



A595 Moresby Hall Embankment

Amey —

Life's better connected



Ashley Turner

Technical Director – Amey

Geotechnical Lead



David Hamilton

Lead Senior Engineer – Amey

Drainage Lead & PM Team



Daniel Parkhill

Assistant Engineer – Amey

Drainage Designer

- Scheme Location
- Scheme Need
- Key Constraints
- Drainage Design
- Embankment Condition
- Embankment Remedial Optioneering
- Earthworks Solution



Scheme Location and Overview

- County Cumbria, Northwest England
- A595 - Main road around the lake district
- Towns & villages including Whitehaven, Egremont and Distington all adjacent to the A595
- Single carriageway Class A Road.
- No Class A suitable diversion routes.
- Sellafield Nuclear Power Station is serviced by the A595.



Why was the scheme needed?

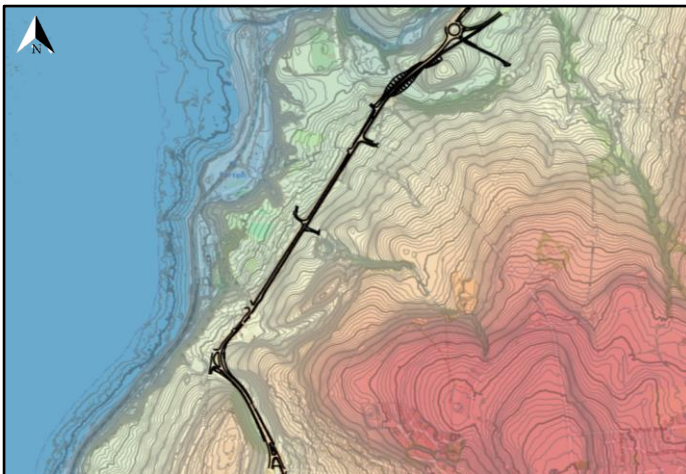
Amey

- Failing embankment
- Collapsed culverts crossing carriageway
- Regular reports of heavy flooding of carriageway
- Poor carriageway condition including substandard construction depths
- Substandard footway widths and cycle connectivity
- Accident hotspot at roundabout



What were the constraints?

- Steep Topography
- Existing gas main within failing embankment
- Existing services connecting to Isle of Man within failing embankment
- Proximity to Sellafield
- Limited closure availability
- Tight design & construction programme



- Initial Optioneering completed in 2014 by third party focused on permanent closure and permanent diversion of A595
- Ruled out due to excessive costs (£20m), lands and environmental/alignment issues
- Amey solution utilised the existing carriageway infrastructure, 2km of drainage refurbishments and carriageway resurfacing, sustainable urban drainage systems and other works for similar cost (£21m).



Scheme Extents



Phasing of Works – Phase 1



Phasing of Works – Phase 2



Phasing of Works – Phase 3



Phasing of Works – Phase 4



Phasing of Works – Phase 5



Phasing of Works – Phase 6



Phasing of Works – Phase 7



Overview - Drainage Design

- Causes of existing flooding and need for upgrade
- Scheme drainage design overview and phasing
- Carriageway drainage design
- Interception of overland flow
- Attenuation pond design



Causes of existing flooding/need for upgrade

- Existing pipe network undersized and not to standard
- Pipe network in poor condition and existing carriageway culvert crossing collapsed
- Collection system not to standard
- Overland flow from neighbouring fields
- Chamber covers in existing carriageway (sub-standard)





Drainage Design Overview and Phasing Amey

- Phase 1 (Yellow) – Tunnelling of pond outfall through embankment.
- Phase 3 (Pink) – Carriageway drainage pipe and collection system from Pelican Garage to the pond.
- Phase 4 (Blue) – Carriageway drainage pipe and collection system from Howgate Roundabout to the pond.
- Phase 6 (Green) – Attenuation pond, inlet and outlet structures.
- Phase 7 (Red) – Overland flow interception.

Carriageway Drainage Design

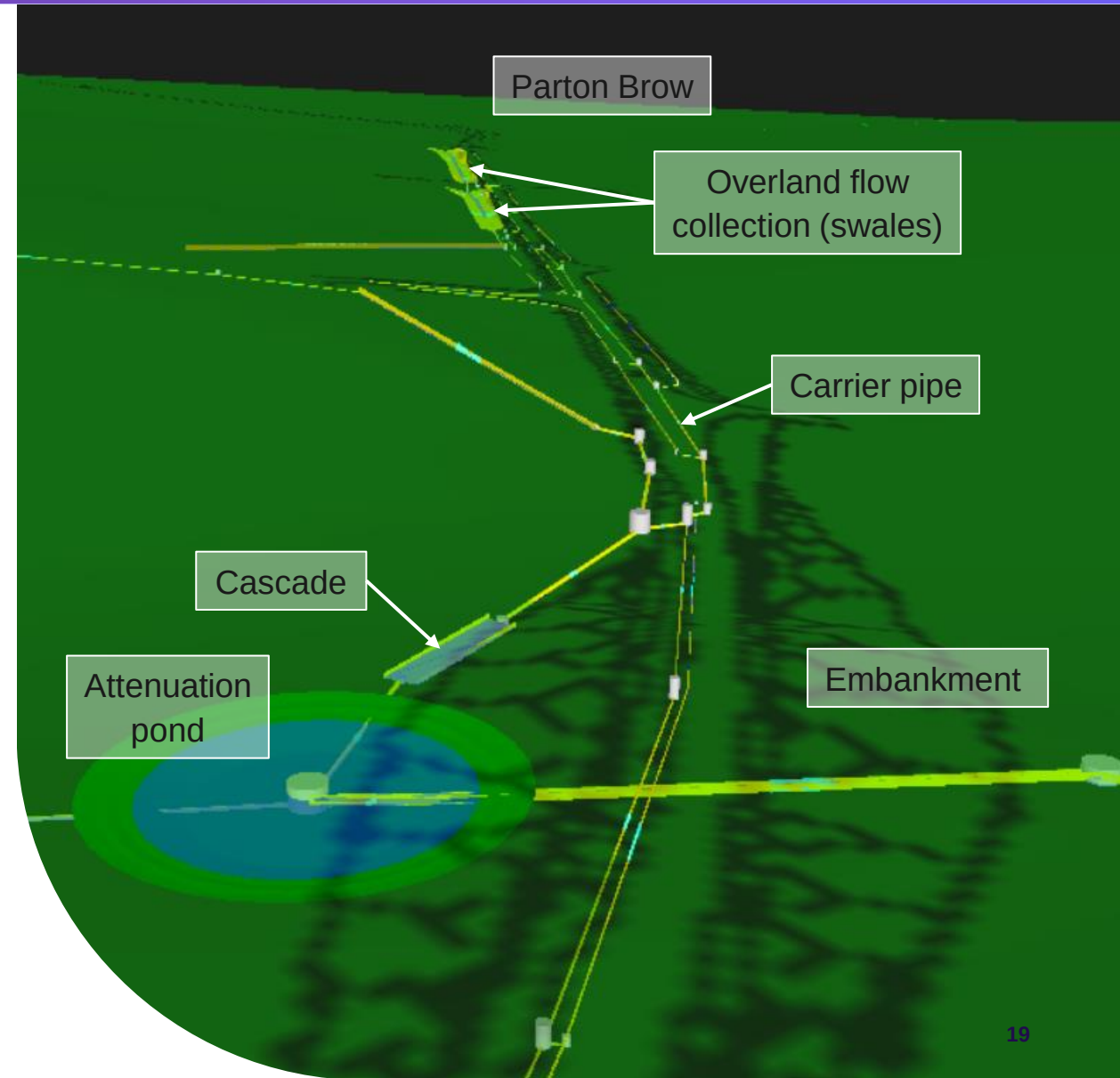
National Highway's assets must be designed to Design Manual for Roads and Bridges (DMRB) standard.

- **CG 501** - Design of Highway Drainage Systems

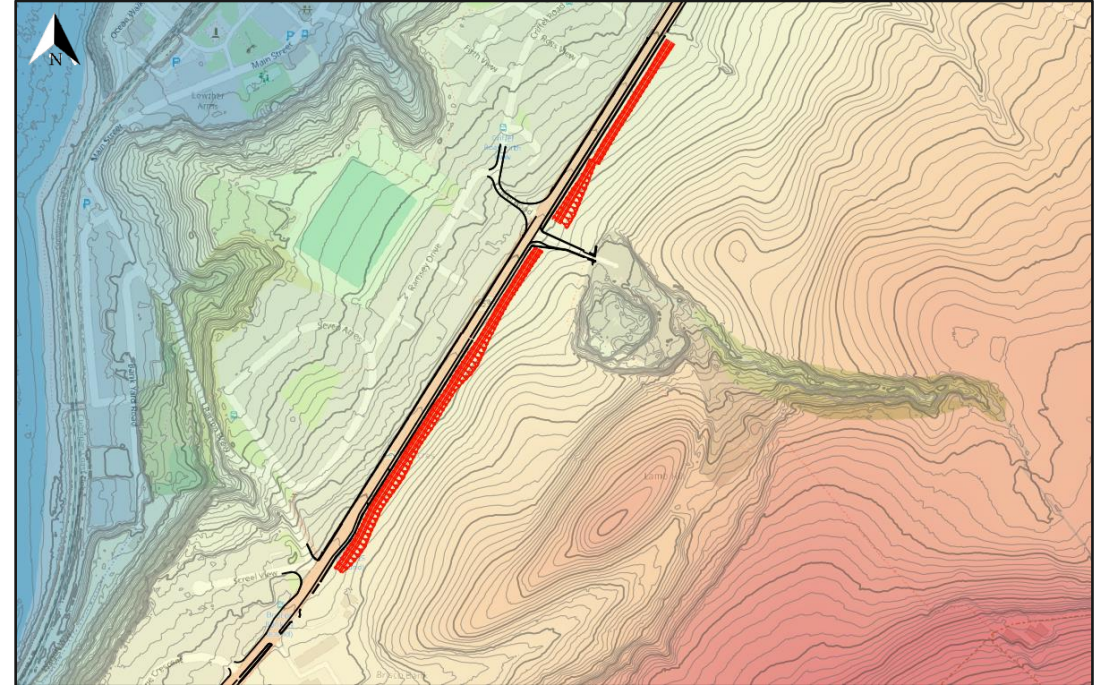
- Drainage network shall not surcharge during a 1-year return period storm event
- Drainage network shall not flood during a 5-year return period storm event

- **CD 534** - Chamber tops and gully tops for road drainage and services

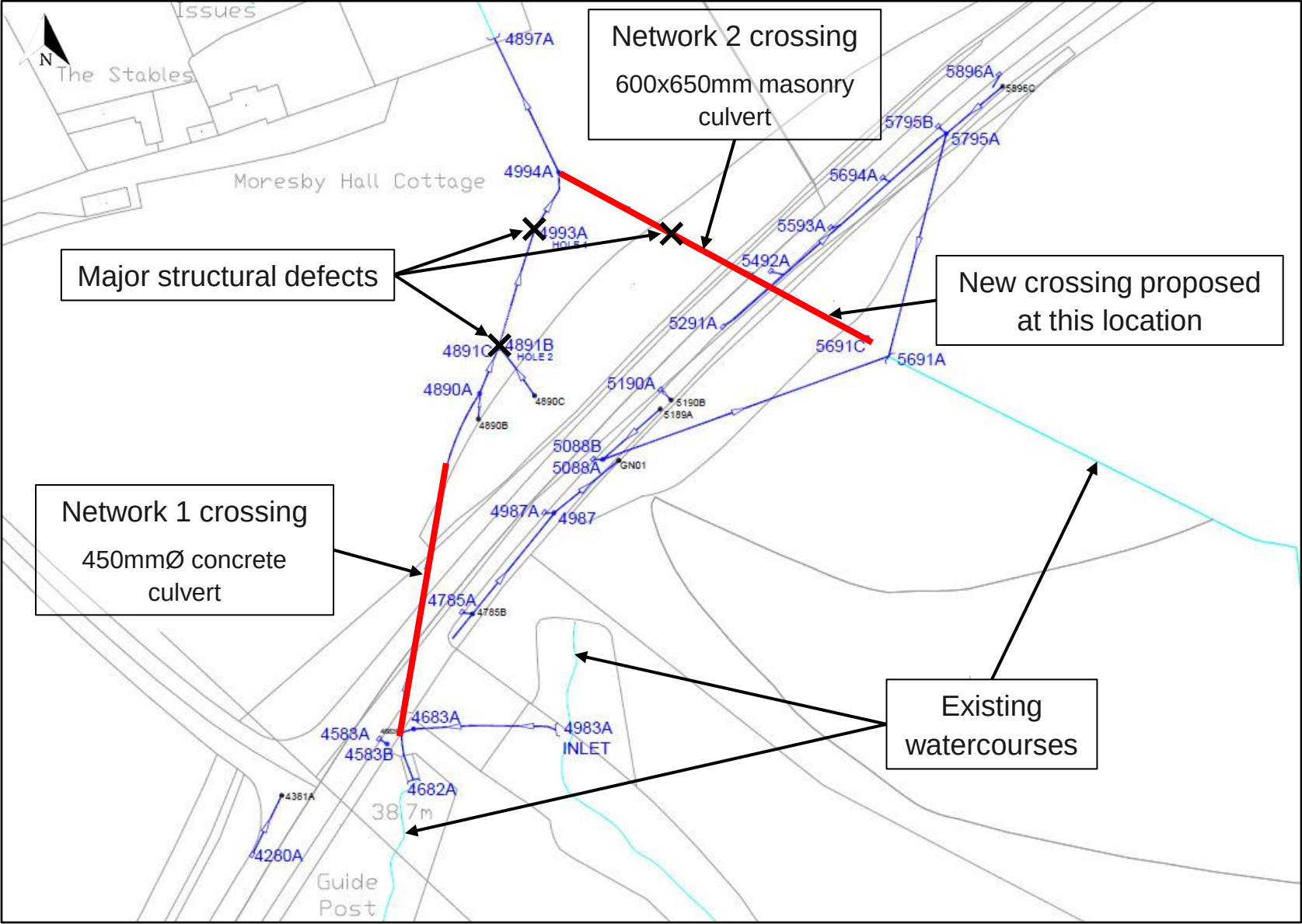
- New chamber tops shall not be installed in carriageways
- Existing chamber tops positioned within the carriageway shall be removed



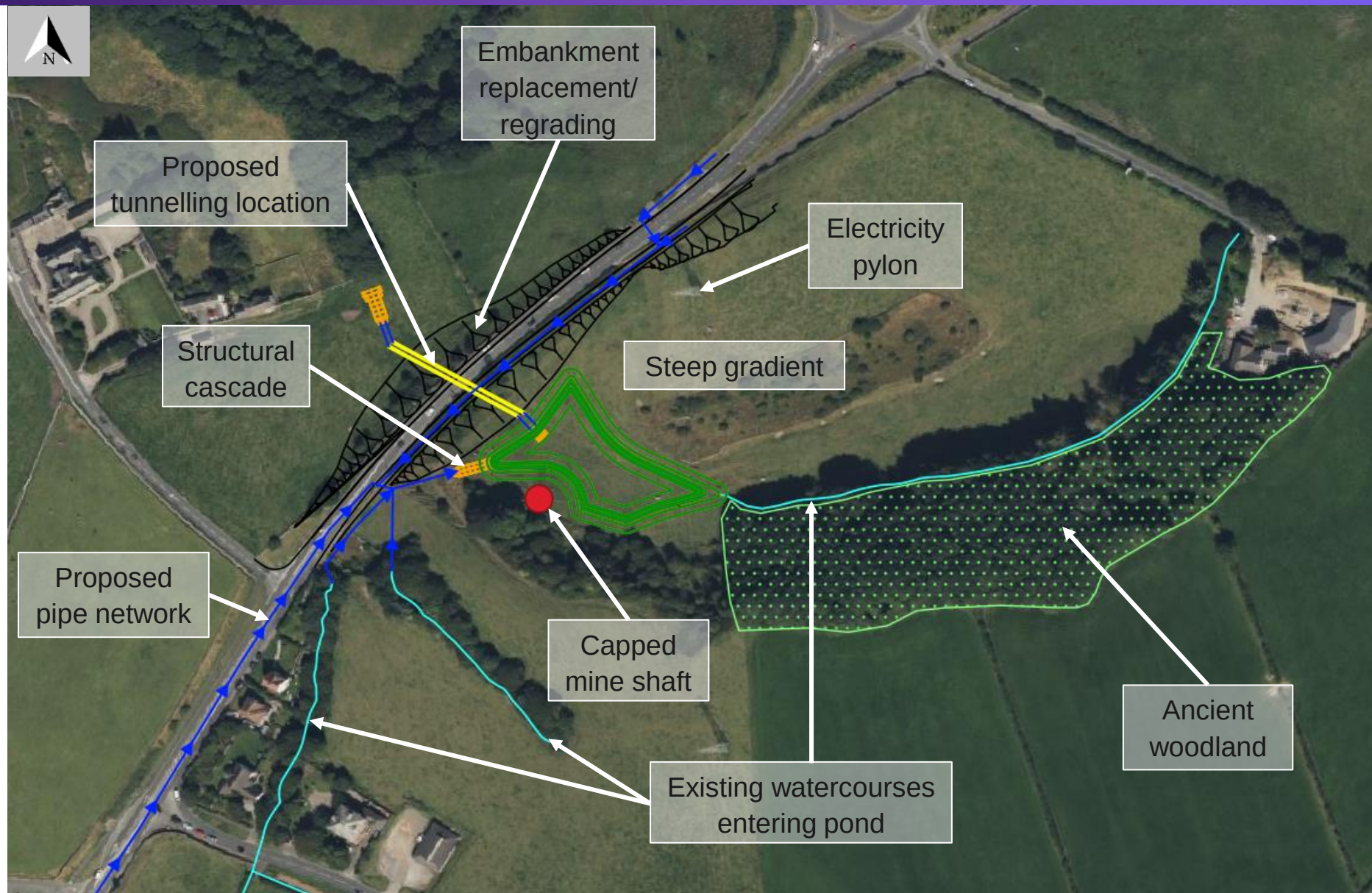
- Overland flow from steep neighbouring fields contributing to carriageway flooding
- Swales intercept overland flow and convey the flow into the drainage system and ultimately the pond
- Excess material from site was utilised in the swale construction



Attenuation Pond - Existing Drainage Layout at Embankment

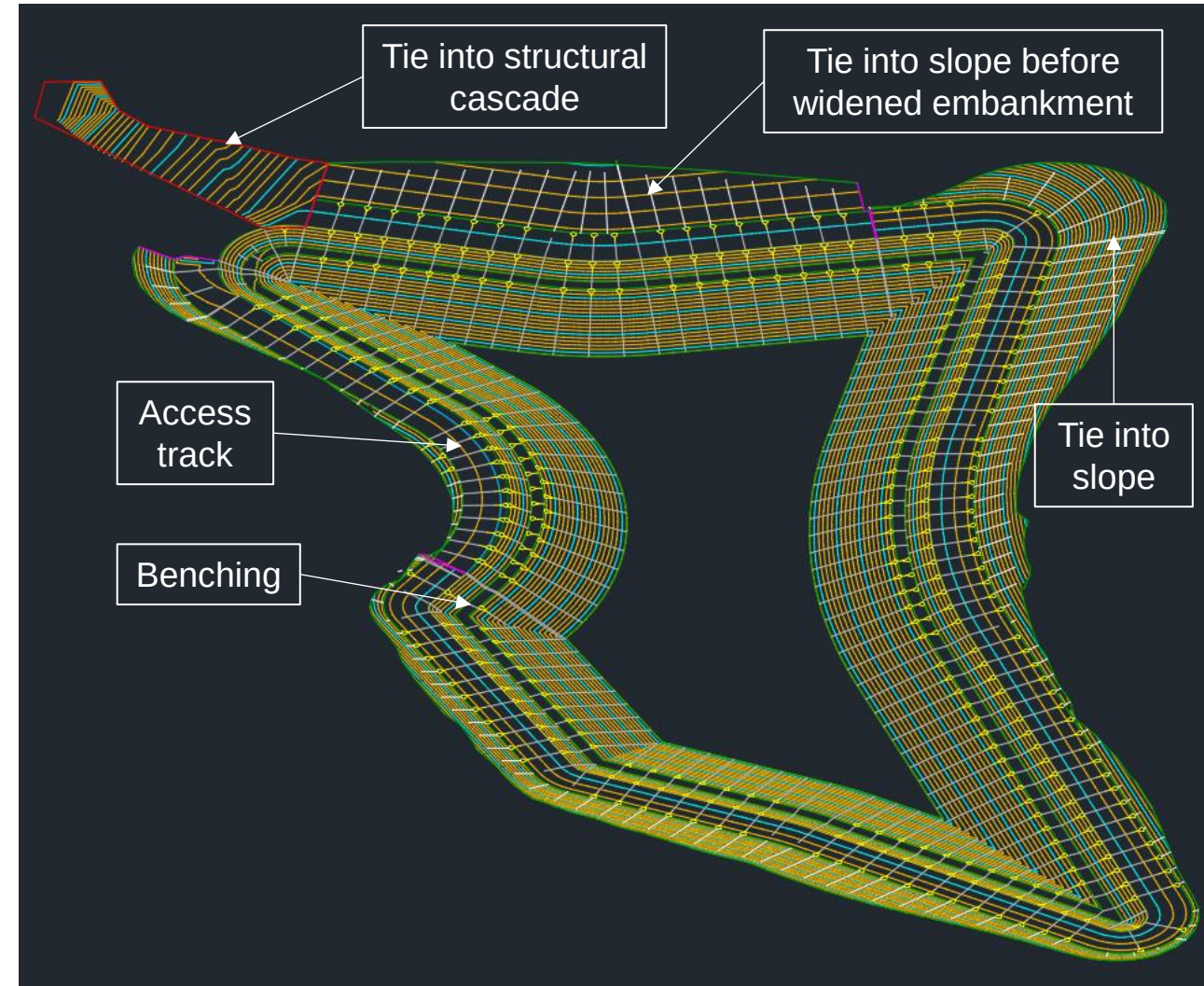
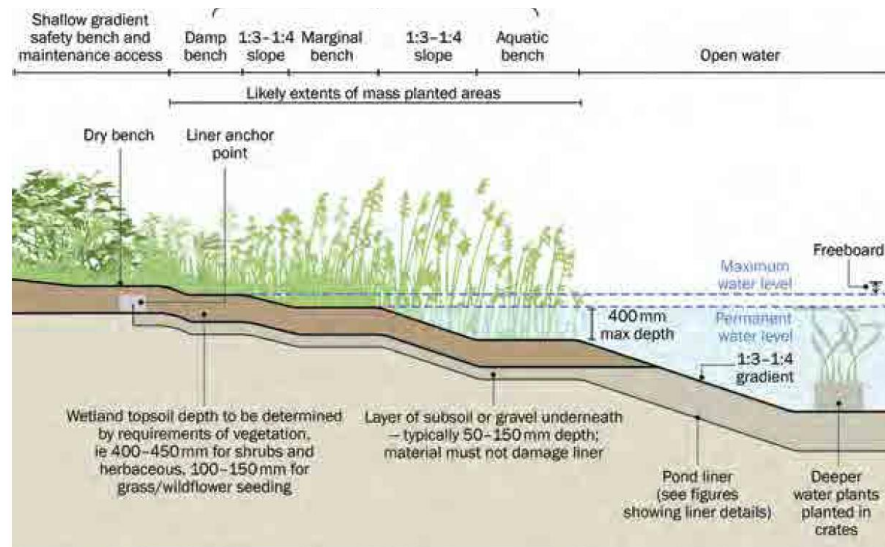


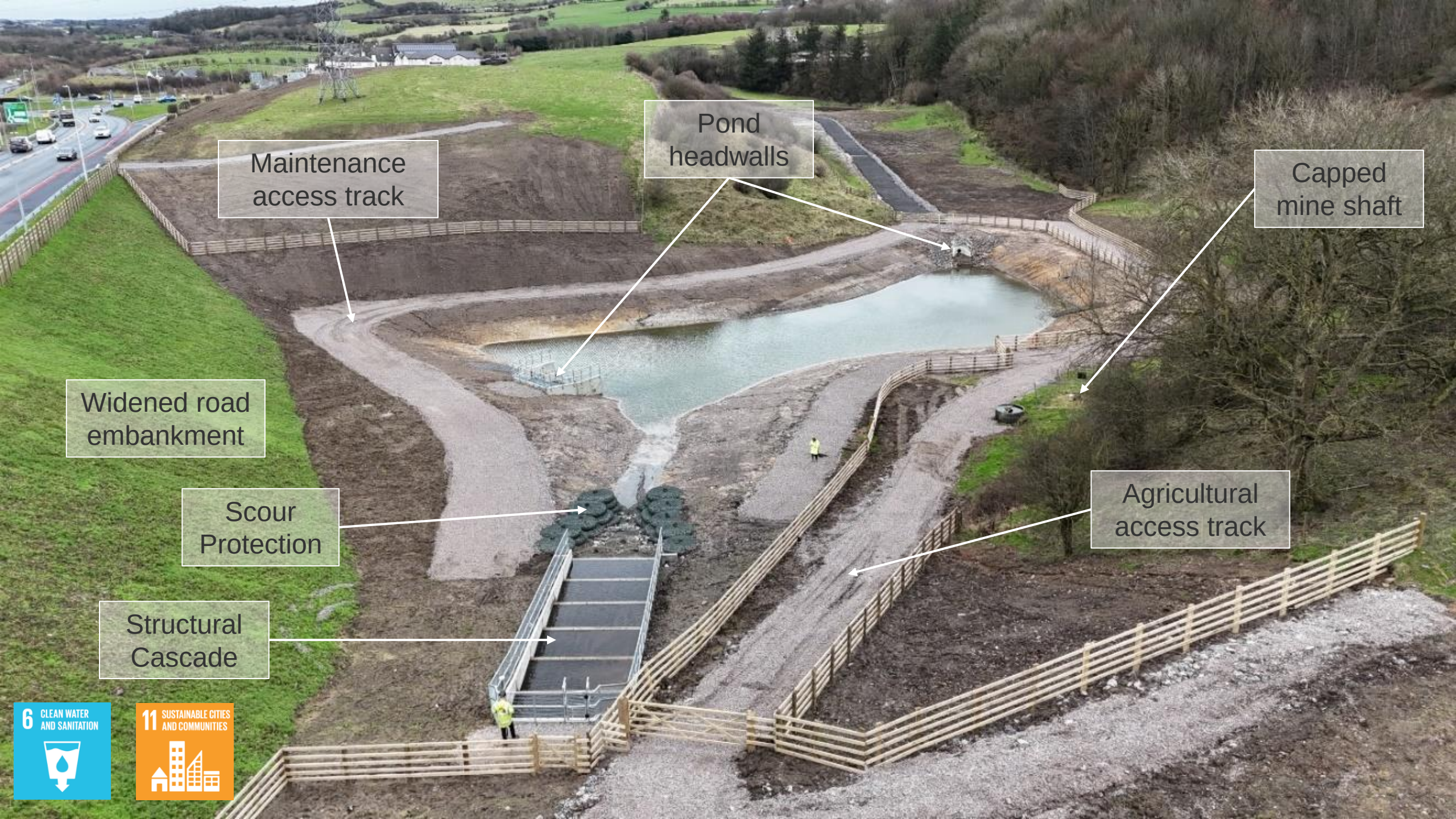
Attenuation Pond - Location and Constraints



Standards & Guidance

- CD 532 - Design of Vegetated Drainage Systems
- CIRIA C753 - The Sustainable Drainage Systems (SuDS) Manual





Maintenance
access track

Pond
headwalls

Capped
mine shaft

Widened road
embankment

Scour
Protection

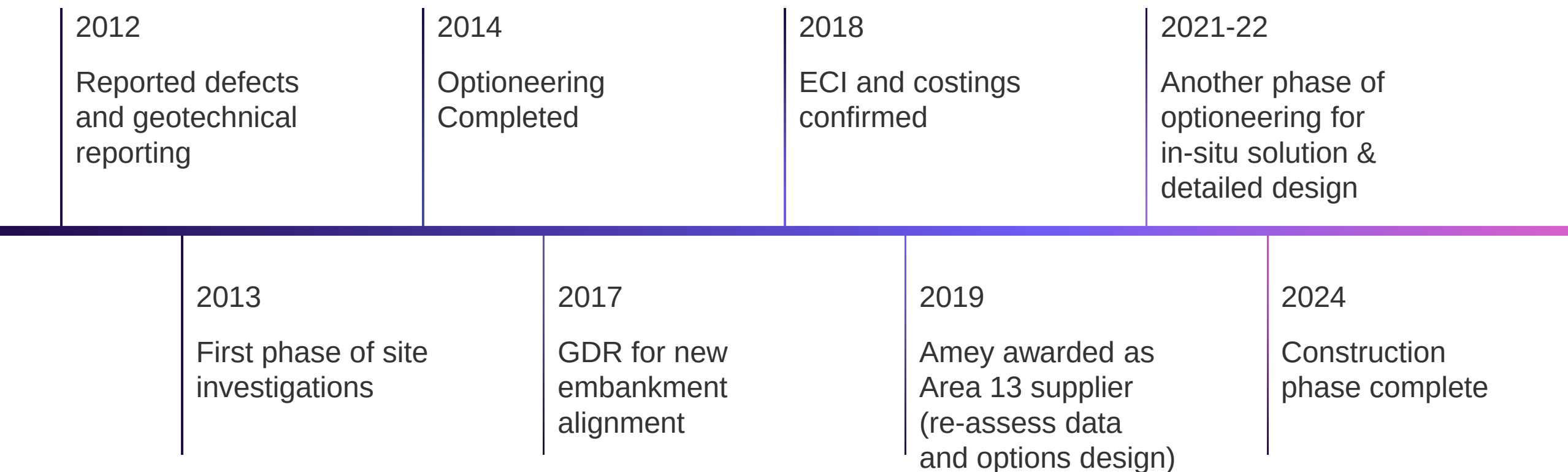
Structural
Cascade

Agricultural
access track



Embankment Remedial Works Timeline (2012 – 2024)

Amey



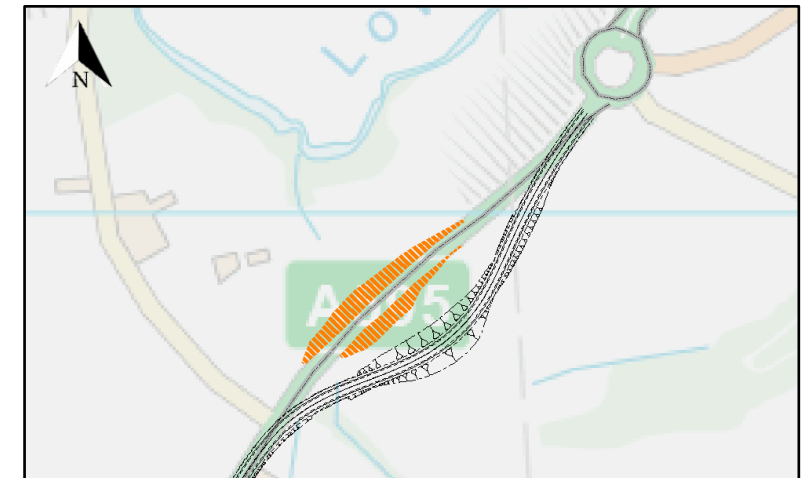
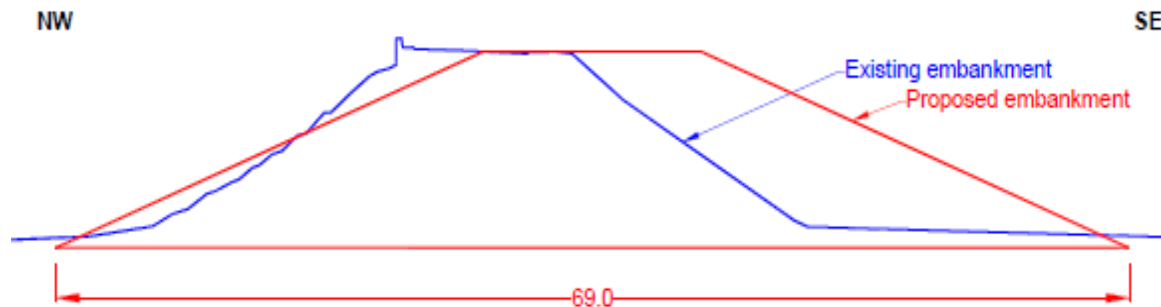
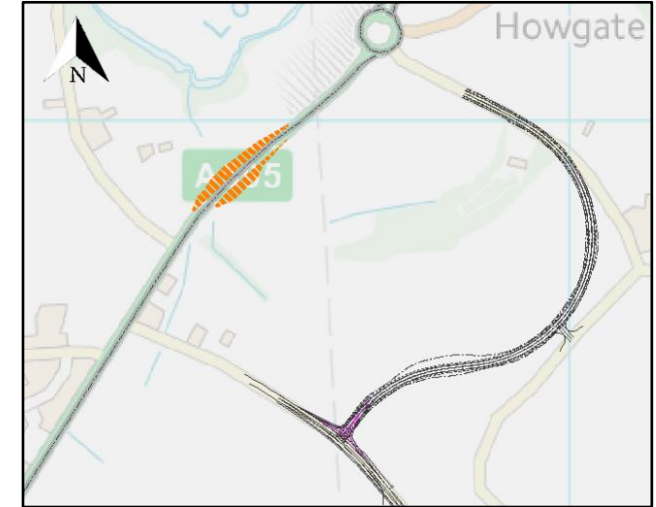
Embankment Defects

- Pavement cracking and suspected subgrade differential settlement
- Stone wall (retaining in places) along the crest of the north-western slope had partially and fully collapse in multiple sections and shows vertical distortion
- Slope terracing, superficial slips and backscarps have been recorded within the embankment



Embankment Remedial Works – Pre-existing Condition & Use

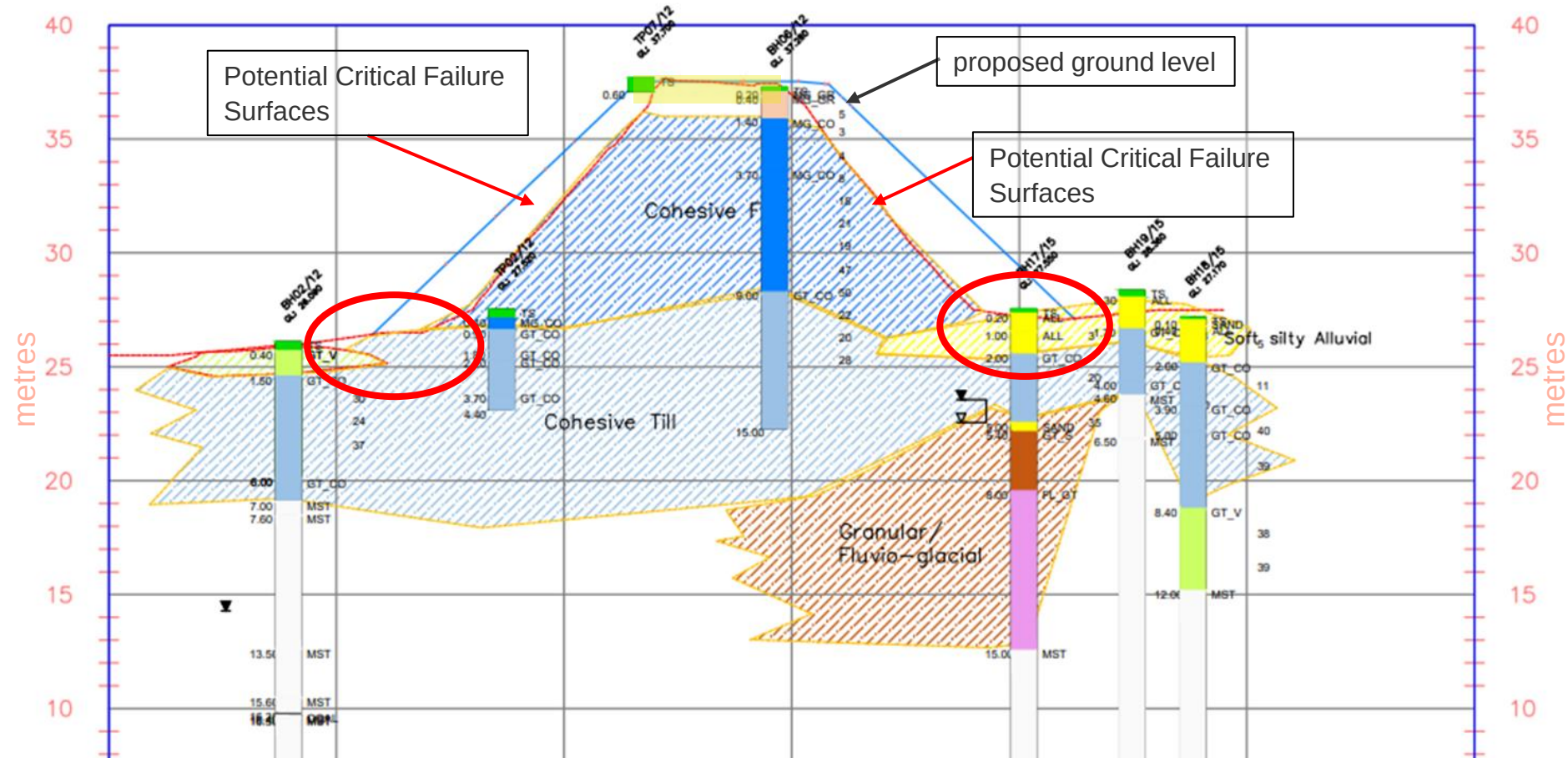
- Previous remedial works considered (2019)
 1. Offline (adjacent) temporary embankment construction
 2. Offline (adjacent) temporary Bailey bridge construction
 3. Offline (via Cumberland Council route) semi-permanent construction
- Circa £20M for 200m of earthworks alone including third party and service diversion costs.





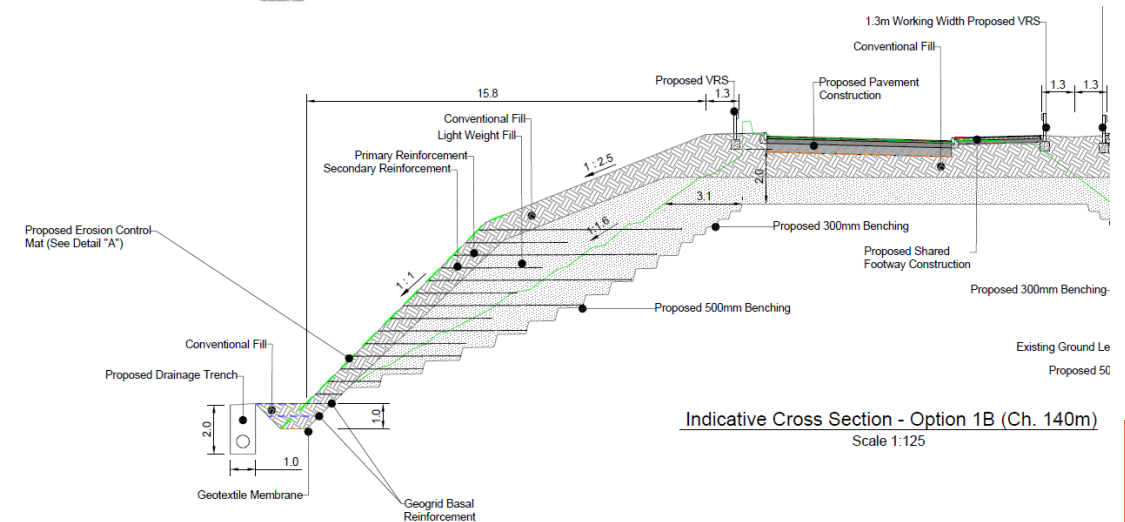
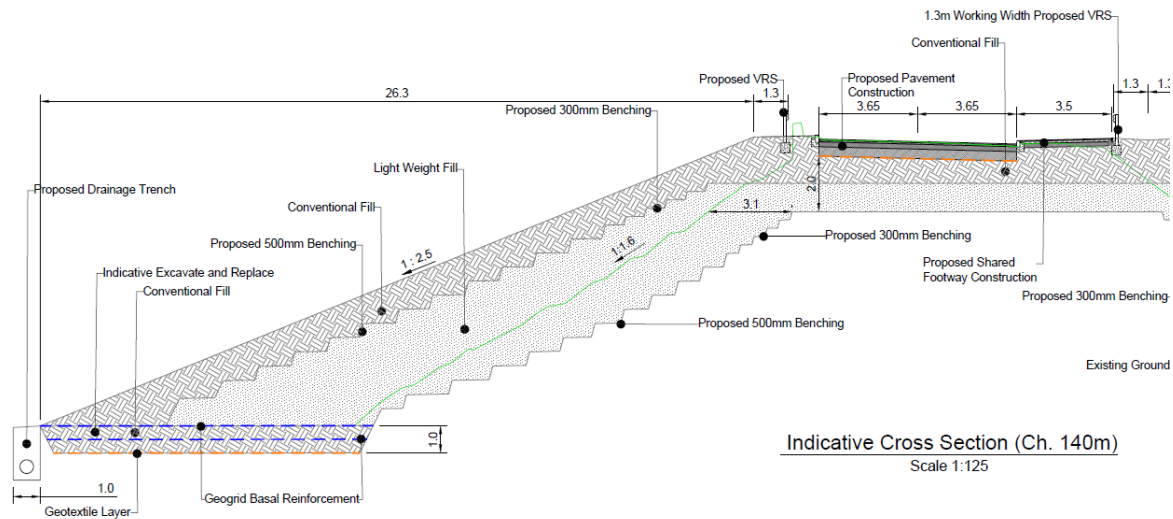
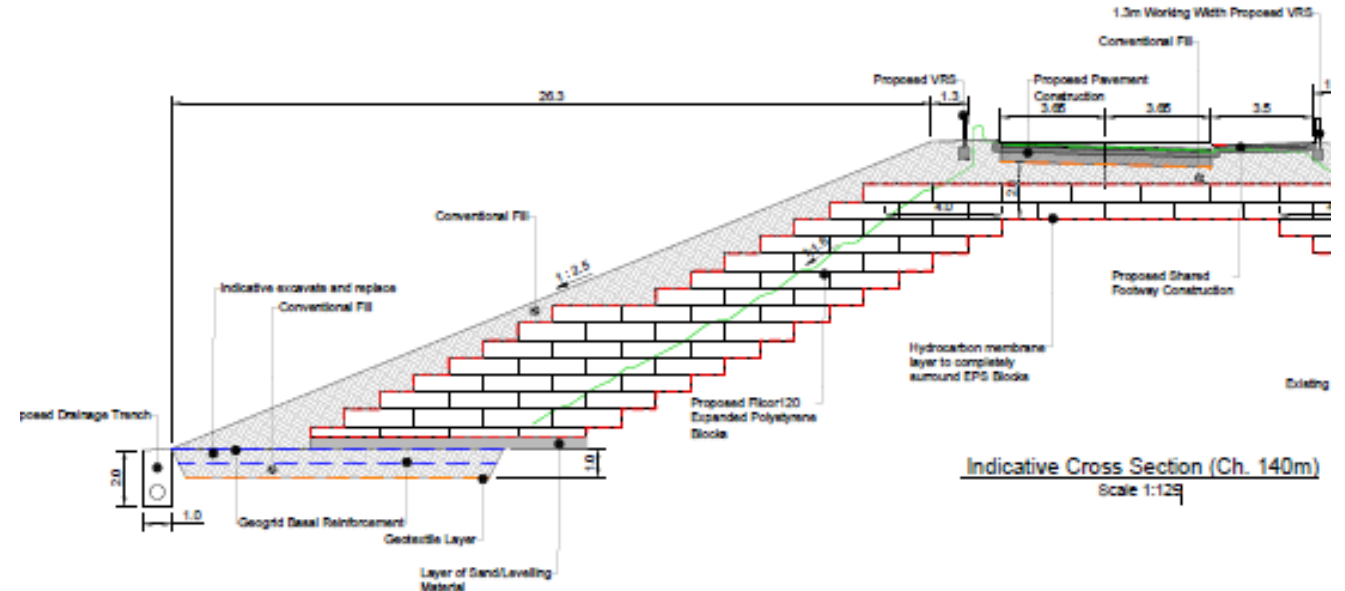
- Review of the historical ground investigation data and CD622 geotechnical reporting of the scheme
- Examination of geotechnical buttressing options (provided by NH) for stabilisation of the existing embankment
- Requirements for mitigating the risk associated existing services within the embankment
- Analysis of the stability of the existing embankment and of each of the proposed options, notably:
 - ✓ settlement checks for each proposed option, including conventional vs. lightweight fill; and
 - ✓ risk of differential settlement between the existing and widened embankment for conventional and lightweight fill.
- Propose three feasible options and outline a preferred option for an online stabilisation solution

- Multiple phases of ground investigation
- Variable embankment fill (granular upper & cohesive lower)
- Suspected perched groundwater
- Areas of concern of soft/ loose materials at embankment toe

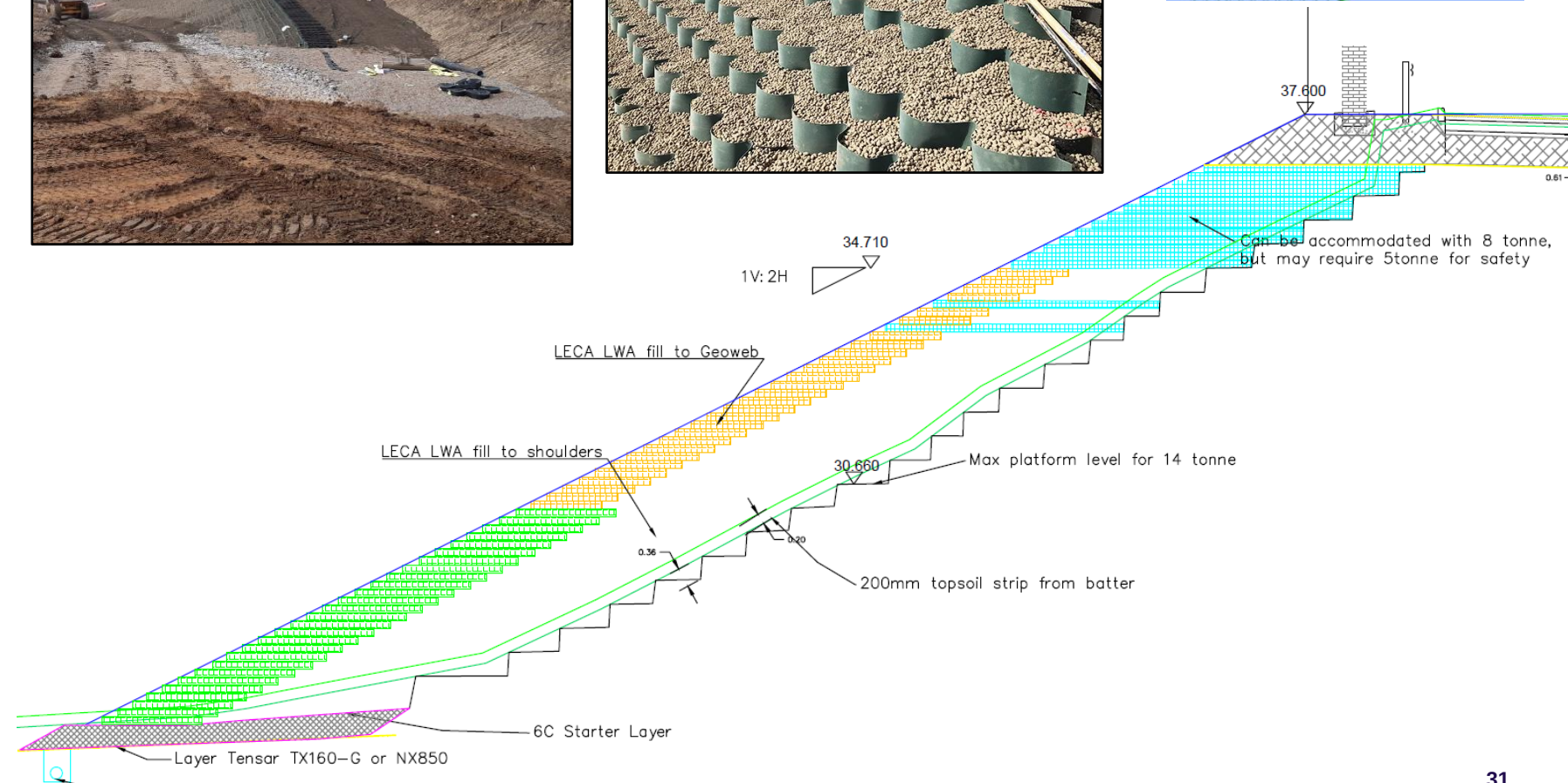
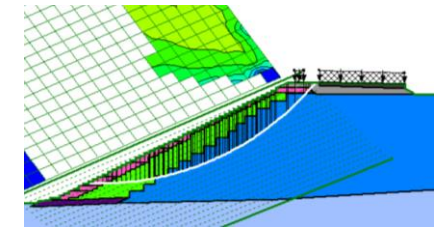


Embankment Remedial Works – Feasibility / Optioneering

- Unreinforced Lightweight Aggregate
- Reinforced Lightweight Aggregate
- Expanded Polystyrene blocks (EPS)



- Use of the layered geocell filled with topsoil capped over the lightweight aggregate
- Use of the varying length and extents of the geocell to accommodate stresses
- Additional geosynthetic reinforcement at the crest of the slope for temporary and permanent loads



Embankment Remedial Works – Sustainability & Social Value

- £3.5 million worth of social value in total!
- 60% of budget spent on local supply chain
- 44 local jobs created
- Two ship vessels were delivered into the Port of Workington
- Planted 3,500 trees in total during the project
- National Highways donated £100,000 in funding to Cumbria Council



Questions



Winner of Social Value Award at Highways UK Excellence Awards 2024



Winner of Environmental Excellence Award and Highly Commended in others at the CECA NW Annual Awards 2024



Finalist at Ground Engineering Awards 2024