Document Ref:

Agricultural benefit statement for the sediment from the proposed dredging of Monmouth and Brecon Canal

Field: Field 1

1.1 Person with appropriate technical expertise and permit details

- Phil Metcalfe, ADAS Agricultural Engineer
- BSc (Hons) Mechanical Engineering, MSc Agricultural Engineering, HND Supplement Aeronautical Engineering, FACTS qualified, Member Institute of Agricultural Engineers, Chartered Engineer Chartered Environmentalist, Registered Professional Energy Consultant.
- Has started his 40th year of experience working for ADAS as an Agricultural Engineer providing machinery, cultivation, crop nutrition, fertiliser and waste management (farm and non-farm) advice and consultancy. Experience includes numerous waste to land applications, nutrient, manure and soil management plans and advice for compliance with Nitrate Vulnerable Zone rules. He has research and development experience with Mechanisation, fertilisers and waste processes.
- FACTS Registration No. R/FE/3731
- **Signed by:** **Date: 07th April 2016**

J. P. Metcalfe

Field: Field 1

1.2 Where the waste is to be spread

Farm address:
4 Lake View Close, Llangorse, Brecon LD3 7US
field at Coed –Yr –Ynyis Road, Llangynidir
Spreading area grid reference:
Field 1. Easting 314948 Northing 220083
Area of the receiving land:
Field 1: Field area 1.91ha Available spreading area 1.52 ha
Quantity to be stored at any one time:
1930 tonnes.

Total quantity to be spread: estimate 1430m^3 (1930 tonnes assuming a dredgings density of 1.35t/m^3)

Location maps showing the field receiving sites and spreading control measures :

- Receiving Sites Location Map -
- Receiving Site Map –

Field: Field 1

1.3 What is the waste to be spread

Waste producer: Land and Water Services

EWC code: 17 05 06 dredging's spoil

Waste description: Sediment dredged from a length of the Monmouth and Brecon Canal with a dry solids content of 62%.

Field: Field 1

1.4 Operational details

Cropping details:

- The field is currently permanent pasture.
- The field will be reseeded to grass following dredged sediment application.
- The dredged sediment will be applied on the current grass sward.
- Directly after dredging the sediment will be spread with a low ground pressure bulldozer to a depth of about 13cm.
- After the dredged sediments are spread they are allowed to dry out before being thoroughly worked into the existing site topsoil to a depth of 15cm.
- No land drains were noted in the field survey.

Field: Field 1

1.5 Compliance with Good Agricultural Practice

Recycling of dredged sediments from inland waterways to agricultural land, can provide a number of agricultural benefits including their contribution of available nitrogen needs to be taken into account in fertiliser planning.

The rate of dredged sediment applied will not supply more available nitrogen than crop nitrogen requirement. The farmer cropping the receiving field will be informed of the amount of available nitrogen applied by the dredged sediment, so that this can be considered in his nitrogen planning for the fields.

Field: Field 1

1.6 Benefits and nutrients supplied to the soil or crop from this application

Table 1

Sediment Analysis Summary for Field 1– sediment to be applied to field

General properties & plant nutrients	Units	Average Result	Comment
pH	-	7.5	The pH is satisfactory for recycling to agricultural land.
Moisture Content (30°C)	%	38	
Dry solids (100 – Moisture Content 30°C)	%	62	The dry solids content of this sample is just above below the typical range of 30-50% for dredged sediment.
Total Nitrogen	%	0.22	See Table 5 for information on available nitrogen supplied by the dredgings.
Ammonium-Nitrogen	mg/kg	44	Only a small proportion (about 2%) of the total N is present as readily available N.
Nitrate-Nitrogen	mg/kg	1	
Available Phosphorus	mg/l	15.1	The sediment contains a higher level of available phosphorus than the receiving field soil (see Table 2).
Available Potassium	mg/l	34.8	The sediment has a lower level of available potassium than in the receiving field soil (see Table 2).
Available Magnesium	mg/l	63.8	The sediment contains a lower level of available magnesium as the receiving field soil (see Table 2).
Organic matter	%	7.4	The organic matter content of the sediment is close to the organic matter content of the receiving field soil (see Table 2).

Field: Field 1

1.6 Benefits and nutrients supplied to the soil or crop from this application

Proposed receiving field

Table 2 pH, major plant nutrients and organic matter analysis results

Field	pH	Lime t/ha Grass Arable	Phosphorus mg/l (Index)	Potassium mg/l (Index)	Magnesium mg/l (Index)	Organic Matter[1] %
	5.5	4 10	11.4 (1)	134 (2-)	90 (2)	7.4
	5.3	5 11	11.8 (1)	91 (1)	74 (2)	8.3
Field 1 Average	5.4	5 10	11.6 (1)	113 (1)	82 (2)	7.9

[1] As determined by Modified Walkey Black Method

Table 3 Estimated crop nutrient requirement as fertiliser [from Defra's RB209 publications 8th edition (and 7th edition for nitrogen)] without dredged sediment application

Field	2015 crop	Crop to be established after sediment application.	Nitrogen[1] kg/ha	Phosphate kg/ha P_2O_5	Potash kg/ha K_2O	Magnesium kg/ha MgO
Field 1	Permanent pasture	Grass (cut once for silage)	120	70	170[2]	Nil

[1] Soil Nitrogen Supply (SNS) Moderate. The soil texture is silty clay loam topsoil over silty clay subsoil (RB209 deep clayey soil).
[2] No more than 80 kg/ha to be applied in the spring. The remainder to be applied after cutting or in the autumn.

Table 4 Proposed Sediment application rates

Field	Total weight of fresh sediment[1] (t)	Dry solids content of sediment (%)	Area to be used for spreading (ha)	Dry solids loading (t/ha)
Field 1	1930	62	1.52	787
				(1261 tonne /ha wet dredged material

[1] From 1430 m^3 of fresh sediment assuming a density of 1.35 t/m^3.

Nitrogen provided by sediment application

The Defra Guidance document "NVZ action Programme and Application of Dredgings to Agricultural Land" provides an indication of the amount of nitrogen that will be available from dredgings for the following crop. The calculation assumes that 3% of the organic nitrogen and all of the ammonium and nitrate nitrogen will be available to the crop. Using these criteria, an application of 787 t/ha of sediment dry solids from the Monmouth and Brecon Canal will supply approximately 86 kg/ha of available nitrogen for the following crop.

Table 5 Available nitrogen provided by sediment application

Field	Sediment dry solids application rate	Available nitrogen from sediment application	
	t/ha	kg/t	kg/ha
Field 1	787	0.11	~86

Field: Field 1

1.6 Benefits and nutrients supplied to the soil or crop from this application

Although at face value using the average available phosphorus (15.1mg/l), potassium (35mg/l) and magnesium (64mg/l) levels for sediment dredged from the Monmouth and Brecon Canal 787 t/ha sediment dry solids would apply about 27 kg available P_2O_5/ha, 33kg available K_2O/ha & 84kg available MgO/ha applying sediment to a field is more akin to applying 'soil' than an 'organic manure', for example, so crop requirement for phosphate, potash and magnesium fertiliser following application should be based on the estimated soil phosphorus, potassium and magnesium indices following incorporation of the sediment (or better a soil analysis of the field following incorporation). Table 6 shows the estimated phosphorus, potassium and magnesium indices and Table 7 the requirement for nitrogen, phosphate and potash fertiliser after sediment application.

Table 6 **Estimated available phosphorus, potassium and magnesium levels after sediment application and incorporation**

Field	Phosphorus mg/l (index)	Potassium mg/l (index)	Magnesium mg/l (index)
Field 1	12.9 (1)	82 (1)	74 (2)

Table 7 **Estimated crop nutrient requirement as fertiliser based on estimated indices after sediment application and incorporation (Table 6)**

Field	2015 crop	Crop to be established after sediment application.	Nitrogen kg/ha	Phosphate kg/ha P_2O_5	Potash kg/ha K_2O	Magnesium kg/ha MgO
Field 1	Permanent pasture	Grass (cut once for silage)	34	70	170[1]	Nil

[1] No more than 80 kg/ha to be applied in the spring. The remainder to be applied after cutting or in the autumn.

In summary application of the dredged canal sediment will confer agricultural benefit by reducing manufactured nitrogen fertiliser requirement for grass following application. The dredged sediment application would be predicted to slightly alter the soil available phosphorus (P), potassium (K) and magnesium (Mg) levels but not sufficiently to increase the soil Index for any of the nutrients so the recommendations remain the same with and without sediment application. The soil has a pH (5.3-5.5) at which there is a lime requirement. The sediment has a higher pH (7.5). Incorporating the sediment into the soil is likely to increase the pH of the soil to a level at which there is no lime requirement for grass. The reduction in lime requirement is a further benefit from sediment application. The dredged sediment application would also increase available water capacity by increasing the depth of topsoil.

Fields: Field 1

1.7 Potential negative impacts to the soil or crop from this application

Table 8 **Potentially Toxic Element (PTE) and Organic Substance Analysis Summary for Monmouth and Brecon Canal sediment**

Potentially Toxic Elements (PTEs) & Organic Substances								
PTE	**Copper**	**Nickel**	**Zinc**	**Cadmium**	**Chromium**	**Lead**	**Mercury**	**Arsenic**
mg/kg	13	15	70	0.4	29	38	0.11	17
PTE		**Selenium**	Boron – water soluble	**Chromium (hexavalent)**	**Fluoride**	Barium	**Sulphide**	
mg/kg		0.5	0.7	<1.0	0.93	106	32	
PTE	**Sulphur as S**	**Sulphate as SO_4**	**Conductivity**					
% (µS/cm for conductivity	0.3	0.08	2015					
Organic substances	**Cyanide total**		**PAH (total 16EPA)**	**EPH (C5-C10)**	**EPH (C10-C25)**	**EPH (C25-C40)**	EPH (C10-C40)	**Phenol-monohydric**
mg/kg	>0.5		<2.48	<0.1	<13	<10	<17.5	<0.5
Comments	The PTE and organic substance levels do not pose any concern for application to agricultural land.							

Table 9 **Field Potentially Toxic Elements levels**

Field		Total Cu mg/kg	Total Ni mg/kg	Total Zn mg/kg	Total Cd mg/kg	Total Pb mg/kg	Total Hg mg/kg	Total As mg/kg	Total Cr mg/kg
Field 1		13	16	70	0.4	37	0.1	16	29
Estimated levels following dredged sediment application									
Field 1		13	16	74	0.7	39	0.1	11	25
Maximum permissible level following sewage sludge application soil pH 5.0-5.4 pH 5.5-5.9 pH 6.0 and over		 80 100 135	 50 60 75	 200 200 200	 3 3 3	 300 300 300	 1 1 1	 50 50 50	 400 400 400

- As the sediment contains similar low PTE levels, to the receiving field soil Zinc copper, nickel, cadmium, lead, mercury, and decrease slightly and arsenic and chromium levels would be expected to increase slightly, the levels remain well below the maximum permissible levels following sewage sludge application.

Site topography

- Field 1 consists of three small areas that were formerly divided by hedges which have now overgrown with many mature trees on top of the hedge bank. These are no longer stock proof. The area is managed as a single field. It is a predominantly flat permanent pasture field situated to the north of the canal. The southern boundary to the field is a raised bank to the canal providing habitat for reptiles and other rare species. The field slopes gently away from the canal. The north boundary is a hedge with public road track forming. The east boundary is a stock proof hedge.
- Although the Field 1 slopes away from the canal, it is not severe and run-off of silt from the land should not be an issue.
- The fields show a high clay content, see photos below.
- The fields are currently affected by leakage of water from the canal that will be remediated within the engineering activities on the canal for which this land spreading operation for the recycling of resultant silt is required. A wet are extends from the canal embankment along the line of tree between area B and C (see images below)

Field 1 Canal Embankment area B

Field 1 Soil area B

Field 1 Looking away from the Canal C

Field 1 Soil area C

Field 1 and Canal Sampling Plan (the field shown as area A is not included in this statement).

- The canal dredgings will be stored at the site.
- With regard to impact of the operations on the receiving soil, for example wheel ruts, compaction, structural damage, soil erosion and run-off, impacts on the soil will be minimized by carrying out the spreading with a low ground pressure bulldozer
- Other potential negative impacts from the operation, for example: traffic management, anti-vandalism measures Land and Water Services will manage the traffic when plant/machinery is delivered to site. No vandalism is expected.

Field: Field 1

1.8 Sensitive human and environmental receptors

Sensitive human receptors

- Residential housing on Orchard Lane is directly to the north east of the field, Grove Cottage is adjacent to the western boundary and The Haven lies to the north of the field and Coed –Yr –Ynyis Road
- Llangynidir township is 700m to the east
- Odour control - Low odour potential from dredged materials.
- Noise control - Equipment is similar to normal agricultural machinery. The fields are within an agricultural environment. Sensitive spreading periods will be avoided e.g. bank holidays and weekends. Deliveries will be during daylight hours.
- Land and Water Services will ensure that there are buffer areas in place when spreading near the footpaths and water courses.
- There are no known amenity areas within in the fields. There is a public highway along the north t boundary of Field 1.
- There are no known boreholes or springs in these fields.
- Land and Water Services will check the location of any water main services in the vicinity of the works before commencement.

Field: Field 1

1.8 Sensitive human and environmental receptors

Sensitive environmental receptors

- Flooding. From the Environment Agency website, the following risks have been considered:

  Flooding from surface waters – Very Low risk.

  Flooding from rivers and sea – none.

  Flooding from reservoirs – none.

  Flood warning areas – none.

- It is not intended to spread near the boundary hedges. A 2.0m, minimum buffer zone will be left free from dredging's adjacent to bushes and hedgerows. No dredgings will be spread beneath tree canopies.
- The contractor proposes to leave buffer strips (10m minimum) free from dredging's adjacent to any watercourses, in this instance the canal and stream in Field 1.

A search on MAGIC Map - http://www.magic.gov.uk/MagicMap.aspx - found the following statutory and non-statutory designations to be nearby but **unaffected:**

- River Usk Site of Scientific Interest and Special Area of Conservation 200m away.

A search on MAGIC Map - http://www.magic.gov.uk/MagicMap.aspx - found the following statutory and non-statutory designations to be **unaffected:**

Statutory designations:

- Area of Outstanding Natural Beauty (AONB)
- Environmentally Sensitive Area
- Local Nature Reserve
- National Nature Reserve
- National Park
- Ramsar Site
- Special Protection Areas
- Biosphere Reserves
- Less Favoured Areas

Non statutory:

- Green belt
- Heritage Coasts
- RSPB Reserves

Field: Field 1

1.9 Practices to reduce the impacts of the operation on identified sensitive receptors

In this section you should set out the measures to be taken to reduce the impact of the operation on the receptors identified for example:

- There is a low odour potential from dredged materials. Sensitive spreading periods e.g. bank holidays and weekends will be avoided.
- Spreading will only be undertaken when weather conditions are suitable.
- There is a low odour potential from dredged materials and therefore odour should not be an issue.
- Buffer strips keeping any operations more than 10 metres from receptors will be put in place
- machinery operations will take account of soil conditions, slope etc
- machinery will be checked daily
- machinery turns will not be executed in the buffer strips
- Waste deliveries to fields will be supervised to minimize impacts
- Spreading restrictions within the 'Code of Good Agricultural Practice' will be adhered to.
- All machinery is regularly serviced and spreading equipment is calibrated.

Fields: Field 1

2.0 Contingency planning

Tell us about the measures you have in place in the event of

- Machinery breakdown; All Land and Water Services (LAWS) Excavators run on Bio Hydraulic Oil. A team of fitting staff are on standby if required.
- Staffing problems due to sickness, holidays etc.; LAWS Carry Sufficient Staff to cover eventualities.

Waste analysis

- Certificate Numbers

ESG – EFS/146423 (Ver. 1) (Sediment Analysis)
NRM-68402-15 (Sediment Analysis)
NRM-69238-15 (Sediment Analysis)

Soil analysis

- Certificate Number 68401-15 (Soil Sample Analysis).

Document: NRM 68401-15

Receiving Site Maps

- Receiving Sites Location Map
- Receiving Site Map