Scottish Canals

Case Study – Union Canal In-house Spot Dredging January 2015

1.0 Summary

1.1 Location: St Michael's Hospital, Linlithgow

1.2 Reason for Dredging: High points of sediment identified by operational team and boaters at a number of sites through Linlithgow

1.3 Solution: Spreading on SC-owned land at the Falkirk Wheel; mixing with green waste compost; producing concrete public art/ street furniture

2.0 Background

During 2014, a number of boaters had pointed out to SC operational staff that there were high spots of sediment in the Union Canal that their boats were scraping into, making navigation difficult. These complaints were combined with data from a dipping survey in the Union Canal completed by volunteers, which supported these complaints. The survey highlighted the same areas as not meeting the advertised MOC for the Union Canal (1.07m). No entirely failing lengths were identified on the Union Canal, so line dredging was not required. As the sediment is concentrated in high spots, spot dredging was determined to be most suitable. Although high spots were recorded along long stretches of the Union Canal, there were a dense concentration of high spots through Linlithgow, so this stretch was prioritised to be the focus of operations.

As a dredging need had been identified, a budget was made available for winter dredging works, scheduled for January 2015. These works were to be completed by Scottish Canals staff themselves, as part of the SC upskilling programme, bringing small-scale dredging works in-house. Suitable staff were identified from Lowlands operational teams, and received training on how to operate the machinery during August/ September 2014. This dredging team had the opportunity to trial operating dredging works during small-scale dredging works on the Forth & Clyde Canal at Twechar in October/ November 2014. SC staff performed the dredging works, with supervision from a Land and Water site supervisor (Avi Verber).

The operations at Linlithgow lasted for 2 weeks, between 20th January – 3rd February 2015. Photographs of the operations can be seen in Figures 1-3.

3.0 Sampling

Sediment samples were taken by SC staff in September 2014. Samples were taken in-situ every 500 metres for a 5km stretch through Linlithgow (see Figure 4) – this was to gain a representative sample of the sediment to be dredged. 3 samples were taken at each site, with 2 samples sent to Land and Water for analysis of contamination and particle size distribution, and 1 sample retained by SC for reference.

4.0 Land Spreading

Once all sediment analyses were available, a number of disposal options were considered for the resulting sediment. Although slightly elevated levels of a number of contaminants were detected,

especially selenium and zinc, none of the samples were heavily contaminated. SC's Environmental Scientist Julia Johnstone determined the sediment was suitable for bankside disposal along the canal under a Paragraph 25 exemption (The deposit of dredging wastes) from Waste Management Licensing (Scotland) Regulations 2011. This reuse option doesn't require haulage, as material is disposed of on-site, and therefore saves Scottish Canals disposal costs. Bankside disposal is also the simplest disposal option.

An early stage of the KTP project examined SC's land bank, and identified a large area of SC-owned land at Locks 1 and 2 at the Falkirk Wheel which was suitable for land spreading. This area was used as a receptor site for material dredged at Linlithgow – dredged sediment was transported there by road in sealed tippers from Linlithgow. An access track from the B816 to the site was upgraded to allow the tippers to access and turn at the site. Fencing was erected around the site for health and safety reasons, to ensure the general public on the nearby public right of way were protected from falling into wet dredged sediment. This material will take approx. 6 months to dewater, and will self-seed with grass.

Photographs of the spreading site can be seen in Figures 5 and 6.

Approximately 477 tonnes of dredged sediment from Linlithgow was spread at this location.

5.0 Recycle Trial – Soil

The KTP is examining the possibility of producing a soil product from dredged sediment. As dredged sediment can have a high silt content, combining it with compost is thought to bulk the material up, ready to be used as a soil improver. To examine the logistics of this, 40 tonnes of dredged sediment were delivered to Levenseat Ltd, near West Calder, on 22nd January 2015. This material was to be used to examine how workable the material was wet, and the logistics of mixing their green waste compost with wet dredgings. Results, and associated guidance, from this trial will be available in the near future.

Photographs of the initial stages of the Soil Recycle Trial can be seen in Figures 7 and 8.

6.0 Edinburgh College of Art

The KTP has also been examining the use of dredged sediment as a recycled aggregate in concrete. Initial trials completed at the University of Strathclyde in 2013 demonstrated that sediment could be dried, sieved, and used as a replacement for sand in a basic lean concrete mix.

One strand of this Recycle Trial is examining the possibility of using a dredging concrete mix to produce pieces of concrete public art or street furniture, for use along the canals. This Trial is running with the MSc Material Practice class at Edinburgh College of Art.

The course organiser, Remo Pedreschi, and the Material Practice class visited the operations on 28th January to observe the works in action, and gain an understanding of the issues involved in reuse/ recycle options. Approximately 1 tonne was delivered to the ECA workshops for the students to work with on 3rd February.

Photographs of their visit, and of their resulting works of concrete art can be seen in Figures 9 – 12.

7.0 Lessons

These dredging operations on the Union Canal definitively demonstrate that Scottish Canals in-house staff can perform spot dredging works safely and successfully. This means SC have the capability to expand on these works, by building their own in-house dredging team, reducing the reliance on external contractors. An in-house dredging team would provide Scottish Canals the flexibility to react quickly and in a cost-effective manner to sediment build-up spots. Larger-scale line dredging operations would still need to be completed by the framework contractor (Land and Water) due to the complexity of these works, and time constraints.

This case study also highlights the importance of analysing the particle size distribution of sediment prior to operations. This information (sand/ silt/ clay content) was vital to plan the most suitable site to use for the Soil Recycle Trial (low silt content), and Concrete Recycle Trial. External partners ask for this information to plan their works, so this has been a gap in our knowledge until now.

These operations also demonstrated the opportunities available when working with external partners. Working with Levenseat and ECA alongside these works, made reuse/ recycle options available to Scottish Canals that would not have been a possibility to complete in-house. Similar partnerships need to continue to be followed up in the future, with a range of commercial partners.

Lastly, the works at Linlithgow were a prime example of how active dredging operations can be used as an educational tool. The visit by the class from ECA was very successful, and the students were able to learn about the history of the canals, the operational considerations of dredging works, and the issues associated with sediment reuse/ recycle options. In the future, dredging operations could be used for visiting school and university groups, to learn about engineering, heritage and the environment.

Figure 1: spot dredging site west of St Michael's Hospital, Linlithgow

Figure 2: SC in-house dredging staff

Figure 3: offloading point at St Michael's Hospital, Linlithgow

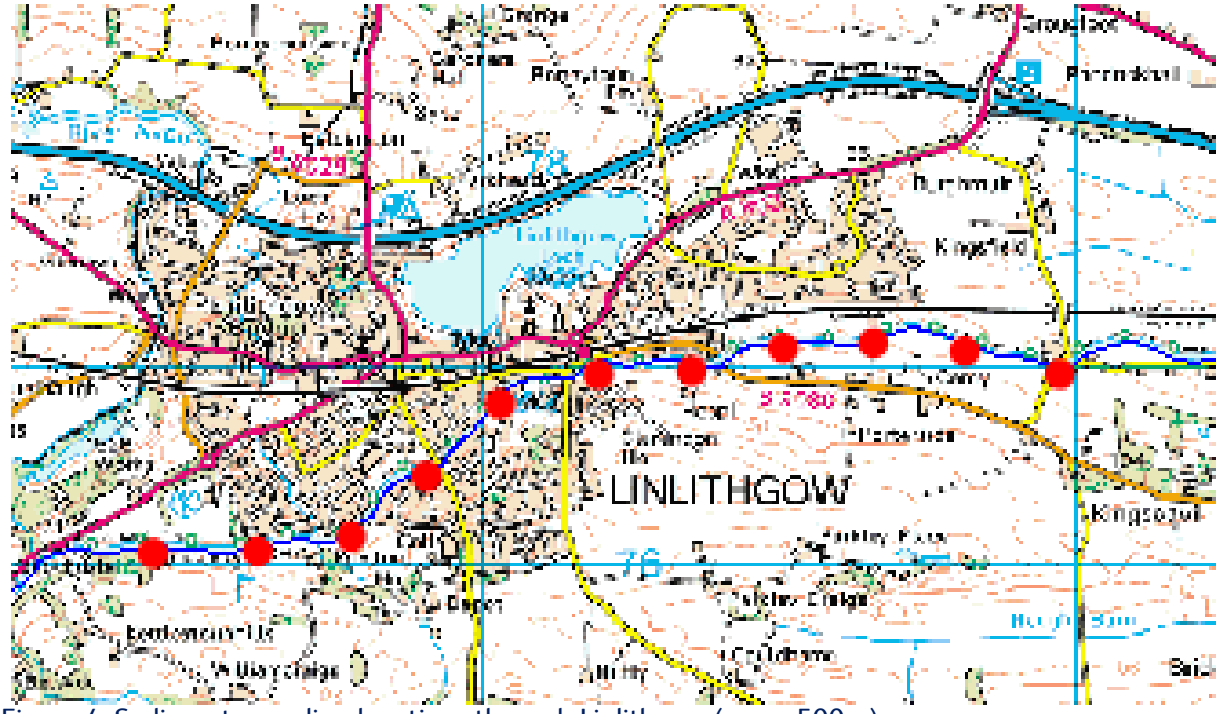

Figure 4: Sediment sampling locations through Linlithgow (every 500m)

Figure 5: Spreading site at the Falkirk Wheel

Figure 6: Wet dredged sediment spread at the Falkirk Wheel

Figure 7: Dredged sediment/ green waste compost mix at Levenseat Ltd

Figure 8: Dredged sediment/ green waste compost mix at Levenseat Ltd

Figure 9: ECA student visit to Linlithgow dredging operations

Figure 10: ECA student project output - tiles

Figure 11: ECA student project output - bricks

Figure 12: ECA student project output – textured concrete panel