Design of a web-based information platform for water quality assessment in urban planning

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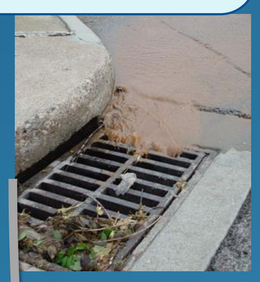
ABSTRACT

The hydrological cycle in urban areas is strongly affected by urbanization process. Urban storm water runoff is a threat to water quality in receiving lakes. Sustainable urban planning decisions require extensive on-line collaboration between urban planners, hydrologists, and public stakeholders.
The hydrologist is responsible for developing and testing a mathematical model that is capable of predicting storm water runoff and pollutant transport under varying land-cover conditions. The urban planner is responsible for maintaining up-to-date spatial data including future land-cover change scenarios.

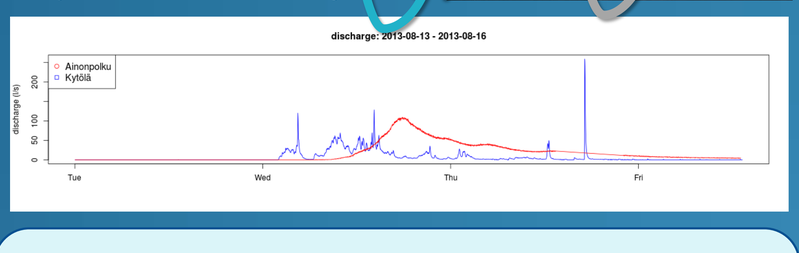
Despite the rapidly increasing availability of geographic information on the web, traditional desktop-based geographic information systems (GIS) and specialized hydrological model software tools are predominantly used in the hydrological model setup, often requiring time-consuming exchange of large datasets between the urban planner, GIS expert and hydrologist and resulting in information loss. The limitation of desktop GIS can be overcome by moving the system to a distributed web-based information platform.

This paper explores options how to efficiently run a hydrological model in an on-line information platform for urban planning. By using a web-based interactive map application, the interface is readily available in any location with Internet access. The up-to date geographical information (urban plans, land cover maps, drainage network) is maintained by respective stakeholders, reducing the need to exchange large datasets. Hydrologists can easily modify the simulation model parameters using latest results from field experimental sites. The interactive web map application is used to present alternatives of urban development and rapidly compare and contrast the impact of urban planning decisions on the water environment.

WHY STUDY URBAN WATER CYCLE IN FINLAND?



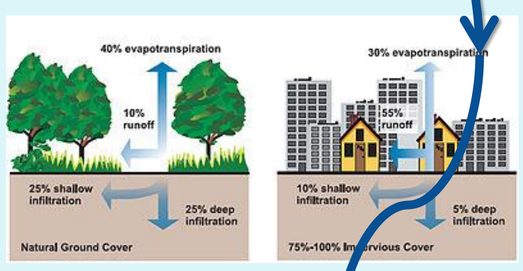
Non-urban sources (left) but also urban water sources (top right] may affect the health of the Vesijärvi and other lakes in the city



LAHTI URBAN LABORATORY VISION AND GOALS

Use case: what is the impact of **projected urbanization** on **water quality** in city **rivers and lakes?**

- Help decision-makiers and public in urban planning better understand effects **on** storm water runoff
- Encourage competition between hydrological models in the world of rapidly changing urban environment



Changing land use, climate and water cycle

Geospatial Data Services Used

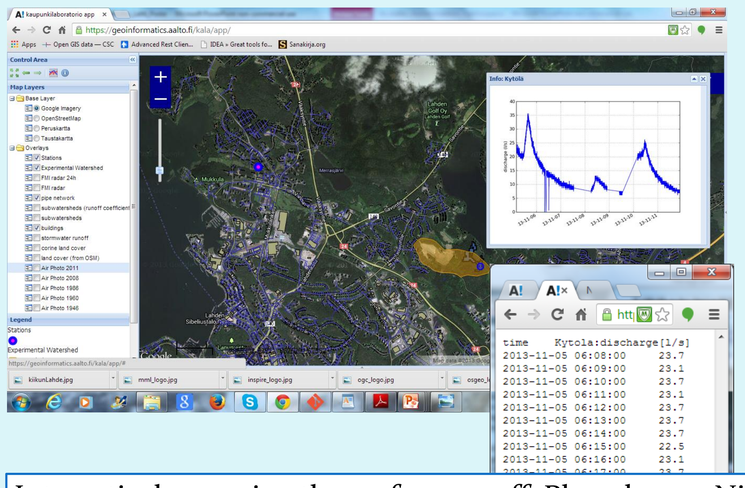
SYKE
MML
FMI
Lahti Aqua
Lahti City Office
OpenStreetMap

CHALLENGES

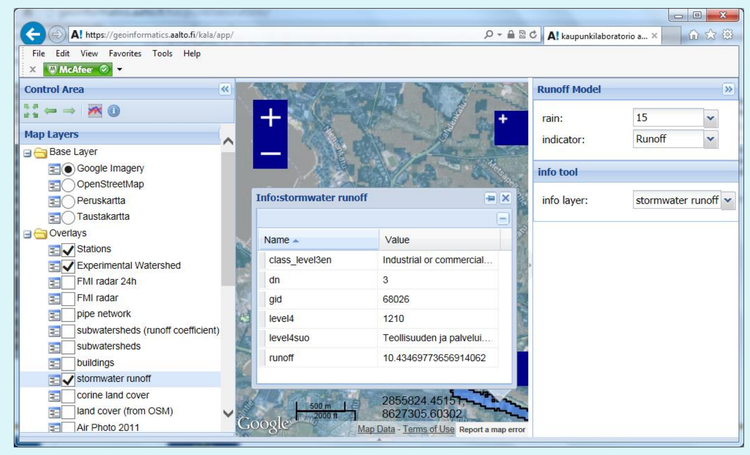
- Handling data privacy and security concerns
- Selection of a suitable platform for launching the web map application
- Cartographic representation of time series in the web map
- Application of standardized web services using OpenGIS standard and open source software that can be transferred to other cities in Finland and Europe

URBAN WATER WEB MAP - EXAMPLES

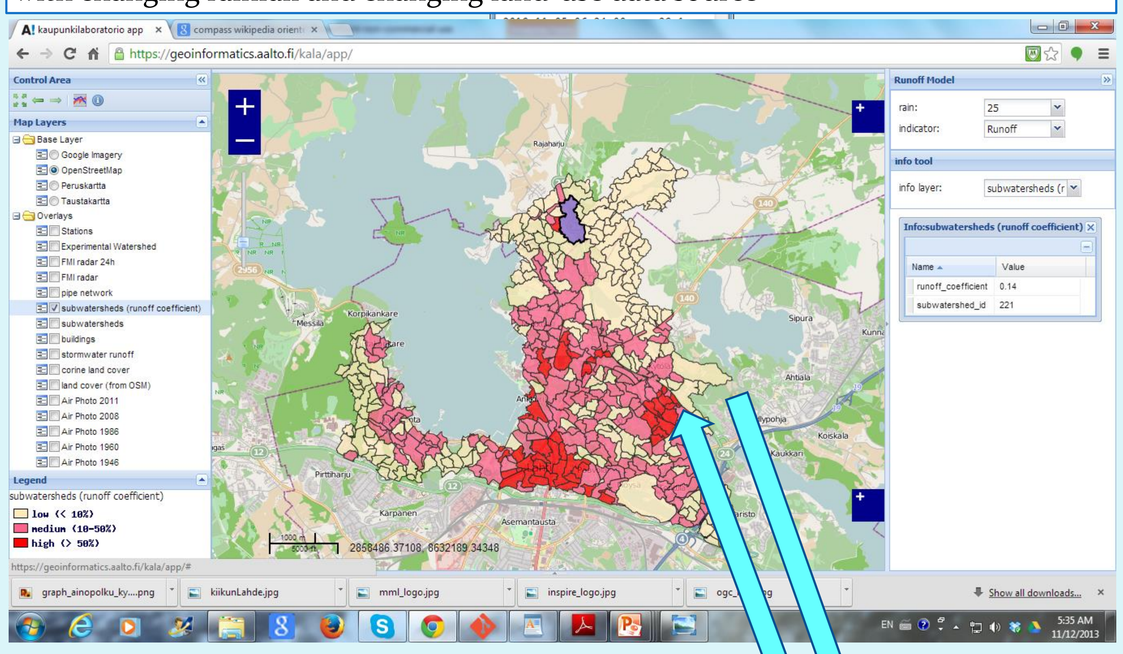
Explore current and historical urban runoff events at measurement sites and experimental catchments



Info tool: Explore the detailed info about each land use area, building, catchment or pipe



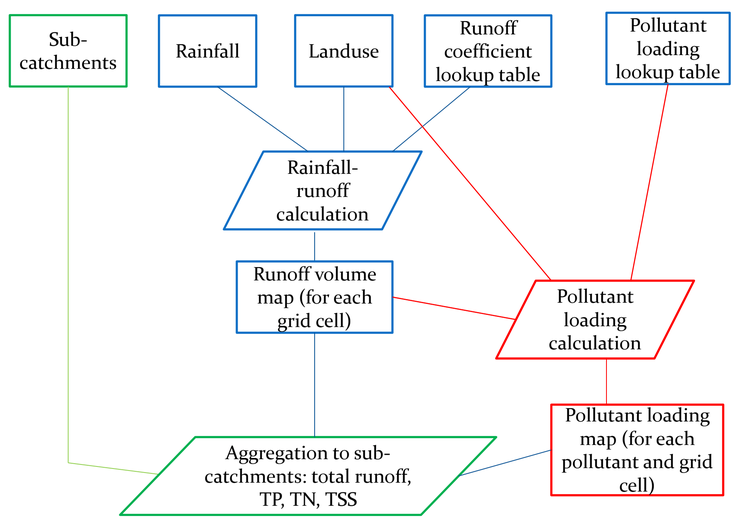
Interactively examine the surface runoff, Phosphorus, Nitrogen, Suspended solids with changing rainfall and changing land-use data source



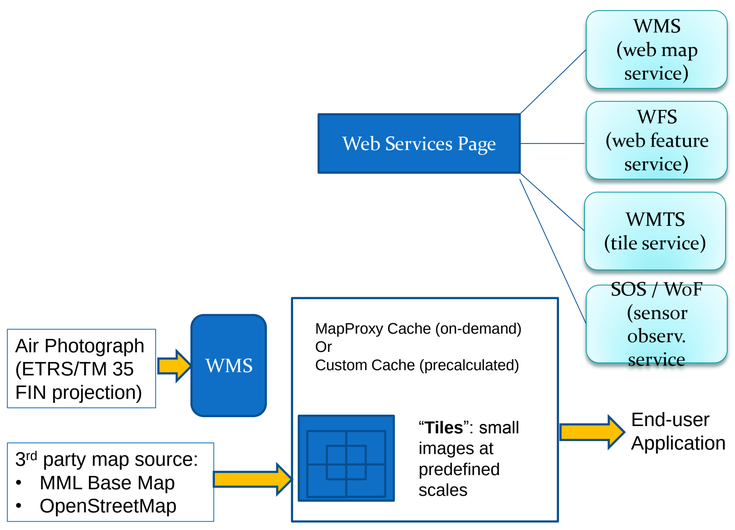
Expected Advantages of Web-Based Modeling Tool:

Desktop GIS and Stormwater model	Web-Based Platform and Apps
Requires expert installation, setup and training on local computer.	Accessible from any computer, tablet or phone with internet connection
High maintenance cost	Reduced maintenance cost expected

URBAN STORMWATER RUNOFF: CONCEPTUAL MODEL

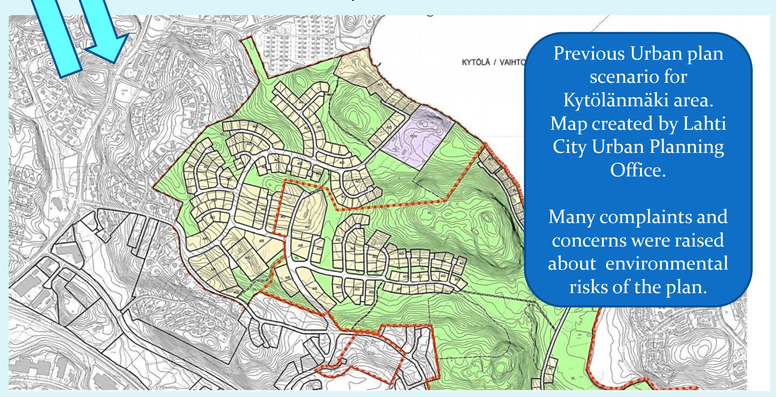


WEB MAP SYSTEM: TECHNICAL COMPONENTS



NEXT STEPS

Task1: Integrate Lahti Urban plan maps and document enable interactive visualization of water quality changes based on different urban plan alternatives



Task 1: Present forecasts of a more physically+based model (SWM) to the web map

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