SUSTAINABLE REUSE SOULTIONS FOR DREDGED SEDIMENTS

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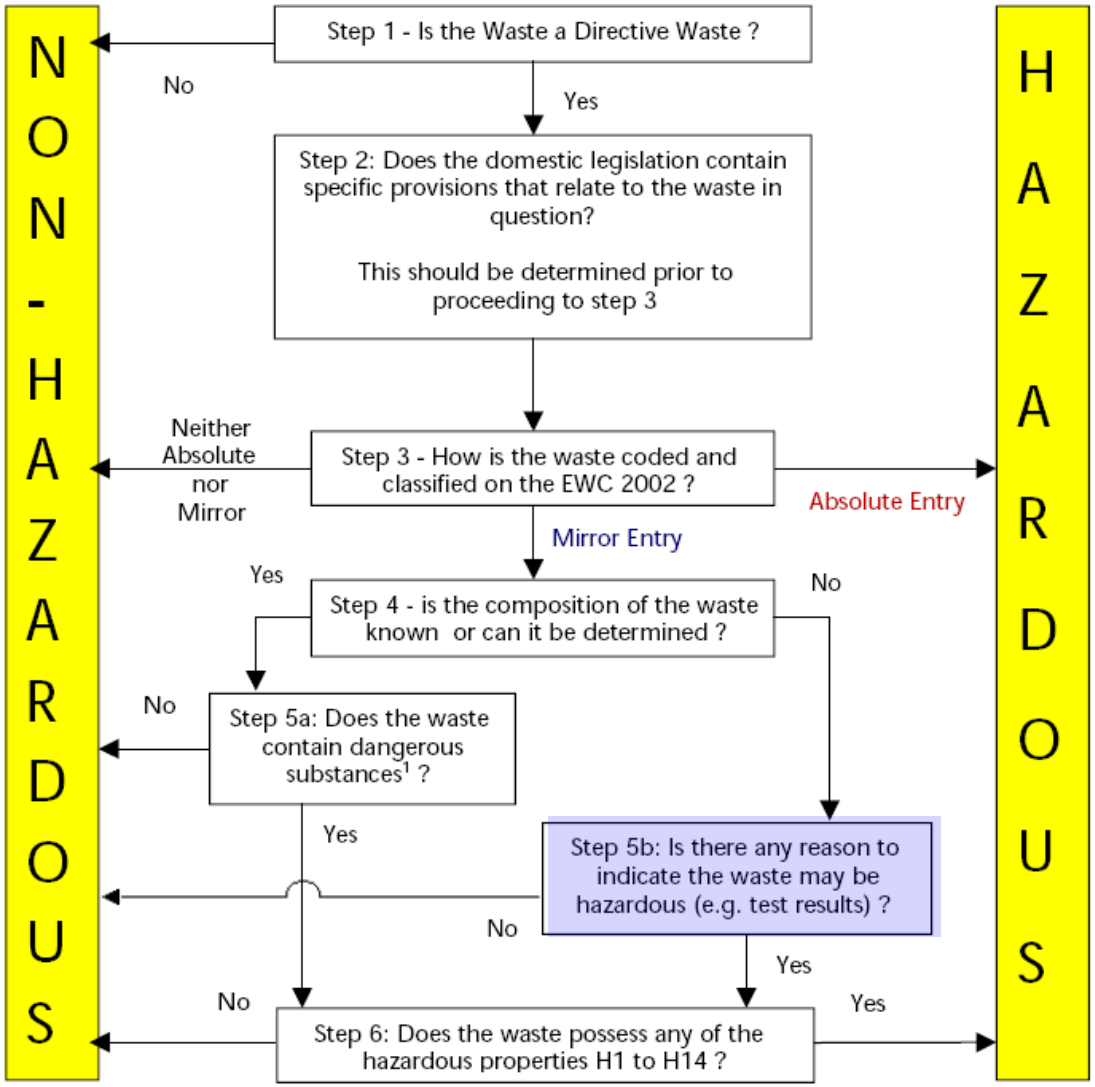
BRITISH WATERWAYS 1992 NATIONAL SEDIMENT SURVEY

Survey based on sampling canal network at 2 km intervals (2,200km)

Only two lengths of canal were identified as having contamination loadings signifying them as “special waste”

1. mercury contaminated sediments in Scotland (associated with a former explosives factory)
2. a short length of a canal in the North West England (associated with a discharge from chemical factory)

Figure 3.1 | Hazardous Waste Assessment Methodology



Note:
[1] Infectious substances should be considered at this stage of the Hazardous Waste Assessment Methodology

CHALLENGE OF USING GUIDANCE DOCUMENT (WM2)

Sediments suddenly classified as hazardous due to the heavy metal and hydrocarbon content

Guidance assumes worst case compound form if the holder of the waste can not identify species likely to be present…but….

"the worse-case chemical form must be able to exist in the environment that the waste being sampled was taken from"

- Many were ignoring the latter point and interpreting all results using worst case speciation - regardless of likelihood of whether chemical compound could exist where found

- Challenge for the waste producer/holder to develop a greater understanding of their waste and present arguments for the characterisation and classification applied to the waste

ASSESSMENT

On behalf of British Waterways Ramboll undertook ‘a study of characterisation of sediments with regard to new waste classification guidance’

The report output included:

- the likely anion-cation relationships present in dredged material for the commonly determined contaminants in BW sediments (carried out by literature search and basic chemistry)

- specialist testing to prove/substantiate conclusion of non–hazardous nature – i.e. SEM/XRF, SedNorm, Siroquant, ecotox…
- a recommended testing specification for sediments to ensure data provision for categorisation of dredged materials as either non-hazardous or hazardous materials

HEAVY METALS
- Arsenic, cadmium, chromium, lead, mercury

"If the holder cannot decide which substances might be present, they should assume the *worst-case* scenario for each component and assess the waste accordingly."

chromium trioxide (CrO_3)

- H2 (combustible material)
- H7 (Cat 1 / 2 carcinogen)
- H8 (causes severe burns)
- H14 (very toxic to aquatic organisms)

di-chromium oxide (Cr_2O_3)

- H4 (irritant)
- H5 (harmful)

METAL SPECIATION

For metal species it is unlikely that they occur in levels that would classify the sediment as “hazardous”

Discounted “worst case” species that were highly soluble or highly reactive and known not to be unlikely to occur in natural environment

METAL SPECIATION

Element	Speciation proposed	Ramboll / BW basis of speciation
As	As_2O_3	Solubility, literature review, XRD / XRF
Ba	$BaSO_4$	Literature review, XRD / XRF
Cd	CdS	Solubility, literature review, XRD / XRF
Cr	Cr_2O_3	Solubility, literature review, XRD / XRF
Cu	CuS	Solubility, literature review, XRD / XRF
Hg	HgS	Solubility, literature review, XRD / XRF
Pb	$PbSO_4$	Solubility, literature review
Mo	MoO_3	Solubility, literature review, XRD / XRF
Ni	NiS	Literature review, XRD / XRF
Se	Se	Solubility, literature review, XRD / XRF
Zn	ZnS	Solubility, literature review, XRD / XRF

HYDROCARBONS – OILY WASTE

Characterise hazardous status of oily sediments based on analysis of:

- Petrol Range Organics (C_6-C_{10})
  – 1,000mg/kg - category 1 & 2 carcinogens
- Diesel Range Organics (C_{10}-C_{25})
  – 10,000mg/kg - category 3 carcinogens
- Lubricating Oils (C_{25}-C_{44})
  – 1,000mg/kg - category 1, 2 & 3 carcinogens

- no exceedence of PRO or DRO;

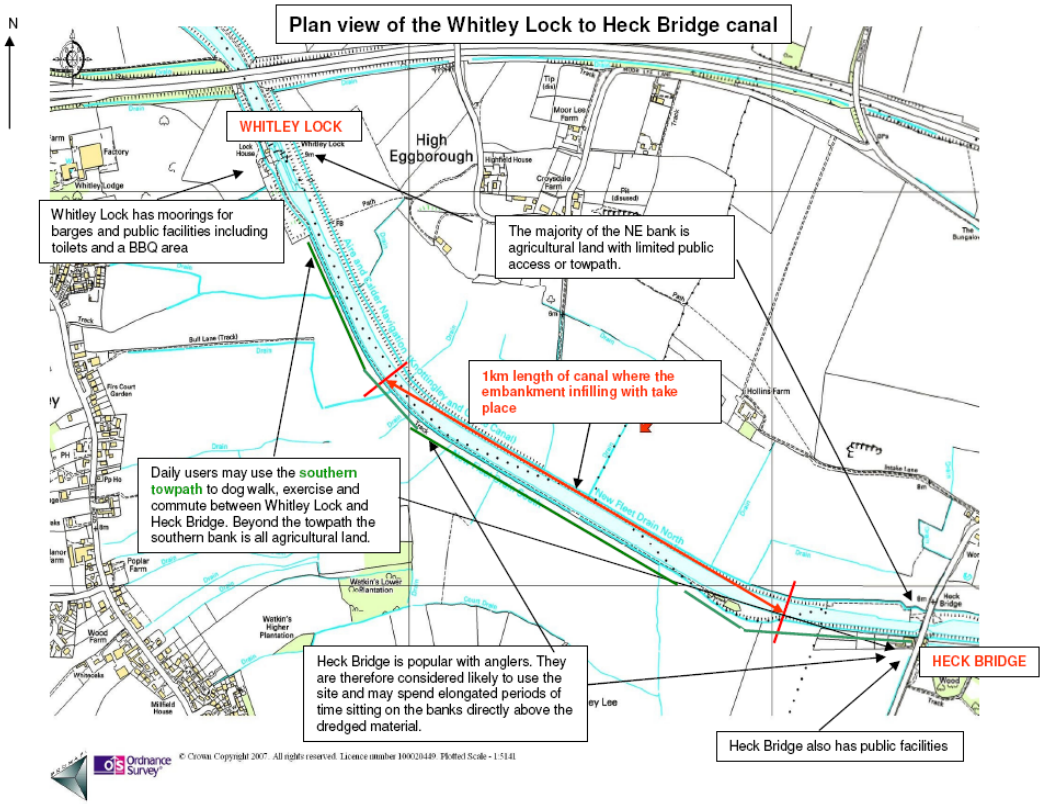
  but lubricating oil > 1,000mg/kg

- PAH (BaP) marker test ? validity
- Potential issues with PEEM testing methodology between laboratories

CASE STUDY - INTRODUCTION

- 100,000m^3 of sediment dredged stored in 6No. lagoons at site in north England
- Propose to use the material as infill in the canal bank stabilisation works under a Paragraph 19 WML Exemption
- Waste classification of the material to prove non-hazardous
- Risk assessment -
  - Human Health to show suitable for use
  - Controlled waters
- Key issues – metals & hydrocarbons

SITE LOCATION



ASSESSMENT AND SAMPLING STRATEGY

- Screening analysis
- Contaminant distribution
- Statistical analysis
- Additional sampling & analysis

- Used previous protocol to demonstrate non-hazardous

CONCEPTUAL SITE MODEL

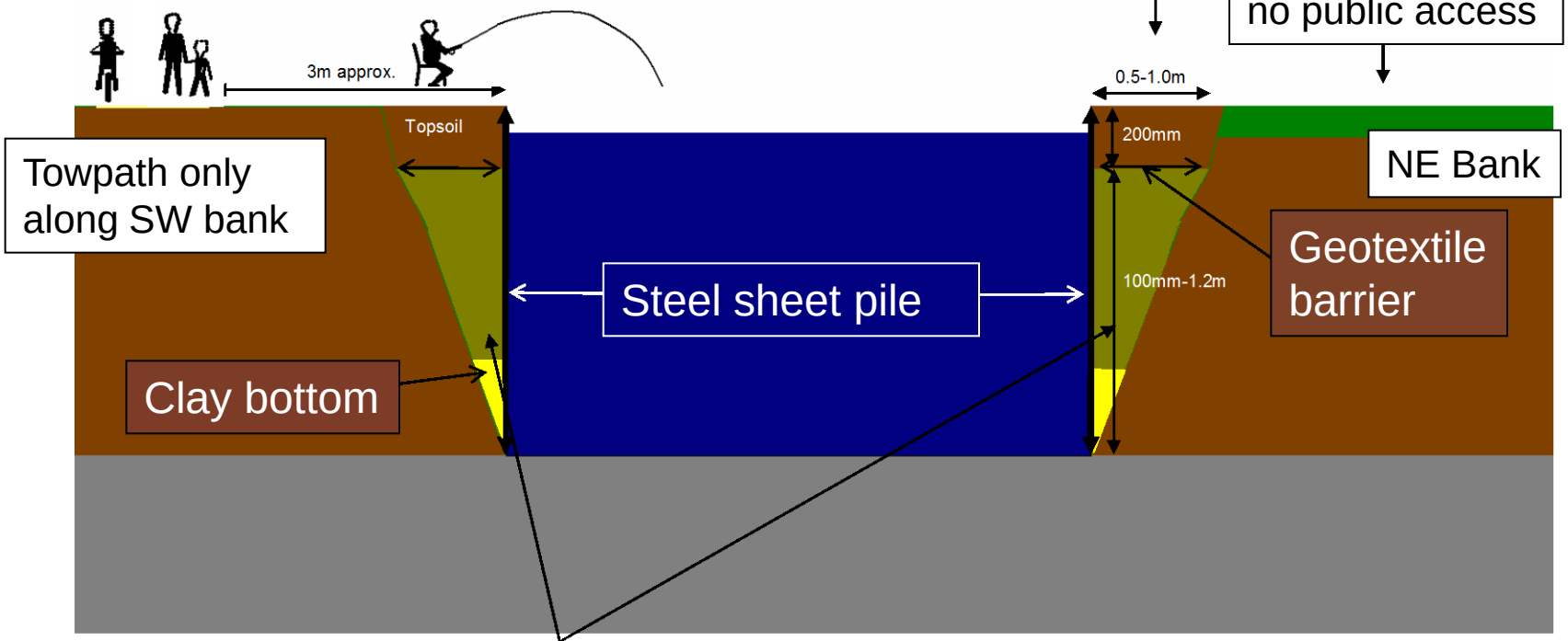
Cross section of canal with contamination pathways

Receptors
- Cyclists
- Walkers / families with young children
- Anglers

Pathways
- Dust inhalation (cyclist & walkers)
- Direct contact (anglers)

No towpath along NE bank with restricted access for public use

Agricultural land no public access



Cross-sectional model

Sediment proposed for embankment infill

COSTS SAVINGS

- Cost saving by avoiding disposal to hazardous landfill £1,000,000.
- Valuable space in a hazardous landfill saved
- Transport the dredgings using the waterway network - saving 10,000 vehicle movements on a 24 mile journey on largely congested roads.
- Using the material from Long Sandall avoided requirement for virgin materials saving £500,000

CONCLUSIONS

- Extending effort into characterisation, it is possible to demonstrate that material potentially classified as hazardous, is in fact non-hazardous
- This effort saves money and gives wider environmental benefits - space in a hazardous landfill saved, transport impacts of moving material unnecessarily to hazardous landfill
- Mindset that sediments are a resource
- Project won Ground Engineering Sustainability Award 2009

Thank you

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