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Environmental monitoring at a sediment source site to qualify for reuse

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Introduction: The Interreg FWVL VALSE project aims to promote sustainable dredged sediment reuse [1]. Reuse options and supporting research were investigated during an earlier project [2]. In order to provide waterways operators and related industries, with case studies, full scale pilot tests are planned at Belgian and French sites.

A former sediment disposal site of the French Waterways (VNF) at Saint Omer, Northern France, is considered as a potential source of mature sediment (14 to 40 years old) for reuse applications (landscaping, cycle paths, dikes). Sediments are now comparable to soil in terms of water content and mechanical behaviour. Sediment environmental characteristics are assessed with laboratory methods, and its variability with on-site methods [3].

Methods: The site survey was completed using a portable XRF (pXRF) to test the presence potential inorganic contaminants in stored sediments and their spatial variability. A new field colorimetric method was used for Acid Volatile Sulfides. Existing boreholes allowed a shallow groundwater survey for inorganic contaminants (water sampling, field electrochemical techniques). This survey is aimed at testing field measurements for effective site monitoring.

Sediments were analysed similarly to raw soil with Olympus Delta Premium and Niton XL3t980 pXRFs at < 15 m intervals. No dehydration by filter press was needed to reach standard water contents (25-35%). In this range, measurements carried out on wet pressed pellets correlate well with laboratory analyses [3].

Results: The resulting map (Fig.1) suggests that sediments are generally homogeneous for inorganic contaminants, with Pb-Zn-Cr levels similar to target site soils. One exception is the northwesternmost storage cell, with moderately higher values.

In the sediments, the S-AVS contents measured in the field are quite low, even under the limit of detection (< 50 ppm) in most cases. Electrochemical measurements (EM) were able to detect Zn after a short acid attack in the field. Samples were analysed in the laboratory with further optimisation of EM, Cu and Pb were detected as well.

In porewater, EM on solid electrodes indicate the presence of metals at low concentrations, most of them under the detection limit (< 0.5 ppb). Further optimisation is required due to the complex matrix.

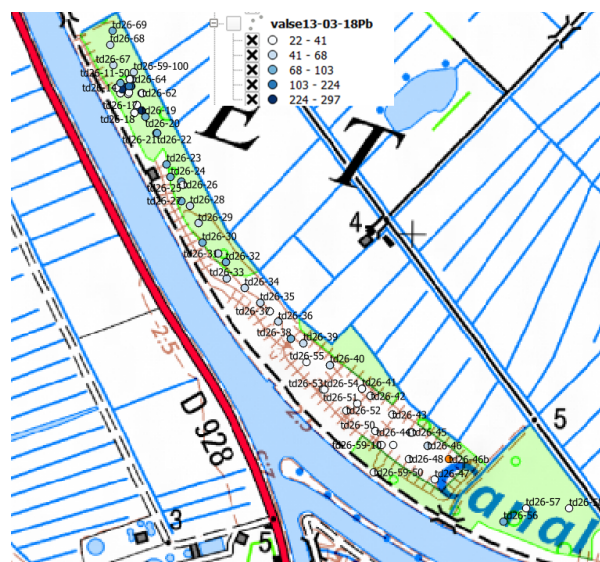


Fig. 1: Map of Pb measurements by pXRF (mg/kg).

Discussion: Site-specific threshold values for pXRF measurements can be derived from regulatory limits or risk-based targets after calibration. Measurements will be used during works to identify potentially off-specification sediments in quasi real time. pXRF measurements will be used at each reuse application site, prior to and after works, in order to monitor application impacts. The low AVS contents indicate that the sediment has been re-oxygenized, and would promote a progressive change in metal speciation with time.

On-site electrochemical analyses for contaminants in groundwater offer flexibility and rapidity when monitoring works impact, and provide an improved response for public awareness.

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References: [1] Alary, C. et al., (2017) *SedNet conference*; [2] Alary, C. et al., (2015) *SedNet conference*; [3] Lemièr, B. et al., (2014) *GEEA* 22:222-233.