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TG I5 Water Quality



Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

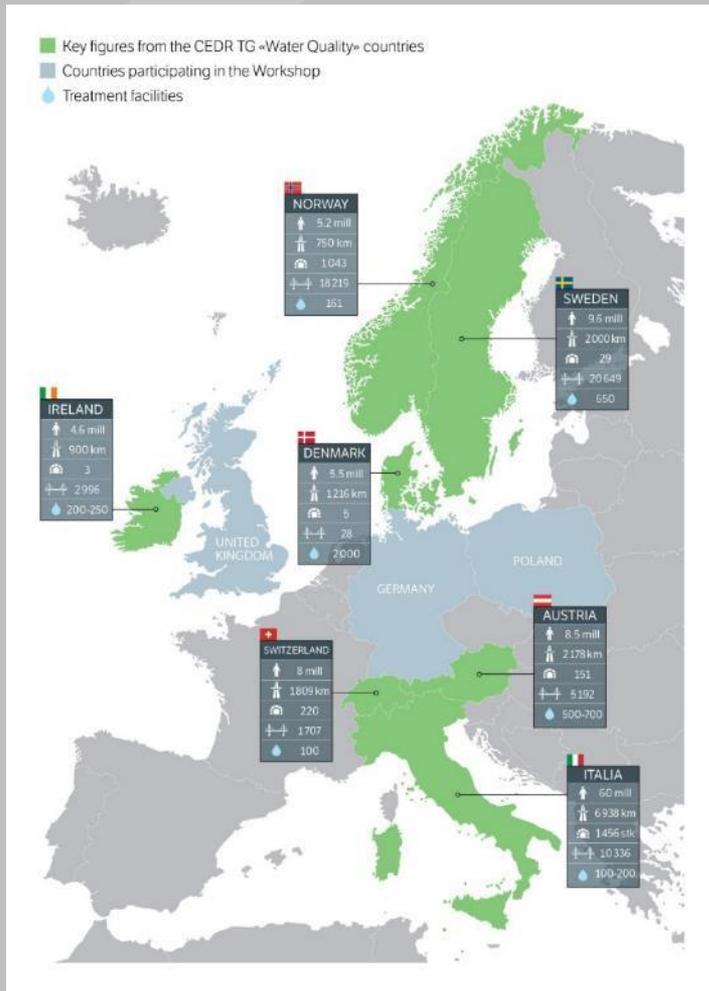
Management of Contaminated Runoff Water – a Review

Background (SP 3 2013 – 2017)



- Increased traffic loadings and building of road in Europe may pose a threat to water bodies
- The TG will focus on means to mitigate negative impacts on water quality during planning, building and operating the road network
 - When should contaminated runoff be treated to meet the requirements in relevant EU directives (EU Water Framework Directive)
 - What will be the best practice when treatment is mandatory?
 - What will be the research needs on these matters within the next decade?
 - **Water quantity, physical barriers, canalization, climate change is not included.**

Outline of the work



2) Workshop:
invited experts
from Germany,
Poland and UK.



1) «mini-reports»
from
TG members.



3) Subtask 1
State-of-the-Art
Report 2015.



4) Subtask 2
Research
needs 2016.

Figure 1. Map showing the CEDR-countries members of the TG Water Quality and those participating in the workshop January 2015. Key figures for the various countries are displayed in the grey boxes (Ill: Jon Opseth, NPRA).

EU Water Framework Directive (WFD)



- WFD aims to achieve “good status” for all of Europe’s surface waters.
 - Good status” implies “good ecological and chemical status” in terms of low levels of chemical pollutants as well as healthy ecosystems.
 - Much effort has been done to meet the objectives in the WFD, but it is still a huge challenge.
 - 47 % of the EU surface waters will not have good ecological status by 2015.
 - **Big uncertainties behind the figures and it is unclear to which extent roads and traffic contributes to this.**

Impacts from roads on the aquatic environment

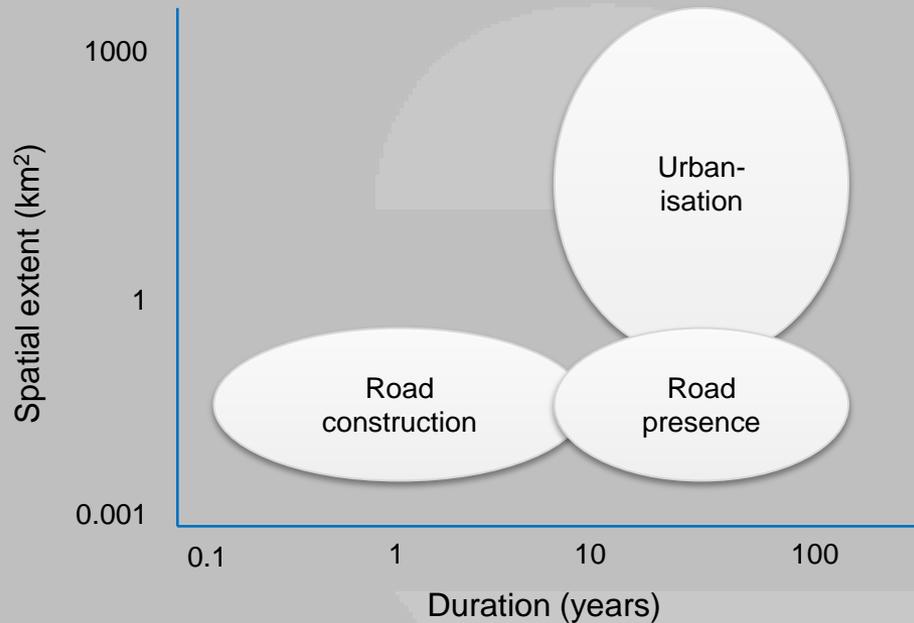


Figure 2. Temporal and spatial extent of impacts due to road development. Road construction occurs over relatively small time and space scales, while urbanisation occurs over much larger scales (axes are logarithmic). Modified after Angermeier et al. (2004).

Mitigating peak runoff volumes as well as reducing pollution loadings and concentrations are now considered important and is often mandatory both from a regulatory perspective and for the National Road Administrations (NRAs) responsible for planning, building and maintenance of the road network.

When to treat road runoff is decided early in the planning process and must be approved by the environmental authorities.

BUILDING

- Environmental Impact Assessments or similar are performed to assure that water bodies are protected from pollution.
 - Few guidelines exists (preferential system, operating, monitoring, maintenance,...).
 - The contractor is normally responsible for adopting proper measures to meet the requirements set by the NRAs and/or the environmental authorities.
 - Various measures are used, mostly low-cost systems such as ditches, channels, earth ponds, tanks etc. Tunnelling require more advanced systems (e.g. pH-adjustments, chemical flocculants to enhance sedimentation,...).

“Little data or experience regarding how these treatment systems perform on-site.”

“Environmental consequences related to road building is poorly described in the scientific literature.”

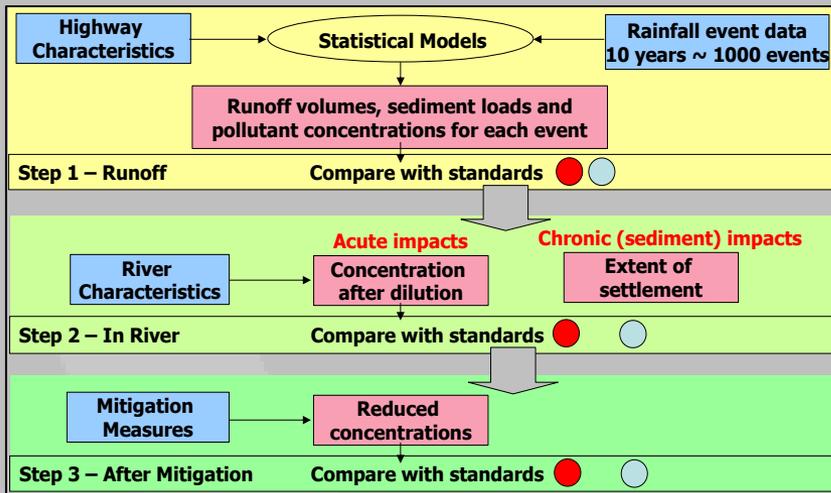
OPERATING: When do NRAs decide to treat road runoff?

- Key indicator is traffic density (i.e. Annual Daily Traffic, ADT)
 - ADT benchmark range from 10' – 15 000 vehicles/day, depending on the country.
 - ADT may be lowered in certain cases e.g. protected water areas or very vulnerable recipients.
- However;
 - Weak correlation between ADT and pollution concentrations, and ADT benchmarks are not well reasoned from a scientific point of view.
 - No well-established criteria to define what a vulnerable recipient is in terms of road runoff pollution.
- Thus;
 - ADT is probably more reasoned from:
 - “precautionary principle”.
 - what has been the practice in previous projects (and in neighbouring countries?).
 - the planners’ professional knowledge.

“May cause an over-provision of measures to mitigate perceived negative impacts and a misdirection of the resources available for the protection of water bodies??”

The UK HAWRAT, an exception from the ADT approach

- Highway Agency Water Risk Assessment Tool (HAWRAT)
 - Joint research program between the Highway and the Environmental Agencies.
 - Evidence-based risk assessment tool incorporating biological/ecological considerations in combination with hydraulics and traffic characteristics such as ADT.
 - Big uncertainties related to the input data, however, the tool is by the Environmental Agency considered to be in accordance with the WFD!



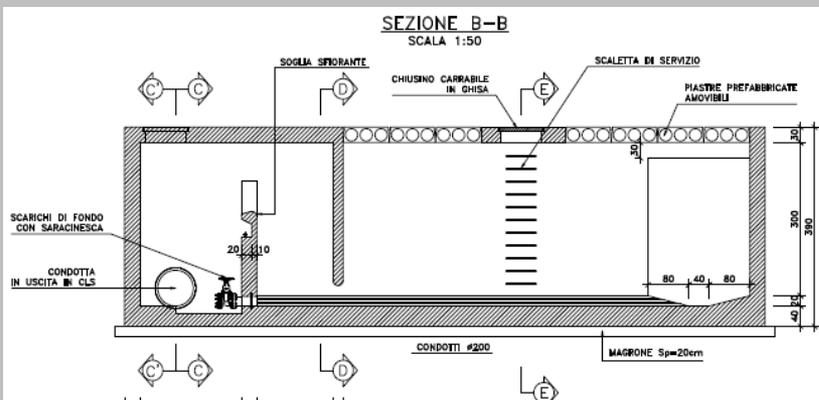
“May cause under-provision considering the huge uncertainties of input data (both traffic and pollution concentrations and the toxicity derived benchmarks)???”

Figure 4. Flow chart of the Highway Agency Water Risk Assessment Tool (HAWRAT).

How to treat polluted runoffs



- Scandinavia, Ireland/UK, Poland:
 - Sedimentation / detention ponds.
 - Remove particle associated pollutants, but less effective on dissolved pollutants.



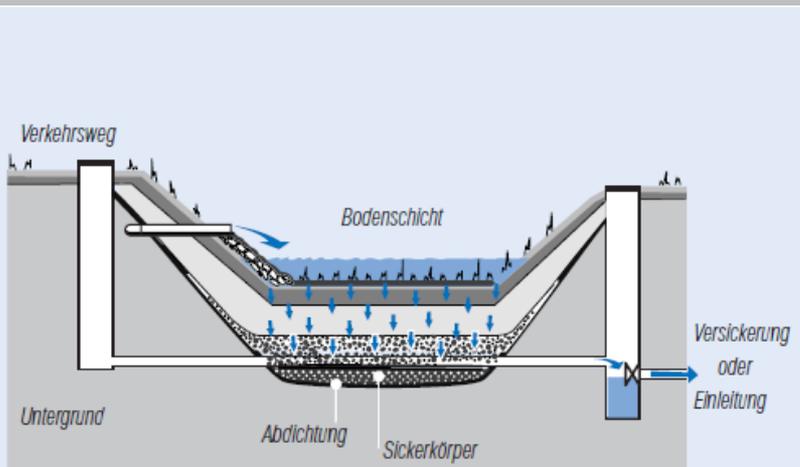
- Italy
 - Small treatment tanks (~40 m³).
 - Retain and treat “first-flush”.

How to treat polluted runoffs



- Austria and Germany:
 - Sedimentation / detention ponds together with infiltration (humus material, ~30 years).
 - Require a lot of space.
 - Clogging may be a problem.
 - Austria is currently moving towards more compact solutions with commercial filter material.

- Switzerland
 - Various infiltration solutions.
 - Sedimentation ponds alone are not approved as adequate by the environmental authorities”.



Special cases: tunnel wash water

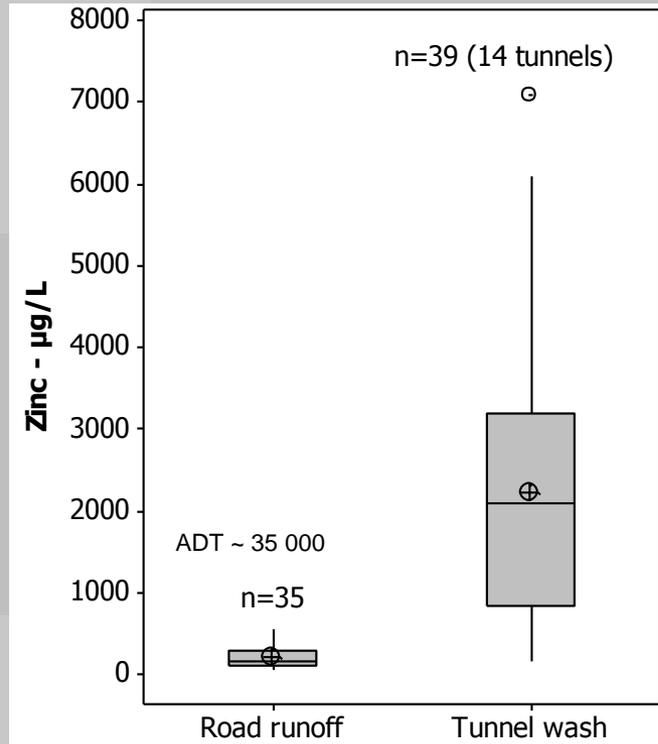
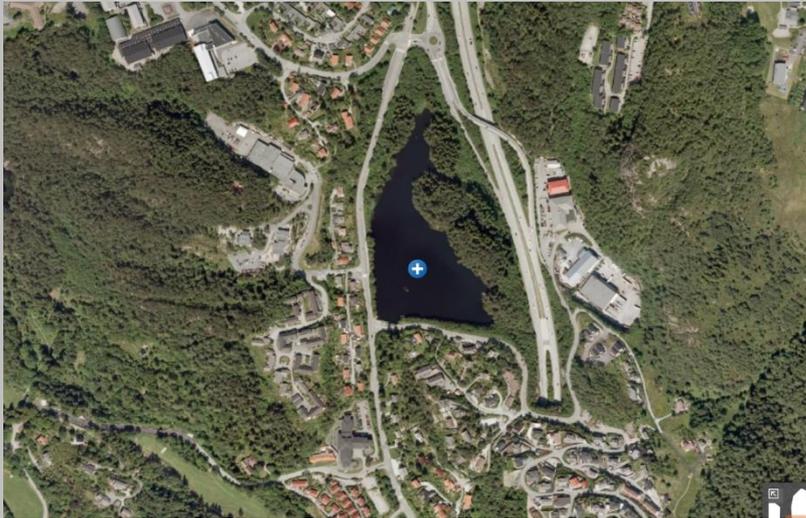


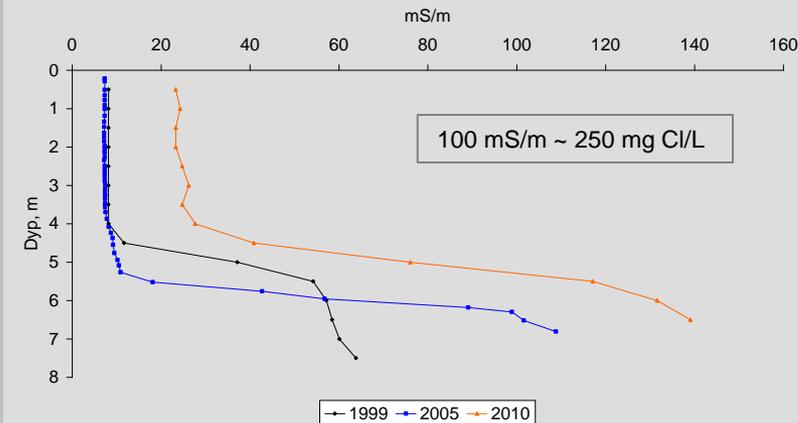
Figure 5. Box-plot showing Zn concentrations in road runoff episodes (E6 Skullerud, based on 35 episodes (Vollertsen et al., 2006; Åstebøl, 2004)) and tunnel wash water (tunnel wash sampling campaigns obtained from 14 tunnels (Unpublished data)). Circle indicates an outlier and circles with cross indicate mean values.

- Tunnels are frequently washed
- Highly polluted and potentially acute toxic → a hot spot!
- Tunnel wash water is always treated in Austria and Switzerland, but not in Norway, Sweden and Italy.
- Treatment include:
 - Sedimentation basins
 - Sedimentation + chemicals/flocculants
 - Sedimentation + mobile treatment units (truck) for filtration and flocculation
 - Conveyed to public wastewater treatment plants

Special cases: de-icing chemicals / road salt



Griggastemma



- Sodium chloride (NaCl) has for decades been used to improve winter road conditions.
 - Poland: ~600 000 t salt/year
 - Norway/Sweden: > 200 000 t salt/year.
 - Ireland: ~ 50 000 t/year.
 - Austria ~ 100 000 t/year.
- Environmental concerns have been raised and chemical and ecological impacts are now documented.
- NaCl is highly mobile and will not be treated (only diluted) in treatment systems. It may, in fact, disturb the treatment processes.

Management of road runoff in Europe - Compliance with the Water Framework Directive?

«Good ecological and chemical status is an overarching goal in the WFD and is of general content for the protection of the aquatic environment without making a specific reference to road runoff.»

- *All countries need to address water quality when planning, building and operating the road network in order to meet the requirements from environmental authorities and regulations such as the WFD.*
 - *All countries include some kind of treatment system when the ADT exceeds 10 – 15 000 vehicles/day → best available technology (BAT) is a pragmatic approach to solve a problem.*
 - *The UK HAWRAT appears to be the only evidence-based risk assessment tool taking into account biological/ecological and chemical considerations and is more likely in compliance with the WFD.*
 - *There are indications that operation and maintenance of the treatment systems are neglected, leading to poor treatment and potentially breakdown of the facility.*
 - *Still uncertainties regarding the performance of the systems, especially for new and emerging chemicals and there is little knowledge about the cost-benefit related to building and operating these system.*

Management of road runoff in Europe - Compliance with the Water Framework Directive?

“The European NRAs do a lot of good things which probably is in compliance with the WFD, but there are certainly room for improvements!”

Five possible ways forward; the NRAs should...



... initiate and develop a common understanding together with the Environmental Agencies on a national or European level when road runoffs should be treated.



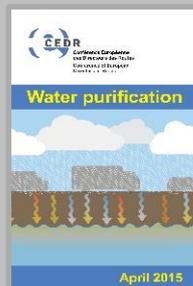
... improve the water management by developing guidelines concerning both the building and operating phase.



... challenge the car manufacturing and related industries to use less hazardous substances in their production as the vehicles are one of the most significant sources of pollutants present in road runoff.



... initiate and conduct research to be able to improve the water management in terms of meeting the requirements in the WFD and other relevant regulations/directives.



... continue the work started in SP3 in SP4, as water management will still be an important issue both at a national and at European level.

Thanks to my CEDR-colleagues!

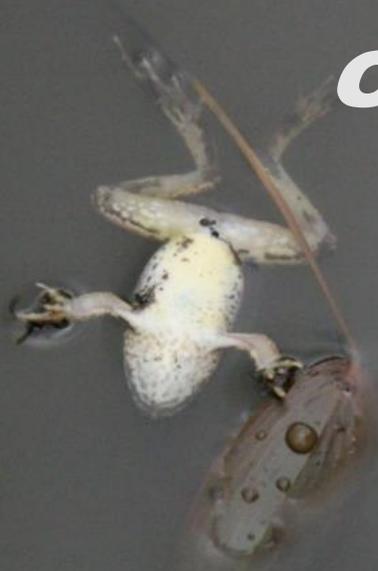
Country	Name and Organisation
Austria	Mr. Roland Gschier (Austrian ministry for Transport, Innovation and Technology) Mr. Heimo Berghold (ASFINAG)
Denmark	Mr. Ulrik Möller Jensen (Danish Road Directorate)
Ireland	Mr. Peter Walsh (Irish National Roads Authority)
Italy	Mr. Alessandro Mita (Italian Autonomous National Roads Corporation)
Norway	Dr. Hedda Vikan (Norwegian Public Roads Administration)
Sweden	Mr. Björn Sundqvist (Swedish Transport Administration) Mr. Thomas Gerenstein (Swedish Transport Administration)
Switzerland	Mr. Adrian Gloor (Swiss Federal Roads Office)
Germany*	Dr. Birgit Kocher (BASt, Federal Highway Research Institute) Mr. Jürgen Roth (DEGES, Deutsche Einheit Fernstraßenplanungs- und -bau GmbH)
Poland*	Ms. Monika Hardej (General Directorate for National Roads and Motorways) Mr. Jacek Wojtowicz (General Directorate for National Roads and Motorways)
UK*	Mr. Mike Whitehead (Highway Agency) Mr. Steve Cox (Ramboll)

* Participated in the workshop in Stockholm, Sweden, January 2015

Tunnel wash can be toxic!



*Questions/
comments?*



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