TITLE OF PROJECT PROPOSAL

***H**ydrogeological processes and Geological settings **over** Europe controlling dissolved geogenic and anthropogenic elements in groundwater of relevance to human health and the status of dependent ecosystems - HOVER*

ABSTRACT

The challenge is to gain understanding of the controls on groundwater quality across Europe using the combined expertise and data held by member states. The project will address groundwater management issues related to drinking water, human and ecosystem health across Europe in relation to both geogenic elements and anthropogenic pollutants by data sharing, technical and scientific exchange between European GSOs[1]. We will link our knowledge of geological settings and understanding of hydrogeological processes to the natural variability of groundwater quality and to the risk of transfer of anthropogenic dissolved compounds to aquifers. For natural water quality this will include evaluating health risks and spatial variability of concentrations of geogenic elements and using a common approach to assessing thermal and mineral water. For diffuse pollutant behaviour we will increase understanding of ecology and microbial diversity controls on transforming pollutants at groundwater-surface water transition zones, quantify groundwater age distributions and nitrate and pesticide travel times in the subsurface and their attenuation patterns for evaluating the efficiency of programme of measures, the design and assessment of monitoring programmes, pollution trends, and create EU-wide aquifer vulnerability maps by comparing assessment methods across Europe. New compounds will be addressed by developing a consistent approach to groundwater monitoring for organic emerging contaminants. Common standards, databases and maps will be developed and project outputs will include thematic maps and web service tools at pan-European scale and databases available through the Information Platform to increase political and public awareness and improve groundwater management at the EU scale.

Groundwater – GW1-Drinking water, human and ecosystem health

LIST OF PARTICIPANTS

#	Participant Legal Name	Country
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1a	DELTARES (DLT)	Netherlands
3	Geologische Bundesanstalt (GBA)	Austria
6	Vlaamse Milieu Maatschappij - Flanders Environment Agency (VMM)	Belgium
7	Federalni zavod za geologiju (Geological Survey of Federation of Bosnia and Herzegovina) (FZZG)	Bosnia-Herzegovina
9	Hrvatski Geološki Institut (HGI-CGS)	Croatia
10	Ministry of Agriculture, Natural Resources and Environment of Cyprus – Geological Survey Department (GSD CYPRUS -> GSD in HOVER)	Cyprus
11	Ceska Geologicka Sluzba – Czech Geological Survey (CGS)	Czech Republic
12	Geological Survey of Denmark and Greenland (GEUS)	Denmark
14	Geologian Tutkimuskeskus (GTK)	Finland
15	Bureau de Recherches Géologiques et Minières (BRGM) [Project Coordinator]	France
17	Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)	Germany
22	Landesamt für Bergbau, Energie und Geologie Niedersachsen (LBEG)	Germany
27	Mining and Geological Survey of Hungary (MBFSZ)	Hungary
28	Islenskar orkurannsoknir - Iceland GeoSurvey (ISOR)	Iceland
29	Geological Survey of Ireland (GSI)	Ireland
30	Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA)	Italy
39	Latvian Centre of Geology, Environment and Meteorology (LEGMC)	Latvia
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42	Ministry for Transport and Infrastructure (MTI)	Malta

[1] GSO : Geological Survey Organisation

44	Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy (PIG-PIB)	Poland
45	Laboratório Nacional de Energia e Geologia (LNEG)	Portugal
46	Institutul Geologic al României (IGR)	Romania
47	Geological Survey of Serbia (GSS)	Serbia
49	Geološki zavod Slovenije (GeoZS)	Slovenia
50	Instituto Geológico y Minero de España (IGME-Spain, IGME in HOVER)	Spain
51	Institut Cartogràfic i Geològic de Catalunya (ICGC)	Spain
52	Sveriges Geologiska Undersökning (SGU)	Sweden
53	State Research and Development Enterprise State Information Geological Fund of Ukraine (GEOINFORM)	Ukraine
54	Natural Environment Research Council (NERC)	United Kingdom
55	Hellenic Survey of Geology & Mineral Exploration (H.S.G.M.E.)	Greece
**	Eesti Geoloogiateenistus (EGT)	Estonia
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**: non-funded partners

1 EXCELLENCE

1.1 Objectives in Relation to the Specific Research Topic (SRT)

Groundwater quantity and quality is of great importance for the economic development of Europe as it is the most important resource for drinking water, irrigation and industrial uses. Groundwater as such and as locally the main contributor to surface water is also a pillar to ecosystem health. Quality of the groundwater is linked to physico-chemical parameters such as temperature, pH, redox potential and the presence of dissolved elements from geogenic (natural) or anthropogenic origin. The project objective is to link the geological settings and hydrogeological processes to the natural quality of groundwater and to the risk of transfer of anthropogenic dissolved elements to aquifers. The technical and scientific fundamentals of the HOVER project are the geological knowledge and comprehensive understanding of the hydrogeological processes involved in the transfer of organic and inorganic elements of natural and anthropogenic origin. Project findings are designed to increase political and public awareness and improve groundwater management at the EU scale. Thus, information and communication technologies involved will allow producing databases, maps and web service tools at pan-European scale that will be made available for a large public through the Information Platform (IP project). As specified in the Groundwater Specific Research Topics of the GW1 (GEOERA joint call document N°9), the HOVER project addresses groundwater management issues, drinking water, human and environmental health, linked to the presence and spatial variability of high concentrations of geogenic elements and the vulnerability to anthropogenic impacts for nutrients (mainly nitrate), pesticides and emerging contaminants.

The project comprises 8 work packages and is directed towards data exchange and database construction for the needs of the development of specific elements in relation to the SRT:

- Determining the natural variability of concentration of elements of geogenic origin depending on the geological and hydrogeological settings, evaluate by the mean of indicators the health risks and benefits and assess using a common approach thermal and mineral water
- Increasing the understanding of how groundwater ecology and microbial diversity determine contaminant-transforming processes at European groundwater-surface water (GW-SW) transition zones
- Assessing nitrate and pesticide travel times in saturated and unsaturated zones and where possible attenuation patterns for a number of relevant European settings for evaluating the efficiency of programme of measures
- Demonstrating the use of groundwater age distributions for the design and assessment of monitoring programmes, pollution trends and history and the evolution of groundwater quality
- Assessing vulnerability of the upper aquifer to pollution using GIS and comparing vulnerability assessment methods used depending on data available and the different hydrogeological conditions in Europe
- Developing a consistent approach to groundwater monitoring for Organic Emerging Contaminants (ECs) in terms of sampling, site selection, monitoring frequency and methodology (including analytical

techniques) and to ensure it is effective and data are comparable across the range of European geological and environmental settings

The HOVER project will also address the development of common standards, database and maps. The database, at the interface of the Information Platform Project will contain information on: soil properties geological characteristics, hydrogeological processes, data quality and physico-chemical parameters, dominating pressure at wells or well subterranean catchments.
One of the objectives of the project is the collaboration of a large number of GSO's for data sharing, technical and scientific exchange that will permit taking into consideration all geological and hydrogeological specificities of Europe in the final products proposed.

1.2. Relation to existing EU programmes and projects – examples of more specific projects

The project is strongly linked to the **Water Framework Directive** (2000/60/EC) and the **Groundwater Directive** (2006/118/EC) since it will provide a basis at a European scale for the estimation of the natural background level necessary for the estimation of the chemical quality of the water, for the design of the monitoring network in relation to emerging contaminants, for a better understanding of the time lags for trend reversal and for evaluation the efficiency of programme of measures. It give also elements of understanding of the hydrogeological functioning such as relation between groundwater and surface water or attenuation processes, needed for the evaluation of the chemical status.

Various topics related to the implementation of the WFD are discussed under the **Working Group on Groundwater** (WGGW) of the Common Implementation Strategy (CIS) of the European Community. For example an initiative was launched three years ago aiming at defining the concept and methodology of a Groundwater Watch List. NERC and BRGM belong to this Initiative Group and will ensure knowledge exchange in relation to emerging contaminants. Various project partners are part of the CIS WGGW and are involved in WG initiatives such as threshold values, trend assessment…

BRIDGE (FP6-policies - Background cRiteria for the Identification of Groundwater Thresholds, Hinsby et al., 2008, Wendland et al., 2008) and **BaSeLiNe** (FP5 - Natural Baseline Quality in European Aquifers: a basis for aquifer management) former EU projects permitted to establish the bases for the estimation of the natural background levels and calculation of threshold values. Many of the eurogeosurveys involved in HOVER were partners of these two projects.

GTK and BRGM are involved in the **AgriAs-project** (Evaluation and management of As contamination in agricultural water and soil) for the EC WATERWORKS2015 ERA-NET Call: Joint WaterJPI Call on Sustainable management of water resources in agriculture, forestry and freshwater aquaculture sectors initiated in 2017. The project is directly linked to HOVER WP3. Data collected and information on the natural origin of arsenic will be an important support to AgriAs to reach its wide objectives.

The CE-project **TRANSENERGY – Transboundary Geothermal Energy Resources of Slovenia, Austria, Hungary and Slovakia** which started in 2010 involved the geological surveys of the 4 countries and will provide various data from the five pilot sites studied. Also **DARLINGe** - Danube Region Leading Geothermal Energy project (2017/2019 Interreg Danube Transnational Programme*)* for a more efficient thermal water management applying geological and hydrogeological models and hydrogeochemical and isotope hydrology data interpretation involved GEO-ZS, HGI-CSG, IGR, FZZG. The project has cross thematic relevance for HOVER and the geoenergy theme of GeoERA.

The WP on GW-SW relation relates to the **BONUS Soils2Sea** and the **ACWAPUR** projects both funded by EU Programs and national research agencies. The WP will benefit from results on nitrate transforming processes in the subsurface being the focus of **Bonus Soils2Sea.** This work package also relates to **ACWAPUR** where transformation of emerging contaminants are studied in soil and sediments during managed aquifer recharge.

The **COST Action 620** "Vulnerability and risk mapping for the protection of karst aquifers" project is closely related to the WP7. The outputs of the project and subsequent studies will be evaluated in task one of the WP (intercomparaison of existing methods).

A sub-group on groundwater of the working group on Prioritisation of emerging substances in the monitoring programs was created three years ago under the **NORMAN** network (Network of reference laboratories, research centres and related organisations for monitoring of emerging environmental substance). This working group is led by BRGM who is also in charge of the WP related to emerging contaminants.

1.3. Concept and methodology

1.3.1. The Project Proposal and the main ideas, models or assumptions involved

The overall concept underpinning the project proposal is the application of our excellent knowledge of the geological and hydrogeological properties of the subsurface and their functioning as dominant drivers of the concentration variability of natural and anthropogenic elements in groundwater coupled with the necessity to share data and develop IT (information technology) tools for water resource management.

Concentrations of elements in European groundwater are very diverse as was recently underlined by the European Commission in taking into account the large ranges of concentrations of dissolved element of natural origin within the Water Framework Directive for establishing the chemical status of groundwater and for risk assessment. Project activities related to geogenic diversity are mainly included in the work package 3 on **Hydrogeochemistry and health: Mapping groundwater characteristics for the management of aquifers naturally enriched in dissolved elements.**

High concentrations of elements in groundwater result in human health concerns and for good status objectives for groundwater itself and associated surface waters. Unacceptably high concentrations of Potentially Toxic Geogenic Trace Elements (PTGTEs), such as arsenic, in drinking water can pose a serious risk to human health and therefore recommendations for best management practice in the context of naturally high concentration are proposed. Determination of the anticipated concentrations of some critical elements (toxic or undesirable elements) of natural origin was tackled previously in European scale projects involving various eurogeosurveys (NERC, BRGM, TNO, BGR…). The HOVER project intends to update and improve the methods developed based on the most recent scientific developments and knowledge and the improvement of chemical data monitoring (lower quantification limits, more frequent measurements). A very large number of countries involved (22), representing all geological / hydrogeological settings will participate in these specific activities that aimed at strengthening the methodology and mapping various management indicators (Natural background level NBL, HydroGeoToxicity (HGT) indicator).

The concentration of elements in groundwater is one of the major criteria for defining special water such as mineral or thermal water. Thermal and mineral water are strongly connected with special geological structures and they represent important natural resources naturally enriched in geogenic elements. Thermal waters and medical springs are mostly used in spas due to their medicinal benefit. Exchanging information on the specific characteristics of these special waters would first be needed before developing a pan European information layer. Mapping this strategic resource is conducted to enhance the awareness of these special types of groundwater among professionals and public.

The implications of the interactions between groundwater (GW) and surface water (SW) in the GW-SW transition zone are related to both geogenic and anthropogenic elements. The GW-SW transition (“hyporheic”) zone is a hotspot for biogeochemical processes controlling contaminant degradation. The specific aim of **WP4 on Linking aquifer microbial ecology and diversity to contaminant transforming processes at European groundwater-surface water transition zones** is to 1) increase our understanding of how groundwater ecology and microbial diversity impact contaminant transforming processes in GW-SW transition zones and 2) provide knowledge on GW-SW diversity and its potential use for GW management as a first step toward the development of a European GW ecosystem assessment scheme.

Nitrate and pesticides continue to be of major concern for groundwater use and environmental impact.and these are address within WP5 **Nitrate and pesticides transport from soil to groundwater receptors**. This WP aims to develop an understanding of the transport of nitrate (N) and pesticides (PST) in groundwater both for travel times in the unsaturated and saturated zones and for attenuation by denitrification in anoxic zones. This will result in a better understanding at the Pan European scale of the time lags for trend reversal, following programmes of measures to reduce N or PST applications to take effect in groundwater and associated surface water.

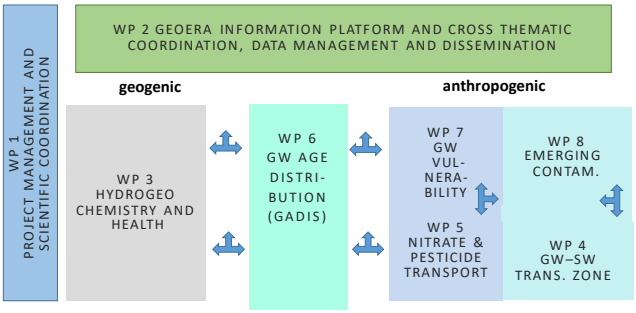
In close collaboration with WP5 e.g. on transfer time of nitrate, WP 6 **Groundwater *A*ge *DIS*tributions and residence times in European aquifers** intends 1) to establish a harmonized database on groundwater age tracers and indicators currently existing in EU member states 2) to develop a good practice protocol on the application of age indicators for estimation of groundwater age distributions in time and space, 3) to demonstrate the use of groundwater age distributions for various hydrogeological purposes and 4) to test and develop new techniques for estimating age distributions of groundwater bodies and water supplies wells with residence times mainly in the age range of 10 to 1000 years.

Vulnerability maps is a widely used tool for groundwater management. The **WP7 Harmonized vulnerability to pollution mapping of the upper aquifer** will permit to carry out: 1) Investigation, comparison and potential extension of methods for assessment of groundwater vulnerability to pollution in Europe, 2) Harmonization of data referring to pan European, cross-border and national scale, 3) Assessments of vulnerability of the upper aquifer to pollution using GIS, 4) Identifying specific areas of high aquifer vulnerability and 5) Data for the GeoERA Information Platform (GIP).

In recent years some compounds, which are not well monitored, and have poorly known chemical behaviour or degradation products have raised the attention of scientists and water managers. These elements called “emerging contaminants” are the focus of **WP8 Effective monitoring of emerging contaminants: development and validation of new assessment methods.** This work package will develop a consistent approach to GW monitoring for Organic Emerging Contaminants (ECs) in terms of sampling, site selection, monitoring frequency and methodology (including analytical techniques) and to ensure it is effective and data are comparable across the range of European geological and environmental settings.

Finally, **WP2 GeoERA Information Platform (GIP) and cross thematic coordination, data management and dissemination** will define requirements for and facilitate data delivery to the GeoERA Information Platform from the different work packages and develop a communication, dissemination and exploitation plan in close collaboration between the WP and project leaders, the groundwater theme coordinator and the GeoERA secretariat.

1.3.2 Main elements of the WP proposal and their interrelationship



The HOVER project is built around 6 technical WPs (WP3-8, see figure) and two coordination WPs (WP1-2). WP3 consider natural geogenic processes while WP4, 5, 7 and 8 considers groundwater with anthropogenic impacts. WP6 on GW age distribution considers both geogenic and anthropogenic water types and the location of the modern water interface as a vulnerability indicator for deeper aquifers. WP7 considers the vulnerability of upper shallow aquifers.)
Overall objective of this GeoERA initiative is the compilation and delivery of harmonized, findable, accessible, interoperable and reusable geodata, contributing to national and EU general activities in the Common Implementation Strategy (CIS) of the WFD. Monitoring data will be compiled and made available for the different activities. Most of the GSO’s involved in the project are in charge of their national groundwater monitoring databases.

By combining rock geochemistry and hydrochemistry with hydrogeological features (fractures, recharge, caption and discharge zones etc.) we will define main settings associated with concentration anomalies for contaminants and hazardous elements of natural origin, incl. time scales and vulnerability of aquifers to pollution in most of Europe (see below figure)

1.3.3 National or international research and innovation activities linked to the project proposal

Most of the eurogeosurveys are deeply involved in the national groundwater quality and quantity monitoring and associated database management. Also many of these institutes are producing geological, hydrogeological or other thematic maps related to groundwater at local, basin and national scales. Various institutes were involved in the determination of natural background level at the national scale. The activities of each institutes and expertise to lead innovation activities can be found in Annex 4 and table 3.3.

1.3.4 Methodologies developed

One of the major problems in determining the natural background level in groundwater is to discriminate between dissolved elements from geogenic and anthropogenic origins, most particularly in areas where human activities are well developed. Over recent years and following the implementation of the WFD, the quality of qualitative monitoring has improved in most EU countries. Improved sampling frequency and density, and lower detection limits permit sophisticated data treatment today. Additional information were also acquired such as trace elements released by human activities. In this project, it is proposed to perform statistical test analyses using monitoring data, and complementary information (geological and hydrogeological settings, land use). The statistical data treatment focuses on the comparison of the distribution of concentrations of major, minor and trace elements depending on different geological, lithological, land use contexts. Non-parametric methods such as Kruskal-Wallis testing will be used. As the Kruskal-Wallis H test cannot tell which specific groups of your independent variable are statistically significantly different from each other it is necessary, additionally, proceed to a post hoc test (for example Nemenyi post hoc test). The data treatment are realised from an independent way for each of the discrete variable (see below statistical data treatment proposed).

Also to determine the area of influence of each of the studies pressure or natural geology/lithology automatic data treatment using GIS may be employed. The generated dataset will be combined with other physico-chemical parameters such as pH or redox to precise the natural occurrence of elements and explain variability of concentrations in similar context.

Where data are insufficient in number or quality, it is proposed to work by analogies. For that purposes the geological and hydrogeological settings will be grouped by classes of similar characteristics. For example 186 hydrogeochemical units were defined for the purpose of mapping of the regional background values of the groundwater systems (German Association of Geology Services). The classes or type-settings may be used also for studying nitrate transfer, vulnerability or transit time.

The data statistic may be plotted (median, min, max of concentrations, 90th percentile) in order to obtain information at the EU scale on areas with anomalies. Ordinary Kriging will be used to estimate and elaborate specific elements mapping. These maps can be compared directly to the mineral and thermal groundwater resources defined elsewhere.

Indicators may be easier tools than simple dataset statistics for water management. One of the indicator that will be proposed is the HydroGeoToxicity (HGT) indicator defined as the quotient between the concentration of a particular Potentially Toxic Geogenic Trace Elements (PTGTE) in a specific water sample and the upper limit value for that element in potable water according to the (WHO) drinking water regulations (Giménez-Forcada et al., 2017a, 2017b). Other indicators may be proposed and developed so the complex links between a concentration of a specific elements in groundwater and the various rocks and processes where the water is flowing could be represented and used for various water management and health perspectives.

The determination of the homogeneous units/type-settings or classes, combining soils, geological and hydrogeological settings will be the starting point for various work packages. The units or classes to be determined could be “homogeneous” in terms of elements able to be released in groundwater, in term of transfer of water and related contaminants from soil to the saturated zone along the unsaturated zone and within the saturated zone, determining as such the vulnerability of upper aquifers.

Mapping at the pan-European scale is not straightforward as the interoperability issues between data of different origin (from thematic and countries) and the 3D aspects need to be solved. This work will be undertaken in direct collaboration with the Information technology Platform. The work will need to be done in a series of steps: collect the geological surveys information on available data and format, develop tool to collect uniformity, (re) interpret, manage and visualize data, provide pan European information layers using specific format such as WMS and then enhance the awareness among professionals and general public.

The goal of the vulnerability WP is to prepare vulnerability maps reflecting these causalities, resulting in products at the Pan European (1:1.5 Mio), supra-regional (1:1.5 Mio), cross-border (1:250k) and optionally national scale, each referring to the potential aquifer vulnerability to pollution. Parametric system methods for assessing vulnerability (rating systems such as DRASTIC, GOD, AVI; point count system models, such as SINTACS, EPIK) are used for establishing these maps. These methods will be evaluated and applied according to the aforementioned criteria.

Overall lag times for type-sites of different hydrogeological settings will be combined with harmonised monitoring data and process indicators to develop overview maps of N and PST travel time. We will apply a similar approach to denitrification.

At small scale, a specific study will be carried out related to the groundwater-surface water relationship in order to assess the environmental impact. Sediments will be sampled from the hyporheic zone of different European river systems and characterized in terms of microbial diversity and potential for sorption and degradation of selected contaminants, including nitrate. The microbial community structure of the sediments will be determined by 16sRNA amplicon sequencing and related to the presence of contaminant degrading bacteria determined by qPCR as well as hydrological and geochemical conditions of the specific site. Finally, relationships between sorption, degradation, presence of degrader genes, as well as hydrological and geochemical characteristics at the GW-SW interface will be established.

Projects are proposed to be carried out at three different scales: pan-European studies with the objectives of covering the largest number of countries in thematic maps or indicators, multi-pilot projects including a great number of functioning classes/units so results could be extend to other countries and small scale, demonstration or methodological studies that meant to produce guidelines, recommendation for good practices or to propose advances for further scientific developments.

In that sense, some activities would lead to thematic maps including most of the participating countries. This is the purpose of WP3 proposing a map of natural water quality and health including thermal and mineral water over Europe. In addition, a vulnerability map to pollution of the upper aquifer will be built.

For developing water quality management tools, Pan-European activities will use geological/lithological contexts as much as possible. These activities are the assessment of N travel times and attenuation patterns (WP5), the establishment of the spatial distribution of groundwater age and vulnerability classes in selected countries, spatial distribution of some selected emerging contaminant.

Lastly, many proposed activities will lead to recommendations for monitoring (age indicators, emerging contaminant), preparation of guidance on i) characterizing agrochemical travel time in the unsaturated and saturated zones, ii) good practice protocol and recommendations for the combined use of different age indicators and models, iii) recommendations on statistical data treatment to evaluate influence of anthropogenic pressure on groundwater dissolved elements or vi) on the use of microbial diversity measures for monitoring contaminant transforming processes at GW-SW transition zones.

1.4 Ambition

Water quality is one of the major problems in European aquifers, with various areas with high content of toxic elements of natural origin (Reimann and Birke, 2010), nitrate and pesticides concentrations over the quality standards for human use (report from the commision to the european parliament and the council on the Implementation of the Water Framework Directive (2000/60/EC) River basin Management plans, 2012; Life's blueprint for water resources, European union, 2012) or degradation of associated ecosystems due to nutrients. Beyond the evaluation of groundwater quality at sampling point or water bodies it is necessary to understand the geological and hydrogeological settings related to the geogenic chemicals and the pressure and transfer processes of the anthropogenic elements. The HOVER projects will put great emphasis on the European scale of the application of the results and therefore would base most of the study on the description and definition of "type-setting" allowing extension of the information acquired at large scale.

Thermal and mineral waters, medical springs are important natural resources. Thermal waters and medical springs are mostly used in spas due to their medicinal benefit. Mineral waters are extremely important for beverage industry. One of the important deliverable of WP3 is getting a Europe-wide overview on special groundwater (thermal and mineral) which are of great economic value and an overview of the anomalies in trace elements based on a uniform method. Some transboundary projects are on-going (**TRANSENERGY, DARLINGe**) and national maps and inventory of thermal and mineral resources exist in most countries. The objective of the project for high salinity water is to use existing data and knowledge developed within the national or multi-partnered projects, in order to establish a map of these special water on a homogeneous way at a European scale.

Groundwater forms an important source of potable water in Europe. The Drinking Water Directive (98/83/EC) imposes stringent quality criteria, for drinking water. For various trace elements, such as arsenic, the legislation establishes limits that are often exceeded, even under natural conditions. The geological matrix and hydrogeological processes are what largely determines the presence of certain trace elements in groundwater. Unacceptably high concentrations of arsenic and other Potentially Toxic Geogenic Trace Elements (PTGTE) in drinking water can pose a serious risk to human health and mapping probabilities of exceedance of the threshold permitted by the Water Framework Directive allow delimiting the most vulnerable areas. The existing geostatistical techniques are a common tool for the evaluation of these maps, though, there is no agreement on which of the methods is the best. Elements such as As, Ba, Cd, Cr, Cu, F, Fe, Hg, Mn, Pb, Ni, Se, Sn or Zn are potentially present in groundwater and may create management problems linked to human and environmental health. Studies at pan-European scale based on chemical analyses of some tap water (Flem et al. 2015) or bottled water (Reimann and Birke, 2010) as well as the threshold values reported to the EU commission (commission staff working document accompanying the Report from the Commission in accordance with Article 3.7 of the Groundwater Directive 2006/118/EC on the establishment of groundwater threshold values, SEC(2010)166 final) are giving a first overview of the spatial distribution and importance of anomalies of the main dissolved elements of geogenic origin in Europe. However none of these studies proceeded to a systematic analyses

of the concentrations of dissolved elements in the groundwater in relation to the geological/hydrogeological settings. There is a need then to share the new methodological advances used to determine the natural background level (NBL), to link the results obtained to geological/hydrogeological type-settings in order to build maps and developed at European scale some management indicators. One of these indicators will be the HydroGeoToxicity (HGT) indicator defined as the quotient between the concentration of a particular Potentially Toxic Geogenic Trace Elements (PTGTE) in a specific water sample and the upper limit value for that element in environmental or drinking water regulations (WFD, Drinking Water Directive, WHO). This indicator was tested successfully in some part of Spain (Gardiola-Albert et al., 2017).

The interface between groundwater and surface water is a highly active zone for geochemical and microbial processes. This so called hyporheic zone potentially could provide conditions favourable for the degradation of pollutants such as pesticides, fertilizers and other organic contaminants (Batioglu-Pazarbasi et al., 2013), either before groundwater is discharged into surface waters, or vice versa when pollutants enter groundwater from surface water bodies (e.g. by river bank infiltration). For the WP 4, the ambition is to provide a framework for harmonization of a groundwater ecosystem assessment scheme in Europe, mentioned as a challenge in the recent report from the WFD CIS Groundwater working group (Robertson et al., 2017). It is hypothesised that microbial diversity measures can be used to identify contaminant degradation potentials controlling contaminant fate at the GW-SW interface. It is also hypothesised that the microbial diversity is shaped by the discharge of contaminants as well as hydrological and geochemical parameters, especially the redox conditions. The WP take a European approach because contamination of groundwater and surface water bodies is a problem throughout Europe. The WP will reveal similarities between microbial diversity of European hyporheic zones and environmental parameters controlling this as a first step towards the development of a European ecosystem assessment scheme.

Nitrate and pesticides remain widespread anthropogenic groundwater pollutants in Europe, despite interventions under the EU Water Framework Directive and the Nitrates Directive. Subsurface transport can be slow, with delays of up to decades between the implementation of catchment measures and responses in abstracted groundwater quality. Redox reactions add considerably to the uncertainty of nitrate breakthrough. It is still highly challenging to evaluate the impact of reductions in agrochemical loadings on groundwater and surface water quality. Whilst some member states have attempted to quantify groundwater lags and denitrification (Wang et al. 2012), little work has addressed this at the European scale (Ascott et al., 2017). Within the WP5, we aim to overcome difficulties by harmonization of data and developing a conceptual framework that accounts for the different hydrogeological conditions in Europe and allows parameterisation of similar settings across member states.

Groundwater quality and protection closely relates to the spatial and temporal distribution of groundwater age and residence time of the protected groundwater body (Hinsby et al., 2007). GSO's and other European research organisations have applied groundwater dating for decades to improve the understanding of groundwater flow and transport and currently an increasing amount of authorities, water supplies and bottled water companies use groundwater dating by many different tracers for assessing the vulnerability of aquifers towards pollution, contaminant trends and history. However, no general overview of existing data and good practice guidance exist in Europe. The "GADIS" WP6 will collate data and continue developing research and knowledge obtained in several previous EU projects such as Palaeaux (Edmunds and Milne, 2001; Hinsby et al., 2001), Baseline (Edmunds and Shand, 2008), and national programmes (e.g. Kloppmann et al., 1998, Broers, 2004, Gooddy et al., 2006, Gourcy et al., 2009, Hansen et al., 2011, Sonnenborg et al., 2016). These projects have provided important contributions e.g. for understanding the relation between groundwater age and quality in relation to EU groundwater policy (Hinsby et al., 2007), the management of transboundary groundwater resources (Szocs et al., 2013) and the distribution of hydraulic parameters of groundwater models required to simulate spatial distributions of groundwater ages in 3D (Meyer et al., 2017). Very recent work demonstrate the importance of understanding age structure of the groundwater resources, globally e.g. for assessing the vulnerability of aquifers (e.g. Jasechko et al., 2017). The WP will built on and further develop recent research findings regarding groundwater age distributions obtained mainly from EU and national research programmes at GSO's and develop databases, maps and cross sections illustrating the current knowledge about

groundwater age distributions in major parts of Europe. Finally, it will consolidate the collaboration between GSOs and leading groundwater dating research institutions and laboratories in Europe

Vulnerability maps are widely used, as it is an important tool for groundwater management and protection at drinking water wells/spring up to national scale. Various methods were developed depending on data availability, scale mapping, hydrogeological characteristics (specific method for karstic areas for example). The Groundwater Vulnerability Maps show the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties. Other approaches could also be used based on the depth of the unsaturated zone and the capabilities of water to infiltrate (using for example the Index of Development and Persistence of the River network, IDPR). The ambitions beyond the WP7 and vulnerability assessment are to compare methods applied in Europe, to propose a harmonized methodology and maps enabling a pan-European view of groundwater vulnerability to pollution. The workpackage will provide coherent dataset and evaluate the best way to map the information at a pan-European scale not yet proposed.

Organic emerging contaminants (ECs) are now being widely detected at trace concentrations in groundwater (GW) in Europe (Lapworth et al., 2012). These include a wide range of personal care products, lifestyle compounds, pharmaceuticals, newly detected pesticides and metabolites and industrial intermediates and products. Existing monitoring data are contributing to the establishment of a GW “watch list” of emerging pollutants as required by the Groundwater Directive 2006/118/EC (amended by Directive 2014/80/EU), however the wide range of compounds found means that the different monitoring approaches, including sampling and analytical methods, applied to date can lead to different results, outcomes and therefore considerable uncertainty. The project will develop indicators based on risk-assessment principles to link the potential leaching of ECs in groundwater with geological setting and land use, anthropogenic activities, chemical and hazard properties and co-occurring tracers based on comparable data collected across Europe.

2 IMPACT

2.1. Expected impact

The results of WP3 are of importance – first of all – for water management. There will be an international exchange about different approaches concerning special groundwater. WP3 will deliver a WMS (web Map service) which is not only interesting for the water management of bottled mineral water, but also for the beverage industry (at the AQUA 2015 - International Hydrogeology Congress in Rome it was criticised by a representative of a European association of mineral water producers that there do not exist a pan European overview on mineral water). Furthermore an overview on medical springs and spas could be of interest for tourism industry and health service.

The work package will also increase political and public awareness of health issues related to groundwater quality permitting, by developing and mapping indicators, a quick overview on a homogeneous way of the sectors with high concentration of toxic or adverse effect dissolved elements.

Delineating the range of concentration of elements of natural origin over European aquifers will be of great support for the implementation of the water framework and groundwater directive in giving a homogeneous basis for deriving at national level the threshold values to be used in the evaluation of the chemical status and the risk evaluation.

Based on indicators and maps best practices in GW management recommendation will be proposed on i) data quality monitoring, ii) data treatment, iii) delineation of indicators in relation to geological families and case studies of specific GW exploitation in areas of high natural background level would be compiled.

The development of a framework for groundwater ecosystem assessment (WP4) will provide information on presence of degraded bacteria and potential degradation activity and reduce costly monitoring of contaminants at the GW-SW interface in future. Evaluating the potential degradation of the surface water (rivers, humid zones,..) due to groundwater, requested by the WFD and helping management of drinking

water wells, is quite complex and need a great amount of data. Looking for indicators such as bacteria is one of the tool with good application perspectives at basin scale.

The proposed work under WP5 should lead to the development of better groundwater protection strategies through establishing travel times for nitrate and pesticides from infiltration to recharge and discharge zones, and thus the time lag between measures and trend reversal and the recovery of water quality. This will assist stakeholders in the evaluation of measures including NVZ (nitrate vulnerable zone) designations. This data is also needed at the time of making the evaluation of the efficiency of programme of measures to reduce impact of pollution pressure associated to diffuse agriculture. Indeed, delay between the application of corrective actions and the decreasing trend of contaminant concentrations in groundwater makes difficult not only the confirmation of the efficiency of measures but also the awareness of stakeholders.

Geological and hydrogeological settings will also be the entry point to classify the samples in age intervals (WP6) as an indicator of the susceptibility/vulnerability of the aquifers to contamination from human activities on the surface, elevated toxic geogenic elements in deeper aquifers and overabstraction. This information, combined with other indicators, is of great importance for better groundwater protection strategies. The project will aim at demonstrating the use of groundwater age distributions for design and assessment of monitoring programmes, pollution trends and history and the evolution of groundwater quality (chemical status).

The main outcome of the project idea developed under WP7 will be harmonized assessment products for groundwater vulnerability to pollution. The main deliverables are maps that can be used in groundwater management, subsurface spatial planning and environmental decision-making processes both at least national and regional scales, and at a cross-border scale. The project will result in methodological harmonization and the establishment of data interoperability at Cross Border, Pan European optionally national scales. More in detailed the project will permit to contribute to national and EU general activities in fulfilling the objectives of the WFD, and to national and regional authorities in environmental assessment and strategic and regional planning; support European-level strategic assessment, planning and forecasts and provide coherent, pan-European dataset for testing the impact of policy changes (e.g. intensified agriculture or reduced nutrient application) on groundwater;

The WP8 will help European countries to identify ECs of high concern regarding global pan-European settings and adapted to local specific contexts and knowledge and will:

- allow wide access to reliable data to support decision making such as groundwater protection
- New challenges in sampling and analytical methodologies developments regarding the increase of the number of substances of interest and the need for streamlining the ECs monitoring across Europe
- A key outcome will be an overview of GW monitoring status of ECs across Europe. Collected ECs occurrence data will be supplied to the European Commission Data Base IPCHEM.
- The development of novel methods to link EC presence with anthropogenic activities, environmental conditions and co-occurring tracers will help to identify hot spots regarding GW contamination by ECs.
- Identify what are the chemical properties that can be used to estimate the leaching potential of ECs to GW and to evaluate how to take into account usage data in risk assessment procedure
- Supporting the implementation of the GW "watch list", definition of pollutants of concern and subsequent consideration for Annex I and II revision, further work is required to ensure effective monitoring is undertaken that is consistent across the EU and enables long term protection of GW, human health and GW dependent ecosystems.

Overall impact of this GeoERA initiative is the compilation and delivery of harmonized, interoperable and comparable geoscientific information, contributing to national and EU general activities in fulfilling the objectives of the WFD. The degree of harmonization depends on data availability, scale of investigation and applied methodology. The improved databases and visualization tools proposed related to thermal and mineral water distribution, natural background levels and related indicators, vulnerability assessment, on groundwater age tracers and indicators currently existing in EU member states are some of the products

that will be produce at pan-European scale for supporting health and environmental issues related to the quality of groundwater.
Also best practice guidance from demonstration projects will be proposed in different hydrogeological settings to support harmonized management strategies and most widely:

- to apply statistical data treatment related to the development and mapping of indicators
- to define the best methodology to organize and visualize data collected
- to test and develop new techniques for estimating age distributions of groundwater bodies
- to monitor key parameters with reference to environmental context, geological setting and risk assessment

2.2. Measures to maximize impact

Three seminars will be held, kick-off seminar (within the first 3 months of the beginning of the project), mid-term seminar (M18) and the final seminar (M34). All HOVER project partners will participate but also the other eurogeosurveys and participants of the other GEOERA when interested and most particularly the Information Platform. These seminars will be divided in three parts; a first time needed for exchange and strengthening collaboration between project partners, second time to ensure collaboration with other GEOERA partners and GEOERA projects, especially the Information Platform project and the last time devoted to public and stakeholder awareness.

The project progress will be presented at least once a year to the WFD CIS (Common Implementation Strategy) working group on groundwater and also, especially for emerging contaminant to the CIS working group on chemicals.

The Advisory Board will be used to communicate with the European Environmental Agency, the Joint Research Center, the EC and the International association of Hydrogeologist (IAH). The GEOERA website and GEOERA Information Portal will be the main mean for day-to-day communication.

Also each of the work packages are including internal seminars and workshop dedicated to the work organisation and exchange of information between eurogeosurveys. This is an essential part for the HOVER project considering that as many as possible pan-European products will be proposed.

A specific workshop will be organised together with the WP3 and WP7 but also partners involved in the WP6 of the RECHARGE project dedicated to Pan-EU Groundwater Resources Map and partners of the Information Platform project. The workshop that may be organised around M18 will be especially dedicated to groundwater mapping.

The production of papers will also be promoted considering different type of audience: Academic and scientific community by publications in peer-reviewed journals, at scientific conferences, web sites; Policy makers by recommendations, web site, newsletters, maps; Stakeholders by Web sites, presentation, technical publication, maps; General public by articles in national press, flyers/brochures and project/work package partners by GeoERA dissemination seminars (Kick-off, Mid-Term, Final Seminar), GeoERA intranet, project member meetings/workshops. Are already planned an Internal workshop on modelling lag times for nitrate and pesticides (WP5) and Journal papers on modelling lag times at the European scale and on denitrification (WP6).

Dissemination activities will be implemented throughout the entire project duration with messages tailored to the receivers/audiences. At the early project stage, focus is on raising awareness about the project, at the end of the project on achievements and deliverables.

2.3. Contribution of Project Proposal to the Information Platform or vice versa

As the cross-thematic integration of information is an important aspect to be addressed in GeoERA most of the Workpackages will develop specific deliverables based on Spatial Information that effectively integrates all ICT-related and technical issues (database and dissemination). These deliverables are clearly identified to be directly linked to the GeoEra Information Platform. The platform will address the

development of a common geoscience information platform capable of integrating up-to-date data, interpretations and models from different and distributed sources.

The databases compiled in WP3, 5, 6, 6 and 8 will be prepared together with IT experts of the Information Platform to insure interoperability and homogeneity of data. At pan-European scale data to be compiled concerned soil, geological and hydrogeological environment. Data collected within the project and raw data already available but also created data such as indicators would be made available through the Information platform. In turn, the Information Platform will give support to prepare the final products such as maps and web services. The most direct links with the Information Platform identified are:

- **Data compilation and database** preparation in order to make them available through web services in all WP
- **Delineation of hydrogeological type–setting** prepared in collaboration with WP3, WP5, WP6, WP7 and WP8 – the hydrogeological type-setting is an important intermediate product as it will be used for most of the WP, may be used to complete information in some sectors/countries not having data/not involved in the project and may be used in the future by the GW community to develop other thematic maps or products
- Preparation of **maps and web services** in WP3, WP5, WP6, WP7 and WP8

Communication with the Information platform will be made through information meeting between the coordinators of both projects and IT experts and WP leader for the technical issues. Also a meeting is planned at the beginning of the project between the Project Board committee and the IP coordinators in order to define the respective expectations (data format, tools, INSPIRE requirements,..). A mid-project meeting, before initiating the various tasks aiming at building maps and web services is also proposed.

3. QUALITY AND EFFICIENCY OF THE IMPLEMENTATION

3.1. Work Plan – Work packages, deliverables

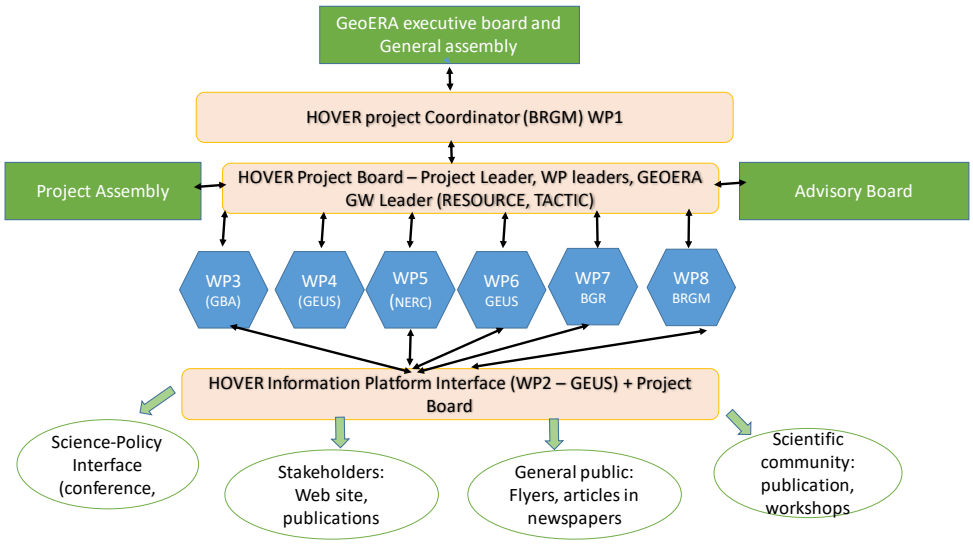
The HOVER project is composed of two management and coordination workpackages and 6 technical WP as described in 1.3.2. One workpackage is dedicated to the study of element of natural (geogenic) origin in groundwater and four WK are focusing on anthropogenic contaminants (nitrate, pesticides and organic emerging contaminants) and their transfer from soil to the aquifer through the unsaturated zone and transport within the saturated zone. One (WP6), centred on groundwater age distribution, is of both geogenic and anthropogenic concern. The timing of the different work packages and their components is given in the below Gantt. In red colour, the activities with most inter-correlations (related to hydrogeological type-settings and vulnerability) and in green the tasks more specially linked to the Information Platform (see also 2.3).

3.2. Management structure, milestones and procedures

As described in the GEOERA Project Agreement the governance bodies are : **Project Assembly** (PA) as the ultimate decision-making body of the Project Consortium ; **Project Board** (PB) as the supervisory body for the execution of the Project which shall report to and be accountable to the Project Assembly and consist of the Project Lead and the WP Leaders ; The **Project Lead** is the legal entity acting as the intermediary between the Parties and the GeoERA Executive Board; **Work Package Leads** (WPL) lead the different Work Packages ; **Task leads** (TKL) lead the different tasks of work packages.

The management and coordination of the project will be led by the **Coordinator** BRGM (French Geological Survey). BRGM will be the official contact between the participants and the GeoERA General Assembly and Executive Board and amongst the project partners. BRGM is responsible for the overall execution and progress of the project, including planning and content. A working team, staff of BRGM well experienced in European project coordination, scientific and technological outputs, planning and communication, financial and administrative issues, will support the project coordinator. The coordinator will be responsible for the communication of all relevant project information from the GeoERA Executive Board to the partners, for regular reporting, for the distribution of funding to the partners, for establishing and maintaining consortium agreement in cooperation with the Project Assembly. To do so, the coordinator will implement the scientific orientations decided by the Project Board (PB), coordinate progress reporting, prepare formal decisions together with the SC and plan the corresponding meetings. Concerning the project activities, the coordinator will monitor the progress of the activities on a regular basis and organize the Consortium Meetings and Workshops.

The coordinator (BRGM) in close connection with the PB will carry out the general management of the project (covered by the work package WP1). The general organisation is illustrated schematically below.



The **Project Board** (PB) is the executive board of the project where the progress of the overall project is discussed in depth. The chairman is the Project Coordinator. Each of the member of the PB have the responsibility to insure full involvement in project decision of the partners actively participating in their respective workpackages. The Project Board does the operational steering of the project in terms of scientific goals, progress, finance, quality, dissemination and exploitation and will discuss the scientific and technological progress; in relation to the SRT call.

The **Workpackages leaders** belong to the Project Board. They will insure the adequate development of the technical and scientific work planed within their workpackages. They report regularly to the Project Leader. They have in charge the preparation of the WP workshops during the general GEOERA meetings. For technical and organisational issues they have the support of the task leaders.

Project Assembly (PA) is the formal decision-making and arbitrary body. The PA is responsible for the execution of the project in terms of science, management and finances. All partners will have a seat in the PA giving the right to vote. In addition, the progress, achievements and overall course of the project will be discussed in the PA. The PA will convene at the three consortium meetings.

The **Advisory Board** is meant to provide experience from the knowledge and management point of view and to give advice to the Project Board based on past or present position in International organisations or partners of International project related to topics developed in HOVER. The Advisory Board will be convened to the three annual project meetings. The two experts composing the advisory board will also be consulted from time to time on an informal mode (visio/web conf). The Advisory Board is composed by:
Adam Porowski (Poland) - specialist in groundwater origin and isotope hydrogeology at the Institute of Geological Sciences PAS, Vice-president of the IAH Commission on Mineral and Thermal Waters.
Johannes Grath (Austria) – Head of unit Groundwater, GW science and policy expert at the Environmental Agency of Austria (Umweltbundesamb) – Chair the EU CIS Working Group Groundwater

The schedule of different HOVER meetings is shown below:

		Year	2018		2019				2020				2021				Year
		Month	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	37-39	>39	Month
HOVER meetings		Durée															
Project Assembly (kick-off, Mid-term, Final)	30/07/2018	30															
Project Board meetings	30/07/2018	30															
Advisory Board meetings	30/07/2018	30															
Workpackages meetings (eventually combined with other GEOERA projects)	31/01/2019	62															
Information Platform seminars	30/07/2018	30															

For optimisation purposes, the advisory board, Consortium assembly, Project Board committee and workpackages meetings will be organised at the same period and place. The time of the second seminar with the GIP team will be proposed around Month 18 in agreement with other GEOERA projects.

It is also proposed to organised one additional workshop about 6-8 months after the beginning of the project in order to discuss more in details the two activities related to the preparation of the hydrogeological-settings and vulnerability assessment. The Project Board will met at that time also. A first evaluation of project's progress is needed soon after the initiation of the project. This workshop could, if considered necessary, be combined with workshops of the GEOERA project RESOURCE and TACTIC as some activities have already been identified as having scientific links. Various web workshops could additionally be organised by the WP leaders within the duration of the projects. In addition it is scheduled to have regular web meeting between the groundwater project coordinators (every 3 months) and it will be decided whether additional face-to-face meetings are required at these meetings.

The schedule of HOVER activities can be summarized as follow:

	2018		2019				2020				2021			
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	37-39	>39
WP1 Project management and scientific coordination														
WP1.1 Consortium internal organisation, progress and communication														
WP1.2 Communication to the GeoERA Executive Board														
WP1.3 Contract and financial administration														
WP1.4 Overall coordination of the scientific programme														
WP2 IP & CT coordination, data management and dissemination														
WP2.1 Development of the data management plan														
WP2.2 Identification of information products and data requirements														
WP2.3 Communication, dissemination and exploitation plan														
WP3 Hydrogeochemistry and Health														
WP3.1 Harmonization of terminalogy, data inventory														
WP3.2 Defining hydrogeological classes/families														
WP3.3 Common methodologies to calculate NBL														
WP3.4 Determination of indicators (NBL, geoenvironment and health)														
WP3.5 Preparing and producing maps, web services														
WP4 Groundwater - surface water transition zone														
WP4.1 Selection and characterization of pilot sites														
WP4.2 Mineralization and degradation rate														
WP4.3 Use of microbial ecology for GW management														
WP5 Nitrate and PST transport from soil to groundwater receptor														
WP5.1 Characterizing agrochemical travel time														
WP5.2 Evaluating GW monitoring data														
WP5.3 Modeling nitrate and pesticides transport														
WP5.4 Assessing the spatial extent and importance of denitrification														
WP5.5 Overview maps														
WP6 Groundwater age distribution and residence time in Europe														
WP6.1 Developing a database of existing age indicators														
WP6.2 Use case and good practice guidance														
WP6.3 Application of GW age distribution for monitoring and trends														
WP6.4 Application of new tracers and modelling techniques														
WP7 Harmonized vulnerability to pollution mapping														
WP7.1 Investigation on appropriate methodologies														
WP7.2 Data harmonization for Pan-European and cross-border sites														
WP7.3 Assessing vulnerability of the upper aquifer to pollution														
WP7.4 Volume and areas of special aquifer vulnerability														
WP8 Effective monitoring of emerging contaminants														
WP8.1 Review of occurrence data, sampling and analytical methods														
WP8.2 Relationship of EC with environmental settings														
WP8.3 European sampling and interlaboratory testing														
WP8.4 Identification of EC of high priority in Europe														
WP8.5 Development of monitoring recommendations														

3.3 Consortium as a whole

As nearly all partners are GSO's they have considerable knowledge and expertise in geology and hydrogeological functioning of their own country. Due to different hydrogeological settings and involvement in EU projects, the GSO's have developed different experience and expertise in groundwater management. The synthesis of GSO expertise relevant for HOVER is given in the following table[2].

Key elements of the topic and of HOVER objectives	**Number and names of HOVER participants supplying skills & experiences relating to the key elements** *(see also section 1.3)*	
Building database and web services	19	BRGM, TNO, BGR, ICGC, MBFSZ, ISPRA, NERC, IGR, GEUS, GeoZS, IGME, GBA, EGT, GSB, LNEG, GSI, FZZG, LGT, LBGR
Multicriteria analysis and GIS	16	BRGM, BGR, ICGC, MBFSZ, ISPRA, IGR, GEUS, GeoZS, IGME, GBA, EGT, GSI, FZZG, ISOR, LGT, LBGR
Geo ICT (information and communication technologies)	5	BRGM, TNO,DLT, IGR, GEUS
Hydrogeological processes	17	BRGM, TNO, ICGC, MBFSZ, ISPRA, MTI, NERC, IGR, PIG-PIB, GEUS, GeoZS, IGME, LEGMC, GBA, EGT, GSI, GTK
Geological and lithological characteristisation	24	BRGM, TNO, DLT, BGR, ICGC, MBFSZ, ISPRA, MTI, GSS, IGR, PIG-PIB, GEUS, HGI-CGS, GeoZS, IGME, GBA, LBEG, EGT, LNEG, GSI, FZZG, ISOR, LGT, HSMGE
Groundwater (bio)geochemistry	15	BRGM, TNO,DLT, ICGC, MBFSZ, IGR, PIG-PIB, GEUS, GeoZS, IGME, LEGMC, GBA, EGT, GSI, GTK
Modelling of groundwater flow and solute transport through saturated zone	12	BRGM, DLT, MBFSZ, NERC, IGR, GEUS, HGI-CGS, GeoZS, IGME, EGT, GTK, ISOR
Hyporheic zone processes and interactions between GW and SW	6	BRGM, TNO, DLT, GEUS, LEGMC, GSI
Statistical data treatment	13	BRGM, TNO, DLT, BGR, SGU, MBFSZ, ISPRA, GEUS, GeoZS, IGME, LEGMC, GBA, GSI
Analyses of emerging contaminant	6	BRGM, TNO, DLT, NERC, PIG-PIB, GBA
Isotope and environmental tracers including age dating	10	BRGM, TNO, MBFSZ, PIG-PIB, GEUS, HGI-CGS, GeoZS, EGT, GSD, GTK
Pressure and impact analyses of diffuse origin contaminants (nitrate and pesticides)	13	BRGM, TNO, DLT, BGR, NERC, PIG-PIB, GEUS, HGI-CGS, GeoZS, LEGMC, GSI, GSD, GTK
Assessing and predicting the mobility and impacts of pollutants from soils to groundwater	8	BRGM, MBFSZ, NERC, GEUS, HGI-CGS, EGT, GSI, GTK
Mapping of water resources	22	BRGM, TNO, BGR, ICGC, SGU, MBFSZ, ISPRA, GSS, IGR, PIG-PIB, GEUS, GeoZS, GBA, EGT, GSB, LNEG, GSI, FZZG, ISOR, LGT, LBGR
Groundwater Monitoring	14	BRGM, TNO, SGU, VMM, MBFSZ, PIG-PIB, GEUS, IGME, GSB, LNEG, GSD, ISOR, LGT, HSMGE
Policy-support and dissemination towards national and European Institutes	18	BRGM, TNO, BGR, VMM, MBFSZ, ISPRA, MTI, NERC, IGR, PIG-PIB, GEUS, GeoZS, GBA, GSI, GSD, GTK, ISOR, LGT

3.4 Resources to be committed

Table 3.1a) Workpackage description

Workpackage number	**WP1**	**Lead beneficiary**			**BRGM**			
Work package title	Project management and Scientific coordination							
Participant number	1	3	12	15	17	54		
Participant short name	TNO	GBA	GEUS	**BRGM**	BGR	NERC		

[2] NOTE! Deltares (DLT, Netherlands) participates in the HOVER as "Third Party" for TNO as indicated in the Grant Agreement of GeoERA. It is listed separately in the financial tables and work package descriptions in order to make clear where they will contribute to HOVER.

Person-months per participant:	1	2	2	9	2	1		

Start month	1	End month	**42**

Objectives

The main objective of WP 1 is administrative, and scientific management of the consortium including communication to the GeoERA Executive Board, Internal and external administrative management, project internal communication and management, financial and management reporting, legal aspects for consortium management, risk management within the project, overall coordination of the scientific programme and activities, coordination of day-to-day technical

Description of work

Task 1.1 – Consortium internal organisation, progress and communication (Lead: BRGM)

- Organisation and administration of Consortium meetings
- Administrative support to workshops, project meetings, conference etc.
- Controlling the timely realisation of deliverables and milestones
- Overall project risk management
- Adaptation and initialisation of measures to guarantee the success of the project
- Design, initialisation and follow-up of contingency plans

Task 1.2 – Communication to the GeoERA Executive Board (Lead: BRGM)

- Focused contact and keeping Executive Board updated on project progress
- General information gateway and responsibility to react and answer specific requests
- Preparation and delivery of periodic progress reports (annual expenditure reports, midterm and final reports – all delivered within 60 days following the period covered)
- Preparation of meetings and interactions between the Advisory Board and the Project Board
- Follow-up on responses received from the GeoERA Executive Board

Task 1.3 - Contract and financial administration (Lead: BRGM)

- Allocation of budgets, transfer of funds
- Updates on accounting and contractual rules (including consortium agreement)
- Preparation of financial data for detailed implementation
- Preparation of audits and cost statements
- Annual summary expenditure report

Task 1.4 – Overall coordination of the scientific programme (Lead: BRGM)

- Preparation and follow-up of a detailed implementation plan during the entire project
- Supervision of work package coordination and support to cross-cooperation between work packages and other relevant projects funded through GeoERA (in coordination with WP2)
- Support to implementation of the scientific work at work package level
- Content management of scientific workshops and organisation of the scientific and technical topics to be discussed at the Consortium Meetings

Deliverables

D1.2a: Project progress report – **M20**
D1.2b: Final project report – **M42**
D1.3a: Cumulative expenditure report 2018 - **M7**
D1.3b: Cumulative expenditure report 2019 - **M19**
D1.3c: Cumulative expenditure report 2020 - **M31**
D1.3c: Cumulative expenditure report 2021 – **M42**

Workpackage number	**WP2**	**Lead beneficiary**			**GEUS**				
Work package title	GeoERA Information platform (GIP) and cross thematic coordination, data management and dissemination								
Participant number	3	12	15	17	54				
Participant short name	GBA	**GEUS**	BRGM	BGR	NERC				
Person-months per participant:	1.5	5	1	1.5	1				
Start month	1				**End month**	**40**			

Objectives

1. To define and coordinate data and information handling from all HOVER WPs and develop a Data Management Plan (DMP) in collaboration with the GIP team in order to make HOVER data findable, accessible, interoperable and reusable according to GeoERA D1.3 and the "FAIR" principles of H2020.
2. To develop a project communication, dissemination and exploitation plan including social media, the project web site and scientific journals. Where required in collaboration with the other themes and the GeoERA secretariat and following the dissemination and exploitation plan (D5.1) of GeoERA.

Description of work

Task 2.1: Development of the data management plan (Lead: GEUS)

A database management plan (DMP) will be established in close cooperation with the GIP Project team, using the provided DMP template developed by the GeoERA secretariat. The DMP is established to support the interaction between the GIP and the HOVER projects and facilitate identification and description of HOVER data to be provided for the GIP.

Task 2.2 Identification of information products and data requirements (Lead: GEUS)

Definition of requirements for data provided to the GIP. Priority will be given to products, which have most benefit to stakeholders of the work under HOVER. Once products from HOVER become available through WP deliverables, the data will be provided to the GIP project for integration in a prototype system. Special attention will be given to the pan-European datasets to be delivered under WP3, 6 and 7 (if possible also WP5 and WP8), in order to make prototyping and implementation efficient within the GIP project. HOVER WP leaders and partners will test data accessibility and GIP functionalities in the different development phases of GIP in collaboration with the GIP team. Information and metadata about HOVER will be included and classified according to the societal challenges of Horizon 2020 in the recently developed European Inventory of Groundwater Research (EIGR). The groundwater theme coordinator will schedule web-meetings together with the HOVER coordinator and the coordinators of the other groundwater projects every third month to coordinate and prioritize data provision for GIP among the groundwater projects and WPs. Where necessary, the web-meetings will be supplemented with face-to-face meetings.

Task 2.3: Communication, dissemination and exploitation plan (Lead: GEUS)

Dissemination of the pan-European work will be established by organizing meetings in conjunction with stakeholder groups at European level, including CIS Working Group on Groundwater, the European Environmental Agency, the Joint Research Centre and other CIS groups wherever relevant. The GeoERA website and Information Platform will be key in those dissemination events and social media will be included to promote events. The production of peer-reviewed papers in international journals will be promoted through this task, prioritizing and integrating project results of the HOVER project and bringing together scientists working in the Groundwater Theme. The HOVER project will cooperate with

the GeoERA secretariat and other projects funded under GeoERA to establish the best possible dissemination strategy.

Deliverables

D.2.1: Data management plan (Internal report) **– M9**
D.2.2a: Definition of data requirements for GIP based on GIP recommendations (internal technical note) – **M8-16**
D.2.2b: Provision of data for upload and testing of GIP second version (internal technical note) – **M30**
D.2.3a: Communication, dissemination and exploitation plan (Internal report) – **M8**
D.2.3b: Article(s) submitted to international peer reviewed journal(s) – **M36**

Work package number	**WP3**		**Lead beneficiary**			**GBA**		
Work package title	Hydrogeochemistry and health: Mapping groundwater characteristics for the management of aquifers naturally enriched in dissolved elements							
Participant number	3	6	7	11	12	15	27	28	29
Participant short name	**GBA**	VMM	FZZG	CGS	GEUS	BRGM	MBFSZ	ISOR	GSI
Person-months per participant:	12	5.8	11	11	3	4	6.5	3.8	5
Participant number	30	39	40	42	44	45	46	47	49
Participant short name	ISPRA	LEGMC	LGT	MTI	PIG-PIB	LNEG	IGR	GSS	GEOZS
Person-months per participant:	5	2	2.5	2	2	3	3	8	7.5
Participant number	50	51	52	53	Non-funded				
Participant short name	IGME	ICGC	SGU	GEOINFORM	RBINS-GSB				
Person-months per participant:	16	6	5	3.8	2				
Start month	1					**End month**	38		

Objectives

- To propose a common methodology to identify the main geological factors and hydrogeological processes regulating the distribution of natural concentrations (Natural background Level) of selected dissolved elements including Potentially Toxic Geogenic Trace Elements (PTGTE) possibly affecting human heath
- To harmonize terminologies and criteria for classification of special water (mineral, thermal water) and for aquifer areas with naturally high concentration of some specific elements
- To propose and calculate indicators comparable over Europe and its wide geological diversity applicable for groundwater management purposes
- To produce pan European information layers of special waters and indicators of chemical anomalies of natural origin

Description of work

Task 3-1: Harmonization of terminology, inventory of available information on mineral, thermal and highly mineralized groundwater (lead: GBA)

First, a big effort must be undertaken to build up a harmonized terminology for characterising the mineral, thermal and highly mineralized groundwater (called "special" water) as there exist variable national classifications. This concerns water temperature, outflow, pressure, mineralization, gas content, purity, residence time and utilization. The same is due to the national approach concerning the definition of the "anomalies" of natural origin of dissolved elements in groundwater. Also the parameters and data existing in each country should be listed. The result will be an inventory of available data. The results concerning the harmonized nomenclature can be delivered to project „GeoERA Information Platform", WP4 „Semantic harmonization issues". Afterward, the involved Surveys will make an investigation on the availability of own data on special groundwater and the selected trace elements as well as their geological background. The result will be an inventory of available data. The investigation will be done by a sending out questionnaires and additional personal contacts in order to clarify open questions.

Task 3-2: Defining lithological/geological water families based on information available at EU scale (lead: GEUS)

Concentrations of dissolved elements in groundwater is directly linked to the mineral composition of rocks/sediments and geochemical processes such as redox, ion exchange, precipitation, dissolution, weathering etc. The geological factors controlling occurrence and distribution of dissolved elements are numerous and of different importance. Different approaches of grouping rock formations depending on their potential of mineral release and the working were developed already and allowed to delineate areas of potentially high concentration in some trace elements. Analysing the different approaches and the data available in the countries would permit to propose a methodology allowing delineating hydrogeological type settings that could be related to trace elements concentration in groundwater. Having a reasonable number of families is needed in order to propose a prospective approach in sector with no water quality data. This task is in straight collaboration with task 1 of WP5.

Task 3-3: Proposing a common methodology to calculate the natural concentration of dissolved elements based on lithological/geological families taking into account possible anthropogenic influences (Lead: BRGM)

The methods used in BRIDGE (Wendland et al. 2007) consisted in using only sampling points exempt of anthropogenic influence (upward basin, GW with low NO_3 concentrations…). However, this approach limits the natural background level determination to some specific areas. Studying the anthropogenic pressure and relating activities to specific dissolved elements would permit to determine the expected NBL in some elements in area under agricultural, industrial (including mining) and urban influence. The accuracy of this approach would depend on the information on the anthropogenic activities (databases on typology of activities) and the association between activities and dissolved elements released. Matrix linking specific activities to determined pollutants exists today in some countries and may be improved and adapted to other EU countries. Based on the aquifer/sectors of aquifer typologies determined in 3.2 and pressure types, statistical data treatment would be used in order to select the most representative water points, eventually to re-group different typologies and to calculate the basic dataset statistics such as centiles, median, outliers for each element of interest (mainly trace elements). Some sophisticated non-parametric statistical tests may be used, depending on the number of data available.

Task 3-4: Natural background levels and health - determination and selection of indicators for GW management (lead IGME)

The direct use of dissolved elements concentrations, because of high range of values due to the great numbers of parameters involved in the water-rocks interactions is difficult. Therefore indicators should be proposed to relate the NBL and lithological/geological environment with human health and GW management, such as the HydroGeoToxicity (HGT) indicator defined as the quotient between the concentration of a particular PTGTE in a specific water sample and the upper limit value for that element in potable water according to the drinking water regulations. Other indicators may be proposed and developed so the complex links between a concentration of a specific element in groundwater and the various rocks and processes where the water is flowing could be represented and used for various water

management and health perspectives. Other existing indicators, from the more simple ones such as centile90 or sophisticated will be compiled and will be evaluated in regards to the potential use and capacity to represent the naturally high concentration areas in relation to the lithological context at the scale of EU or large region is a challenge.

Task 3-5: Preparing and producing maps, web map service and associated explanatory information (Lead: GBA)

Firstly, it would be necessary to produce a data model and then a legend for the planned web services, which will be documented in a report. In the frame of this task, the best methodology to organize and visualize such data should be found. International standards like the international standard legend for hydrogeological maps, INSPIRE etc. have to be taken under consideration. The available data will be collected in the delivery format determined in task 3.1. Furthermore a multi-lingual legend suitable for WMS will be produced in the language of the project partners. WMSs will highlight regions with special waters (thermal and mineral waters), litho/geological regions (determined in task 3.2) with elevated concentration of the selected tracer elements, and indicators designed in task 3.4. Also associated publication (map notices, guidances for mapping and indicator calculation, scientific article) will be proposed wherever relevant. The final data and information products from WP3 developed for the GeoERA Information Platform will be prioritized in WP2 together with the other WP leaders.

Deliverables

D.3-1: Database for concentrations of dissolved elements and associated parameters and harmonized terminology to define thermal and mineral water (Database and associated technical report) – **M12**
D.3-2: A litho-geological classification system based on the capacities of rocks to release elements to GW including development of the methods in some EU countries (Report) – **M12**
D3.3: Data set of the results of the statistical data treatment allowing the preparation of the raw elements for the tasks 4 and 5 i.e. concentrations of elements of natural origin per typologies (Report and database)– **M32**
D3.4: Compilation of indicators, analyses of possible use at pan-European scale and test application in countries of contrasted main litho/geology (Report) – **M32**
D3.5a: Data model and the legend of the planned web service (Report) - **M29**
D3.5b: Development of European exposure maps of selected elements (and indicators) based on GIS interpolation of measurements (Maps and related scientific publications) – **M38**
D3.5c: Support to GIP for the development of a Web Services with multi-lingual legend concerning special ground water in Europe – **M38**

Work package number	**WP4**		**Lead beneficiary**			**GEUS**			
Work package title	Linking aquifer microbial ecology and diversity to contaminant transforming processes at European groundwater-surface water transition zones								
Participant number	12	15	29	39	38	53			
Participant short name	**GEUS**	BRGM	GSI	LEGMC	IGR	GEOINFORM			
Person-months per participant:	16	6	1	1.5	1	0.7			
Start month	1			End month	40				

Objectives

- Increase our understanding of how groundwater ecology and microbial diversity determine contaminant-transforming processes at European groundwater-surface water (GW-SW) transition zones.
- To provide knowledge on GW-SW diversity and its potential use for GW management as a first step toward the development of a European GW ecosystem assessment scheme.

Description of work

Task 4.1 Selection and characterization of European sites (lead: GEUS)

A number of field sites will be identified in Denmark, Latvia, Ireland, and France. In Latvia the sites are 1) a pristine GW fed creek near Rucava, Southwestern Latvia and 2) a site impacted by agriculture and urban activities in Daugavpils City next to Daugava river. Both the Rucava and the Daugavpils sites have several monitoring wells installed and water quality data are available. In France the sites are 1) the GW fed Ariège river basin where there is an alluvial plain under high agricultural pressure that has led to a contamination of the aquifer by several pesticides and nitrate and 2) a site along the river Rhône with river bank infiltration. In Denmark a site along the Sillerup Creek or a site along the Knud stream have been selected. Both sites are impacted by agriculture and screens for geochemical measurements are planned to be installed. It is also planned to have an Irish site, but this has not been identified yet. No sites have been selected in Ukraine, but GEOINFORM will contribute with comparisons to Ukrainian sites and associated data. The characterization of the sites will be optimized to best exploit already existing data. Detailed information on hydraulic heads and hydraulic conductivities near and below the surface water body will be obtained using driven wells with short screens. The groundwater will be sampled at intervals and analyzed for groundwater chemistry, including EC, pH, Eh, dissolved O_2, iron, ammonium, nitrate, sulfate and relevant contaminants. In addition seepage meters will be installed to directly measure the GW-SW flux and for analysis of contaminant concentrations. Sediments will be sampled as intact cores, sealed on-site to maintain the redox conditions, and shipped to relevant partners for task 4.2 and 4.3.

Task 4.2 Degradation and mineralisation rates (lead: GEUS)

The effect of organic carbon, redox conditions, pH, and temperature on contaminant degradation and mineralisation will be determined for the selected European GW-SW sediments. Degradation and mineralisation rates will be determined from microcosm studies with sediments and water using ^{14}C labelled pollutants. The following organic pollutants have already been selected: The pesticides MCPA, bentazone, and atrazine, the pesticide residue 2,6 dichlorobenzamide, the antibiotics sulfadiazine, and erythromycin and the steroid hormone 17β-estradiol. More will be included following inputs from WP 9 on the most dominant emerging pollutants found in European groundwater. Furthermore, the potential for removal of nitrate by denitrification in the GW-SW transition zones will be studied.

Task 4.3 Use of microbial ecology and community composition of European GW-SW sites for GW management (lead: BRGM)

SubTask 4.3.1. Characterization of bacterial diversity using 16S rRNA amplicon sequencing: DNA will be extracted from GW-SW sediments and used for 16S rRNA amplicon sequencing and qPCR of marker genes involved in degradation of organic contaminants and nitrogen cycling (e.g. *tfd, atz, nir, hzo, amoA*). The qPCR results will be used to further identify and quantify specific degrading bacteria within the community. The bioinformatics will focus on linking the bacterial community composition to the presence of marker genes and contaminant degradation rates obtained from task 4.2. To pinpoint the controlling parameters that determine bacterial diversity at the GW-SW interface multivariate statistical analyses will be used. Here the redox conditions, and chemical and hydrological parameters will be used to explain the variation in the bacterial community compositions. Finally, (dis)similarities between the bacterial communities of the different sediments will be determined by indirect gradient analysis (e.g NMDS, PCA) and by the calculation of diversity indices (richness and Shannon index).*The outcome is information on the bacterial ecology of European GW-SW transition zones, including the presence of specific degrading bacteria following contaminant exposure.*

SubTask 4.3.2. Implementation of microbial diversity as a tool for monitoring water quality and identifying abnormalities – what future on a European scale? This task will look into the question of the

use of microbial diversity as an integrating tool for monitoring groundwater. Indeed, the regular monitoring of a huge number of emerging molecules is both costly and time consuming, whereas a single DNA extraction followed by sequencing gives access to total bacterial diversity. More and more studies are also emerging using DNA to monitor other bioindicators of water quality (macro fauna). This task will work with the results from subtask 4.3.1 where the sensitivity of bacterial diversity in relation to GW-SW chemistry will be assessed, as well as a review of the literature to identify European case studies of the impact of environmental GW parameters on bacterial diversity. The task aims to lay the foundations for wider knowledge of GW diversity and its potential use for GW management (Robertson et al., 2017).

Deliverables

D.4-1: Characterization of field sites based on existing and measured data as input to task 4.3 (report) – **M16**

D.4-2: Degradation and mineralisation of selected contaminants in European GW-SW transition zones as input to task 4.3 (report) – **M40**

D.4-3: The use of microbial diversity measures for monitoring contaminant transforming processes at GW-SW transition zones (report) – **M40**

Work package number	**WP5**	**Lead beneficiary**			**NERC**		
Work package title	Nitrate and pesticides transport from soil to groundwater receptors						
Participant number	1	1c	9	10	12	15	29
Participant short name	TNO	DLT	HGI-CGS	GSD	GEUS	BRGM	GSI
Person-months per participant:	12	3.7	7	3	11	5.5	1
Participant number	39	42	49	53	54		
Participant short name	LEGMC	MTI	GEOZS	GEOINFORM	**NERC**		
Person-months per participant:	1.5	1	10	0.7	7		
Start month	1			**End month**	39		

Objectives

- Develop an atlas of geological/hydrogeological settings relevant to agrochemical transport across Europe and collate datasets characterizing these settings (in relation to task 2 of the WP3). These will provide conceptual models of key European settings
- Assess nitrate (N) and pesticide (PST) travel times and where possible attenuation patterns for a number of relevant European settings for evaluating regulatory timescales for achieving good status and/or trend reversal For N this will be a contribution towards Pan-European N vulnerability assessment including modelling of storage in the unsaturated zone
- Provide datasets characterizing N and PST transport in a useful format to the Information Platform Theme
- Develop transport models able to simulate contaminant discharge through the unsaturated zone and produce maps of groundwater travel time
- Produce maps of areas of potential denitrification/low redox in groundwater

Description of work

Task 5-1 – Characterizing agrochemical travel time in the unsaturated and saturated zones (lead: NERC)

This first task will define a series of conceptual models addressing time scales related to N and PST transport in the subsurface and the understanding of lag times between the implementation of measures and improvement of groundwater quality at receptors. The first step will be to establish geological/hydrogeological type settings with similar characteristics across Europe, e.g. using existing datasets. These should provide a common basis for use in other work packages, e.g. WP3 and WP7. A number of type sites representing these different settings will be selected for use in Task 3. The unsaturated zone for each type-setting will be parameterized using both existing datasets and making limited new field measurements of unsaturated zone profiles for N. The distribution of travel times will be assessed using established modelling methods. Travel times in the saturated zone will be assessed using existing datasets and coordinated with WP6. Conceptual models of overall lag times will be developed using these type-sites for illustration of different hydrogeological settings.

Task 5-2 – Evaluating groundwater monitoring data (Lead: TNO)

Data from existing groundwater quality monitoring networks will be assessed and harmonized in order to provide information about the transport of N and PST. This includes analysis using process indicators such as N_2 -excess characterization, redox indicators (such as Fe and Mn and dissolved gas concentrations CH_4, H_2S, N_2, O_2) and age indicators (from existing $^3H/^3He$ data). This will be extended using shallow monitoring programs as an early warning indicator of PST leaching to groundwater following on from the registration process. The information on groundwater N and PST distribution and behavior over time will be used to calibrate and validate the coupled models in Task 3.

Task 5-3 – Modelling nitrate and pesticide transport through unsaturated and saturated zones to groundwater receptors (Lead: NERC)

The process understanding from the type-sites from Task 5.1 will be combined with available European-scale datasets to develop a European map of lag times and timescale of pollutant impact on drinking water sources, surface water and groundwater dependent ecosystems. For N, national fertilizer applications and leaching time series will be assessed to characterize peak N applications across Europe. Modelling of unsaturated zone timescales will be extended across Europe. Attenuation processes could include denitrification using spatial data from Task 5.4 and PST sorption and degradation rates from partner and literature data (linked to WP4). This will be coupled with saturated zone modelling and residence time indicators including WP6 and calibrated and validated using data from Task 5.2 to quantify the amount of pollutant stored in the saturated and unsaturated zones, and to provide estimated lag times and attenuation for mapping agrochemical transport towards receptors such as streams and drinking water production sites in Task 5.

Task 5-4 – Assessing the spatial extent and importance of denitrification (lead: BRGM)

To assess the spatial extent and importance of denitrification, we will evaluate and harmonize of N contamination patterns in relation to redox processes, using well established monitoring networks in pilot areas in England, Denmark, Flanders, France and the Netherlands, using a range of methods including process indicators such as N_2 -excess characterization, redox indicators (such as Fe and Mn and dissolved gas concentrations CH_4, H_2S, N_2, O_2) and age indicators (from existing $^3H/^3He$ and CFC data) as a signal for denitrification. This will be combined with existing denitrification potential mapping e.g. from England and Denmark.

Task 5-5 – Overview maps (lead: NERC)

Designing data output display/formats including overview maps over areas of Europe, with methodology to extend this to the European scale. These will indicate lag times and attenuation involved in N and PST transport. These will have wide application e.g. to contribute to Nitrate Vulnerability Zone designation or verification and to N vulnerability mapping (WP7).

Deliverables
D.5-1: Atlas of geological/hydrogeological settings found across Europe with selected type sites (Report and map) – **M13**
D.5-2: Datasets with characterization of these settings relevant for agrochemical transport (REPORT) – **M18**
D.5-3: Assessments of N travel times for a number of relevant European settings (report)– **M29**
D. 5-4**:** Assessments of attenuation patterns for a number of relevant European settings (report) – **M29**
D.5-5: Maps of groundwater-N travel time – pan-European if there are sufficient partners – **M39**
D5-5b**:** Redox potential maps – **M33**

Work package number	**WP6**		**Lead Beneficiary**			**GEUS**			
Work package title	***G***roundwater ***A***ge ***DIS***tributions and residence times in European aquifers (***"GADIS"***)								
Participant number	1	1a	3	9	10	12	15	27	42
Participant short name	TNO	DLT	GBA	HGI-CGS	GSD	**GEUS**	BRGM	MBFSZ	MTI
Person-months per participant:	8.5	3.7	2.5	7.5	3	11.5	5	7	2.7
Participant number	46	49	50	52	53	Non-funded			
Participant short name	IGR	GEO ZS	IGME	SGU	Geo-inform	EGT Estonia			
Person-months per participant:	2	6.5	1	2	1	1			
Start month	1					End month	40		

Objectives
1.To establish a harmonized database on groundwater age tracers and indicators currently existing in EU member states (GSO's) and develop different age / residence time intervals suitable for classifying age structures and degree of protection of European aquifers on *maps and cross sections on the information platform (EGDI).*
2. To identify and describe a number of important European aquifers with a significant amount of age indicators as use cases and develop a good practice protocol on the application of age indicators for estimation of groundwater age distributions in time and space (including a sampling guide).
3. To demonstrate the use of groundwater age distributions for design and assessment of monitoring programmes, pollution trends and history and the evolution of groundwater quality (chemical status).
4. To test and develop new techniques for estimating age distributions of groundwater bodies with residence times mainly in the age range of 10 to 1000 years. Demonstration pilots at a number of drinking water well fields in contributing countries are developed to establish a common methodology for characterization of the age distribution of pumped wells by using a suite of tracers and models.

Description of work
T<u>ask 6-1: Developing a database of existing groundwater age indicators in Europe (lead: GEUS)</u>
The task establishes an overview of groundwater age indicators applied in Europe by the use of questionnaires to involved partners and it develops a harmonised database for the analytical results, estimated average ages and groundwater age distributions. The indicators include radioactive (e.g. ^{3}H, ^{85}Ar, ^{39}Ar, ^{14}C) and stable isotopes (e.g. ^{3}He, ^{4}He, ^{13}C, ^{2}H, ^{18}O) as well as industrial gases (eg. CFCs

and SF_6) as well supporting data required for estimation of groundwater ages (recharge temp., elevation, noble gas contents). It furthermore defines and classify the samples in age intervals as an indicator of the susceptibility/vulnerability of the aquifers to contamination from human activities on the surface, elevated toxic geogenic elements in deeper aquifers and overabstraction. The task relates to activities in WP3, WP5 and WP7.

Task 6-2: Use cases and good practice guidance (lead: MBFSZ)
Five to ten European aquifers with a significant amount of groundwater age indicators preferably corroborated by groundwater flow models are identified and presented as use cases for demonstration of good practices and management applications. The task includes developing a good practice protocol and recommendations for the combined use of different age indicators and models, and a groundwater sampling guide for collecting groundwater samples intended for the analysis of different age indicators.

Task 6-3: Application of groundwater age distributions for design and assessment of monitoring programmes and trend assessment (lead: BRGM).
This task develops good practices guidance on the estimation and application of groundwater age distributions for the design and evaluation of the results of groundwater monitoring programmes e.g. for assessment of trends / evolution of groundwater quality in time and space, and the efficiency of programme of measures for drinking water wells with high content of nitrate or pesticides.

Task 6-4: Application of new tracer and modelling techniques for estimation of groundwater age distributions in the age range 10-1000 years in water supply wells (lead: TNO).
Nitrate, pesticides and emerging contaminants contaminates drinking water supplies all over Europe. Understanding groundwater age distributions of water supply wells with long screens significantly improve the management of well fields and knowledge of contaminant transport, fate and history. The task investigates and develops guidance on the estimation and application of new methods for the assessment of groundwater age distributions in water supply wells with long screens and groundwater ages in the range of 10 – 1000 years.

Deliverables
D.6-1a: Database for concentrations of groundwater age indicators, estimated mean ages and age distributions, vulnerability classes and associated guidance (Database and associated technical guidance) – **M40**

D.6-1b: A classification system based on groundwater age distributions defining shallow and deep aquifer vulnerability classes indicating the risk of pollution and elevated concentrations of geogenic elements (REPORT) – **M15**

D.6-1c: Maps and cross sections on the information platform / EGDI showing spatial distribution of groundwater age and vulnerability classes in selected European aquifers (Web service) – **M34**

D.6-2: Collection of use cases including good practice guidance and age indicator sampling guide (REPORT) – **M29**

D.6-3: Recommendations for estimating groundwater age distributions and the application of these in groundwater monitoring and quality estimation (including trend assessment) (REPORT) – **M40**

D.6-4: Investigation of age distributions in water supply wells with long screens and recommendations for application of tracers and models mainly for estimating groundwater ages between 10 and 1000 years (REPORT) – **M40**

Work package number	**WP7**		**Lead Beneficiary**			**BGR**				
Work package title	Harmonized vulnerability to pollution mapping of the upper aquifer									
Participant number	3	12	14	15	17	22	27	29	40	44
Participant short name	GBA	GEUS	GTK	BRGM	**BGR**	LBEG	MBFSZ	GSI	LGT	PIG-PIB
Person-months per participant	4,5	2,5	1,4	1	12	4,5	5	4,5	2,5	3,5
Participant number	46	49	50	51	53	Non-funded				
Participant short name	IGR	GEOZS	IGME	ICGC	Geo-inform	LBGR				
Person-months per participant	2,7	5,5	5	7	1	1				
Start month	1					End month		36		

Objectives

- Investigation, comparison and potential extension of index methods for groundwater vulnerability assessment to pollution,
- Interoperabilization of spatial data basis for vulnerability assessment (e.g. soil, subsoil and aquifer properties available),
- Assessment of selected point information from representative drill logs and selected cross sections to get a specific view on the hydrogeological structure at pan European and at cross-border pilot areas scale,
- Presenting the geospatial information results using the Information Platform.

Description of work

Task 7-1: Investigation and selection of appropriate methodologies (lead: BGR)

Numerous parametric system methods for assessing aquifer vulnerability to pollution are used for establishing vulnerability maps (rating systems such as GOD, AVI; point count index system models, such as SINTACS, DRASTIC, EPIK). Existing groundwater vulnerability assessments elaborated by the individual European geological surveys differ in methodology, input parameters and applicability in the given hydrogeological setting. For supranational enhancement of vulnerability of the upper aquifer to pollution, further investigations in a preferably interoperabilized procedure of mapping extent and nature of the geological layers and characteristics that control the resilience of the groundwater resources, need to be conducted on the cross-border pilot area and pan-European scale.

To reach this target, internationally existing and usually applied index methodologies for assessing relative groundwater vulnerability to pollution of the upper aquifer have to be investigated, compiled, compared, assessed and assigned to the respective scale according spatial information.

Task 7-2: Harmonization of data referring to pan European and cross-border pilot area scale (Lead: BGR)

The basis for aquifer vulnerability assessments is provided by specific attribute data of the underground (e.g. soil, geology, depth to water table, etc.). Particularly in transboundary studies, these data often suffer from incompatible scale and variable quantity and quality of input information. In order to adopt the scale-dependent harmonized index methods for aquifer vulnerability to pollution mapping by the European Geological Surveys identified within Task 1, an interoperabilized definition of input parameters and data base is mandatory. Existing geological, hydrogeological, hydrogeochemical, meteorological and soil data of national and international organizations (e.g. WMO, FAO, JRC, igrac,

Geological Surveys, environmental institutions…) need to be taken into account. The International Hydrogeological Map of Europe (IHME1500) and its derivatives offer a central hydrogeological data pool to be improved and used by the work package partners. On selected cross-border pilot areas additionally higher resolution input data, such as extend and thickness of the aquifer and the overburden, depth of the water table, detailed lithological information obtained by representative drill logs, structures derived from local and regional cross sections, will be taken into account.
To reach this target selected national and international input data sets for the respective vulnerability assessment methodologies have to be investigated, compiled, compared and potentially assigned to the respective scale-dependent spatial information. Data bases are to be established at the partners and are to be connected using given geo data infrastructure techniques.

Task 7-3: Assessing vulnerability of the upper aquifer to pollution using GIS (lead: ICGC)
Mapping of spatial information to assess vulnerability of the upper aquifer to pollution at pan European and selected cross-border pilot areas scales requires the application of geoinformation systems. Spatial information needed for this assessment are data related to soil properties (e.g., filter function) and aquifer properties (e.g., known/potential karst and fissured areas, type of rock/cavity,…). Data compilation is in straight collaboration with WP3, WP5, WP6 and WP8. To reach this target the mapping of aquifer vulnerabilities to pollution, applying the methodologies identified in WP7-1 at the respective scales, will be conducted using Geoinformation Systems (GIS). Spatial information at the pan-European scale will be elaborated from BGR on the basis of the "International Hydrogeological Map of Europe (IHME1500)". Depending on data availability and general feasibility, the mapped aquifer vulnerabilities will be validated based on expert knowledge and, optionally, based on available independent spatial information on aquifer contamination. During data compilation, particular attention will be drawn to the interoperability of the utilized Geoinformation Systems (GIS) concerning data bases and models, data transformations (to raster and/or polygons) and output files (including feature information and meta data). Moreover, discrepancies along administrative units need to be harmonized (geometries and attribute information) by each of the cross-border partners.

Task 7-4: Volumes and areas of special aquifer vulnerability to pollution (lead:IGME)
In addition to the spatial maps, optionally in selected national pilot areas results about the volume of an aquifer that is over a certain threshold or in certain level or class of vulnerability will be obtained and represented by using 2D schematic cross section of the aquifer.
To reach this target several specific volumes will be defined from the vulnerability maps taking into account the geometry and hydrogeological properties of the aquifer. A vulnerability index for the groundwater body corresponding to the spatial method chosen will be defined taking into account the information included in the cited 2D sections of the aquifer. The effects on the vulnerability will be summarized in a visual way with a conceptual 2D/2.5D schematic cross section in combination with a map of the lateral extend of the aquifer.

Task 7-5: Data exchange with the Information Platform (Lead BGR)
Through the whole compilation and aggregation process interfaces will be established to the unit of partner organization participating in the Information Platform project in order to efficiently deliver the data to the GeoERA data service for Europe.

Deliverables
D.7-1: Comparison of international commonly applied index methodologies for assessing the vulnerability of the upper aquifer to pollution. Report – **M6**
D.7-2: Compilation of the examination results of the data sets of input data for the respective methodologies assessing vulnerability of the upper aquifer to pollution. Report and dataset – **M29**
D.7-3: Provision of scale and data-dependent products on the vulnerability of the upper aquifer to pollution using GIS. Maps and dataset – **M34**
D.7-4: Delivering of cross sections and maps of extend of selected aquifers in specific national pilot areas – Maps and associated report – **M34**

Work package number	**WP8**	**Lead beneficiary**				**BRGM**				
Work package title		Effective monitoring of emerging contaminants: development and validation of new assessment methods								
Participant number	1	15	40	42	44	49	50	52	53	54
Participant short name	TNO	**BRGM**	LGT	MTI	PIG-PIB	GeoZS	IGME	SGU	Geoinform	NERC
Person-months per participant:	8.5	7	2.5	1.5	5.5	8	6	2.5	1	6

Start month	1	**End month**	40

Objectives

This work package will develop a consistent approach to GW monitoring for Organic Emerging Contaminants (ECs) in terms of sampling, site selection, monitoring frequency and methodology (including analytical techniques) and to ensure it is effective and data are comparable across the range of European geological and environmental settings. Specific objectives are:

- Assessment of status and scope of monitoring of groundwater for organic emerging contaminants (ECs) across Europe;
- Develop recommendation for statistical analysis of monitoring data and evaluate existing results in terms of geological setting and land use/anthropogenic activities.
- Provide multi-country/pan European information GIS layers on selected ECs
- Develop recommendations to enable effective monitoring for current / future emerging contaminants and key pollutants of concern on a Europe-wide basis;
- Develop indicators based on risk-assessment principles to link the potential leaching of ECs in groundwater with geological setting and land use, anthropogenic activities, chemical and hazard properties and co-occurring tracers.

Description of work

Task 8.1 : Review of GW occurrence data, sampling and analytical methods for ECs across Europe (Lead: NERC)

Task 1 aims to provide a review of existing monitoring results for organic ECs for each partner across Europe (national studies considered as a priority). ECs sampling methods – including both passive and active samplers, and macro and micro biomonitoring (linked to WP5) – and analytical methods – ranging from specific compound suites to screening and non-target screening methods – used by EuroGeoSurvey laboratories will be reviewed and shared as well. Results will be collected and reviewed to identify those with high quality and comparable data. Selected comparable ECs occurrence data will be mapped at the European scale. As the results will be reinterpreted in Task 2, context data of monitoring sites (geological setting and land use, anthropogenic activities, wells technical description) will be collected as far as possible.

Task 8.2- Relationship of ECs with environmental setting (lead IGME)

The relationship of detected compounds in GW with hydrogeological characteristics, anthropogenic activities, and hydro-climatic and environmental settings will be assessed in Task 2. This will be in relation to WP3, WP5, WP6 and WP7. Using the data and metadata gathered in Task 1, statistical tests for discriminant and canonical variate analysis will be applied to identify natural and anthropogenic forcing factors which may relate the presence of ECs in GW. These factors include hydrological considerations (GW recharge, age and vulnerability and redox status) and anthropogenic activities/land use management considerations. After an inventory of potential usage and origins of ECs of high concern, compounds known as being characteristic of one specific pressure will be used to assess links between land use and ECs occurrence in GW. Co-occurring contaminants and tracers will be statistically identified.

Task 8.3: European sampling and interlaboratory testing (lead TNO)
Based on knowledge of task 1 and 2 new sampling analyses on emerging compounds will be undertaken that includes interlaboratory testing. Analyses are directed to a number of pilot areas defined under the GW1 proposal and is directed towards potential hotspots for emerging contaminants transport in Europe. We will test the hypotheses under Tasks 1 to 2 to test effective monitoring in practice on some specific potentially contaminated sites.

Task 8.4: Identification of ECs of high concern in connection with European initiative (Lead: BRGM)
ECs of high importance to groundwater will be identified on the basis their properties (mobility, degradability and toxicity and eco-toxicity) and usage at the EU scale. Work will focus in particular on methods for combining and aggregating occurrence data and chemical properties to prioritize ECs regarding their GW leaching potential and hazard. Novel indicators will be developed, tested and validated using the pan-European occurrence data collected in Tasks 1 and 3.

Task 8.5: Development of monitoring recommendations (Lead BRGM)
Setting up an effective monitoring network for groundwater quality requires defining both lists of sampling sites and substances, and methods for sampling and analyzing these chemicals in water. Based on the results of the first 4 tasks, a framework for establishing key parameters and appropriate monitoring methodologies for groundwater will be developed to obtain comparable European data. This will lead to the development of monitoring recommendations appropriate for the range of partner backgrounds and expertise. A rigorous statistical approach will be used to inform this process to ensure an optimal number of sites and the substances to deliver a sustainable and cost-effective approach for future monitoring.

Deliverables
D.8-1a. Critical review report of published European-monitoring results for organic emerging contaminants (report) - **M17**
D8.1.b. Critical review report of non-published European-monitoring results for organic emerging contaminants (report) – **M29**
D.8-2. Report with recommendations for monitoring of key parameters with reference to environmental context, geological setting and risk assessment – **M40**
D.8-3. Report describing new sampling analyses and interlaboratory tests directed towards potential hotspots for emerging contaminants transport (report) – **M40**
D.8-4. GIS-layers published by a GeoERA (EGDI) web service on the selected ECs (dataset) – **M38**
D.8-5. Concrete proposal and design for an EU wide monitoring program customized to emerging pollutants of high concern - **M40**

Table 3.1b) List of work packages
This table is not covered by the page limit.

WP No	Work package Title	Lead No	Lead Participant short-name	Person Months	Start-Month	End Month
1	Project management and scientific coordination	15	BRGM	17	1	42
2	GIP & CT coordination, data management and dissemination	12	GEUS	10	1	40
3	Hydrogeochemistry and health: Mapping groundwater characteristics for the management of aquifers naturally enriched in dissolved elements	3	GBA	127.9	1	38
4	Linking aquifer microbial ecology and diversity to contaminant transforming processes at European groundwater-surface water transition zones	12	GEUS	26.2	1	40
5	Nitrate and pesticide transport from soil to groundwater receptors	54	NERC	63.4	1	39
6	***G***roundwater ***A***ge ***DIS***tributions and residence times in European aquifers (***"GADIS"***)	12	GEUS	63.9	1	40
7	Harmonized vulnerability to pollution mapping of the upper aquifer	17	BGR	62.6	1	36
8	Effective monitoring of emerging contaminants: development and validation of new assessment methods	15	BRGM	48.5	1	40
			Total Person Month	**419.5**		

Table 3.1c) List of deliverables
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Internal = GeoERA

Delivrable No	Delivrable name	WP No	Short Name of Lead	Type	Dissemination Level	Delivery Date (in months)
D.2-1	Data Management Plan	2	GEUS	Report	internal	6
D.7-1	Comparison of international commonly applied index methodologies for assessing the vulnerability of the upper aquifer to pollution clarifying differences in parameterization, weighting and final assessment	7	BGR	Report	Internal	6
D.1-3a	Cumulative expenditure report Y1	1	BRGM	Report	internal	7
D.2-3a	Communication, dissemination and exploitation plan	2	GEUS	Report	internal	8

D.2-2a	Definition of data requirements for GIP based on GIP recommendations	2	GEUS	Technical Note	Internal	9 and 16
D.3-1	Database for concentrations of dissolved elements and associated parameters and harmonized terminology to define thermal and mineral water (Database and associated technical report	3	GBA	Database Report	Internal	12
D.3-2	A litho-geological classification system based on the capacities of rocks to release elements to GW including development of the methods in some EU countries	3	GEUS	Report	Internal	12
D.5-1	Atlas of geological/hydrogeological settings found across Europe with selected type sites	5	NERC	Report Map	Internal	13
D.6-1b	A classification system based on groundwater age distributions defining shallow and deep aquifer vulnerability classes indicating the risk of pollution and elevated concentrations of geogenic elements	6	GEUS	Report	Internal Policy Makers Scientific community	15
D.4-1	Characterization of field sites based on existing and measured data as input to task	4	GEUS	Report	Internal	16
D.8-1a	Critical review report of published European-monitoring results for organic emerging contaminants	8	NERC	Report	Internal	17
D.5-2	Report with characterization of the settings relevant for agrochemical transport	5	TNO	Report	Internal	18
D.1-3b	Cumulative expenditure report Y2	1	BRGM	Report	internal	19
D.1-2a	Project progress report	1	BRGM	Report	internal	20
D.6-2	Collection of use cases including good practice guidance and age indicator sampling guide	6	MBFSZ	Report	Scientific community	29
D.3-5a	Data model and the legend of the planned web service (Report	3	GBA	Report	Internal	29
D.6-3	Recommendations for estimating groundwater age distributions and the application of these in groundwater monitoring and quality estimation	6	BRGM	Report	Policy Makers	29

D.7-2	Compilation of the examination results of the international data sets of input data for the respective methodologies assessing vulnerability of the upper aquifer to pollution	7	BGR	Report Database	Internal	29
D.8-1b	Critical review report of unpublished European-monitoring results for organic emerging contaminants	8	NERC	Report	Internal	29
D.5-3	Assessments of N travel times for a number of relevant European settings	5	NERC	Report	Internal Scientific community	29
D.5-4	Assessments of attenuation patterns for a number of relevant European settings	5	BRGM	Report	Internal Scientific community	29
D.2-2b	Provision of data for upload and testing of GIP second version	2	GEUS	Technical Note	internal	30
D.1-3c	Cumulative expenditure report Y3	1	BRGM	Report	internal	31
D.3-3	Data set of the results of the statistical data treatment allowing the preparation of the raw elements for the tasks 4 and 5 i.e. concentrations of elements of natural origin per lithogeological units	3	BRGM	Database report	Internal	32
D.3-4	Compilation of indicators, analyses of possible use at pan-European scale and test application in countries of contrasted main litho/geology	3	IGME	Report	Scientific community Policy Makers Internal	32
D.6-1c	Maps and cross sections on the information platform / EGDI showing spatial distribution of groundwater age and vulnerability classes in selected European aquifers	6	GEUS	Web service	Policy Makers General public	34
D.7-3	Provision of scale- (pan European, cross-border pilot area) and data-dependent (quantity, quality) products on the vulnerability of the upper aquifer to pollution using GIS	7	ICGC	Maps Database	Scientific community Internal	34
D.7-4	Delivering of cross sections and maps of extend of selected aquifers in specific national pilot areas	7	IGME	Maps Report	Internal Scientific community	34
D.2-3b	Article(s) submitted to international peer reviewed journal(s)	2	GEUS	Articles	Scientific community	36
D.5-5b	NEW – Map of redox potential at EU scale	5	BRGM	Map Report	Policy Makers Scientific community	36
D.3-5b	Development of European exposure maps of selected	3	GBA	Maps Articles	Scientific community	38

	elements (and indicators) based on GIS interpolation of measurements			Flyers	Policy Makers Internal General Public Medias	
D.3-5c	Web Services with multi-lingual legend concerning special ground water in the EU participating countries	3	GBA	Web service	Policy Makers Internal General Public Medias Industry	38
D.8-4	GIS-layers published by a GeoERA (EGDI) web service on the selected ECs	8	BRGM	Database	Policy Makers Scientific community General public	38
D.5-5	Maps of groundwater-N travel time – pan-European if there are sufficient partners	5	NERC	Map	Policy Makers Scientific community	39
D.8-3	New sampling analyses and interlaboratory tests directed towards potential hotspots for emerging contaminants transport	8	TNO	Report	Internal	40
D.8-5	Concrete proposal and design for an EU wide monitoring program customized to emerging pollutants of high concern	8	BRGM	Report	Policy Makers	40
D.8-2	Recommendations for monitoring of key parameters with reference to environmental context, geological setting and risk assessment	8	IGME	Report	Policy Makers Scientific community	40
D.6-1a	Database for concentrations of groundwater age indicators, estimated mean ages and age distributions, vulnerability classes and associated guidance	6	GEUS	Database Report	Policy Makers Scientific community	40
D.4-2	Degradation and mineralisation of selected contaminants in European GW-SW transition zones as input to task 4.3	4	GEUS	Report	Internal Scientific community	40
D.4-3	The use of microbial diversity measures for monitoring contaminant transforming processes at GW-SW transition zones	4	BRGM	Report	Policy Makers	40
D.6-4	Investigation of age distributions in water supply wells with long screens and recommendations for application of tracers and models mainly for estimating	6	TNO	Report	Scientific community	40

	groundwater ages between 10 and 1000 years					
D.1-2b	Final project report	1	BRGM	Report	internal	42
D.1-3d	Cumulative expenditure report final	1	BRGM	Report	internal	42

Table 3.2a) List of Milestones
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Milestone No	Milestone name	Related WP	Due date (in months)	Means of verification
1	Kick-off meeting	all	1	Report on the detailed WP plans and summary of discussion reviewed by Project Board Committee
2	WP and PB meeting	all	8	Progress report by WP leader and update of the risk of implementation by PB
3	Seminar with IP	All except WP4	18	Technical documents on map and web services needs and IT specificities reviewed by PB et IP coordinator
4	Mid-term meeting	all	20	Progress reports verified by PB and Advisory Board
5	Project Board meeting	All	26	Progress report by WP leader
6	Final meeting	All	40	Final reports verified by PB and Advisory Board

Table 3.2b) List of critical risks for implementation
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Description of Risk	***Level of likehood***	***Work package(s) involved***	***Proposed risk-mitigation measures***
Insufficient data or data quality to calculate the indicators linked to highly mineralized groundwater	High for some dissolved elements (Zn, Al…) Medium for the most common toxic elements (such as As)	WP3	*Proposing hydrogeological type- settings will permit to have a critical look at the compiled data and make a strong selection of data to be used in the statistical data treatment. The hydrogeological type settings would be based on geological and hydrogeological information and on major dissolved elements, usually of good quality and sufficient number. Some elements may also not be considered for the indicator development.*
Data density not sufficient to permit statistical data treatment proposed to discriminate natural from anthropogenic origin of dissolved elements in densely populated areas	Medium	WP3	Some elements could be discarded from the database in sector with high industrial, agriculture and urban areas. It is also possible to work by analogies using information available in other countries/sectors. The area under important/multiple pressure could, in some cases, not be taken into consideration.
Limited number of pilot sites to have a wide EU	High	WP4	One of the objectives of the WP is to make progress in the use of microbial

representativeness of bacterial diversity			ecology and community composition of European GW-SW site and data collected with the project will be completed by existing information. Although covering all European representative sites is far beyond the objectives of this project, as it would need specific EU project and additional funds.
Overview map indicating lag times and attenuation involved in N and PST transport cannot be produced since insufficient partners could provide adequate data for this task	High	WP5	Designing data output display/formats and methodology to extend it to the European scale will be developed. Some cross-border or national maps may be produced instead of pan-European product. However the use of existing information (from WHYMAP for example) at European scale and possibilities to combine different methods depending on data available in the different countries would be the preparation of such map possible.
It is not possible to create vulnerability maps including all EU countries	Low	WP7	Definition of hydrogeological-type settings should allow data extrapolation in some cases – Also external data could be used such as the WHYMAP products in order to propose a pan European map – In addition the possibilities of using various vulnerability assessment method would made possible working in some countries with less/different data
A small number of countries would be involved in the European sampling and interlaboratory testing	Medium	WP8	Advances in emerging contaminant monitoring and analyses the EU countries are disparate. In addition, funds are limited for this activity. Therefore, the number of the EC to be analysed and number of analyses may be limited. In order to make the best use of the available resources, the efforts will concentrate on the elements highlighted in the different tasks of this WP (of high concern due to their properties or prevalence)

Table 3.3a) Summary of Staff Effort
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Please indicate the number of person/months over the whole duration of the planned work, for each work package, for each participant. Identify the work-package leader for each WP by showing the relevant person-month figure in **bold**.

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	Total Person-Months per participants
1 /TNO	1				12.0	8.5		8.5	30
1a/DLT					3.7	3.7			7.4
3/GBA	2	1.5	**12.0**			2.5	4.5		22.5
6/VMM			5.8						5.8

7/FZZG			11.0						11
9/HGI-CGS					7.0	7.5			14.5
10/GSD					2.0	2.0			4
11/GSS			8.0						8
12/GEUS	2	5	3.0	16.0	11.0	**11.5**	2.5		51
14/GTK							1.4		1.4
15/BRGM	**9**	1	4.0	6.0	5.5	5.0	1.0	7.0	38.5
17/BGR	2	1.5					**12.0**		15.5
22/LBEG							4.5		4.5
27/MBFSZ			6.5			7.0	5.0		18.5
28/ISOR			3.8						3.8
29/GSI			4.0	1.0	1.0		4.5		10.5
30/ISPRA			5.0						5
39/LEGMC			2.0	1.5	0.92				4.42
40/LGT			2.5				2.5	2.5	7.5
42/OPM			2.0		1.0	2.7		1.5	7.2
44/PIG-PIB			2.0				3.5	5.5	11
45/LNEG			8.0						8
46/IGR			30	1.0		20	27		78
47/GSS			8.0						8
49/GEOZS			7.5		10.0	6.5	5.5	8.0	37.5
50/IGME Spain			16.0			1.0	5.0	6.0	28
51/ICGC			6.0				7.0		13
52/SGU			5.0			2.0		2.5	9.5
53/GEOINFORM			0.66				1.0		1.66
54/NERC	1	1			7.0			6.0	15
55/HSGME							12		12
*EGT						(1)			(1)
*RBINS-GSB			(2)						(2)
*LBGR							(1)		(1)
Total Person Months	17	10	152.76	25.5	60.12	79.9	98.9	47.5	491.68

* Non-funded partners (not considered for calculation Total Person Month)

Table 3.3b) 'Other direct cost' items (travel, equipment, other goods and services)
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Please complete the table below for each participant.

1/TNO	Cost (€)	Justification
Travel	20000	Participation to all HOVER meetings, field trips related to sampling for emerging contaminants and age tracers
Equipment	20000	Consumables for fieldwork, sampling and chemical and tracer analysis for WP8 Emerging contaminant and WP6 Age Distributions
Other goods and Services		
Total	40000	

1a/DLT	Cost (€)	Justification

Travel	4700	HOVER meetings and field work
Equipment		
Other goods and Services		
Total	4700	

3/GBA	Cost (€)	Justification
Travel	8000	Project board meetings
Equipment		
Other goods and Services		
Total	8000	

6/VMM	Cost (€)	Justification
Travel	3500	HOVER meetings
Equipment		
Other goods and Services		
Total	3500	

7/FZZG	Cost (€)	Justification
Travel	1400	HOVER meetings
Equipment		
Other goods and Services		
Total	1400	

9/HGI-CGS	Cost (€)	Justification
Travel	3600	Travel to project meetings, visits to pilot sites
Equipment		
Other goods and Services		
Total	3600	

10/GSD CYPRUS	Cost (€)	Justification
Travel	3600	HOVER meetings – Cost high due to
Equipment		
Other goods and Services		
Total	3600	

11/GSS	Cost (€)	Justification
Travel	1000	travel to HOVER meetings, fieldwork
Equipment	1000	field equipment, software
Other goods and Services		
Total	2000	

12/GEUS	Cost (€)	Justification
Travel	20000	(as a justification for the amount being higher than the indicted 15%, it is to be noted that travelling from Malta (do to insularity) is generally more expensive

		than from other EU countries requiring air travel with connecting flights)
Equipment	18800	Consumable and analyses for age dating
Other goods and Services		
Total	38800	

14/GTK	Cost (€)	Justification
Travel	1500	Travel cost to project meetings
Equipment		
Other goods and Services		
Total	1500	

15/BRGM	Cost (€)	Justification
Travel	20000	Participation to all HOVER meetings as global coordinator of the project for up to 3 persons
Equipment	20000	Analytical tests included on emerging contaminant (WP8) and microbial experiments/microbial diversity measures (WP4)
Other goods and Services		
Total	40000	

17/BGR	Cost (€)	Justification
Travel	5000	Participation to project board meetings
Equipment		
Other goods and Services		
Total	5000	

22/LBEG	Cost (€)	Justification
Travel	2700	Participation to HOVER meetings
Equipment		
Other goods and Services		
Total	2700	

27/MBFSZ	Cost (€)	Justification
Travel	4100	Travels to meetings Pilot site visits, fieldwork, sampling
Equipment		
Other goods and Services		
Total	4100	

28/ISOR	Cost (€)	Justification

Travel	3000	Participation to HOVER meetings
Equipment		
Other goods and Services		
Total	3000	

29/GSI	Cost (€)	Justification
Travel	2500	Participation to HOVER meetings
Equipment		
Other goods and Services		
Total	2500	

30/ISPRA	Cost (€)	Justification
Travel	5550	Participation to project meetings and visits to pilot sites
Equipment		
Other goods and Services		
Total	5550	

39/LEGMC	Cost (€)	Justification
Travel	1700	travels to attend 2 project meetings
Equipment		
Other goods and services		
Total	1700	

40/LGT	Cost (€)	Justification
Travel	1700	Travels to attend 2 project meetings
Equipment		
Other goods and Services		
Total	1700	

42/MTI (OPM)	Cost (€)	Justification
Travel	5000	travels to attend 3 project meetings (kick-off, mid-term, final), and 1 WP meeting (as a justification for the amount being higher than the indicted 15%, it is to be noted that travelling from Malta (do to insularity) is generally more expensive than from other EU countries requiring air travel with connecting flights)
Equipment		
Other goods and Services		
Total	5000	

44/PIG-PIB	Cost (€)	Justification

Travel	7000	travels to international meetings; national field trips related to sampling for emerging contaminants
Equipment	8800	Consumables (printing materials, shipment costs). Additional costs associated with sampling and analyses for emerging contaminants, including purchase of materials such as bottles, filters, reagents, shipping, etc. Min 10 samples
Other goods and Services		
Total	15800	

45/LNEG	Cost (€)	Justification
Travel	0	
Equipment/consumables		
Other goods and services		
Total	0	

46/IGR	Cost (€)	Justification
Travel	7000	Travel to HOVER meetings and field missions
Equipment/consumables	2210	Sampling and analyses
Other goods and services		
Total	9210	

47/GSS	Cost (€)	Justification
Travel	2000	Travel to HOVER meetings
Equipment/consumables		
Other goods and services		
Total	2000	

49/GEOZS	Cost (€)	Justification
Travel	10500	Travel to HOVER meetings
Equipment/consumables	3000	Additional costs associated with sampling and analyses, including purchase of materials such as bottles, filters, reagents, shipping, etc.

Other goods and services		
Total	13500	

50/IGME SPAIN	Cost (€)	Justification
Travel	9000	Travel to HOVER meetings, field missions
Equipment/consumables	3000	Analyses and consumables
Other goods and services		
Total	12000	

51/ICGC	Cost (€)	Justification
Travel	7500	Travel costs for attendance of 1-2 persons for a maximum of six key project meetings/workshops
Equipment		
Other goods and Services		
Total	7500	

52/SGU	Cost (€)	Justification
Travel	5200	Travel to HOVER meetings
Equipment/consumables		
Other goods and services		
Total	5200	

53/GEOINFORM	Cost (€)	Justification
Travel	543.95	travels to attend projects meetings (kick-off, mid-term, final)
Equipment		
Other goods and Services		
Total	543.95	

54/NERC	Cost (€)	Justification
Travel	7000	travels to attend project board meetings
Equipment		
Other goods and Services		
Total	7000	

55/H.S.G.M.E.	Cost (€)	Justification
Travel	8000	travels to attend project meetings
Equipment		
Other goods and Services		
Total	8000	

Table 3.3c) Financial table with requested budget

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Participant	(A) Direct personnel costs (EUR)	(B) Other direct costs; travel, equipment, infrastructure, other (EUR)	(C) Direct costs of sub-contracting (EUR)	(D) Indirect costs (=(A+B)*0,25) (EUR)	(E) Total eligible costs (=A+B+C+D) (EUR)	(F) Reimbursement Rate (29,7%)	(G) Requested EU contribution (=E*F)	(H) Surveys in-kind contribution (=E-G)
BGR	99 691.00	5 000.00	0.00	26 172.75	130 863.75	0.30	38 866.53	91 997.22
BRGM	284 672.00	40 000.00	0.00	81 168.00	405 840.00	0.30	120 535.00	285 305.00
CGS	24 970.00	2 700.00	0.00	6 917.50	34 587.50	0.30	10 272.49	24 315.01
DLT	58 974.00	4 700.00	0.00	15 918.50	79 592.50	0.30	23 638.97	55 953.53
FZZG	14 555.00	1 400.00	0.00	3 988.75	19 943.75	0.30	5 923.29	14 020.46
GBA	112 500.00	8 000.00	0.00	30 125.00	150 625.00	0.30	44 735.63	105 889.37
GEOINFORM	7 991.26	543.95	0.00	2 133.80	10 669.01	0.30	3 168.70	7 500.31
GeoZS	131 250.00	13 500.00	0.00	36 187.50	180 937.50	0.30	53 738.44	127 199.06
GEUS	384 905.00	38 800.00	0.00	105 926.25	529 631.25	0.30	157 300.48	372 330.77
GSD	18 000.00	3 600.00	0.00	5 400.00	27 000.00	0.30	8 019.00	18 981.00
GSI	46 808.03	2 500.00	0.00	12 327.01	61 635.04	0.30	18 305.61	43 329.43
GSS	7 160.00	2 000.00	0.00	2 290.00	11 450.00	0.30	3 400.65	8 049.35
GTK	9 180.00	1 500.00	0.00	2 670.00	13 349.00	0.30	3 965.00	9 384.00
HGI-CGS	34 800.00	3 600.00	0.00	9 600.00	48 000.00	0.30	14 256.00	33 744.00
ICGC	68 815.00	7 500.00	0.00	19 078.75	95 393.75	0.30	28 331.94	67 061.81
IGME-Sp	126 728.00	12 000.00	0.00	34 682.00	173 410.00	0.30	51 502.77	121 907.23
IGR	64 064.00	9 210.00	0.00	18 318.50	91 592.50	0.30	27 202.97	64 389.53
ISOR	32 300.00	3 000.00	0.00	8 825.00	44 125.00	0.30	13 105.13	31 019.87
ISPRA	27 500.00	5 550.00	0.00	8 262.50	41 312.50	0.30	12 269.81	29 042.69
LBEG	27 000.00	2 700.00	0.00	7 425.00	37 125.00	0.30	11 026.13	26 098.87
LEGMC	7 794.23	1 700.00	0.00	2 373.56	11 867.79	0.30	3 524.00	8 343.79
LGT	15 750.00	1 700.00	0.00	4 362.50	21 812.50	0.30	6 478.31	15 334.19
LNEG	21 682.53	0.00	0.00	5 420.63	27 103.16	0.30	8 049.64	19 053.52
MBFSZ	29 137.50	4 100.00	0.00	8 309.38	41 546.88	0.30	12 339.42	29 207.45
OPM	26 640.00	5 000.00	0.00	7 910.00	39 550.00	0.30	11 746.01	27 803.99
NERC (UKRI)	87 185.00	7 000.00	0.00	23 546.25	117 731.25	0.30	34 966.18	82 765.07
PIG-PIB	29 150.00	15 800.00	0.00	11 237.50	56 187.50	0.30	16 687.69	39 499.81
SGU	70 775.00	5 200.00	0.00	18 993.75	94 968.75	0.30	28 205.72	66 763.03
TNO	192 870.00	40 000.00	0.00	58 217.50	291 087.50	0.30	86 452.99	204 634.51
VMM	40 000.00	3 500.00	0.00	10 875.00	54 375.00	0.30	16 149.38	38 225.62
H.S.G.M.E.	37 200.00	8 000.00	0.00	11 300.00	56 500.00	0.30	16 780.50	39 719.50

4 MEMBERS OF THE CONSORTIUM

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Please note that the presentation of the members of the consortium has been intentionally limited to 1 page for each partner.

Name of organisation	1. Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek TNO		
Short name	TNO	**Country**	Netherlands

Organisation profile

TNO is a semi-independent Dutch research and technology organisation active in technical, earth, environmental, life, societal and behavioural sciences, focussing of healthy living, industrial innovation, defence, safety and security. The Geological Survey of the Netherlands (TNO-GSN) provides geoscientific data, information and knowledge for sustainable management of earth resources and the environment. TNO-GSN is the national information provider on subsurface data, including the 3D groundwater information products REGIS, GeoTop and webservices such as Groundwater Tools.

Roles / tasks in the project	Special relevant skills
Participant in WP5, WP6 & WP8	• Building databases and web services for subsurface and groundwater data • Integrated interpretation of hydrological, hydrochemical and hydrogeological datasets towards custom made information products

Short profile of staff member(s) who will be undertaking the work

Dr. Hans Peter Broers (m): senior expert groundwater quality & groundwater modelling at TNO-GSN, specialising in groundwater-surface water interaction and tracer hydrogeology. Vice-chair of the EGS Water Resources Expert Group. Coordinator of several EU Framework Proposals and work packages (FP6 Aquaterra, FP7 MARS). **Drs. Ronald Vernes (m)** senior expert and project manager at TNO-GSN. Responsible for the national 3D hydrogeological model REGIS II, project initiator and manager of the cross border hydrogeological harmonization H3O-projects with Belgium and Germany. **Dr. Willem Jan Zaadnoordijk (m)**: senior hydrogeologist at TNO-GSN and guest researcher at Technical University Delft. Experienced in groundwater modeling, modeling of piezometric time series and groundwater surface water interaction.

Publications, infrastructure / technical equipment

National DINO database on subsurface information (boreholes, groundwater heads and qroundwater quality) and 3D geomodels GeoTOP and REGIS II (*www.dinoloket.nl*), timeseries models for heads DINO database (*www.grondwatertools.nl*)

Publications:

Visser A., H.P. Broers, R. Purtschert, J. Sültenfuss and M.de Jonge (2013). Groundwater travel time distributions at a public drinking water supply well field derived from multiple age tracers (85Kr, 3H, noble gases and 39Ar). Water Resources Research 49(11):7778-7796

Geer F.C., M.F.P. Bierkens and H.P. Broers (2008) Groundwater monitoring strategies. Encyclopedia of Hydrological Sciences. DOI: 10.1002/0470848944.hsa316

Broers, H.P. & B. van der Grift (2004) Regional monitoring of temporal changes in groundwater quality. Journal of Hydrology 296:192-220

Berendrecht, W.L., F.C. van Geer (2016) A dynamic factor modeling framework for analyzing multiple groundwater head series simultaneously, Journal of Hydrology, 536, 50-60.

Zaadnoordijk, W.J., M. Bakker (2013) Application of spatial time-series analysis to determine calibration targets for transient groundwater models, in: proceedings MODFLOW and More 2013 Translating Science into Practice, June 2-5, 2013, IGWMC, Colorada School of Mines, Golden CO, USA.

Relevant projects/activities

- H3O (2013-present): cross-border harmonization of 3D hydrogeological models within the Dutch-Belgian cross-border region.
- FP 6 Aquaterra (partner): Trends in groundwater quality and interpretation of groundwater-surface water interaction in a number of European pilots.
- FP6 BRIDGE (partner): policy support for the EU Groundwater Directive.

Name of organisation	**1a. Deltares**		
Short name	Deltares	**Country**	The Netherlands

Organisation profile

Deltares is an independent institute for applied research in the field of water and subsurface. Deltares works on smart solutions, innovations and applications for people, environment and society. Deltares employs over 800 people and is based in Delft and Utrecht. The unit subsurface and groundwater systems is based in Utrecht. Deltares is working in modelling, development of software and databases, laboratory and monitoring activities. Deltares hosts the national hydrological model, the Netherlands Hydrological Instruments (NHI), the integrated model for soil, subsurface and surface water for water quantity and nutrient modelling). The groundwater modelling team in Utrecht works closely with the geological modelling team at TNO, the modelling team for the vadose zone at Wageningen University and the surface water modelling team of Deltares in Delft. The team has broad experience in developing and applying hydrological models within research and projects for water quantity and water quality, including the interaction of surface water and ground water and impact of climate change as well as social and economic scenario's.

Roles / tasks in the project	**Special relevant skills**
Within GeoERA Deltares works as subcontractor of TNO.	• Integrated hydrological modelling on national scale, water quantity and water quality • Modelling on different scales (local, regional national, continental /world wide scale). • Hydrological characterisation of GW

Short profile of staff member(s) who will be undertaking the work

Marta Faneca Sanchez (f) is specialized in the analysis of groundwater systems, and in groundwater modelling on a regional, national and global scale.
Bas van der Grift (m) has a extensive scientific background in water quality and environmental geochemistry.
Gijs Janssen's (m) expertise is ground water quality, soil pollution, uncertainty analysis and geohydrology. Gijs has a broad experience in ground water modelling (reactive transport modelling density dependent flow, transport modelling, inverse modelling).
Timo Kroon (m) experience focusses on integrated hydrological modelling of groundwater and surface water. Timo is project leader of the NHI (Netherlands Hydrological Instrument) for water quantity and water quality and involved in many modelling projects within the Netherlands.

Publications, infrastructure / technical equipment

B. van der Grift, H.P. Broers, W. Berendrecht, et al. High-frequency monitoring reveals nutrient sources and transport processes in an agriculture-dominated lowland water systemHydrology and Earth System Sciences 20 (5), 2016
Janssen, G.M.C.M., J.R. Valstar and S.E.A.T.M. van der Zee Measurement network design including travel time determinations to minimize prediction uncertainty Water, Water Resources Research 2008.
De Lange, W.J., Prinsen, G.F., Hoogewoud, J.C. et al An operational, multi-scale, multi-model system for consensus-based, integrated water management and policy analysis: The Netherlands Hydrological Instrument. Environmental Modelling & Software, 2014.

Relevant projects/activities

Netherlands Hydrological Instrument (NHI), (2005,--) lead by Deltares. (www.nhi.nu).
Netherlands Water Quality Instrument (2015,--) lead by Deltares and Wageningen University and Research. Based on the national hydrological model an nutrient model for the Netherlands is developed. The model wil be applied in 2018 for national policy studies.
Global scale ground water modelling using MODFLOW and PCRGLOB. In cooperation with Utrecht University a global MODFLOW model, coupled to the PCRGLOB model is developed.

Name of organisation	3. Geologische Bundesanstalt		
Short name	GBA	Country	Austria

Organisation profile

The **Geological Survey of Austria (GBA)** undertakes core programmes, such as geoscientific mapping of the Austrian territory. Applied tasks include assessment of mineral and ground water ressources, natural hazard mitigation & monitoring as well as geothermal exploration. Furthermore, GBA operates a geological information service, acts as a service for the public administration and participates actively in international research projects, in particular with EuroGeoSurvey, where it is a member of most expert groups.

Roles / tasks in the project	Special relevant skills
Coordination of WP3 Participant in WP1, WP2, WP6 & WP7	- Groundwater mapping - Radionuclides in groundwater

Short profile of staff member(s) who will be undertaking the work

Gerhard Schubert (m) is the Head of Austria's Geological Survey's Department Hydrogeology and Geothermal Energy. He was involved in several EU-funded projects as responsible partner and is member of the EGS Water Resources Expert Group.

Publications, infrastructure / technical equipment

The following recent publications applies to project GW1: :

*SCHUBERT, G, BERKA, R., KATZLBERGER, Ch., MOTSCHKA, K., DENNER, M., GRATH, J. & PHILIPPITSCH, R. (2017: Radionuclides in groundwater, rocks and stream sediments in Austria - results from a recent survey. – Special Publications, Radon, Health and Natural Hazards, Geological Society of London. (*https://doi.org/10.1144/SP451.10*)*

*ELSTER, D., GOLDBR UNNER, J., WESSELY, G., NIEDERB ACHER, P., SCHUBERT, G., BERKA, R., PHILIPP ITSCH, R. & HÖRHAN, T. (2016): Erläuterungen zur geologischen Themenkarte Thermalwässer in Österreich 1:500.000. – 296 S., Wien. (*http://opac.geologie.ac.at/wwwopacx/wwwopac.ashx?command=getcontent&server=images&value=Erlaeuterungen_Thermalwaesser.pdf *and* http://opac.geologie.ac.at/wwwopacx/wwwopac.ashx?command=getcontent&server=images&value=Karte_Thermalwaesser_Scan_400.pdf*)*

*SCHUBERT, G. (Red.) (2015): Trinkbare Tiefengrundwässer in Österreich. – Abhandlungen der Geologischen Bundesanstalt, 64, 179 S., Wien. (*https://www.bmlfuw.gv.at/dam/jcr:17ad0c30-d42d-4c20-ac13-ddab607cb97c/AB0064_Gesamt_Trinkbare%20Tiefengrundw%C3%A4sser%20in%20%C3%96sterreich.pdf *and* https://www.bmlfuw.gv.at/dam/jcr:bc3a402a-5ac0-4c58-9c0a-69b11ee6013d/TGW-Karte%5B1%5D_web.pdf*)*

LOISHANDL-WEISZ, H., WEMHÖNER, U., SCHARTNER, CH., SCHUBERT, G., SCHEDL, A. & PHILIPPITSCH, R. (2012): Metalle im Grundwasser Österreichs. Karten und Erläuterungen. – 63 S., 13 Beilagen, Umweltbundesamt, Wien. (https://www.google.at/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwi46oSPzvfXAhWBmBoKHUIMChMQFggvMAE&url=https%3A%2F%2Fwww.bmlfuw.gv.at%2Fdam%2Fjcr%3Aebb5c343-9c26-4092-a2e3-78e10825db70%2FMetalle_im_Grundwasser_Letztfassung%2520032013_Karten_und_Erl%25C3%25A4uterungen.pdf&usg=AOvVaw3vCdNDkzuvauc4ZCTFJZ2I)

Relevant projects/activities

The following ongoing national projects of the Austrian Geological Survey refer to project GW1:

- *Hydrogeological Map of Austria 1 : 500 000 - Update*
- *Hydrogeological Map of Upper Austria 1 : 200 000, explanatory notes*
- *Mineral Water and Medical Springs in Austria (map 1 : 500 000 and explanatory notes)*
- *Uranium in Groundwater*
- *Geochemical Background and Baseline Values in Austrian groundwater (in cooperation with Umweltbundesamt)*

Name of organisation	**6. Vlaamse Milieu Maatschappij (Flanders Environment Agency)**		
Short name	VMM	**Country**	Belgium

Organisation profile

Flanders Environment Agency (VMM) is an internally independent government agency with powers of jurisdiction under supervision of the Flemish Minister of the Environment, Nature and Agriculture. VMM's legal basis is the decree of 05/04/1995 (Belgian Official Journal of 03/06/1995). The mission of VMM is to contribute to the realisation of the objectives of the environmental policy by preventing, limiting and eliminating the harmful effects to water systems (including groundwater) and the atmosphere and by reporting on the state of the environment and to the realisation of the objectives of integrated water management.

Roles / tasks in the project	**Special relevant skills**
Participant in WP3	- Groundwater quality monitoring - Status assessment of groundwater quality Policy development on groundwater and drinking water

Short profile of staff member(s) who will be undertaking the work

Kris Van den Belt (m) graduated as a biologist and holds a phd in biology. He is head of the groundwater and local water management section of VMM and is representing Flanders in the CIS Working Group Groundwater and the European network of drinking water regulators.
Ralf Eppinger (m) graduated as a geologist in 1995 and holds a phd in geology (2008). He leads the groundwater monitoring team of the groundwater and local water management section of VMM and is representing Flanders in the CIS Working Group Groundwater.
Griet Heuvelmans (f) graduated as bio-engineer in 2001 and holds a phd in bio-engineering (2005) from the University of Leuven. She works at the groundwater and local water management section of VMM and is mainly involved in the initiation and coordination of studies in support of groundwater policy and management.

Publications, infrastructure / technical equipment

- Groundwater quality data: 2 monitoring campaigns per year on > 5000 screens since 2004. Screen are distributed over all groundwater layers in Flanders and data are used for reporting groundwater quality in the framework of EU directives
- Groundwater quality database and web-portal for data dissemination
- Publications for a wider audience (in Dutch), a.o. 'Heavy metals in groundwater in Flanders', 'Pesticides in groundwater in Flanders', 'Quality of drinking water in Flanders in 2016'

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Relevant projects/activities

- Reporting the qualitative status of groundwater bodies to EU
- Preparing policy and legislation concerning groundwater (e.g. setting natural background concentrations and threshold values for groundwater quality) and drinking water in Flanders
- Participating in international working groups on groundwater (e.g. CIS Working group Groundwater) and drinking water (e.g. ENDWARE)
- Disseminating groundwater information to the general public in Flanders, via publications and a web-portal (dov.vlaanderen.be)

Name of organisation	7. Federalni zavod za geologiju (Geological Survey of Federation of Bosnia and Herzegovina)		
Short name	FZZG	Country	Bosnia and Herzegovina

Organisation profile

Geological Survey of Federation of Bosnia and Herzegovina carries out researching, expert-analytical and other tasks in area of fundamental and regional geologic researches of interest for the Federation referring to producing the basic geologic, hydrogeologic, engineering-geologic, seismologic-tectonic and other geologic maps and carries out preparation for printing thereof

Roles / tasks in the project	Special relevant skills
Participating in WP3	• Building databases for groundwater • Characterisation and mapping of hydrogeological systems

Short profile of staff member(s) who will be undertaking the work

Hazim Hrvatović (m): Director Federal Institute for Geology; key expert for structural geology and geological mapping.
Ferid Skopljak (m): Assistant director, key expertise is research and protection of groundwater. He has experience of 27 years in hydrogeological studies
Jasminka Nikolić (f):senior hydrogeologist, expert in hydrogeological mapping
Ćazim Šarić (m): - Senior hydrogeologist, expert in exploration of groundwater dynamics and protection of groundwater resources; expert for GIS.
Nermina Omerhodžić (f): key expert for GIS

Publications, infrastructure / technical equipment

1. Map of mineral, thermal and thermomineral waters of B&H with Explanation and Catalogue of waters (Miošić, 1978) in the frame of Map of mineral and thermal waters of Yugoslavia (1983).
2. Investigations of regime and balance of mineral, thermal and thermomineral waters of Bosnia and Herzegovina (Slišković, Plavkić, Miošić, 1982, 1985, 1990).
3. Geothermal Atlas of Europe – B&H (Miošić, 1987).
4. Geothermal map of Bosnia and Herzegovina, 1:200.000 (Miošić, 1989).
5. Atlas of Geothermal Resources in Europe – B&H (Miošić, 1994).
6. Global Heat Flow Data Base (GHFDB) – B&H (Miošić, 1988).
7. Cadastre and GIS database of mineral, thermal and thermomineral waters of Federation of B&H (Miošić, Skopljak, Samardžić, Saletović-Nikolić, Begić, 2010).

Relevant projects/activities

1. APOPSBAL (2002-2005);
2. ANTHROPOL. PROT (2003-2005);
3. IGME 5.000.000 (1994-2010);
4. BSHAP, NATO Project (2007-2011);
5. OneGeology (2008.);
6. GEMAS (2008-2013);
7. DanReGeotherm-DATA (2015);

Name of organisation	9. Hrvatski geološki institut – Croatian Geological Survey		
Short name	HGI-CGS	Country	Croatia

Organisation profile

Croatian Geological Survey (HGI-CGS) is the foremost public research institute in the field of geosciences and geological engineering in Croatia (HR). HGI-CGS is divided into three departments: Department of Hydrogeology and Engineering Geology, Department of Mineral Resources and Department of Geology. HGI-CGS collaborates with many institutions of similar affiliation, organizations and faculties in the country and neighbouring countries. Beside scientific research, the institute provides consulting services for private companies and stakeholders. HGI-CGS basic activity includes long-term project of producing Basic Geological Maps of the Republic of Croatia among which is also Basic Hydrogeological Map. Regarding groundwater resources HGI-CGS experts have experience and competence in groundwater protection, modelling and solving various groundwater connected environmental problems.

Roles / tasks in the project	Special relevant skills
Participant in WP5 & WP6	• Characterisation and mapping of hydrogeological systems • Modelling of groundwater flow and solute transport through saturated zone • Groundwater age dating

Short profile of staff member(s) who will be undertaking the work

Željka Brkić (f): - Senior Research Associate at Croatian Geological Survey, Department of hydrogeology and engineering geology. Leader of the projects linked to the implementation of the EU Water Framework Directive in Croatia.
Ozren Larva (m): - Senior Research Associate at Croatian Geological Survey, Department of hydrogeology and engineering geology with expertise in exploration of groundwater dynamics and protection of groundwater resources, vulnerability and risk assessment and modelling of groundwater flow and solute transport.

Publications, infrastructure / technical equipment

Brkić, Ž., Kuhta, M. & Hunjak, T. (2018): Groundwater flow mechanism in the well-developed karst aquifer system in the western Croatia: insights from spring discharge and water isotopes. Catena, 161, 14-26.
Brkić, Ž., Briški, M. & Marković, T. (2016): Use of hydrochemistry and isotopes for improving the knowledge of groundwater flow in a semiconfined aquifer system of the Eastern Slavonia (Croatia). Catena, 142, 153-165.
Marković, T., Brkić, Ž. & Larva, O. (2013): Using hydrochemical data and modelling to enhance the knowledge of groundwater flow and quality in an alluvial aquifer of Zagreb, Croatia. Science of Total Environment, Vol. 458-460;. 508-516.
Larva, O., Marković, T. & Mraz, V. (2010): Hydrodynamic and hydrochemical conditions at the groundwater source "Pašino vrelo", with a focus on its development. Geologia Croatica Vol 63 (3): p 299-312.

Relevant projects/activities

- TRANITAL – Origin, fate and transport modelling of nitrate in the Varaždin alluvial aquifer
- ISTRA-HIDRO – Sustainable management of transboundary groundwater between Trieste and Kvarner bay
- DARLINGe – Danube Region Leading Geothermal Energy; Interreg Danube Transnational Programme; 2017-2019.

Name of organisation	10. Cyprus Geological Survey Department		
Short name	GSD	Country	Cyprus

Organisation profile

The Cyprus Geological Survey Department (G.S.D.) was established in 1950 with a mandate to consult the state on geological matters. It is a state-funded public institution under the Ministry of Agriculture, Rural Development and Environment and its mission is to safeguard the public interest through the identification, the exploitation and protection of mineral and groundwater resources, the investigation and assessment of the geological environment and geohazards, the monitoring and assessment of seismicity, the investigation of foundation conditions, the protection and promotion of sites of geological and mining heritage and the production and dissemination of unbiased geological information to society.

Roles / tasks in the project	Special relevant skills
Participant in WP5 & WP6	• Groundwater qualitative and quantitative monitoring and reporting • Groundwater exploration in fractured systems

Short profile of staff member(s) who will be undertaking the work

Christos Christofi (m): Senior Geological Officer, head of hydrogeology and drilling section. Groundwater exploration and hydrochemistry. National representative in Working Group Groundwater within the Common Implementation Strategy of the Water Framework Directive.
Theodosia Herakleous (f)
Michales Rigas (m)

Publications, infrastructure / technical equipment

- *Konstantinou K., Kallergis G. and Christofi C. 2005. Study of groundwater flow regime in fractured formations with data from dataloggers: The Troodos Ophiolite Complex (2005). In G. Stournaras et al. (Eds.), Proceedings of 7th Panhellenic Hydrogeological Conference, Athens 2005*
- *Christofi C and Konstantinou K. 2011. Nitrogen sources and denitrification potential of Cyprus aquifers, through isotopic investigation on nitrates. In: N. Lambrakis et al. (Eds.), Advances in the Research of Aquatic Environment, Vol. 2: DOI 10.1007/978-3-642-24076-8.*
- *Konstantinou K., Rigas M. and Christofi C. 2014. Concentration and distribution of arsenic, cadmium, lead and mercury in the groundwater bodies of Cyprus (2014). In K. Voudouris, G (Eds.), Advances in the Research of Aquatic Environment, Vol. 1: 978-960-88816-62-2.*
- *Rigas M., Christofi C. and Konstantinou K 2017. Volume analysis using the ManKendall test of nitrate concentration of groundwater in Cyprus. 11th International Hydrogeological Conference, Athens 2017, Conference proceedings V.2.*

Relevant projects/activities

GSD hydrogeology database (Hydrogeoanalyst) holds ground, surface and precipitation water quality data (and quantitative, where applicable). Furthermore, geological logging data are also stored in the database.

Name of organisation	**11. Ceska geologicka sluzba / Czech Geological Survey**		
Short name	CGS	**Country**	Czech Republic

Organisation profile

Ceska geologicka sluzba / Czech Geological Survey (CGS) is a research institute of the Ministry of Environment of the Czech Republic. The mission of the CGS, the history of which has started in 1919, is the performance of the state geological survey in the Czech Republic and research in geosciences. CGS leads and participates in basic and interdisciplinary research projects.
The main fields of expertise include hydrogeological research and mapping; geochemistry and environmental studies (interaction atmosphere – biosphere –hydrosphere – geosphere, monitoring of element budgets, acidification of forest soils, organic pollutants, radon risk); applied geology and natural risks (hydrogeological mapping and research, radioactive waste disposal, support of development planning).
The system of CGS district geologists and associated specialists assists in acquisition and assessment of data on the geological composition of the state territory and the CGS provides expert information to the authorities.

Roles / tasks in the project	**Special relevant skills**
Participant in WP3	- data management - GIS - Web Map Services

Short profile of staff member(s) who will be undertaking the work

Eva Kryštofová (f) Researcher, district hydrogeologist. Involved in mapping projects, including special GW mapping initiated by the Radioactive Waste Repository Authority. Experienced in hydrogeological map compilation and data assessment.
Iva Kůrková (f) Researcher, district hydrogeologist. Involved in mapping projects and applied hydrogeological projects. Experienced in hydrogeological and hydrochemical data assessment.
Both were involved in EU-funded project " Review of groundwater resources in the Czech Republic".

Publications, infrastructure / technical equipment

- Map application presenting the hydrogeological zones of the Czech Republic territory as defined in 2005. http://mapy.geology.cz/hydro_rajony/index_EN.html?config=config_EN.xml
- Map application giving key information about boreholes. http://mapy.geology.cz/GISViewer/?mapProjectId=15&cultureInfo=en
- Map application giving information about surface water chemistry (Czech only): http://mapy.geology.cz/chemismus_vod/
- CGS hosts the national repository for subsurface data and information including hydrogeological information (water heads, hydrochemistry, pumping tests).

Relevant projects/activities

- Hydrogeological mapping of the Czech Republic territory at different scales http://www.geology.cz/extranet-eng/science/natural-resources/ground-waters/hydrogeological-mapping
- Review of groundwater resources in the Czech Republic. This already finished project included reassessing of groundwater resources within app. one third of the territory of the Czech Republic. An integral part of the project is the development of methodological steps for the future periodical updating of groundwater resources including the water quality.

Name of organisation	12. Geological Survey of Denmark and Greenland, GEUS		
Short name	GEUS	**Country**	Denmark

Organisation profile

GEUS is an independent research and advisory institution in the Danish Ministry of Energy, Utilities and Climate. Primary activities are research in water, energy, minerals and other natural resources. GEUS provide geological advice to public authorities in nature, environment, climate, energy and raw materials issues and participate in the performance of tasks within these areas. GEUS is the national geological data centre and in that capacity make data and knowledge available to the authorities, educational institutions, government agencies, private enterprises and the public.

Roles / tasks in the project	Special relevant skills
Coordinator of WP2, WP4 & WP6 Participant in WP1, WP3, WP5, & WP7	• Groundwater quality monitoring and assessment, drinking water quality and health, groundwater dating, microbial ecology, transport and degradation of pesticides and emerging contaminants

Short profile of staff member(s) who will be undertaking the work

Jens Aamand (m) – professor, research microbiologist, expert in microbial degradation of organic contaminants, **Klaus Hinsby (m):** Senior Scientist/Hydrogeologist, theme coordinator for GeoERA groundwater, Chair of the EGS Water Resources Expert Group and EGS representative in the EU Working Group Groundwater, expert in groundwater dating. **Lærke Thorling (f):** Senior Adviser/Chemist/Physicist, Expert in groundwater chemistry, monitoring and statistical analysis, member of the EGS Water Resources Expert Group and the CIS Working Group Groundwater. **Birgitte Hansen (f):** Senior Scientist/ Hydro-geochemist, Expert in groundwater nitrate vulnerability, drinking water quality and health, statistical analysis and synthesis of geochemical and hydrogeological data. **Anette Rosenbom (f)**, Senior Scientist, expert in pesticide leaching, degradation and transport, responsible for the Danish Pesticide Leaching Assessment Programme.

Publications, infrastructure / technical equipment

*Batioglu-Pazarbasi, M, N. Milosevic, F. Malaguerra, P. J. Binning, H. -J Albrechtsen, P. L. Bjerg, and **J. Aamand** 2013. Discharge of landfill leachate to streambed sediments impacts the mineralization potential of phenoxy acid herbicides depending on the initial abundance of tfdA gene classes. Environ. Poll 176: 275-283*

***Hansen B.,** Sonnenborg, T.O., Møller, I., Bernth, J.D., Høyer, A.-S., Rasmussen, P., Sandersen, P.B.E. & Jørgensen, F. (2016). Nitrate vulnerability assessment of aquifers. Environ. Earth Sci. 75:999, doi:10.1007/s12665-016-5767-2.*

***Hansen B, Thorling L**, Dalgaard T, et al. (2011) Trend Reversal of Nitrate in Danish Groundwater - a Reflection of Agricultural Practices and Nitrogen Surpluses since 1950. Environmental Science & Technology 45(1): 228–234. doi:10.1021/es102334u*

***Hinsby K**.; Condesso de Melo MT and Dahl M (2008) European case studies supporting the derivation of natural background Levels and groundwater threshold values for the protection of dependent ecosystems and human health. Sci Total Env, 401: 1-20*

***Rosenbom A**, Olsen P, Plauborg F, et al. (2015) Pesticide leaching through sandy and loamy fields – Long-term lessons learnt from the Danish Pesticide Leaching Assessment Programme. Environmental Pollution, 201: 75–90.*

Lead of the Danish Pesticide Leaching Assessment Programme, including monitoring sites, modern laboratories for microbial and chemical analyses including organic contaminants, drilling facilities, Access to national databases on groundwater quality etc.

Relevant projects/activities

- National Groundwater Monitoring Programme (2007-date) http://www.geus.dk/DK/publications/groundwater_monitoring/Sider/1989_2015.aspx
- The Pesticide Leaching Assessment Programme: http://pesticidvarsling.dk/om_os_uk/uk-forside.html
- DnMARK (2013-2017): Health effects of nitrate in groundwater and drinking water: http://dnmark.org/?page_id=887&lang=en
- Accelerated water purification during artificial recharge of aquifers - a tool to restore drinking water resources (**ACWAPUR**) EU – ERANET collaboration (JPI) coordinated by GEUS, J. Aamand

Name of organisation	14. Geologian Tutkimuskeskus		
Short name	GTK	**Country**	Finland

Organisation profile

The Geological Survey of Finland (GTK) is a European competence centre on assessment and sustainable use of geological resources operating under the Ministry of Economic Affairs and Employment. The person-years worked amounts to 450 of which 50% are highly qualified professionals in various aspects of geology, environmental sciences, geophysics, geochemistry and IT technology, many of them with strong international background. GTK´s groundwater services include hydrogeological mapping and 3D modelling, flow and transport modelling, water quality and vulnerability assessment, groundwater management, training and capacity building, isotopes in groundwater investigations, especially related to the managed aquifer recharge.

Roles / tasks in the project	Special relevant skills
Participant in WP7	• Mapping and modelling of groundwater using different novel technologies including gravity survey, GPR, remote sensing and LiDAR. • Groundwater flow and reactive transport modelling and mapping.

Short profile of staff member(s) who will be undertaking the work

Samrit Luoma (f) is a Geologist, Groundwater modeller and GIS expert at GTK. Involved in several European Programme's projects related to groundwater and environmental impacts studies e.g. EU-Life+ Environmental Programme, and the EU Spatial Planning Observation Network (ESPON), the EU Programme for Critical Infrastructure Protection in the Baltic Sea Region (CIP) project, and the INTERREG IIIB Baltic Sea Region projects. Groundwater modeller for the EAKR Project - groundwater flow and reactive transport modelling for the aquifers in Finland (2016-2018), the POVEYTKE project - development of the methods for groundwater monitoring and vulnerability assessment of aquifers in south Finland (2015-2017).
Tiina Kaipainen (f) is a Geologist and project manager. Project manager of multiple projects concerning geological structure of groundwater areas in Southern Finland. Also involved in groundwater - surface water interaction (the H&O stable isotopes)**.**

Publications, infrastructure / technical equipment

- Luoma, S., Okkonen, J. & Korkka-Niemi, K. 2016. Comparison of the AVI, modified SINTACS and GALDIT vulnerability methods under future climate-change scenarios for a shallow low-lying coastal aquifer in southern Finland. Hydrogeology J., doi:10.1007/s10040-016-1471-2
- Luoma, S. & Okkonen, J. 2014. Impacts of Future Climate Change and Baltic Sea Level Rise on Groundwater Recharge, Groundwater Levels, and Surface Leakage in the Hanko Aquifer in Southern Finland. Water 2014, 6(12), 3671-3700; doi:10.3390/w6123671.
- Luoma, S., Okkonen, J., Korkka-Niemi, K., Hendriksson, N. & Backman, B. 2015. Confronting the vicinity of the surface water and sea shore in a shallow glaciogenic aquifer in southern Finland. Hydrol. Earth Syst. Sci., 19, 1353-1370, 2015, doi:10.5194/hess-19-1353-2015.
- Okkonen, J. & Neupauer, RM., 2016. Capture zone delineation methodology based on the maximum concentration-Preventative groundwater well protection areas for heat exchange fluid mixtures. Water Resources Research 52 (5), 4043-4060, doi: 10.1002/2016WR018715.

Relevant projects/activities

- **EAKR KArhinkangas** (2016-2018) - Groundwater flow and reactive transport modelling for the shallow aquifers in Finland.
- **POVEYTKE** (2015-2017) - (http://www.vhvsy.fi/files/upload_pdf/7425/Julkaisu%2077-2017%20POVEYTKE-loppuraportti.pdf in Finnish).
- **BaltCICA** (2009-2012) - Climate Change: Impacts, Costs and Adaptation in the Baltic Sea Region. (http://www.baltcica.org).
- **RAMAS** (2006-2008) - Risk Assessment and Risk Management Procedure for Arsenic in the Tampere Region. (http://projects.gtk.fi/ramas).

Name of organisation	15. Bureau de Recherches Géologiques et Minières		
Short name	BRGM	**Country**	France

Organisation profile

BRGM (Bureau de Recherches Géologiques et Minières) is the French geological survey. It was created in 1959 and is France's reference public institution for Earth Science applications in the management of surface and subsurface resources and risks. BRGM's activities are focused on increasing geological knowledge and understanding surface and subsurface phenomena related in particular to groundwater, mineral and geo-energy resources. By addressing major environment and sustainability issues, BRGM provides support for public policies and decision making, and contributes to the development of innovative technologies featuring research in public and private partnership, at national and international level.

Roles / tasks in the project	Special relevant skills
Overall coordination proposed project Coordination of WP1 & WP 8 Participant in WP2, WP3, WP4, WP5, WP6 & WP7	• Analysis of groundwater quality monitoring data and scientific expertise on emerging pollutants • Multicriteria analyses and mapping • Mapping of hydrogeological Systems • Assessing and predicting the mobility and impacts of pollutants in soils and groundwater • Establishing natural concentrations of pollutants in the environment

Short profile of staff member(s) who will be undertaking the work

Chrystelle Auterives (f): Expert in groundwater quality and interference with terrestrial ecosystems. Pesticide transfer from soil to saturated zone
Stéphanie Pinson (f): Developer of the IDPR method, bases of the vulnerability map in France
Alexandre Brugeron (m): Hydrogeologist and GIS expert – Coordinator of the French hydrogeological reference system.
Laurence Gourcy (f): Head of the "assessment and evaluation of water knowledge" unit at the D3E Department, member of the EuroGeoSurveys Water Resources Expert Group
Benjamin Lopez (m): expert in emerging contaminant – Leader of the Norman network sub-group 1 on **Prioritisation of Contaminants of Emerging Concern in Groundwater**
Jennifer Hellal (f) – microbiologist and biogeochemist, expert in interactions between microbial communities and water pollutants (organic and inorganic)

Publications, infrastructure / technical equipment

Lopez B., Ollivier P., Togola A., Baran N., Ghestem J-P., 2015. Screening of French groundwater for regulated and emerging contaminants. Science of the Total Environment 518–519 (2015) 562–573
Gourcy L., Baran N., Vittecoq B., 2009. Improving the knowledge of pesticide and nitrate transfer processes using age-dating tools (CFC, SF_6, ^3H) in a volcanic island. Journal of contaminant hydrology, 108, 107-117.
Wendland F., Berthold G, Blum A. et al., 2008. Derivation of natural background levels and threshold values for groundwater bodies in the Upper Rhine Valley (France, Switzerland, Germany). Desalinisation, vol.226 (1-3), 160-168.
Hellal J, Guédron S, Huguet L et al. (2015). Mercury mobilization and speciation linked to bacterial iron oxide and sulfate reduction: A column study to mimic reactive transfer in an anoxic aquifer. J Contaminated Hydrology, vol.180, 56-68
Tools developments in "R" such as QUALINET - A tool for statistical and multicriteria analyses of groundwater data and HYPE - A statistical tool for analysis of trends and breaks in GW quality records

Relevant projects/activities

http://www.brgm.eu/project/karst-floods-characterization-development-of-management-tools
http://www.brgm.eu/project/multimethod-geophysics-survey-to-detect-characterise-karsts
http://www.brgm.eu/project/hydrogeological-map-of-africa
http://www.brgm.eu/news-media/new-hydrogeological-map-of-france
http://ades.eaufrance.fr

Name of organisation	17. Federal Institute for Geosciences and Natural Resources		
Short name	BGR	**Country**	Germany

Organisation profile

BGR is an Authority and Research Institute of the Federal Republic of Germany within the portfolio of the Federal Ministry for Economic Affairs and Energy. BGR gives independent advice to the Federal Government on all geoscientific questions. It cooperates on the European level with the National Geological Surveys and is member of EuroGeoSurveys. BGR harmonizes methods taking into account hydrogeological and hydrogeochemical data as well as information on soil. BGR's International Hydrogeological Map of Europe at the scale of 1:1.500.000 (IHME1500) could serve as information basis for standardization. The interpretation of national information is performed using standardized methods for all of Germany, developed in close collaboration with the Federal State Geological Surveys, such as the aquifer vulnerability map to pollution at the scale of 1:200.000 or the groundwater recharge map at the scale 1:2.000.000.

Roles / tasks in the project	Special relevant skills
Coordination of WP7	• Hydrogeological mapping at various scales. • Building databases and web services for subsurface and groundwater data. • Interpretation of hydrogeological datasets towards custom-made information products.

Short profile of staff member(s) who will be undertaking the work

Jörg Reichling (m): senior hydrogeologist and groundwater expert. Head of sub-department „Basic Information Groundwater and Soil" at BGR. Member of the EGS Water Resources Expert Group.
Stefan Broda (m): senior groundwater expert and project manager at BGR. Head of unit "Spatial information on groundwater". Responsible for the national (Hydrogeological Map of Germany) and international hydrogeological data base (WHYMAP).
Andreas Günther (m): senior geologist and project manager at BGR. Responsible for the IHME1500.

Publications, infrastructure / technical equipment

National database on subsurface information at the scale of 1:200.000 (Hydrogeological Map of Germany; Mean Annual Groundwater Recharge of Germany; Aquifer Vulnerability Map to Pollution; hydrogeochemical Groundwater Background Level Values), International database on subsurface information at the scale of 1:1.500.000 (IHME1500) and 1:25.000.000 (WHYMAP)

Ad-hoc-AG Hydrogeologie (2016): Regionale Hydrogeologie von Deutschland - Die Grundwasserleiter: Verbreitung, Gesteine, Lagerungsverhältnisse, Schutz und Bedeutung. - Geologisches Jahrbuch Reihe A, Heft 163: 456 S., ISBN 978-3-510-96852-7

Duscher, K., Günther, A., Richts, A., Clos, P., Philipp, U. and Struckmeier,W. (2015): The GIS layers of the "International Hydrogeological Map of Europe 1:1,500,000" in a vector format. - Hydrogeol. J.; DOI 10.1007/s10040-015-1296-4

Günther, A., Van Den Eeckhaut, M., Malet, J.-P., Reichenbach, P., and Hervás, J. (2014): Climate-physiographically differentiated Pan-European landslide susceptibility assessment using spatial multi-criteria evaluation and transnational landslide information. Geomorphology, 224, pp. 69-85.

Relevant projects/activities

- International Hydrogeological Map of Europe IHME1500 including lithological harmonization.
- World-wide Hydrogeological Mapping and Assessment Programme WHYMAP - World Karst Aquifer Map, Vulnerability to floods and droughts.
- Protection potential to pollution of aquifer in Germany.

Name of organisation	22. Landesamt für Bergbau, Energie und Geologie (LBEG) – Geologischer Dienst für Niedersachsen		
Short name	LBEG	**Country**	Germany

Organisation profile

LBEG (Landesamt für Bergbau, Energie und Geologie) is Geological Survey of Lower Saxony (ERA project partner) and Mining Authority of Lower Saxony, Hamburg, Bremen and Schleswig-Holstein as well as the German continental shelf of the North Sea and a part of the German continental shelf of the Baltic Sea. The main responsibilities of the Geological Survey are development of geo-resources, protection of soil and groundwater, and state advisor of geological matters related to the Mining Act. The survey´s core skills are geological and hydrogeological mapping, hydrogeology, engineering geology, soil science, geophysics, geochemistry, management of geo-data and geological 3D mapping. Projects of the survey include mapping of groundwater resources, determination of geothermal potential, large scale 3D modeling of the deeper underground, remediation of contaminated sites, mapping of soil erosion and determination of geo-hazards.

Roles / tasks in the project	Special relevant skills
Participant in WP7	• Geological, hydrogeological and soil mapping. • Building databases and web services for surface, subsurface and groundwater data.

Short profile of staff member(s) who will be undertaking the work

Dr. Jörg Elbracht (m) head of the sub department Hydrogeology, geologist. Works as geologist and hydrogeologist in Lower Saxony, geological and hydrogeological mapping in Lower Saxony, head of geological and hydrogeological working-groups (e.g. 3D-modelling of quaternary deposits at German north-sea-sector (GPDN)).
Melanie Witthöft (f) scientific officier in the sub department Hydrogeology, geoscientist. Works as geologist and hydrogeologist and in geological and hydrogeological mapping in Lower Saxony (e.g. map of hydraulic heads, geological and hydrogeological crosssections).

Publications, infrastructure / technical equipment

Public database on surface and subsurface information (groundwater, geology, soil, mining) offering maps, boreholes, crosssections and 3D-models (http://nibis.lbeg.de/cardomap3/).

- HERMANN, F., CHEN, S., HEIDT, L., ELBRACHT, J., ENGEL, N., KUNKEL, R., MÜLLER, U., RÖHM, H., VEREECKEN, H. & WENDLAND, F. (2013): Zeitlich und räumlich hochaufgelöste flächendifferenzierte Simulation des Landschaftswasserhaushalts in Niedersachsen mit dem Modell mGROWA. Hydrologie u. Wasserbewirtschaftung, 57 (5), 206-224, 9 Abb., 3 Tab., Koblenz (BfG)
- Deus, N.; Elbracht, J.; Siemon, B.: 3D-Modelling of the salt-/fresh water interface in coastal aquifers of Lower Saxony (Germany) based on airborne electromagnetic measurements (HEM) – in: AquaConSoil Copenhagen 2015 : 13th International UFZ_Deltares Conference on Sustainable Use and Management of Soil, Sediment and water Resources, 9-12 June 2015, Copenhagen, Denmark; programme, book of abstracts. – Copenhagen. – (2015), S.76-77
- Röhm, H.: Grundwasser-Monitoring: Erstellung geologischer und hydrostratigrafischer Schnitte zur Umsetzung der EG-WRRL, Teil 2 – Hannover: la F: Bergbau; Energie und Geologie

Relevant projects/activities

- Geological and hydrogeological crosssections showing the structures and characteristics of groundwaterreservoir in Lower Saxony (https://www.lbeg.niedersachsen.de/boden_grundwasser/grundwasser/hydrogeologische_schnitte/hydrogeologische-schnitte-627.html)
- Hydrogeological maps (groundwater quality, vulnerability, aquifer types of shallow subsurface rocks , groundwater heads) at different scales (https://www.lbeg.niedersachsen.de/karten_daten_publikationen/karten_daten/grundwasser/729.html)
- Project partner in TOPSOIL (http://www.topsoil.eu/)

Name of organisation	27. Mining and Geological Survey of Hungary		
Short name	MBFSZ	Country	Hungary

Organisation profile

The Mining and Geological Survey of Hungary (MBFSZ) was established on 1st July 2017 by the merger of the Hungarian Office for Mining and Geology and the Geological and Geophysical Institute of Hungary. It provides background support to the Ministry of National Development and gives advice on policy matter to the Ministry. MBFSZ carries out scientific research in the fields of geology, hydrogeology, geophysics, mining and climate policy. MBFSZ is the designated state institution dealing with groundwater. Furthermore it operates a national groundwater observation system – 140 monitoring wells form part of the National Groundwater Monitoring System (quantity). Based on the Ministerial Decree 101/2007. (XII.23) MBFSZ operates the National Hydrogeological Archive.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP6 & WP7	• National and cross-border hydrogeochemical hydrogeology surveys with special emphasis on thermal waters, hydrodynamic and water-rock interaction modelling • Building databases and web services for subsurface and groundwater data

Short profile of staff member(s) who will be undertaking the work

Teodóra Szőcs (f): Chief hydrogeologist, hydrogeochemist, head of the Hydrogeology Department at MBFSZ. She coordinated a team of scientists and worked as expert responsible for the background values, threshold values and evaluation of chemical status of GW.

Ágnes Rotár Szalkai (f): senior expert in hydrogeology, geothermal resource survey, responsible for the operation of the groundwater monitoring network. She took part in the evaluation of chemical status of the groundwater bodies in Hungary in the framework of the WFD.

Nóra Gál (f): Expert in hydrogeochemistry, water-rock interaction modelling, geothermal resource survey, GIS, thermal well cadastre. She took part in the determination of background values and evaluation of chemical status of the groundwater bodies in Hungary.

Tamás Kerékgyártó (m): expert in geothermal resource survey, hydrogeochemistry, water-rock interaction modelling and hydrodynamic modelling. He took part in the evaluation of chemical status of the groundwater bodies in Hungary.

Publications, infrastructure / technical equipment

T. Szocs, S. Frape, R. Gwynne, L. Palcsu, 2017: Chlorine stable isotope and helium isotope studies contributing to the understanding of the hydrogeochemical characteristics of old groundwater. Procedia Earth and Planetary Science pp. 877-880 DOI information: 10.1016/j.proeps.2017.01.004

T. Szocs, N. Rman, M. Suveges, L. Palcsu, Gy. Toth, A. Lapanje, 2013: The application of isotope and chemical analyses in managing transboundary groundwater resources. Applied Geochemistry 32 (2013) 95–107

Relevant projects/activities

Coordinator of the **DARLINGe** - Danube Region Leading Geothermal Energy project (1 January 2017 – 30 June 2019 Interreg Danube Transnational Programme).

Coordinator of the „**TRANSENERGY** – Transboundary Geothermal Energy Resources of Slovenia Austria, Hungary and Slovakia" (2010-2013 – 2CE124P3), project, which provided tools for sustainable use of geothermal resources at the Western part of the Pannonian Basin.

Coordinator of the **NAGiS** - National Adaptation Geo-information System project, whose objective was to develop a multipurpose geo-information information system.

Name of organisation	28. Islenskar orkurannsoknir (Iceland GeoSurvey) ISOR		
Short name	ISOR	Country	Iceland

Organisation profile

ISOR is a governmental non-profit service, research and training institute under the Icelandic Ministry for the Environment and Natural Resources. ISOR is one of the world's leading geothermal research organizations and stands for over 70 years of continuous experience in geothermal research, encompassing all disciplines of geosciences, drilling engineering, utilisation technology and reservoir physics and management. ISOR has been the main scientific leader in the successful geothermal development in Iceland. Iceland GeoSurvey carries out mapping of water drainage, groundwater systems and groundwater flow where the interaction of surface and subsurface flow and rock formations is outlined.

Roles / tasks in the project	Special relevant skills
Participant in WP3	• Characterizing and mapping of hydrogeological data at national scale • 3D geological modelling • Integrated interpretation of geochemical, hydrogeological and hydrological data

Short profile of staff member(s) who will be undertaking the work

Steinunn Hauksdóttir (f): Director natural resources**.** Supervision, marketing and project management of projects in the fields of geothermal research and utilization and natural resources. Geologist/Geochemist with experience in geothermal mapping, sampling of fluids and rocks. Supervision of various Information Technology projects and systems.
Árni Hjartarson (m): Senior hydrogeologist**.** Geological mapping and hydrogeology of volcanic regions; Groundwater recearch and advice for municipal water works. Stratigraphy in basaltic and volcanic terrains. Borehole geology, interpretation of temperature and pressure data from boreholes. Hydrogeological modelling.
Dadi Thorbjornsson (m): Senior Hydrogeologist**.** Geochemical studies such as sampling, chemical modelling and interpretation, hydrogeological studies (including assessment of hydrogeological properties of reservoirs rocks), reservoir monitoring, conceptual modelling, environmental studies, well testing.
Vaiva Cypaité (f): Hydrogeologist. Modelling hydrogeological data with Visual MODFLOW flex, ArcGis, AutoCad. Evaluation of hydrogeological conditions and geothermal potential in D. Riese. Hydrogeology, geology and geothermal resources of Iceland, groundwater flow, sedimentary aquifers.

Publications, infrastructure / technical equipment

Árni Hjartarson and Thórólfur H. Hafstad 2010: *Water resources registry of Iceland*. Report and dataset for National Energy Authority.
Vaiva Cypaité 2015: *Determination of groundwater flows in SW Iceland with environmental tracers.* M.Sc. thesis University of Iceland.
Postgres and Oracle Database management system, ESRI-GIS geographical information system, iTOUGH2, Visual MODFLOW flex, LeapFrog and PETREL 3D visualization and modelling.

Relevant projects/activities

Numerous projects for various clients, including municipalities and potable water suppliers regarding water exploration, drilling, protection, polllution, mapping. Also work for preparations for hydropower plants including mapping, modelling and consulting. E.g.:
Thorolfur H. Hafstad and Vaiva Cypaite 2017: Vogar. Exploration well for water supply and suggested need of water protection areas. Report for HS Veitur, Iceland.
Thórólfur H. Hafstad, Vaiva Cypaité, Steinunn Hauksdóttir 2016: Hydrogeological study of waterbasin of Stora-Laxa at Laxarsgljufur. Report for National Power of Iceland.
Árni Hjartarson et al. 1992-1997: Hydrogeological Maps of the Reykjavík Capital Area.

Name of organisation	29. Geological Survey Ireland (Department of Communications, Climate Action and the Environment)		
Short name	GSI/DCCAE	Country	Ireland

Organisation profile

Founded in 1845, Geological Survey Ireland is the Republic of Ireland's public earth science knowledge centre. We are a division of the Department of Communications, Climate Action and Environment. We provide free, open and accurate data and maps on Ireland's subsurface to landowners, the public, industry, and all other stakeholders, within Ireland and internationally. In addition, we act as a project partner in interpreting data and developing models and viewers to allow people to understand the underground.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP4, WP5, WP7.	• Hydrochemical data interpretation • Creation of national databases and maps • Groundwater vulnerability mapping • Characterisation and mapping of hydrogeological systems • Establishing natural concentrations of pollutants in the environment

Short profile of staff member(s) who will be undertaking the work

Katie Tedd (f) Senior Hydrogeologist, expert in hydrochemistry, developed Natural Background Levels for Ireland.
Taly Hunter Williams (f) Senior Hydrogeologist with expertise in groundwater resources estimation and hydrochemistry. Member of the EuroGeoSurveys Water Resources Expert Group.
Contract staff (m/f) Suitably qualified contract staff member to be appointed.

Publications, infrastructure / technical equipment

K.M. Tedd, C.E. Coxon, B.D.R. Misstear, D. Daly, M. Craig, A. Mannix and N.H. Hunter Williams (2017) Assessing and Developing Natural Background Levels for Chemical Parameters in Irish Groundwater. EPA Research Report (2007-FS-WQ-16-S4).

E.R. McGrory, C. Brown, N. Bargary, N.H. Hunter Williams, A. Mannix, C. Zhang, T. Henry, E. Daly, S. Nicholas, B.M. Petrunic, M. Lee, L. Morrison (2017) Arsenic contamination of drinking water in Ireland: A spatial analysis of occurrence and potential risk. STOTEN 579: 1863–1875.

K.M. Tedd, C.E. Coxon, B.D.R. Misstear, D. Daly, M. Craig, A. Mannix, N.H. Hunter Williams (2014) An integrated pressure and pathway approach to the spatial analysis of groundwater nitrate: A case study from the southeast of Ireland. STOTEN 476-477C:460-476

Geological Survey Ireland. National Groundwater Chemistry Database and Chemistry Typology Maps. K.M. Tedd and N.H.Hunter Williams.

N.H. Hunter Williams, B.D.R. Misstear, D. Daly and M. Lee (2013) Development of a national groundwater recharge map for the Republic of Ireland. QJEGH. 46(4):493-506.

Relevant projects/activities

CatchmentCARE (2017-2021). Catchment Community Action for Resilient Ecosystems. InterReg VA.
Groundwater3D https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/projects/gw3d/Pages/default.aspx
Protecting Drinking Water https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/projects/protecting-drinking-water/Pages/default.aspx

Name of organisation	30. Istituto Superiore per la Protezione e la Ricerca Ambientale		
Short name	ISPRA	**Country**	Italy

Organisation profile

ISPRA (Italy) is a national public body, subject to the vigilance of the Ministry for Environment, Territory and Sea. The Institute results from the merging of three former institutions: the Agency for Environmental Protection and Technical Services (APAT), the Central Institute for Scientific and Technological Research Applied to the Sea (ICRAM) and the National Institute for Wildlife (INFS). ISPRA will be represented in Geo-ERA by the former Geological Survey of Italy that is now a Department of ISPRA. It undertakes technical-scientific activities to support policies and legislation on several environmental issues (e.g. land planning, natural hazard, etc.) and provides geological data collection, management and publication. In its role of Geological Survey of Italy, ISPRA is the reference institution for the geological information in Italy, including the official geological and geothematic maps of the Italian territory, as well as several databases providing information about subsurface geology and geohazards.

Roles / tasks in the project	Special relevant skills
Participant in WP3	• Characterisation and mapping of hydrogeological Systems • Building databases and web services for subsurface and groundwater data • Natural hazard risk assessment and natural resource protection and management

Short profile of staff member(s) who will be undertaking the work

Barbara DESSI (f): hydraulic Engineer, researcher technologist on natural hazard risk assessment and natural resource protection and management. Member of the Water Resource EGS Expert Group. Author of several scientific papers and technical reports.
Rossella Maria GAFÀ (f): Geologist, researcher technologist on hydrogeological issues. Author of scientific papers and technical reports.
Lucio MARTARELLI (m): Geologist, senior researcher technologist on hydrogeological issues. EGS Water Resource Expert Group member. Author of several scientific papers and technical reports.
Gennaro Maria MONTI (m): Geologist, researcher technologist on hydrogeological issues. Author of scientific papers and technical reports.
Anna Rosa SCALISE (f): Geologist, senior researcher technologist on hydrogeological issues. Author of several scientific papers and technical reports.
Angelantonio SILVI (m): Cartographer, expert in GIS cartography and hydrogeological mapping. Author of several scientific papers and technical reports.

Publications, infrastructure / technical equipment

- Antonakos A., Martarelli L., Scalise A.R. et al. (2009) - International Hydrogeological Map of Europe 1:1.500.000 scale. Sheet D6 Athina. (Nikas K., Strub H. & Winter P., coords.). BGR/UNESCO, Hannover (Germany).
- Dessì B., Martarelli L., Spizzichino D. (2015) - Italy. In: EuroGeoSurveys "Wonder water. The value of water". Brussels.
- La Vigna F., Mazza R., Amanti M., Martarelli L., Conte G., Falcetti S., Gafà R.M., Monti G.M., Roma M., Silvi A. et al. (2016) - Groundwater of Rome. Journal of Maps Vol. 12 , N.S1, 88-93.
- Wu Aimin, Conte G., Martarelli L., Ma Rong (2016) - Understanding and Discussion on Hydrogeological Map of Italy-Guideline to Survey and Mapping. Hydrog. Engin. Geol. 43, 166-172.

Relevant projects/activities

- EPOS, European Plate Observing System (http://www.epos-ip.org).
- CEWP, China Europe Water Platform - PI Focus Area: Rural Water and Food Security (http://cepw.eu).

Name of organisation	39. State limited liability company "Latvian Centre of Geology, Environment and Meteorology"		
Short name	LEGMC	**Country**	Latvia

Organisation profile

LEGMC is State limited liability company under the Ministry of Environmental Protection and Regional Development and it is the central legal body in Latvia at subsoil field comprising geology, hydrogeology, and geophysics. According to Law on Subsoil the main tasks of LEGMC in the field of subsoil can be divided as follows: 1) estimation and approval of mineral and groundwater reserves and determination of extraction areas; 2) geological and hydrogeology data preparation for government, municipalities and private sector; 3) reporting for national and international institutions. LEGMC also ensures water quality and quantity monitoring, as well as data quality control and availability of these data for public, maintenance of data base on use of water resources, river basin management (preparation of River Basin Management Plans), preparation of for national and EU institutions, as well as calculation of flood territories.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP4 & WP5	• Responsible for national Latvian groundwater monitoring • Holder of the largest hydrogeological database in Latvia (abstraction well data, monitoring data, water chemistry)

Short profile of staff member(s) who will be undertaking the work

Inga Retiķe (f). Hydrogeology expert and responsible for reporting to EK (WFD and River Basin Management Plans, Nitrates directive), preparation of national reviews related to water quality and quantity issues, project coordination related to water management issues. She is currently a PhD aspirant at University of Latvia and working with multivariate statistics and long term water quality data; assessment of N fate in shallow groundwater under agricultural pressure, surface-groundwater interaction in coastal areas (e.g. sea water intrusion at city "Liepāja").

Publications, infrastructure / technical equipment

Retike, I., Kalvans, A., Popovs, K., Bikse, J., Babre, A., Delina, A. 2016. Geochemical classification of groundwater using multivariate statistical analysis in Latvia. Hydrology Research. Vol. 47, Issue 4.
Babre, A., Kalvāns, A., Popovs, K., Retiķe, I., Dēliņa, A., Vaikmäe, R., Martma, T. 2016. Pleistocene age paleo-groundwater inferred from water-stable isotope values in the central part of the Baltic Artesian Basin. Isotopes in Environmental and Health Studies. Vol. 52, Issue 6.
Retike, I., Delina, A., Bikse, J., Kalvans, A., Popovs, K., Pipira, D. 2016. Quaternary groundwater vulnerability assessment in Latvia using multivariate statistical analysis. 22nd International Scientific Conference Research for Rural Development, 2016; The Latvia University of Agriculture, Jelgava; Latvia; 18-20 May 2016. Volume 1, 2016, Pages 210-215.

Relevant projects/activities

- Second cycle River Basin Management Plans in Latvia.
- Report to EK under Nitrates directive
- **The Administration of Latvian Environmental Protection Fund project "Improvement of groundwater characterisation and status assessment for the next cycle River Basin management period" 2017.**
- ERDF, Interreg Central Baltic project "Innovative, sustainable remediation" (INSURE).
- Latvia- Lithuania cross border cooperation program project "Sustainable Rainwater Sewerage Management for Improved Environmental Quality of the Lielupe River Basin".

Name of organisation	40. Lietuvos geologijos tarnyba prie Aplinkos ministerijos (Lithuanian Geological Survey under the Ministry of Environment of the Republic of Lithuania)		
Short name	LGT	**Country**	Lithuania

Organisation profile

LGT is an independent governmental institution, which directly carries out geological investigations necessary to the State and controls the system of geological information alongside the regulation of the use of subsurface. LGT will be represented in Geo-ERA through the Lithuanian Geological Survey. The survey's core skills and services relate to subsurface investigations and protection, and include geological data management. Its products and services are primarily targeted at the groundwater, mineral resources and energy sectors (the latter in the broadest possible sense, including land use and environmental planning). The organisation hosts the national repository for subsurface data and information and is the designated state advisor of all geological matters related to the Subsurface Law.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP7 & WP8	• Characterisation and mapping of hydrogeological systems • Groundwater quality monitoring • Status assessment of groundwater quality • Natural resource protection and management

Short profile of staff member(s) who will be undertaking the work

Rasa Radiene (f): Head of Hydrogeology Department. Initiating, participating and leading research and hydrogeological investigation activities related to the environmental and groundwater issues.
Jurga Arustiene: Head of groundwater monitoring sub-division. Initiating, participating and leading research and hydrogeological investigation activities related to the environmental and groundwater issues.
Petras Pūtys. Chief specialist. Cartographer, expert in GIS cartography and hydrogeological mapping.
Jurgita Kriukaitė. Chief specialist. Hydrogeologist, expert in groundwater quality monitoring and assessment.

Publications, infrastructure / technical equipment

Pūtys P. The Map of Groundwater Recharge on a scale of 1:200 000. Report 2013. - Vilnius : LGT
Gedžiūnas P. Mineral water mapping at a scale 1:400 000. Report 2010. - Vilnius : LGT
Arustienė J., Kadūnas K. Investigative groundwater monitoring of active substances of plant protection products. Lithuanian Geological Survey Annual Report 2016. - Vilnius : LGT, 2017.
Arustienė J. Overview of Water Protection Problems in Groundwater Bodies of Lithuania. Lithuanian Geological Survey: Annual Report 2013. - Vilnius : LGT, 2014.
Arustienė J., Giedraitis R., Karmazinas B. Natural background levels of main aquifers. Groundwater Monitoring in Lithuania 2006 : Bulletin. - Vilnius : LGT, 2007.
Groundwater information system – containing DB's of groundwater quality, groundwater resources.

Relevant projects/activities

- Assessment and reporting the chemical status of groundwater bodies to EU
- Participating in international working groups on groundwater (e.g. CIS Working group Groundwater)
- Programme of State Geological Investigations 2016-2020 "Geoenergy and Safe Environment" of Republic of Lithuania
- Development and management of Groundwater information system

Name of organisation	42. Ministry for Transport and Infrastructure		
Short name	MTI	**Country**	Malta

Organisation profile

Malta will be represented in the GeoERA Groundwater theme through the Continental Shelf Department (CSD) within the Ministry for Transport and Infrastructure. The CSD performs the function of the Malta Geological Survey .

Roles / tasks in the project	Special relevant skills
Participation in WP3, WP5, WP6 & WP8	• EU water policy • Island and coastal aquifer hydrogeology • Sea-water intrusion • Management of water resources under water scarcity conditions.

Short profile of staff member(s) who will be undertaking the work

Albert Caruana (m) is the Director General of the Continental Shelf Department and oversees Malta's overall participation in GeoERA**. Charles Galea (m)** is a Principal Scientific Officer at the CSD. He is a geoscientist by background and is a coordinator of the GeoERA project in Malta. **Manuel Sapiano (m):** Water Director for Malta, responsible for coordinating the implementation of EU Water Policies in the Maltese islands. Represents Malta on the Groundwater Working Group within the WFD CIS. A hydro-geologist by profession with specialisation in coastal and island groundwater management. **Michael Schembri (m)**, Senior Officer managing the implementation of the EU Water Framework and Floods Directives. Also coordinates hydrological spatial data management systems and groundwater monitoring framework. **Henry Debattista (m):** technical officer providing support on groundwater data management and groundwater modelling exercises.

Publications, infrastructure / technical equipment

National groundwater monitoring framework (quality and quantity) and groundwater database (borehole logs, groundwater level and groundwater quality).

Publications:

*Mangion, J., **Sapiano, M., 2006.** Malta Water Resources Review. Food and Agriculture Organisation of the United Nations. Rome, Italy.*
*Mangion, J**., Sapiano, M. 2007.** The Mean Sea Level Aquifer – Malta and Gozo, in: Edmunds et al. (eds), Natural Groundwater Quality. Blackwell Publishing, Oxford, United Kingdom.*
*Stuart, M.E., Maurice, L., Heaton, T.H.E., **Sapiano**, **M.,** Micallef Sultana, M., Gooddy, D.C. & Chilton, P.J. 2010. Groundwater residence time and movement in the Maltese islands – A geochemical approach. - Applied Geochemistry, 25, 609-620.*
*Heaton, T.H.E., Stuart, M.E., **Sapiano**, **M.** & Micallef Sultana, M. 2012**.** An isotope study of the sources of nitrate in Malta's groundwater. - Journal of Hydrology, Vols. 414/415, 244–254.*
***Sapiano, M., Schembri. M**., Brincat, C. 2013**.** State of water resources in Mediterranean Islands, in MEDIWAT, Sustainable management of environmental issues related to water stress in Mediterranean islands, Final conference proceedings.*

Relevant projects/activities

MARSOL – Demonstrating managed aquifer recharge as a solution to water scarcity and drought (7th Framework Programme)
MORISO – Monitoring of groundwater resources to limit saline intrusion and pollution by nitrates (Interreg Italia-Malta 2007-2013)
ERDF346 – Assessment of sub-surface groundwater discharge in the Maltese islands (ERDF 2017-2013)
WATERMAP- Development and utilization of vulnerability maps for the monitoring and management of groundwater resources (INTERREG-Archimed)

Name of organisation	44. Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy		
Short name	PIG-PIB	**Country**	Poland

Organisation profile

The Polish Geological Institute was founded in 1919 and is the oldest Polish nation-wide scientific institution. It is involved in comprehensive studies of geological structure of the country for practical use in national economy and environmental protection. In addition to scientific activities in all fields of modern geology the Institute was entrusted with the tasks of the Polish Geological Survey and the Polish Hydrogeological Survey. Moreover, it is responsible for the country's security in supply of mineral resources, the groundwater management, for monitoring of the geological environment and warning against natural hazards and risks.

Roles / tasks in the project	Special relevant skills
Participation in WP3, WP7, WP8	Analysis of groundwater quality monitoring data ; QC/QA procedures in groundwater monitoring; Hydrogeological cartography and Vulnerability mapping; Characterization and mapping of mineral waters.

Short profile of staff member(s) who will be undertaking the work

Anna Kuczyńska (f): environmental engineer; 15 years of experience, including 5 years of academic research. Expert in assessing and managing groundwater resources on local and national scales; groundwater quality monitoring; vulnerability and risk assessments.

Michał Wyszomierski MSc.(m): geologist**;** 15 years of experience in hydrogeological and geological assessments, including geological cartography. Expert in QA/QS procedures in groundwater monitoring.

Marzena Nowakowska MSc.(f): hydrogeologist; 10 years of experience. Expert in mineral and water resource management, groundwater chemistry and groundwater cartography.

Magdalena Nidental MSc. (f): hydrogeologist (additional specialization in environmental protection) ; over 10 years of experience. Expert in hydrogeological assessment, hydrogeological cartography, groundwater vulnerability and water quality.

Agnieszka Felter MSc (f): hydrogeologist; 20 years of experience. Expert in mineral water resources; groundwater chemistry; hydrogeological assessments on local and national scales.

Publications, infrastructure / technical equipment

Kuczyńska A., 2017, *Results of a pilot study on the assessment of pharmaceuticals in groundwater in samples collected from the national groundwater monitoring network*, Przegląd Geologiczny tom 65 nr 11/1 Listopad 2017

Kuczyńska A., Janica R., 2017, *Analysis of the influence of sewage from diffuse sources to groundwater quality based on an example of work of the polish hydrogeological survey intervention team*, Przegląd Geologiczny tom 65 nr 11/2 Listopad 2017

Herbich P., Nidental M., Woźnicka M., 2007, *Methodological Guidelines of Creating GIS Database Information Layers of Hydrogeological Map of Poland 1:50000" First Aquifer – Groundwater Vulnerability and Water Quality*, Współczesne problemy hydrogeologii, część 2, Kraków 2007

Jóźwiak K., Mikołajków J., Nidental M., Woźnicka M., *The question of the groundwater vulnerability assessment with the Hydrogeological Map of Poland 1:50 000 and Major Groundwater Reservoirs projects as the case studies*, in press

Relevant projects/activities

Assessment of pharmaceuticals in groundwater samples taken from the national groundwater monitoring network in Poland.

Name of organisation	45. Laboratório Nacional de Energia e Geologia		
Short name	LNEG	Country	Portugal

Organisation profile

The National Laboratory of Energy and Geology (LNEG) is a State Laboratory of the Ministry of Economy that makes RD&D oriented to the needs of society and enterprises. LNEG ensures state functions by developing knowledge of the geological and hydrogeological infrastructure of the emerging territory, coastal zones, and contributing to related activities such as exploration and valorization of endogenous resources, prevention and mitigation of geological risks, environment and land use planning and correlated strategic innovative technologies. LNEG undertakes as within its core functions the research on CO2 storage, geothermal assessment and land use valorization. LNEG is also responsible for integrated management and availability of geoscientific contents regarding the Portuguese territory in digital format.

Roles / tasks in the project	Special relevant skills
Participant in WP3	• National responsible for hydrogeological assessment and thematic mapping at several scales. • Building databases and web services for groundwater data.

Short profile of staff member(s) who will be undertaking the work

The staff is from the Department of Geology, Hydrogeology and Coastal Geology:
José Sampaio (m): senior hydrogeologist. Skills on hydraulic, hydrology, geochemistry, geophysics, climatology, boreholes construction and testing, hydrogeological mapping, karst aquifers, volcanic islands aquifers and CO2 geological storage in saline aquifers.
Ana Paula Pereira (f): senior hydrogeologist, expert in hydrogeological mapping and in Geographical Information Systems. Coordinates the project "Hydrogeologic map - Sheet 2 (scale 1/200 000)" at LNEG.
Rayco Marrero-Diaz (m): senior hydrogeologist, expert in hydrogeochemistry. Nowadays, he is a LNEG's collaborator and is carrying out a low-enthalpy geothermal assessing project.
Carla Midões (f): senior hydrogeologist, expert in integration of the geologic and hydrogeologic information on SIG with sight to the attainment of Hydrogeology cartography of Portugal and Thematic Cartography.
Judite Fernandes (f): senior hydrogeologist, expert on flow and hydrogeochemical modeling, hydrogeophysics, geostatistics, saltwater intrusion, aquifer contamination, aquifer testing, drilling and piezometer construction, monitoring equipment.
Pedro Patinha (m): senior mining engineer, expert in mapping and Geographical Information Systems. He currently works at the "Geoscientific Information Unit" of LNEG and is responsible for the LNEG's GeoPortal infrastructure development.

Publications, infrastructure / technical equipment

Infrastructure: Geoportal (databases and web services for groundwater data). LNEG's geoPortal is an infrastructure of integrated services to support the management and visualization of spatial data, which aims to provide, in a web environment, geo-referenced information related to the various activities of the LNEG. This application has the following features: 1) Metadata Catalogue: A search and query engine for LNEG's data (according to ISO 19139), which provides information about the existence and availability of Institutional Geographic Information; 2) Online Databases: A set of applications that enables the query of institutional data; 3) Map Viewer: A view and download service of LNEG's maps and spatial information.
Publications:
Portuguese hydrogeological and hydrogeochemical mapping (scales 1/200 000) and explanatory books.
Portuguese geological mapping (scales 1/50 000) and explanatory books, which includes a hydrogeology chapter (national cover).
AMARAL, H.I.F; MIDÕES, C.; KIPFER, R. (2017) - Helium evidences of mantle degassing to the groundwater of Madeira Island - Portugal. Applied Geochemistry 81, 98-108.
MARRERO-DIAZ, R.; RAMALHO, E. C. (2015). Características geoquímicas das antigas nascentes termominerais de Alfama (Lisboa, Portugal): estudo preliminar do seu potencial geotérmico e hidromineral. Comunicações Geológicas, 102 (Fascículo Especial I), p. 129-132. (ISSN: 0873-948X; e-ISSN: 1647-581X).
MARRERO-DIAZ, R.; CARVALHO, M.R.; POLICARPO, A.; CARREIRA, P. (2015). Tracing Groundwater Salinization of Thermomineral Waters in Estoril Region by Geochemical and Isotopic Approach. "International Symposium on Isotope Hydrology: Revisiting Foundations and Exploring Frontiers - CN225", Book of extended synopses. Vienna, Austria. 136, p. 86-89.
POLICARPO, A.; CARVALHO, M.R.; MARRERO, R.; CARREIRA, P. (2014) - Origem da Mineralização das Águas Termais da Região de Lisboa. "XII Congresso da Água da Associação Portuguesa de Recursos Hídricos", Lisbon, Portugal, 5-7 March.
REIMANN & BIRKE (eds.): Geochemistry of European Bottled Water 2010. 280 p., 28 figs, 6 tab., 2 app., 67 element maps, data CO. 27 x 21 cm. ISBN 978-3-443-01067-6

Relevant projects/activities

Geoportal (http://geoportal.lneg.pt/), Building databases and web services for groundwater data.
Portuguese hydrogeological and hydrogeochemical assessment and mapping (scales 1/200 000 and 1/50 000
HYDROTHERMAL: Physical-Chemical Conceptual Model of Lower Cretaceous Geothermal Reservoir at Lisbon Region (Portugal).
GEOALFAMA: Characterization and geothermal / hydromineral exploitation of the thermo-mineral waters in the Alfama area (Lisbon, Portugal).
EGEM - Evaluation of the geothermal energy potential of Madeira Island.
ERHSISMA – Groundwater resources of S. Miguel Island – Azores (Portugal).
GEOCHEMISTRY OF EUROPEAN BOTTLED WATER

Name of organisation	46. Institutul Geologic al României		
Short name	IGR	Country	Romania

Organisation profile

Institutul Geologic al României was founded in 1906, with the mission of a national geological survey. Now, its research activity covers the fields of mineral resources, hydrocarbon resources, geophysics, hydrogeology, geochemistry, geohazard and geological mapping.
During the late decades, IGR has participated in national and international projects dedicated to raw materials (aggregates, metallic ores, secondary resources), energetic resources (oil, shale gas, geothermal resources), geohazards (landslides, complex impact of mining waste and excavation), geoinformation (mineral resources information networks, implementation of INSPIRE Directive in Romania, free access to geoinformation), ground water chemistry (composition of mineral water, influence of mine waters on surface and undeground water sources), CO_2 storage.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP4, WP6 &WP7	• Building databases for groundwater data • National responsible for creating hydrogeological maps and spatial plans

Short profile of staff member(s) who will be undertaking the work

Diana Persa (f) - researcher with experience in spatial groundwater modelling, statistical analysis, GIS analysis, water resources management, groundwater vulnerability assessment.
Radu Farnoaga (m)- senior researcher - research and protection of drinking water resources, the technical projects regarding water supply wells design, completion and testing; processing and interpretation of the data provided by the above-mentioned wells, water resources management.
Albert Baltres (m)- senior researcher expert in geology, geomorphology, and geological mapping.
Marian Munteanu (m): experience in economic geology, geological exploration, ore deposits, environmental impact of mining; reserve/resource classification, implementation of INSPIRE Directive in Romania, themes Geology and Mineral Resources.
Stefan Marincea (m) - senior researcher mineralogy, crystal chemistry, geochemistry, petrology.

Publications, infrastructure / technical equipment

- Geological Maps of Dobrogea, scale 1:50 000.
- Delineation and characterization of geothermal reservoirs in the Southern part of the Pannonian Basin.
- Area mapping of superficial geothermic resources by soil and groundwater data in Constanta County, Romania, Diana Perşa, Anca Vijdea, The Journal of Environmental Protection and Ecology, BENA,2012.
- Basic measures against diffuse pollution in water quality of the ground water bodies and surface water bodies, Rosu Alina Letitia, Damian Gabriela, Persa Diana, published in The papers of the XXIII Conference of The Danubian Countries on The Hydrological Forecasting and Hydrological Bases of Water Management, August 2006, Belgrade - Republic of Serbia.
- Significant sources of diffuze pollution for Dobrogea Region, Romania - H.Uzun, D. Persa. Published in The Official Journal of Balkan Environmental Association, 2004, vol. 2.

Relevant projects/activities

- Hydrogeological Maps of Romania, scales 1:500 00, and 1:50 000.
- Maps of thermal and mineral waters
- Combined Heat Power and Metals, acronym: CHPM2030, financed by Horizon 2020 (http://www.chpm2030.eu/)
- Danube Region Leading Geothermal Energy, acronym: DARLINGe financed by INTERREG Danube Transnational Programme (http://www.interreg-danube.eu/approved-projects/darlinge).

Name of organisation	47. Geological Survey of Serbia		
Short name	GSS	Country	Serbia

Organisation profile

GSS was formed based on the Mining and Geological Investigations Law („Official Gazette RS“, no. 88/2011) On 29. 06. 2012. Geological Survey of Serbia was formed from Geological Institute of Serbia, organization with long history. First organization was the Geological Institute of the Kingdom of Yugoslavia, formed 1930. Geological Survey of Serbia has three geological departments: Fundamental Geology, Mineral Resources, Geotechnic and Hydrogeology, as well as Groups for Geophysical investigation and Laboratory for rocks, ores, soil and water analysis. Our mission is to create geological, geomorphological, geochemical, hydrogeological and engineering geological maps, protect geodiversity and geoheritage, protection and promotion of the environment, investigation of mineral resource deposits.

Roles / tasks in the project	Special relevant skills
Participant in WP3	Building databases for groundwater data National responsible for creating hydrogeological maps and spatial plans Groundwater monitoring

Short profile of staff member(s) who will be undertaking the work

Tanja Petrović Pantić (f) is a senior hydrogeologist at Department of Geotechnic and Hydrogeology. Research focuses are thermal and mineral waters, geothermal energy, hydrogeochemistry.
Milan Tomić (m): hydrogeologist at Department of Geotechnic and Hydrogeology. Expert in creating hydrogeological maps 1: 100.000, mineral and thermal groundwater studies, spatial plan projects and Impact of Climate Change projects.
Katarina Samolov (f): Fellow worker on GW projects and participant in UNDP Beware Project of Unifying landslide data standards and creating landslide database.
Mihajlo Mandić (m) Engineer of geology and speleologist. Senior hydrogeologist at Geological Survey of Serbia, Department of Geotechnic and Hydrogeology. Expert for karst areas and in creating hydrogeological maps 1: 100 000 and studies;

Publications, infrastructure / technical equipment

- Nikolov, J., Todorovic, N., Petrović Pantić, T. Forkapic, S., Mrdja, D., Bikit, I., Krmar, M., Veskovic, M. (2012) Exposure to radon in the radon spa Niška Banja, Serbia, Radiation Measurements, Volume 47, Issue 6, p. 443-450 Radiation Measurements.
- Petrović, T., Zlokolica-Mandić, M., Veljković, N., Papić, P., Stojković, J. (2012) Chapter 19. Geochemistry of Bottled Water in Serbia, in F.F. Quercia and D. Vidojevic (eds.), Clean Soil and Safe Water, NATO Science for Peace and Security Series C: Environmental Security, XVII, 247-266 p, Springer, Dordrecht
- Petrović, T., Zlokolica, Zlokolica-Mandić, M., Veljković, N., Papić, P., Poznanović, M., Stojković, J., Magazinović, S. (2012) Macro and micro elements of bottled waters and water from public water supply in Serbia, Chemical Industry 66 (1) 107-122
- Petrović, T., Zlokolica-Mandić, M., Veljković, N., Vidojević, N. (2010) Hydrogeological Conditions for the Forming and Quality of Mineral Waters in Serbia, Journal of Geochemical Exploration 107 (2010), pp. 373-381

Relevant projects/activities

- Hydrogeological maps, scale 1:100.000
- Spatial plans of Municipalities of Republic of Serbia
- Geochemistry of European Bottled Water
- Alternative groundwater sources for public water supply
- Update of geothermal resource database of Republic of Serbia

Name of organisation	49. Geološki zavod Slovenije		
Short name	GeoZS	**Country**	Slovenia

Organisation profile

Geološki zavod Slovenije – Geological Survey of Slovenia (GeoZS) is a public research organisation established by the Government of the Republic of Slovenia. The Survey carries out fundamental, applied, developmental and object research within all geological branches and related fields of work. It consists of research – programme groups and geological expert services. The main goals are contributing to the knowledge about geological composition of the national territory, production of geological maps, assessment of geological hazards, natural and anthropogene, to living environments, assessment of threats to geological environment due to pollution and other anthropogene factors, assessment of groundwater, mineral resources and geothermal energy resources, assessment of natural geological heritage, and development of geological knowledge and research methods.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP5, WP6, WP7 & WP8	- Hydrogeochemistry - Unsaturated zone - Groundwater modelling and GIS

Short profile of staff member(s) who will be undertaking the work

Janko Urbanc (m) **-** senior researcher with experiences in the fields of research and protection of drinking water resources, water resources management, groundwater hydrochemistry, isotope geochemistry and tracer hydrology, agricultural impacts on groundwater quality
Nina Mali (f) – Head of Hydrogeology Department, senior researcher with experience in GW protection, GW pollution, water resources management , and research of unsaturated zone, responsible for GW protection areas
Sonja Cerar (f) **–** young expert of groundwater quality and spatial modelling at GeoZS. Experienced in statistical analysis and spatial groundwater modelling with GIS.
Anja Koroša (f) - young researcher, experienced in GW pollution (emerging contaminants in GW)
Nina Rman (f) – research associate with experience in exploration, monitoring and management of low-enthalpy geothermal system, transboundary aquifers, mineral and thermal water and mofettes

Publications, infrastructure / technical equipment

Mali, N., Cerar, S., KoroŠa, A., Auersperger, P. Passive sampling as a tool for identifying micro-organic compounds in groundwater. Science of the total environment, ISSN 0048-9697, 2017, vol. 593/594, str. 722-734, doi: 10.1016/j.scitotenv.2017.03.166. [COBISS.SI-ID 2609493],
Cerar, S., Mali, N. Assessment of presence, origin and seasonal variations of persistent organic pollutants in groundwater by means of passive sampling and multivariate statistical analysis. Journal of geochemical exploration, ISSN 0375-6742. [Print ed.], 2016, vol. 170, str. 78-93,
Rman, N. Hydrogeochemical and isotopic tracers for identification of seasonal and long-term over-exploitation of the Pleistocene thermal waters. Environmental monitoring and assessment, ISSN 0167-6369, April 2016, vol. 188, no. 4, str. 242-[262] str.

Relevant projects/activities

- Life project INCOME **-** Improved management of contaminated aquifers by integration of source tracking, monitoring tools and decision strategies (2009 – 2012)
- Improved water and nutrient use efficiency in plant production to protect drinking water sources (2017 - 2020)
- Groundwater age determination in deep aquifers of Slovenia (2011 – 2014)
- Study of pharmaceutical residue transport processes in gravel aquifers (2009 – 2012)
- Hydrogeological numerical model of groundwater flow and heat transfer in deep geothermal groundwater body in the northeastern Slovenia - natural state and production models (2014-2017)

Name of organisation	50. Instituto Geológico y Minero de España (Geological Survey of Spain)		
Short name	*IGME*	***Country***	*Spain*

Organisation profile

The Geological Survey of Spain (IGME) is a Public Research Organization, an autonomous institution attached to the Ministry of Economy and Competitiveness. It was founded in 1849 and is the main Earth Sciences Research Centre of Spain. A staff of 400 employees, 185 graduated, specialized in various fields of activity such as geology, environment, hydrogeology, mineral resources, natural hazards and land use planning. IGME-Spain facilities, including its headquarters, project offices in several places around the country, laboratories, warehouses, drill core repository, library and museum, are equipped with advanced technology and technical resources. IGME-Spain is the national centre for the creation of knowledge infrastructure, information and R&D in Earth Sciences.

Roles / tasks in the project	***Special relevant skills***
Participant in WP3, WP6, WP7 & WP8	• *Analysis of groundwater natural quality and distribution of Potentially Toxic Geogenic Trace Elements (PTGTE) in European countries.* • ***V****ulnerability mapping at national scale* • ***M****apping of hydrogeological Systems*

Short profile of staff member(s) who will be undertaking the work

Elena Gimenez Forcada (f)*. Expert in hydrogeochemistry research (trace element behaviour) and environmental health (medical geology). Leader of the HidroGeoTox Project, about distribution of HydroGeoToxicity by toxic elements related to geological environment.*
Juan Grima Olmedo (m). *Senior hydrogeologist, expert in groundwater quality and risk assessment. Protection and sustainable use of soil.*
David Pulido-Velazquez (m). *Field of expertise in assessment of groundwater quantity and quality issues. Team member in EU projects (eg. GENESIS, GESHYDRO,GESINH-IMPADAPT.*
Juan de Dios Gómez Gómez (m). *Senior hydrogeologist, expert in groundwater modeling, coastal aquifers, GIS and vulnerability mapping. Member of the EuroGeoSurveys Water Resources Expert Group.*

Publications, infrastructure / technical equipment

Giménez-Forcada. E.*; Vega-Alegre, M.; Timón-Sánchez, S. (2017). Characterization of regional cold-hydrothermal inflows enriched in arsenic and associated trace-elements in the southern part of the Duero Basin (Spain), by Multivariate Statistical Analysis. Science of the Total Environment 593–594: 211–226.*
Giménez-Forcada, E.*; Timón-Sánchez, S.; Kohfahl, C. (2017). Distribution of Hydrogeotoxicity by Arsenic and Uranium in the SE edge of the Duero Basin, Spain. Journal of Geochemical Exploration 183: 197–205.*
Grima, J., Luque, J.A., Mejía et al. *(2015). Methodological approach for the analysis of groundwater quality in the framework of the Groundwater Directive. Environmental Earth Sciences (2015) 74:4039–4051.*
Peña-Haro, S., Llopis-Albert, C., Pulido-Velazquez, M., ***Pulido-Velazquez, D****., 2010. Fertilizer standards for controlling groundwater nitrate pollution from agriculture: El Salobral-Los Llanos case study, Spain, Journal of Hydrology 392 (2010) 174–187, doi: 10.1016/j.jhydrol.2010.08.006*

Relevant projects/activities

IGME-2303. 2013-2017. *Identification of geo-environmental factors that control the distribution of arsenic and other PTGTPs as a management tool in the hydrological planning of groundwater masses with hidrogeotoxic risk (HydroGeoTox Project). Instituto Geológico y Minero de España (Geological Survey of Spain). Elena Giménez Forcada, main researcher.*

Name of organisation	51. Institut Cartogràfic i Geològic de Catalunya (Cartographic and Geological Institute of Catalonia)		
Short name	ICGC	Country	Spain

Organisation profile

The ICGC is the official mapping and geological agency of the autonomous government of Catalonia. The ICGC sum-up the legacies of the former cartographic and geological agencies, both created in 1982 and belongs to the Department of Territory and Sustainability of the Government of Catalonia. The ICGC has a staff around 270 people and is a beginning-to-end cartographic and geological institution comprising: a) data acquisition owning 3 airplanes and 7 sensors, skilled staff in the use of satellite imagery, geophysical instrumentation and geotechnics equipment, b) processing capabilities, c) technical support to land and urban planning, d) geological resources analysis (hydrogeology, geoenergies, mineral resources and soils), d) geological hazards assessment and prevention. One of the main missions of the ICGC is to obtain, process, supply and disseminate geoscientific information on the Catalan territory.

Roles / tasks in the project	Special relevant skills
Participation in WP3 & WP7	• Hydrogeological mapping, 3D geomodelling • Building and manage databases and web services • Applied geochemistry • Groundwater resources estimation

Short profile of staff member(s) who will be undertaking the work

Joan Palau (m): Ph.D. in Geology. Professor in the University of Barcelona during 3 years in the petrology and geochemical department. More than 35 years of professional experience working as CEO in *Geocat, Gestió de projectes. S.A.* and currently Deputy Director of Geology and Geophysics at ICGC. Degree in Business administration. **Ignasi Herms (m)**: head of the geological resources department at ICGC. Senior geologist, hydrogeologist and mining engineer technician, project coordinator and expert on groundwater modelling. Project coordinator of: GIS programs for hydrogeological and soil mapping, applied hydrogeology for civil/mining works and environmental impact, 3D reservoir flow and applied hydrochemistry. PhD (in progress) at Mining Engineering and Natural Resources Department (EPSEM-UPC) titleholder *'Hydrogeochemistry in the karst aquifer system of the massif Port del Comte''*. **Georgina Arnó (f)**: project manager and responsible for the hydrogeology and geothermal team at ICGC. Senior geologist and hydrogeologist expert on groundwater mapping and modelling. Collaborating teacher on groundwater at Polytechnic University of Catalonia (UPC). **Montse Colomer (f):** senior geologist and hydrogeologist. Expert in GIS programs, hydrogeology mapping, databases and 3D geological modelling. **Víctor Camps (m):** senior geologist and hydrogeologist. Expert in acquisition and processing of hydrogeological and geothermal data and hydrogeological mapping.

Publications, infrastructure / technical equipment

Herms, I., Arnó, G. (2016). "Información hidrogeológica y base cartográfica continua. Perspectivas en el ámbito digital". Jornada Hidrogeología emergente | 50 CIHS 2016. ISBN 978-84-921469-3-2.
Colomer, M., Herms, I. et al. (2016). "Distribución digital en formato vectorial de datos del Mapa Hidrogeológico de Catalunya a escala 1:25 000". Jornada Hidrogeología emergente | 50 CIHS 2016. ISBN 978-84-921469-3-2.
Arnó, G., Camps, V., Colomer, M. et al (2016). Caracterización geoquímica ambiental de las aguas subterráneas en el ámbito del complejo minero de Bellmunt y el Molar (Priorat). Jornada Hidrogeología emergente. 50 CIHS. ISBN 978-84-921469-3-2.
Navarro, A., Arnó, G., Camps, V., et al (2016). Incidencia ambiental de las actividades mineras en la zona del Priorat (Tarragona). IX Congreso de la Sociedad Geológica de España. Huelva.
Navarro, A., Herms, I., Cirés et al. (2016). Estimación del fondo geoquímico para metales en suelos y sedimentos en el antiguo distrito minero del Priorat (Tarragona). IX Congreso de la Sociedad Geológica de España. Huelva.
Database on subsurface information (boreholes, water point's database, groundwater heads and groundwater quality data). Geological and Hydrogeological maps at different scales and WMS available at http://icgc.cat/Administracio-i-empresa/Eines/Visualitzadors-Geoindex.

Relevant projects/activities

- *Groundwater vulnerability mapping*
- *Special springs inventory and database creation and management*
- *Hydrogeological database generation and management*
- *Hydrogeological mapping at 1:25 000 scale including new data acquisition*
- *Aquifer characterization and delimitation*

Name of organisation	52. Sveriges Geologiska Undersökning		
Short name	SGU	**Country**	Sweden

Organisation profile

The Geological Survey of Sweden (SGU) is the national expert agency for issues relating to bedrock, soil and groundwater in Sweden. One key task is to meet society's need for geological information. SGU is a governmental body governed by The Ministry of Enterprise and Innovation.
•Supporting the increase of mineral exploration interest and the sustainable development of mining, and quarrying industry
•Promoting the use of geological information in societal planning
•Consolidating and strengthening geological research in Sweden
•Bringing geology and geo-scientific knowledge to the fore in social debate and in schools
The Mining Inspectorate is a separate decision-making body within SGU. It is responsible for issuing permits for minerals exploration and exploitation under the Swedish Minerals Act.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP6 & WP8	• Hydrogeological mapping • Building and manage databases and web services • Applied geochemistry Groundwater resources estimation

Short profile of staff member(s) who will be undertaking the work

Mattias Gustafsson (m): Leader of SGU groundwater resources mapping
Lena Maxe (f): Senior expert groundwater quality
Lars-Ove Lång (m): Senior expert groundwater quality and groundwater resources mapping
Lars Rosenqvist (m): Reseacher, groundwater quality and mapping
Anna Ladenberger (f): Senior expert geochemistry

Publications, infrastructure / technical equipment

Griffioen, J., van Helvoort, P.-J., Edmunds, M., Wendland, F., Jongbloed, R., van der Wal, J.-T., Holthaus, K., van der Grift, B., Gerritse, J., Jeannot, R., Kalevi, K., **Gustafsson**, J., Witzak, S., Kania, J. & Rozanski, K., 2006: BRIDGE. Background criteria for the identification of groundwater thresholds. Deliverable 7: State-of-the-art knowledge on behaviour and effects of natural and anthropogenic groundwater pollutants relevant for the determination of groundwater thresholds values. Final reference report.

Relevant projects/activities

http://resource.sgu.se/produkter/sgurapp/s1301-rapport.pdf
http://grundvatten.nu/modelgroundwater/client-sgu/index.html.
http://resource.sgu.se/produkter/sgurapp/s1603-rapport.pdf

Name of organisation	53. State Research and Development Enterprise “State Informational Geological Fund of Ukraine”		
Short name	GEOINFORM	**Country**	Ukraine

Organisation profile

The State Research and Development Enterprise "State Informational Geological Fund of Ukraine" – SRDE “GeoInform of Ukraine”, or GEOINFORM is the specialized research and development unit of the State Geological and Subsurface Survey of Ukraine which collects, stores, analyzes and provides information received from geological study and use of subsurface. GEOINFORM conducts research work on monitoring of mineral resources of Ukraine on the basis of geological and mining activities during the year, recording deposits and making public the balance of mineral resources management of the State fund of deposits and occurrences (more than 10,000 objects recorded), synthesis and analysis of exploration for oil and gas, creating a system of state accounting of oil and gas wells, completion and maintenance of the State cadastre of mineral deposits and occurrences as well as State cadastre of groundwater deposits of Ukraine.

Roles / tasks in the project	Special relevant skills
Participant in WP3, WP4, WP5, WP6, WP7 & WP8	Building databases and web services for subsurface data

Short profile of staff member(s) who will be undertaking the work

Dr. hab. Boris Malyuk (m): Director for International Cooperation. National Delegate of Ukraine to the EuroGeoSurveys. In the Project he will contribute to general project management and geoscientific data systems.
Natalia Pyshna (f): Chief, Division of groundwater resources inventory. She has experience in the sphere of hydrogeological studies for fresh and mineral water of Ukraine for more than 30 years. She represents SGSSU in the EU project 'Water Initiative for Eastern Partnership' (EUWI+4EaP).
Larysa Lopata (f): Senior Hydrogeologists, Division of groundwater resources inventory. She has experience in the sphere of hydrogeological studies for mineral groundwater of Ukraine for more than 10 years.
Mykola Danevych (m): Leading Hydrogeologists. He has experience in the sphere of hydrogeological and geological-ecological studies for more than 10 years.
Lesia Babichenko (f): Leading Hydrogeologists. She is experienced in hydrogeological studies, environment protection, specifically, groundwater protection.

Publications, infrastructure / technical equipment

Interactive map of mineral deposits of Ukraine (in Ukrainian)
http://geoinf.kiev.ua/wp/interaktyvna-karta-rodovyshch-korysnykh-kopalyn.htm
Interactive map of mineral licenses (in Ukrainian)
http://geoinf.kiev.ua/wp/interaktyvni-karty-spetsdozvoliv.htm
Interactive geological map of Ukraine 1:1 000 000 (in Ukrainian)
http://geoinf.kiev.ua/wp/Interaktyvna-heolohichna-karta-Ukrayiny.htm
Interactive geological map of Ukraine 1:1 000 000 (in English)
http://geoinf.kiev.ua/wp/Interactive-Geological-Map-of-Ukraine.htm
Interactive State Geological Map of Ukraine 1:200 000 (in Ukrainian with English entries)
http://geoinf.kiev.ua/wp/kartograma.htm

Relevant projects/activities

ESTMAP - EU
EUOGA - EU
NUMIRE – Norway-Ukraine (NGU/SGSSU)
EIMIDA – Norway-Ukraine (NGU/Geoinform)

Name of organisation	**54. Natural Environment Research Council (British Geological Survey)**		
Short name	NERC	**Country**	United Kingdom

Organisation profile

The British Geological Survey (BGS) is a component body of the Natural Environment Research Council (NERC), the UK's largest funder of independent environmental science including basic, strategic and applied research and monitoring, training and innovation. BGS was founded in 1835 and is the world's longest established national geological survey. BGS seeks to advance the understanding of the structure, properties and processes of the solid Earth system through interdisciplinary surveys, monitoring and research for the benefit of society. BGS is a public sector organization responsible for advising the UK government on all aspects of geosciences, as well as providing impartial geological advice to industry, academia and the public. It is the UK's premier provider of objective and authoritative geoscientific data, information and knowledge for sustainable use of natural resources, reducing risk and living with the impacts of environmental change.

Roles / tasks in the project	Special relevant skills
Coordinating WP5 Participant in WP1, WP2 & WP8	• Large scale modelling of N transport in groundwater • Databasing and geospatial data analysis, • Analysis of groundwater quality monitoring data • Expertise on emerging pollutants

Short profile of staff member(s) who will be undertaking the work

Marianne Stuart (f) has over 30 years experience at BGS in groundwater quality research including emerging contaminants, agrochemicals, chlorinated solvents, microbiological problems and risk assessment. **Matthew Ascott (m)**, hydrogeologist at BGS with 6 years' experience in hydrogeological research and industry. Experience in large scale modelling of nitrate in the unsaturated zone and groundwater, groundwater-surface water interactions and macronutrient cycling. **Lei Wang (m)**, a groundwater modeller at BGS with expertise in agricultural diffuse water pollution, hydrological and hydrogeological modelling and environmental real-time modelling. He is the owner of the nitrate time bomb (NTB) model, which has been successfully applied at the catchment, national and global scales and attracted research funding from NERC, EA and DEFRA. **Dan Lapworth (m)**, a hydrogeochemist with 17 year experience at BGS in groundwater contaminant research including pesticides, emerging contaminants, nutrients (C, N and P) and pathogens. Had a 6 month secondment to BRGM in 2011-12 on emerging contaminants.

Publications, infrastructure / technical equipment

Ascott, M.J., Gooddy, D.C., Wang, L., Stuart, M.E., Lewis, M.A., Ward, R.S. and Binley, A.M. (2017) Global patterns of nitrate storage in the vadose zone. Nature Communications 8(1), 1416.

Lapworth D J, Baran N, Stuart M E, Manamsa K, Talbot J.(2015) Persistent and emerging micro-organic contaminants in Chalk groundwater of England and France. Environmental Pollution, 203, 214-225.

Wang, L., Stuart, M.E., Bloomfield, J.P., Butcher, A.S., Gooddy D.C., McKenzie, A.A., Lewis, M.A., Williams, A.T. (2012) Prediction of the arrival of peak nitrate concentrations at the water table at the regional scale in Great Britain. Hydrological Processes 26, 226-239.

Lapworth D J, Baran, N, Stuart M E, and Ward R S. (2012) Emerging contaminants: A review of occurrence, sources and fate in groundwater. Environmental Pollution, 163, 287-303.

Stuart M E, Lapworth DJ, Crane E J and Hart A. (2012) Review of risk from potential emerging contaminants in UK groundwater, Science of the Total Environment, 416, 1-21.

Relevant projects/activities

1. BGS research project on nitrate modelling in the unsaturated zone at the global scale
2. BGS research project on national scale emerging contaminants
3. UK Environment Agency funded research projects on national scale mapping and modelling for quantifying denitrification potential and Nitrate Vulnerable Zone Designation
4. DEFRA-funded projects on assessing nitrate mitigation measures - Demonstration Test Catchments and a field tool kit for ecological targeting of agricultural diffuse pollution mitigation measures
5. EU-funded project assessing the sources of nitrate pollution of groundwater in Malta
6. Membership of European Commission's WFD CIS Groundwater Expert Group
7. Membership of the European Commission working group for the Groundwater Watch List

Name of organisation	**55. Hellenic Survey of Geology & Mineral Exploration**		
Short name	HSGME	**Country**	Greece

Organisation profile

In compliance with Article 25 of L.4602/2019 (issued: March 9th, 2019), the Institute of Geology and Mineral Exploration (I.G.M.E.) of Greece was wound up, while a new Authority entitled Hellenic Survey of Geology and Mineral Exploration (H.S.G.M.E.) was established in its place. H.S.G.M.E. is a legal entity governed by public law and supervised by the Minister for the Environment and Energy. The objective of the Hellenic Survey of Geology and Mineral Exploration (H.S.G.M.E.) is to investigate and scientifically monitor geological and mining issues on behalf of the State, to carry out studies and provide individuals or legal entities of public or private law with its opinion in the fields of geosciences, geohazards, geoenvironment, energy, mining and other related subjects, to perform the geological, hydrogeological and mining research of the country, including exploitation studies of underground resources and to exercise control and regulatory competent activities.

Roles / tasks in the project	Special relevant skills
Participant in WP7	• Harmonised vulnerability to pollution mapping of the upper aquifer. Study of a pilot area (Atalanti – Greece) with DRASTIC

Short profile of staff member(s) who will be undertaking the work

Kostas Kontodimos is a member of HSMGE staff, working as a hydrogeologist since 2004. Currently is working also in natural disasters unit as a member of a task force regarding landslides, earthquakes, floods etc. As a hydrogeologist he was participating in the planning the groundwater monitoring network in Greece and he was project manager in various European and National scale projects. He was in charge of Greek Groundwater Monitoring Network the Aegean Islands Groundwater Unit from 2013-2019. He was the co-author of Management Plan (MP), which corresponds to a River Basin District (RBD) for Aegean area, regarding groundwater. He was also member of the Greek natural mineral water committee. He is currently working in 3 national scale projects in the fields of groundwater quality and quantity, earthquake risk assessment in industrial areas, and designs a database of active faults in Greece.

Ioannis Lappas was a member of HSMGE staff, working as a hydrogeologist since 2004. His is currently working in Ministry of Energy as a member of Water Unit. He is in charge of various projects regarding mostly groundwater monitoring, and producing national guidelines for hydrogeological studies. He was the author or co-author of a number of papers in the field of groundwater quality and vulnerability

Publications, infrastructure / technical equipment

Relevant projects/activities

Name of organisation	Eesti Geoloogiateenistus (non-funded)		
Short name	EGT	Country	Estonia

Organisation profile

The Geological Survey of Estonia (GSE) is a state agency responsible the activities in geology and hydrogeology in Estonia and operates under the governance of Minister of Economy. GSE assembles the geology, hydrogeology and environmental expertise in one place and its main aim is to provide the high-quality information to other state agencies, local authorities and businesses for environmental research, the planning processes and the management of mineral resources in Estonia.

The main activities and competencies of the Geological Survey of Estonia are in following fields of geological mapping; marine geological surveys, mineral resources surveys, hydrogeology and geophysical research, and environmental research. EGT is also responsible for compiling, updating and management of geology, hydrogeology databases, the storage of drill cores and rock samples and it conducts the seismic, groundwater, and seacoast surveillance.

Roles/tasks in the project	Special relevant skills
Participant in WP7	Building databases Groundwater modelling Geological Mapping Groundwater geochemical studies

Short profile of staff member(s) who will be undertaking the work

Andres Marandi (m), PhD: *– Head of Hydrogeology Department. Has long-term experience of international research projects. Professional experience in the field of groundwater modelling and geochemical studies.*
Valle Raidla (m), PhD: *senior hydrogeologist. Is responsible for geochemical and isotope studies of groundwater.*
Maile Polikarpus(f), MSc*: – hydrogeologist. Is responsible for groundwater modelling studies and compilation of GIS databases of groundwater.*

Publications, infrastructure / technical equipment

Gerber, C.; Vaikmäe, R.; Aeschbach, W.; Babre, A.; Jiang, W.; Leuenberger, M.; Lu, Z-T. ; Mokrik, R.; Müller, P.; ***Raidla, V****.; Saks, T.; Waber, H.; Weissbach, T.; Zappala, J. C.; Purtschert, R. (2017). Using 81Kr and noble gases to characterize and date groundwater and brines in the Baltic Artesian Basin on the one-million-year timescale. Geochimica et Cosmochimica Acta, 205, 187−210.10.1016/j.gca.2017.01.033.*

Pärn, Joonas; ***Raidla, Valle****; Vaikmäe, Rein; Martma, Tõnu; Ivask, Jüri; Mokrik, Robert; Erg, Katrin (2016). The recharge of glacial meltwater and its influence on the geochemical evolution of groundwater in the Ordovician-Cambrian aquifer system, northern part of the Baltic Artesian Basin. Applied Geochemistry, 72, 125−135.10.1016/j.apgeochem.2016.07.007.*

Islam, M. B.; Firoz, A. B. M.; Foglia, L.; ***Marandi, A.;*** *Khan, AR.; Schuth, C.; Ribbe, L. 2017. A regional groundwater-flow model for sustainable groundwater-resource management in the south Asian megacity of Dhaka, Bangladesh. Hydrogeology Journal Volume: 25: 3, 617-637*

Sahib, L.; ***Marandi, A****.; Schueth, C. 2016. Strontium isotopes as an indicator for groundwater salinity sources in the Kirkuk region, Iraq. Science of the Total Environment. 562: 935-945*

Marandi, A., *Karro, E., Polikarpus, M., Jõeleht, A., Kohv, M., Hang, T., Hiiemaa, H. 2013. Simulation of the hydrogeologic effects of oil-shale mining on the neighbouring wetland water balance: case study in north-eastern Estonia. Hydrogeology Journal, 21(7), 1581 – 1591.*

Relevant projects/activities

Groundwater Modelling of Regional Mining effects in NE Estonia.
Assessment of the Status of Groundwater Bodies in Estonia
Hydrogeological Mapping of Estonia
Geochemical Studies of the Groundwater of Mining Areas in Estonia

Name of organisation	Royal Belgian Institute of Natural Sciences – Geological Survey of Belgium (non-funded)		
Short name	RBINS-GSB	**Country**	Belgium

Organisation profile

The Geological Survey of Belgium (GSB) is an autonomous subsection of the RBINS OD Earth. Created in 1896, the GSB is a key geological and mineralogical research centre developing both applied and fundamental research approaches. It is also an independent, non-commercial provider of geoscientific services. These services are oriented towards local, regional, federal, European and international authorities, as well as researchers of institutions/universities and research groups, private companies, NGO's and citizens. In spite of retaining this profile and strong societal focus, which is typical for the geological surveys of Europe, the GSB has at the same time become one of the most research-oriented Surveys in Europe, evidenced by a rapidly increasing scientific output in recent years.

Roles / tasks in the project	**Special relevant skills**
Participants in WP3	• 3D geomodelling of cross-border regions • Building databases and web services for subsurface and groundwater data • Integrated interpretation of hydrochemical and hydrogeological datasets

Short profile of staff member(s) who will be undertaking the work

Vanessa Heyvaert (PhD, 15 year of experience, female) is a quaternary geologist specialised in coastal and fluviatile deposits, and coordinator of the groundwater related projects at the RBINS-GSB.

Kris Piessens (PhD, 15+ year experience, male) is one of the key members of the GeoEnergy team. He has been involved in CCS related research for 15 years, working on the interface between geological, economic, policy, engineering and regulatory aspects, but also more fundamental topics such as geogenic release of CO_2 in springs.

Publications, infrastructure / technical equipment

- Makarewicz M., Welkenhuysen K., Dhaerens D., Piessens K. 2016. Measuring the amount of CO2 in oversaturated waters by mass balance: an overview of trials and errors. Abstract for the 5th International Geologica Belgica Congress 2016, Mons, Belgium.
- Burlet C., Vanbrabant Y., Piessens K., Welkenhuysen K., Verheyden S. 2015. Niphargus: A silicon band-gap sensor temperature logger for High-precision environmental monitoring. Computers & Geosciences 74:50-59. DOI 10.1016.
- Möller I., Piessens K., Welkenhuysen K., Janssens R., Schloemer S. 2012. Geogenic CO_2 releases in Belgium and Germany as natural analogues for the development and evaluation of monitoring tools and methods. Schriftenreihe der Deutschen Gesellschaft für Geowissenschaften 80:445
- Geological maps of Belgium, boreholes database, field observations are available online through the webGIS portal developed by GSB (www.belgiumgeology.net).

Relevant projects/activities

- RESPONSE (BELSPO - national funding agency, 2016-2020): Reactive transport modelling of point source contamination in soils and groundwater.
- H3O-De Kempen (ALBON – regional funding, 2015-2017): Geological and hydrogeological 3D-model of the Cenozoicum of the Campine Basin in Middle-Brabant and Flanders.
- H3O-Roerdalslenk (VMM & ALBON – regional funding, 2012-2014): Geological and hydrogeological 3D-model of the Cenozoicum of the Roer Graben in South-East Netherlands and Flanders.

Name of organisation	Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg (non-funded)		
Short name	LBGR	**Country**	Germany

Organisation profile

LBGR is a subordinated state authority of the Ministry for Economic Affairs and Energy and the central geo-scientific state institution of the Federal State Brandenburg. LBGR provides geoscientific knowledge, data and planning-relevant documents for the protection and sustainable use of soil, groundwater, geothermal energy, raw materials and construction ground. For this reason LBGR maintains specialised information systems in the field of geology, hydrogeology, economical geology and geopedology. These information systems include the central repository for subsurface data of the Federal State of Brandenburg.

Roles / tasks in the project	**Special relevant skills**
Participant in WP7 (non-funded partner)	• hydrogeological mapping, • building databases and web services for hydrogeological data

Short profile of staff member(s) who will be undertaking the work

Silvio Janetz (m): hydrogeologist and GIS specialist at LBGR. He has working experience as scientist in the fields of environmental geology, hydrogeology and groundwater modelling. Since 2013 he is an employee at the State Office for Mining, Geology and Raw Materials Brandenburg (LGBR) and responsible for 2D/3D hydrogeological mapping and hydrogeological database development in the state of Brandenburg.

Publications, infrastructure / technical equipment

Janetz, S. & Reyes, S. (2015): Von der hydrogeologischen Karte zum dreidimensionalen Grundwasserleitermodell – Stand und Perspektiven der hydrogeologischen Landesaufnahme in Brandenburg. (*From hydrogeological map to 3D groundwater model – state and prospects of the hydrogeological mapping in the state of Brandenburg*). Schriftenreihe des Landesamtes für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern - 2015, Heft 1, Güstrow, S. 78

Kempka, T., Herd, R., Huenges, E., Endler, R., Jahnke, C., Janetz, S., Jolie, E., Kühn, M.,Magri, F.,Meinert, P., Moeck, I., Möller, M., Munoz, G., Ritter, O., Schafrik, W., Schmidt-Hattenberger, C. Tillner, E., Voigt, H-J., Zimmermann, G. (2015): Joint Research Project Brine: Carbon Dioxide Storage in Eastern Brandenburg: Implications for Synergetic Geothermal Heat Recovery and Conceptualization of an Early Warning System Against Freshwater Salinization. In: Liebscher, A. & Münch, U. (Eds.): Geological Storage of CO_2 – Long Term Security Aspects, GEOTECHNOLOGIEN Science Report No. 22, Series: Advanced Technologies in Earth Sciences, p. 183-209. Springer

Janetz, S.; Jahnke, C.; Tillner, E.; Kempka, T.; Röhmann, L.; Kühn, M. (2013): Effects of brine displacement on pressure and salinity increases in a regional freshwater aquifer complex with respect to CO2 storage in saline subsurface formations, In: General Assembly of the European Geosciences Union 2013, 07 - 12 April 2013, Vienna (Austria). Geophysical Research Abstracts. 10 (EGU2013-9559).

Relevant projects/activities

- hydrogeological maps and cross-sections at the scale of 1:50.000 to 1:300.000
- Database for groundwater and subsurface information
- “brine” - CO2 storage in eastern Brandenburg: Implications for geothermal heat provision and conception of a salinisation early warning system. BMBF/DFG research project GEOTECHNOLOGIEN. Duration 2010-2013.

5 ETHICS AND SECURITY

5.1 Ethics

Have you completed an ethics self-assessment? YES, see Table below

Does your research involve Human Embryonic Stem Cells (hESCs)?	NO
Does your research involve human participants?	NO
Does your research involve human cells or tissues	NO
Does your research involve personal data collection and/or processing?	NO
Does your research involve animals?	NO
In case non-EU countries are involved, do the research related activities undertaken in these countries raise potential ethics issues?	NO
Does your research involve the use of elements that may cause harm to the environment, to animals or plants?	NO
Does your research involve the use of elements that may cause harm to humans, including research staff?	NO
Does this research involve dual-use items in the sense of Regulation 428/2009, or other items for which an authorisation is required?	NO
Could your research raise concerns regarding the exclusive focus on civil applications?	NO
Does your research have a potential for misuse of research results?	NO
Any other ethics issues that should be taken into consideration ?	NO

5.2 Security

Please indicate if your project will involve:

- Activities or results raising security issues: NO
- 'EU-classified information' as background or results: NO

Cited references

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Batioglu-Pazarbasi, M, N. Milosevic, F. Malaguerra, P. J. Binning, H.-J Albrechtsen, P. L. Bjerg, and J. Aamand 2013. Discharge of landfill leachate to streambed sediments impacts the mineralization potential of phenoxy acid herbicides depending on the initial abundance of tfdA gene classes. Environ. Poll 176: 275-283

Broers H (2004). The spatial distribution of groundwater age for different geohydrological situations in the Netherlands: implications for groundwater quality monitoring at the regional scale. Journal of Hydrology, 299(1-2): 84–106.

Edmunds W.M. Milne, C.J. (2001). Palaeowaters in Coastal Europe: Evolution of Groundwater Since the Late Pleistocène. Geol.Soc. Special Publ. 189. Geological Society, London, UK.

Edmunds W.M., Hinsby K., Marlin, C., Melo T., Manzano M., Vaikmae R and Travi Y. (2001) Evolution of groundwater systems at the European coastline. In: Palaeowaters in Coastal Europe: evolution of groundwater since the late Pleistocene. Geol Soc Spec.Pub. 89(1): 289–311.

Edmunds W.M., Shand P. (2008): Natural groundwater Quality. Blackwell Ed. 469pp.

Flem et al. 2015. Inorganic chemical quality of European tap-water. 2. Geographical distribution. https://doi.org/10.1016/j.apgeochem.2015.01.016

Giménez-Forcada, E.; Timón-Sánchez, S.; Kohfahl, C. (2017b). Distribution of Hydrogeotoxicity by Arsenic and Uranium in the SE edge of the Duero Basin, Spain. *Journal of Geochemical Exploration* 183: 197–205.

Giménez-Forcada. E.; Vega-Alegre, M.; Timón-Sánchez, S. (2017a). Characterization of regional cold-hydrothermal inflows enriched in arsenic and associated trace-elements in the southern part of the

Duero Basin (Spain), by Multivariate Statistical Analysis. *Science of the Total Environment* 593–594: 211–226.

Gooddy D, Darling G, Abesser C, Lapworth D.J. (2006) Using chlorofluorocarbons (CFCs) and sulphur hexafluoride (SF6) to characterise groundwater movement and residence time in a lowland Chalk catchment. Journal of Hydrology, 330(1-2): 44–52.

Gourcy L, Baran N, Vittecoq B (2009) Improving the knowledge of pesticide and nitrate transfer processes using age dating tools (CFC, SF_6, ^3H) in a volcanic island. J. Cont. Hydrol. 108(3-4): 107–117.

Guardiola-Albert C., Pardo-Iguzquiza E. Giménez-Forcada E. (2017) – Métodos estadísticos para la elaboración de mapas de probabilidad de riesgo hidrogeotoxico (HGT) por altas concentraciones de As en las aguas subterráneas. Aplicación a la distribución de HGT en la provincia de Ávila (España). Ingeniería del Agua 21.1.

Hansen B, Thorling L, Dalgaard T, et al. (2011) Trend Reversal of Nitrate in Danish Groundwater - a Reflection of agricultural practices and Nitrogen Surpluses since 1950. Env Sci & Techn. 45(1): 228–234.

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Hinsby, K., Purtschert, R. & Edmunds, W.M. 2007: Groundwater age and quality. In: Quevauviller, P. (ed.): Groundwater Science and Policy, 217-239. Royal Society of Chemistry. London.

Hinsby K, de Melo T, Dahl M (2008) European case studies supporting the derivation of natural background levels and groundwater threshold values for the protection of dependent ecosystems and human health. Sci. Total Environ. 401(1-3): 1–20.

Jasechko S, Perrone D, Befus K, et al. (2017) Global aquifers dominated by fossil groundwaters but wells vulnerable to modern contamination. Nature Geoscience 10(6): 425–429

Kloppmann W, Dever L, Edmunds WM (1998) Residence time of Chalk groundwaters in the Paris Basin and the North German Basin: a geochemical approach. Applied Geochemistry 13(5): 593–606.

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Szocs T, Rman N, Süveges M, et al. (2013) The application of isotope and chemical analyses in managing transboundary groundwater resources. Applied Geochemistry 32: 95–107.

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Wendland F, Blum A, Coetsiers, et al. (2007) European aquifer typology: a practical framework for an overview of major groundwater composition at European scale. Environmental Geology 55(1): 77–85.