

PROPER PROJECT

WP2 - ASSESSING THE VULNERABILITY OF EUROPEAN SURFACE AND GROUNDWATER BODIES TO ROAD RUNOFF DURING THE BUILDING AND OPERATING OF ROADS

**Deliverable 2.3 – Evaluation of International, European and national
legislative frameworks and approaches**

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DELIVERABLE 2.3

Title

PROPER PROJECT - WP2 - ASSESSING THE VULNERABILITY OF EUROPEAN SURFACE AND GROUNDWATER BODIES TO ROAD RUNOFF DURING THE BUILDING AND OPERATING OF ROADS

Deliverable 2.3 – Report on evaluation of International, European and national legislative frameworks and approaches

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Abstract

This report refers to the project Deliverable 2.3. It concerns the work developed under Task 2.3 which involves an evaluation of the non-technological mitigation measures to assess the vulnerability of European surface and groundwater bodies to road runoff. This refers to an assessment of legislative and non-legislative initiatives pertaining to the management of surface and groundwater bodies potentially impacted by road and traffic related activities.

The report presents an overview of the current European practices with regard to protecting and enhancing surface water and groundwater bodies, based on the application of legislation to develop and implement an integrated water resources management strategy at a river basin scale. This is achieved through the application of the EU Water Framework Directive and all Directives containing procedures to identify pressures affecting the state of water and environment, and the establishment of measures to ensure that all surface water and groundwater bodies achieve good status by 2027. Existing national guidelines are also presented for the consortium countries.

A flowchart has been constructed to assist the assessment of the environmental legal constraints relating to a road project. A reference matrix, built with the help of all partners, contains the necessary GIS combination of layers to address legislative needs and constraints to protect surface and groundwater bodies from impacts caused by traffic-related activities.

Keywords: Legislation review, guidelines, vulnerability, protection, road runoff pollution.

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Acronyms and glossary

APSFR – Areas with Potentially Significant Flood Risk

BAT – Best Available Technology

BMP – Best Management Practice

BOD – Biochemical Oxygen Demand

CEDR – Conference of European Directors of Roads

COD – Chemical Oxygen Demand

EC – European Commission

EIA – Environmental Impact Assessment

EEC – European Economic Community

ELV – Emission Limit Values

EQS – Environmental Quality Standard

GDE – Groundwater Dependent Ecosystems

GIS – Geographic Information System

MS – Member State

PAH – Polycyclic Aromatic Hydrocarbons

p.e. – population equivalent [1 p.e. means the organic biodegradable load having a five-day biochemical oxygen demand (BOD₅) of 60 g of oxygen per day]

RBMP – River Basin Management Plans

TSS – Total Suspended Solids

WHPA – Wellhead Protection Area

WFD – Water Framework Directive

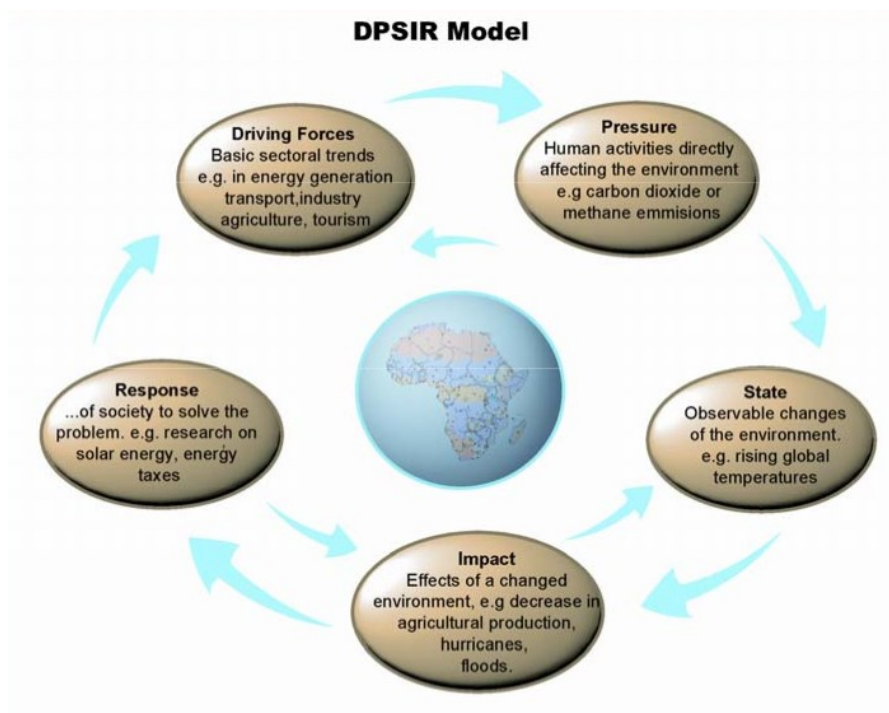
1 | Introduction, aim and objectives

Work Package 2 of the PROPER project aims to "compile, review and critique existing data sets and tools to define surface and groundwater body vulnerability in relation to the polluting impacts of road construction and operation activities".

The first two tasks of this WP (Tasks 2.1 and 2.2) were devoted to a review of the current knowledge on the vulnerability of European surface water and groundwater to road-related pollution, together with a critique of related assessment tools. Subsequently, a justified list of parameters was selected to support an assessment of the vulnerability of surface waters and groundwaters impacted by runoff and accidental spills/incident road related activities.

Task 2.3 involves an evaluation of the non-technological mitigation measures. This refers to an assessment of legislative and non-legislative initiatives pertaining to the management of surface and groundwater bodies impacted on by traffic related activities. In fact, the current international best practices with regard to protecting and enhancing surface water and groundwater bodies is to develop and implement an integrated water resources management strategy at a river basin scale through the application of the EU Water Framework Directive (EU WFD, 2000). Amongst other procedures, it requires Member States (MS) to identify pressures (e.g. point and diffuse source pollution, water abstraction, flow regulation, morphological pressure, land use patterns, and other pressures like invasive species) affecting the state of the water environment, and the establishment of 'Programmes of Measures' to ensure that all surface water and groundwater bodies achieve good status by 2027.

In order to facilitate the evaluation of legislative frameworks, this section was structured using the conceptual index framework of DPSIR (driver-pressure-state-impact-response) initially proposed by OECD (in Shah, 2000) (Figure 1.1). This framework helps the structuring all important datasets and approaches leading to the evaluation of vulnerability and impacts, which will serve as the basis for the definition of programmes of measures, i.e., the responses, which will be analysed in WP3 and WP4.



Source: Adapted from Shah, 2000

Figure 1.1 – DPSIR Framework

In the process envisaged in our proposal, the road is considered to be the driver and the pressures are the contaminant loads associated with highway runoff or aerial dispersion (vehicle activities, road surface material and vehicle emissions). The status concerns the quality of soil and water. The magnitude of the impact of highway runoff on receiving waters depends on several aspects concerning the flow regime of receiving water, infiltration facility, depth to groundwater, and different land cover data sets. Some of these sensitive areas have been legislated as protected areas (e.g. flood risk zones, sensitive zones, vulnerable areas) imposing specific constraints to the discharge of road-related pollutant emissions in receiving water bodies. The development of a user-friendly decision support tool to assess surface and groundwater vulnerability and impact of road pollution to support the sustainable development of the road network is viewed as a tool to mitigate environmental impacts from roads, being therefore a response measure.

The aim of this report is to summarize the main legislation instruments that exist to impose specific constraints on the discharge of road-related pollutant emissions to receiving water bodies. This includes an assessment of EU WFD, EU Habitats Directive, EU Groundwater Directive, Natura 2000 areas, surface and groundwater (drinking water) protection zones, and non-legislative initiatives pertaining to the management of surface and groundwater bodies impacted on by traffic related activities.

The current report is divided into the following sections: 1 | Introduction, aim and objectives; 2 | Legislative frameworks and guidelines; 3 | Approaches for integrating legislative constraints; 4 | Example of application: Portugal – A6; and 5 | Conclusions.

2 | Legislative frameworks and guidelines

2.1 International and European

2.1.1 Related to hazards (pressures)

Water Framework Directive

The Water Framework Directive (WFD, Directive 2000/60/EC on "establishing a framework for Community action in the field of water policy"), published in December 2000, aims to establish a framework for the protection of inland surface waters, transitional waters, coastal waters as well as groundwater. Its objective is to prevent further deterioration, and protect and enhance the status of aquatic ecosystems, by promoting sustainable water use based on a long-term perspective. This implies the implementation of measures for the progressive reduction of discharges, emissions and losses of priority substances to prevent further pollution of water. The hazards considered in PROPER are highway discharges (PROPER Deliverable 2.1, Revitt *et al.*, 2018).

The WFD presents an indicative list of what, in general, are considered the main groups of pollutants in water. Some of these are toxic while others are nutrients or substances causing oxygen depletion. In particular, a number of priority substances have been given special attention. This is the List of Priority Substances, which includes some hazardous substances, in the field of water policy defined in Annex X of the WFD and reviewed in the Directive 2013/39/EU ("amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy"). Some of these are typical traffic and road pollutants, such as PAH and heavy metals.

Concerning pressures, the WFD states that a summary of the significant pressures on the status of surface water and groundwater should be ascertained during the River Basin Management Plans (RBMP) (WFD, Annex VII, A.2.), including an estimation of point and diffuse pollution sources, their concentrations and loads, in order to ensure the implementation of the relevant Emission Limit Values (ELV).

WFD Annex IX started to define ELV and environmental quality based on several directives. Directive 2008/105/EC "on environmental quality standards in the field of water policy" has "amended and subsequently repealed Council Directives 82/176/EEC (Mercury Discharges), 83/513/EEC (Cadmium Discharges), 84/156/EEC (Mercury Directive), 84/491/EEC (Hexachlorocyclohexane Discharges), 86/280/EEC (Dangerous Substance Discharges), thus also amending Directive 2000/60/EC of the European Parliament and of the Council. Directive 2013/39/EU amended Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy".

Other ELV are stated in other directives (as stated in WFD Article 16): these include Directive 2010/75/EU "on industrial emissions (integrated pollution prevention and control)", Directive

91/271/EEC "concerning urban waste water treatment" and Directive 91/676/EEC "concerning the protection of waters against pollution caused by nitrates from agricultural sources".

A summary of the controls adopted for point source discharges with an impact on the status of water is made in accordance with the provisions of WFD Article 11(3)(g) and 11(3)(i). WFD Point 3 of Article 11 establishes basic measures that, among others, define minimum requirements to be complied for:

- (g) Point source discharges liable to cause pollution, a requirement for prior regulation, such as a prohibition on the entry of pollutants into water, or for prior authorisation, or registration based on general binding rules, laying down emission controls for the pollutants concerned, including controls in accordance with WFD Articles 10 and 16.
- (i) Any other significant adverse impacts on the status of water identified under WFD Article 5 (Characteristics of the river basin district, review of the environmental impact of human activity and economic analysis of water use) and Annex II (Characterisation of surface water body types), in particular measures to ensure that the hydromorphological conditions of the water bodies are consistent with the achievement to require ecological status or good ecological potential for water bodies designated as artificial or heavily modified.

Concerning the point source emissions, Article 10 establishes that MS shall ensure implementation of emission controls in all discharges into surface water, based on best available technologies or in relevant ELV set out in the Directives referred to in Section 2.1.2. For diffuse source emissions, Article 10 also establishes that MS shall ensure that the controls, include, when necessary, the best environmental practices.

Also, Article 16 states that the European Parliament and the Council shall adopt specific measures against pollution of water by individual pollutants or groups of pollutants presenting a significant risk to or via the aquatic environment, including risks to waters used for the abstraction of drinking water. For those pollutants, measures shall be aimed at the progressive reduction and, for priority hazardous substances, at the cessation or phasing-out of discharges, emissions and losses.

The identification and prioritization for action of these substances (defined in Annex X of the WFD and replaced by Annex II of Directive 2013/39/EU) is based on evidence regarding the intrinsic hazard of the substance concerned, and in particular its aquatic ecotoxicity and human toxicity via aquatic exposure routes. Evidence from monitoring of widespread environmental contamination, and other proven factors which may indicate the possibility of widespread environmental contamination, such as production or use volume of the substance concerned, and use patterns are also taken into account.

The regulatory regime consists of a system of authorization, together with environmental monitoring to ensure that pollution by dangerous substances does not exceed Environmental Quality Standards (EQS) in the water (defined in Annex X of the WFD and reviewed in the Directive 2013/39/EU).

Directive 2013/39/EU, on environmental quality standards in the field of water policy, defines in Annex I the EQS for priority substances and certain other pollutants and in Annex II presents the list of priority substances in the field of water policy.

Article 4 (7) of the WFD states that MS will not be in breach of this Directive when failure to prevent deterioration from higher status to good status of a body of surface water is the result of new sustainable human development activities, considering that some specified conditions are met.

Groundwater Directive

The Groundwater Directive 2006/118/EC "on the protection of groundwater against pollution and deterioration" is also an issue for the WFD. Environmental quality standards have been established, by Member States, for individual pollutants or groups of pollutants, for those water bodies identified as being at risk of failing the environmental quality objectives to or via the aquatic environment.

Road runoff discharges can also affect groundwater and its protection depends on the specific risks identified. For that assessment, all MS are required to carry out an initial characterisation of groundwater bodies to assess their uses and the degree to which they are at risk of failing to meet the objectives established under Article 4. This analysis may employ existing hydrological, geological, pedological, land use, discharge, abstraction and other data but shall identify:

- The location and boundaries of the groundwater body or bodies.
- The pressures to which the groundwater body or bodies are liable to be subject including diffuse and point sources of pollution.
- The general character of the overlying strata in the catchment area from which the groundwater body receives its recharge.
- Those groundwater bodies for which there are directly dependent surface water ecosystems or terrestrial ecosystems.

Following this initial characterisation, MS are required to carry out further characterisation of those groundwater bodies or groups of bodies which have been identified as being at risk in order to establish a more precise assessment of the significance of such risk and the identification of any measures to be required under Article 11. Accordingly, this characterisation shall include relevant information on the impact of human activity and, where relevant, information on:

- Geological characteristics of the groundwater body including the extent and type of geological units.
- Hydrogeological characteristics of the groundwater body including hydraulic conductivity, porosity and confinement.
- Characteristics of the superficial deposits and soils in the catchment from which the groundwater body receives its recharge, including the thickness, porosity, hydraulic conductivity, and absorptive properties of the deposits and soils.
- Stratification characteristics of the groundwater within the groundwater body.
- An inventory of associated surface systems, including terrestrial ecosystems and bodies of surface water, with which the groundwater body is dynamically linked.
- Estimates of the directions and rates of exchange of water between the groundwater body and associated surface systems.

- Sufficient data to calculate the long term annual average rate of overall recharge.
- Characterisation of the chemical composition of the groundwater, including specification of the contributions from human activity, in PROPER project the human activities contribution refers to road runoff.

The information gathered for each case-study area concerning pressures within the PROPER project will be considered by using:

- a flowchart including the question "Are road discharges liable to cause pollution?" If the answer is No, then the next question should follow. If the answer is Yes, a risk assessment should be done to show if unacceptable environment contamination is predicted (cf. Environmental Impact Assessment Directive - 2011/92/EU). This should take into account if the discharges are into a surface or groundwater body in a poor state, and ensure that emission controls are based on Best Available Technology (BAT) or the relevant ELV are considered.
- GIS – the following shapefiles, produced by each MS and submitted to the Water Information System for Europe (WISE), should be considered providing prior information for the risk assessment:
 - existing diffuse pollution emissions;
 - existing point pollution emissions;
 - new point source road runoff discharges (information provided by WP1 of the PROPER project).

This will allow determining existing pressures and combined impacts if a new road discharge is proposed into receiving water bodies.

2.1.2 Related to the magnitude of impacts (state and impact)

Water Framework Directive – Water bodies status

The magnitude of an impact depends on several factors related to the intrinsic vulnerability of the receiving media, but also on the state of that media before the discharge. If the state of the receiving water body is poor, it is necessary to analyse if the discharge could have significant adverse effects.

To evaluate the surface and groundwater status, Article 8 of the WFD determines that all Member States (MS) shall ensure the establishment of monitoring programmes for all water status bodies in order to create a coherent and comprehensive overview within each river basin district. WFD Annex V defines the elements, methodologies and the maps requested from the results of the monitoring programmes.

The information gathered for each case-study area within the PROPER project will be considered by using:

- a flowchart – the risk assessment should consider if discharges are into a surface water body in poor state and if discharges are to an area with groundwater in poor state. If the risk assessment shows unacceptable environment contamination, then the project needs to be revised.
- GIS – shapefiles, relating to the following three aspects produced by each MS and submitted to the WISE, should be considered, and discharges should not be allowed if the risk assessment shows unacceptable environment contamination:
 - quantitative status of groundwater bodies;
 - chemical status of groundwater bodies;
 - ecological and chemical status of surface water bodies.

This will allow the determination of road discharge constraints into receiving water bodies due to existing poor state.

Water Framework Directive – Protected areas for abstraction of water intended for human consumption

The areas which have been designated as requiring special protection under specific European Community legislation, either for the protection of surface water and groundwater or for the conservation of habitats and species directly depending on water, are those in which discharges are not allowed if the risk assessment shows unacceptable environmental contamination. MS shall ensure the establishment of their inventories.

Identification and mapping of protected areas is defined by Article 6 and Annex IV of the WFD. The register of protected areas required under Article 6 includes the areas designated for the abstraction of water intended for human consumption under Article 7.

MS are required to identify, within each river basin district, all bodies of water used for the abstraction of water intended for human consumption providing more than 10 m³ a day, as an average, or serving more than 50 persons, as well as those bodies of water intended for such future use. MS are required to monitor, in accordance with WFD Annex V, those bodies of water which provide more than 100 m³ a day as an average.

MS shall ensure the necessary protection for the bodies of water identified with the aim of avoiding deterioration in their quality in order to reduce the level of purification treatment required in the production of drinking water. Identification of pollution problems and the substances causing them, and the establishment of quality standards, shall be applied. MS may establish safeguard zones or wellhead protection areas (WHPA) for those bodies of water.

A WHPA is the surface and subsurface area around a well for which limits are defined to assure that potential bacteriological contaminants, after reaching groundwater inside or outside protection zones, become harmless before reaching the well. Groundwater resources polluting activities are prohibited or restricted inside the WHPA.

Different member countries may have their own specific interpretations. Thus in Portugal, Decree Law 382/99 states that all groundwater extraction wells designed for public water supply shall have a zone of immediate protection. Wells extracting water for public supply with a discharge above 100 m³/day or serving more than 500 inhabitants shall have three protection zones (immediate, intermediate and extended).

The Decree-Law 382/99 refers also to the following restrictions concerning the land use and anthropogenic activities:

- Zone of immediate protection - area around the well in which, by default, all activities are prohibited, except those for conservation, maintenance or better exploitation of the aquifer.
- Zone of intermediate protection - area around the zone of immediate protection with variable extension, in which the objective is to reduce or eliminate pollution of the groundwater resources. Installations or activities capable of polluting groundwater resources from sources such as agricultural use or cattle raising, roads and railways, industrial units, sanitary landfills, garages and gas stations, could be prohibited or restricted.
- Extended zone of protection - area around the zone of intermediate protection, in which activities are prohibited or restricted regarding installations capable of polluting groundwater resources with persistent pollutants, taking into account the nature of the terrain, the nature and quantity of pollutants as well as the type of emission of these pollutants (e.g. application of persistent pesticides, cemeteries, transport of hydrocarbons, radioactive materials or other hazardous substances, deposits of radioactive materials, chemical industries and refineries).

In the case of karstic or fractured aquifers where preferential flowpaths exist, special protection zones can be set up. These zones impose limits on areas located outside the WHPA, characterized by hydraulic connection with the well due to the existence of fractures or fissures. Restrictions are similar to those applied inside the zone of immediate protection.

In coastal regions, saltwater intrusion protection zones can be defined, inside which extraction rates that might lead to an eventual degradation of groundwater quality, by favouring saltwater intrusion, are limited. The construction or exploitation of new wells can be limited and the exploitation regime can also be conditioned.

The information gathered for each case-study area within the PROPER project will be considered by using:

- a flowchart including the question "Are discharges planned into areas designated for the abstraction of water intended for human consumption?" and "Are discharges planned into a groundwater wellhead protection zone?" If the answer is No, then the next question should follow. If the answer is Yes, then discharges should not be allowed if the risk assessment proves the existence of unacceptable environmental contamination.
- GIS – the areas designated for the abstraction of surface and groundwater intended for human consumption represented by a shapefile, produced by each MS and submitted to the

WISE, should be considered, and discharges not allowed if the risk assessment shows unacceptable environment contamination.

This will allow the determination of road discharges constraints into receiving water bodies due to existing areas for abstraction of water intended for human consumption.

Water Framework Directive – Protected aquatic ecosystems

The register of protected areas within each river basin required under Article 6 of the WFD includes the areas designated for the protection of economically significant aquatic species. Direct discharges into these areas depend on risk assessment results.

The information gathered for each case-study area within the PROPER project will be considered by using:

- a flowchart including the question "Are discharges planned into areas designated for the protection of economically significant aquatic species?" If the answer is No, then the next question should follow. If the answer is Yes, then discharges should not be allowed if the risk assessment proves the existence of unacceptable damages to a habitat or ecosystem.
- GIS – the areas designated for the protection of economically significant aquatic species represented by a shapefile, produced by each MS and submitted to the WISE, should be considered, and discharges should not be allowed into an area protected due to the presence of significant aquatic species.

This will allow the determination of road discharge constraints into receiving water bodies due to existing areas designated for the protection of economically significant aquatic species.

Nitrates Directive (nutrient-sensitive or vulnerable zones)

The Nitrates Directive (91/676/EEC) aims to prevent and reduce water pollution caused or induced by nitrates from agricultural sources (Article 1). It defines vulnerable zones (Article 3) as waters affected by pollution and waters which could be affected by pollution – by monitoring nitrate concentrations in freshwaters over a period of one year, for four consecutive years and reporting to the European Commission the location and criteria of identification.

Within the goal of providing all waters with a general level of protection against pollution, MS have to establish codes of good agricultural practice, to be implemented by farmers on a voluntary basis and, if necessary, with a training and information programme for farmers promoting application of good agricultural practice codes (Article 4). MS are required to review and, if necessary, revise their action programmes, including any additional measures, at least every four years. The European Commission should be informed of any changes to the action programmes.

This Directive makes no specific reference to road runoff pollution. The vulnerable zones defined by the criteria established by the Directive refer to low quality status and nutrient sensitive water bodies and therefore another pressure, such as that resulting from road runoff pollution, should be avoided or heavily mitigated so it does not hinder the effect of applied measures for protection.

The information gathered for each case-study area within the PROPER project will be considered by using:

- a flowchart including the question "Do discharges occur into an area where groundwater annual average nitrate concentration exceeds or could exceed 50 mg/L?" If the reply is No, then the next question should follow. If the answer is Yes, then discharges should not be allowed if the risk assessment proves unacceptable environmental contamination, since the area is declared a vulnerable zone by the Nitrates Directive (91/676/CEE).
- GIS – the vulnerable zone shapefiles, produced by each MS and submitted to the WISE, should be considered, and discharges should not be allowed if the risk assessment proves the existence of unacceptable environmental contamination.

Urban Waste Water Directive (sensitive areas)

The Urban Waste Water Directive (91/271/EEC; 98/15/EC) concerns the collection, treatment and discharge of urban waste water (domestic waste water or the mixture of domestic waste water with industrial waste water and/or runoff rain water) and the treatment and discharge of urban waste water from certain industrial sectors. The main objective is the protection of the environment from the adverse effects of the above mentioned waste water discharges. The Directive outlines the appropriate treatment requirements prior to discharges in sensitive areas, defined as areas particularly exposed to eutrophication (enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned).

Article 3 defines the rules for the implementation of urban waste water collecting systems :

1. "[...] For urban waste water discharging into receiving waters which are considered "sensitive areas" as defined under Article 5 and Annex II, MS shall ensure that collection systems are provided at the latest by 31 December 1998 for agglomerations of more than 10000 population equivalent (p.e.).

Where the establishment of a collecting system is not justified, either because it would produce no environmental benefit or because it would involve excessive cost, individual systems or other appropriate systems which achieve the same level of environmental protection shall be used".

Article 5 defines the requirements of urban waste water discharge into sensitive areas:

2. "Member States shall ensure that urban waste water entering collecting systems shall, before discharge into sensitive areas, be subject to more stringent treatment [...] at the latest for all discharges from agglomerations of more than 10 000 p.e.".

3. "Discharges from urban waste water treatment plants described in paragraph 2 shall satisfy the relevant requirements of Annex I B".

4. "Alternatively, requirements for individual plants set out in paragraphs 2 and 3 above need not apply in sensitive areas where it can be shown that the minimum percentage of reduction of the overall load entering all urban waste water treatment plants in that area is at least 75% for total phosphorus and at least 75% for total nitrogen".

5. "Discharges from urban waste water treatment plants which are situated in the relevant catchment areas of sensitive areas and which contribute to the pollution of these areas shall be subject to paragraphs 2, 3 and 4".

Table 1 of Annex 1 defines the requirements for discharges from urban waste water treatment plants for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Suspended Solids (TSS). Table 2 of the same annex defines requirements for discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication, concerning total phosphorus and total nitrogen concentrations. There is no explicit reference to road runoff impact or treatment specifications in this Directive.

The information gathered for each case-study area within PROPER project will be considered by using:

- a flowchart including the question "Do discharges occur into an area designated by the Urban Waste Water Directive criteria as a sensitive area?" This also applies to the catchment area of the sensitive area. If the reply is No, then the next question should follow. If the answer is Yes, then discharges should not be allowed if the risk assessment proves unacceptable environmental contamination, since the area is exposed to eutrophication risk.
- GIS – the following shapefiles, produced by each MS and submitted to the WISE and other platforms¹ should be considered, and discharges should not be allowed if the risk assessment proves the existence of unacceptable environmental contamination:
 - designated sensitive areas;
 - designated catchment areas of sensitive areas (defines the extended zone of influence of sensitive areas, designated under Article 5 of the Directive which are less restrictive and therefore discharges can be conditionally accepted if no impact to the sensitive area is proven).

Natura 2000 (areas designated for the protection of habitats or species)

The Natura 2000 Directive (92/43/EC) aims to contribute towards ensuring bio-diversity through the conservation of natural habitats and the populations of species of wild fauna and flora in the European Territory. This should be achieved by defining measures designed to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora, taking into account economic, social and cultural requirements and regional and local characteristics.

¹ <https://www.eea.europa.eu/themes/water/water-pollution/uwwtd/interactive-maps/urban-waste-water-treatment-maps>

The sites are defined based on criteria and relevant scientific information describing the natural habitat types and which species are native to the site. For special areas of conservation, MS shall establish the necessary conservation measures involving, if needed, appropriate management plans specifically designed for the sites or integrated into other development plans, and appropriate statutory, administrative or contractual measures which correspond to the ecological requirements of the natural habitat types and species present in the sites. The MS shall also take appropriate steps to avoid, in the special areas of conservation, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated.

The Directive defines that any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. The competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public. On the other hand, if in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature. The MS are required to take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected.

In the road runoff pollution context, the Deliverable 2.1 of this project (Revitt *et al.*, 2018) clearly states that highway runoff can impact negatively on the chemical and ecological status of receiving waters and ecosystems. Research has shown impacts on a range of species and allowed for the conclusion that, in addition to road construction and operation affecting ecosystems in a variety of ways, highway discharges can be a main driver in ecological impacts due to changes in water quality.

Therefore, the water bodies within the areas defined by this Directive which are exposed to road runoff should have a risk assessment.

The information gathered for each case-study area within PROPER project will be considered by using:

- a flowchart including the question "Do discharges occur into a water body within an area defined as Natura 2000 habitat or ecosystem area" If the reply is No, then the next question should follow. If the answer is Yes, then discharges should not be allowed if the risk assessment proves unacceptable damage to the habitat or ecosystem exists, unless compensatory measures have been accepted.
- GIS – the Natura 2000 shapefile, produced by each MS and submitted to the WISE, should be considered, and discharges should not be allowed if the risk assessment proves the existence of unacceptable damage to the habitat or ecosystem or unless compensatory measures have been accepted.

Flood Risks Management Directive

The Flood Risks Management Directive (2007/60/EC) establishes a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in the European Community. Article 1 of the Directive (following Water Framework Directive (2000/60/EC) Article 3) concerns the coordination of administrative arrangements within river basin districts.

Article 4 requires that MS shall, for each river basin district, unit of management, or the portion of an international river basin district lying within their territory, undertake a preliminary flood risk assessment based on available or readily derivable information, such as records and studies on long term developments. In particular impacts of climate change on the occurrence of floods should be considered.

No reference is made in this Directive directly to road runoff pollution, but road sections prone to the effects of flooding (that are within Areas with Potential Significant Flood Risk) may result in increased flow volumes entering the receiving water, with contaminants mobilization from the road surface, or treatment systems, to adjacent water bodies.

The information gathered for each case-study area within PROPER project will be considered by using:

- a flowchart including the question "Is the road prone to flooding?" If the reply is No, then the next question should follow. If the answer is Yes, one should see if treatment systems are also prone to flooding and check altogether if there is risk of contaminant mobilization to adjacent water bodies.
- GIS – the Potentially Significant Flood Risk (APSFR) shapefile areas, produced by each MS and sub mitted to the WISE, should be considered, checking if the road is prone to flooding and therefore presents a risk of contaminant mobilization to adjacent water bodies.

2.1.3 Related to the measures (response)

Water Framework Directive – Controls adopted for point source discharges and other activities

The Article 11 of the WFD (2000/60/EC) defines the programs of measures necessary to bring the water bodies to required good status. For diffuse sources liable to cause pollution, like road runoff, WFD considers measures to prevent or control the input of pollutants.

In the context of road runoff pollution and from the DPSIR (cf. chapter 1 |) Response perspective, the evaluation of impact in the discharge area may be different from what was presented in previous sections (2.1.1 and 2.1.2). One has to consider the composition of the road runoff discharge through the emission limit values, to ensure that no significant impact occurs. This is not the purpose of Deliverable 2.3, and may be later defined in the context of mitigation measures and/or structure design (WP3 and WP4).

2.2 National

2.2.1 Portugal

Portuguese legislation concerning Environmental Impact Assessment was first published in 1990 with the Decree-Law 186/90 that transposed to national law Directive 85/337/CEE concerning the "legal framework for environmental impact assessment of public and private projects likely to have significant effects on the environment". The legislation was further complemented with other legal documents (such as, Regulatory-Decree 38/90 and Ordinance 590/97) and, following the publication of the new Directive 97/11/CE, Decree Law 69/2000 has replaced the former legislation. It was updated by Decree Law 197/2005, which transposed the Directive 2003/35/CE. Presently, Directive 2011/92/EU is in force.

In paragraph 7 of Annex I of the current Decree Law (Decree Law 197/2005), there is an obligation to submit to environmental impact assessment (EIA) all projects involving highway and road construction, where there are at least two traffic lanes with a central separator, as well as other main roads in sections of more than 10 km length. According to Annex II, construction of roads with small cross sections may also be subject to EIA when they are located in sensitive areas.

This legal regulatory instrument establishes the need to conduct an environmental impact study (EIS) prior to the legal consent for the project construction. Among other contents, the EIS must:

- Identify and analyse all possible direct and indirect effects of the project (construction and operation) on the environment, including socio-economic factors.
- Evaluate the significance of each impact and propose the implementation of measures to avoid, minimize or compensate significant impacts.

On the other hand, Law 58/2005, which transposes into national law the Directive 2000/60/EC, sets out the measures for protecting water abstractions for human consumption defining also protection zones for groundwater and surface water bodies. The Ordinance 702/2009 establishes criteria for defining surface water protection zones and identifies restrictions concerning pollution risks that occur by land use and anthropogenic activities.

Road projects require another kind of environmental assessment - if they are situated in sensitive areas such as Ecological Reserves, Vulnerable Areas, Protected Areas or Natura 2000 areas. A licence or authorisation of a project must be preceded by an environmental decision; otherwise it will be null.

The Ordinance No. 702/2009 of 6 July under the Decree-Law 58/2005 of 29 December (amended by Decree-Law 130/2012) that transposes into national law Directive No. 2000/60/EC, establishes definition criteria for surface water protection areas and its related restrictions concerning the pollution risks that occur by land use and anthropogenic activities. Article No. 6 of Ordinance No. 702/2009 establishes the following, which can include road runoff pressures:

- The protection areas are subject to hydrological and economic criteria established according to the characteristics of the water body where the abstraction point is located, including:
 - drainage basin delimitation where the abstraction point is located and identification of critical areas inside the immediate and extended zones with significant impact on water quality;
 - identification and characterization of water pollution sources and diffuse pollution;
 - accident risk identification, including pollutant identification and their associated risks.

The main national entities responsible for the administration and enforcement of the environmental law are the Portuguese Environment Agency (APA, I.P. that includes the Water Authority and the Regional Hydrographic Administrations - ARH), Planning and Regional Development and its subordinated entities referred to as the Regional Development Coordination Commissions and several Agencies, such as, Institute for Nature Conservation and Forests (ICNF, I.P.), Water and Waste Regulation Agency (ERSAR, I.P.). The Municipalities have also responsibility for ensuring compliance with environmental law particularly in the context of licensing civil constructions. All these entities have a different kind of approach related to the level and scope of their responsibilities and the specific procedures which they are required to intervene in. In general, they provide legal opinions, technical advices and recommendations but they also prepare proposals for ministerial decisions in Environmental Impact Assessments and they issue several authorisations and licenses. They have also an important role in the control and inspection of certain activities.

The Portuguese authority responsible for the strategic road network is the Portuguese Road Agency (EP). As part of its responsibilities, the EP Environmental Office is involved in all processes related to environmental planning, road design and implementation. Its core competencies in this matter are:

- Collaboration with sponsorship of research projects on issues related to the road environmental impacts.
- Confirm and verify if the previous studies and project executions are designed under the EIA law.
- Control the environmental monitoring during the road construction and operation.
- Follow-up of environmental monitoring studies.
- Guarantee the landscape integration.

2.2.2 The Netherlands

For environmental impacts of road runoff in the Netherlands, the following laws are relevant:

- Environmental Protection Act (WM: Wet Milieubeheer).
- Water Act (WW: Waterwet).
- Soil Protection Act (WBB: Wet Bodembescherming).
- Decree on discharging outside a facility (blbi: besluit lozen buiten inrichtingen).

The decree on discharging outside a facility contains rules for a large number of discharges that are caused by activities that do not take place in a facility, including road runoff.

Relevant articles in these acts and in the decree on discharging outside a facility are addressed by the Dutch Road Authority (Rijkswaterstaat) in a framework for road runoff (Kader Afstromend Wegwater), which provides a guidance for road runoff in planning and maintaining roads. This framework describes the possible measures that could be implied to reduce the impact of road runoff on receiving waters. The following order of preference is used for the measures:

1. Use of porous asphalt, in combination with infiltration in the road bank.
2. If infiltration in the road bank is not possible, then there will be use of infiltration areas that are not directly connected to a surface water body. The water will only be discharged in events with heavy rainfall.
3. For runoff from bridges and viaducts, infiltration areas will be used. When this is not possible (technically or financially), then the runoff will be directly discharged to a designated surface water body.
4. At service stations along highways, road runoff will be collected and transported to oil separators.

The philosophy behind this order is that research has proven that it is most cost-effective to immobilise the pollution as close as possible to the pollution source (*i.e.* the road lanes).

In order to immobilise the pollution, an accompanying guidance is given for proper maintenance measures of road surfaces and road border soil and vegetation as well.

The framework contains guidance on how to include runoff in the plans and construction of the road. It is necessary to discuss this with the competent authority (province) and the local water board.

This framework also contains a description of 'good housekeeping' practices for maintaining the roads, which includes cleaning the porous asphalt, road bank maintenance, cleaning treatment systems (gutter, infiltration locations, ditches), accident plans, maintenance of street furniture, monitoring the top layer of the road banks, maintenance of bridges, viaducts, etc.

The framework for road runoff (Kader Afstromend Wegwater) can be downloaded via (in Dutch): <http://publicaties.minienm.nl/documenten/kader>.

2.2.3 United Kingdom

Guidance documents which are currently used in the UK for assisting in the design and construction of motorways and trunk roads and for mitigating their impacts on the water environment include those published under the auspices of the following:

- a) the Design Manual for Roads and Bridges (DMRB);
- b) the UK Water Framework Directive Technical Advisory Group (UKTAG);
- c) the Construction Industry Research and Information Association (CIRIA) SuDS Manual;

d) the Welsh Government Consultation Document on the Implementation of Sustainable Drainage Systems(SuDS).

a) The Design Manual for Roads and Bridges (DMRB) (<http://www.standardsforhighways.co.uk/ha/standards/dmrbl/>) consists of a suite of documents which contain requirements and advice relating to works on motorway and all-purpose trunk roads for which one of the overseeing organisations is the highway or road authority. The DMRB embodies the collective experience of the relevant agencies in England, Scotland, Wales and Northern Ireland and provides requirements and advice resulting from research, practical experience of constructing and operating motorways and all-purpose trunk roads, and from delivering compliance to legislative requirements. It was most recently updated in June 2018. Highways England are required to use these guidelines in constructing motorways and trunk roads (and mitigating their impacts) and its use is also considered best practice for the construction of all other types of roads.

Of particular relevance to the PROPER project is Volume 11 of the DMRB, dealing with Environmental Assessment, which seeks to ensure that information about the environmental effects of projects is collected, assessed and used to inform option choice, design and decision-making in a timely and cost effective manner. The guidance aims to provide an approach which ensures that all environmental regulations, policies and procedures are complied with. Specifically, the guidance seeks to promote consideration of the likely environmental effects of possible alternatives to inform option and design choice in a way which enables the importance of the predicted effects and the scope for mitigating these effects to be assessed. In addition, it is expected that opportunities are provided for stakeholders, including the public and statutory environmental bodies, to comment on proposals taking account of their environmental implications.

Within Volume 11 of the DMRB, Section 3 deals specifically with Environmental Assessment Techniques and Part 10 addresses all aspects of Road Drainage and the Water Environment (<http://www.standardsforhighways.co.uk/ha/standards/dmrbl/vol11/section3/hd4509.pdf>). Guidance is provided on the assessment and management of the impacts that road projects may have on the water environment including the possible impacts on the quality of water bodies and on the existing hydrology of the catchments through which roads pass. The described methods are intended to be used during the environmental assessment process to provide the most objective and structured evaluation of the potential impacts of proposed road projects, and hence ensuring that:

- the need for the avoidance, and reduction, of impacts on the water environment is taken fully into account in the environmental evaluation of projects and in route selection;
- the selection of appropriate means of preventing any significant predicted impacts of the chosen route is made, through modification of the drainage design, choice of discharge location(s) and/or adoption of runoff treatment methods, with the objective of designing out potential adverse environmental impacts.

b) UKTAG (the UK Water Framework Directive Technical Advisory Group) is a partnership of the UK environment and conservation agencies which was established to provide coordinated advice on the scientific and technical aspects of the EU Water Framework Directive (<https://www.wfduk.org/>). This is deemed to be required as the Directive sets substantial challenges in meeting the objectives of improving and protecting the water environment and it is the major driver for the sustainable management of water systems (rivers, canals, lakes, estuaries, wetlands, coastal waters as well as underground water).

The high level work priorities, regarding the water environment, addressed by UKTAG include concerns relating to:

- the viability of existing standards;
- gaps in the present understanding of the relationships between pressures and ecological impact where there may be challenges;
- interlinkages between Natura protected areas and the WFD.

The work priorities also aim to look at likely future issues, develop guidance on national measures and investigate an integrated catchment approach. Examples of areas for which guidance documents have recently been published include:

- Groundwater hazardous substances standards: this document sets out the list of standards that can be used to assess inputs of hazardous substances into groundwater. Member States are required to prevent inputs of hazardous substances into groundwater (subject to exemptions) by both the Water Framework Directive (2000/60/EC) and Groundwater Daughter Directive (2006/118/EC).
- Rivers - invertebrates (general degradation) classification method: identifies a new methodology for the assessment of invertebrates in rivers in relation to general degradation, including organic pollution. Whalley, Hawkes, Paisley and Trigg (WHPT) metrics replace the Biological Monitoring Working Party (BMWP) metrics which were used for status classifications in the first river basin planning cycle.
- Rivers and lakes - metal bioavailability assessment tool (M-BAT): provides guidance on the use of the metal bioavailability assessment tool (M-BAT) for practitioners involved in monitoring, assessment and classification using the new bioavailable environmental quality standards (EQS_{bioavailable}) that have been developed for a number of metals under the WFD.

c) The CIRIA SuDS manual (C753) published in 2015, although not confined in its scope only to roads, incorporates the latest research, best practice and guidance for the planning, design, construction, management and maintenance of Sustainable Drainage Systems (https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx). It was prepared to meet the framework set out by the UK Government's 'non statutory technical standards' and in addition to complementing these it supports the cost-effective delivery of multiple benefits within both new and existing developments. The guidance looks at how to maximise amenity and biodiversity benefits, and deliver the key objectives of managing flood risk and water quality. There is also

supporting information covering topics such as materials, landscape design, maintenance, community engagement and costs and benefits. A key message of this guidance is that SuDS should be designed to maximise the opportunities and benefits that can be secured from surface water management.

Part C, Chapter 9 of the manual deals specifically with how SuDS can be incorporated into the design process for roads and highways. The emphasis is on the design opportunities and constraints which can be encountered when implementing SuDS primarily in or adjacent to new developments. Although the retrofitting of SuDS into existing roads is not considered in any detail, much of the advice is considered to be relevant to this situation. Specific challenges encountered when draining roads using SuDS include the need to protect the road pavement from damage and to ensure that extra safety risks are not introduced by the design of the drainage system. Road/highway design requirements will also be a key influence, and there needs to be close cooperation between road/highway and SuDS designers to achieve the most effective schemes.

d) In November 2017 the Welsh Government issued a consultation document seeking views on a proposed approach for delivering effective sustainable drainage systems (SuDS) on new developments (https://beta.gov.wales/sites/default/files/consultations/2018-02/171130-annex_f-en.pdf?_ga=2.172261987.1324389540.1532421874-1595392283.1532013951). Currently, the published interim non-statutory standards and guidance are for the design, construction, operation and maintenance of SuDS serving new developments in urban or rural areas but they are also seen as being relevant to existing developments. Although the proposed standards apply for developments which include road drainage, they are not intended to supersede the DMRB for the trunk road network. The standards provide information for designers, property developers and local authorities in Wales. It is considered vital that adoption and management arrangements for SuDS infrastructure and all drainage elements are agreed at the planning stage to ensure proper maintenance and effective functioning for the design life.

In the published document, the description of the Standards is preceded by an introductory Principles section which explains the objectives behind the application of the Standards. There are two types of Standards. Standard S1 is a Hierarchy Standard giving the criteria for prioritising the choice of runoff destination. It comprises 5 levels with the most preferred level (Level 1; surface water runoff is collected for use) representing the situation which should be met to the maximum extent possible, with lower levels used where required and where appropriate justification can be provided. The use of less preferential Levels may be required to effectively drain a complete site and in such situations exception criteria may apply. Discharges to sewerage systems (Level 4, surface water sewers; Level 5, combined sewers) should only be permitted in exceptional circumstances.

Standards S2 to S6 are Fixed Standards each of which states the minimum design criteria that all SuDS should satisfy. Standard S2 addresses surface water runoff hydraulic control and aims to manage the surface water in order to protect people and properties from flooding from the drainage system for events up to a suitable return period and to protect the receiving water body from morphological damage. Standard S3 (Water Quality) aims to minimise the potential pollution risk

posed to the receiving water body by surface water runoff by addressing the drainage system design. Standard S4 (Amenity) recognises that the design of SuDS components can influence the provision of high quality, attractive public space which, in turn, can help to provide health and wellbeing benefits and contribute to improving liveability for local communities. Standard S5 (Biodiversity) addresses the design of SuDS to ensure that, where possible, they create ecologically rich green and blue corridors in developments and enrich biodiversity value by linking networks of habitats and ecosystems together. This can best be achieved by considering biodiversity at the early design stages of a development. Standard S6 (Design of Drainage for Construction, Operation and Maintenance and Structural Integrity) deals with designing robust surface water drainage systems so that they can be easily and safely constructed, maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.

Sustainable drainage is one of a range of measures designed to reduce flood risk, protect water quality as well as encourage biodiversity and amenity. The guidance provided in the Welsh Government Consultation Document on Implementation of Sustainable Drainage Systems on New Developments adopts the philosophy that instead of connecting surface water drainage from new developments directly to public sewers and watercourses, developers should provide a sustainable drainage system (SuDS) wherever possible.

2.2.4 France

In France, road runoff is regulated by the Water Law of 1992, completed by the Water and Aquatic Resources Law of 2006 (the latter law is the French transposition of the WFD). These two laws and the associated decrees are part of a French legal code related to the protection of the environment, the Code de l'Environnement. All types of water (surface waters, groundwater, coastal waters and wetlands) are covered by this legal code.

The Water Law created a system of declaration/authorization. If the area affected by the project is small enough, a simple declaration is sufficient (except if the local prefect has a motivated reason to reject it). However, if the affected area is larger than a given threshold, the project requires an authorization. The currently applicable thresholds are detailed in Article 2.1.5.0 of the Code de l'Environnement. Technical guidelines specific to road construction are provided in a report edited in 2004 by Sétra, a French governmental body, entitled "Nomenclature de la loi sur l'eau – Application aux infrastructures routières". This report stresses that the applicant has to take into account all possible harmful effects of the project on the surrounding waters, including during the construction of the road and also in case of exceptional circumstances (accidental pollution, natural hazard...). The applicant has to comply with:

- The Schéma Directeur d'Aménagement et de Gestion des Eaux (SDAGE) at the level of the major hydrographic basin and to the Schéma d'Aménagement et de Gestion des Eaux (SAGE) that outlines water resources development and management at a local level.

- Natura 2000 protection areas as well as other types of protected areas recognized in France (ZNIEFF, areas protected by the French Coastal Law, ZICO, natural parks, hunting or fishing reserves...).

Finally, each project that could affect a drinking water protection zone or an area important for the fish or fauna has to be authorized, whatever its importance is.

2.2.5 Slovenia

Road runoff and pollution in the Republic of Slovenia is regulated by general rules included in the Law for Environment Protection and in the Water Law. Some aspects of relevance, mainly indirect requirements, can also be found in the legislation related to the spatial planning and, in the case of public works, in the investment legislation. These laws implement guidelines and regulations from European directives such as the WFD. General demands defined in these laws are transferred to subsidized technical legislation which defines rules and ordinances.

The main legal document dealing with road runoff is the "Decree on the emission of substances in the discharge of water from public roads" (Official gazette RS 47/2005). Some requirements for road runoff are defined also in the "Decree on the discharge and treatment of urban wastewater" (Official gazette RS 98/15 in 76/17). This document is dealing with technical regulations for waste waters in general.

The Decree supposes that all other legal documents must be considered during implementation of road drainage design and construction of roads. In the Decree this is defined by the category "other legal regimes in the space". These legal regimes are usually defined by: Rules on criteria for the designation of a water protection zone (Official gazette RS 64/2004), Decree on special protection areas - Natura 2000 areas (Official gazette RS 49/2004 with very many later supplements), Legislation related to nature protected reserves, Nature Conservation Act and subordinate Decrees and Governmental Ordinances, Decree concerning the management of bathing water quality (Official gazette RS 25/2008), and Landsliding and flooding legislation.

Among cited legal documents the only document directly related to water protection from road pollution is called "Rules on criteria for the designation of a water protection zone". Since 2002, when the new Water Law was implemented, responsibility for water protection and safeguarding is a state responsibility from the ministry for planning and environment and its services. Before its implementation, in 2002, local communities were responsible for their own drinking water resources, and therefore decided their own local protection ordinances.

Under the new Water Law, other water rights besides water for drinking purposes must be considered (e.g. water for irrigation). Identification of existing water rights is very much related to the planning stage of the road project where all spatial planning and permitting stakeholders are identified. These stakeholders are performing their requirements and demands on the proposed plan and the planner is

responsible for identification and verification of their rights according to the law. At the same time the plan is assessed through the environmental study.

Natura 2000 regions can be, from road drainage point of view, considered only in some cases when the region is protected due to the presence of habitats that rely on water. These regions can be understood in the manner defined by WFD as ecological sensitive zones. A large part of Slovenia is covered by Natura 2000 but only a small portion is related to water habitats. When roads are crossing or passing such ecosystems, the water drainage design is part of the permitting system where the authority responsible for nature protection estimates if the designed measures are acceptable or not.

Rules for bathing waters are, from a legal point of view, defined in a similar way as drinking water safeguard zones. Criteria for their determination are defined by technical legislation and their implementation is related to the ministerial decree. Usually, these acts prohibit direct discharge of water from roads in the area of bathing waters.

As a country, Slovenia is very vulnerable to landsliding and flooding and therefore an important part of environmental, planning, and construction legislation dealing with water is related to these issues. Questions related to these are not directly linked to the water quality problems originating from roads; however, flooding and landsliding represent very important constraints in the design of treatment facilities and retention ponds.

The "Decree on the emission of substances in the discharge of water from public roads" defines requirements for the design of road runoff drainage. In general, this is divided into two groups: point dispersion and dispersal. The point dispersal represents concentration of runoff with different drainage and treatment facilities. The interaction with water and roads is understood as interaction with water bodies. Two types of water bodies are recognised: surface water bodies and groundwater bodies. Only a small part of the country is lying in the coastal area which is the reason why coastal area and seawater and road interaction was not regarded as important. Further, to understand the relation between roads and water bodies, it is important to conceptualize the relation between water flowing direction and the discharge of water precipitated on the road surface and road environment in the vicinity of the road surface. Interaction between roads and water phenomena are conceptualized on the basis of the recharge area of the water that intercepts the road. These phenomena of water road interaction can be divided into three groups: road runoff, hinterland waters, and remote waters. Water bodies are defined based on these sensitive areas. In the next step it is estimated what is the expected traffic load of the road and, according to Passenger Car Equivalent – PCE limits defined in the Degree, requirements for the road drainage are defined. The dispersal is regarded as unsuitable if the prescribed PCE limit is exceeded.

2.2.6 Czech Republic

On 20th February 2001 the Law No. 100/2001 Coll., on Environmental Impact Assessment, entered into force in the Czech Republic. This Law transposed Directive 85/337/EEC on environmental impact

assessment of public and private projects into Czech legislation. The Law also takes into account Council Directive 97/11/EC (now Directive 2011/92/EU) amending Directive 85/337/EEC as well as Directive 2001/42/EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programs on the environment. The Law has been amended many times, most recently in 2017.

Paragraph 4 of this Law provides the subjects of the environmental impact assessment which are directly provided in Annex 1. Articles 9.3 and 9.4 of Annex I, Category I of this Law, states that new roads, extension and relocation of motorways and roads with four or more lanes, as well as roads and local roads, with two or less lanes, must always be subject to environmental impact assessment. In the case of the construction, extension or relocation of lower class roads, the project is subject to at least an assessment in the context of a screening procedure if it is not an intention stated in Category I, Law No. 100/2001 Coll. Assessment includes the detection, description and evaluation of direct and indirect effects on the environment in both cases of the implementation and non-implementation. It is based on the state of the environment in the affected area at the time of notification of the project. The assessment evaluates the impacts on the environment during the preparation, implementation, operation and completion of the project. The assessment also includes proposals for measures to prevent adverse impacts on the environment through the implementation of a project (elimination, reduction, mitigation or minimization of impacts) but also favourable effects, including an evaluation of the effectiveness of the proposed measures.

In the screening procedure, the competent authority office, on the basis of background material, ascertains whether and to what extent the project may affect the environment. Criteria that characterize the plan, the area of interest and the resulting significant potential impacts on the environment are used to evaluate the assessment. They are criteria for the characteristics of the project (e.g. use of natural resources, waste production, environmental pollution, disturbance effects, accident risks, etc.), Criteria for the Location of the Project (e.g. existing land use, system of ecological stability of the territory, special protected areas, etc.) and Criteria of Predicted Impacts on the environment (e.g. affected area, duration of influences, nature of influences, size and complexity of influences, etc.). If the project has a connection with the Natura 2000 protected area, several variants of the project must always be submitted for consideration.

The basic regulation for water in the Czech Republic is Law No. 254/2001 Coll., on Waters (as amended), which has been harmonized with the Water Framework Directive 2000/60/EC. Article 2, paragraph 17 of this Law, states that the approval of the water authority is required for constructions that may affect water conditions. These include, besides others, construction on lands where watercourses are located or on adjacent lands and construction in buffer zones of water resources. Paragraph 38, Article 3 also defines that rain water from roads is not considered as a waste water, if the pollution of these waters is solved by technical measures pursuant to Decree No. 104/1997 Coll., which implements the Act on Roads, which is referenced to paragraph 36, Article 8 of Law No. 13/1997 Coll., on Roads.

The Water Law is followed up by the Government Regulations and Decrees of the Czech Republic, which regulates the legislative framework for the use and handling of groundwater and surface waters. Among other things, they are:

- Government Regulation No. 57/2003 Coll., as amended, on indicators and values of permissible waste water pollution and requirements for permitting discharges to groundwater.
- Government Regulation No. 71/2003 Coll., as amended, on the determination of surface waters suitable for the life and reproduction of native fish species and other aquatic animals and on the establishment and assessment of the quality of these waters.
- Government Regulation No. 143/2012 Coll., as amended, on the procedure for determining the pollution of waste water, monitoring the amount of pollution and measuring the volume of discharged waste water into surface waters.
- Government Regulation No. 401/2015 Coll., as amended, on indicators and values of permissible pollution of surface water and waste water, the requirements for permitting the discharge of waste water into surface and sewerage water and on sensitive areas.
- Degree No. 5/2011 Coll., on the delimitation of hydrogeological districts and bodies of groundwater, on the evaluation and condition of groundwater and requirements of groundwater establishment and assessment programs.
- Degree No. 20/2002 Coll., on the method and frequency of measurement of water quantity and quality.
- Degree No. 24/2011 Coll., on river basin plans and flood risk management plans.
- Degree No. 49/2011 Coll., on the definition of surface water bodies.
- Degree No. 98/2011 Coll., on the method of assessing the status of surface water bodies, the method of evaluation of the ecological potential of heavily influenced and artificial bodies of surface water and the necessity of the programs for the detection and evaluation of surface water status.
- Degree No. 137/1999 Coll., as amended, which establishes the list of water reservoirs and the principles for establishing and changing the protection zones of water resources.

In connection with the construction and repair of the road network, there are also Technical Conditions in the Czech Republic. These are documents of a non-legislative disposition, dealing with the solution of drainage of roads and the monitoring of the quality and quantity of runoff from roads. They are approved by the Ministry of Transport and they are mainly used by designers, contracting authorities and road managers. From the field of road and water policy, these are:

- Technical Conditions No. 83 – Drainage of Roads - contain principles for designing drainage water from roads and eventual quality adjustments prior to water infiltration or draining into surface water or other recipient.
- Technical Conditions No. 107 - Drainage of road bridges - contain guidelines for removing rainfall from bridge road infrastructure. They follow TP 83.

- Technical Conditions No. 202 - Monitoring of the precipitation-outflow conditions of motorways and express roads - they deal with the description of the methodology for monitoring of the precipitation-outflow ratio of motorways and express roads. Applies to monitoring of the quality and quantity of rainwater flowing out of the drainage systems of these road types. They offer methodological guidance on how to perform the relevant measurements and at the same time allow for comparison with the limit values for traffic pollution indicators.

The state administration in the field of water management is in the Czech Republic composed of water authorities, regional authorities and municipality with extended powers. The Ministry of the Environment, together with the Ministry of Agriculture and the Ministry of Health of the Czech Republic, is authorized with the state administration. In addition, there are five state-owned organizations (state enterprises) in the Czech Republic, which are responsible for managing individual river basins (Povodí Vltavy, Povodí Labe, Povodí Ohře, Povodí Moravy and Povodí Odry). They are responsible for managing watercourses, surveying and assessing the status of surface and groundwater and other activities under the Water Act and related regulations. Furthermore, monitoring of hydrological balances and quality of groundwater and surface waters is the responsibility of the Czech Hydro-Meteorological Institute and T.G. Masaryk Water Research Institute carries out the management of the Hydro-ecological Information System and the Digital Database of Water Management Data, which are directly related to the EU Water Framework Directive No. 2000/60/EC. The licences for water management in specially protected areas are emitted by the Nature Conservation Agency of the Czech Republic. The Czech Environmental Inspectorate is the main body supervising compliance with environmental legislation. It supervises and controls compliance with the laws and binding decisions of the environmental authorities.

The state administration in the field of transport is the responsibility of the Ministry of Transport, which is the central body. It is responsible for making state transport policy and its implementation. Other authorities supervising compliance are an executive unit of state administration, regional authorities and municipalities with extended powers. The organization that deals with the research of impacts of transport and transport constructions on the environment is the Transport Research Centre (CDV), which is an institute established by the Ministry of Transport. CDV performs service for the Ministry of Transport and, among other things, deals with research projects related to transport and environment.

3 | Approaches for integrating legislative constraints

3.1 Flowchart

Based on the analysis of the common European legislative framework presented in chapter 2 |, Figure 3.1 presents a flowchart for the assessment of a road project taking into account the relevant environmental legal constraints.

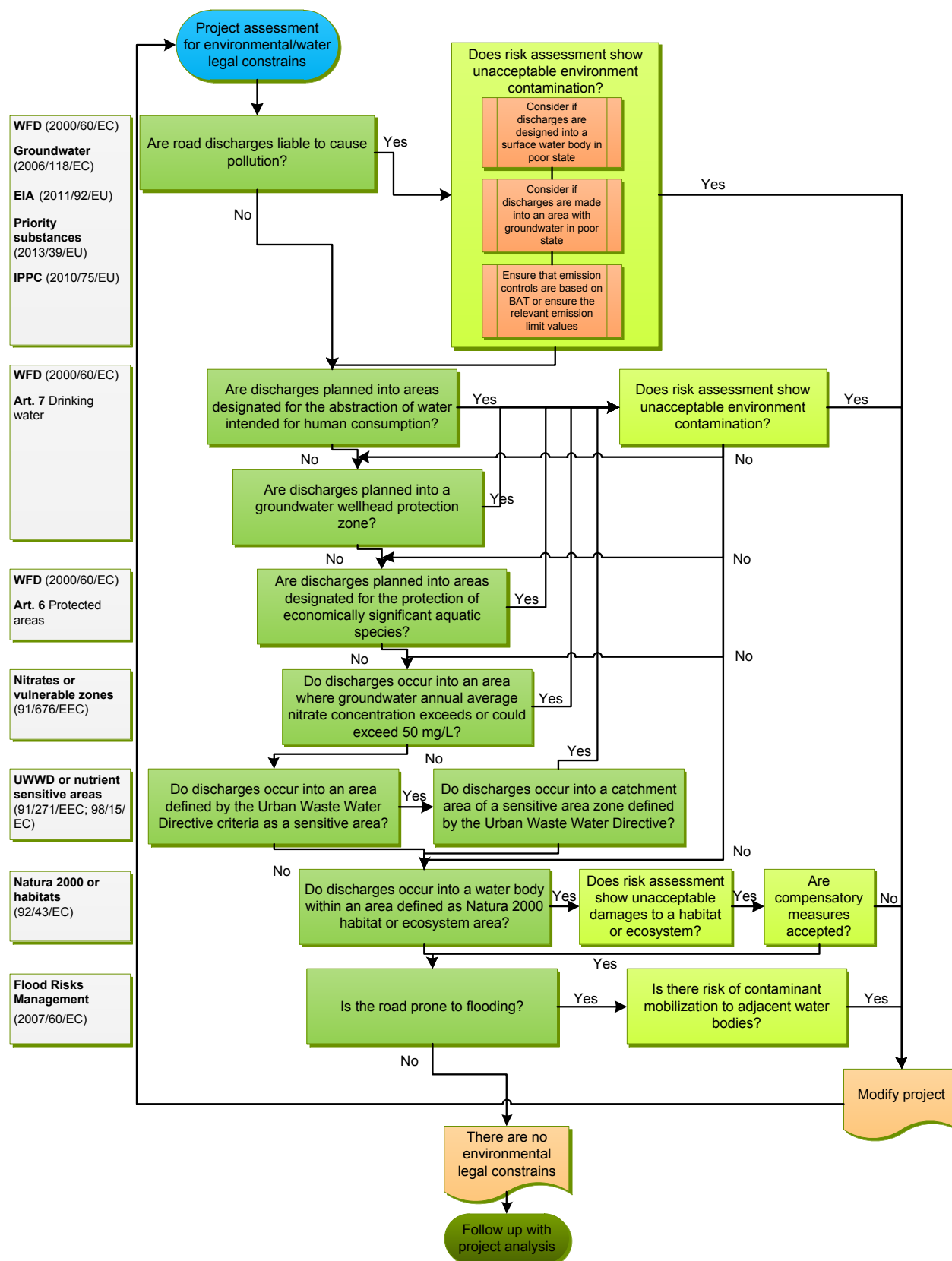


Figure 3.1 – Flowchart for the assessment of a road project aiming to analyse environmental/water legal constraints

3.2 GIS combination of layers

The geographical information gathered, produced within each legal framework referred to in Section 2 |, is the basis of the application of the flowchart presented in Section 3.1. The use of GIS platforms is essential as it allows the user to visually validate each sequential question posed in the flowchart.

The Annex of this report presents a table with a synthesis of the legislation addressed, the type of information to be used, and the maps available for each consortium country, by referring to the source of information, the information available and the respective temporal coverage.

Standardization of the geographical information that is already available in EU platforms, such as WISE, is fundamental to the implementation of automatic processes for decision making by creating tools within GIS platforms. These layers of information, and the sequence of analysis presented in the flowchart, can represent a primary structure and can feed into Task 5 of WP2.

The simple intersection processes that are usually used in GIS can be later integrated in the decision support tool, to allow user visualization by automatically producing maps such as those presented in the practical application in Chapter 4. This shows sensitive, vulnerable or protected areas requiring further risk assessment for the decision process.

4 | Example of application: Portugal – A6

To illustrate the application of GIS, having the flowchart as guideline, a Portuguese highway segment (Autoestrada 6 – A6) has been selected. The set of information layers gathered in Section 2 | are integrated into a map dataset as presented in Figure 4.1. The map presented was developed in open-source QGIS platform.

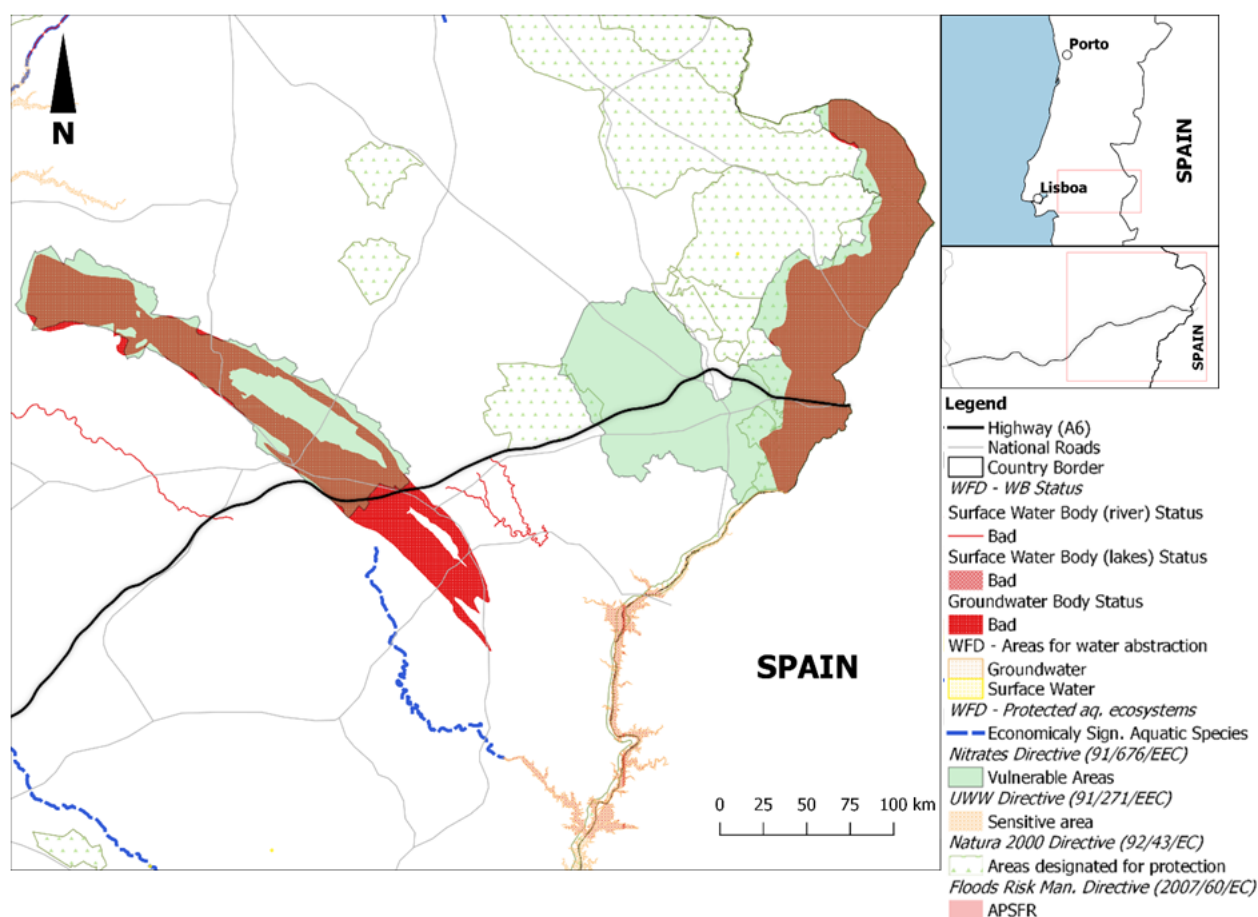


Figure 4.1 – Map with geographical dataset produced within the legal framework concerning environmental/water legal constraints

Following the sequence proposed in the flowchart, a set of questions can be answered, as described in Table 4.1 and direct visualization provided of possible highway segment intersections with specific areas defined by legal constraints.

Table 4.1 – Set of questions and answers resulting from the flowchart analysis with visual validation through GIS

Legal framework	Question	Answer	
WFD (2000/60/EC) Groundwater (2006/118/EC) EIA (2011/92/EU) Priority substances (2013/39/EU) IPPC (2010/75/EU)	<ul style="list-style-type: none"> Are road discharges liable to cause pollution? Are poor state surface water or groundwater body intersected? 	Yes	Risk assessment may be necessary in those areas
WFD (2000/60/EC) Art. 7 Drinking water	<ul style="list-style-type: none"> Are discharges planned into areas designated for the abstraction of water intended for human consumption? Are discharges planned into a groundwater wellhead protection zone? 	No	
WFD (2000/60/EC) Art. 6 Protected areas	<ul style="list-style-type: none"> Are discharges planned into areas designated for the protection of economically significant aquatic species? 	Yes	Risk assessment may be necessary in those areas
Nitrates or vulnerable zones (91/676/EEC)	<ul style="list-style-type: none"> Do discharges occur into an area where groundwater annual average nitrate concentration exceeds or could exceed 50 mg/L? 	Yes	Risk assessment may be necessary in those areas
UWWD or nutrient sensitive areas (91/271/EEC; 98/15/EC)	<ul style="list-style-type: none"> Do discharges occur into an area defined by the UWWD criteria as a sensitive area? 	No	
Natura 2000 or habitats (92/43/EC)	<ul style="list-style-type: none"> Do discharges occur into a water body within an area defined as Natura 2000 habitat or ecosystem area? 	Yes	Risk assessment may be necessary in those areas
Flood Risks Management (2007/60/EC)	<ul style="list-style-type: none"> Is the road prone to flooding? 	No	

The main result is a map that supports decision making with regard to the placement of discharges along the highway, as presented in Figure 4.2.

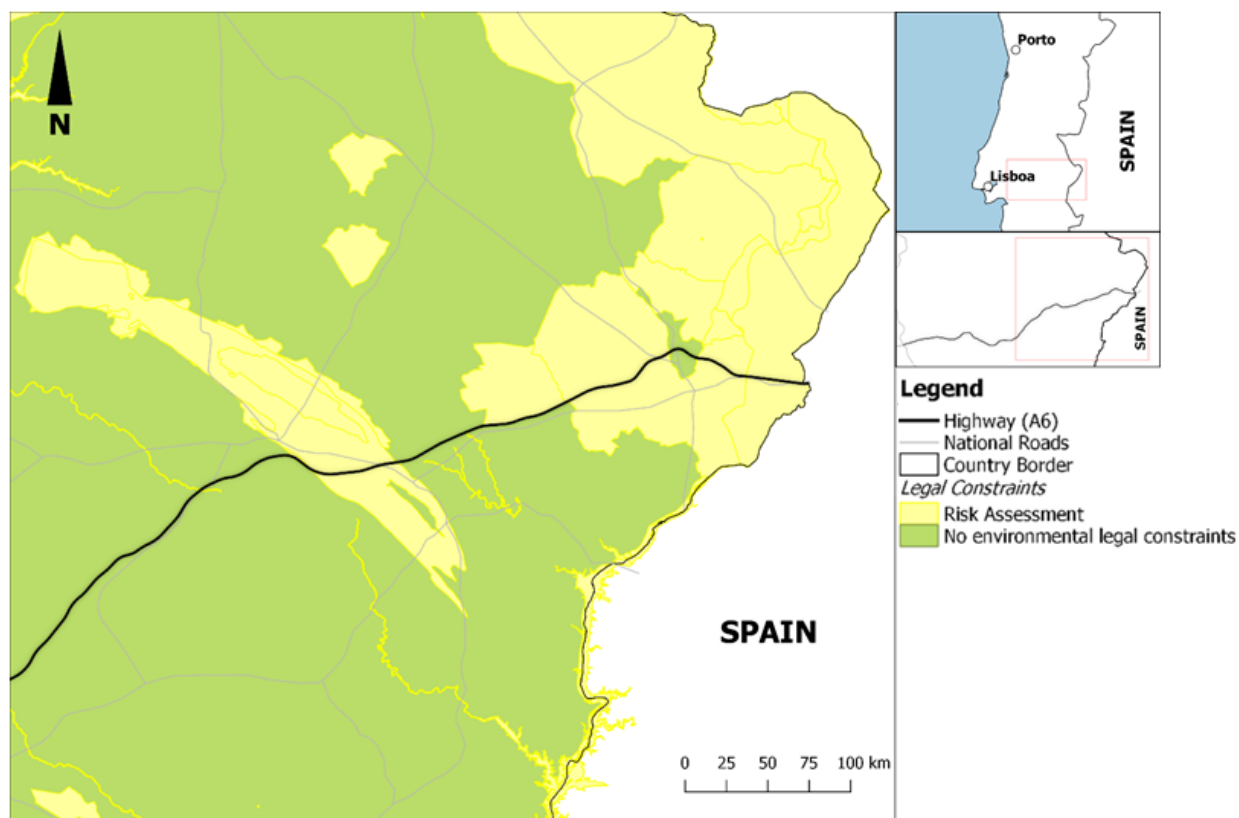


Figure 4.2 – Final map presenting areas where risk assessment may be necessary if discharges are to be allowed

5 | Conclusions

Deliverable 2.3 of the PROPER project presents a brief overview of existing European legislation and national guidelines/requirements currently used to evaluate road pollution prevention and impact mitigation with regard to protecting and enhancing surface water and groundwater bodies.

The EU Water Framework Directive and other Directives designed to mitigate pressures affecting the state of water and environment are briefly discussed. The existing national guidelines for the project consortium countries are also presented.

An approach for the integration of all relevant environmental legislative constraints to a road project has been defined through a flowchart that guides the use of a GIS procedure with a combination of layers to address legislative needs and constraints to protect surface and groundwater bodies from impacts caused by traffic-related activities. The flowchart can assist the determination of the risk assessment associated with roads on a European scale based on a set of questions and answers resulting from its analysis. The visual validation of the risk assessment analysis is only possible through GIS.

The report presents an example of an application to a Portuguese highway using the procedure defined in the flowchart through GIS to support the decision process concerning road runoff discharges. It is expected that this procedure will be applied to all PROPER case-study sites. This will occur after integration into the wider user-friendly decision support tool to be developed under Deliverable 2.5 to assess the vulnerability of surface water and groundwater to road-related pollution activities.

References

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration.

Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks.

Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy.

Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment text with EEA relevance.

Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy Text with EEA relevance.

Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment.

Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.

Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Revitt, M., Ellis, B. and Lundy, L. (2018). Deliverable 2.1 A Review of Current Knowledge on the Vulnerability of European Surface Water and Groundwater to Road Related Pollution, Together with a Critique of Related Assessment Tools. Middlesex University, UK. CEDR PROPER Project.

Shah, R. (2000). International Frameworks of Environmental Statistics and Indicators. Proceedings of the Inception Workshop on the Institutional Strengthening and Collection of Environment Statistics, Samarkand, Uzbekistan, 25-28 April 2000. United Nations Economic and Social Commission for Asia and the Pacific. <http://www.unescap.org/stat/envstat/stwes-015.pdf>.

Annex - Reference matrix with a GIS combination of layers to address legislative needs and constraints to protect surface and groundwater bodies from impacts caused by traffic-related activities

Vulnerability of water bodies and risk assessment. Evaluation of international, European and national legislative frameworks and approaches

Category	Legislation addressed	Information to be used / Output	Existing maps in WISE			Existing information for PT		
			Source	Info.	Temporal coverage	Source	Info.	Official designation (metadata)
Related to WP1 Pressure	WFD (2000/60/EC) (Annex VII, A.2.) - Summary of significant pressures and impact of human activity on the status of surface water and groundwater	Estimation of diffuse pollution sources	-	-	-	-	Information not officially published or available for download	PGRH2_SWB_DIFUSA_AGRICOLA_FLORESTAL_2006 e PGRH2_SWB_DIFUSA_GOLFE_2009
		Estimation of point pollution sources	-	-	-	-	Information not officially published or available for download	PGRH2_PRESSOES_PONTUAL_CARGAS_2012
		Estimation of pollution from road concentrations & loads	-	-	-	-	-	To be delivered from WP1
Related to WP2 State	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status. Groundwater Directive (2006/118/EC) (Part A, Annex II)	Chemical and quantitative status of groundwater bodies	https://www.eea.europa.eu/data-and-maps/data/wise-groundwater	Available in Shapefile/Spatialite.	2009-2010	https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={C18C09D-A-C38B-42C9-A861-18FB687F3E3}	Available in Shapefile and in WMS - only from 2010 Watershed Management Plan	geoapagreen.geoapagreedata.vw_wfdgroundwaterbodies_status_2010 (from 2010 WMP). Newer version from 2013 available but not yet officially published (PGRH2_GWB_STATUS_2013).
	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status	Ecological and chemical status of surface water bodies	https://www.eea.europa.eu/data-and-maps/data/wise-wfd-spatial	Available in Shapefile/Spatialite.	2009-2010	https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={7FC70C03-BED7-4FE8-B1A1-F178FE3A2F55}	Available in Shapefile and in WMS - only from 2010 Watershed Management Plan	geoapagreen.geoapagreedata.vw_wfdsurfacewaterbodyl_status_2010 (from 2010 WMP). Newer version from 2013 available but not yet officially published (PGRH2_SWB_STATUS_2013).
Related to WP2 Impact (protected areas)	WFD (2000/60/EC) (Article 6 and Annex IV) - Identification and mapping of protected areas	Areas designated for the abstraction of water intended for human consumption under Article 7	-	-	-	https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={400D3B0E-98ED-4DED-BEC2-ACD18FB459FA}	Available in Shapefile and in WMS	ProtCaptacoes_AgConsHumano PGRH2_PA_A7_PTCONT_2014. Só existe publicada a zona protegida da Albufeira de Odelouca, as restantes que são disponibilizadas no SNIAMB (D311_ZonasProtegidas_AguasConsumoHumano), foram áreas delimitadas provisoriamente até serem publicadas as oficiais, pelo que se disponibiliza os pontos das captações que constam dos PGRH.
	WFD (2000/60/EC) (Article 6, 7, and Annex IV) - Protect aquatic ecosystems, terrestrial ecosystems	Areas designated for the protection of economically significant aquatic species	-	-	-	https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={%7B5B67DFBC-3F33-43C5-91C3-078E7CF6AC09%7D}	Available in Shapefile and in WMS	PGRH2_PA_FI_PTCONT_2014. Referidas como Zonas designadas para proteção de espécies aquáticas de interesse económico
	Nitrates Directive (91/676/CEE); WFD (2000/60/EC) (Annex IV)	Vulnerable zones; nutrient-sensitive areas	http://www.eea.europa.eu/the-mes/water/interactive/soe-wfd/nitrate-directive-viewer	Web map viewer	2010	https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={84D6671D-6105-4F15-BB3D-5431AA3DC9B4}	Available in Shapefile and in WMS	D311_ZonasProtegidas_ZVulneraveisPolNitratos (available for 2010). More recent data only available by asking directly to APA.
	Urban Waste Water Directive (91/271/CEE; 98/15/CE)	Sensitive areas	https://www.eea.europa.eu/themes/water/water-pollution/wwtwd/interactive-maps/urban-waste-water-treatment-maps	Web map viewer	2013-2014	https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={0754160B-3EEA-4EF4-95E1-893E5E293A0D}	Available in Shapefile and in WMS	ZnSensíveis_MenosSens_Arlnfi; More recent data (07-02-2017) available after contact Portuguese Environmental Agency
	Natura, 2000 (habitats) (92/43/EC, 79/409/EEC); WFD (2000/60/EC) (Annex IV)	Habitats protection zones	https://www.eea.europa.eu/data-and-maps/data/natura-8#tab-gis-data	Available in Shapefile/Spatialite.	2016	http://www2.icnf.pt/portal/pn/bio-diversidade/cart	Available in Shapefile/KMZ from Portuguese ICNF. Also redirects to EEA web map viewer	areas-classificadas-2017jul07
	Flood risks management Directive (2007/60/EC)	Flood risk areas	http://www.eea.europa.eu/the-mes/water/interactive/floods-directive-viewer	Web map viewer	2011	https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={3C79B38B-1EF5-4E28-86CB-B4020C5D515D} https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={83E647E1-5131-4E04-AF4B-40D79C375468} https://sniambgeoportal.apambiente.pt/geoportal/catalog/search/resource/details.page?uuid={D2D9F660-0C63-4D8A-B64F-6E003C2550DF}	Available in Shapefile and in WMS	NZ_Diretiva200760CE_ptcont_20_WMS; NZ_Diretiva200760CE_ptcont_100_WMS; NZ_Diretiva200760CE_ptcont_1000_WMS

Vulnerability of water bodies and risk assessment. Evaluation of international, European and national legislative frameworks and approaches

Category	Legislation addressed	Information to be used / Output	Existing maps in WISE			Existing information for NL		
			Source	Info.	Temporal coverage	Source	Info.	Official designation (metadata)
Related to WP1 Pressure	WFD (2000/60/EC) (Annex VII, A.2.) - Summary of significant pressures and impact of human activity on the status of surface water and groundwater	Estimation of diffuse pollution sources	-	-	-	www.prtr.nl	Diffuse emissions to water and sewer are calculated by the Dutch PRTR. This website contains data on emissions per emission source and per water body. And there is a detailed description for every emission source (also traffic)	
		Estimation of point pollution sources	-	-	-	www.prtr.nl	Emissions from point sources to surface water and sewer are available from environmental reports from companies, and are reported by the Dutch PRTR. This website contains data on emissions per emission source and per water body.	
		Estimation of pollution from road concentrations & loads	-	-	-	www.prtr.nl	Emissions to water and sewer are calculated by the Dutch PRTR. This website contains data on emissions per emission source and per water body. And there is a detailed description for every emission source (also traffic)	
Related to WP2 State	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status. Groundwater Directive (2006/118/EC) (Part A, Annex II)	Chemical and quantitative status of groundwater bodies	https://www.eea.europa.eu/data-and-maps/data/wise-groundwater	Available in Shapefile/Spatialite.	2009-2010	https://www.waterkwalietsportaal.nl/Beheer/Rapportage/Kaart/gw_sgbp2_2015	Online map	Select "Vlekken kwantiteit" for quantity data and select "vlekken kwaliteit" for chemical status
	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status	Ecological and chemical status of surface water bodies	https://www.eea.europa.eu/data-and-maps/data/wise-wfd-spatial	Available in Shapefile/Spatialite.	2009-2010	https://www.waterkwalietsportaal.nl/Beheer/Rapportage/Kaart/ow_sgbp2_2015	Online map	Select "oordeel ecologie totaal" for ecological status and select "oordeel chemie totaal" for chemical status.
Related to WP2 Impact (protected areas)	WFD (2000/60/EC) (Article 6 and Annex IV) - Identification and mapping of protected areas	Areas designated for the abstraction of water intended for human consumption under Article 7	-	-	-	https://www.waterkwalietsportaal.nl/Beheer/Rapportage/Kaart/register_beschermde_gebieden	Online map	Select "Onttrekking menselijke consumptie"
	WFD (2000/60/EC) (Article 6, 7, and Annex IV) - Protect aquatic ecosystems, terrestrial ecosystems	Areas designated for the protection of economically significant aquatic species	-	-	-	https://www.waterkwalietsportaal.nl/Beheer/Rapportage/Kaart/register_beschermde_gebieden	Online map	Select "schelpdierwater"
	Nitrates Directive (91/676/CEE); WFD (2000/60/EC) (Annex IV)	Vulnerable zones; nutrient-sensitive areas	http://www.eea.europa.eu/themes/water/interactive/soe-wfd/nitrate-directive-viewer	Web map viewer	2010			In the Netherlands, the entire country is indicated as a vulnerable area for the nitrates directive.
	Urban Waste Water Directive (91/271/CEE; 98/15/CE)	Sensitive areas	https://www.eea.europa.eu/themes/water/water-pollution/wwtwd/interactive-maps/urban-waste-water-treatment-maps	Web map viewer	2013-2014			In the Netherlands, the entire country is indicated as a vulnerable area for the urban waste water directive.
	Natura, 2000 (habitats) (92/43/EC, 79/409/EEC); WFD (2000/60/EC) (Annex IV)	Habitats protection zones	https://www.eea.europa.eu/data-and-maps/data/natura-8#tab-gis-data	Available in Shapefile/Spatialite.	2016	https://www.waterkwalietsportaal.nl/Beheer/Rapportage/Kaart/register_beschermde_gebieden	Online map	Select "Natura 2000 gebieden"
	Flood risks management Directive (2007/60/EC)	Flood risk areas	http://www.eea.europa.eu/themes/water/interactive/floods-directive-viewer	Web map viewer	2011	www.risicokaart.nl or http://www.overstroomik.nl/overstroomik.html?adres=&latitude=&longitude=	Online map	Two online maps with the possible flood risk in the Netherlands.

Vulnerability of water bodies and risk assessment. Evaluation of international, European and national legislative frameworks and approaches								
Category	Legislation addressed	Information to be used / Output	Existing maps in WISE			Existing information for the UK		
			Source	Info.	Temporal coverage	Source	Info.	Official designation (metadata)
Related to WP1 Pressure	WFD (2000/60/EC) (Annex VII, A.2.) - Summary of significant pressures and impact of human activity on the status of surface water and groundwater	Estimation of diffuse pollution sources	-	-	-	https://data.gov.uk/datasets/pollution-inventory	discharge of certain substances to controlled waters from point and non-point sources	
		Estimation of point pollution sources	-	-	-	https://data.gov.uk/datasets/pollution-inventory	discharge of certain substances to controlled waters from point and non-point sources	
		Estimation of pollution from road concentrations & loads	-	-	-			
Related to WP2 State	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status. Groundwater Directive (2006/118/EC) (Part A, Annex II)	Chemical and quantitative status of groundwater bodies	https://www.eea.europa.eu/data-and-maps/data/wise-wfd-groundwater	Available in Shapefile/Spatialite.	2009-2010	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/503282/RBMP_Guide_to_accessing_data_and_information.pdf	Document with provides links to all RBMP data files as GEOPDFs (interactive PDF maps)	
	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status	Ecological and chemical status of surface water bodies	https://www.eea.europa.eu/data-and-maps/data/wise-wfd-spatial	Available in Shapefile/Spatialite.	2009-2010	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/503282/RBMP_Guide_to_accessing_data_and_information.pdf	Document with provides links to all RBMP data files as GEOPDFs (interactive PDF maps)	
Related to WP2 Impact (protected areas)	WFD (2000/60/EC) (Article 6 and Annex IV) - Identification and mapping of protected areas	Areas designated for the abstraction of water intended for human consumption under Article 7	-	-	-	https://environment-agency.cloud.esri.com/farmers/	Drinking water safeguard zones (surface and ground water; interactive map) Also access drinking water protection zone RBMP maps as geopdf at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/503282/RBMP_Guide_to_accessing_data_and_information.pdf	
	WFD (2000/60/EC) (Article 6, 7, and Annex IV) - Protect aquatic ecosystems, terrestrial ecosystems	Areas designated for the protection of economically significant aquatic species	-	-	-	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/503282/RBMP_Guide_to_accessing_data_and_information.pdf	Register of protected areas Spreadsheet containing the register of protected areas and information on each PA including: bathing (recreational) waters, shellfish waters, rinking water protected areas, Natura 2000, nutrient sensitive areas, nitrate vulnerable zones and information	
	Nitrates Directive (91/676/CEE); WFD (2000/60/EC) (Annex IV)	Vulnerable zones; nutrient-sensitive areas	http://www.eea.europa.eu/themes/water/interactive/soe-wfd/nitrate-directive-viewer	Web map viewer	2010	https://environment-agency.cloud.esri.com/farmers/	Nitrate vulnerable zones. Also use: Register of protected areas Spreadsheet containing the register of protected areas and information on each PA including: bathing (recreational) waters, shellfish waters, rinking water protected areas, Natura 2000, nutrient sensitive areas, nitrate vulnerable zones and information	
	Urban Waste Water Directive (91/271/CEE; 98/15/CE)	Sensitive areas	https://www.eea.europa.eu/themes/water/water-pollution/uuwtd/interactive-maps/urban-waste-water-treatment-maps	Web map viewer	2013-2014	https://data.gov.uk/datasets/uk-sensitive-areas-under-the-urban-waste-water-treatment-directive	Sensitive areas currently identified in the UK under the Urban Waste Water Treatment Directive since 1994 as CSV or XLS files	
	Natura, 2000 (habitats) (92/43/EC, 79/409/EEC); WFD (2000/60/EC) (Annex IV)	Habitats protection zones	https://www.eea.europa.eu/data-and-maps/data/natura-8#tab-gis-data	Available in Shapefile/Spatialite.	2016	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/503282/RBMP_Guide_to_accessing_data_and_information.pdf	Register of protected areas Spreadsheet containing the register of protected areas and information on each PA including: bathing (recreational) waters, shellfish waters, rinking water protected areas, Natura 2000, nutrient sensitive areas, nitrate vulnerable zones and information	
	Flood risks management Directive (2007/60/EC)	Flood risk areas	http://www.eea.europa.eu/themes/water/interactive/floods-directive-viewer	Web map viewer	2011	https://flood-map-for-planning.service.gov.uk/	interactive map showing flood risk by identified area	

Vulnerability of water bodies and risk assessment. Evaluation of international, European and national legislative frameworks and approaches

Category	Legislation addressed	Information to be used / Output	Existing maps in WISE			Existing information for FR		
			Source	Info.	Temporal coverage	Source	Info.	Official designation (metadata)
Related to WP1 Pressure	WFD (2000/60/EC) (Annex VII, A.2.) - Summary of significant pressures and impact of human activity on the status of surface water and groundwater	Estimation of diffuse pollution sources	-	-	-	-	Not available	
		Estimation of point pollution sources	-	-	-	-	Not available	
		Estimation of pollution from road concentrations & loads	-	-	-	-	Not available	
Related to WP2 State	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status. Groundwater Directive (2006/118/EC) (Part A, Annex II)	Chemical and quantitative status of groundwater bodies	https://www.eea.europa.eu/data-and-maps/data/wise-groundwater	Available in Shapefile/Spatialite.	2009-2010	www.adeseaufrance.fr		
	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status	Ecological and chemical status of surface water bodies	https://www.eea.europa.eu/data-and-maps/data/wise-wfd-spatial	Available in Shapefile/Spatialite.	2009-2010	www.nalades.eaufrance.fr		
Related to WP2 Impact (protected areas)	WFD (2000/60/EC) (Article 6 and Annex IV) - Identification and mapping of protected areas	Areas designated for the abstraction of water intended for human consumption under Article 7	-	-	-	www.adeseaufrance.fr	Database SISE-EAUX (code: RNSISEAU)	
	WFD (2000/60/EC) (Article 6, 7, and Annex IV) - Protect aquatic ecosystems, terrestrial ecosystems	Areas designated for the protection of economically significant aquatic species	-	-	-	http://www.data.eaufrance.fr/jdd/6362596f-29d2-4e94-af9b-04283841e3f7 http://www.atlas-sanitaire-coquillages.fr/statuts		
	Nitrates Directive (91/676/CEE); WFD (2000/60/EC) (Annex IV)	Vulnerable zones; nutrient-sensitive areas	http://www.eea.europa.eu/the-mes/water/interactive/soe-wfd/nitrate-directive-viewer	Web map viewer	2010	http://www.sandre.eaufrance.fr/atlas/srv/fre/catalog.search#/metadata/8ddc0f01-6708-4b23-a79a-e9bac3beeee6		
	Urban Waste Water Directive (91/271/CEE; 98/15/CE)	Sensitive areas	https://www.eea.europa.eu/themes/water/water-pollution/wwtd/interactive-maps/urban-waste-water-treatment-maps	Web map viewer	2013-2014	http://assainissement.developpement-durable.gouv.fr/	Web map	
	Natura, 2000 (habitats) (92/43/EC, 79/409/EEC); WFD (2000/60/EC) (Annex IV)	Habitats protection zones	https://www.eea.europa.eu/data-and-maps/data/natura-8#tab-gis-data	Available in Shapefile/Spatialite.	2016	https://www.geoportail.gouv.fr/donnees/sites-natura-2000-directive-habitats	Web map	
	Flood risks management Directive (2007/60/EC)	Flood risk areas	http://www.eea.europa.eu/the-mes/water/interactive/floods-directive-viewer	Web map viewer	2011	www.georisques.gouv.fr	JSON	

Vulnerability of water bodies and risk assessment. Evaluation of international, European and national legislative frameworks and approaches

Category	Legislation addressed	Information to be used / Output	Existing maps in WISE			Existing information for SLV		
			Source	Info.	Temporal coverage	Source	Info.	Official designation (metadata)
Related to WP1 Pressure	WFD (2000/60/EC) (Annex VII, A.2.) - Summary of significant pressures and impact of human activity on the status of surface water and groundwater	Estimation of diffuse pollution sources	-	-	-			
		Estimation of point pollution sources	-	-	-	http://www.mop.gov.si/si/delovna_podrocja/voda/nacrt_upravljanja_voda/uv_publikacijske_karte/	Several data maps are available, shape files available on the request	
		Estimation of pollution from road concentrations & loads	-	-	-	http://www.mop.gov.si/si/delovna_podrocja/voda/nacrt_upravljanja_voda/uv_publikacijske_karte/	Several data maps are available, shape files available on the request	To be delivered from WP1
Related to WP2 State	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status. Groundwater Directive (2006/118/EC) (Part A, Annex II)	Chemical and quantitative status of groundwater bodies	https://www.eea.europa.eu/data-and-maps/data/wise-groundwater	Available in Shapefile/Spatialite.	2009-2010	http://kazalci.arso.gov.si/?data=indicator&ind_id=769&lang_id=94	Overview maps, point data in Excel; shape file available on the request	
	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status	Ecological and chemical status of surface water bodies	https://www.eea.europa.eu/data-and-maps/data/wise-wfd-spatial	Available in Shapefile/Spatialite.	2009-2010	http://kazalci.arso.gov.si/?data=indicator&ind_id=775	Overview maps, point data in Excel; shape file available on the request	
Related to WP2 Impact (protected areas)	WFD (2000/60/EC) (Article 6 and Annex IV) - Identification and mapping of protected areas	Areas designated for the abstraction of water intended for human consumption under Article 7	-	-	-	http://gis.arso.gov.si/atlasokolja	Available in Shapefile	
	WFD (2000/60/EC) (Article 6, 7, and Annex IV) - Protect aquatic ecosystems, terrestrial ecosystems	Areas designated for the protection of economically significant aquatic species	-	-	-	http://gis.arso.gov.si/atlasokolja	Available in Shapefile	
	Nitrates Directive (91/676/CEE); WFD (2000/60/EC) (Annex IV)	Vulnerable zones; nutrient-sensitive areas	http://www.eea.europa.eu/themes/water/interactive/soe-wfd/nitrate-directive-viewer	Web map viewer	2010	http://gis.arso.gov.si/atlasokolja	Available in Shapefile	
	Urban Waste Water Directive (91/271/CEE; 98/15/CE)	Sensitive areas	https://www.eea.europa.eu/themes/water/water-pollution/wwtwd/interactive-maps/urban-waste-water-treatment-maps	Web map viewer	2013-2014	http://gis.arso.gov.si/atlasokolja	Available in Shapefile	
	Natura, 2000 (habitats) (92/43/EC, 79/409/EEC); WFD (2000/60/EC) (Annex IV)	Habitats protection zones	https://www.eea.europa.eu/data-and-maps/data/natura-8#tab-gis-data	Available in Shapefile/Spatialite.	2016	http://gis.arso.gov.si/atlasokolja ; http://www.naravovarstveni-atlas.si	Available in Shapefile	
	Flood risks management Directive (2007/60/EC)	Flood risk areas	http://www.eea.europa.eu/themes/water/interactive/floods-directive-viewer	Web map viewer	2011	http://gis.arso.gov.si/atlasokolja	Available in Shapefile	

Vulnerability of water bodies and risk assessment. Evaluation of international, European and national legislative frameworks and approaches								
Category	Legislation addressed	Information to be used / Output	Existing maps in WISE			Existing information for Czech Republic		
			Source	Info.	Temporal coverage	Source	Info.	Official designation (metadata)
Related to WP1 Pressure	WFD (2000/60/EC) (Annex VII, A.2.) - Summary of significant pressures and impact of human activity on the status of surface water and groundwater	Estimation of diffuse pollution sources	-	-	-	-	Information is published as part of water planning - 1st planning period in pdf. and maps	http://eagri.cz/public/web/mze/voda/planovani-v-oblasti-vod/plany-povodi-pro-1-obdobi/plany-oblasti-povodi/
		Estimation of point pollution sources	-	-	-	-	Information is published as part of water planning - 1st planning period in pdf. and maps	http://eagri.cz/public/web/mze/voda/planovani-v-oblasti-vod/plany-povodi-pro-1-obdobi/plany-oblasti-povodi/
		Estimation of pollution from road concentrations & loads	-	-	-	-	-	-
Related to WP2 State	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status. Groundwater Directive (2006/118/EC) (Part A, Annex II)	Chemical and quantitative status of groundwater bodies	https://www.eea.europa.eu/da/ta-and-maps/data/wise-groundwater	Available in Shapefile/Spatialite.	2009-2010	https://heis.vuvv.cz/data/webmap/datoovesady/isyv/utvarypovstav/HTML_ISV/\$\$utvarypovstav5stazeni.asp?doc=full	Available in Shapefile and in WMS and on-line map in https://heis.vuvv.cz/data/webmap/isapi.dll?map=mp_isvs&TMPL=AJAX_MAIN&IFRAME=1&LEGEND_HIDE=0&QUERY_SELECTION=1&FULLTEXT_CHECKED=1	https://heis.vuvv.cz/data/spusteni/pgstart.asp?pg=HTML_ISV\$\$utvarypovstav5stazeni&pgload=1&ico=icoopeninf.png&nadpis1=Stav%20vodn%EDch%20%FAtvar%F9%20a%20ekologick%FD%20potenci%E1%20sIn%EC%20ovlivn%ECn%FDch%20a%20um%EC%FDch%20vodn%EDch%20%FAtvar%F9&nadpis2=Informace%20o%20datech&pagenavig=Informace%20o%20datech%20%3E%20
	WFD (2000/60/EC) (Article 8 and Annex V) - Map form of the results of the monitoring programmes carried for the status	Ecological and chemical status of surface water bodies	https://www.eea.europa.eu/da/ta-and-maps/data/wise-wfd-spatial	Available in Shapefile/Spatialite.	2009-2010	https://heis.vuvv.cz/data/webmap/datoovesady/isyv/utvarypovstav/HTML_ISV/\$\$utvarypovstav5stazeni.asp?doc=full	Available in Shapefile and in WMS and on-line map in https://heis.vuvv.cz/data/webmap/isapi.dll?map=mp_isvs&TMPL=AJAX_MAIN&IFRAME=1&LEGEND_HIDE=0&QUERY_SELECTION=1&FULLTEXT_CHECKED=1	https://heis.vuvv.cz/data/spusteni/pgstart.asp?pg=HTML_ISV\$\$utvarypovstav5stazeni&pgload=1&ico=icoopeninf.png&nadpis1=Stav%20vodn%EDch%20%FAtvar%F9%20a%20ekologick%FD%20potenci%E1%20sIn%EC%20ovlivn%ECn%FDch%20a%20um%EC%FDch%20vodn%EDch%20%FAtvar%F9&nadpis2=Informace%20o%20datech&pagenavig=Informace%20o%20datech%20%3E%20
Related to WP2 Impact (protected areas)	WFD (2000/60/EC) (Article 6 and Annex IV) - Identification and mapping of protected areas	Areas designated for the abstraction of water intended for human consumption under Article 7	-	-	-	https://heis.vuvv.cz/data/webmap/datoovesady/isyv/opvz/HTML_ISV\$\$opvz5stazeni.asp?doc=f	Available in Shapefile and in WMS and on-line map in https://heis.vuvv.cz/data/webmap/isapi.dll?map=mp_isvs&TMPL=AJAX_MAIN&IFRAME=1&LEGEND_HIDE=0&QUERY_SELECTION=1&FULLTEXT_CHECKED=1	https://heis.vuvv.cz/xmicka/index.php?ak=detail&uuid=CZ-VUV-MD-OPVZ
	WFD (2000/60/EC) (Article 6, 7, and Annex IV) - Protect aquatic ecosystems, terrestrial ecosystems	Areas designated for the protection of economically significant aquatic species	-	-	-	https://heis.vuvv.cz/data/webmap/datoovesady/isyv/RybnVody/HTML_ISV\$\$RybnVody5stazeni.asp?doc=full	Available in Shapefile and in WMS and on-line map in https://heis.vuvv.cz/data/webmap/isapi.dll?map=mp_isvs&TMPL=AJAX_MAIN&IFRAME=1&LEGEND_HIDE=0&QUERY_SELECTION=1&FULLTEXT_CHECKED=1	https://heis.vuvv.cz/xmicka/?ak=detail&uuid=CZ-VUV-MD-RybnVody
	Nitrates Directive (91/676/CEE); WFD (2000/60/EC) (Annex IV)	Vulnerable zones; nutrient-sensitive areas	http://www.eea.europa.eu/the-mes/water/interactive/soe-wfd/nitrate-directive-viewer	Web map viewer	2010	https://heis.vuvv.cz/data/webmap/datoovesady/isyv/zranitoblasti/HTML_ISV\$\$zranitoblasti5stazeni.asp?doc=full	Available in Shapefile and in WMS and on-line map in https://heis.vuvv.cz/data/webmap/isapi.dll?map=mp_isvs&TMPL=AJAX_MAIN&IFRAME=1&LEGEND_HIDE=0&QUERY_SELECTION=1&FULLTEXT_CHECKED=1	http://geoportal.gov.cz/php/micka5/page/CZ-VUV-MD-Zranitoblasti
	Urban Waste Water Directive (91/271/CEE; 98/15/CE)	Sensitive areas	https://www.eea.europa.eu/themes/water/water-pollution/uwwtd/interactive-maps/urban-waste-water-treatment-maps	Web map viewer	2013-2014	https://heis.vuvv.cz/data/webmap/datoovesady/isyv/citliveoblasti/HTML_ISV\$\$citliveoblasti5stazeni.asp?doc=full	Available in Shapefile and in WMS	https://heis.vuvv.cz/xmicka/index.php?ak=detail&uuid=CZ-VUV-MD-CitOblasti
	Natura, 2000 (habitats) (92/43/EC, 79/409/EEC); WFD (2000/60/EC) (Annex IV)	Habitats protection zones	https://www.eea.europa.eu/da/ta-and-maps/data/natura-8#tab-gis-data	Available in Shapefile/Spatialite.	2016	http://www.nature.cz/natura2000-design3/web_habitaty.php?cast=1805&ake=seznam&quickfilters=3&order=HABITATKOD&orderhow=ASC	Information is available after clicking the site code, including the map view	Metadata is not available
Flood risks management Directive (2007/60/EC)	Flood risk areas	http://www.eea.europa.eu/the-mes/water/interactive/floods-directive-viewer	Web map viewer	2011	http://cds.chmi.cz/?lang=cs&presenter=StreamTile	Available in on-line map in http://cds.chmi.cz/?lang=cs&presenter=CDSMap	http://cds.chmi.cz/?lang=cs&presenter=Help;http://cds.chmi.cz/dokumentace/Metodika_mapovani_2012-03-13.pdf;http://www.dibavod.cz/74/mapy-povodnoveho-nebezpeci-a-mapy-rizik.html	