The Lower Tees and its Coast – The Risks that Industry, Dredging and Development Pose to Crabs and Seals

Dr Simon Gibbon

River Tees Chemical Coordinator, North East Marine Research Group

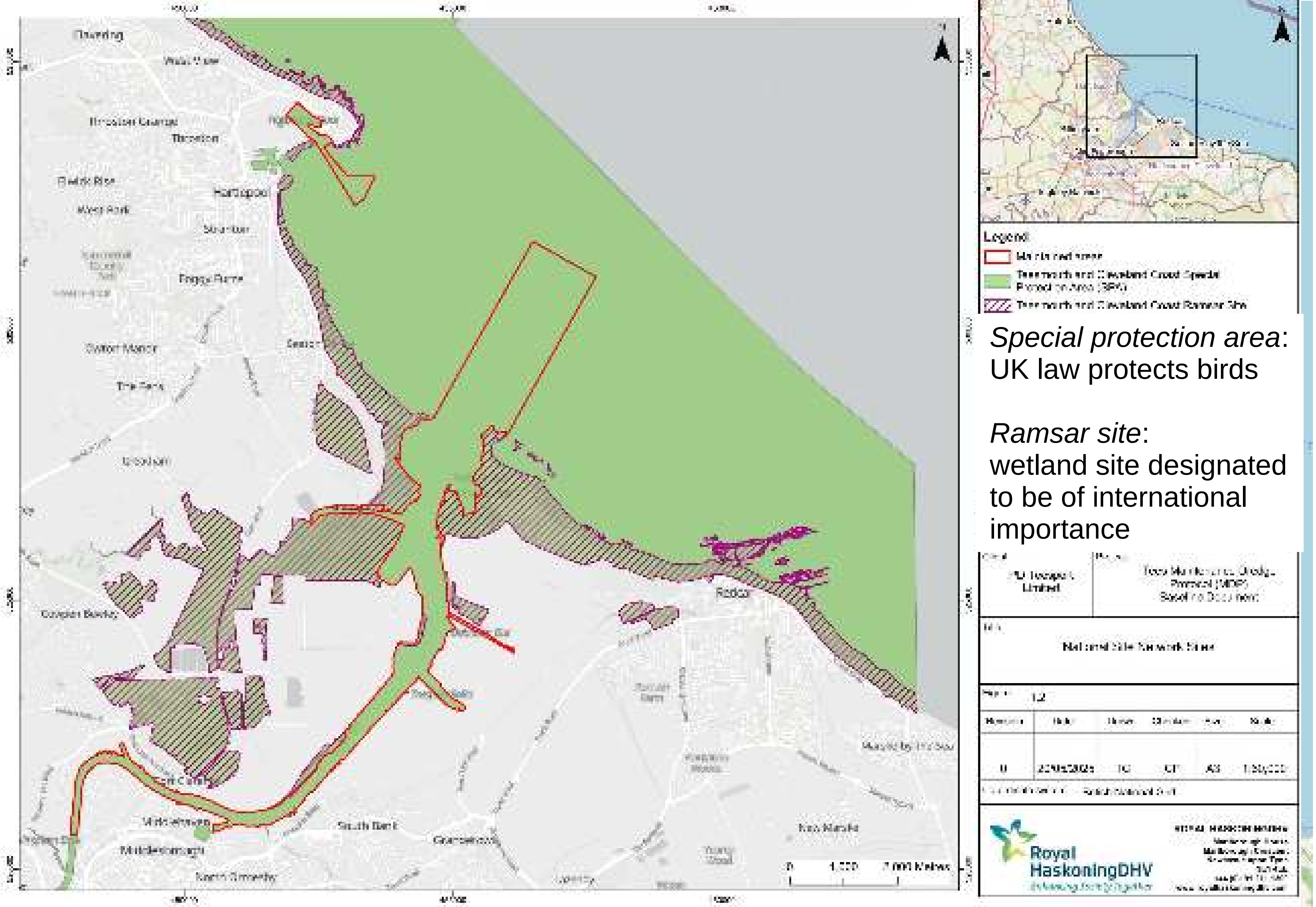
https://northeastfc.uk
simonrg@northeastfc.uk

Acknowledgements

- **North East Marine Research Group**
  - Universities of Durham, Hull, Newcastle, York
  - Fishmongers' Company
  - NEFCC
- **North East Fishing Collective**
  - Hartlepool
  - Redcar
  - Whitby
- **Tees Estuary Seal Study (TESS) / Tara Seal Research**
- **Multi-Council - Crustacean Deaths Collaborative Working Group**
  - Redcar & Cleveland, Middlesbrough, Stockton, Hartlepool, North Yorkshire
- **Reclaim Our Sea**
- **Tees Pollution Group 2021 -2023**
  - Sally Bunce / Dawn Love / Richard Randle / Robin Yardly / Simon Gibbon

Topics

- Crab die-off – September 2021 - …..
- Harbour seal pups - ?2021 - …..
- River Tees
- Contamination
- Dredging
- Conclusions



Special protection area:
UK law protects birds

Ramsar site:
wetland site designated to be of international importance


Licensed
Dredge Areas
Tees Bay A
Disposal site

Crab Die-off 2021

Crab Die-off – 2021

- 25/9 – 5/10 total crab die-off
- 4/11 – Hartlepool
- 2021 – present many reported die-offs
  - EA – natural
  - storm related
  - unbalanced ecosystem
- 2021 – 2024
  - Drastically decreased inshore catches – Harltepool to Whitby
- 2025
  - Some small crabs

Links / embedded videos
https://www.northeastfc.uk/doku.php?id=start
Channel 4 – What's killing marine life in North East England? 30th September 2022
https://youtu.be/HZdXyrTLjhk
Gary Caldwell – Mass Marine Die-off: Searching for Cause of These Events in Northeast England - 27th July 2023
https://youtu.be/9ZW6B9t-XPw
Chronology of Marine Die-offs
https://www.northeastfc.uk/doku.php?id=chronology_of_marine_die-offs

Fig 1: Location map for the coastline from which unusual crab wash ups were reported between October and November 2021, adapted from the Environment Agency's incident investigation summary. Locations with washups shown in Figures 2 to 5. Key industrial facilities considered as possible point source pollution are marked with black dots, and the extent of dredging in the Tees and dredging disposal site are outlined in black. (22_1BH_NEIFCA wash up incidents and logs record October 2021 to September 2022; 23_1BH_Wash Up Reports September to December 2022).

Map of 2021 Die-off

- Localised to inshore waters
- Not all species impacted
- Crabs are born on Lindisfarne
- No large crabs but few small crabs
- Migratory lobsters unafffected

Crab Die-off – Theories

- Algal Bloom - 2021
  simultaneous die-off / nutrient enrichment
  wrong time of year
- Pyridine – 2022
  detected in dead crabs
  volatile / would require large amount
  simultaneous die-off / detected at disposal site 1 year later
  2024 - new DEFRA test suggests no pyridine in crabs
- Novel pathogen - 2023
  ruled out by CEFAS in 2021
  wouldn’t expect simultaneous die-off c.f. bird flu / Covid etc.
- Multiple causes – 2025
  no die-off without anthropogenic causes

DEFRA - Joint agency investigation into Teesside and Yorkshire Coast Crab and Lobster mortalities
https://www.gov.uk/government/publications/joint-agency-investigation-into-teesside-and-yorkshire-coast-crab-and-lobster-mortalities
Determining the toxicity and potential for environmental transport of pyridine using the brown crab Cancer pagurus (L.) pre-print
http://dx.doi.org/10.1101/2022.11.17.516169
DEFRA Chief Scientist convened Independent Expert Assessment of Unusual Crustacean Mortality in the North-east of England in 2021 and 2022
https://www.gov.uk/government/publications/assessment-of-unusual-crustacean-mortality-in-the-north-east-of-england-in-2021-and-2022

Seals 2024/2025

Harbour Seal Colonies

- Tees isolated

Seals


1980s
By the 1960s seals were occasionally seen again and after more than half a century without seals the recolonisation gathered pace as the quality of the river improved.
By the late 1980s harbour seals began to breed here once again.
INCA
TATA STEEL


Today
The seals are thriving. Up to 80 harbour seals and 30 grey seals live around the Tees estuary, many of them remaining here all year round.
We have a healthy breeding population of harbour seal. It is the only colony in North West Europe where seals have reappeared after having been lost due to industrialisation.
INCA
TATA STEEL

Harbour Seals

- Tees colony pups are born late June to Early July
- 12 pups born live between 1989 and 1997, 7 stranded
- Then until 2021 all appeared ok?
- Since 2021 exceptional pup mortality observed
- Maximum pup count - 10th July 2024 – ~22 pups
- Next breeding colony over 100miles North or South
- August to October 2024 - 23 harbour seal pup strandings between Northumberland and North Yorkshire

2024: 23 Stranded Pups

- 16 had mouth rot
- All underweight many below birth weight
- Different bacteria not common source
- Mainly weaned / some unweaned
- All high PCB tissue levels
- Opportunistic bacteria

2024 TESS Conclusions

- Pups dying postweaning.
- Pups dying due to:
  - low body weight and physical weakness
  - mouth-rot bacterial infection
- Both of these principal factors caused by:
  - PCB contamination of their body tissues
  - Shown by blubber analyses for PCBs.
- PCBs are known to cause:
  - poor prenatal and postnatal growth
  - immunosuppression in harbour seals / other marine mammals.
- The PCB findings do not rule out contributions to this from other pollutants but may be enough on their own to account for the extraordinarily high Tees pup postweaning mortality of close to 100%.

2025 Births / Stranding Locations

- 2025: ~21 pups born

- 18 pups euthanised
- Seal pups from Tees

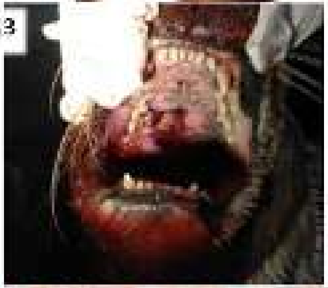
TESS stranded seal pup investigation 2025
https://www.sealresearch.org/research/tess-seal-pup-crowdfunding-project
MPs call for inquiry into seal deaths
https://www.bbc.co.uk/news/articles/c62qnqvj93go

Mouth Rot

- All pups underweight
- Failing to thrive
- Mouth rot unable to eat
- Most put to sleep at Vets

TS12

TS13



TS14

TS16

DEFRA: BDMLR / Teesside University

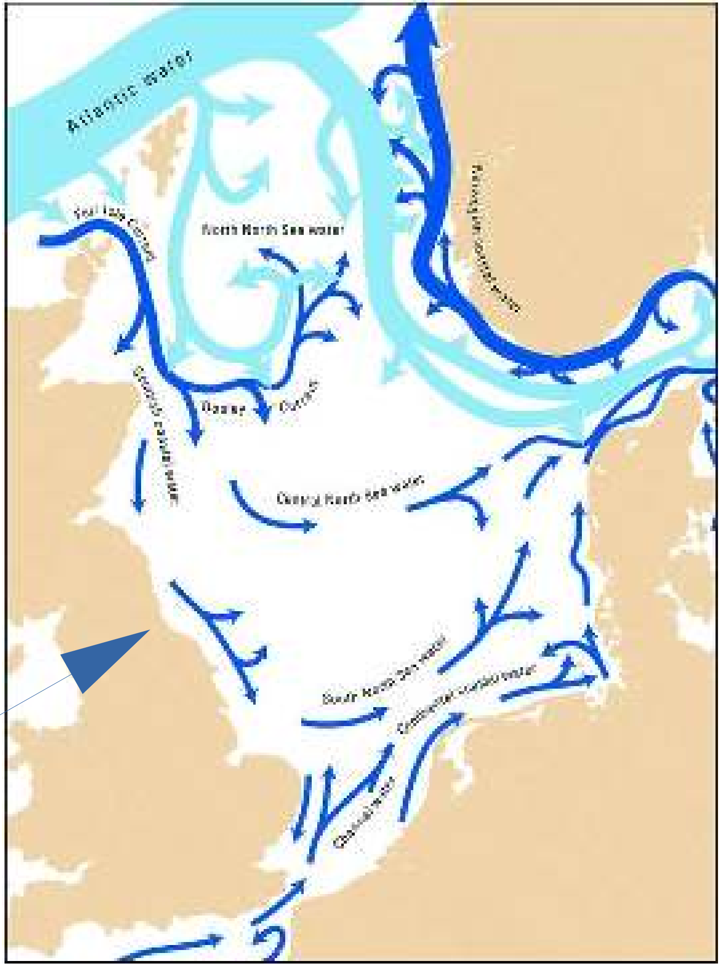
- BDMLR take stranded living seals to either rehabilitation or vets
- Sadly most seals are put to sleep – too ill or no rehabilitation spaces
- “At the lab, *(mouth)* samples are screened for the presence *of* pathogens using a general genomic approach (searching for the genetic material of pathogens such as viruses and bacteria).”
- No post mortem analysis to ascertain cause of death

Common Seal Mouth Rot Project - https://bdmlr.org.uk/common-seal-mouth-rot-project
Mouth rot study offering hope for seal pups - https://www.bbc.co.uk/news/articles/cy7exjrg4l5o

River Tees Estuary / Coast

The North Sea

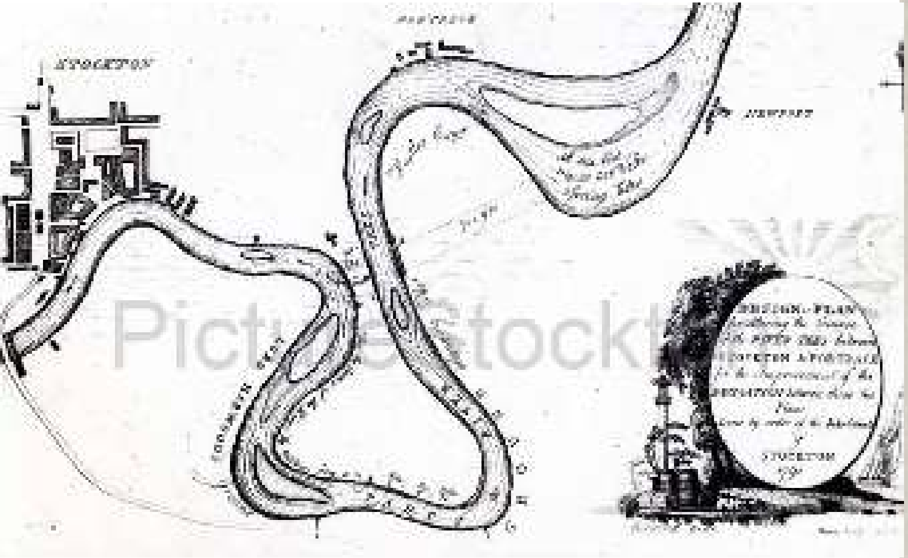
- River Tees discharges into the North Sea
- What happens in the wider sea?
- Disposal sites on continental shelf

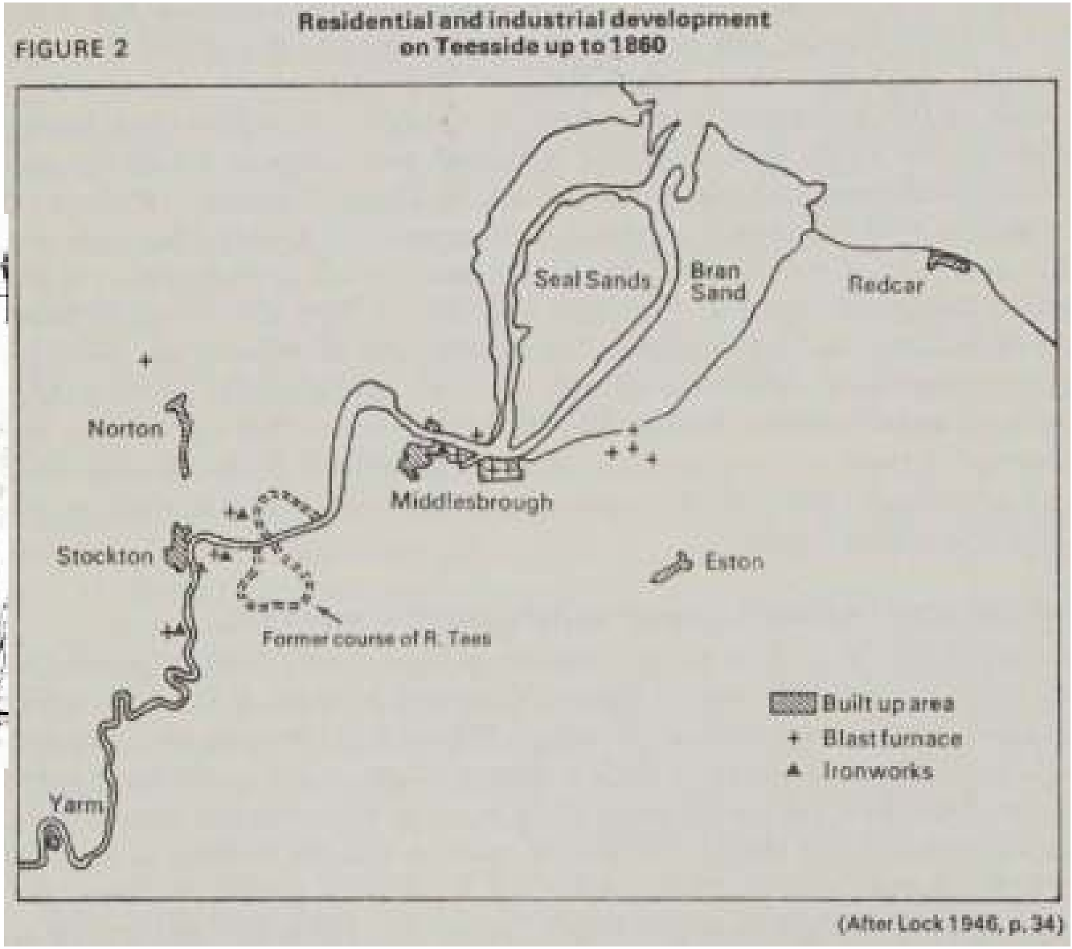


River Tees

The Lower River Tees – 1791, 1860

1791 – 1810 & 31





Pollution in four industrialised estuaries – studies in relation to changes in population density and industrial development by Elizabeth Porter, Four case studies undertaken for The Royal Commission on Environmental Pollution – London Her Majesty's Stationery Office 1973
https://archive.org/details/pollutioninfouri0000port/page/n3/mode/2up

Duddon Estuary, Cumbria

History of Land Reclamation

- 90% intertidal area in estuary lost (reclaimed)
- Straightening of river
- Hard boundaries between river and land

Figure 1. The pattern and sequence of land claim in the Tees Estuary

Wild Teesside – Thirty years of industry and nature
INCA (Industry Nature Conservation Association), 2019
https://inca-teesvalley.co.uk/wild-teesside-book/

Bran Sands

Saltmarsh Formation – North Gare

Greetham Creek – Salt Marsh

Greatham South managed realignment

- Remove sea wall
- Letting sea back in
- Flood resilience
- Nature too

- Tees Tidelands

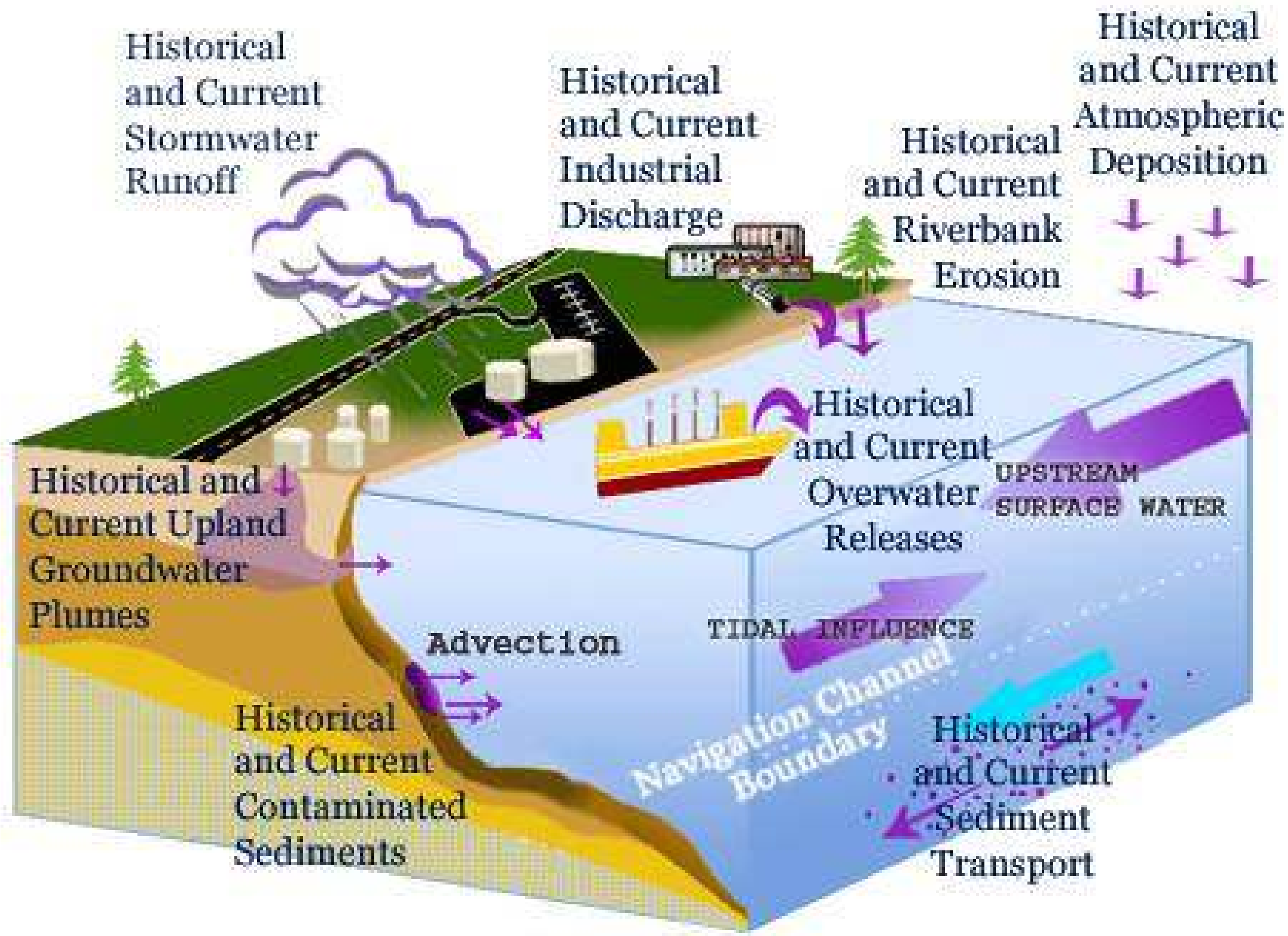
Saltmarsh fish survey shows positive results – Enivronment Agency 2024
https://www.gov.uk/government/news/saltmarsh-fish-survey-shows-positive-results-in-teesside

Dredgers and Seals

Grecko Indie Media - The dredger Causeway in Seaton aka Able UK channel at Teesmouth Part 1.
https://www.youtube.com/watch?v=4iTnjh5rvys
Grecko Indie Media - The dredgers Causeway and Magnor in Seaton channel Teesmouth Part 2
https://www.youtube.com/watch?v=nBBuZalbbmc
NorthEastFC - Magnor dredging Seaton Channel - 1st June 2024
https://www.youtube.com/watch?v=AjcaNnUkbZw

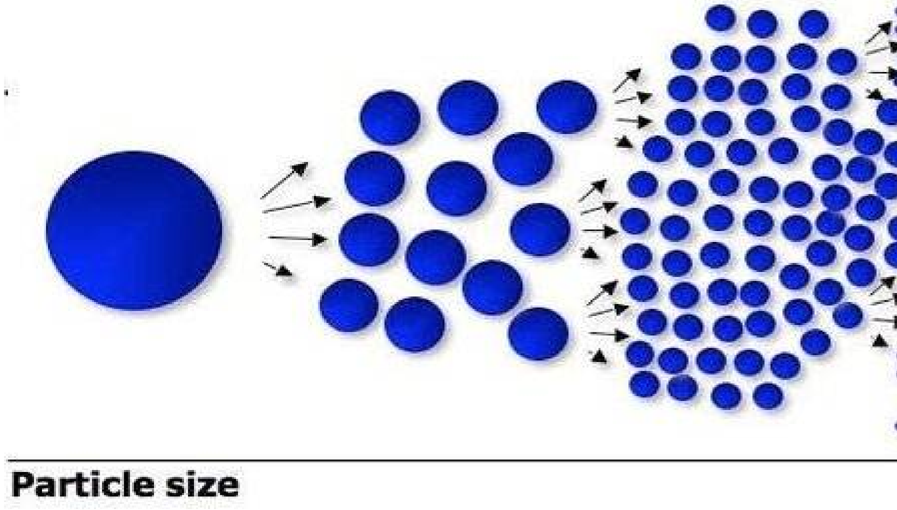
Contamination

Sediment Contamination



Small Particles and Contamination

- **Organic hydrophobic contamination** is adsorbed on **particle surfaces**
  - Per unit mass **small particles** have **larger surface areas**
  - <1 µm particles **ratio** of surface area fraction to mass fraction
  - Contamination of small particles is average contamination multiplied by **ratio**
- Small particles lost during overflowing while dredging
- Small particles lost at dredge head
- Small particles stay resuspended, travel further than particles
- **Majority of hydrophobic contamination is released into river** not at disposal site



Particle radius		
10cm	1mm	1um
Relative Area		
1	100	100,000

Teesworks / South Tees Site

- Reclaimed land
- Historical site of:
  - Steel works
  - Coke ovens
  - Metal recovery
  - Landfills

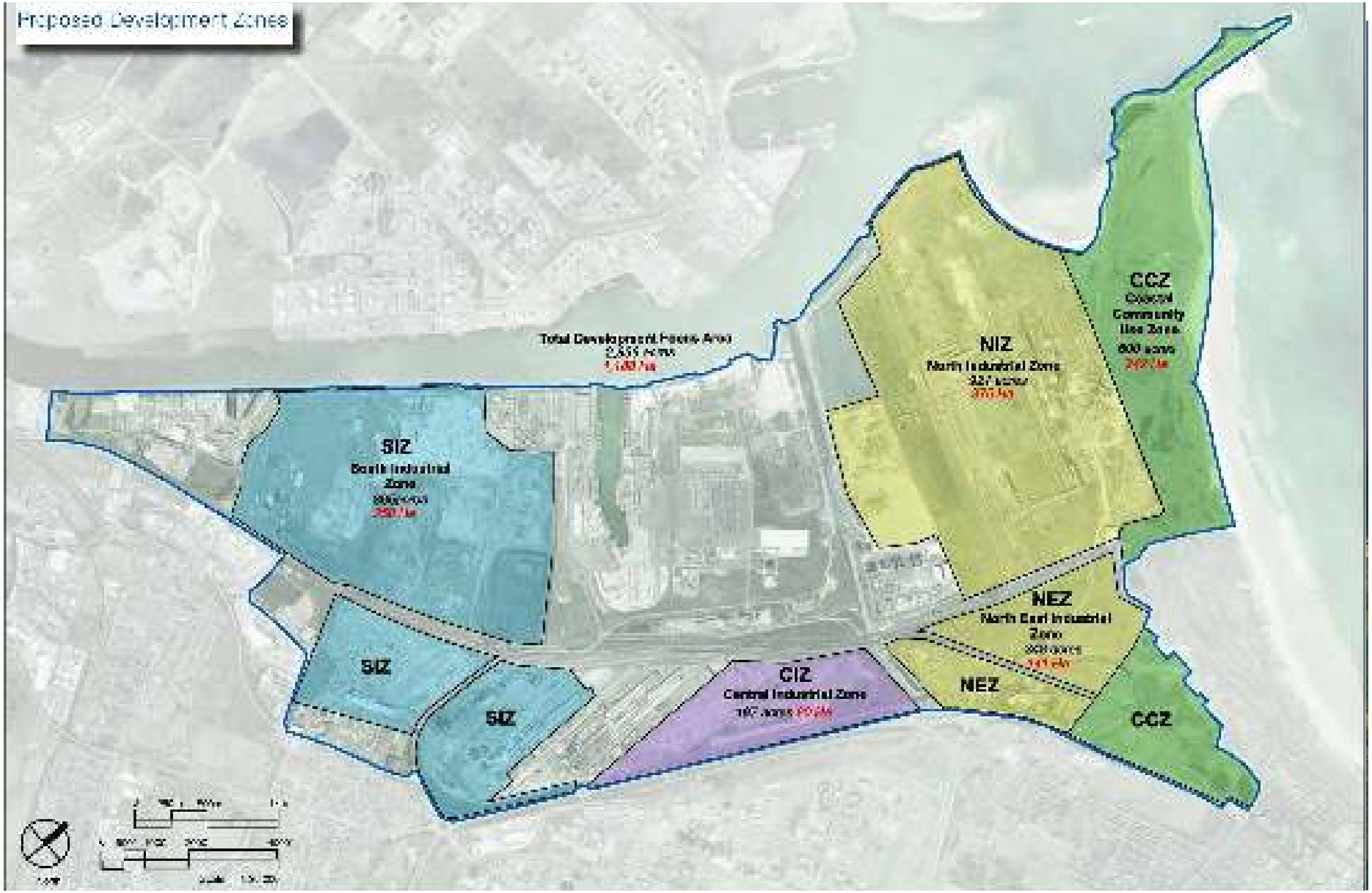
2019 South Tees Regeneration Master Plan
https://www.northeastfc.uk/Teesworks/1911South-Tees-Master-Plan-Nov-19.2.pdf

Teesworks / South Tees Site

- Reclaimed land
- Historical site of:
  - Steel works
  - Coke ovens
  - Metal recovery
  - Landfills

2019 South Tees Regeneration Master Plan
https://www.northeastfc.uk/Teesworks/1911South-Tees-Master-Plan-Nov-19.2.pdf

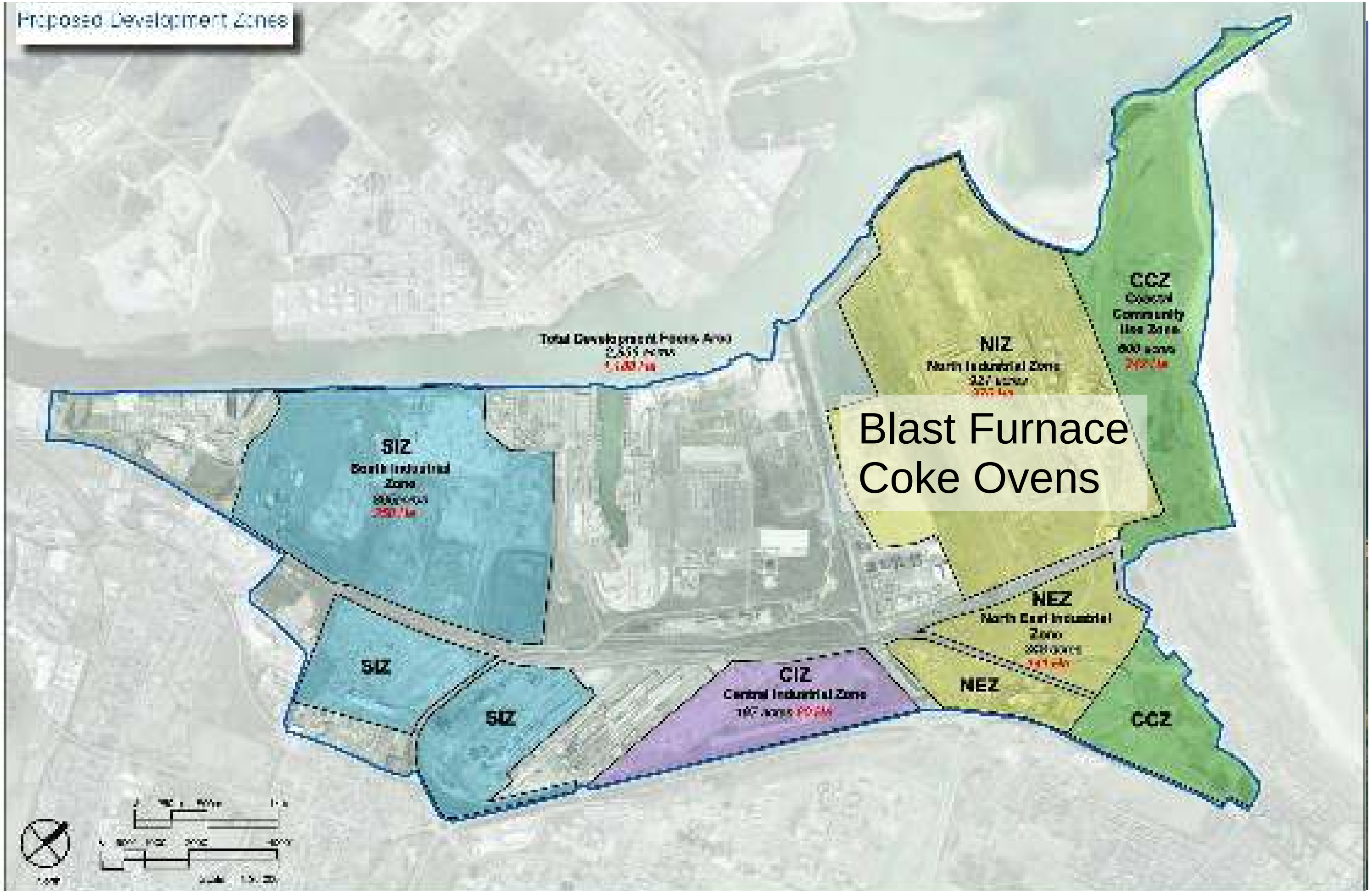
Teesworks / South Tees Site



- Reclaimed land
- Historical site of:
  - Steel works
  - Coke ovens
  - Metal recovery
  - Landfills

2019 South Tees Regeneration Master Plan
https://www.northeastfc.uk/Teesworks/1911South-Tees-Master-Plan-Nov-19.2.pdf

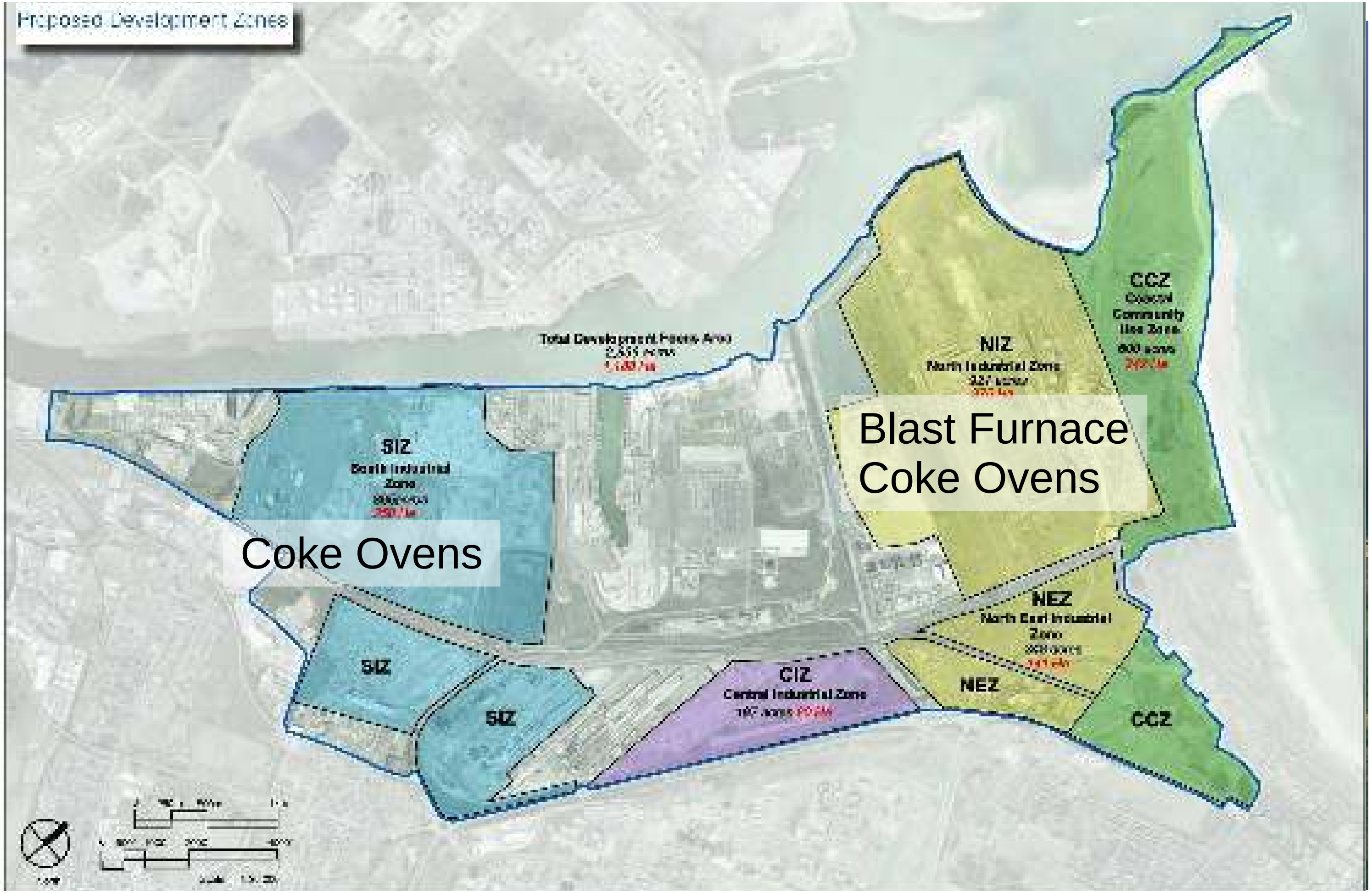
Teesworks / South Tees Site



- Reclaimed land
- Historical site of:
  - Steel works
  - Coke ovens
  - Metal recovery
  - Landfills

2019 South Tees Regeneration Master Plan
https://www.northeastfc.uk/Teesworks/1911South-Tees-Master-Plan-Nov-19.2.pdf

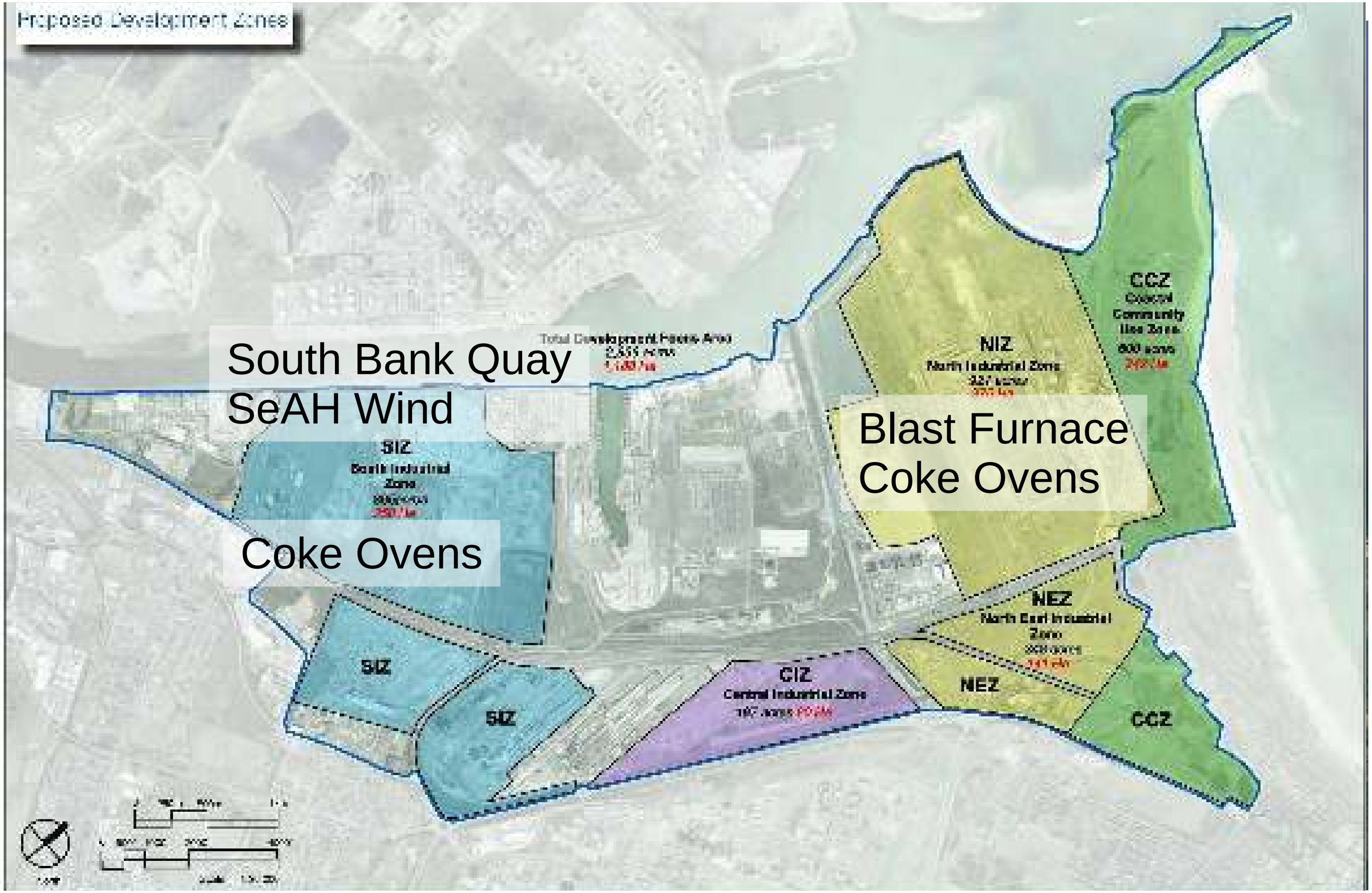
Teesworks / South Tees Site



- Reclaimed land
- Historical site of:
  - Steel works
  - Coke ovens
  - Metal recovery
  - Landfills

2019 South Tees Regeneration Master Plan
https://www.northeastfc.uk/Teesworks/1911South-Tees-Master-Plan-Nov-19.2.pdf

Teesworks / South Tees Site



- Reclaimed land
- Historical site of:
  - Steel works
  - Coke ovens
  - Metal recovery
  - Landfills

2019 South Tees Regeneration Master Plan
https://www.northeastfc.uk/Teesworks/1911South-Tees-Master-Plan-Nov-19.2.pdf

Teesworks

- Teesworks redevelopment (not remediation)
  - High contamination areas unremediated
  - Redeveloped areas will already be being recontaminated
  - Therefore most development monies used inefficiently
- Teesworks pollution into ground then river then sea
  - Groundwater into river
  - Dense non-aqueous phase liquids on river bed
  - Not if but when

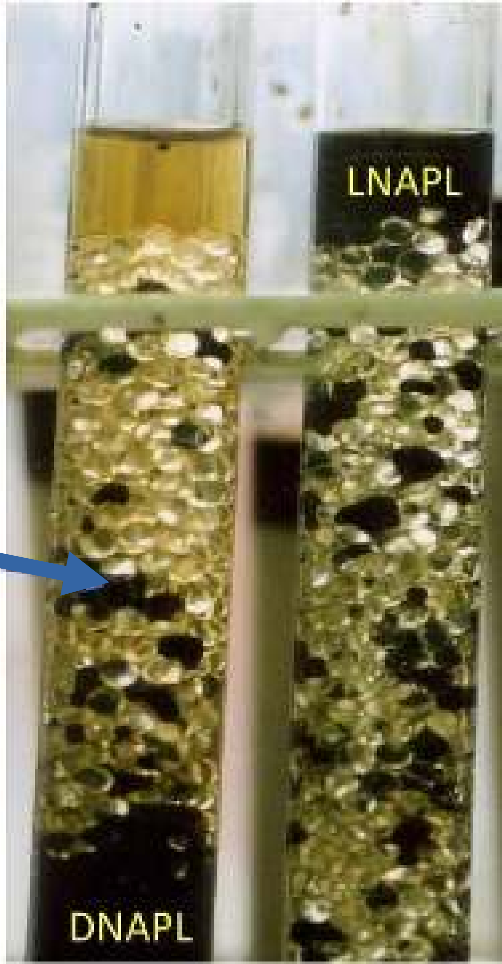
Was this when it all went wrong?
https://www.northeastfc.uk/doku.php?id=teesworks_-_was_this_when_it_all_went_wrong
Ignoring pipes kills crabs
https://www.northeastfc.uk/doku.php?id=teesworks_-_ignoring_pipes_kills_crabs

Dense NAPL (DNAPL)

- NAPL = Non-aqueous phase liquid
  - Hardly soluble organic compounds
  - 10-100s year reservoirs of slow release contamination
- DNAPL = NAPL that is more dense than water
  - Coal Tar, *Chlorinated solvents – PCE, TCE, TCA*
  - *Single-component products*

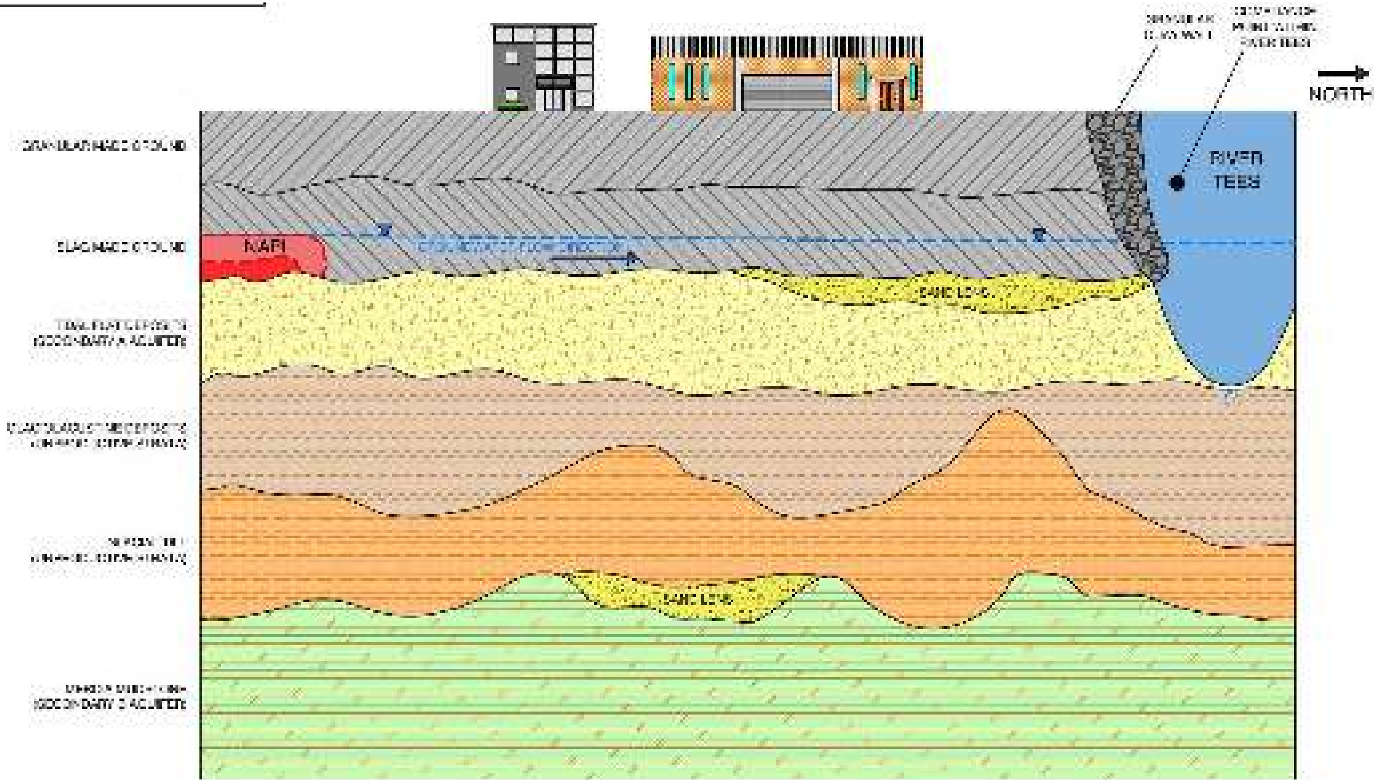
- South Bank Quay Historic Uses
  - Coking ovens – **dense coal tar**
  - Heavy fuel oil storage – **heavy fuel oil**

Capillary held residuals of NAPL



Environment Agency 2003 – R&D Pulbication 133 – An illustrated handbook of DNAPL transport and fate in the subsurface
https://www.clu-in.org/conf/itrc/dnaplpa/dnapl_handbook_final.pdf

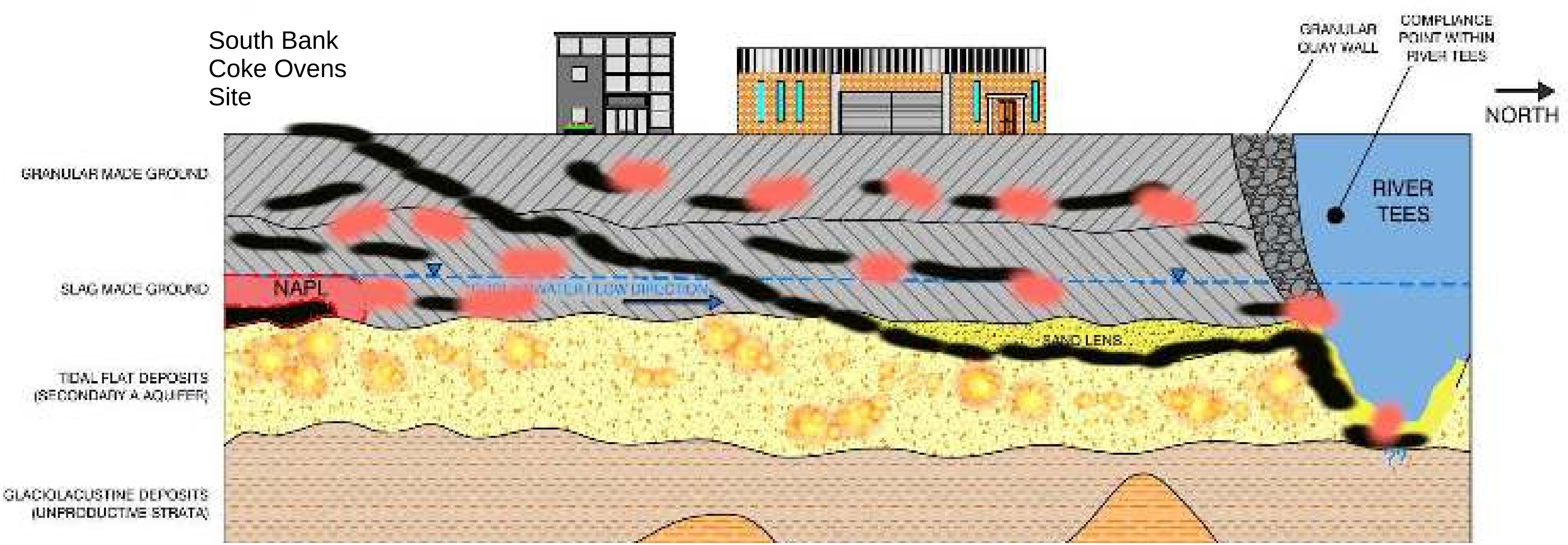
Site Conceptual Map



- Simplified
- End state
- Not construction
- Incorrect isolation of NAPLs

South Bank, Teesworks, Redcar - Detailed Quantitative Risk Assessment - South Tees Development Corporation - Document Ref: 10035117-AUK-XX-XX-RP-ZZ-0331-02-SB_DQRA - Revision: 02 - SEPTEMBER 2021 - Arcadis
https://www.northeastfc.uk/Teesworks/Planning/R-2022-0096-CD/R-2022-0096-CD-10035117-AUK-XX-XX-RP-ZZ-0331-02-SB_DQRA.pdf

EA DNAPL + Arcadis South Bank



South Bank, Teesworks, Redcar - Detailed Quantitative Risk Assessment - South Tees Development Corporation - Document Ref: 10035117-AUK-XX-XX-RP-ZZ-0331-02-SB_DQRA - Revision: 02 - SEPTEMBER 2021 - Arcadis
https://www.northeastfc.uk/Teesworks/Planning/R-2022-0096-CD/R-2022-0096-CD-10035117-AUK-XX-XX-RP-ZZ-0331-02-SB_DQRA.pdf
Environment Agency 2003 – R&D Pulbication 133 – An illustrated handbook of DNAPL transport and fate in the subsurface
https://www.clu-in.org/conf/itrc/dnaplpa/dnapl_handbook_final.pdf

NAPLs in Water Courses

- In the Tees DNAPL will be hidden below sediments
- On a small clear water course coal tar can be seen:
  - Hydrocarbon staining on far bank

  - DNAPL Coal tar on bed of river (+ house bricks for scale) – in flood event this DNAPL will get dispersed downstream (perhaps several Km)

  - Emergence of DNAPL at discrete points in river bed, that then runs down topography of riverbed to collect in pools

Photographs provided by Dr Michael Rivett, GroundH2O Plus Ltd, Birmingham (rivett@groundh2oplus.co.uk)

Groundworks underway Autumn 21

- For example:
  - Excavation of hinterland South Bank Quay
  - Excavation of South Bank to 7.5m
  - Decanting of heavy fuel oil deposits
  - Demolition of buildings
  - CoMAH product removal from vessels/pipes
  - Explosive blowdown of coke ovens / related plant

Teeswoks – Groundworks Including Prior to October 2021
https://www.northeastfc.uk/doku.php?id=teesworks_-_timeline_of_groundworks_including_prior_to_october_2021

September 2021

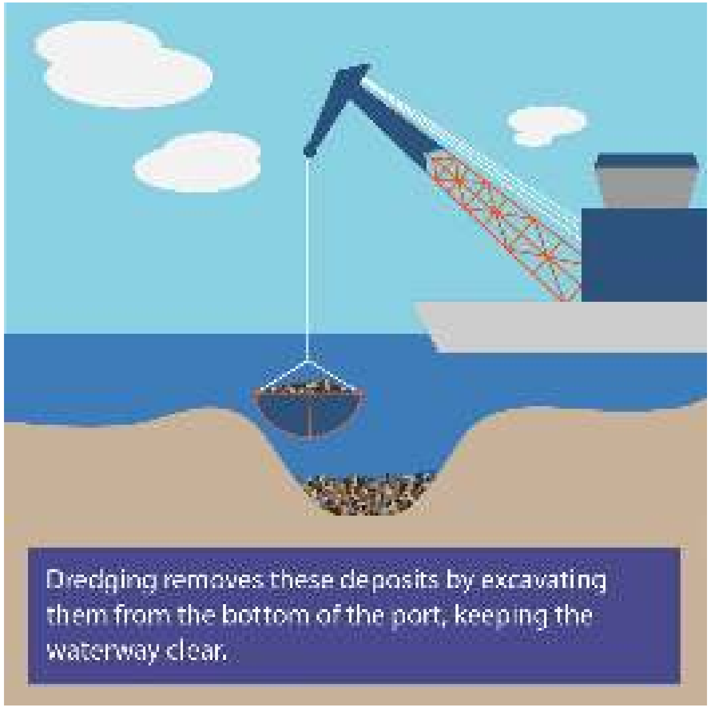
Dorman Long Tower listed in September 2021
Listing revoked 19th September 2021
Demolished night of 19th September 2021

Steve DJI Mavic Pilot – South Bank Coke Overs - 15th September 2021
https://www.youtube.com/watch?v=yfCqeg02aiQ
Tees Valley Combined Authority – Dorman Long Tower Demolition - 19th September 2021
https://www.youtube.com/watch?v=LJ1-aFIRIzg

Dredging

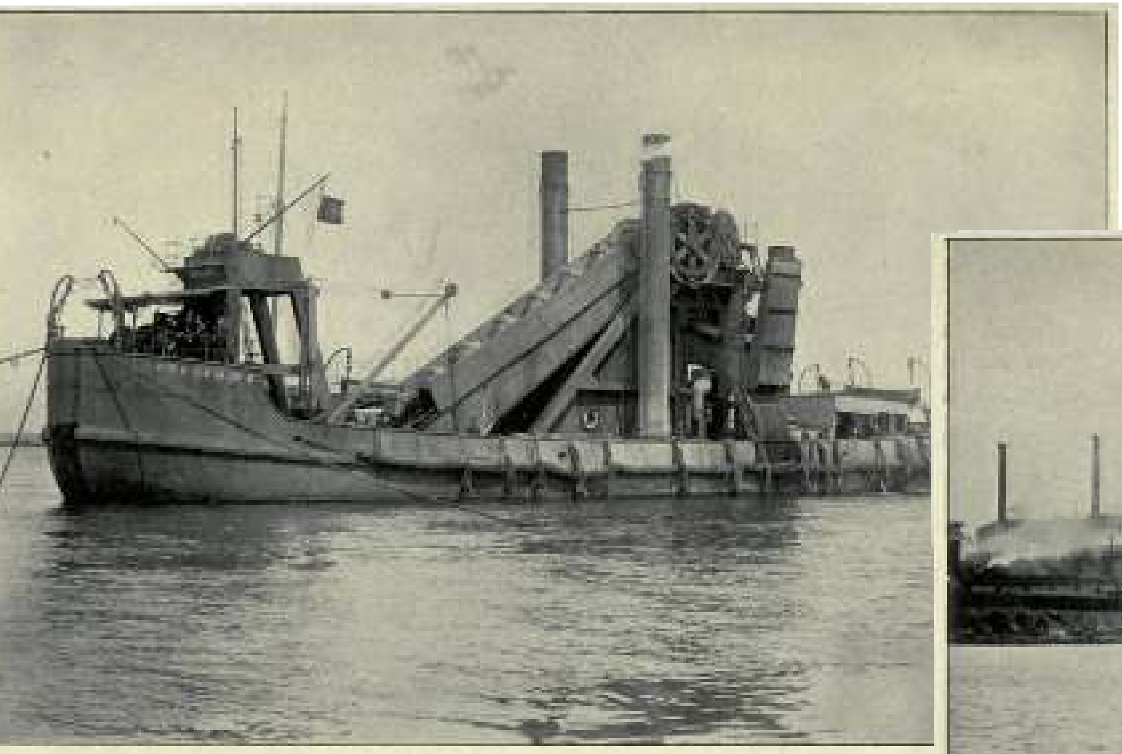
Maintenance Dredging

- Sand washes up
- Silt washes down

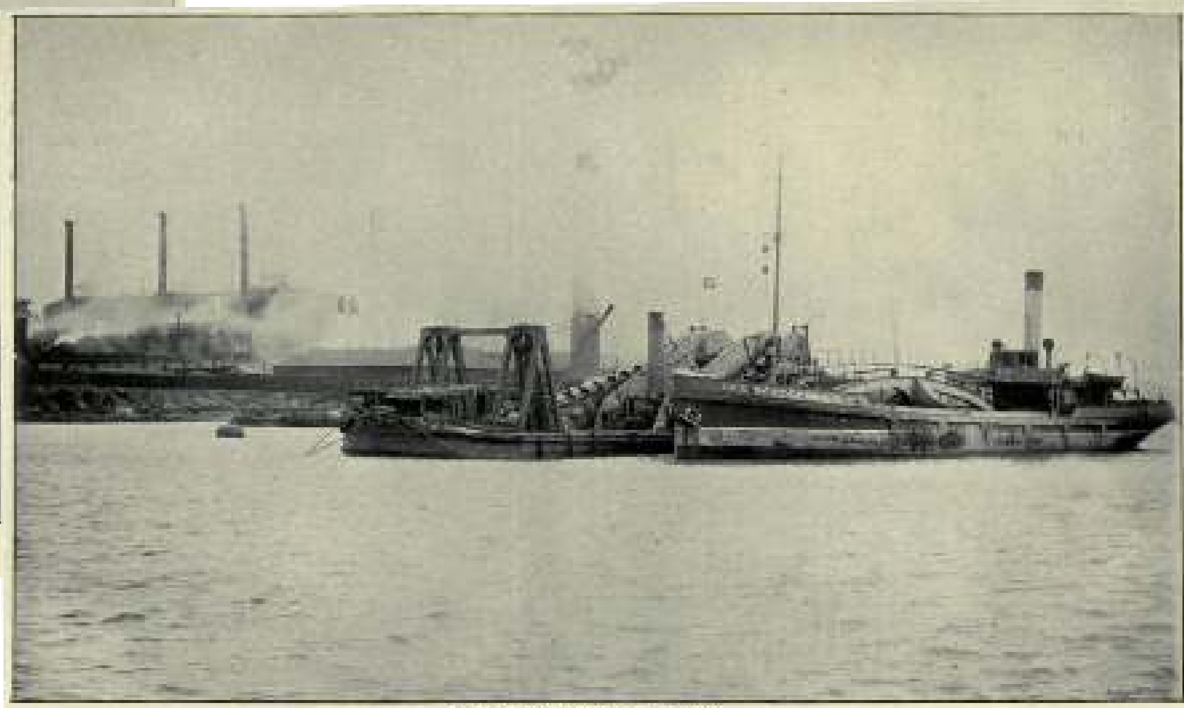


Montrose Port Authority - https://montroseport.co.uk/2020/05/01/faqs-all-about-dredging/

1906



TEES COMMISSIONERS' NEW DREDGER, No. 6.



MIDDLESBROUGH REACH.
(T.C.C. DREDGER AND TWIN SCREW STEAM HOPPER)

Ports of the River Tees
The Tees Conservancy Commissioners, 1906
https://archive.org/details/portsofrivertees00grearich/page/n5/mode/2up

Trailing Suction Hopper Dredger

Trailing Suction Hopper Dredger

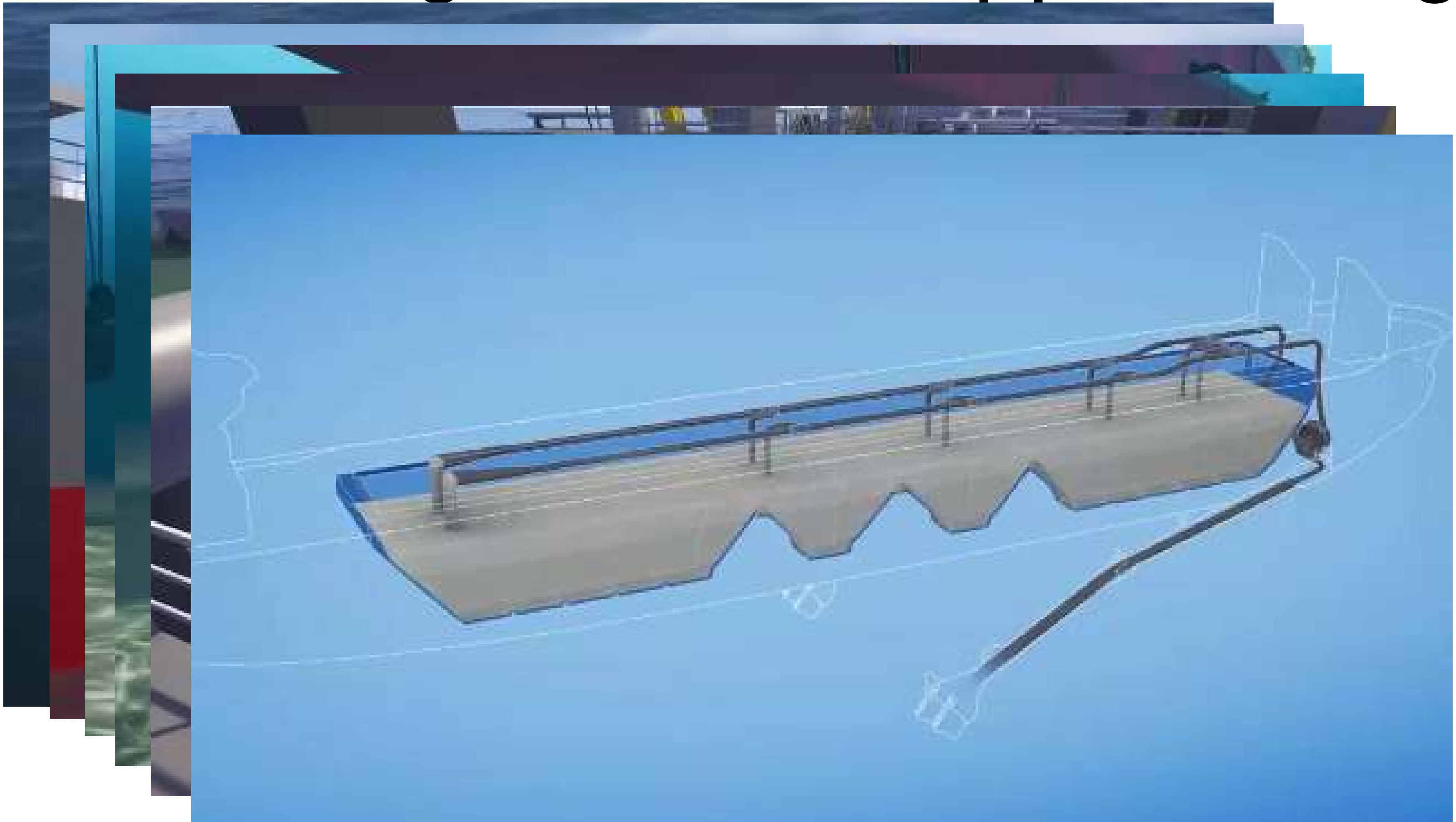
Trailing Suction Hopper Dredger

Trailing Suction Hopper Dredger

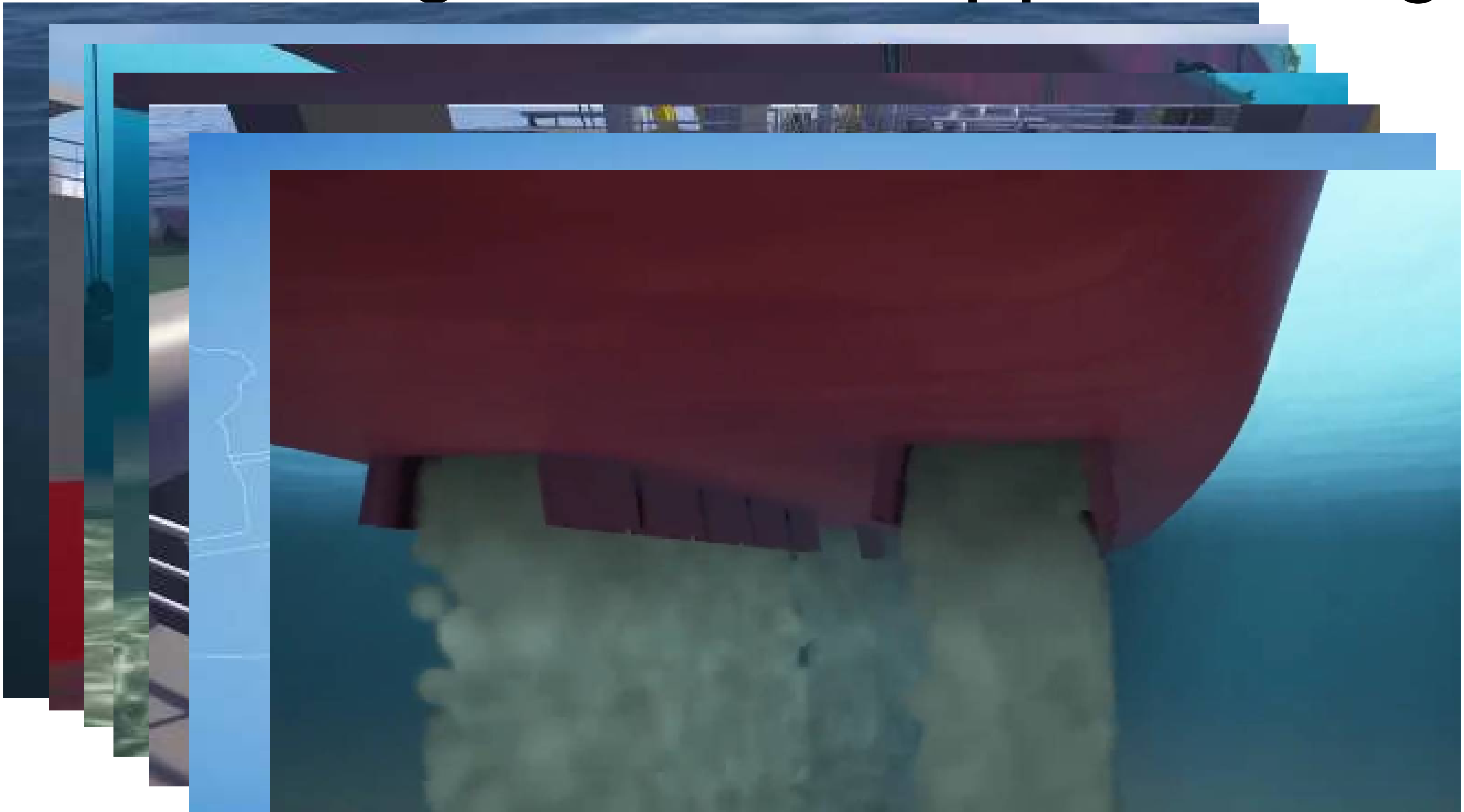
Trailing Suction Hopper Dredger

Trailing Suction Hopper Dredger

Trailing Suction Hopper Dredger

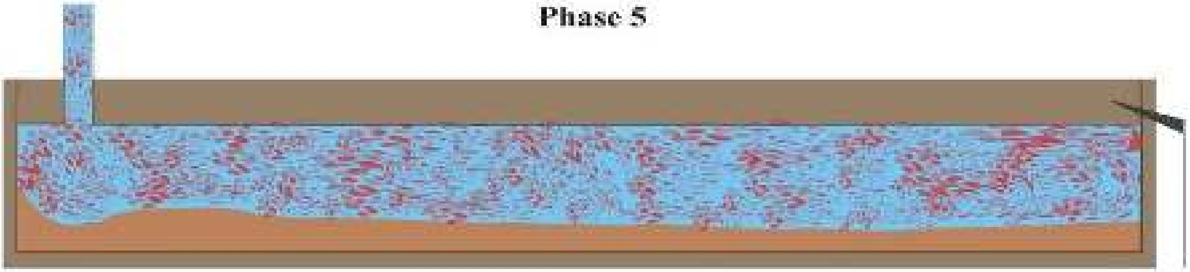


Trailing Suction Hopper Dredger



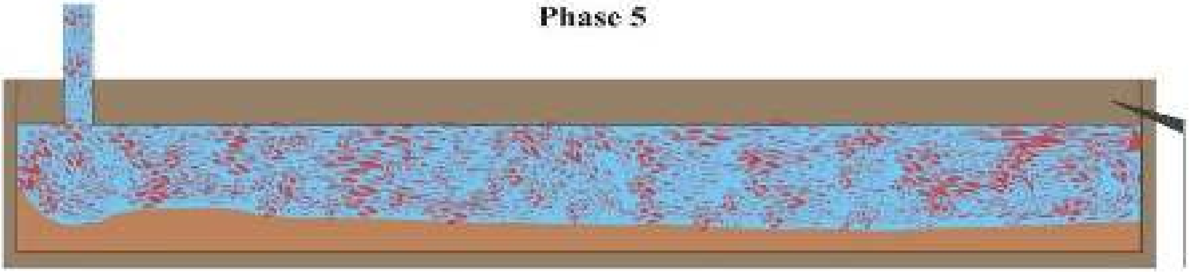
Heortnesse
Hopper Filling

Heortnesse Hopper Filling

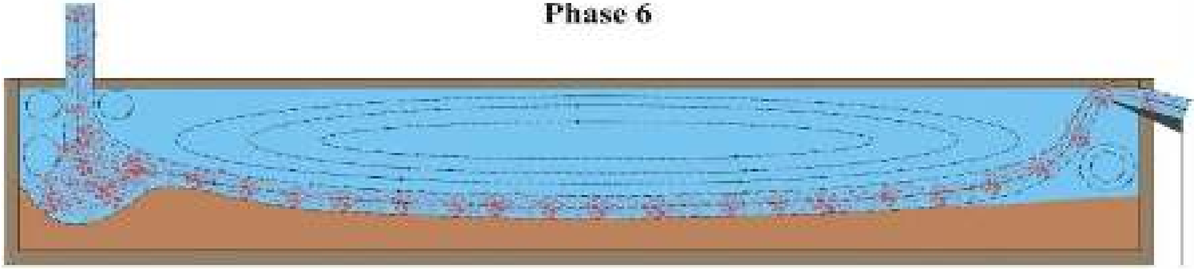


Heortnesse Hopper Filling

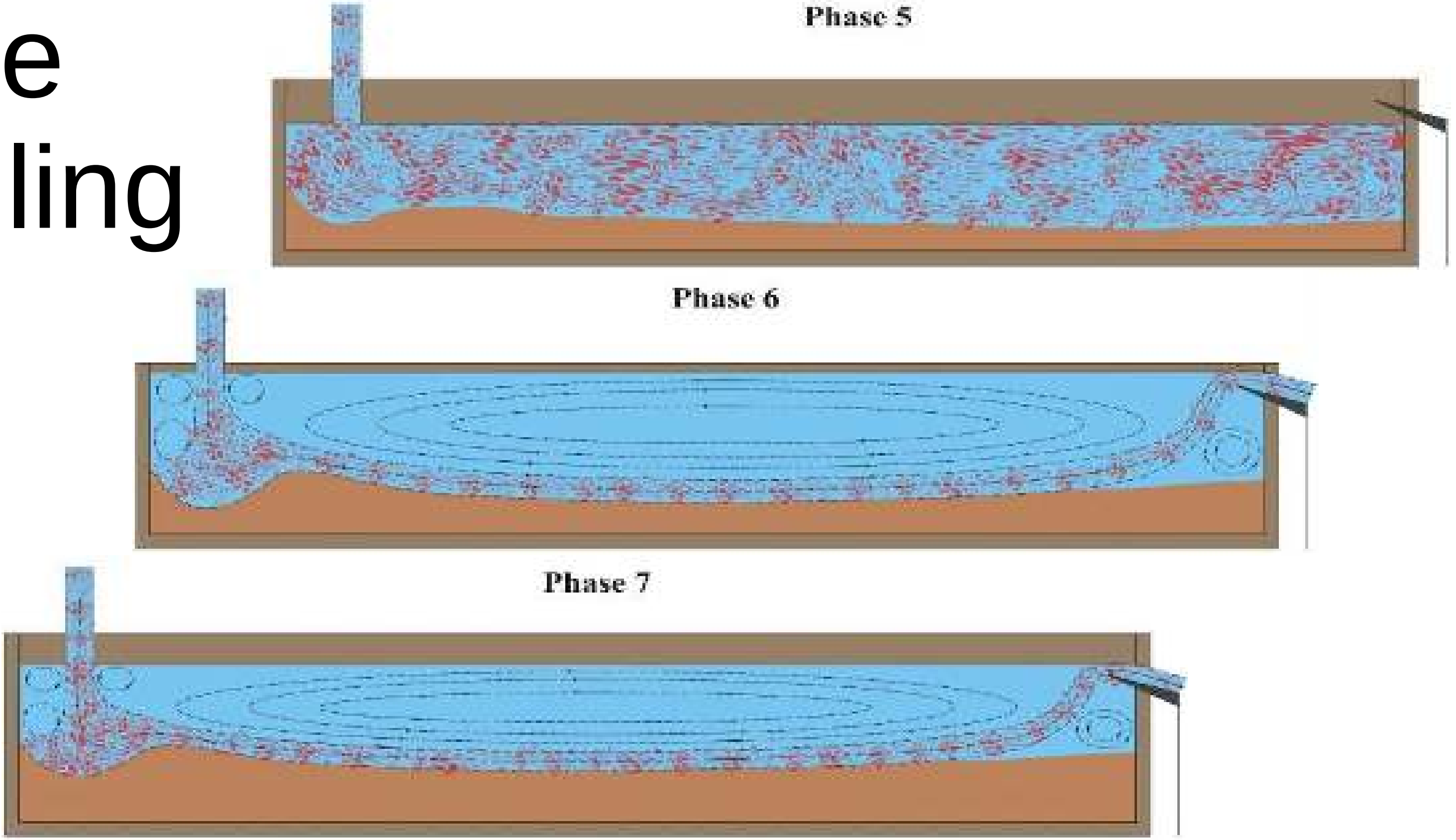
Phase 5



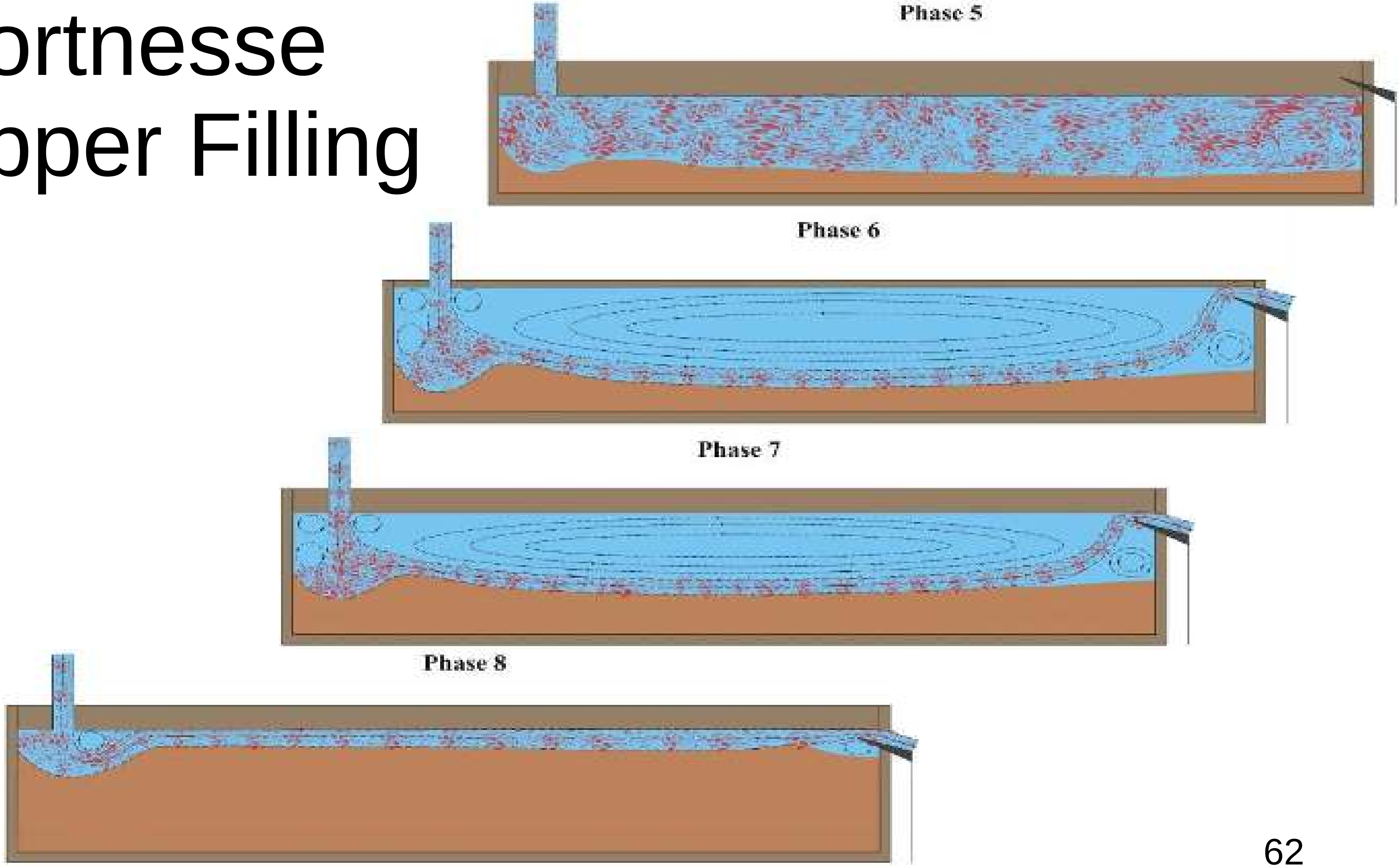
Phase 6



Heortnesse Hopper Filling



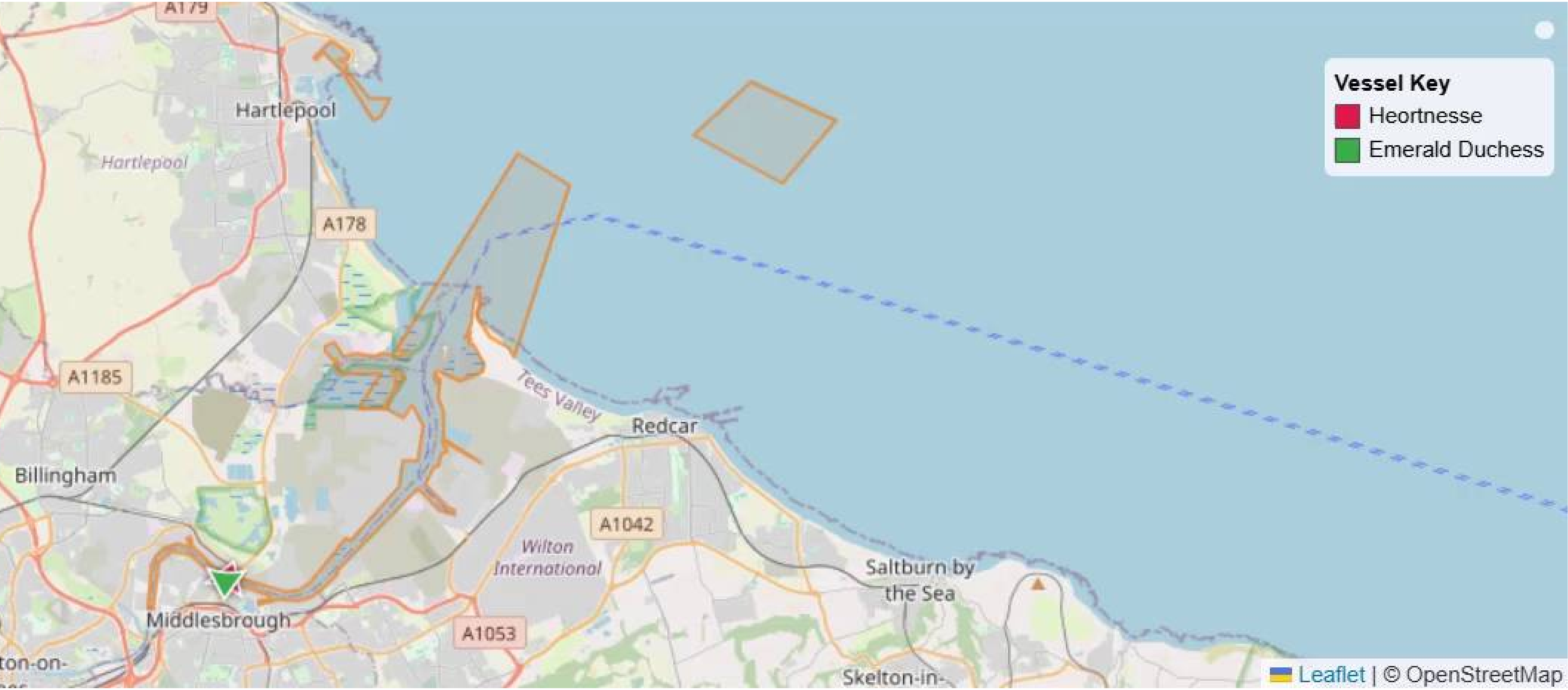
Heortnesse Hopper Filling



Dredging Material Destination

- Local (>10%)
  - Resuspension
  - Turbidity
  - Release of contaminant
- Disposal site (<90%)
  - Resuspension
  - Turbidity
  - Release of contaminant
  - Seabed loss

Emerald Duchess & Heortnesse 1-4/3/2025 (4 days)



UKD Orca

- Tees dredgers Cleveland County & Heortnesse low availability autumn 2021
- UK Dredging Ltd’s THSD Orca commissioned to dredge outer Tees estuary channel 25/9 to 4/10
- Potential differences:
  - 50% larger than Cleveland County / Heortnesse
  - 24 / 7 operation
  - what was being dredged

UKD Orca 25/9-04/10/2021 (10days)

Independent Expert Assessment of Unusual Crustacean Mortality in the North-east of England in 2021 and 2022
https://www.gov.uk/government/publications/assessment-of-unusual-crustacean-mortality-in-the-north-east-of-england-in-2021-and-2022

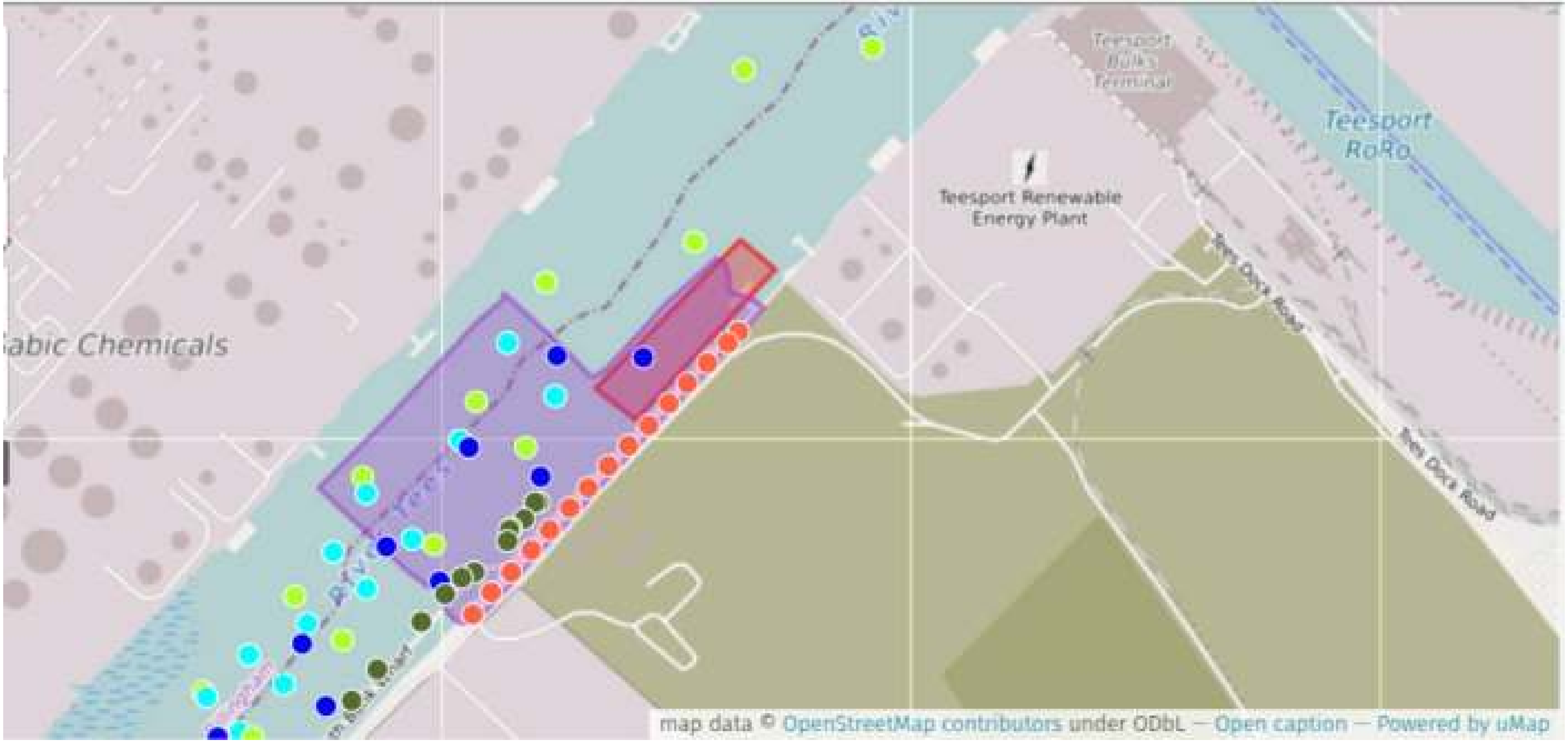
Documented Dredge Contamination

Documented Dredge Contamination

- South Bank Quay required dredging of highly contaminated area (Borehole 34)
- Excluded from disposal at sea
- Material had to be taken to land
- Dredge had to avoid any spillage into the river
- MMO license required before and after sediment sampling

Ecocide in Tees Bay: Environment Committee Hears the Evidence – Scott Hunter - 30th October 2022
https://www.teesvalleymonitor.com/ecocide-in-tees-bay-environment-committee-hears-the-evidence
Even "Safe" Dredging Caused Increased Contamination
https://www.northeastfc.uk/doku.php?id=teesworks_-_recorded_contamination_of_tees_by_closed_bucket_dredging
Teesworks – Capital dredging the Tees
https://www.northeastfc.uk/doku.php?id=teesworks_-_capital_dredging_the_tees

Exclusion Zone



Exclusion Zone

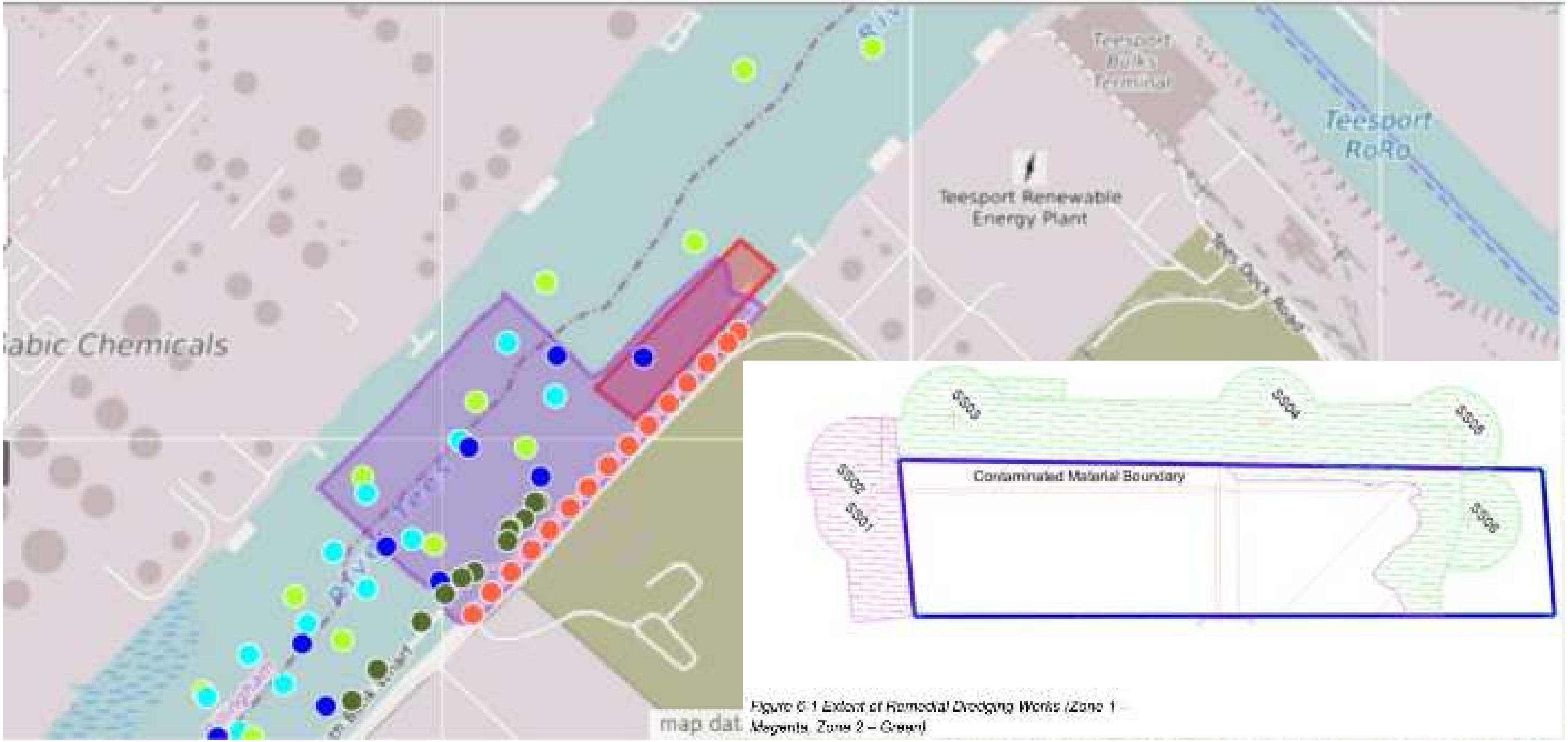
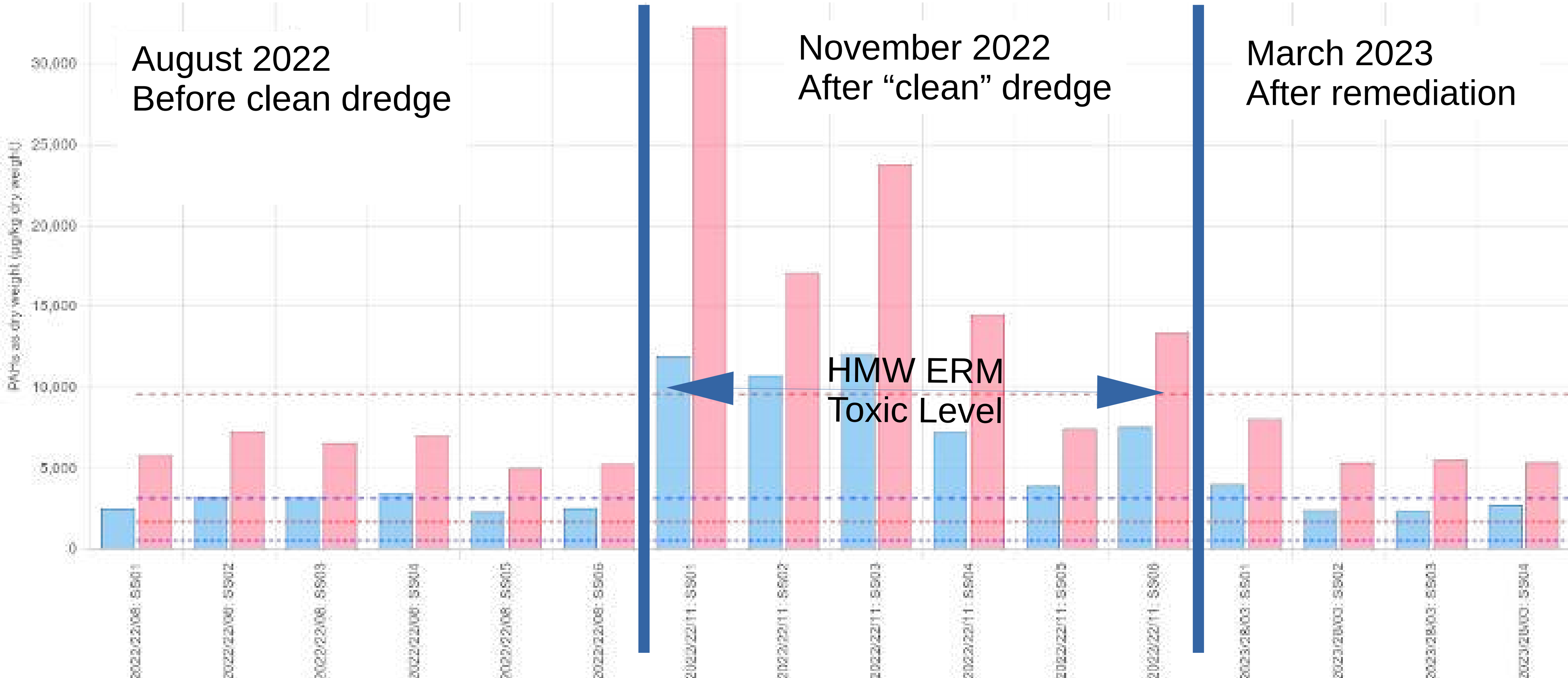


Figure 6.1 Extent of Remedial Dredging Works (Zone 1 – Magenta, Zone 2 – Green)

Surface Sampling Around Exclusion Zone



Is There Other Undocumented Dredge Contamination?

- This contamination was only discovered because the license required sediment sampling immediately after the completion of the dredging
- The River Tees is dredging over 250days a year for 10 hours a day by 2 dredgers plus any capital dredging occurring
- Around 40 samples are taken once every 3 years
- So unless sampling occurs before an area is redredged then that event will be unknown / undocumented / unrecorded
- More than 1500 dredger days occur between each sampling

Even "Safe" Dredging Caused Increased Contamination
https://www.northeastfc.uk/doku.php?id=teesworks_-_recorded_contamination_of_tees_by_closed_bucket_dredging
Teesworks – Capital dredging the Tees
https://www.northeastfc.uk/doku.php?id=teesworks_-_capital_dredging_the_tees

To Conclude

NEMRG Ongoing

- Sampling sediment around Tees
- Reanalysing sediment sampling data from MMO applications
- Publishing new scientific understanding around environmental threats to marine life
- Increase engagement with agencies / government

Tara Seal Research Hopes (TSR)

- Set up temporary seal rehabilitation centre in Hartlepool
- Summer 2026 timely / transparent information sharing Teesside University, BDMLR and TSR
- Immediate notification of all seal pup strandings (location, time, pup weight, receiving vet, outcome)
- Discuss options and – if the pup is to be euthanised – taking of tissue samples for bacterial culture and toxicology as well as for TU's genomic analyses
- BDMLR should bring any stranded pups collected from the Tees area to Tees area vets and liaise with Clifton Lodge vets in Hartlepool
- 2025 there were 18 Tees pups recorded as being euthanised
- 2026 an attempt will be made to save at least some of these pups with treatment by Clifton Lodge vets and care for a few weeks in a temporary Hartlepool seal hospital
- Sharing of genomic pathology sampling and analytic results from individual pups stranding in Tees area (North Yorkshire to Northumberland)

How dredging should change?

- Far more regular and extensive measurement of sediment / dredged materials
- Adopt precautionary dredger operation
  - No overflow
    - Unless overflow regularly measured to be clean
  - Dredging operations to take greater account of river / tide / weather state

What I Hope I Have Explained

- Cause of crab die-off is still unclear – too little investigation in 2021
- Cause of seal pup mortality is unclear – **need more investigation now**
- River Tees sediment is contaminated
- Much of the contamination is on silt (small particles)
- Contaminated silt is released into the river during dredging
- The release of contaminated silt is damaging the River Tees Estuary’s ecology
- Dredging methods need to be changed to protect the estuary’s ecology

Vision

- Co-ordinated seal research / seal rehabilitation facility in place by June 2026
- Contamination from small particles eliminated from River Tees estuary
- Contamination of River Tees by dredging significantly reduced
- Contaminated small particles largely deposited at Tees Bay A
- Small particle contamination will be dispersed over a wider area from Tees Bay A than is the case when the release happens in river
- Environment significantly improved for seals / other marine animal
- Accidental dredging of contaminated areas of River Tees will no longer create extensive contamination
- Better environment for marine life, bird life and humans

Acknowledgements

- **North East Fishing Collective**
  - Hartlepool
  - Redcar
  - Whitby
- **Multi-Council - Crustacean Deaths Collaborative Working Group**
  - Redcar & Cleveland, Middlesbrough, Stockton, Hartlepool, North Yorkshire
- **Reclaim Our Sea**
- **Tees Estuary Seal Study (TESS) Tara Seal Research**
- **North East Marine Research Group**
  - Universities of Durham, Hull, Newcastle, York
  - Fishmongers' Company
  - Reclaim Our Sea
- **Tees Pollution Group 2021 -2023**
  - Sally Bunce / Dawn Love / Richard Randle / Robin Yardly / Simon Gibbon

Where to read around

- NorthEast File Collection – https://northeastfc.uk - this talk plus supporting articles / information
- Tees Valley Monitor – https://www.teesvalleymonitor.com/
- Teesside Lead – https://thelead.uk/teesside
- North East Bylines – https://northeastbylines.co.uk/ - Ray Casey, Julia Mazza, Simon Gibbon, ...
- Tees Tidelines – https://engageenvironmentagency.uk.engagementhq.com/sto021-tees-tidelands
- River Tees Trust – https://www.teesriverstrust.org/
- Tees Valley Wildlife Trust – https://www.teeswildlife.org/
- Industry Nature Conservation Association (INCA) – http://www.inca.uk.com/
- Tara Seal Research - https://www.sealresearch.org/

simonrg@northeastfc.uk

https://northeastfc.uk

Dead Pup South Gare (TS17)

26th August

- Post mortem: 8.8kg

Healthy seal pups:

- Birth weight: 10 – 12kg
- 6 week wean: 20 – 30kg
- 8 week: 18 – 22kg

2025 PCBs in the Blubber? 8 seals

- Blubber
  - Thin
  - Thick
- Analysed for
  - 18 PCBs

Tees Estuary Seal Study (TESS)

"*Comment*. There is no other breeding colony of harbour seals for 100 miles to the south of the Tees Estuary or for more than a hundred miles to the north. Therefore it seems likely that most of the pups stranding in the summer between north Yorkshire and Northumberland were born in the Tees. Since the total number of reported strandings in this area was approximately equal to the number of live pups counted with their mothers in the Tees breeding colony, it seems that the Tees pup post-weaning mortality in 2024 was close to 100%."

Tara Seal Research

Seal Sands Colony

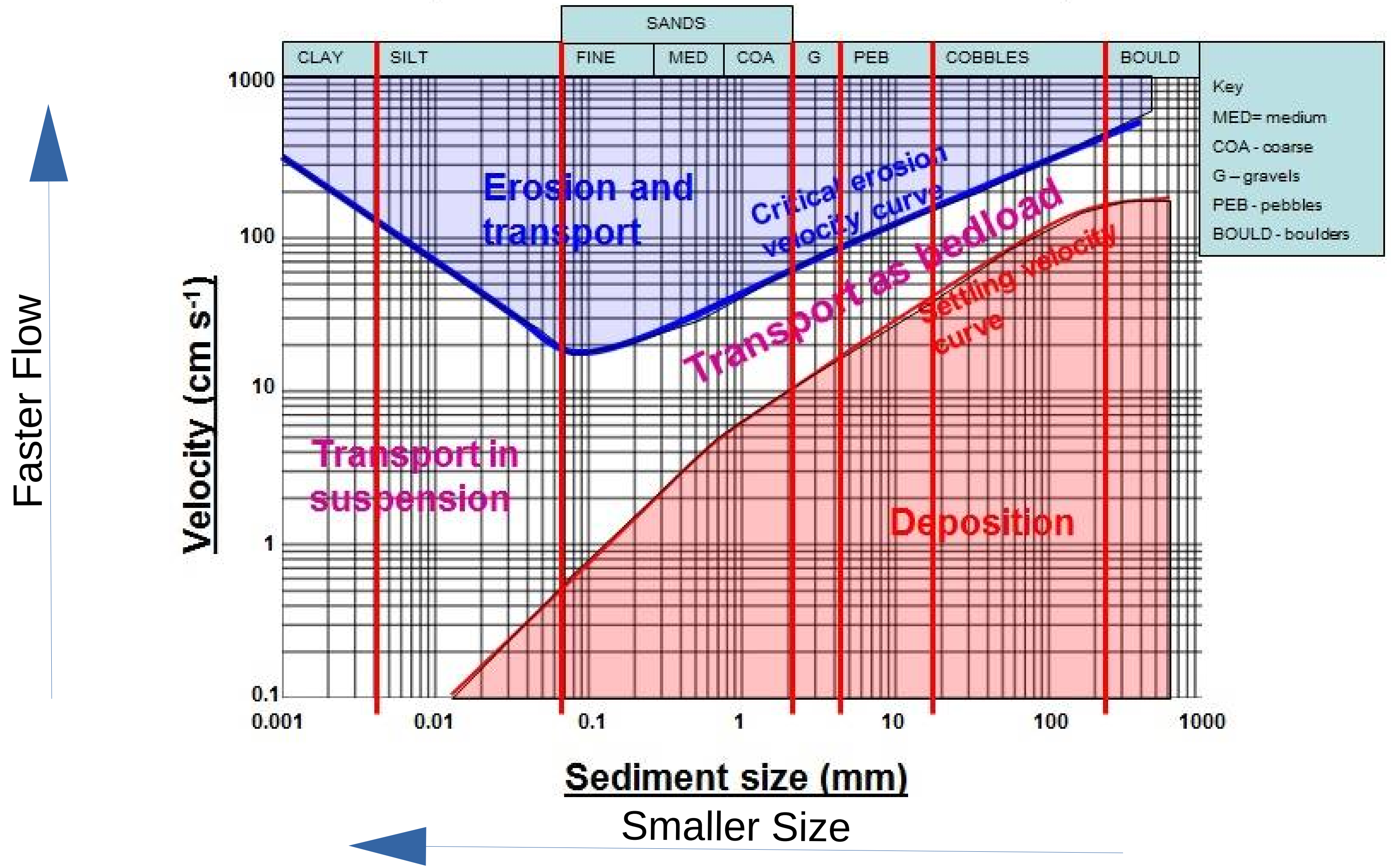
- Harbour seals
- 2025: 21 seal pups
- Group image from July 2024

TESS stranded seal pup investigation 2025
https://www.sealresearch.org/research/tess-seal-pup-crowdfunding-project
MPs call for inquiry into seal deaths
https://www.bbc.co.uk/news/articles/c62qnqvj93go

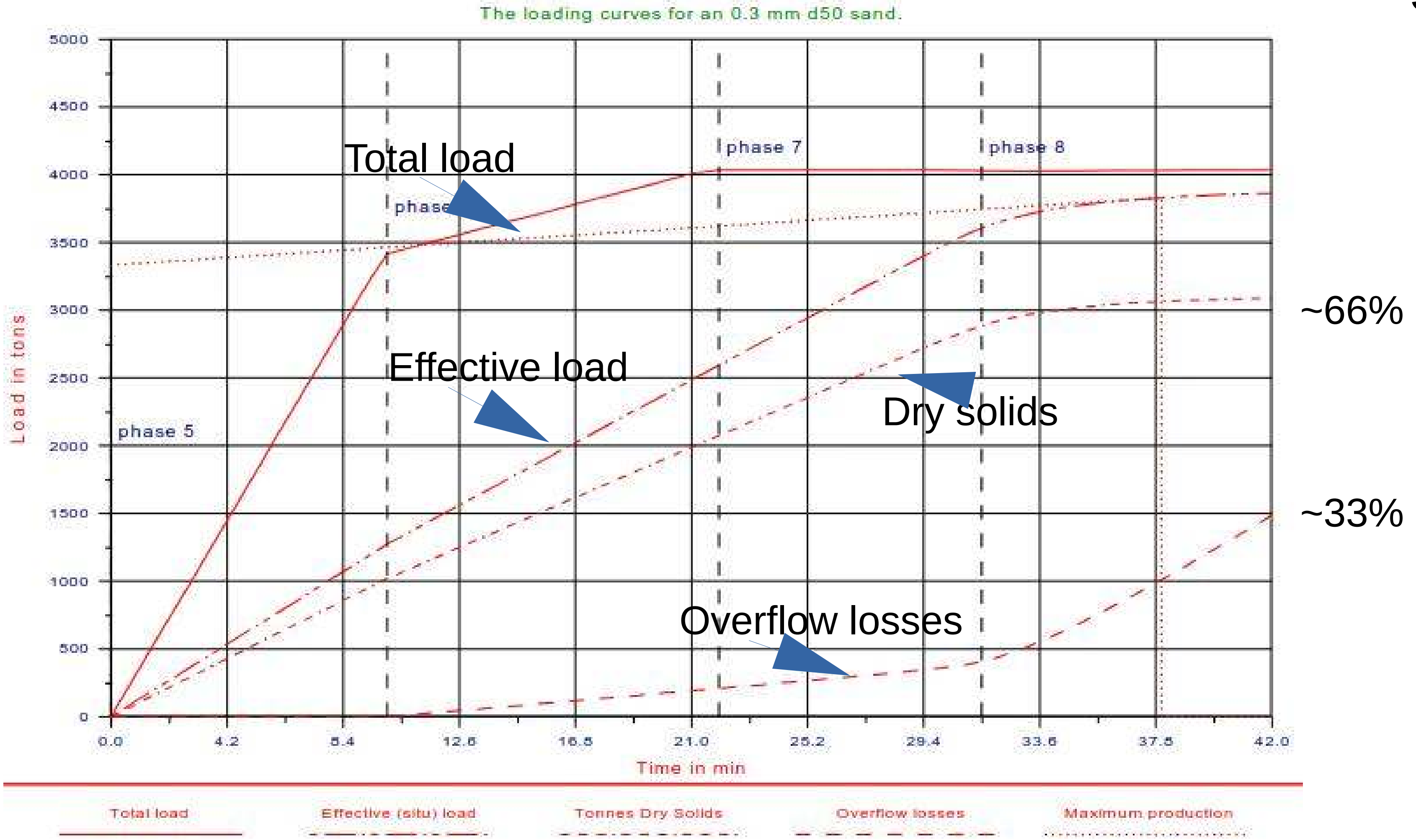
Small Particles and Contamination

- Small particles contain most contamination
- Lots of small particles are dispersed in the river
- Most of small particles won’t get to the disposal site

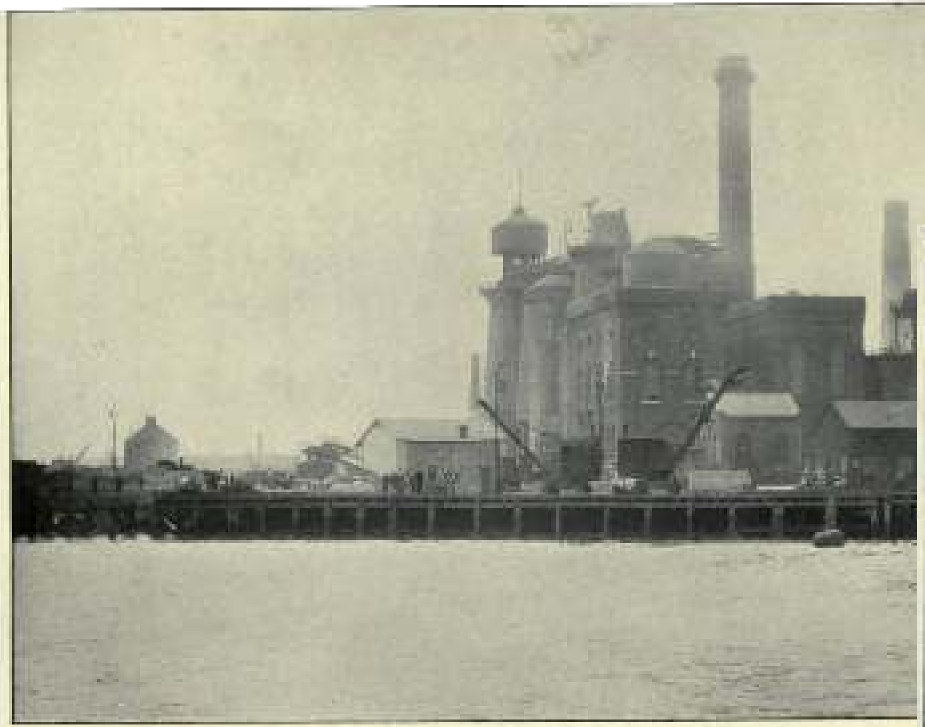
The Hjulström curve



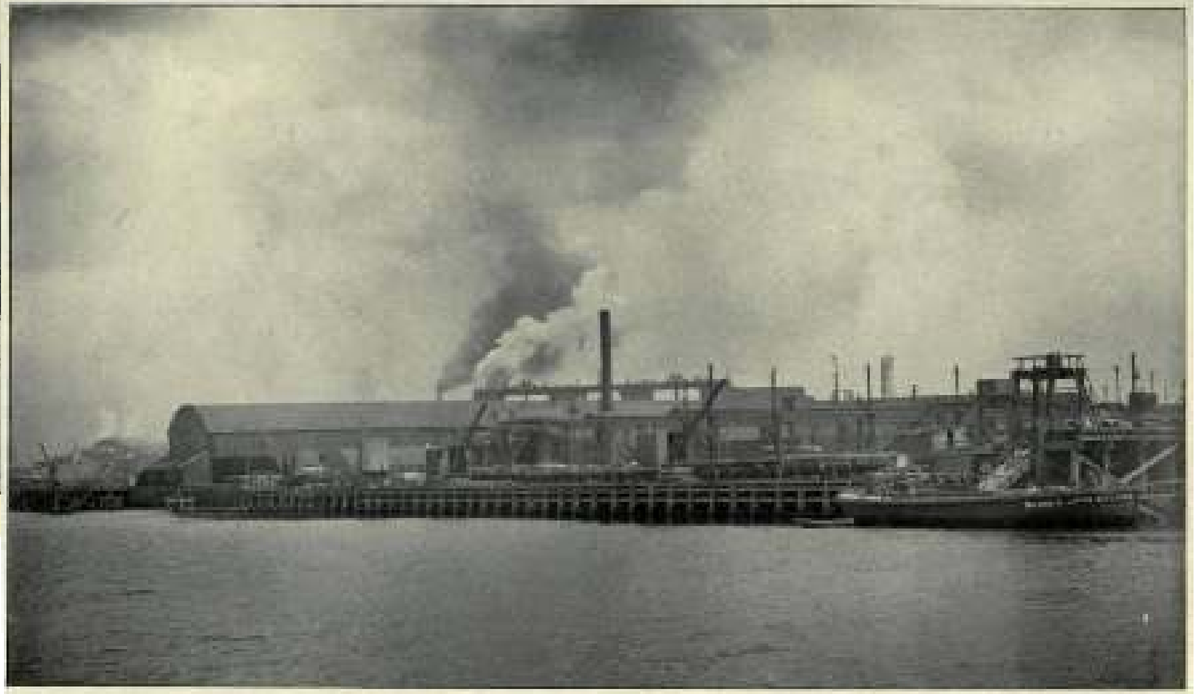
The Loading of Trailing Suction Hopper Dredgers



1906



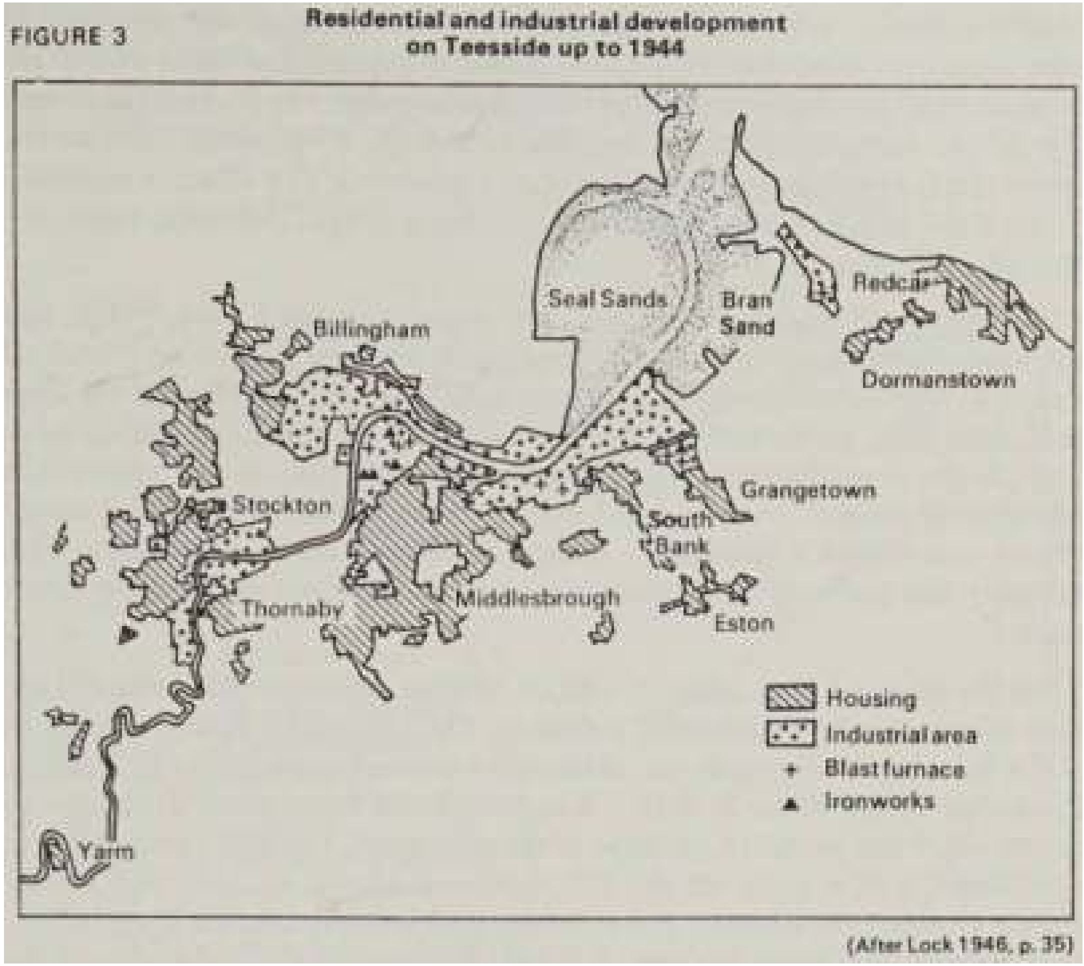
IRON WORKS ON SOUTH BANK OF THE TEES.



STEEL WORKS ON SOUTH BANK OF THE TEES.

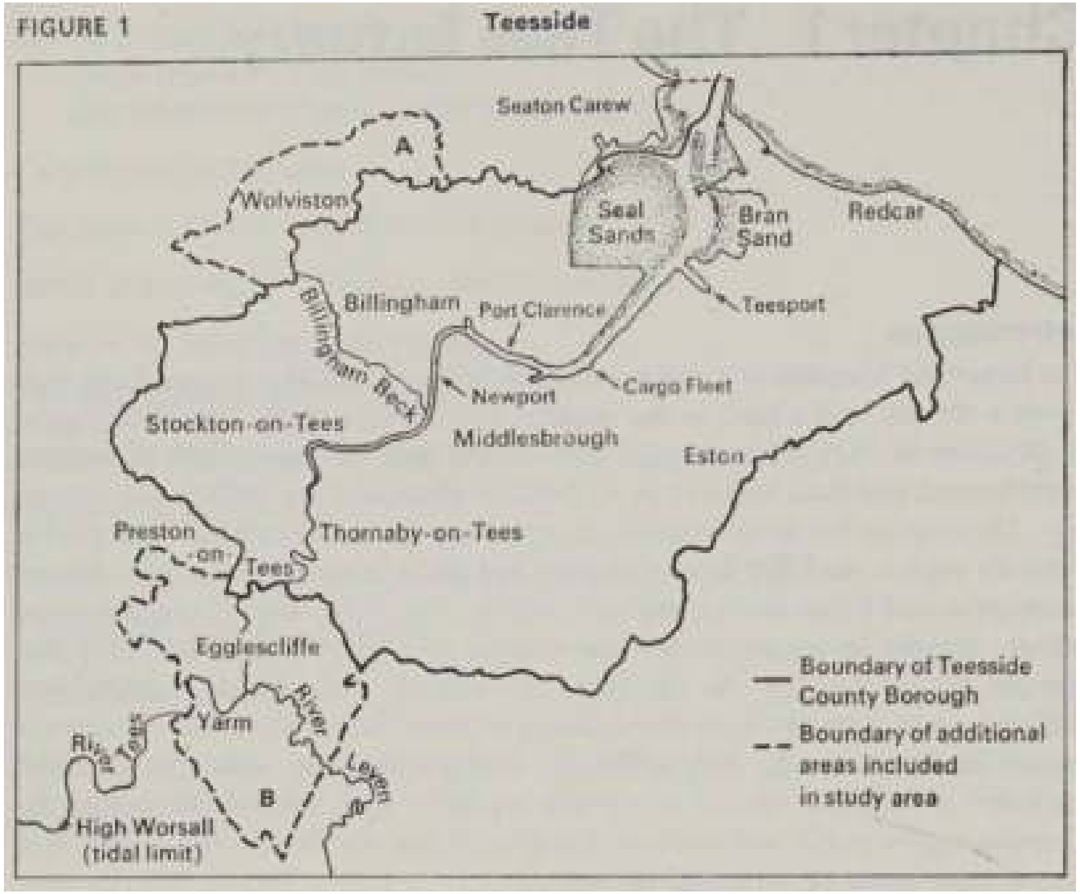
Ports of the River Tees
The Tees Conservancy Commissioners, 1906
https://archive.org/details/portsofrivertees00grearich/page/n5/mode/2up

The Lower River Tees – 1944



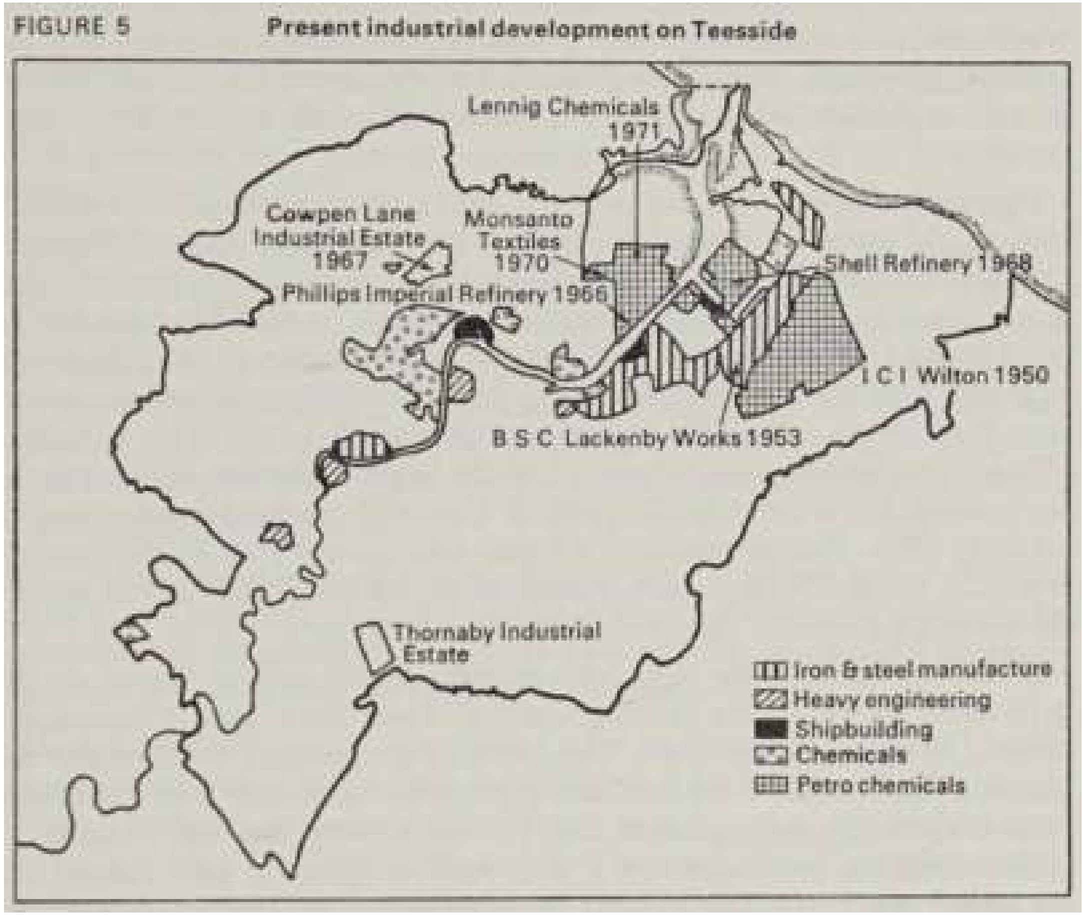
Pollution in four industrialised estuaries – studies in relation to changes in population density and industrial development by Elizabeth Porter, Four case studies undertaken for The Royal Commission on Environmental Pollution – London Her Majesty's Stationery Office 1973
https://archive.org/details/pollutioninfouri0000port/page/n3/mode/2up

The Lower River Tees - 1971



Pollution in four industrialised estuaries – studies in relation to changes in population density and industrial development by Elizabeth Porter, Four case studies undertaken for The Royal Commission on Environmental Pollution – London Her Majesty's Stationery Office 1973
https://archive.org/details/pollutioninfouri0000port/page/n3/mode/2up

The Lower River Tees - 1971



Pollution in four industrialised estuaries – studies in relation to changes in population density and industrial development by Elizabeth Porter, Four case studies undertaken for The Royal Commission on Environmental Pollution – London Her Majesty's Stationery Office 1973
https://archive.org/details/pollutioninfouri0000port/page/n3/mode/2up

Changes to Dredging the Tees

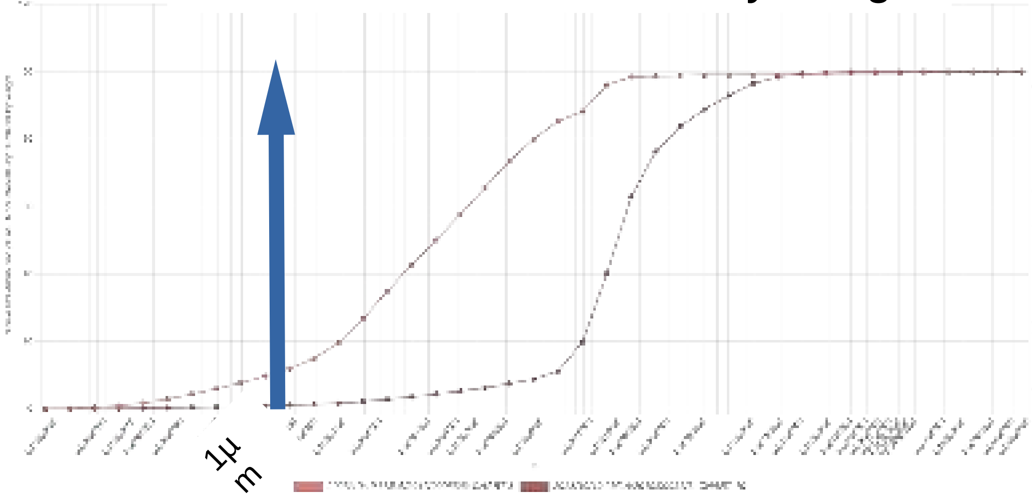
- All dredging must be carried out with zero overflow from hoppers / barges
- Hoppers will only be filled to << 100% (40%?)
- Implications
  - Improvements to River Tees marine environment
  - Double number of dredger trips to disposal site?
  - Halve dredging capacity?

UK Wide - MMO Licensing

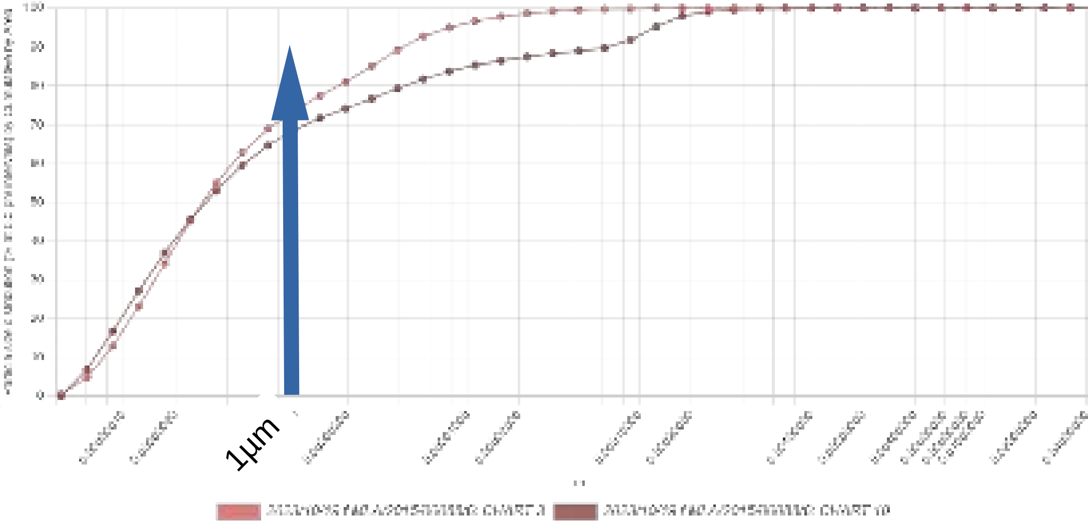
- Must take account of sediment particle size distribution
- Must calculate or measure small particle contamination concentrations
- If small particle contamination concentrations exceed Action Levels / Gorham-Test / toxicity levels then:
  - Any dredging must operate with no overflow
  - Any dredging must actively contain all resuspended material close to dredge site and remediate following dredging

Volume ≠ Area

Particle Size Distribution by Weight

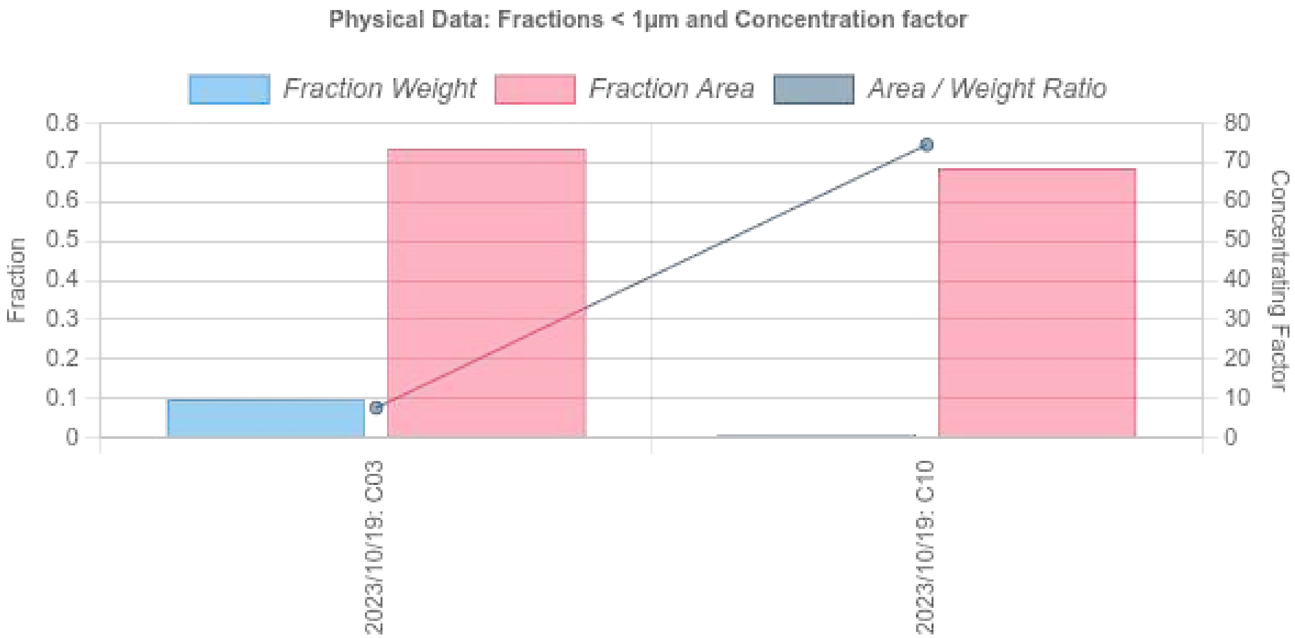


Particle Size Distribution by Area



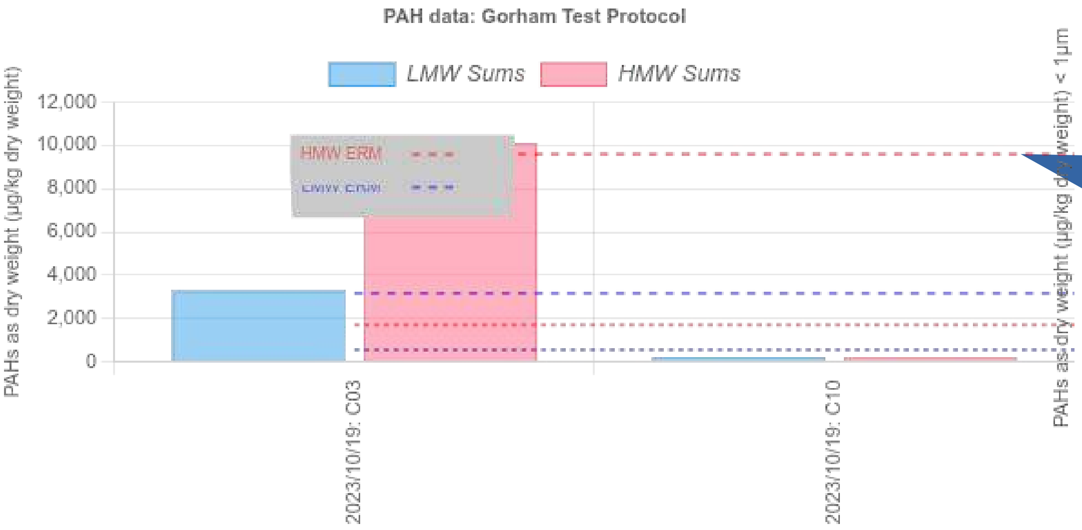
Many Contaminants Adsorbed So Area not Weight Controls Level

- Small particles
  - Large area
  - Contamination 10 x & 70 x average



Average OK – Small Particles Toxic

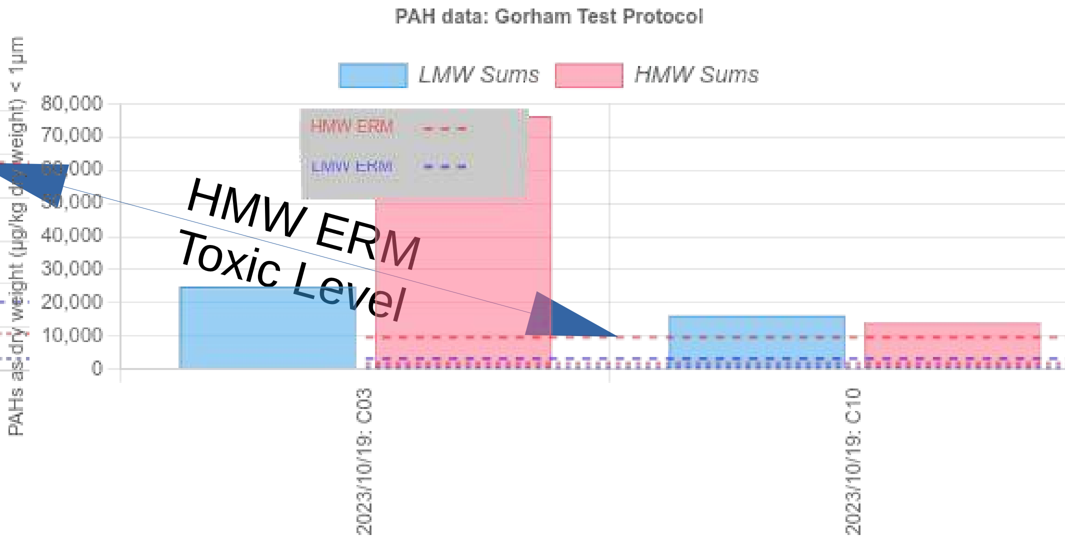
1 sample toxic



Toxic

Non Toxic

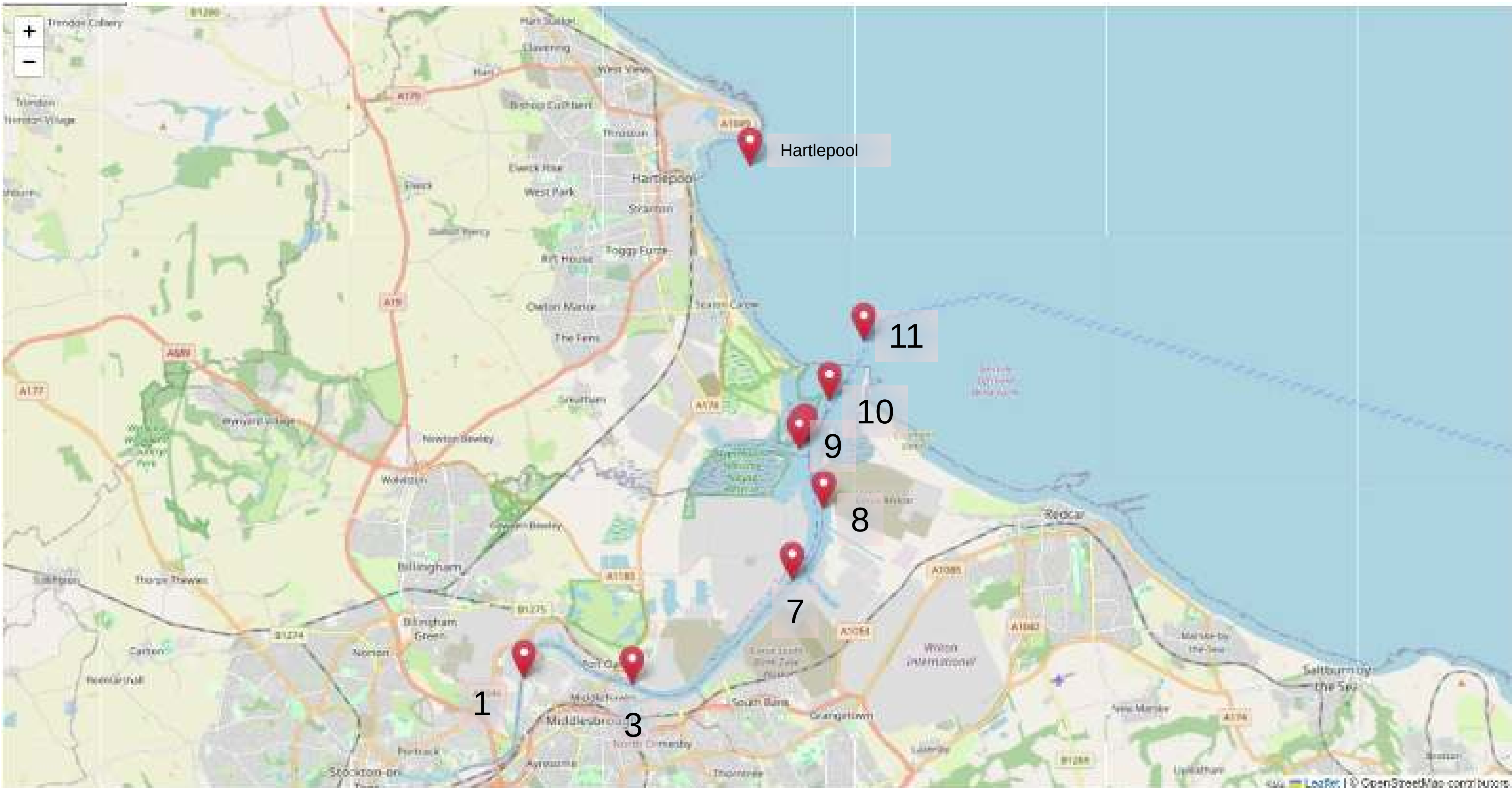
<1µm particle all samples toxic

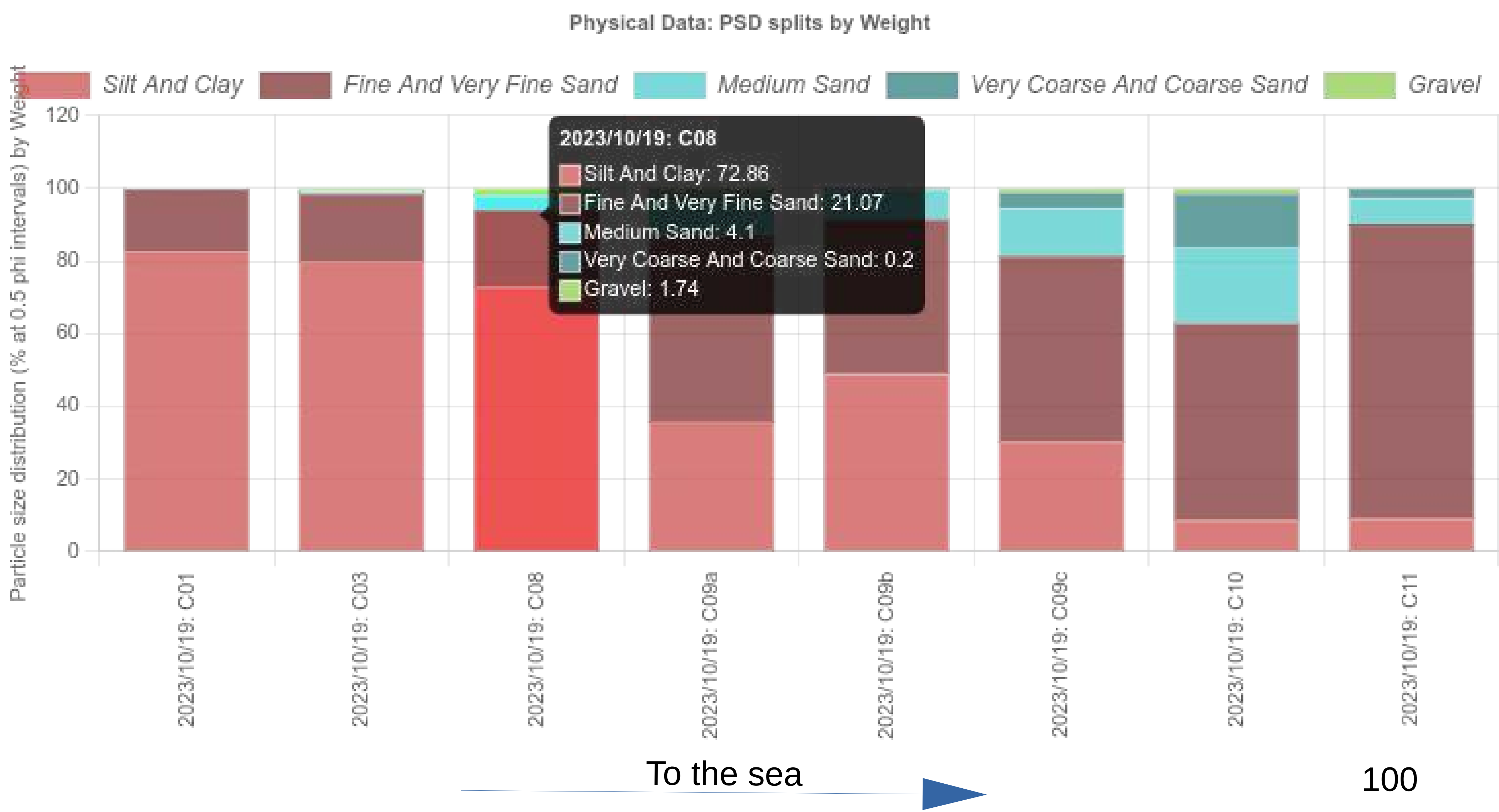


Toxic

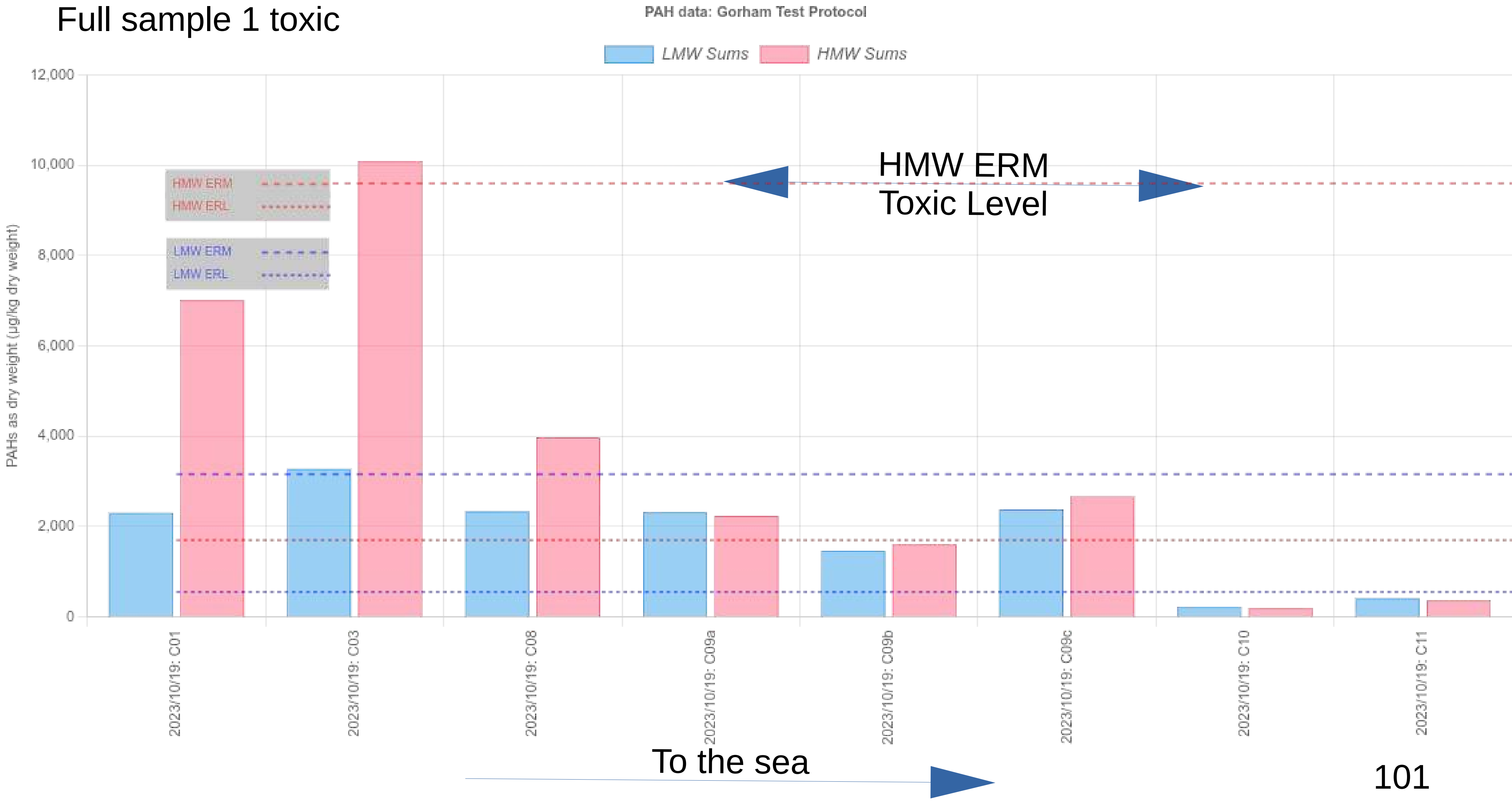
Toxic

Samples Taken in October 2023 as Requirement MLA/20215/00088 - River Tees Maintenance Dredging Licence

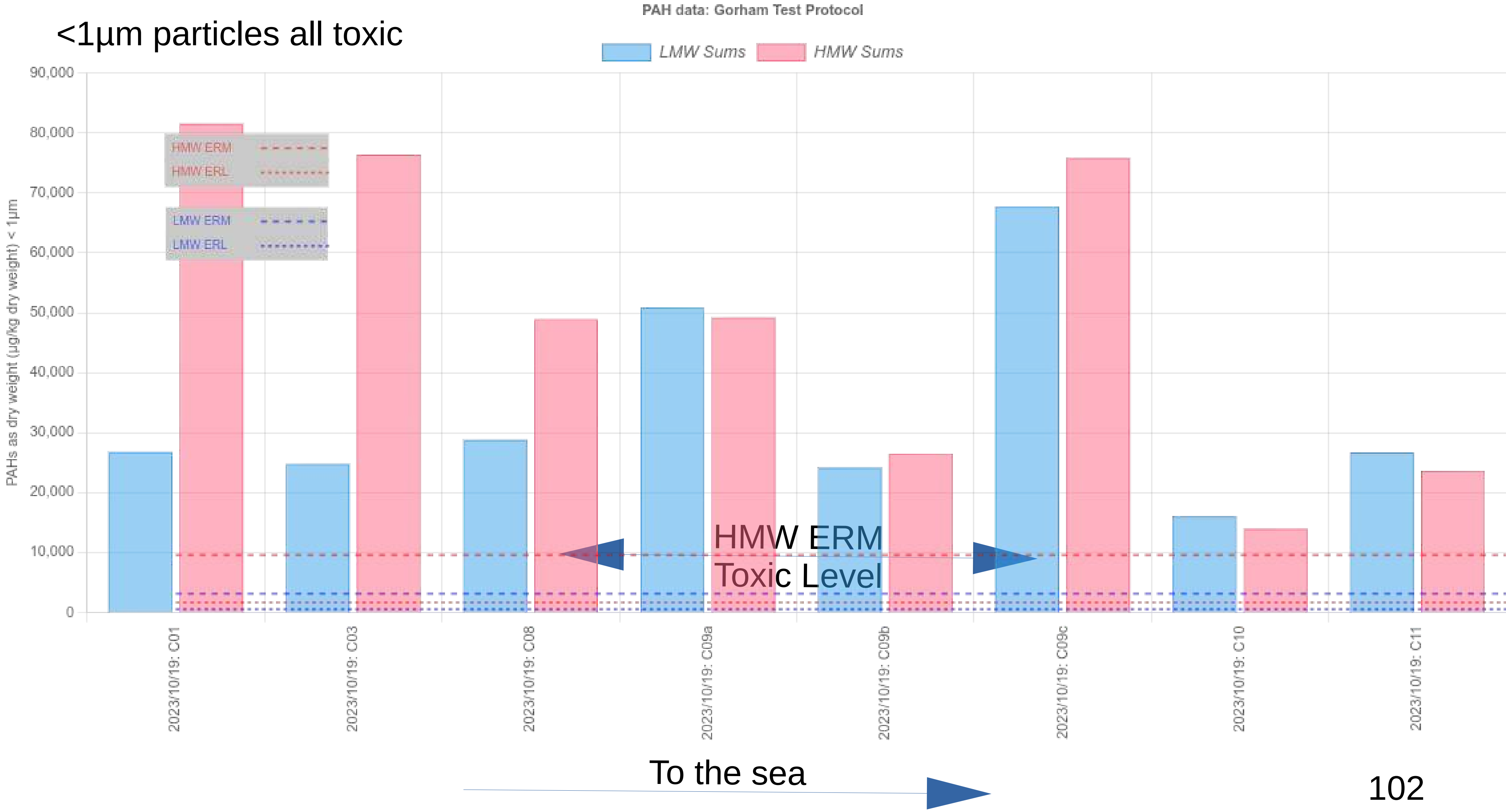



Physical Data: PSD splits by Weight
Silt And Clay
Fine And Very Fine Sand
Medium Sand
Very Coarse And Coarse Sand
Gravel
Particle size distribution (% at 0.5 phi intervals) by Weight
120
100
80
60
40
20
0
2023/10/19: C08
Silt And Clay: 72.86
Fine And Very Fine Sand: 21.07
Medium Sand: 4.1
Very Coarse And Coarse Sand: 0.2
Gravel: 1.74
2023/10/19: C01
2023/10/19: C03
2023/10/19: C08
2023/10/19: C09a
2023/10/19: C09b
2023/10/19: C09c
2023/10/19: C10
2023/10/19: C11
To the sea

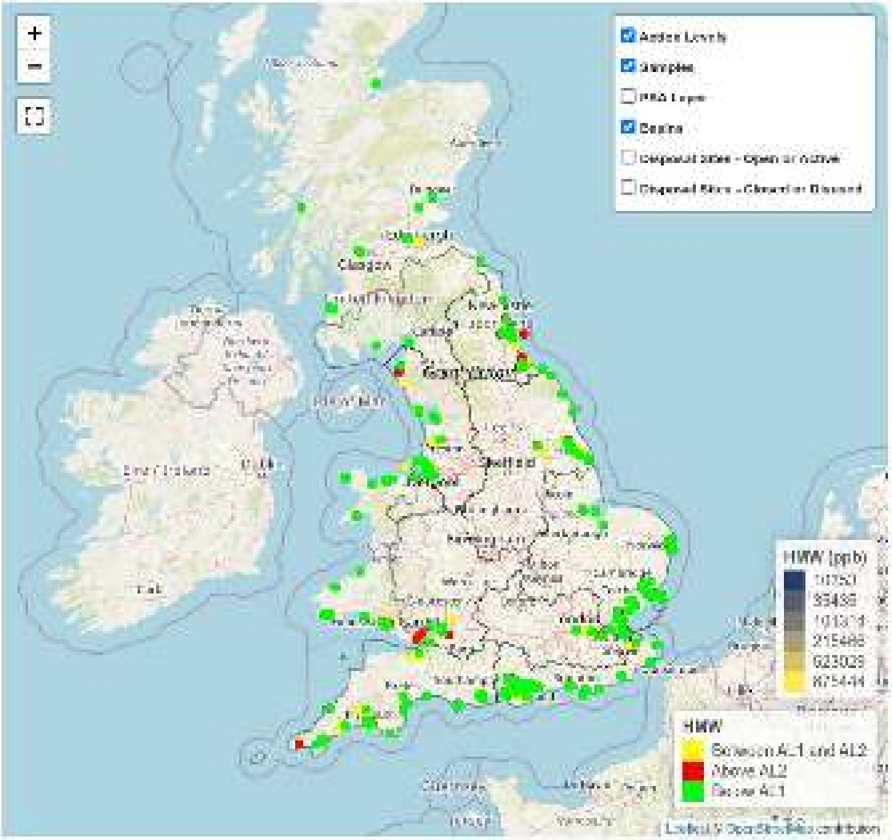
Full sample 1 toxic



<1µm particles all toxic

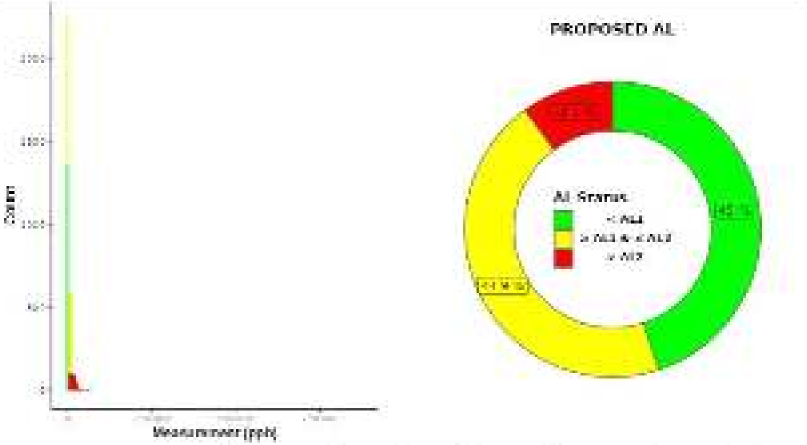


Proposed ALs Gorham-Test - HMW



Results | Data Table | Data Input | PSA Data | Data Sources

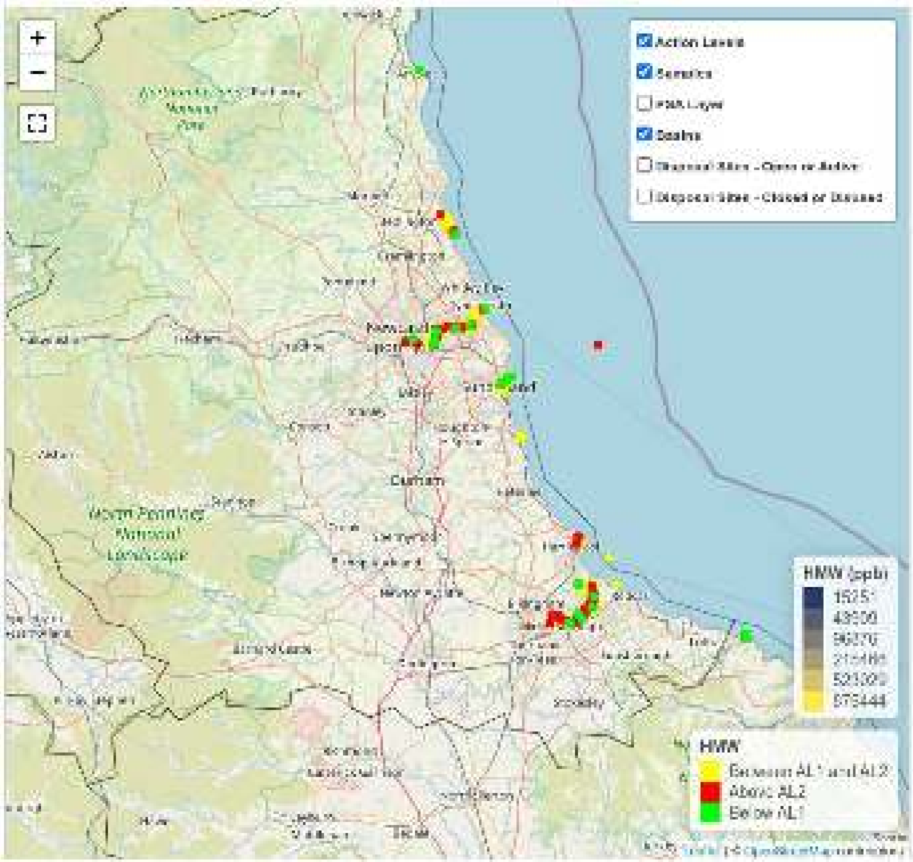
Contaminant	Proposed AL1	Proposed AL2
HMW - sum of Fluoranthene, Pyrene, Benz[a]anthracene, Chrysene, Benzo[a]pyrene, Dibenz[a,h]anthracene	1700ppb	9600ppb

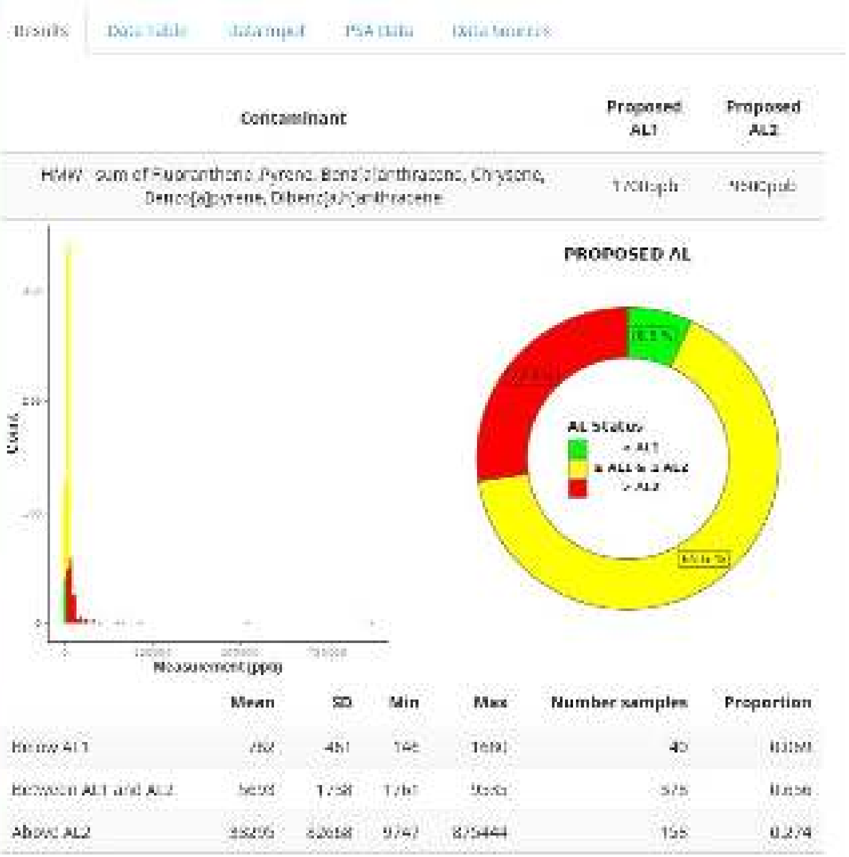


	Mean	SD	Min	Max	Number samples	Proportion
Below AL1	615	402	1	1692	1350	0.45
Between AL1 and AL2	4083	2023	1703	9575	1336	0.449
Above AL2	25547	59958	9730	875444	305	0.10[illegible]

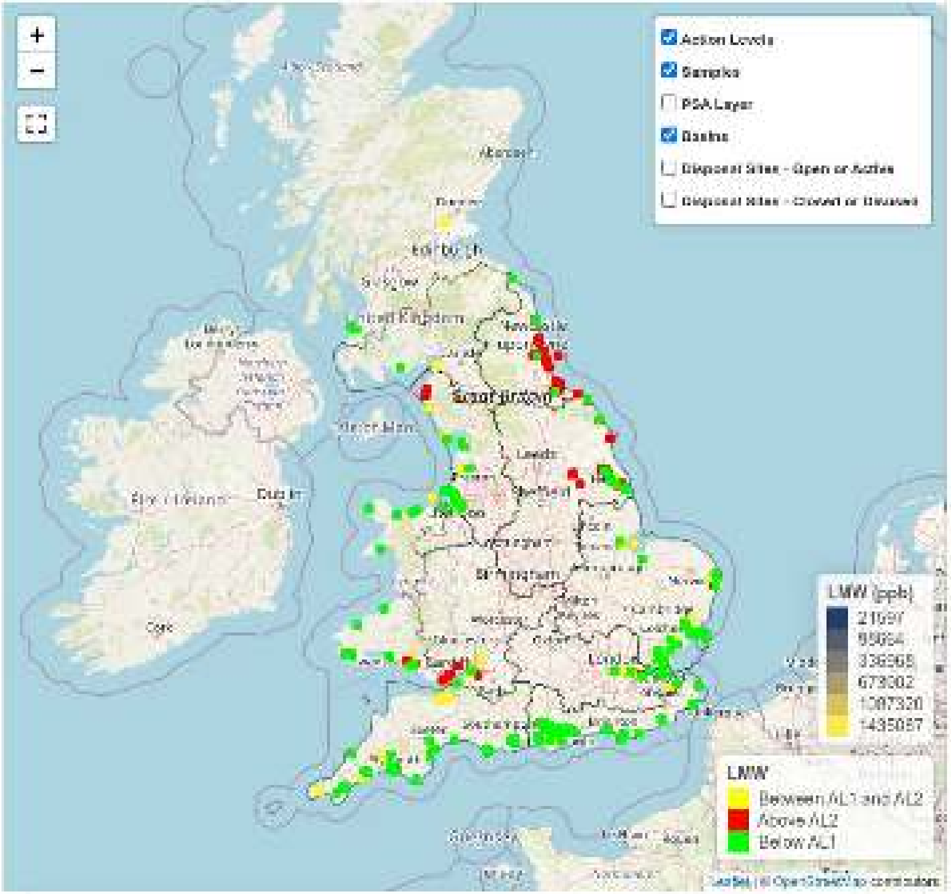
CEFAS Action level tools includes Marine Licence data from 1998 - 2019
https://rconnect.cefas.co.uk/content/692515e9-65a5-41d8-9117-79a9798a0519

Proposed ALs Gorham-Test - HMW



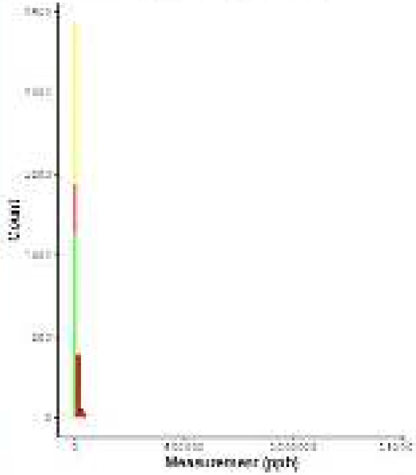


Proposed ALs Gorham-Test - LMW



Results | Data Table | Data Input | PSA Data | Data Sources

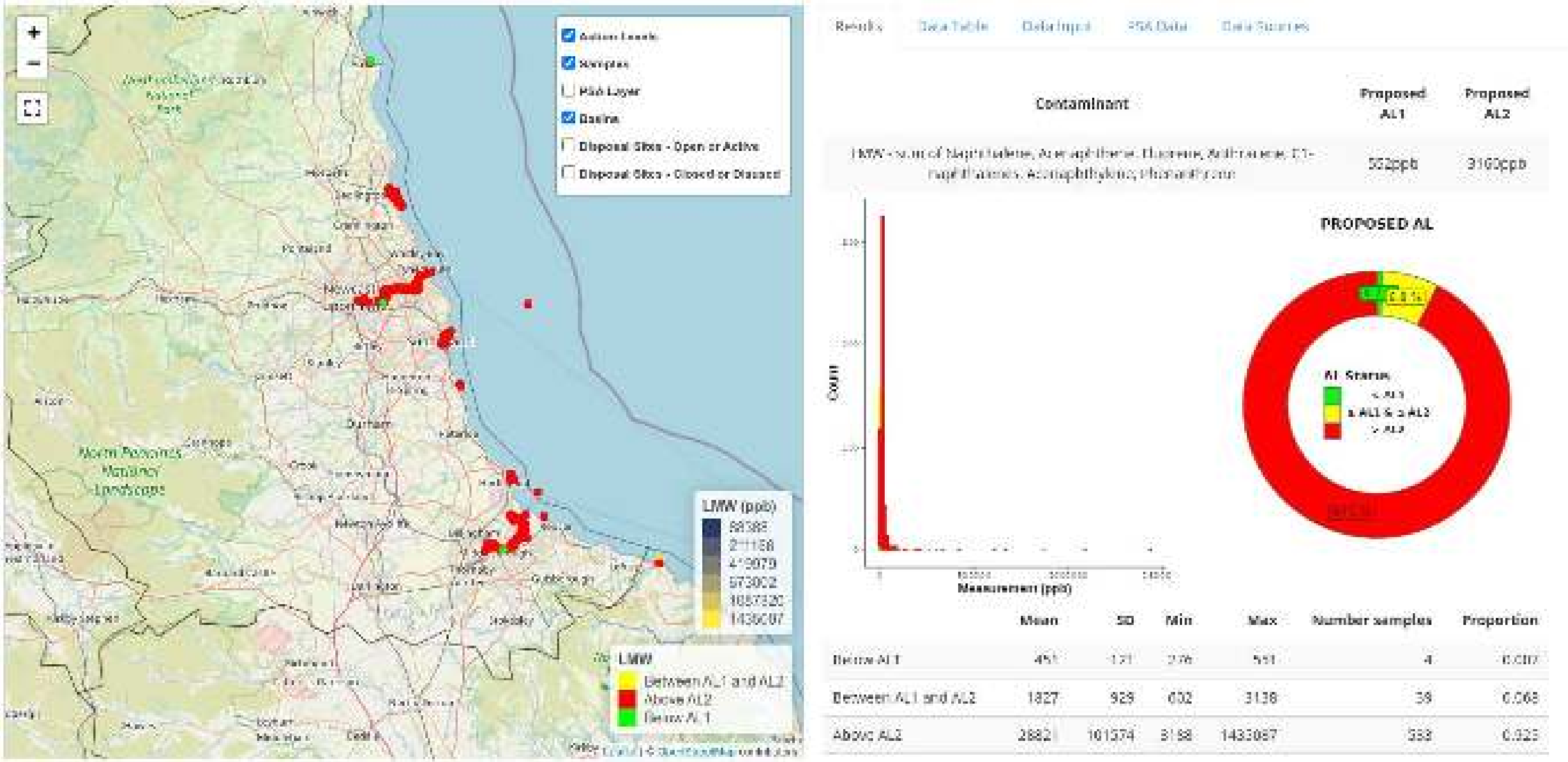
Contaminant	Proposed AL1	Proposed AL2
LMW - sum of Naphthalene, Acenaphthene, Fluorene, Anthracene, C1-naphthalenes, Acenaphthylene, Phenanthrene	[illegible]	[illegible]



	Mean	SD	Min	Max	Number samples	Proportion
Below AL1	198	161	1	551	1141	[illegible]
Between AL1 and AL2	1438	723	553	3159	[illegible]	[illegible]
Above AL2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CEFAS Action level tools includes Marine Licence data from 1998 - 2019
https://rconnect.cefas.co.uk/content/692515e9-65a5-41d8-9117-79a9798a0519

Proposed ALs Gorham-Test - LMW



CEFAS Action level tools includes Marine Licence data from 1998 - 2019
https://rconnect.cefas.co.uk/content/692515e9-65a5-41d8-9117-79a9798a0519

North East and Planning

- Public information gives a picture of what is going into our marine environment
- The North East is poorly served by current dredging regulation:
  - Too little measuring
  - If its already bad it can stay bad
- Assumptions
  - Infinite dilution
  - Instant dilution
  - Single component toxicity
- Regulation both out of date and not fit for purpose
- Easy 1 step review of action levels
- New approach needed