planes or drones, • Detection via satellite imagery, • Risk profiling and validation methods, • Coupling with groundwater monitoring, • GPS-tracking of drilling equipment, • Reporting of illegal drilling or groundwater abstraction, • Picture database of wells, • Database of drilling tools

4. Elaborating on specific methods

During the autumn TIGDA-meeting a number of methods were discussed with participants and Portuguese inspection services. For each method potential application, uptake in each member state and points of attention for successful application were shared.

Following methods were discussed:

- Portugal - drone inspection for illegal abstractions
- Lithuania - legalisation campaign for illegal groundwater wells
- Belgium - gps tracking of drilling rigs (pilot)



See Appendix IV for more details.

5. Next steps

In the next project phases the potentially promising methods will be further elaborated. Specifically for remote sensing techniques a external consultant is sought to report on the state-of-the-art of these methods and how they could be applied for illegal groundwater abstractions.



Annexes



Annex I. Tackling Illegal Groundwater Drilling and Abstractions (TIGDA) Questionnaire (2021)

1. Person completing this questionnaire

Kristin Haugen	Norway
Martin Golčer	Slovenia
Ian Jones (with Geoscience Team Support)	Wales, UK
Stojan Kranjc	Slovenia
Ruxandra Bobocea (inspection, control); Adrian Vlăducu (monitoring)	Romania
Antonio Chambel	Portugal
Asta Navickienė, Jurga Arustienė	Lithuania
Ywan De Jonghe	Belgium
David Seccombe	England

2. Which organisation are you representing?

Kristin Haugen	Norwegian Water and Energy Directorate
Martin Golčer	Inspectorate Of Environment And Spatial Planning
Ian Jones	Natural Resources Wales
Stojan Kranjc	Slovenian Water Agency
Ruxandra Bobocea, Adrian Vlăducu	National Administration Romanian Waters
Antonio Chambel	International Association of Hydrogeologists (IAH)
Asta Navickienė, Jurga Arustienė	Environmental control department under the Ministry of Environment, Lithuanian Geological Survey under the Ministry of Environment
Ywan De Jonghe	Flanders Environment Agency (VMM)
David Seccombe	Environment Agency



3. Administrative Level

● National	7
● Regional	1
● Province	0
● Basin	0
● Andere	1

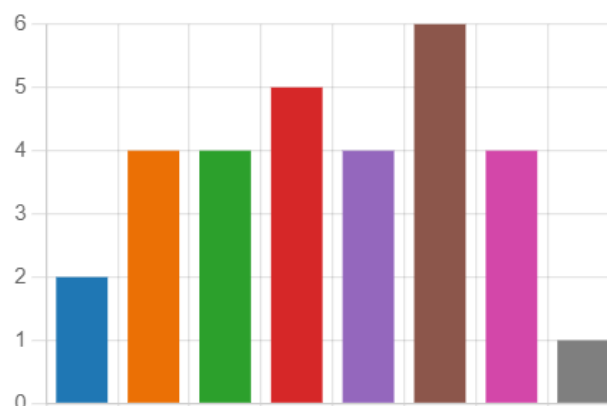


Kristin Haugen	National
Martin Golčer	National
Ian Jones	National
Stojan Kranjc	National
Ruxandra Bobocea, Adrian Vlăducu	National
Antonio Chambel	International
Asta Navickienė, Jurga Arustienė	National
Ywan De Jonghe	Regional
David Seccombe	National



5. What issues are you focused on regarding illegal drilling and abstraction?

- Impacts on monitoring water qu... 2
- Impacts on monitoring water qu... 4
- Developing legislation 4
- Developing policy 5
- Meeting requirements of River ... 4
- Understanding the location and ... 6
- Enforcement 4
- Andere 1

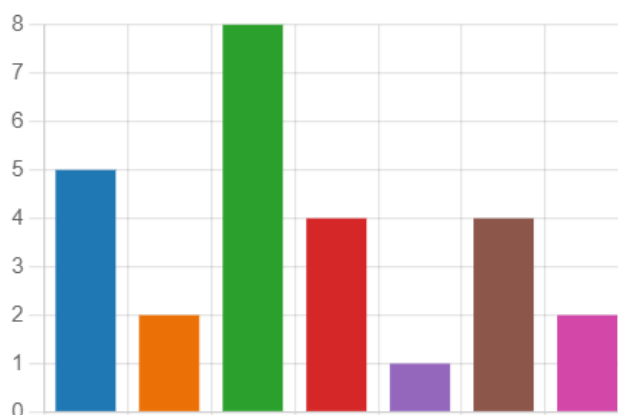


Kristin Haugen	Impacts on monitoring water quantity and levels (surface wate and/or groundwater); Developing legislation; Developing policy; Meeting requirements of River Basin Management Plans; Understanding the location and range of abstraction points
Martin Golčer	Enforcement
Ian Jones (with Geoscience Team Support)	Impacts on monitoring water quality (surface wate and/or groundwater); Impacts on monitoring water quantity and levels (surface wate and/or groundwater); Developing policy; Meeting requirements of River Basin Management Plans; Understanding the location and range of abstraction points; Enforcement
Stojan Kranjc	Other - For now we don't have focus on illegal drilling and abstraction. Enforcement is covered within Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
Ruxandra Bobocea, Adrian Vlăducu	Meeting requirements of River Basin Management Plans; Understanding the location and range of abstraction points
Antonio Chambel	Impacts on monitoring water quality (surface wate and/or groundwater); Impacts on monitoring water quantity and levels (surface wate and/or groundwater); Developing legislation; Developing policy; Meeting requirements of River Basin Management Plans; Understanding the location and range of abstraction points
Asta Navickienė, Jurga Arustienė	Developing legislation; Developing policy; Enforcement
Ywan De Jonghe	Developing legislation; Developing policy; Understanding the location and range of abstraction points; Enforcement
David Seccombe	Understanding the location and range of abstraction points; Impacts on monitoring water quantity and levels (surface wate and/or groundwater)



6. Sectors you are covering in your responses

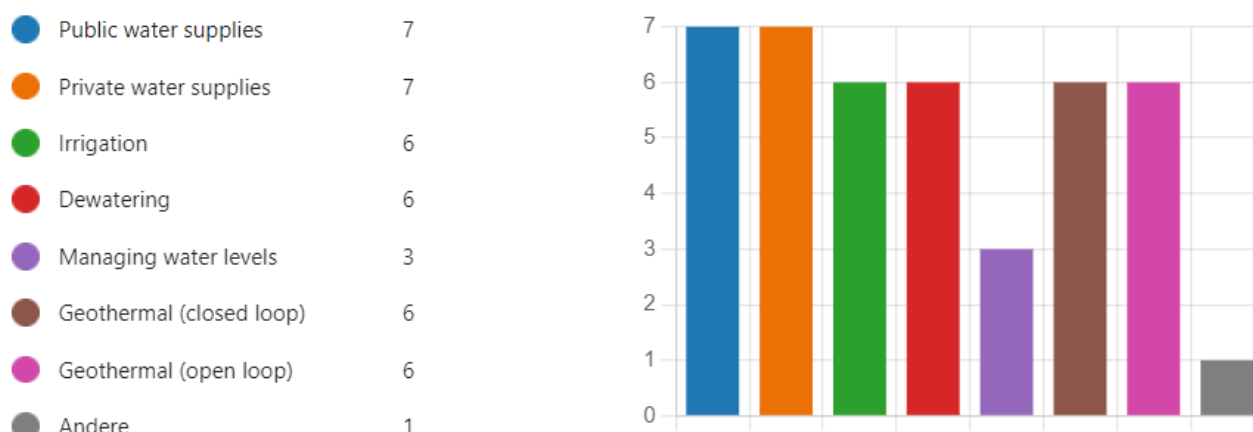
Environment	5
Agriculture	2
Water Resources	8
Water Quality	4
Academia	1
Industry (including drillers)	4
Andere	2



Kristin Haugen	Water Resources
Martin Golčer	Environment; Industry (including drillers); Water Resources
Ian Jones (with Geoscience Team Support)	Environment; Water Resources; Water Quality; Agriculture; Industry (including drillers); Construction Industry
Stojan Kranjc	Water Resources
Ruxandra Bobocea, Adrian Vlăducu	Water Resources; Water Quality
Antonio Chambel	Environment; Water Resources; Water Quality; Academia; Industry (including drillers); Water management
Asta Navickienė, Jurga Arustienė	Environment; Water Resources
Ywan De Jonghe	Industry (including drillers)
David Seccombe	Environment; Agriculture; Water Resources; Water Quality



7. Types of installations you have within your administrative level



Kristin Haugen	Public water supplies; Private water supplies; Irrigation; Dewatering; Managing water levels; Geothermal (open loop)
Martin Golčer	Dewatering; Geothermal (closed loop)
Ian Jones (with Geoscience Team Support)	Public water supplies; Private water supplies; Irrigation; Dewatering; Managing water levels; Geothermal (closed loop); Geothermal (open loop)
Stojan Kranjc	Public water supplies; Private water supplies; Irrigation; Geothermal (closed loop); Geothermal (open loop)
Ruxandra Bobocea, Adrian Vlăducu	Public water supplies; Private water supplies; Irrigation
Antonio Chambel	I don't have any administrative level
Asta Navickienė, Jurga Arustienė	Public water supplies; Private water supplies; Dewatering; Geothermal (closed loop); Geothermal (open loop)
Ywan De Jonghe	Geothermal (open loop); Geothermal (closed loop); Public water supplies; Private water supplies; Irrigation; Dewatering
David Seccombe	Public water supplies; Private water supplies; Irrigation; Dewatering; Managing water levels; Geothermal (closed loop); Geothermal (open loop)



8. Temperature Statistics (please include min, max, average per each month of the year)

Kristin Haugen																																																					
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.																																																				
Ian Jones (with Geoscience Team Support)	Variable by location and changing due to climate change, see https://rmets.onlinelibrary.wiley.com/toc/10970088/2020/40/S1																																																				
Stojan Kranjc	N/A, Slovenian Environment Agency																																																				
Ruxandra Bobocea, Adrian Vlăducu	Data from Meteorological National Administration (https://www.meteoromania.ro/clim/caracterizare-lunara/index.html)																																																				
Antonio Chambel	Annual average: 18°C																																																				
Asta Navickienė, Jurga Arustienė	<p>Month Average Temperature</p> <table border="1"> <thead> <tr> <th colspan="2">Monthly Average Temperature (°C)</th> </tr> </thead> <tbody> <tr><td>January</td><td>-3,2</td></tr> <tr><td>February</td><td>-3,2</td></tr> <tr><td>March</td><td>+0,4</td></tr> <tr><td>April</td><td>+6,7</td></tr> <tr><td>May</td><td>+12,4</td></tr> <tr><td>June</td><td>+15,4</td></tr> <tr><td>July</td><td>+17,9</td></tr> <tr><td>August</td><td>+17,1</td></tr> <tr><td>September</td><td>+12,0</td></tr> <tr><td>October</td><td>+7,2</td></tr> <tr><td>November</td><td>+1,9</td></tr> <tr><td>December</td><td>-1,9</td></tr> <tr><td>Annual;</td><td>+6,9</td></tr> </tbody> </table> <p>Average temperature °C in Vilnius</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Annual</th> <th>January</th> <th>July</th> </tr> </thead> <tbody> <tr><td>2016</td><td>7,4</td><td>7,6</td><td>18,2</td></tr> <tr><td>2017</td><td>7,3</td><td>4,6</td><td>16,7</td></tr> <tr><td>2018</td><td>8,0</td><td>2,6</td><td>19,5</td></tr> <tr><td>2019</td><td>8,8</td><td>4,4</td><td>17,1</td></tr> <tr><td>2020</td><td>9,0</td><td>2,0</td><td>17,6</td></tr> </tbody> </table> <p>Statistics from osp.stat.gov.lt Changes from January to December are illustrated here: http://www.hkk.gf.vu.lt/vu_ms/duomenu-suvestine/</p>	Monthly Average Temperature (°C)		January	-3,2	February	-3,2	March	+0,4	April	+6,7	May	+12,4	June	+15,4	July	+17,9	August	+17,1	September	+12,0	October	+7,2	November	+1,9	December	-1,9	Annual;	+6,9	Year	Annual	January	July	2016	7,4	7,6	18,2	2017	7,3	4,6	16,7	2018	8,0	2,6	19,5	2019	8,8	4,4	17,1	2020	9,0	2,0	17,6
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	July	20.97	11.64
	August	20.7	11.52
	September	17.89	9.54
	October	13.89	6.86
	November	9.86	3.78
	December	7.18	1.55
	Annual	13.47	5.85

9. Precipitation Statistics (please include min, max, average per each month of the year)

Kristin Haugen																																									
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.																																								
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Antonio Chambel	Total minimum: 300 mm Total maximum: 1300 mm Average: 600 mm																																								
Asta Navickienė, Jurga Arustienė	<p>Month Average (mm)</p> <table border="1"> <thead> <tr> <th colspan="2">Monthly Average Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>January</td><td>51</td></tr> <tr><td>February</td><td>38</td></tr> <tr><td>March</td><td>42</td></tr> <tr><td>April</td><td>36</td></tr> <tr><td>May</td><td>54</td></tr> <tr><td>June</td><td>75</td></tr> <tr><td>July</td><td>78</td></tr> <tr><td>August</td><td>77</td></tr> <tr><td>September</td><td>65</td></tr> <tr><td>October</td><td>66</td></tr> <tr><td>November</td><td>58</td></tr> <tr><td>December</td><td>55</td></tr> <tr><td>Annual;</td><td>695</td></tr> </tbody> </table> <p>Precipitation per year mm in Vilnius</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Annual Rainfall (mm)</th> </tr> </thead> <tbody> <tr><td>2016</td><td>686</td></tr> <tr><td>2017</td><td>899</td></tr> <tr><td>2018</td><td>541</td></tr> <tr><td>2019</td><td>536</td></tr> <tr><td>2020</td><td>563</td></tr> </tbody> </table> <p>Statistics from osp.stat.gov.lt Changes from January to December are illustrated here: http://www.hkk.gf.vu.lt/vu_ms/duomenu-suvestine/</p>	Monthly Average Rainfall (mm)		January	51	February	38	March	42	April	36	May	54	June	75	July	78	August	77	September	65	October	66	November	58	December	55	Annual;	695	Year	Annual Rainfall (mm)	2016	686	2017	899	2018	541	2019	536	2020	563
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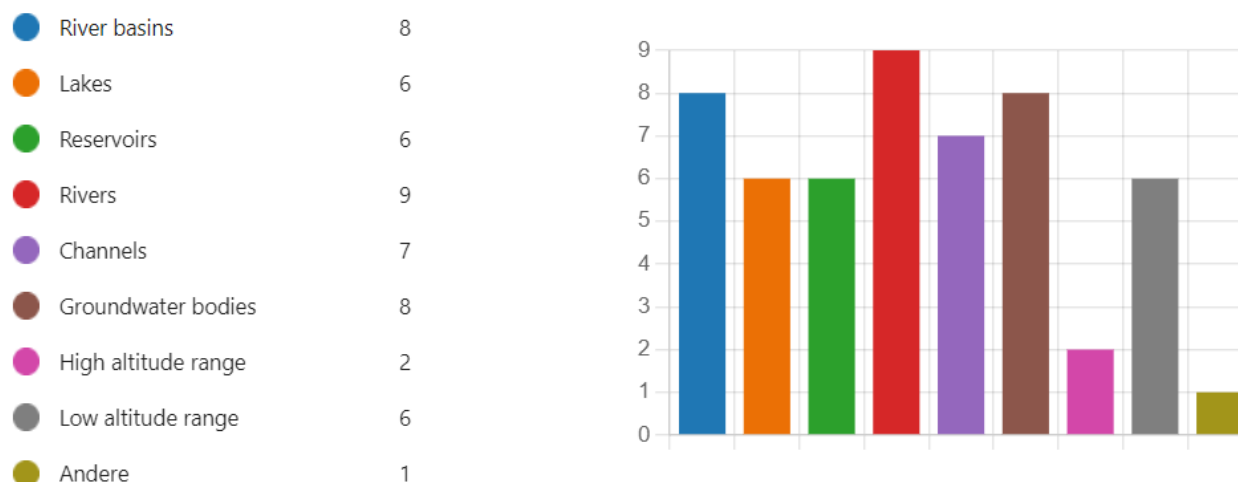
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December	87.04																												
Annual	853.28																												

10. Evaporation Rates (please include min, max, average per each month of the year)

Kristin Haugen	
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.
Ian Jones	Variable by location and changing due to climate change, see https://rmets.onlinelibrary.wiley.com/toc/10970088/2020/40/S1
Stojan Kranjc	N/A, Slovenian Environment Agency
Ruxandra Bobocea, Adrian Vlăducu	No public available data
Antonio Chambel	
Asta Navickienė, Jurga Arustienė	No public statistics available.
Ywan De Jonghe	
David Seccombe	Data not to hand



11. Significant hydrological features in your administrative area



Kristin Haugen	River basins; Lakes; Reservoirs; Rivers; Channels; Groundwater bodies; High altitude range; Low altitude range
Martin Golčer	Reservoirs; Rivers
Ian Jones	River basins; Lakes; Reservoirs; Rivers; Channels; Groundwater bodies; Low altitude range; Coastal
Stojan Kranjc	River basins; Lakes; Rivers; Channels; Groundwater bodies; High altitude range; Low altitude range
Ruxandra Bobocea, Adrian Vlăducu	River basins; Lakes; Reservoirs; Rivers; Channels; Groundwater bodies
Antonio Chambel	River basins; Reservoirs; Rivers; Channels; Groundwater bodies; Low altitude range
Asta Navickienė, Jurga Arustienė	River basins; Lakes; Rivers; Groundwater bodies; Low altitude range
Ywan De Jonghe	Rivers; Groundwater bodies; Channels; River basins
David Seccombe	River basins; Lakes; Reservoirs; Rivers; Channels; Groundwater bodies; Low altitude range

12. Average available water for abstraction (m³/year) (please include total and the split between surface water and groundwater if available)

Kristin Haugen	
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.
Ian Jones	Later
Stojan Kranjc	N/A
Ruxandra Bobocea, Adrian Vlăducu	Total average available water for abstraction according to the current infrastructure; 38,346,760,000 m ³ /year out: of which: Surface waters (including Danube river): 33,697,121,000 m ³ /year Groundwaters: 4,667,639,000 m ³ /year
Antonio Chambel	
Asta Navickienė, Jurga Arustienė	Available groundwater resources - 1 358 000 000 m ³ /year
Ywan De Jonghe	not yet 100% calculated



David Seccombe	Available groundwater resource is 30782.1 MI/d. Do not have figures for the available surface water as there are hands off flow constraints which makes the bulking up calculations difficult.
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13. Average demand for water (m3/year) (please split this across different sector types if available)

Kristin Haugen	
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.
Ian Jones	Maximum Licenced Abstractions: 13.011 Billion m3/year; 99% Surface Water and 1% Groundwater. Includes non-consumptive abstractions, such as Hydropower. Will update when more information available.
Stojan Kranjc	
Ruxandra Bobocea, Adrian Vlăducu	Total average water demand according to the operational capacities; 6,544,632,000 m3/year, out of which: Surface waters: 5,909,545,500 m3/year Groundwaters: 635,086,500 m3/year
Antonio Chambel	
Asta Navickienė, Jurga Arustienė	Total abstraction of groundwater 160 000 000 <ul style="list-style-type: none"> • for public water supply 132 000 000 • for agriculture 3 700 000 • for industry 6 000 000 Total abstraction of surface water 147 000 000 <ul style="list-style-type: none"> • for public water supply 300 000 • for agriculture 55 000 000 • for industry 26 000 000 (EUROSTAT)
Ywan De Jonghe	2019: approx. 645 000 000 m ³ /year (380 surface and 265 groundwater) <ul style="list-style-type: none"> • houses: 38% • industry (excl. cooling water): 50% • farmers: 12%
David Seccombe	Refer to https://data.gov.uk/dataset/7619198a-1bbf-4cbc-8014-f6a46edb230e/water-abstraction-data-sets

14. How many permits are issued for each sector type (please include numbers and total volume for each sector type if available)?

Kristin Haugen	
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.
Ian Jones	Total 2489 currently.
Stojan Kranjc	
Ruxandra Bobocea, Adrian Vlăducu	
Antonio Chambel	



Asta Navickienė, Jurga Arustienė	Permits are required for groundwater abstraction since 2015, up till 2020-12-31 permits were issued for groundwater abstraction in 1572 well-fields, most of them for public water supply - 1311.
Ywan De Jonghe	
David Seccombe	Refer to https://data.gov.uk/dataset/7619198a-1bbf-4cbc-8014-f6a46edb230e/water-abstraction-data-sets

15. What is your definition of a Drought?

Kristin Haugen	Lowering ground water table. Less abundant rain or snow. Lack of snow melting.
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to Ministry of environment and spatial planning, which has some of this information.
Ian Jones	Droughts are a prolonged period of little or no rainfall which, when combined with the usually hotter temperatures experienced, puts severe pressure upon our water resources and our ability to meet high customer demand for water. A drought is a natural event that we can't prevent and each drought is different, with the nature, timing and impacts varying according to location and which sectors are affected such as public water supply, agriculture, the environment or industry.
Stojan Kranjc	N/A, Slovenian Environment Agency
Ruxandra Bobocea, Adrian Vlăducu	Drought is the natural phenomenon that results from the decrease of precipitation significantly below the average level, producing major hydrological imbalances and negatively influencing production systems (according to the Ordinance 97/63/2020)
Antonio Chambel	Precipitation less than half the annual average. Aggravated drought: the same condition, repeated for more than one consecutive year.
Asta Navickienė, Jurga Arustienė	Hydrological drought is defined as dry period in the surface water bodies, when surface water level drops down in more than 50% of measuring stations below long-term average minimum of warm season. Hydrological droughts could be correlated with droughts in shallow groundwater.
Ywan De Jonghe	
David Seccombe	We identify 3 main types of drought which may occur separately or together: Environmental drought This happens when a shortage of rainfall is having a detrimental impact on the environment. It is likely that there will be reduced river flows, exceptionally low groundwater levels and insufficient moisture within soils. These conditions often result in signs of stress for wildlife, fish and habitats. We normally take action to reduce environmental impact by restricting the amount of water taken from rivers and groundwater when these sources are at low levels. Agricultural drought This happens when there isn't enough rainfall and moisture in soils to support crop production or farming practices such as spray irrigation. Irrigation may also be



	<p>constrained by environmental conditions on abstraction licences or statutory restrictions. These drought conditions often happen alongside an environmental drought but usually before public water supplies are affected.</p> <p>Water supply drought This happens when a shortage of rainfall is causing water companies concern about supplies for their customers. It tends to take longer to develop than environmental or agricultural drought because water company supply systems are developed to cope with dry weather. Water companies affected by drought will manage the impacts by following their drought plans. These plans set out a range of short-term actions to monitor and manage the impact of drought on customers and the environment. Some water companies in England use reservoirs in Wales to supply some of their customers so could be affected by a drought in Wales.</p>
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16. Have you had any drought events in the last 5 years (please include relevant details if available)?

Kristin Haugen	2018 - Cold winter, above average spring flood due to rapid melting, dry summer.
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to Ministry of environment and spatial planning, which has some of this information.
Ian Jones	Yes, 2018 and 2020
Stojan Kranjc	N/A, Slovenian Environment Agency
Ruxandra Bobocea, Adrian Vlăducu	Mostly local extreme drought in 2016 and 2019 (according to the Environment State of Romania http://www.anpm.ro/ro/raport-de-medi)
Antonio Chambel	Yes
Asta Navickienė, Jurga Arustienė	In 2015, 2019 and 2020 hydrological droughts were registered: <ul style="list-style-type: none"> • 2015.08.20-2015.11.10 • 2019.07.02-2019.09.19 • 2020.08.14-2020.10.24
Ywan De Jonghe	From 2017 to 2020 there was each year an extended period with no (or very little) rain.
David Seccombe	Yes - in 2018 and 2019



17. How did the drought impact on abstraction and the environment?

Kristin Haugen	Low flow in rivers. Need of irrigation. Lack of water for husbandry. Low levels in many water supply reservoirs and ground water wells.
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to Ministry of environment and spatial planning, which has some of this information.
Ian Jones	Environment, agriculture
Stojan Kranjc	No significant impact
Ruxandra Bobocea, Adrian Vlăducu	Reduction of the available water resources for users (i.e. hydro-energy sector); applying restrictions and water uses plans for drought and scarcity periods; supplementary efforts to assure the ecological flow for aquatic ecosystems
Antonio Chambel	Strong reduction of groundwater levels, with the water level down the bottom of many shallow wells. The urgency of new wells from farmers, causing still more stress on the water resources.
Asta Navickienė, Jurga Arustienė	Productive aquifers used for public water supply are not sensitive to seasonal droughts, reported shortages of water are related to lack of proper infrastructure. The most sensitive to drought is rural population, not connected to public water supply and relying on shallow groundwater from dug wells for water supply. During droughts, dug wells become dry. Groundwater abstraction has not observed negative impact on surface water and terrestrial ecosystems currently.
Ywan De Jonghe	Limitations on water use. No specific impact on abstractions. Groundwater levels were dropping (to historic low levels).
David Seccombe	Had an impact more on public water supply reservoirs and surface water abstractions (especially spray irrigation). In terms of the environment there were rivers below summer baseflow, low oxygen levels leading to fish deaths in slow moving rivers, algal blooms. We also had instances of wildfires. Navigation in canals in some places had to be closed as the feeder reservoirs were too low.



18. Are there alternatives to the lack of water (for example treated effluent)?

Kristin Haugen	No
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to Ministry of environment and spatial planning, which has some of this information.
Ian Jones	Reserve sources for drought, including groundwater
Stojan Kranjc	No
Ruxandra Bobocea, Adrian Vlăducu	Water recycling process in industrial sector
Antonio Chambel	Yes, but the use of treated effluents are just punctual. There are many surface water reservoirs to help overcome the situation of droughts during a few years.
Asta Navickienė, Jurga Arustienė	No, usually there is possibility to get water from nearest public well-field
Ywan De Jonghe	Under investigation, some projects are running (treated effluent of food factory is used for irrigation of crops).
David Seccombe	Treated effluent was considered but there are issues of permitting discharges that could lead to pollution of groundwater. We have some river transfer schemes but these will be limited by the capacity of the reservoir or limited by the groundwater level impact and recovery period.



19. To what extent do you know illegal drilling and groundwater abstraction a problem in your area? What is your estimation about the size of this problem?

Kristin Haugen	I don't know, but guess there is some extent.
Martin Golčer	The Inspectorate also supervises taxpayers in the field of concessions for the use of groundwater from wells
Ian Jones	Aware of some; size of problem unknown.
Stojan Kranjc	We have no data about extent of illegal drilling and abstraction. Small.
Ruxandra Bobocea, Adrian Vlăducu	There were identified illegal drilling, but these are not so many.
Antonio Chambel	It's a huge problem. Illegal drilling on the past was the norm. Today 90% of the drillings are legal. Over abstraction is under no control.
Asta Navickienė, Jurga Arustienė	Illegal drilling and groundwater abstraction doesn't pose the significant risk to quantitative status of groundwater bodies in overall, but lack of information about groundwater abstraction sites postpone identification of problems and makes rational groundwater resources management more difficult, especially in sensitive areas like suburban territories, Northern Lithuania karst zone, the risk zones of flowing wells and well-field protection zones etc. During the last few years more active control of illegal drilling and groundwater abstraction was carried out, as a result, now this problem is not so significant. Currently Environmental control department under the Ministry of Environment pays more attention to control accounting and declaration of tax on state natural resources (water is one of the tax objects).
Ywan De Jonghe	
David Seccombe	The main source of illegal abstraction is dewatering for construction. This is mainly due to change in legislation that meant that dewatering is no longer an exempt activity. It is difficult to assess these as they tend to be small and temporary in nature, generally within built up areas where we tend not to undertake compliance and assessment visits.



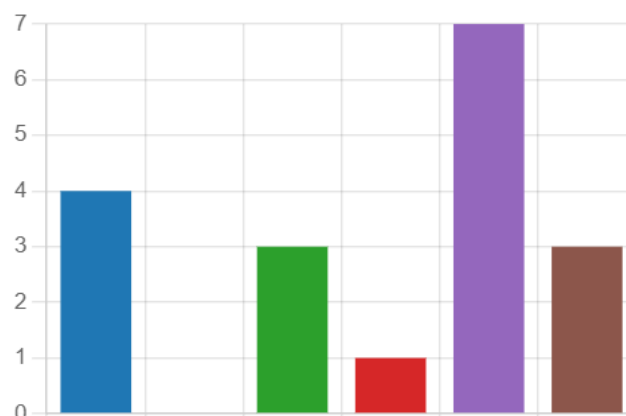
20. What is the scale or estimate of illegal abstraction (please indicate abstraction types, numbers, volumes)?

Kristin Haugen	
Martin Golčer	The inspectorate receives several reports a year in the field of illegal water use (without permits)
Ian Jones	Few 100 abstractions, mostly farm boreholes, abstractions <100 m ³ /day (per abstraction).
Stojan Kranjc	Less than 10 %.
Ruxandra Bobocea, Adrian Vlăducu	No available data on numbers and volumes of illegal abstractions.
Antonio Chambel	The biggest problem is related with agriculture. There are no numbers, but it must be enormous, once there is no control over the abstracted values.
Asta Navickienė, Jurga Arustienė	It is estimated that approximately one third of all individual wells could be installed without proper documentation and registration and one third of well-fields (mostly for commercial use with abstraction less than 100 m ³ /d) could be exploited without permission, the volume of abstracted groundwater could make ~ 10% from total reported groundwater abstraction.
Ywan De Jonghe	It was estimated that illegal groundwater abstractions take 10% of water use. However, this estimate was done before 2017. There is a big chance that illegal groundwater abstraction has increased during recent years (for sure for households).
David Seccombe	Do not have an estimate as some abstractions are below the 20m ³ /d de minimus.



21. How do you become aware of illegal activities?

● Routine enforcement	4
● Remote sensing	0
● Targetted campaigns	3
● Monitoring of river flows and/or...	1
● Reports from public	7
● Andere	3

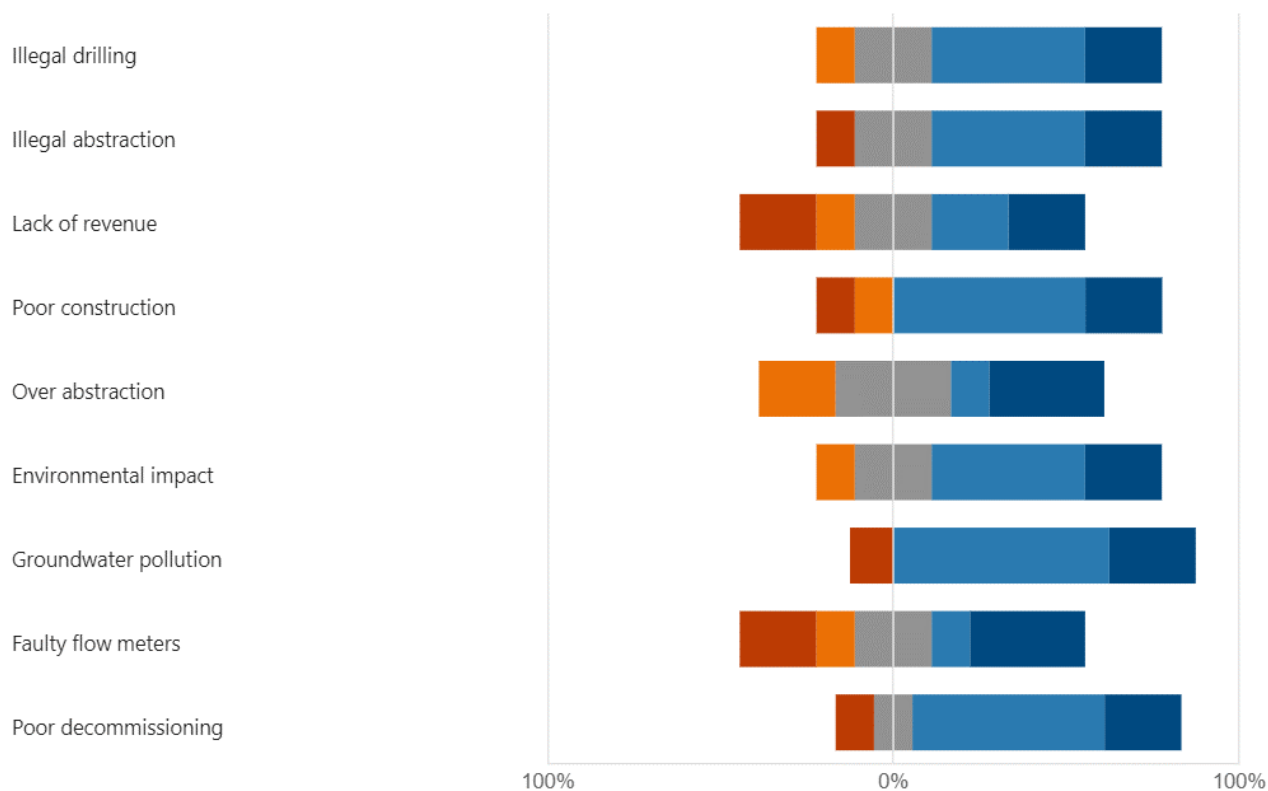


Kristin Haugen	Reports from public
Martin Golčer	Routine enforcement; Reports from public
Ian Jones	Routine enforcement; Reports from public; Monitoring of river flows and/or groundwater levels; Incidents
Stojan Kranjc	Reports from public
Ruxandra Bobocea, Adrian Vlăducu	Targetted campaigns; Reports from public
Antonio Chambel	During field work and drilling activities
Asta Navickienė, Jurga Arustienė	Other - Routine enforcement; checking information from state registers, provided by Lithuanian Geological Survey under the Ministry of Environment
Ywan De Jonghe	Reports from public; Targetted campaigns
David Seccombe	Reports from public; Targetted campaigns; Routine enforcement



22. How concerned are you about types of illegal activities

Very unconcerned Somewhat unconcerned Neither concerned nor unconcerned Somewhat concerned Very concerned



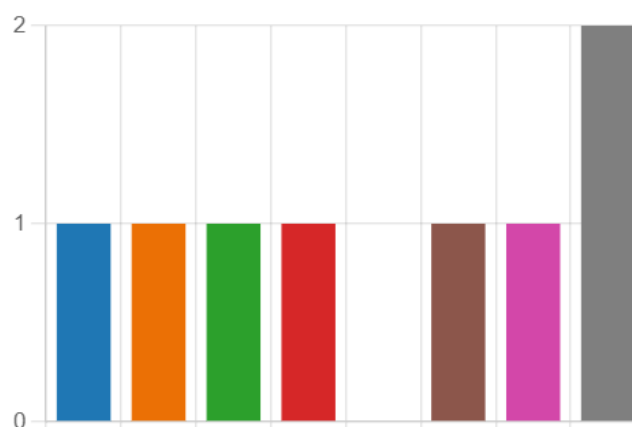


	Illegal drilling	Illegal abstraction	Lack of revenue	Poor construction	Over abstraction	Environmental impact	Groundwater pollution	Faulty flow meters	Poor decommissioning
Kristin Haugen	Somewhat concerned	Somewhat concerned	Very unconcerned	Somewhat concerned	Somewhat unconcerned	Neither concerned nor unconcerned		Very unconcerned	Somewhat concerned
Martin Golčer	Somewhat concerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Somewhat unconcerned	Neither concerned nor unconcerned	Somewhat concerned	Very concerned	Very concerned	Very concerned
Ian Jones	Neither concerned nor unconcerned	Somewhat concerned	Somewhat concerned	Somewhat concerned	Very concerned	Very concerned	Somewhat concerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned
Stojan Kranjc	Somewhat unconcerned	Very unconcerned	Very unconcerned	Very unconcerned	Somewhat unconcerned	Somewhat unconcerned	Very unconcerned	Very unconcerned	Very unconcerned
Ruxandra Bobocea, Adrian Vlăducu	Somewhat concerned	Somewhat concerned	Very concerned	Somewhat concerned	Very concerned	Somewhat concerned	Very concerned	Somewhat concerned	Somewhat concerned
Antonio Chambel	Very concerned	Very concerned	Very concerned	Very concerned	Very concerned	Very concerned	Somewhat concerned	Very concerned	Very concerned
Asta Navickienė, Jurga Arustienė	Somewhat concerned	Somewhat concerned	Neither concerned nor unconcerned	Somewhat concerned	Neither concerned nor unconcerned	Somewhat concerned	Somewhat concerned	Neither concerned nor unconcerned	Somewhat concerned
Ywan De Jonghe	Very concerned	Very concerned	Somewhat concerned	Very concerned	Somewhat concerned	Somewhat concerned	Somewhat concerned	Very concerned	Somewhat concerned
David Seccombe	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Somewhat unconcerned	Somewhat concerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Somewhat concerned	Somewhat unconcerned	Somewhat concerned



23. What are the most frequent observed deficiencies regarding groundwater drilling and abstractions

- Non permitted installations 1
- Over abstraction 1
- Faultly installation of drilling & ... 1
- Faulty monitoring of drilling & a... 1
- Lack of good maintenance 0
- Faulty flow meters or tampering... 1
- Faulty decommissioning of wells... 1
- Andere 2



Kristin Haugen	Faulty decommissioning of wells and drilling sites
Martin Golčer	Faulty monitoring of drilling & abstraction sites (e.g. volumes, water levels, groundwater quality)
Ian Jones	Non permitted installations
Stojan Kranjc	Over abstraction
Ruxandra Bobocea, Adrian Vlăducu	
Antonio Chambel	Other - It doesn't allow to define more than one point; except the lack of good maintenance, I would like to point all the others
Asta Navickienė, Jurga Arustienė	Other - Non-declaration or incorrect declaration of abstracted water and accordingly tax on state natural resources
Ywan De Jonghe	Faulty flow meters or tampering with flow meters
David Seccombe	Faulty installation of drilling & abstraction sites



24. How many groundwater monitoring points do you have in your administrative area?

Kristin Haugen	
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.
Ian Jones	NRW WFD Groundwater Monitoring Networks: Levels: 140; Quality: 170
Stojan Kranjc	N/A, Slovenian Environment Agency
Ruxandra Bobocea, Adrian Vlăducu	2918 phreatic wells and 96 deep wells
Antonio Chambel	Not applicable
Asta Navickienė, Jurga Arustienė	National groundwater monitoring network includes 120 observation wells for groundwater level monitoring, 65 are monitored
Ywan De Jonghe	approx 2500
David Seccombe	Around 5000 to 5500 monitoring boreholes for groundwater levels

25. Do you have a design density for spatial distribution of piezometers?

Kristin Haugen	
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.
Ian Jones	Predominantly based on WFD Requirements
Stojan Kranjc	N/A, Slovenian Environment Agency
Ruxandra Bobocea, Adrian Vlăducu	
Antonio Chambel	Just on half of Portugal; in the other half no.
Asta Navickienė, Jurga Arustienė	Distribution of monitoring wells is based on territorial division of the country to geomorphological-geological-meteorological regions
Ywan De Jonghe	yes, but some areas need an upgrade (due to changing groundwater levels)
David Seccombe	Developed in an adhoc fashion to monitor issues - such as public water abstraction - as well as the aquifer response characteristics. Under WFD there are less gw quality monitoring points for the assessment of water body status.



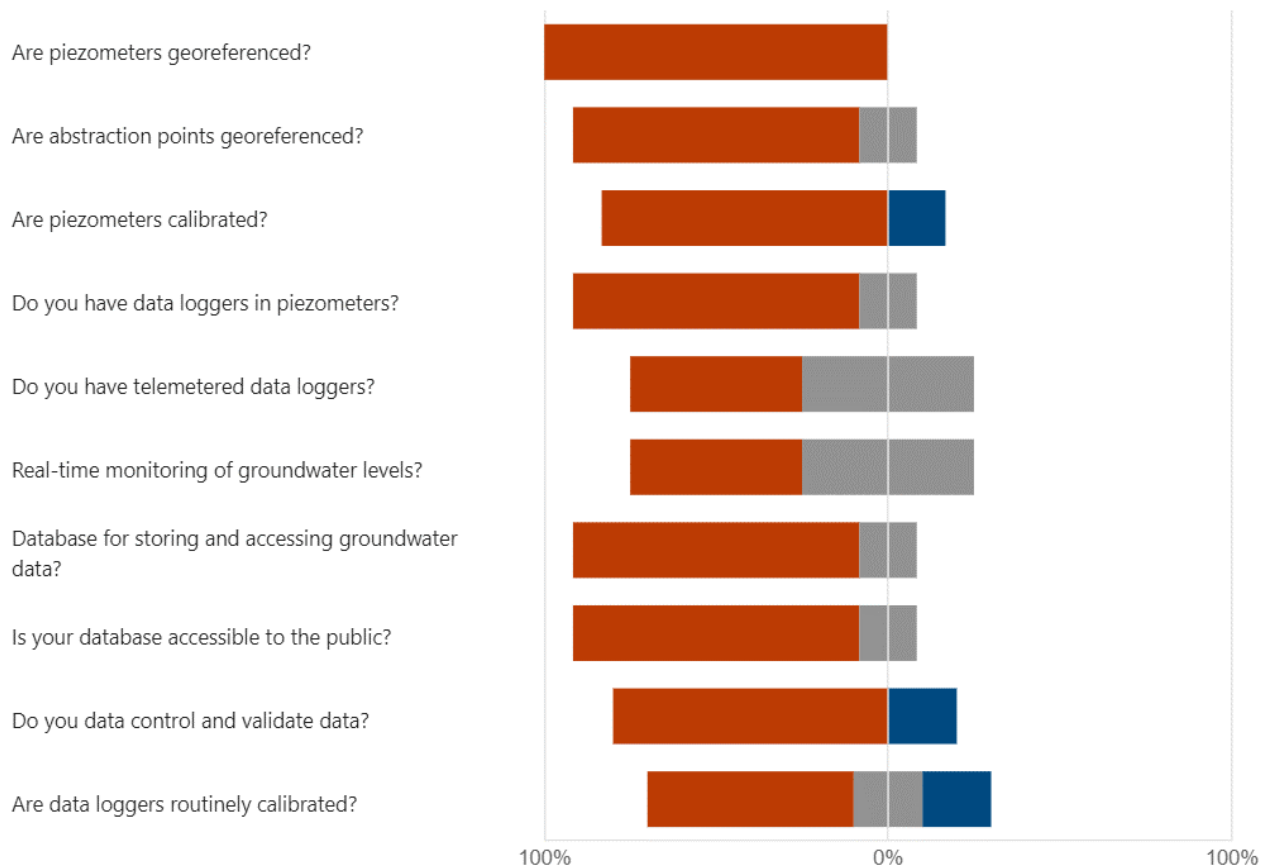
26. What is the frequency of data acquisition?

Kristin Haugen	
Martin Golčer	Inspectorate doesn't have this information. The questionnaire will also be sent to the Environment Agency, which has some of this information.
Ian Jones	Levels hourly, Quality semi-annually
Stojan Kranjc	N/A, Slovenian Environment Agency
Ruxandra Bobocea, Adrian Vlăducu	daily; 2,3,5,10 per month; monthly; twice per year; yearly
Antonio Chambel	Not sure
Asta Navickienė, Jurga Arustienė	From daily (20 monitoring stations) to yearly
Ywan De Jonghe	monthly (levels); 2 times a year (quality-analysis)
David Seccombe	Tend to be manual dips on a monthly basis - in slow moving aquifers this could be extended from anywhere between 3 months to 1 year. There are around 500 telemetered monitoring on 15min intervals. There are around 1000 piezometers that have data loggers (not telemetered).



27. Details on monitoring

■ Yes ■ No ■ Unsure





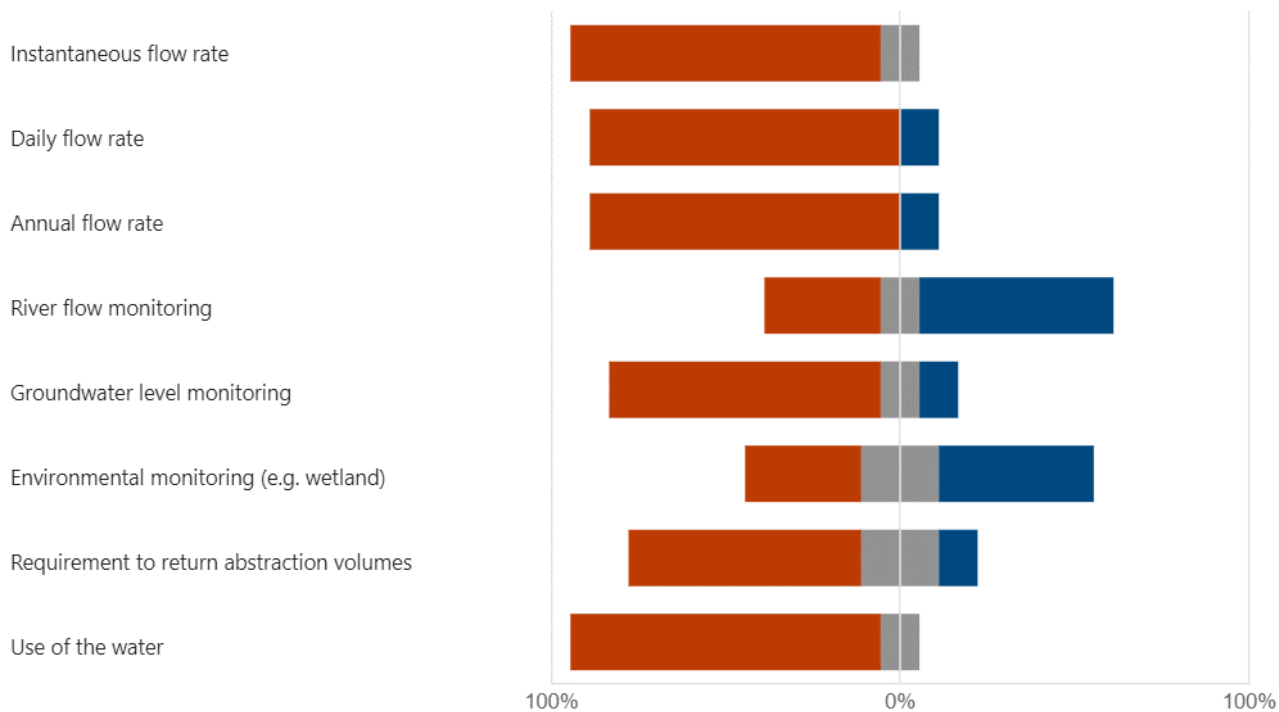
28. Do you have a permitting regime for groundwater abstractions?

Kristin Haugen	Yes
Martin Golčer	Yes
Ian Jones	Yes
Stojan Kranjc	Yes
Ruxandra Bobocea, Adrian Vlăducu	Yes
Antonio Chambel	Yes
Asta Navickienė, Jurga Arustienė	Yes, since 2015
Ywan De Jonghe	yes
David Seccombe	Yes - based on the Water Resources Act 1991



29. What controls can be included on a permit?

■ Yes ■ No ■ Unsure





30. Do you have a permit database?

Kristin Haugen	Yes
Martin Golčer	Yes, the base is managed by Slovenian Water Agency
Ian Jones	Yes
Stojan Kranjc	Yes
Ruxandra Bobocea, Adrian Vlăducu	Yes
Antonio Chambel	Yes
Asta Navickienė, Jurga Arustienė	Yes, ALIS (Environmental Permitting System)
Ywan De Jonghe	yes
David Seccombe	Yes - not accessible to the public due to GDPR restrictions

31. Who has authority to enforce permits and permit conditions?

Kristin Haugen	Norwegian Water and Energy Directorate
Martin Golčer	Slovenian Water Agency
Ian Jones	Natural Resources Wales (NRW)
Stojan Kranjc	Slovenian Water Agency
Ruxandra Bobocea, Adrian Vlăducu	National Administration Romanian Waters
Antonio Chambel	Portuguese Environmental Agency (APA)
Asta Navickienė, Jurga Arustienė	Lithuanian Geological Survey under the Ministry of Environment
Ywan De Jonghe	local and regional administrations
David Seccombe	Environment Agency



32. Do inspectors and enforcing bodies have access to a digital permit database?

Kristin Haugen	Yes
Martin Golčer	No
Ian Jones	Yes
Stojan Kranjc	Yes
Ruxandra Bobocea, Adrian Vlăducu	Yes
Antonio Chambel	At least partially
Asta Navickienė, Jurga Arustienė	Environmental control department under the Ministry of Environment, which carries out inspections, does not have a direct access to a permit database, however some facts can be checked using publicly available data or information is exchanged between institutions on request
Ywan De Jonghe	Yes
David Seccombe	Yes.

33. What information would be available during an inspection?

Kristin Haugen	License
Martin Golčer	
Ian Jones	Information on Permit + returns data + anything required (NRW has a warrant process)
Stojan Kranjc	Permit holder, position, allowed abstraction in l/s and m3/year
Ruxandra Bobocea, Adrian Vlăducu	In general the inspectors and enforcing bodies have access to all the necessary data and information related to those included in the water management licences and permits.
Antonio Chambel	Not sure
Asta Navickienė, Jurga Arustienė	The main information and risk criteria causing the inspection, all information provided by the entity or natural person.
Ywan De Jonghe	
David Seccombe	Full licence details, including licence holder/address, type of abstraction (sw/gw), location of abstraction point, type of abstraction, abstraction limits (instantaneous, daily, annual), purpose



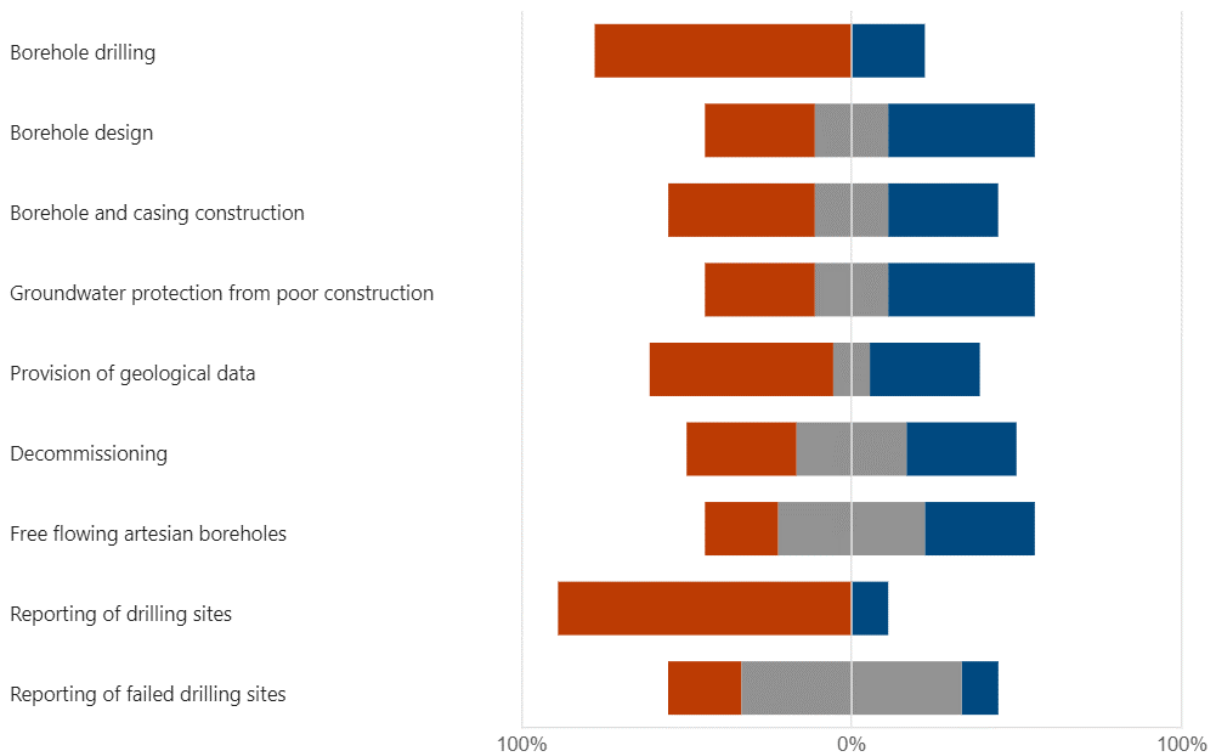
34. Do you have exemptions for permitting (for example, a minimum daily volume)?

Kristin Haugen	Yes, when drilling for own use in a household, no net withdrawal (re-infiltration) or when the withdrawal do not harm public interest.
Martin Golčer	
Ian Jones	Yes
Stojan Kranjc	No
Ruxandra Bobocea, Adrian Vlăducu	Minimum volume excepted from licensing/permitting process is 0.2 l/s, according to the Water Law no. 107/1996 with amendments.
Antonio Chambel	Yes, shallow wells (less than 20 m deep) only need the announcement of the construction, submitted obligatory to the Portuguese Environmental Agency (APA), they don't need an official permission.
Asta Navickienė, Jurga Arustienė	Yes, for individual water supply - less than 10 m ³ /d (all productive wells must be registered in the official Registry of the Underground) and for growing agricultural production - less than 100 m ³ /d (well-fields must be registered and volume of groundwater abstraction reported annually).
Ywan De Jonghe	
David Seccombe	There is a de minimus of 20m ³ /day



35. Do you have legislative controls for drilling and construction?

■ Yes ■ No ■ Unsure





	Borehole drilling	Borehole design	Borehole and casing construction	Groundwater protection from poor construction	Provision of geological data	Decommissioning	Free flowing artesian boreholes	Reporting of drilling sites	Reporting of failed drilling sites
Kristin Haugen	Yes	No	No	Unsure	Yes	Unsure	No	Yes	Yes
Martin Golčer	Unsure	Unsure	Unsure	Unsure	Unsure	Unsure	Unsure	Unsure	Unsure
Ian Jones	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Stojan Kranjc	Yes	No	No	No	Yes	No	No	Yes	No
Ruxandra Bobocea, Adrian Vlăducu	Yes	Unsure	Unsure	Unsure	Unsure	Unsure	Unsure	Yes	No
Antonio Chambel	Unsure	Unsure	Unsure	Unsure	Unsure	Yes	No	Yes	No
Asta Navickienė, Jurga Arustienė	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ywan De Jonghe	Yes	Unsure	Yes	Yes	Yes	Yes	Unsure	Yes	No
David Seccombe	Yes	Yes	Yes	No	No	No	No	Yes	No



36. What is considered as an illegal exploitation?

- Without permit 3
- Over abstraction 1
- Abandoned wells 0
- Andere 5



Kristin Haugen	Over abstraction
Martin Golčer	Without permit
Ian Jones	No Permit / Over abstraction / Leaving artesian well open
Stojan Kranjc	Without permit
Ruxandra Bobocea, Adrian Vlăducu	without permit and over abstraction
Antonio Chambel	Only permits one option, but all are valid
Asta Navickienė, Jurga Arustienė	Without permit
Ywan De Jonghe	without permit and over abstraction
David Seccombe	Without permit or over abstraction



37. What types of inspection checklists do you use?

Kristin Haugen	
Martin Golčer	the inspectorate does not have a special form or list
Ian Jones	Compliance & Recording Form
Stojan Kranjc	N/A , Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
Ruxandra Bobocea, Adrian Vlăducu	Water management licence (authorization)
Antonio Chambel	Not applicable
Asta Navickienė, Jurga Arustienė	A separate checklist for control of tax on state natural resources is used. There is no particular checklist for groundwater drilling and abstractions, but questions regarding this issue are included in other checklists, for example, the checklist on environmental requirements for heat and hot water production has 13 questions regarding groundwater drilling and abstractions.
Ywan De Jonghe	
David Seccombe	Compliance inspections are generally covering many different activities (pollution inspection, abstraction inspection).

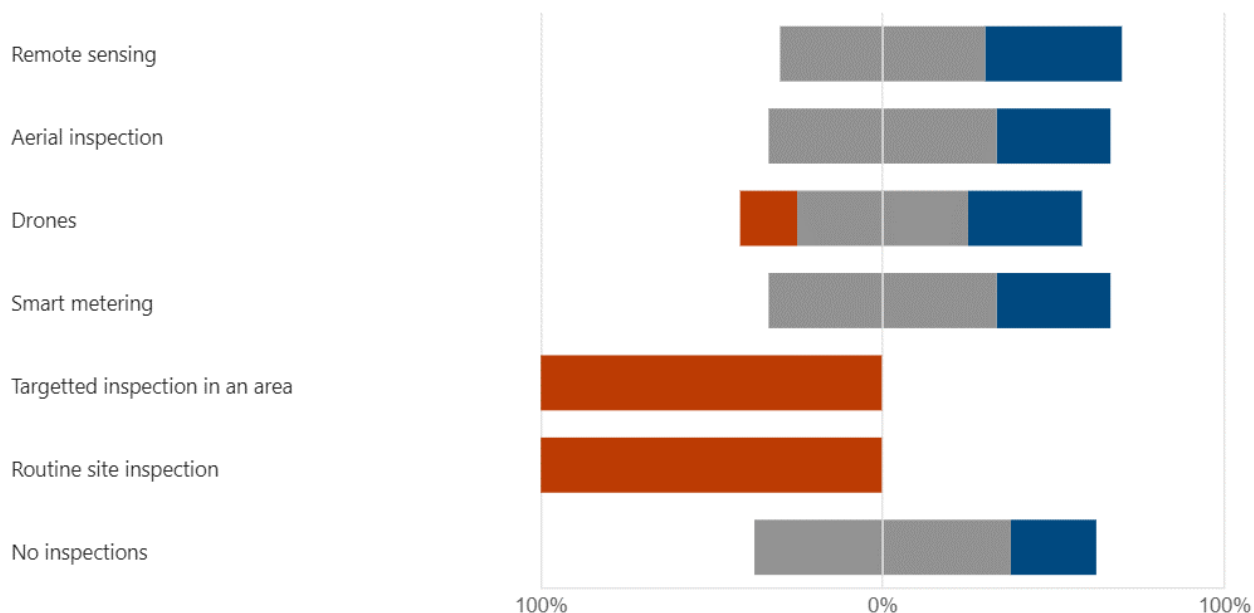
38. What equipment is used during an inspection?

Kristin Haugen	
Martin Golčer	the inspectorate does not have a special equipment. an expert shall be appointed for specific questions. the inspector also uses the data of the Slovenian Water Agency and other State authority.
Ian Jones	Phone / Camera / Forms / Notebook
Stojan Kranjc	N/A, Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
Ruxandra Bobocea, Adrian Vlăducu	
Antonio Chambel	Not applicable
Asta Navickienė, Jurga Arustienė	No specific equipment is used by Environmental control department under the Ministry of Environment.
Ywan De Jonghe	
David Seccombe	Visual inspection only. There is a H&S risk to inspect a third party borehole. The Environment Agency Officers do have powers of entry to take reasonable steps of enforcement, however, bringing in additional equipment would require several layers of paperwork



39. What types of inspections are used?

■ Yes ■ No ■ Unsure



Person completing this questionnaire	Remote sensing	Aerial inspection	Drones	Smart metering	Targetted inspection in an area	Routine site inspection	No inspections
Kristin Haugen							
Martin Golčer	Unsure	Unsure	Unsure	Unsure	Yes	Yes	
Ian Jones	No	No	No	No	Yes	Yes	No
Stojan Kranjc							
Ruxandra Bobocea, Adrian Vlăducu		No	No	No	Yes	Yes	
Antonio Chambel	No	No	No	No	Yes	Yes	No
Asta Navickienė, Jurga Arustienė	Unsure	Unsure	Unsure	Unsure	Yes	Yes	Unsure
Ywan De Jonghe						Yes	
David Seccombe	No	No	Yes	No	Yes	Yes	No



40. What kind of penalties are in place for illegal drilling or abstraction?

Kristin Haugen	
Martin Golčer	For own drinking water supply, for technological purposes, for bathing activities, for heat production, for irrigating agricultural land or other areas, etc. a water permit for water use must be obtained for a violation of the provision on the use of water from drinking water supply facilities, a fine of 4,000 euros to 125,000 euros is prescribed for a legal entity
Ian Jones	Standard criminal and offence specific responses are: <ul style="list-style-type: none"> • Warning • Formal Caution • Prosecution Civil Sanctions which can be imposed are: <ul style="list-style-type: none"> • Compliance Notice • Restoration Notice • Fixed Monetary Penalty • Variable Monetary Penalty • Stop Notice Civil Sanctions which can be offered are: <ul style="list-style-type: none"> • Enforcement Undertaking
Stojan Kranjc	N/A, Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
Ruxandra Bobocea, Adrian Vlăducu	The penalties are large fines according to the Water Law no. 196/107 with amendments.
Antonio Chambel	In reality, no penalties
Asta Navickienė, Jurga Arustienė	1) administrative liability for infringements; 2) 10 times higher tax rate is applied for undeclared water abstraction.
Ywan De Jonghe	
David Seccombe	We take a stepped approach of working with the abstractor to resolve the illegal activity, a formal warning and these do not work then we can take legal action through the courts. We can also notify the Rural Payments Agency who distribute CAP and there may be reductions in payments



42. How are the inspections on groundwater drilling and abstractions financed?

Kristin Haugen	
Martin Golčer	funding for controls is provided by the state in the event of infringements, the costs shall be recovered from the violators
Ian Jones	Annual abstraction fee
Stojan Kranjc	N/A, Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
Ruxandra Bobocea, Adrian Vlăducu	The inspections on groundwater drilling and abstractions are financed through own economic mechanism of the National Administration Romanian Waters and its 11 Water Basin Administration.
Antonio Chambel	Public funds from the state
Asta Navickienė, Jurga Arustienė	There is no specific financing, inspections are carried out by Environmental control department under the Ministry of Environment - a state institution, financed from the state budget and supervised by the Ministry of Environment.
Ywan De Jonghe	
David Seccombe	Through a combination of public fund allocation and water resources abstraction charges

43. What are the lessons learned from these inspections (good & bad)?

Kristin Haugen	
Martin Golčer	It is difficult to obtain all the data in controls
Ian Jones	Lots of lessons processed by Abstraction Compliance Group
Stojan Kranjc	N/A, Inspectorate of the Republic of Slovenia for the Environment and Spatial Planning
Ruxandra Bobocea, Adrian Vlăducu	The inspections that have as result an identification of illegal drilling and abstractions can be solved by discussions with the water users and they can afterword send all the documents for getting the water management licences / permits.
Antonio Chambel	Not applicable
Asta Navickienė, Jurga Arustienė	-
Ywan De Jonghe	They are necessary over extended period and with high chance of inspection.
David Seccombe	The lessons learnt are used to update procedures and training material.



44. What kind of further guidance (e.g. provided by this IMPEL project) would your organization like to receive?

- Guidance documents on specifi... 2
- Guidance documents on enforc... 5
- Andere 2

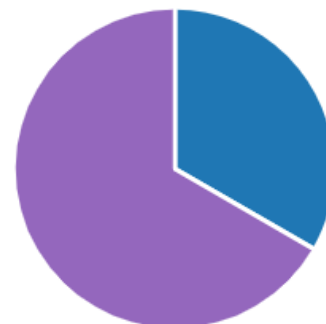


Kristin Haugen	Guidance documents on enforcement methods
Martin Golčer	Guidance documents on enforcement methods
Ian Jones	Guidance on Decommissioning Boreholes
Stojan Kranjc	Guidance documents on specific requirements which can be included in regional legislation
Ruxandra Bobocea, Adrian Vlăducu	Guidance documents on enforcement methods
Antonio Chambel	Just admit one answer; Guidance about methods to detect illegal drilling and over abstraction, and both points before this one
Asta Navickienė, Jurga Arustienė	Guidance documents on enforcement methods
Ywan De Jonghe	Guidance documents on enforcement methods
David Seccombe	Guidance documents on specific requirements which can be included in regional legislation



45. What kind of installations should this guidance be tailored to?

- Groundwater abstraction 3
- Dewatering sites for construction 0
- Geothermal drilling (open loop ... 0
- Geothermal drilling (closed loop... 0
- Andere 6



Kristin Haugen	Groundwater abstraction
Martin Golčer	Groundwater abstraction
Ian Jones	All wells and boreholes, including geothermal
Stojan Kranjc	Groundwater abstraction
Ruxandra Bobocea, Adrian Vlăducu	Surface and groundwater abstractions
Antonio Chambel	Only admits one point; I would consider the four of them
Asta Navickienė, Jurga Arustienė	abstraction & geothermal
Ywan De Jonghe	all
David Seccombe	The above with the exception of closed loop systems as they do not require licensing or pre-notification to the Environment Agency



46. Your additional comment

Kristin Haugen	
Martin Golčer	
Ian Jones	Questions a little ambiguous with respect to type of boreholes/wells; we answered for abstraction boreholes only and not for monitoring wells, unless specifically asked (e.g. piezometer questions). Drilling and installation of boreholes/wells for quality monitoring, remediation etc. can also have important impacts on groundwater quality and resources, such as cross-connection, exposure of aquifers to pollution, this should also be covered by the this group.
Stojan Kranjc	
Ruxandra Bobocea, Adrian Vlăducu	DIANA project - Detection and Integrated Assessment of Non-authorized water Abstractions using EO ()
Antonio Chambel	Important project to help control and to avoid the future depletion of groundwater resources in the world.
Asta Navickienė, Jurga Arustienė	-
Ywan De Jonghe	
David Seccombe	None



Annex II. Tackling Illegal Groundwater Drilling and Abstractions (TIGDA) Questionnaire (May 2022)

1. Respondents

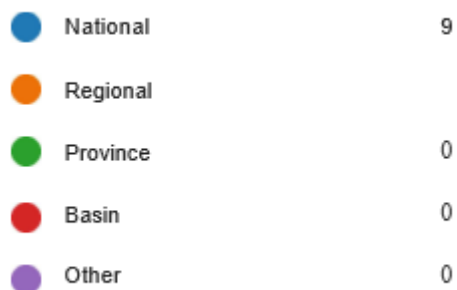
George Cassar	Malta
Ian Jones	Wales, UK
Martin Golčer	Slovenia
Lucio Martarelli	Italy
George Melekis	Greece
Slavica Čikotić	Croatia
Maja Pelajić	Croatia
S Liakou	Greece
Craig Hatcher	England, UK

2. Which organization are respondents representing?

George Cassar	MRA
Ian Jones	Natural Resources Wales (NRW)
Martin Golčer	Inspectorate of environment and spatial planning
Lucio Martarelli	ISPRA - Geological Survey of Italy
George Melekis	Region of Attica
Slavica Čikotić	State Inspectorate
Maja Pelajić	State Inspectorate, Republic of Croatia
S Liakou	Ministry of Environment and Energy/ General Directorate for Waters
Craig Hatcher	Environment Agency (England)



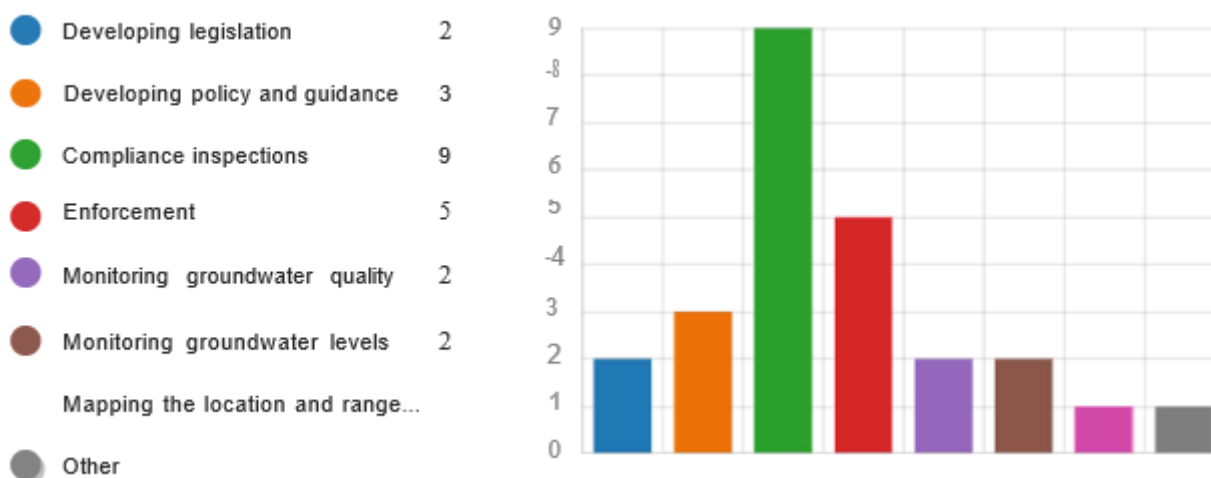
3. What is the administrative level of your organization?



George Cassar	National
Ian Jones	National
Martin Golčer	National
Lucio Martarelli	National
George Melekis	Regional
Slavica Čikotić	National
Maja Pelajić	National
S Liakou	National
Craig Hatcher	National



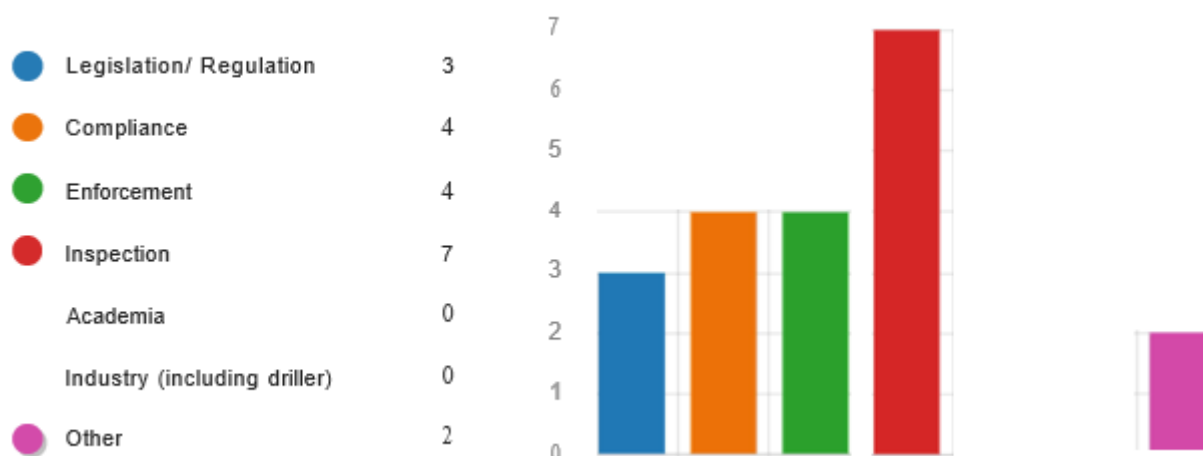
4. How is respondents organisation involved with respect to illegal abstraction and drilling



George Cassar	Compliance inspections; Enforcement
Ian Jones	Developing legislation; Developing policy and guidance; Compliance inspections; Enforcement; Monitoring groundwater quality; Monitoring groundwater levels; Drilling not currently regulated, only abstractions
Martin Golčer	Compliance inspections
Lucio Martarelli	Mapping the location and range of illegal sites; Compliance inspections
George Melekis	Compliance inspections
Slavica Čikotić	Enforcement; Compliance inspections
Maja Pelajić	Compliance inspections
S Liakou	Developing legislation; Developing policy and guidance
Craig Hatcher	Developing policy and guidance; Compliance inspections; Enforcement; Monitoring groundwater quality; Monitoring groundwater levels



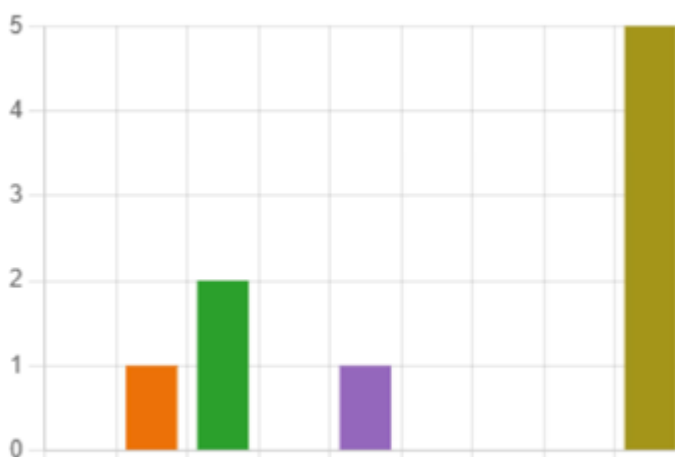
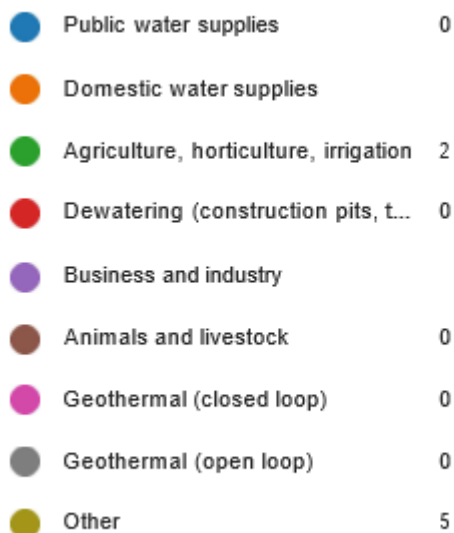
5. What areas are respondents covering in their response?



George Cassar	Compliance; Enforcement; Inspection; Legislation / Regulation
Ian Jones	Other - Abstractions quite well controlled. Primarily concerned with lack of regulation regarding drilling and decommissioning of boreholes/wells
Martin Golčer	Inspection
Lucio Martarelli	Compliance
George Melekis	Compliance; Inspection; Preliminary stage of water abstractions licensing
Slavica Čikotić	Enforcement; Inspection
Maja Pelajić	Inspection
S Liakou	Legislation / Regulation
Craig Hatcher	Legislation / Regulation; Compliance; Enforcement; Inspection



8. Types of installations you have within your administrative level in which there is evidence of illegal drilling and/or abstraction?



George Cassar	Other - Growing of crops and discharges
Ian Jones	Other - List only allows one choice, so listing here for illegal abstractions: Agriculture/ Farming, Livestock (Dairy, Poultry), Parks & Recreation (golf courses, campsites); smaller quarries.
Martin Golčer	
Lucio Martarelli	Domestic water supplies
George Melekis	Other - Agriculture, horticulture, irrigation, Domestic water supplies, Business and industry
Slavica Čikotić	Agriculture, horticulture, irrigation
Maja Pelajić	Business and industry
S Liakou	Other - Administrative level: Ministry - Legislative. Illegal abstractions: Domestic, agriculture, industry etcl
Craig Hatcher	Other - No evidence to hand of such illegality



9. Could you indicate how significant is illegal drilling and abstraction in your administrative area (e.g. m³/year, number of illegal activities)? Any additional details on split of sectors is also welcome.

George Cassar	Typically 5 per year
Ian Jones	No data, just a sense from inspectors and permitting staff. Some improvements with inspections and compliance occurring; more information needed.
Martin Golčer	At the inspectorate, we have opened several proceedings annually due to illegal abstraction of water (e.g. due to illegal abstraction of water for irrigation, use of household water, etc.)
Lucio Martarelli	Illegal activity is estimated to affect up to 20-50% of existing drillings.
George Melekis	
Slavica Čikotić	Not available data
Maja Pelajić	
S Liakou	The data which corresponds to illegal abstractions is collected by the Water Directorates pf Decentralized Administration Authorities.
Craig Hatcher	No evidence. Currently there is a suspicion of it happening, but no successful cases of enforcement I am aware of.

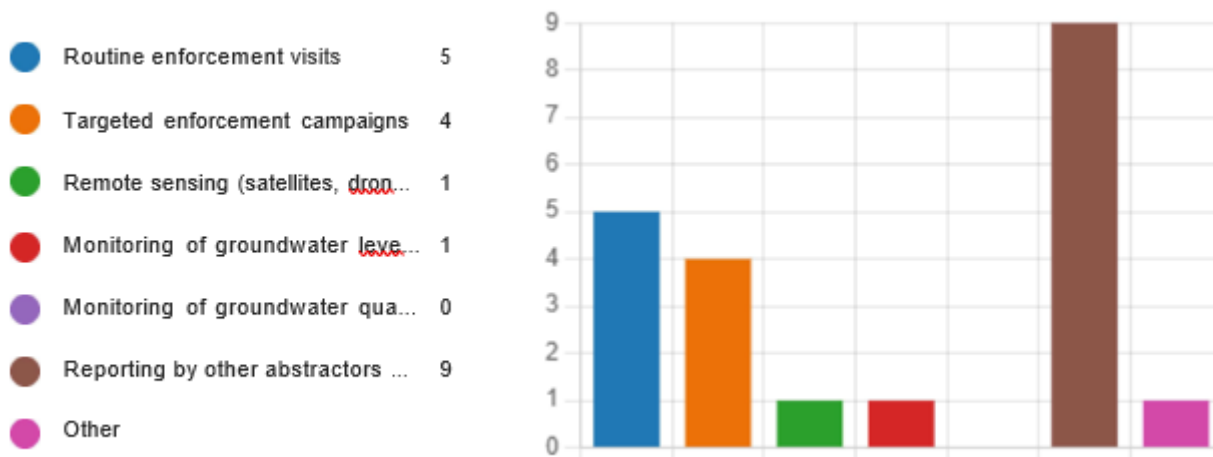


10. Do you consider that the scale of illegal drilling and/or abstraction affects groundwater management goals (e.g. assessment of the River Basin Management Plans or local groundwater goals)?

George Cassar	No
Ian Jones	Likely yes, but need more data.
Martin Golčer	not a lot
Lucio Martarelli	Yes, of course, but probably not always in a relevant balance amount.
George Melekis	Illegal drilling and / or pumping significantly affects and distorts the assessment of the quantitative status of groundwater bodies
Slavica Čikotić	I do.
Maja Pelajić	
S Liakou	
Craig Hatcher	Not possible to say.



11. How do you become aware of illegal activities?



George Cassar	Reporting by other abstractors or by the public; Routine enforcement visits;
Ian Jones	Remote sensing (satellites, drones, aeroplanes); Monitoring of groundwater levels and/or river flows; Routine enforcement visits; Targeted enforcement campaigns; Reporting by other abstractors or by the public;
Martin Golčer	Targeted enforcement campaigns; Reporting by other abstractors or by the public;
Lucio Martarelli	Reporting by other abstractors or by the public; Reporting by law enforcement;
George Melekis	Routine enforcement visits; Reporting by other abstractors or by the public;
Slavica Čikotić	Reporting by other abstractors or by the public;
Maja Pelajić	Reporting by other abstractors or by the public; Routine enforcement visits; Targeted enforcement campaigns;
S Liakou	Reporting by other abstractors or by the public; Routine enforcement visits; Targeted enforcement campaigns;
Craig Hatcher	Reporting by other abstractors or by the public;



12. Which types of illegal activities are the most frequent?

George Cassar	Faulty installation of monitoring equipment (e.g. flow meters)
Ian Jones	Over abstraction; Note: Wales / NRW does not have specific requirements for drilling, well construction, decommissioning, our answers only relate to abstractions although Geoscience Team thinks we need rules for drilling, construction and decommissioning of wells.
Martin Golčer	Faulty installation of monitoring equipment (e.g. flow meters)
Lucio Martarelli	Unauthorized drillings and abstractions
George Melekis	Over abstraction; Water abstractions without licensing
Slavica Čikotić	Faulty installation of drilling and casing; Over abstraction; Non permanent installations
Maja Pelajić	Faulty installation of monitoring equipment (e.g. flow meters); Over abstraction; Lack of good maintenance
S Liakou	Over abstraction
Craig Hatcher	Unable to advise



13. What illegal activities (and negative consequences) are you most concerned of?

	Non permitted installations	Over abstraction	Faulty installation and casing	Faulty installation of monitoring equipment (e.g. flow meters)	Lack of good maintenance	Poor decommissioning of boreholes and wells	Groundwater pollution	Environmental impact	Loss of revenue
George Cassar	Very concerned	Very concerned	Very concerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Very concerned	Very concerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned
Ian Jones	Somewhat unconcerned	Somewhat concerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Somewhat concerned	Very concerned	Very concerned	Neither concerned nor unconcerned
Martin Golčer	Neither concerned nor unconcerned	Somewhat unconcerned	Somewhat concerned	Somewhat concerned	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Somewhat concerned	Somewhat concerned	Neither concerned nor unconcerned
Lucio Martarelli	Very concerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned
George Melekis	Very concerned	Very concerned	Somewhat concerned	Very concerned	Somewhat concerned	Neither concerned nor unconcerned	Very concerned	Very concerned	Neither concerned nor unconcerned
Slavica Čikotić	Neither concerned nor unconcerned	Neither concerned nor unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Somewhat unconcerned	Unconcerned
Maja Pelajić	Somewhat concerned	Very concerned	Somewhat concerned	Very concerned	Somewhat concerned		Very concerned	Somewhat concerned	Neither concerned nor unconcerned
S Liakou	Very concerned	Somewhat concerned	Neither concerned nor unconcerned	Somewhat concerned	Neither concerned nor unconcerned	Somewhat unconcerned	Very concerned	Very concerned	Neither concerned nor unconcerned
Craig Hatcher	Somewhat concerned	Somewhat concerned	Neither concerned nor unconcerned	Somewhat concerned	Neither concerned nor unconcerned	Somewhat concerned	Somewhat concerned	Somewhat concerned	Neither concerned nor unconcerned

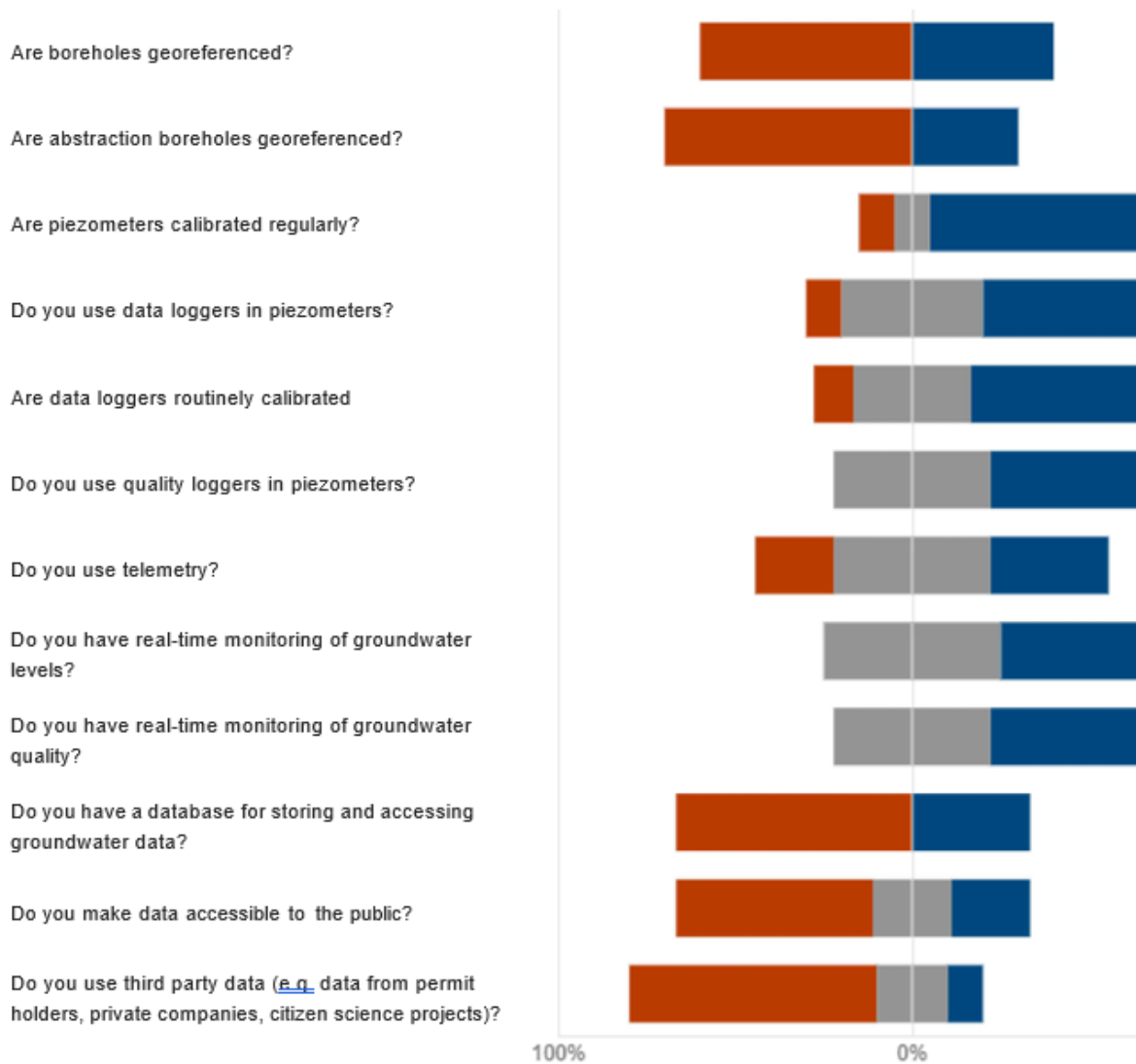


14. Any other comments on the impact of illegal groundwater abstractions: interesting facts or projects for the TIGDA-project

George Cassar	
Ian Jones	The table in Question 13. has an error! I presume that the second column from the left should be "concerned", so I have answered accordingly. We do not regulate or control well installation or construction or monitoring equipment. We in the NRW Geoscience Team have concerns with not regulating well / borehole construction, equipment and decommissioning, but NRW as an organisation does not appear to be overly concerned. Unsure as to what "loss of revenue" refers to?
Martin Golčer	
Lucio Martarelli	
George Melekis	Detection of illegal over abstractions could be achieved correlating them with electricity consumption
Slavica Čikotić	No comment
Maja Pelajić	
S Liakou	
Craig Hatcher	No.

15. Details on monitoring

■ Yes ■ No ■ I don't know





	Are boreholes georeferenced?	Are abstraction boreholes georeferenced?	Are piezometers calibrated regularly?	Do you use data loggers in piezometers?	Are data loggers routinely calibrated	Do you use quality loggers in piezometers?	Do you use telemetry?	Do you have real-time monitoring of groundwater levels?	Do you have real-time monitoring of groundwater quality?	Do you have a database for storing and accessing groundwater data?	Do you make data accessible to the public?	Do you use third party data (e.g. data from permit holders, private companies, citizen science projects)?
George Cassar	Yes	Yes	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	Yes	No	Yes
Ian Jones	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Martin Golčer	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know		I don't know	Yes	I don't know	Yes
Lucio Martarelli	Yes	Yes	I don't know	No	No	No	No	No	No	Yes	Yes	Yes
George Melekis	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes
Slavica Čikotić	I don't know	Yes	I don't know	No	No	No	No	I don't know	I don't know	I don't know	No	No
Maja Pelajić	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know
S Liakou	Yes	Yes	I don't know	I don't know	I don't know	I don't know	No	No	No	Yes	Yes	Yes
Craig Hatcher	I don't know	I don't know	I don't know	I don't know	I don't know	I don't know	Yes	I don't know	I don't know	I don't know	Yes	Yes



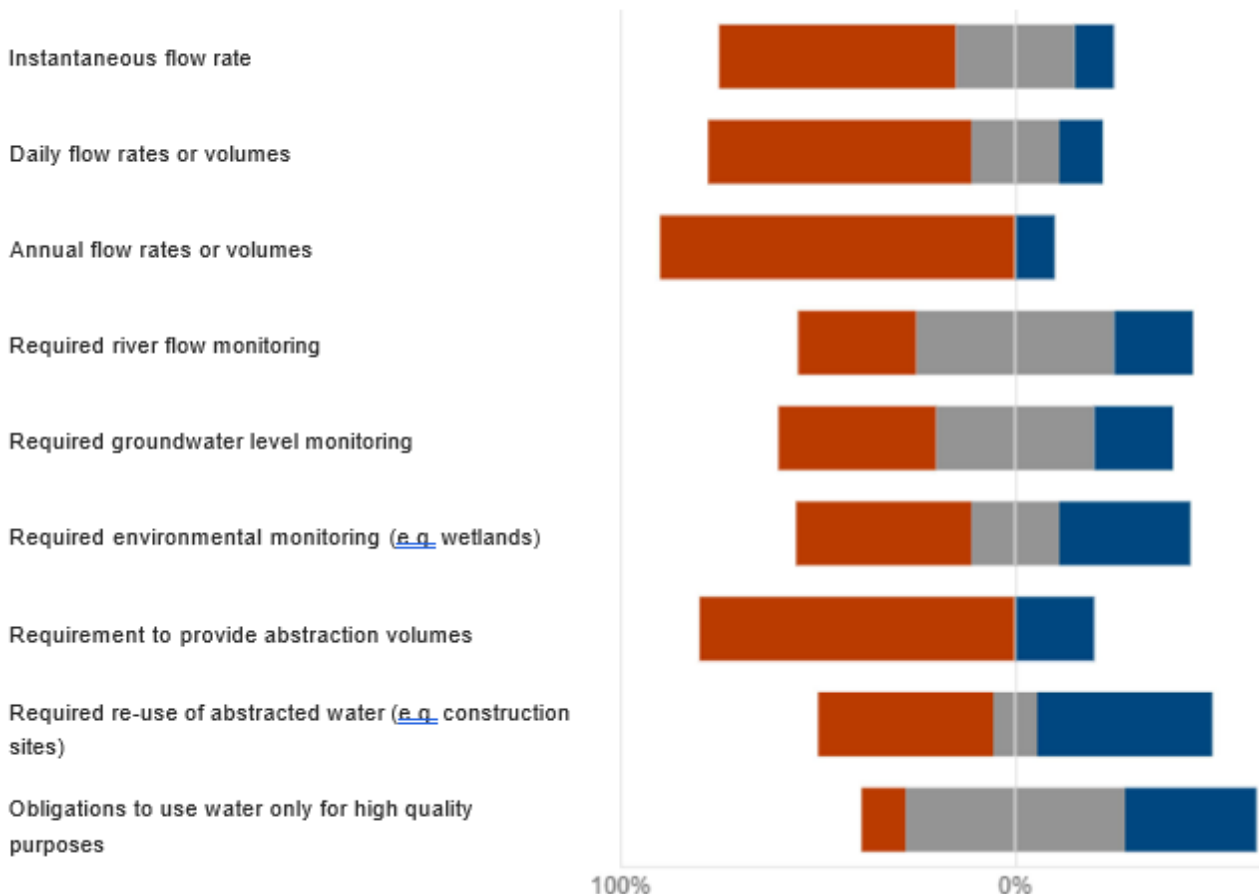
16. Any additional comments on groundwater monitoring (e.g. interesting projects or techniques we should be aware of)

George Cassar	
Ian Jones	Question 15. refers to NRW groundwater monitoring networks only. NRW water level networks are mostly NRW owned/ operated, whereas NRW groundwater quality network is made up of third party boreholes, wells, springs etc. Data is accessible to public on request.
Martin Golčer	
Lucio Martarelli	
George Melekis	Groundwater monitoring is carried out by the National Monitoring Program under the auspices of the National Institute of Geological and Mineral Research. The program is funded by the EU. At regional level, there is a prediction at RBMP for the design of a more detailed monitoring network under the authority of the Decentralized Administration.
Slavica Čikotić	No comment
Maja Pelajić	
S Liakou	There are plenty of academic and scientific environmental and groundwater studies. Our Authority is responsible for the implementation of the Directive 2000/60, in Greece. Info at River Basin Management Plans of Water Districts in Greece and their Analytical Documentation Texts.
Craig Hatcher	



17. What constraints can be included on a permit for groundwater abstractions?

■ Yes ■ No ■ I do not know





	Instantaneous flow rate	Daily flow rates or volumes	Annual flow rates or volumes	Required river flow monitoring	Required groundwater level monitoring	Required environmental monitoring (e.g. wetlands)	Requirement to provide abstraction volumes	Required re-use of abstracted water (e.g. construction sites)	Obligations to use water only for high quality purposes
George Cassar	No	Yes	Yes	I do not know	No	No	Yes	Yes	No
Ian Jones	Yes	Yes	Yes	Yes	Yes	Yes	Yes	I do not know	No
Martin Golčer	Yes	Yes	Yes	Yes	I do not know	I do not know	I do not know	Yes	I do not know
Lucio Martarelli	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know
George Melekis	No	Yes	Yes	No	Yes	Yes	Yes	No	I do not know
Slavica Čikotić	Yes	No	Yes	No	No	I do not know	Yes	I do not know	No
Maja Pelajić	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
S Liakou	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Craig Hatcher	Yes	Yes	Yes	Yes	Yes	Yes	Yes	I do not know	No



18. Do all abstractions require a permit, or do you have exemptions for permitting (for example, abstractions below a minimum daily volume)?

George Cassar	No.
Ian Jones	Abstractions over 20m ³ /day require a permit.
Martin Golčer	Water law require permit
Lucio Martarelli	Yes, but this matter is not directly managed by ISPRA-Geological Survey of Italy, but by regional/provincial agencies
George Melekis	There are exceptions related on the type of water abstractions which are defined in the existing legal framework. An example is for forest firefighting
Slavica Čikotić	Surface abstraction for domestic use is exemption.
Maja Pelajić	According to Croatian legislation, Water Law (Official Gazette of the Republic of Croatia, 66/2019, 84/2021), permits are not required for water abstraction intended for domestic use (household purpose, individual personal use). However, any other water abstractions intended for economic activities, e.g. for business, industry, agriculture, public water supplies, require permissions.
S Liakou	All abstractions require a permit except for a) for academic or research purposes, b) dewatering from urban building construction
Craig Hatcher	Groundwater abstraction exempt from need of licence if takes no more than 20 cubic metres per day.



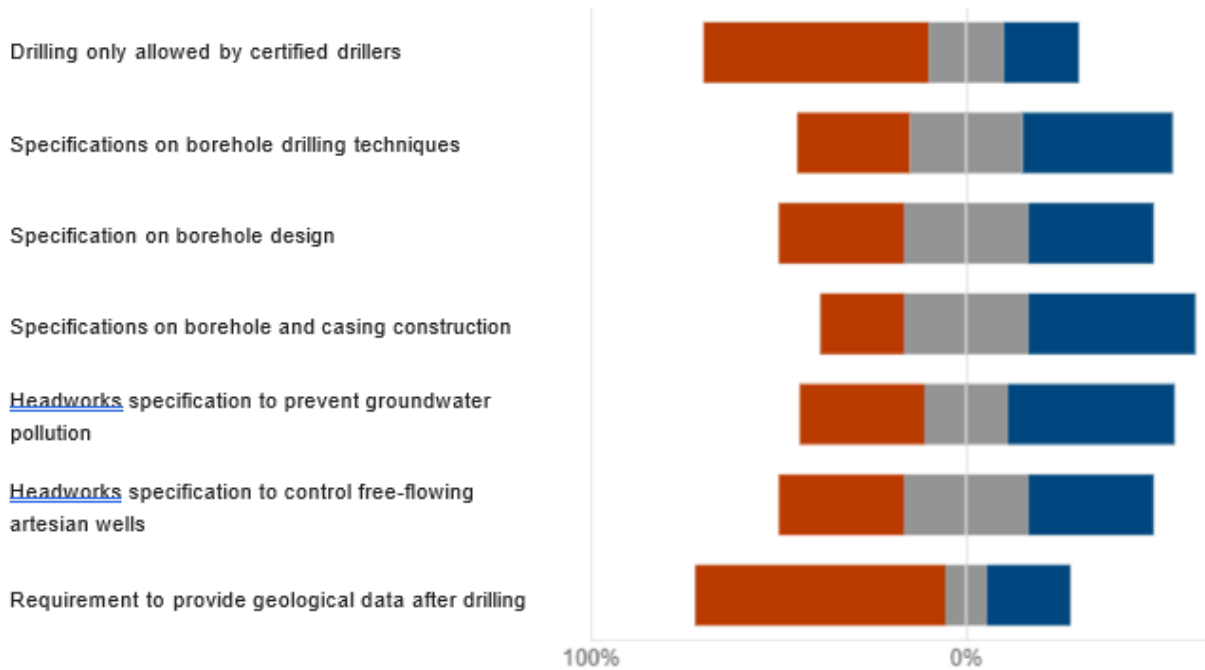
19. Are permits stored in a permit database? Can permits easily be checked and queried in this database?

George Cassar	Yes
Ian Jones	Yes and yes
Martin Golčer	Yes sometimes it is necessary to check the data with the ministry itself, there is not enough access to the evidence
Lucio Martarelli	Yes, but this matter is not directly managed by ISPRA-Geological Survey of Italy, but by regional/provincial agencies
George Melekis	Permits are stored in a permit database at the Decentralized Administration. There is also an obligation to be on public through program DIAVGEIA
Slavica Čikotić	Permits are available to inspectors.
Maja Pelajić	Permits are stored in permits database maintained by legal entity for water management in Croatia, Hrvatske vode.
S Liakou	Yes they are stored Diavgeia, a national electronic system where all the Administrative Decisions are published. Also, there is the National Registry of Water Abstractions, where the Directorates for Waters insert the data for abstractions
Craig Hatcher	Yes.



20. Do you have constraints for drilling and construction of wells (including good practice guides)

■ Yes ■ No ■ I do not know





	Drilling only allowed by certified drillers	Specifications on borehole drilling techniques	Specification on borehole design	Specifications on borehole and casing construction	Headworks specification to prevent groundwater pollution	Headworks specification to control free-flowing artesian wells	Requirement to provide geological data after drilling
George Cassar	Yes	No	No	No	No	No	Yes
Ian Jones	No	No	No	No	No	No	Yes
Martin Golčer	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know
Lucio Martarelli	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know	Yes
George Melekis	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Slavica Čikotić	Yes	I do not know	I do not know	I do not know	I do not know	I do not know	I do not know
Maja Pelajić	Yes	Yes	Yes	I do not know	Yes	No	No
S Liakou	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Craig Hatcher	No	No	No	No	I do not know	Yes	Yes



21. Any additional comments on permitting of groundwater abstractions and drilling (e.g. useful legislation or constraints we should be aware of)?

George Cassar	In so far as Q17 is concerned, this is what i consider should be included, not what is actually included. We also include a requirement for provision of water quality information (conductivity) in some cases.
Ian Jones	Generally no specific universal requirements, although drillers are expected to submit details of drilling boreholes / wells to the British Geological Survey (BGS). We refer to guidance from England and Scotland, but this does need updating. For boreholes / wells that are part of a planning application, landfill or other application we will comment, but there are no borehole / well specific requirements.
Martin Golčer	
Lucio Martarelli	
George Melekis	Drilling rigs should have a geolocation system and the obligation to declare their location for the purpose of drilling a water borehole
Slavica Čikotić	no
Maja Pelajić	
S Liakou	Legislation: JMD 146896/2014 , as amended Special hydrogeological Studies required by RBMPs
Craig Hatcher	



22. Who has authority to inspect and/or enforce permits, permit conditions and drilling activities? How are inspections and enforcement organized?

George Cassar	MRA, with the assistance of the police if required
Ian Jones	Environment Officers, Permitting Enforcement Officers in NRW for abstractions, nothing specific for drilling.
Martin Golčer	Inspectorate, ministry, directorate for water for issuing permits the inspectorate has 8 regional units throughout Slovenia, inspectors in that area inspectorate violations first, an enforcement order is issued, which sets a deadline for remedying the violation then enforcement occurs - by monetary coercion or by another person through the inspectorate
Lucio Martarelli	Environmental agencies at regional/provincial/municipality level (including ISPRA-Geological Survey of Italy, for geological-hydrogeological aspects), law enforcements
George Melekis	Licenses are issued by the Decentralized Administration which is responsible for complying with the terms of a license. In case of violation, this is ascertained by the Region or Municipality either independently or in cooperation with the Decentralized Administration. An audit report is then prepared by the Region or Municipality which is sent to the Decentralized Administration for the imposition of an administrative and monetary fine. In case of serious violations it is sent to the prosecutor for criminal prosecution due to environmental degradation
Slavica Čikotić	Water inspection in State Directorate and Croatian Waters.
Maja Pelajić	Republic of Croatia, State Inspectorate, Water Rights Inspection has authority for the above.
S Liakou	Environmental Authorities of the Regions make inspections on drilling activities, with the cooperation of the Water Directorates of Decentralized Authorities, after specific reports/complaints
Craig Hatcher	The Environment Agency. Inspections are organised on a risk-based approach. Larger abstractions with more risk to the environment or other water users will be more likely to be inspected than smaller ones. Smaller licensed groundwater abstractions may be visited very rarely (every 20 years), or not at all.



23. Do inspectors and enforcing bodies have access to a digital permit database?

George Cassar	Yes
Ian Jones	Yes
Martin Golčer	permits are not in electronic records/evidence when the inspector needs information on permits, he asks the Water Directorate (usually via email)
Lucio Martarelli	Yes
George Melekis	Yes
Slavica Čikotić	No
Maja Pelajić	Yes, water rights inspectors have access to permit database through Hrvatske vode (legal entity for water management in Croatia).
S Liakou	Yes they do
Craig Hatcher	Yes.




24. What information would be available during an inspection (desktop or on site)?

George Cassar	Location and photos of site
Ian Jones	Any permits with full details, background information, ownership, maps, water resources information etc.
Martin Golčer	the public is not particularly acquainted with the evidence during the proceedings - information can only be obtained by those who have a legal interest after the procedure is completed, the public can get acquainted with the findings (without personal data)
Lucio Martarelli	
George Melekis	??
Slavica Čikotić	All information are available to inspector. Inspected person has the obligation to submit all required documentation on site.
Maja Pelajić	Both.
S Liakou	they usually make inspections on site, but with the help of digital technology (e.g. satellite images). They have all the necessary documents / permits and constraints (if any) for the reported boreholes/drillings.
Craig Hatcher	Inspector should have a copy of the whole licence document at the time of inspection.



25. What type of inspection checklist do you use?

George Cassar	Manual
Ian Jones	Not aware of checklist - would need to enquire
Martin Golčer	At the inspection, the inspectors write a report
Lucio Martarelli	
George Melekis	1. Type of abstraction, 2 Coordinates, 3. Pumping rate, 4. depth, 5. borehole and casing diameter, 6. water level, 7. type and power of water pump 8. Type of water use and consumption 9. Area of crop.
Slavica Čikotić	Individual checklist.
Maja Pelajić	Evidence of permits for water abstractions and compliance with the same. If there is no permits, checklist and compliance with Croatian Water Law (Official Gazette of the Republic of Croatia, 66/2019, 84/2021), .
S Liakou	Our Authority doesn't make inspections.
Craig Hatcher	<p>Template we call WR51, our water resources compliance inspection form, prompts inspector to check compliance with all licence conditions and take a reading of (any) water meter installed.</p> <p style="text-align: center;">  EA WR51 inspection report.doc </p>

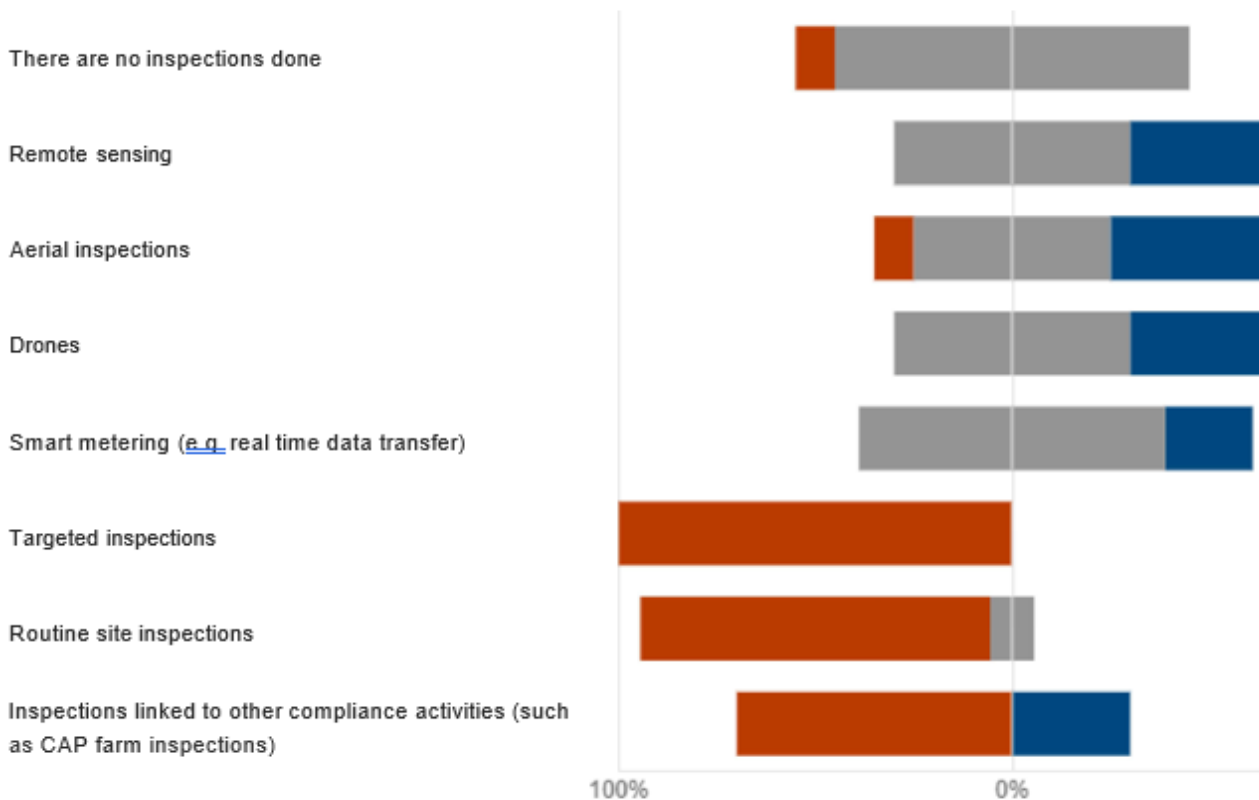


26. What equipment is used during an inspection (e.g. dip meters, iPads)

George Cassar	Level tapes, camera.
Ian Jones	
Martin Golčer	Mobile phone for imaging, meter, etc.
Lucio Martarelli	
George Melekis	Handheld gps, water level gauge, conductive meter
Slavica Čikotić	Laptop
Maja Pelajić	No equipment such as mentioned is used during an inspection.
S Liakou	The competent for the inspections Authorities use as many tools as it can (e.g. dip meters . GPS , flow meters etc)
Craig Hatcher	Usually pen and paper. Might be recorded digitally on a tablet or laptop. Water level dip meters would be unusual.

27. What types of inspection are used

■ Yes
 ■ No
 ■ I do not know





Your name	There are no inspections done	Remote sensing	Aerial inspections	Drones	Smart metering (e.g. real time data transfer)	Targeted inspections	Routine site inspections	Inspections linked to other compliance activities (such as CAP farm inspections)
George Cassar	No	No	No	No	No	Yes	Yes	I do not know
Ian Jones	No	I do not know	I do not know	I do not know	I do not know	Yes	Yes	Yes
Martin Golčer	No	I do not know	I do not know	I do not know	I do not know	Yes	Yes	I do not know
Lucio Martarelli	No	I do not know	I do not know	I do not know		Yes	No	Yes
George Melekis	No	No	Yes	No	No	Yes	Yes	Yes
Slavica Čikotić	No	No	No	No	No	Yes	Yes	Yes
Maja Pelajić	Yes	No	No	No	No	Yes	Yes	Yes
S Liakou	No	No	No	No	No	Yes	Yes	Yes
Craig Hatcher	No	I do not know	I do not know	I do not know	No	Yes	Yes	I do not know

28. What penalties or sanctions are available for illegal drilling?

George Cassar	<p>(a) a fine (multa) of not less than twenty thousand euro (€20,000) but not exceeding fifty thousand euro (€50,000) or to imprisonment for a term from twelve months to eighteen months, or to both such fine and imprisonment</p> <p>(b) confiscation of the equipment used for the drilling of a borehole or for carrying out the excavation works</p> <p>(c) reimbursement to the Authority for any inspection, enforcement and monitoring costs incurred</p>
Ian Jones	None I am aware of.
Martin Golčer	The Water Act has no articles on punishing the ban on drilling - is likely in other (e.g. mining) legislation not controlled by the Environment Inspectorate
Lucio Martarelli	ISPRA-Geological Survey of Italy is charged of the correct application of a law which forces the transmission of geological-hydrogeological data after drilling completion. A fee of about 500-1000 Euros is imposed to transgressors.
George Melekis	Administrative and monetary fines.
Slavica Čikotić	Administrative, misdemeanour and crime.
Maja Pelajić	Penalties and sanctions are listed in Croatian Water Law (Official Gazette of the Republic of Croatia, 66/2019, 84/2021) and include money charges, restoration of previous state, depending on type of offence.
S Liakou	For illegal drillings there are Administrative Economic Penalties, by Decentralized Administration/ Directorates for Waters to both end users and drillers or/and geologists.
Craig Hatcher	Civil Sanctions (fixed monetary penalties, variable monetary penalties, enforcement undertakings), prosecution.



29. What penalties or sanctions are available for illegal abstraction?

George Cassar	Not applicable
Ian Jones	Various - would need to enquire to obtain specifics
Martin Golčer	the Water Act provides: from 4,000 euros to 125,000 euros for a misdemeanour for a legal entity, from 600 euros to 2,000 euros shall also be imposed on the responsible person of the legal person from 400 euros to 1,200 euros shall be imposed on an individual.
Lucio Martarelli	This matter is not directly managed by ISPRA-Geological Survey of Italy.
George Melekis	Administrative and monetary fines. In case of serious violations criminal prosecution due to environmental degradation
Slavica Čikotić	Administrative, misdemeanour and crime.
Maja Pelajić	Please see answer above.
S Liakou	For illegal abstractions there are Administrative Economic Penalties, by Decentralized Administration/ Directorates for Waters to end users.
Craig Hatcher	Civil Sanctions (fixed monetary penalties, variable monetary penalties, enforcement undertakings), prosecution.





30. Any additional comments on inspection and enforcement (e.g. novel techniques not mentioned above, pilot projects that you have running, interesting facts on effectiveness)?

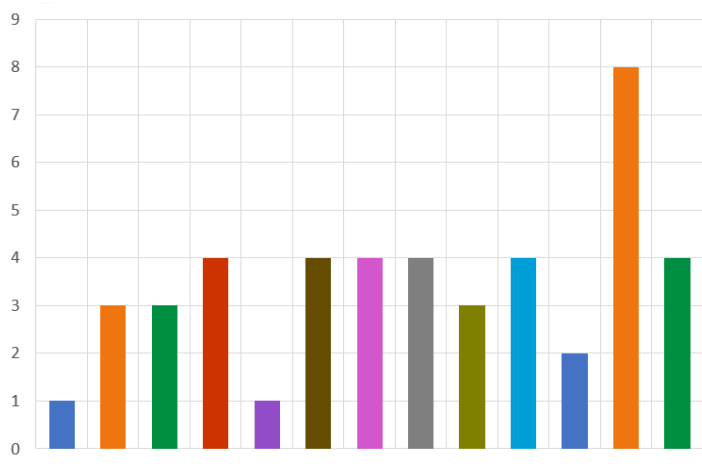
George Cassar	
Ian Jones	No
Martin Golčer	
Lucio Martarelli	
George Melekis	1. Corelation of energy consumption to water abstraction 2. Public Awareness by publishing fines
Slavica Čikotić	No comment
Maja Pelajić	
S Liakou	
Craig Hatcher	The difficulty in England is the <20 m ³ /day exemption means that a company can drill a borehole and install pumping equipment without the need to notify us, the regulator, as they can claim it is exempt. There is no need to install a water meter. This risks exploitation of water theft by those taking more than 20 m ³ /day as we will not necessarily know where these are taking place - it'll rely on reports from 3rd parties. Even if we do find them then it's down to us to prove how much they are abstracting when it wont have a meter on.





31. Are there areas you would like the TIGDA project to develop supporting guidance?

- Best practices for monitoring wa... 0
- Best practices for monitoring wa... 2
- Developing legislation 2
- Developing policy 3
- Meeting requirements of River 0
- Compliance 3
- Enforcement 3
- Borehole drilling 3
- Borehole and casing construction 2
- Decommissioning 3
- Controlling free-flowing artesia... 3
- Inspection techniques 7
- Remote sensing to detect illegal 3
- Other



Graph data altered as Other = All of the above

George Cassar	Borehole drilling; Borehole and casing construction; Decommissioning; Inspection techniques
Ian Jones	Borehole drilling; Borehole and casing construction; Decommissioning; Developing policy
Martin Golčer	Inspection techniques
Lucio Martarelli	Best practices for monitoring water quantity and levels (surface water and/or groundwater); Remote sensing to detect illegal drilling and/or abstraction; Compliance; Borehole drilling; Developing legislation; Developing policy
George Melekis	All the above
Slavica Čikotić	Enforcement; Inspection techniques



Maja Pelajić	Developing legislation; Compliance; Enforcement; Inspection techniques
S Liakou	Inspection techniques; Remote sensing to detect illegal drilling and/or abstraction; Decommissioning; Compliance
Craig Hatcher	Best practices for monitoring water quantity and levels (surface water and/or groundwater); Developing policy; Controlling free-flowing artesian boreholes; Inspection techniques; Remote sensing to detect illegal drilling and/or abstraction

32. Your additional comments

George Cassar	
Ian Jones	I have answered these question best I can, with limited support from others in NRW. To answer more fully would require help from various staff across the organisation. I am a Hydrogeologist with limited NRW / UK regulatory experience. Reason I volunteer for TIGDA is because I have specialist experience in drilling, construction , monitoring, with 8 years as a researcher on EU projects on groundwater monitoring with 18 years in California where drilling and well construction and decommissioning is carefully controlled and recorded. I thought I may be able to offer perspective from CA as to how TIGDA issues are dealt with. Thanks.
Martin Golčer	
Lucio Martarelli	
George Melekis	
Slavica Čikotić	No comment
Maja Pelajić	
S Liakou	
Craig Hatcher	









33. Do you have reports to share with the TIGDA project - such as reports, best practice guidance.

■ Yes ■ No

Reports or guidance to share

100%

0%

George Cassar	No
Ian Jones	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  ca_well_standards_bulletin74-81_1981- </div> <div style="text-align: center;">  EPA-Ohio-Monitoring Well Design-200 </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">  CA_well_standards_bulletin74-90_1991- </div> <div style="text-align: center;">  EPA_monitoring_wells.pdf </div> </div> <p style="text-align: center; margin-top: 10px;">These reports can be found on Basecamp</p>
Martin Golčer	No
Lucio Martarelli	No
George Melekis	No
Slavica Čikotić	No
Maja Pelajić	No
S Liakou	No
Craig Hatcher	No



Annex III. Longlist of TIGDA-methods

Version 0.2 - July 14th 2022

1. Introduction

This longlist gives an overview of potential methods for detection, monitoring and enforcement of illegal groundwater drilling and extractions. The methods were inventoried using responses to the questionnaire, a similar questionnaire in 2015 (VMM, BE) and experiences of the project team.

For each method a brief description is given, as to how this method is currently understood by the project team. Also a list of countries is given where the method is possibly already applied (in one way or another).

In the next project phases potentially promising methods can be selected for further investigation, during which more data can be gathered from current users, and a proper description can be worked out.

From the questionnaire evidence of illegal drilling exists in following installations: irrigation and growing crops, livestock (dairy, poultry), parks & recreation (golf courses, campsites), smaller quarries, discharges, temporary dewatering of construction sites, domestic water supply

2. Building a proper legislative framework

2.1 Drilling contractors need a license

Description: Only licensed contractors are allowed to drill groundwater wells. Licenses are given by the government or by some intermediate accreditation organization.

Applied in: BE, GR, MT

2.2 Legal obligation to pre-register drilling activities

Description: some days before the actual drilling and/or well installation, the drilling activity needs to be pre-registered, with details on location, date, contact details of contractor. This information allows the inspection teams to organize themselves to oversee and inspect the drilling activity if desired.

Applied in: BE (preregister 2 days before drilling), MT (drilling can only start after inspection of site).

2.3 Legal obligation to (post-)register drilling activities

Description: after the actual drilling the as-build details of the borehole are registered. This could include location, depth, construction details, contractor involved, but also details on lithology, linked permits. This information can be used as inventory of the drill holes as such,



but also provides invaluable information for future projects in the neighborhood, or for geological modelling of the underground. Also failed drilling may be reported.

Applied in:

- BE, NO, UK (Wales), SL, LT, MT, IT

+ suggestion by Ian Jones to also look at experiences from California: 'where drilling and well construction and decommissioning is carefully controlled and recorded'.

2.4 Legal obligation to register new groundwater abstractions

Description: new wells need to be registered in a central database, with information on location, associated permits, permitted abstraction volumes, operator, status. It allows accounting of total regional volumes abstracted.

Most countries have some sort of central database, often filled during the permitting procedure. However, exemptions may exist for permitting, and hence for the registration in the database. The fewer exemptions exist for permitting, the more groundwater abstractions are properly known by the authorities, so they can be inspected, monitored and the total abstraction can be accounted.

Applied in:

- RO: Minimum volume excepted from licensing/permitting process is 0.2 l/s, according to the Water Law no.107/1996 with amendments
- PT: shallow wells (less than 20 m deep) only need the announcement of the construction, submitted obligatory to the Portuguese Environmental Agency (APA), they don't need an official permission.
- LT: for individual water supply - less than 10 m³/d (all productive wells must be registered in the official Registry of the Underground) and for growing agricultural production - less than 100 m³/d (well-fields must be registered and volume of groundwater abstraction reported annually).
- UK (England): there is a de minimus of 20m³/day + the exception of closed loop systems as they do not require licensing or pre-notification
- GR: There are exceptions related on the type of water abstractions which are defined in the existing legal framework. An example is for forest firefighting.
- GR: All abstractions require a permit except for a) for academic or research purposes, b) dewatering from urban building construction
- HR: permits are not required for water abstraction intended for domestic use (household purpose, individual personal use).

2.5 Legal obligation to register effective parameters of the well

Description: during permitting design flow are given. However, it is useful to know the effective abstracted volumes, but also other time-varying parameters, such as flow, water





level, water quality, monitoring of wetlands. Different mechanism may be foreseen to collect these data.

Applied in:

- BE: yearly reporting for larger abstractions. Local requirements are added to permits to collect parameters during dewatering (e.g. water quality, water level,...)
- MT: We also include a requirement for provision of water quality information (conductivity) in some cases.
- GR: abstraction volumes, required environmental monitoring (e.g. wetland),
- SL: flow measurements for thermal water are sent in real-time to the government, so inspection team can follow water usage live from their office.

2.6 Efficient penalty principles are foreseen

Description: The law provides 'efficient' penalty principles, that allows that water abuse is properly penalized, and operators are effectively encouraged to abide the rules. E.g. the fined amounts are in relation to the level of benefits enjoyed by abstracting water.

Applied in: to be compared

- SL: the Water Act provides: from 4,000 euros to 125,000 euros for a misdemeanor for a legal entity, from 600 euros to 2,000 euros shall also be imposed on the responsible person of the legal person from 400 euros to 1,200 euros shall be imposed on an individual. The Water Act has no articles on punishing the ban on drilling
- LT: 1) administrative liability for infringements; 2) 10 times higher tax rate is applied for undeclared water abstraction
- UK (England): We can also notify the Rural Payments Agency who distribute CAP and there may be reductions in payments
- MT: (a) a fine (multa) of not less than twenty thousand euro(€20,000) but not exceeding fifty thousand euro(€50,000) or to imprisonment for a term from twelvemonths to eighteen months, or to both such fine and imprisonment; (b) confiscation of the equipment used for the drilling of a borehole or for carrying out the excavation works; (c) reimbursement to the Authority for any inspection, enforcement and monitoring costs incurred
- IT: ISPRA-Geological Survey of Italy is charged of the correct application of a law which forces the transmission of geological-hydrogeological data after drilling completion. A fee of about 500-1000 Euros is imposed to transgressors.
- GR: For illegal drillings there are administrative economic penalties to both end users and drillers or/and geologists. For illegal abstractions there are administrative economic penalties to end users

3. Legislative instruments

3.1 Regulation campaign for existing illegal groundwater abstractions





Description: operators of illegal wells are given a one-off opportunity to regularize their well, without a fine, or with limited fines. It may convince such owners who would like to regularize their well, but are afraid of the consequences. Similar regularizations exist for firearms or black money, with good success. A good communication strategy is important, so that unknown operators are reached by the information.

Applied in:

- LT

4. Compliance Promotion

4.1 Raising public awareness

Description: communicate about the obligations for drilling and water abstraction

Applied in:

- GR: public awareness by publishing penalties
- BE: Compliance Promotion in joint-effort with sector of dewatering contractors: review of legal requirements, technical assistance (e.g. training, documents of best practices, improve digital skills, one-stop digital platform, manuals, public publication of info of wharfs via webmaps for reuse, QR-codes, publication of inspection results,

4.2 Information for well operators

Description: new well operators can easily find all information on owning, permitting, operating a well, with administrative and technical requirements, and existing prohibitions. Such information could be generally available on websites, or send over during the permitting procedure.

Applied in: to be compared.

- BE: o.a. website + drilling contractors are obliged to inform their customers

4.3 Publication of best-practices documents

Description: a document of best practices is available.

- Best-practices for drilling operations: It explains how a well is properly drilled and constructed, without risks for safety, for the environment or for neighbors.
- Best-practices for flow measurements: how to measure flow rates in extraction wells,
- Best-practices on free-flowing artesian wells,
- Best-practices for decommissioning.



Best-practices documents could come in different flavors. They can be legal documents, legally binding how the drilling needs to be performed (also used during inspection). They can be formal documents setting norms (ISO, or national standards). They can also be more informal guidelines that have more an instructive purpose. The form can be a document, a website, an instruction video. Terminology could be vary as well: best-practices, guidelines, specifications, standards, technical working instructions.

Applied in:

- ISO-standards exists for many topics: e.g. ISO14688 (geotechnical investigation: soil), ISO22475 (geotechnical investigation: groundwater), Geothermal drilling (?)
- EU: cascading principle where at the lowest level it is obligatory to follow general existing standard (like ISO) unless a national standard exists. Examples?
 - BE:
 - a BP-document for drilling methods was added as appendix to environmental law. As such it can be enforced, but it is hard to update. Newer methods or useful addenda are now added through sectoral agreements. Drilling companies can propose newer methods during the permitting process. For installation of monitoring wells or for groundwater sampling methods (which is regulated by another law) no appendix was added, but only references to suitable technical compendia. These can be more easily changed by a ministerial decree. For flow measurements the environmental law only states that some code of good conduct needs to be followed, without specifying further. A code of good conduct was made available by the authorities.
These documents are published together with summarizing text and even short instruction videos (e.g. on decommissioning of wells).
 - The sector organization of driller/construction is investigating novel techniques for groundwater management at construction sites and putting up a website to make them better known. The authorities are actively participating in this project.
- UK (England): instructions for free-flowing artesian wells

4.4 Evaluation report for drilling contractor

Description: drilling contractors and well owner get a yearly overview on their performance, based on e.g. outcome of inspections, on how well they meet their legal or administrative obligations (e.g. timely registration of new wells), with suggestions on how to improve. Scores can be compared with scores of the competitors, can be published for interested customers, or turned into a quality label.

Applied in:

- BE: yearly evaluation report ('school report') for drilling contractors





- ES: farmers where remote sensing indicated a clear over-consumption against established standard water volume for a crop, received a warning letter , informing them of the possibility to receive support for preparing an irrigation plan for the next cropping campaign (adjusted to the maximum allow water volume for their farming area).

4.5 Benefits for contractors who perform well

Description: based on previous controls, contractors who perform well, can get lower reporting obligations, lower inspection frequency or requests for additional administrative paperwork, reduction on license fee, incentive in insurance conditions, ...

Applied in: ?

5. Inspection tools

5.1 Inspection checklists

Description: inspection checklists help the less-experienced inspectors on what they should control in a drilling operation or in a operating well. Inspection lists can be published publicly.

Applied in: GR, BE, UK (Wales, England), LT, HR,

- GR: inspection checklists for 1. Type of abstraction, 2 Coordinates, 3. Pumping rate, 4. depth, 5. borehole and casing diameter, 6. Water level, 7. type and power of water pump 8. Type of water use and consumption 9. Area of crop.
- BE: specific checklists for drilling and groundwater abstraction
- LT: A separate checklist for control of tax on state natural resources is used. There is no particular checklist for groundwater drilling and abstractions, but questions regarding this issue are included in other checklists, for example, the checklist on environmental requirements for heat and hot water production has 13 questions regarding groundwater drilling and abstractions.
- HR: Evidence of permits for water abstractions and compliance with the same. If there is no permits, checklist and compliance with Croatian Water Law (Official Gazette of the Republic of Croatia, 66/2019, 84/2021),
- UK: Template we call WR51, our water resources compliance inspection form, prompts inspector to check compliance with all licence conditions and take a reading of (any) water meter installed

5.2 Detection with helicopters, planes or drones

Description: detection of illegal abstractions from aerial observation. This could be by observing wells directly, or by observing their impact on the surrounding (e.g. green fields in an arid region).

Applied in:





- UK (England -> drones, Wales?)
- GR

5.3 Detection via satellite imagery

Description: This could be by observing wells directly, or by observing their impact on the surrounding (e.g. green fields in an arid region)

Applied in: RO, ES, (HU?, PT?)

- In RO: DIANA project - Detection and Integrated Assessment of Non-authorized water Abstractions using EO (<https://cordis.europa.eu/project/id/730109>)
- ES: detecting over-consumption in water irrigation, and illegally irrigated plots. <https://www.researchgate.net/publication/342159293> Actions to detect and combat illegal water use in Spain Two case studies
- IT: detection of illegal irrigation (not necessarily groundwater extraction). <https://www.researchgate.net/publication/315994779> APPLYING EARTH OBSERVATION TO DETECT NON-AUTHORISED IRRIGATION THE CASE STUDY OF CONSORZIO SANNIO ALIFANO ITALY
- CY: study in 2008: detection of 9000 groundwater wells of which 3000 illegal wells (mainly for domestic use).

5.4 Risk profiling and validation methods

Description: Risk profiling, with cross-checking of several available data sources (permits, data on economic activities of a well operator, geographic datasets) or machine-learning against previous inspection outcomes. Risk profiles are then used to preferentially steer inspection teams to high-risk drilling sites or wells operators

Validation methods are related to risk profiling. Trying to obtain an alternative confirmation whether e.g. reported abstractions are indeed correct.

Applied in: BE, LT, GR, (HU?)

- BE: Drilling sites located in high-risk areas (natura 2000, wetlands, aquifers under pressure, salinized areas),
- BE: Drilling contractors with previous offences,
- BE: Well operators with low drinking water consumption compared to their economic activities,
- BE: Well operators in industries with known high levels of offences or water consumption (machine learning)
- LT: checking information from state registers, provided by Lithuanian Geological Survey under the Ministry of Environment





- GR: detection of illegal over abstractions could be achieved correlating them with electricity consumption.
- UK: The EA-inspections are organized on a risk-based approach. Larger abstractions with more risk to the environment or other water users will be more likely to be inspected than smaller ones. Smaller licensed groundwater abstractions may be visited very rarely (every 20 years), or not at all.
- California: comparing the electricity consumption of a pump with the reported pumping hours. Such additional data can be requested by the water director

5.5 Coupling with groundwater monitoring

Description: based on a detailed groundwater monitoring network areas with abnormal groundwater fluctuations are identified, and focused controls performed.

Applied in:

- AU: in the 60's and 80's suspicion of illegal abstraction were confirmed using groundwater head analysis, illegal abstractions were detected using aerial photography.

5.6 GPS-tracking of drilling equipment

Description: obligatory tracking of drilling equipment, so inspection teams are informed where drilling is on-going, but which could also be cross-checked against groundwater extraction wells.

Applied in: GR, BE

- GR: Drilling rigs should have a geolocation system and the obligation to declare their location for the purpose of drilling a water borehole
- BE: research phase, pilots start after summer.

5.7 Reporting of illegal drilling or groundwater abstraction

Description: suitable communication channels are provided where the public can report (possibly) illegal activities for follow-up by inspection services.

Applied in: NO, BE, SI, UK (Wales, England), RO, GR

5.8 Picture database of wells

Description: besides location and other data fields, pictures of the location and the installation are added to the database. These pictures can be used during inspection.

Applied in: MT





5.9 Database of drilling tools

Description: inspection has a database of all drilling tools used by drilling contractors. It contains serial numbers, type of machine, owner, pictures.

Applied in: ?

6. Response on the questionnaire

Representatives of ten countries have filled the questionnaire so far. These countries are: Belgium (Flanders), Croatia, Greece, Italy, Malta, Norway, Portugal, Romania, Slovenia, UK (Wales & England).





Annex IV. TIGDA-methods discussed at Lisbon Meeting (Oct 2022)

1. Portugal - Drone inspection for illegal abstractions

On Oct 14th the TIGDA-group observed in a drone inspection at Coruche, led by GNR (Guarda Civil). The purpose of the mission was to search for illegal surface water abstractions. These abstractions are used to irrigate rice fields along a river section. The mission was started based on suspicions that illegal activities were going on in the neighborhood.

Staff present:

- The GNR-pilot team of 3 people (flying the drone),
- local GNR-officers (from Coruche) including the commander of the Coruche branch, the head of the environmental team and three supporting staff riding around on motorbikes and 4-wheeldrive to go to detected positions.
- representatives of the Environmental Agency (IGAMOAT??) were also present as observers. They are dealing with licenses and fiscal aspects of abstractions.

All in all quite a lot of people needed to be deployed. The minimal team for such an operation would be about 7 to 8.

Equipment used:

- A larger type of DJI-drone, which was equipped with telescopic lens on a gimbal.
- The drone can also be equipped with thermal camera (spotting heat of pumps is possible early in the morning). Spotting of cooler water during the day does not work.
- A smaller drone was used for a reconnaissance flight, that was used to prepare the operation. This smaller drone can also be equipped with speakers and search lights (handy during search-and-rescue operations)
- A temporary control center was setup in the back of a 4WD. Four screens allowed to a) follow the images from the telescopic camera in the drone, b) track location of drone over satellite image, c) track location of drone with known/permitted abstraction locations in the license database.

Result of the operation:

- Eventually three pumps were found: two of them were permitted (could be checked in the database), one was not having a known permit. The owner of the land is accountable, so they will go and ask him for further details. The pump was also leaking oil and polluting the river (fine of 20000€). If the pump is indeed illegally placed, that would be another fine of 20000€.

Operations with drones within GNR:

- The GNR-pilot team is highly specialized, and can offer support to other GNR-divisions for a wide variety of tasks: environmental inspections, search and rescue, larger scale reconnaissance flights (to prepare missions), supervision of mass events, ... This team has a regular piloting permit (as required in Portugal), with additional 140 hours of task-specific training within GNR. They have a huge number of flight hours, with the drones being used several times a week.
- During operations there is a clear line of command. For every mission the goal is clearly specified, and the observations are only made for this purpose. Any other observations made (by coincidence or accident) can only be used/recorded after approval at the appropriate level in the line of command.



Additional notes:

- Attacks by birds: reflecting stripes on the drone can help against bird attacks, but seagulls are aggressive birds, and their presence can make flying impossible. Flying around designated natural areas is done with advisory of nature protection instances. In some situations it can be decided not to fly (e.g. when flamingos are nesting).
- The drone can only cover a relative small area. Observations from helicopters or planes are not used by GNR. Using crop images from satellite imagery is not frequent enough to detect flooded parcels at the right moment (when pumps are active).



Figure 2: take-off of drone and temporary control centre in the back of a 4WD.



2. Lithuania - Legalisation campaign for illegal groundwater wells

Context:

- as water distribution networks are not available in part of the territory, many private houses depend on groundwater wells. These wells are typically 60m to 80 m deep. These household wells need to be registered with the Geological Survey of Lithuania (who is responsible for groundwater). About 30.000 wells have been registered. However, another 30.000 wells are assumed unregistered.
- Normally unregistered wells need to be decommissioned (filled up). With the legalisation campaign these wells can get registered, and do not need to be decommissioned.
- No permits are allowed if a drinking water supply is foreseen in the area.
- No taxes need to be paid for owning a well, if used for private drinking water.
- Water availability was not a problem in Lithuania, but in the recent dry years many well owners report that they had to hang the pump a lower depth in the well.

Procedure of legalisation:

- The well owner hires a certified surveyor to measure the well (depth, exact location, sample of water quality). Such a survey costs about 1000€. The paperwork is sent to the Geological Survey. The details are checked. If everything is OK, the well gets registered.
- One of the recurring problems for registration is that no constructions are allowed within 3 meters around the well. If constructions are present, the well cannot get registered, and in principle these wells should be decommissioned.
- Only information of registered wells are kept in the permit database. Currently no location data is kept of the wells that could not get registered.
- So far about 130 existing wells have been legalised

Water quality control:

- Every well needs to be sampled at startup. The Geological Survey uses the data to map the evolution of groundwater pollutants. These maps show a deterioration of the groundwater quality in several areas. It is often bacterial contamination, probably linked to on-premised sewage water installation (many houses are not connected to a waste water collection system). Also an increase with nitrate. So far PFAS occurrences have not been a problem

Additional notes:

- Also companies need to register for water usage. They get temporal permits (1 year).





3. Belgium –GPS tracking of drilling rigs (pilot)

Context:

- In Flanders only certified contractors can perform drilling activities. They need to work according to legal environmental regulations, such as following best practice guidelines. A new regulations dictates “GPS-tracking on all motorized drilling equipment”. Similar systems already exist for following manure transports and for mobile breaking installations.
- A feasibility study (Jan-Nov 2022) is started to help define such a system (legal, technical, GDPR, ...). Deliverables are a best practices document and technical requirements. Currently a number pilot tests are conducted with different trackers on different types of drilling equipment. The tested trackers are already used for track & trace purposes of assets.
- Topics covered: battery life, coverage of signal (country boundaries, basements, bridges), ways of signaling start of drilling (physical buttons, app), how to deal with smaller (handheld) pumps?, what data to send (xy, engine status, accelerometer, assignment info, drilling parameters, ...)? advantages for drilling company?

Preliminary conclusions:

- When using existing T&T-trackers, not a lot of additional development is needed to send location data to the government.
- Attention with GDPR-issues (e.g. privacy of drill master)
- The system works well for larger rigs, for smaller systems beacons may be an option.
- A suitable configuration for the ‘sleep mode’ needs to be considered. So that rigs don’t disappear of the radar, but trackers don’t drain the battery during longer periods of inactivity.
- There is room for service provider to offer additional services, although the location is not very accurate (e.g. for as-build plans).

Are you interested in this method and want to know more?

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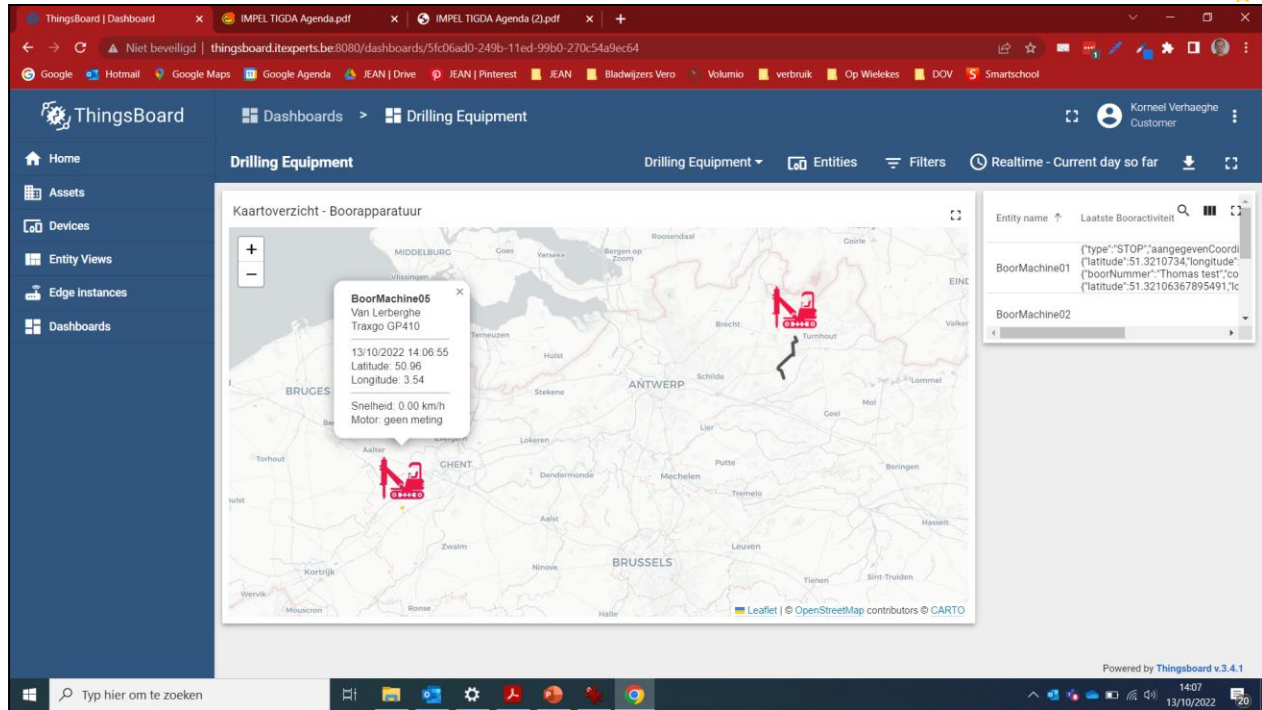


Figure 3: Proof-of-Concept webpage showing live location of test drill rigs

