Norwich Western Link

Drainage Strategy Report Appendix 4 : Study of scour protection methods and product data sheet for Flex MSE

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Contents

1 Introduction

1.1.1 This document contains the slide deck presented to Norfolk County Council Lead Local Flood Authority on the proposed use of Flex MSE to provide protection against erosion within the proposed drainage network.

The presentation includes slides on the locations within the Proposed Scheme that require erosion protection, proposed arrangements for the use of FlexMSE in these circumstances and information from the manufacturer on the FlexMSE product.

NWL – FlexMSE Discussion

February 2024

Content

1. **AIM OF THE PRESENTATION**
2. **BACKGROUND –EROSION CONTROL DESIGN (PA)**
3. **WHAT IS FlexMSE? - from the Manufacturer**
4. **CONCLUSIONS**

ferrovial construction

1. Aim of the presentation

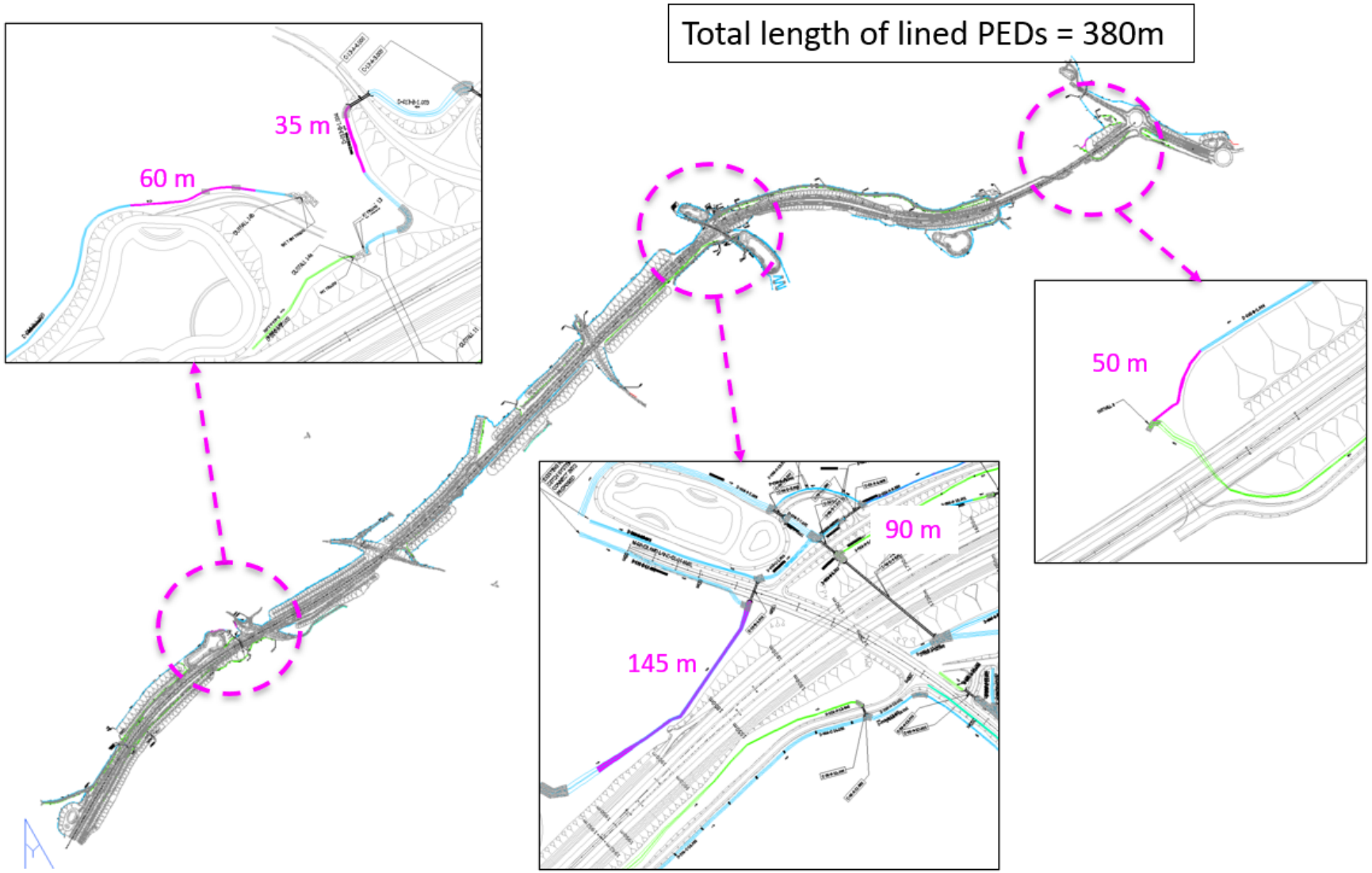
- In response to TQ-95 response - To discuss erosion protection measures for NWL scheme with a focus on the use of Flex MSE (a concrete bagging alternative).

2. Background

- In NWL project, there are several drainage features that require erosion protection, these are:

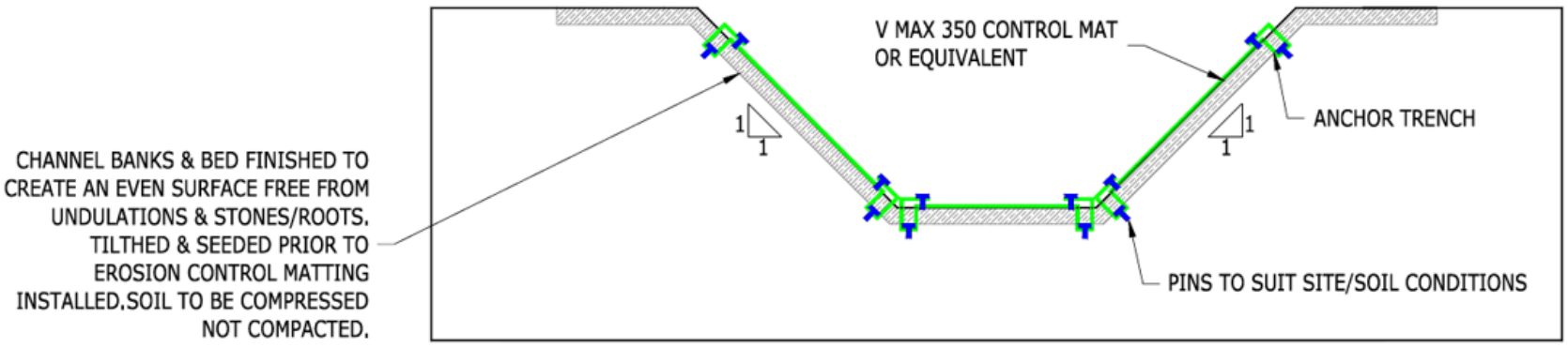
A. PED lining on steeped sections
B. PEDs outfalls to OWC
C. Berms in PEDs
D. Bends and junctions in PEDs
E. Culverts outfalls / Headwalls to PEDs
F. Carrier pipes outfalls / Headwalls to Basins
G. Basin Berms

A. PED lining on steep sections - Plan



A. PED lining on steep sections - Detail

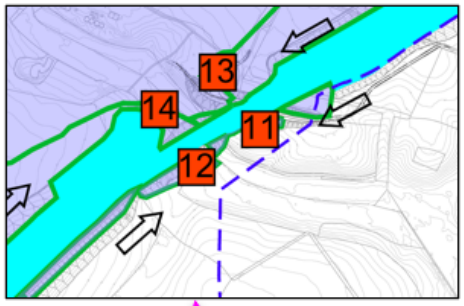
Total length of lined PEDs = 380 m

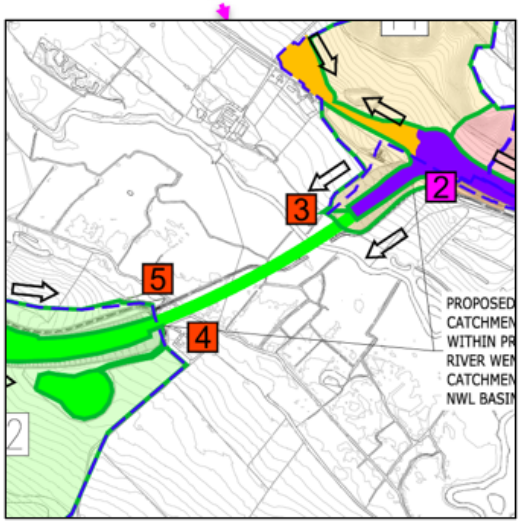


DITCH LINING CROSS SECTION

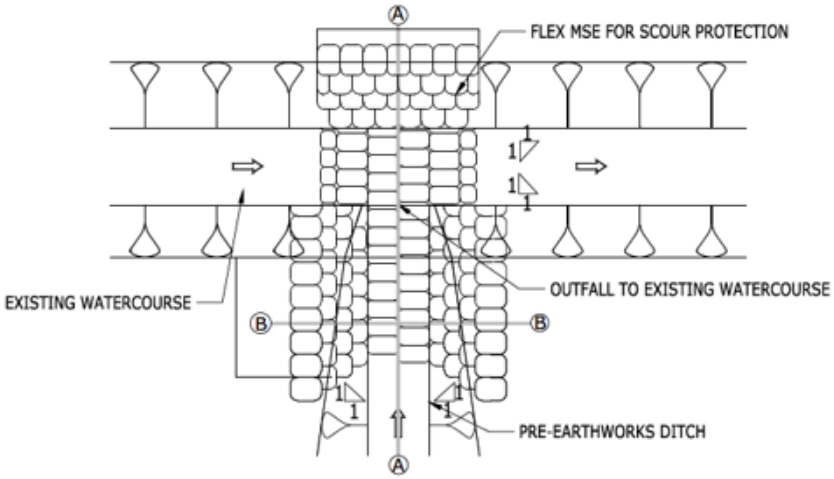
B. PEDs outfalls to OWC - Plan

Outfalls to OWC: 3,4,5,11,12,13, 14a,14b
Total=8 outfalls

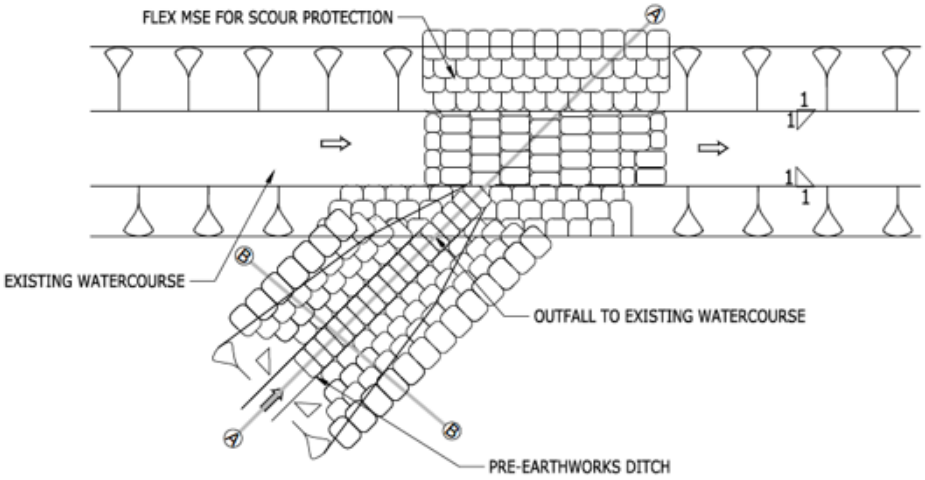




B. PEDs outfalls to OWC - Detail

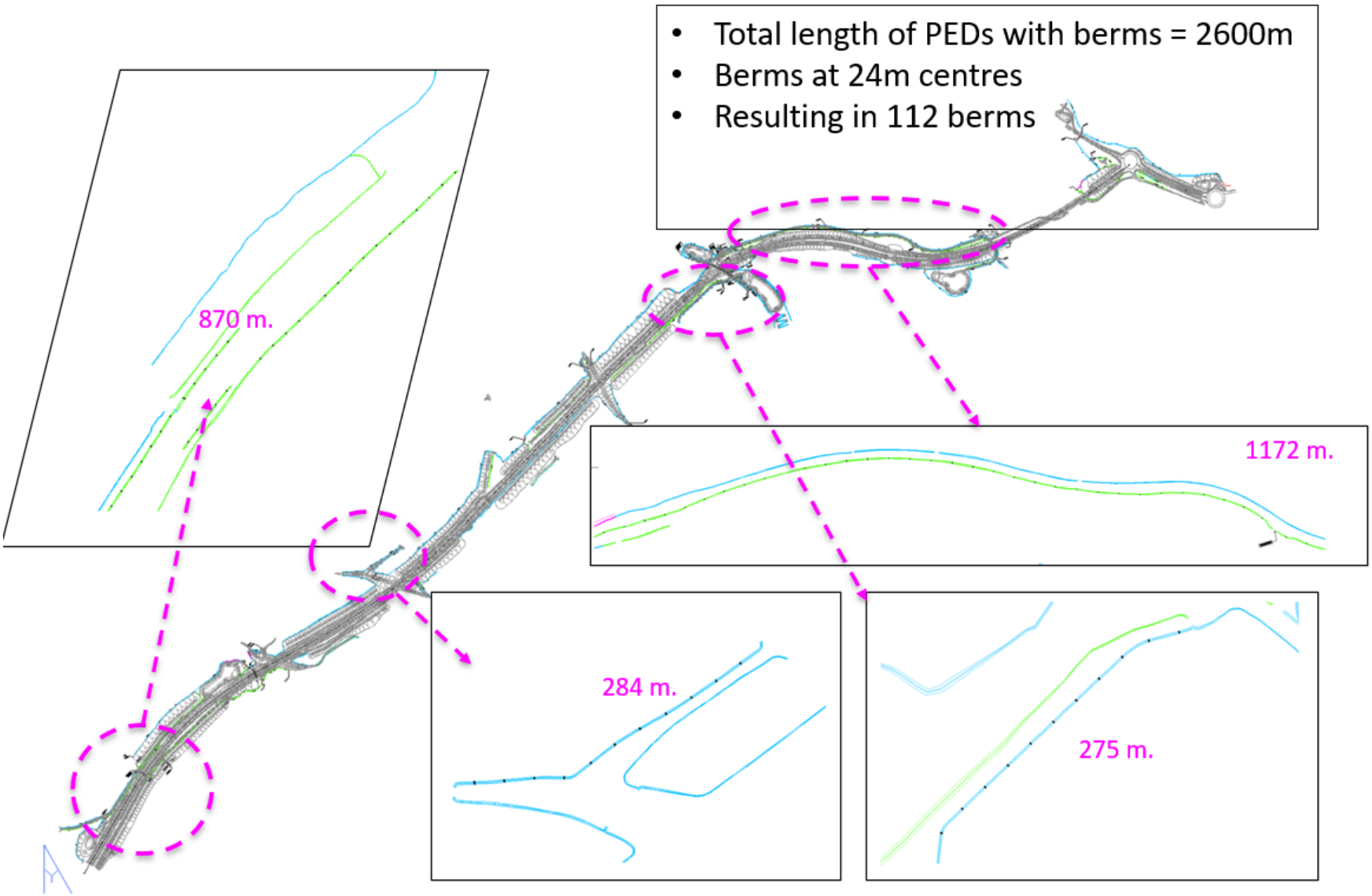


TYPICAL PRE-EARTHWORKS DITCH
OUTFALL TO STREAM AT 90°
PLAN VIEW

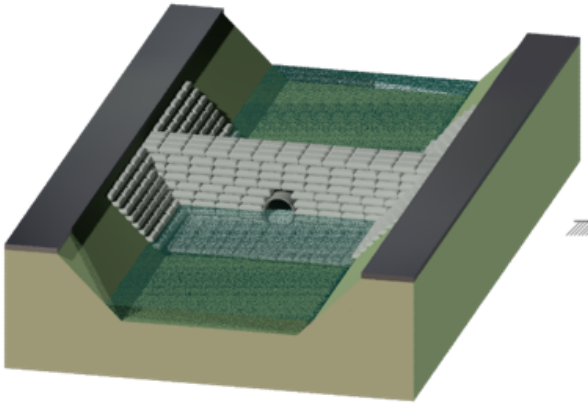


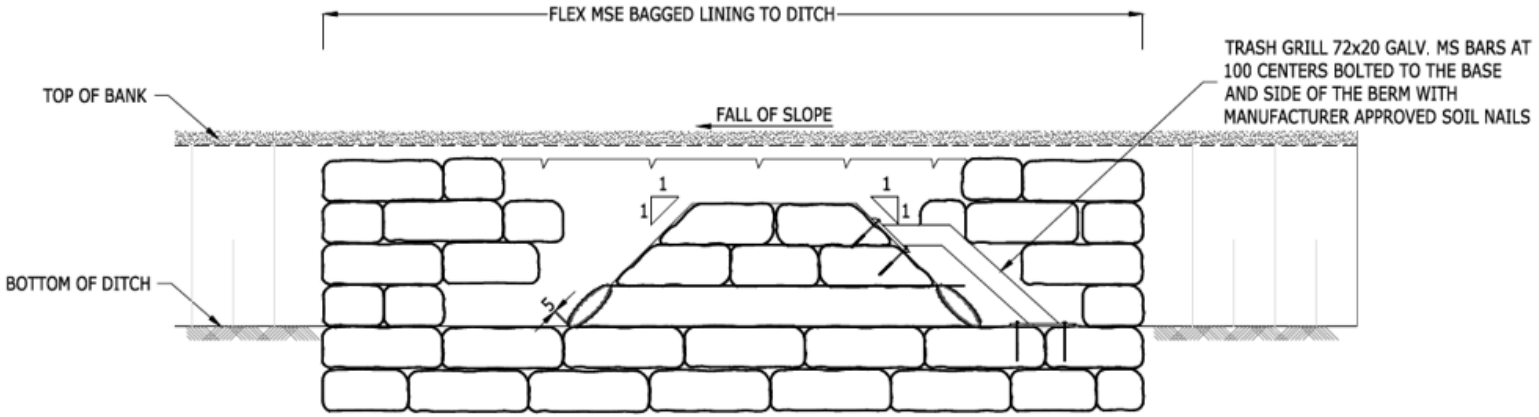
TYPICAL PRE-EARTHWORKS DITCH
OUTFALL TO STREAM AT 45°
PLAN VIEW

C. Berms in PEDs – Plan

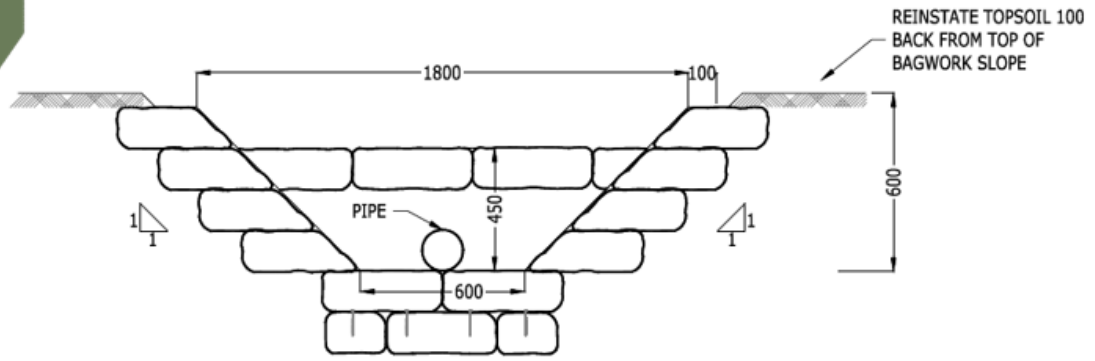


C. Berms in PEDs - Detail





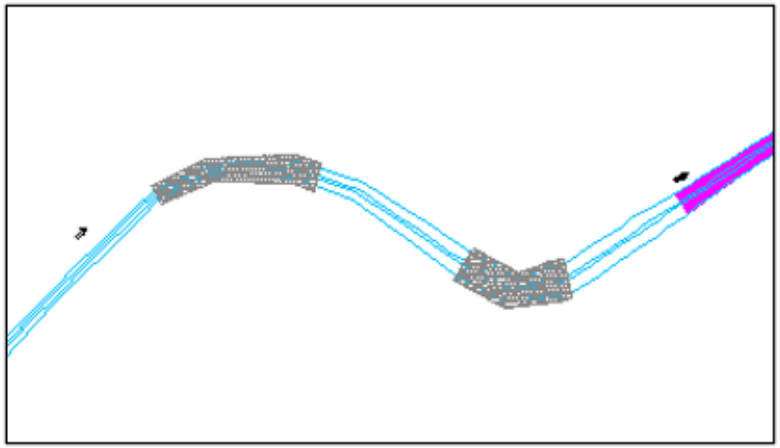
LONG SECTION A-A
BERM DETAIL

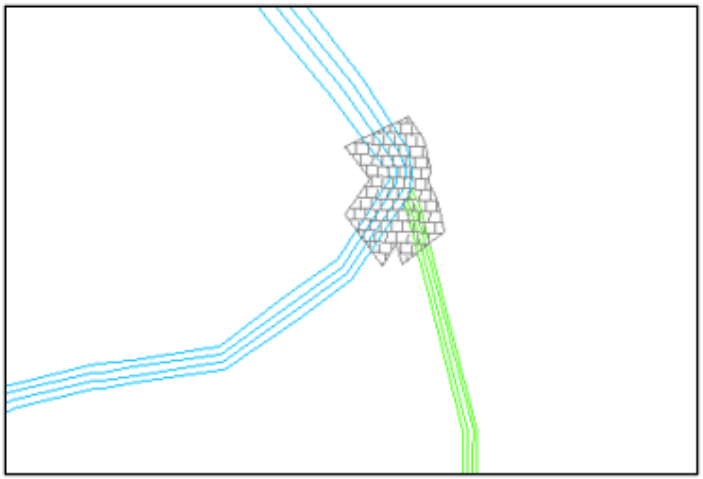


CROSS SECTION B-B
BERM DETAIL

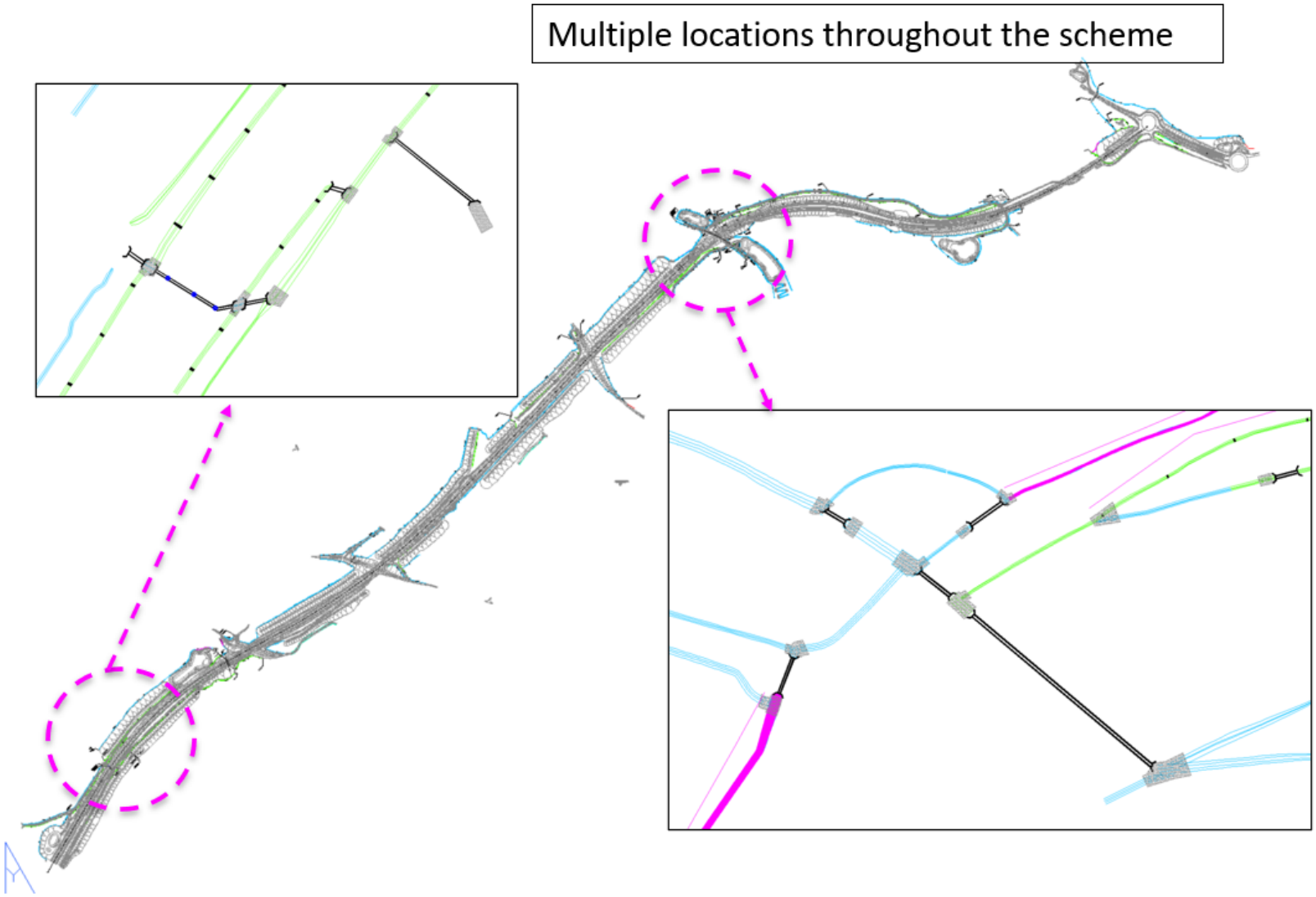
D. Bends and junctions in PEDs

- Multiple locations throughout the scheme
- 18 sharp changes of direction
- 35 ditch-to-ditch junctions



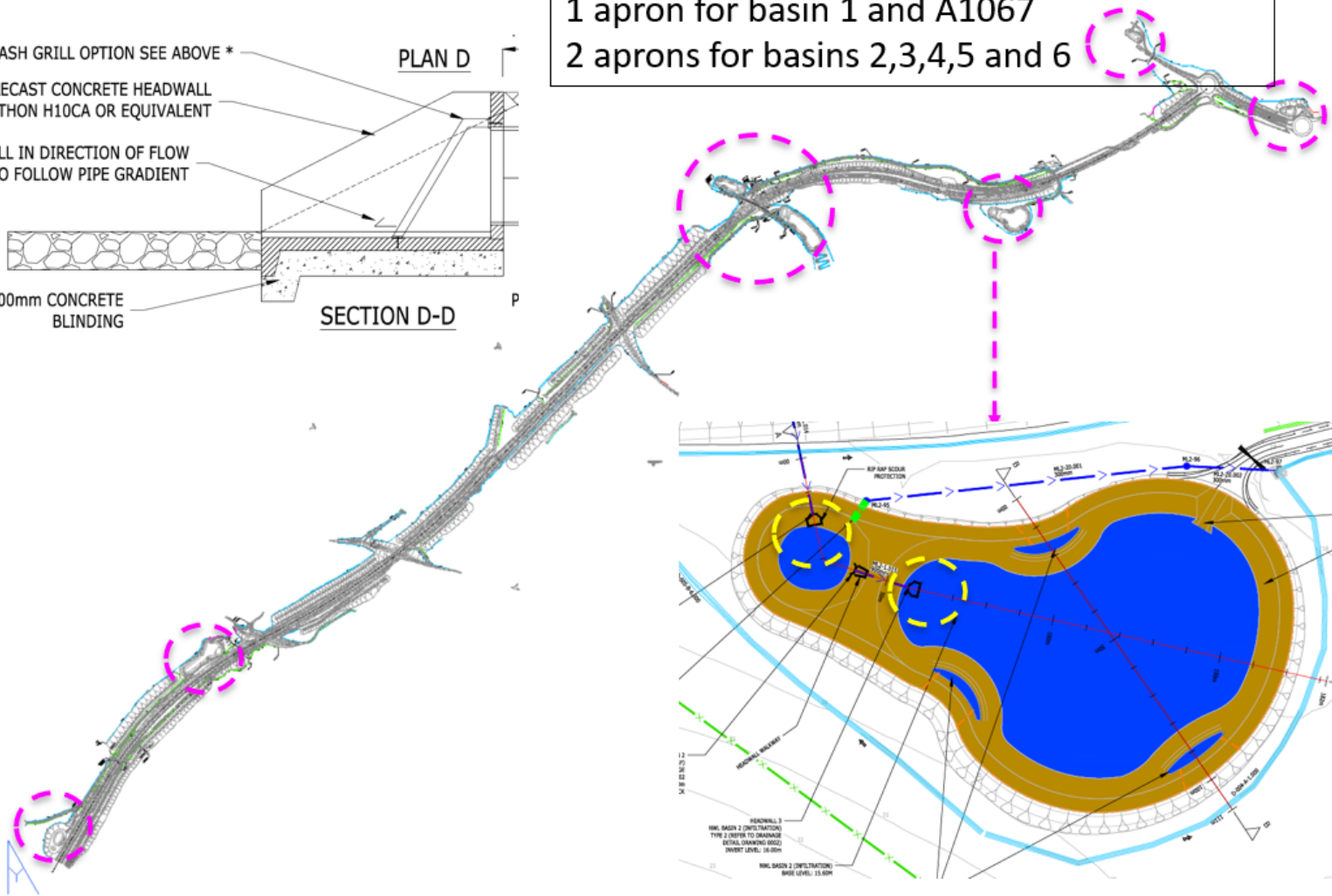


E. Culverts Outfalls/headwalls to PEDs



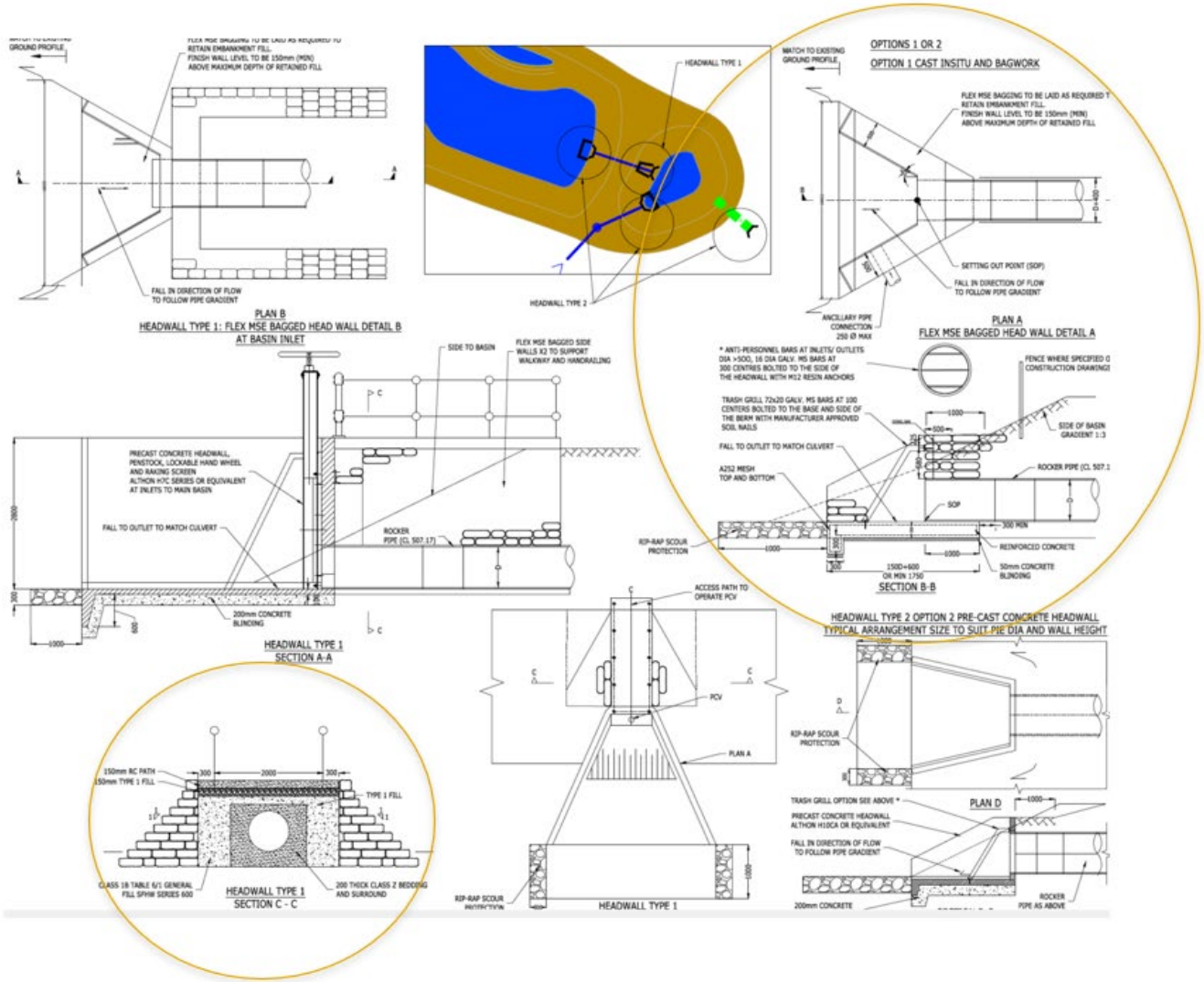
F. Carrier pipes Outfalls/headwalls to Basins

1 apron for basin 1 and A1067
2 aprons for basins 2,3,4,5 and 6



E. Culvert Outfalls/headwalls to PEDs

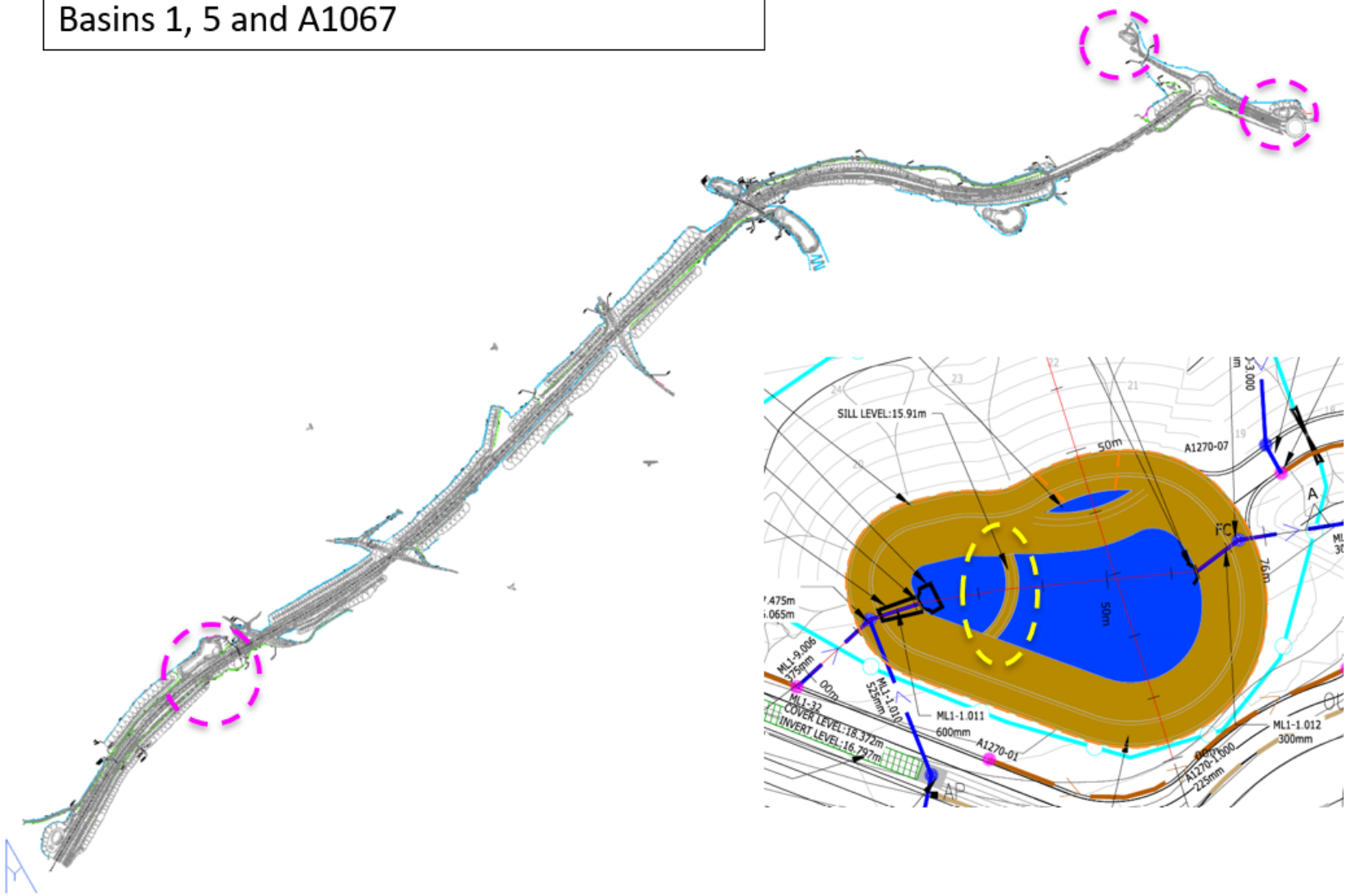
F. Carrier pipes Outfalls/headwalls to Basins



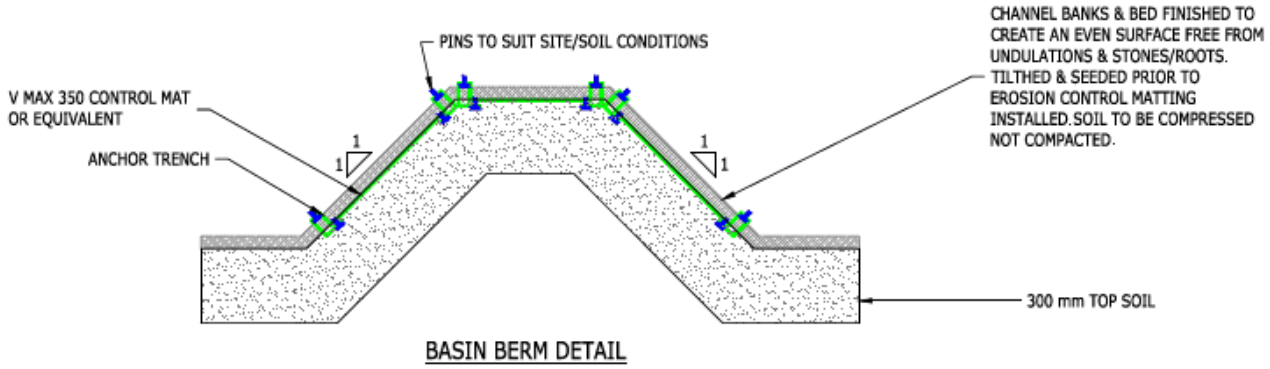
Refer to drainage detail drawing 0002

G. Basin Berms - Plan

Basins 1, 5 and A1067



G. Basin Berms - Detail



BASIN BERM DETAIL

2. Background

- The following erosion control methods have been discussed to date:
  - Riprap aprons
  - Concrete bagwork
  - Concrete Canvas
  - TRM – turf reinforced mats
  - Flex MSE

- Challenges:
  - Delivery team -> Riprap is not available in Norfolk

    Alternatives:
    - From West England by trains and lorries
    - From Norway by port
  - LLFA –> A soft/sustainable/green solution is preferred unless it is technically demonstrated that there is no other option

2. What is Flex MSE?

- Flex MSE is a patented, engineered solution for vegetated retaining walls and erosion control.
- The Flex MSE Vegetated Wall System provides the strength of interlocking components without the need for concrete, rebar, wire mesh or other formwork.
- Flex MSE GTX Bags and Interlocking Plates are used to build naturally resilient geomodular structures, viable for horizontal to near-vertical installations.

- MANUFACTURER PRODUCT DATA SHEET – pdf

2. What is Flex MSE?

- Two technical meetings have been held with manufacturer

- List of technical questions
  - Performance in channels/submerged conditions
  - Roughness
  - Design life
  - Loads
  - Settlements
  - Allowed wall heights – reinforcement needed
  - Permeability
  - Vegetation
  - How to install rack/trash grill
  - Maintenance
  - Construction
  - Testing
  - Case studies

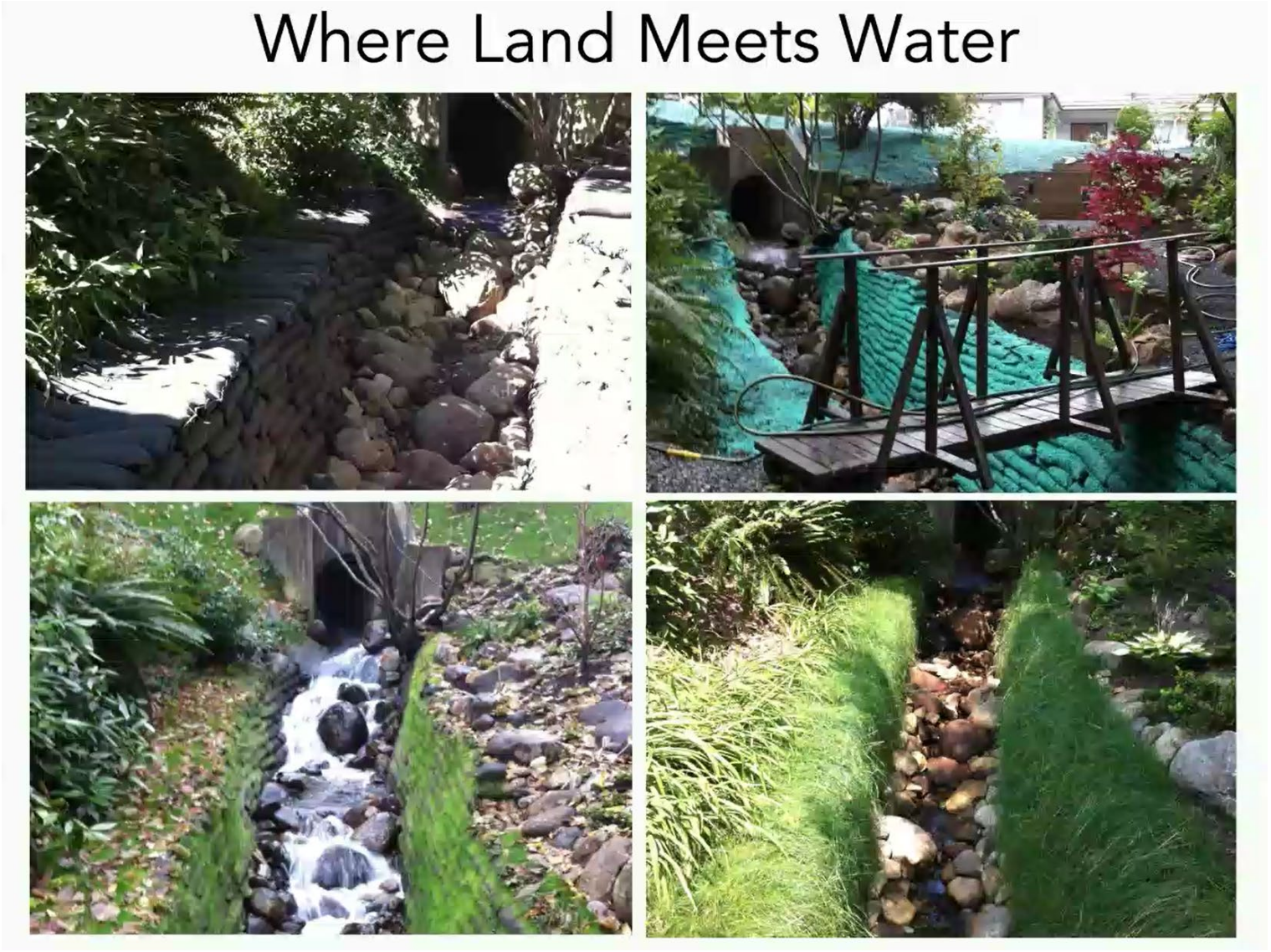
2. What is Flex MSE? - from the Manufacturer

- Performance in channels/submerged conditions
  - 3 m/s max velocity physically tested in a real channel
  - 9 m/s max velocity (theoretically)
  - High roughness due to vegetation helps to slow the flows
- Design life
  - Requirement: 60 years
  - 120 yrs
  - 75 yrs guaranteed by manufacturer
- Loads
  - Accepted – 300 mm away from top edge of the wall
- Settlements
  - Able to withstand unlimited differential settlements
- Allowed wall heights – reinforcement needed
  - Unlimited wall height
  - Reinforcement when **H>1.20 m** with geogrids
- Permeability
  - Permeable wall
  - Pending to receive the permeability values/tests
- Vegetation
  - Hydroseeding
  - Grass/bushes

2. What is Flex MSE? -from the Manufacturer

- How to install rack/trash grill
  - Pending to study
- Maintenance
  - Annual trim
- Construction
  - Good performance/easy to construct
  - Only 2 people to move/lift/install each bag
- Testing and case studies
  - Pending to receive more info
  - Flex MSE® Case Study - War Memorial Park, Romsey, Hants, 2017

2. What is Flex MSE? -from the Manufacturer



2. What is Flex MSE? -from the Manufacturer

2. What is Flex MSE? -from the Manufacturer

4. Conclusions

Criteria for comparison of the different methods:

- Technical considerations
  - Performance
  - Physical conditions
  - Engineering
  - Construction
  - Maintenance
- Environmental considerations
  - Environmental impacts for construction: reducing CO2 emmisions
  - Potential environmental benefits of scheme
  - Acceptability of physical appearance

- Social considerations
  - Stakeholder participation

(Economic considerations)

PRODUCT DATA SHEET

FlexMSE®
Vegetated Wall System

Flex MSE is a patented, engineered solution for vegetated retaining walls and erosion control.

The Flex MSE Vegetated Wall System provides the strength of interlocking components without the need for concrete, rebar, wire mesh or other formwork.

Flex MSE GTX Bags and Interlocking Plates are used to build naturally resilient geomodular structures, viable for horizontal to near-vertical installations.

10m (33ft) tall municipal roadway

APPLICATIONS AND USES

Slope Repairs (shallow and reinforced)
Retaining Walls
Highway Walls
Bridge Abutments
Noise Barriers
Levees/ Dikes
Permanent Flood Protection Walls
Blast Walls and Bunkers
Culverts and Pump Stations
River and Stream Bank Protection
Coastal Protection
Channel Linings
Detention/ Retention Ponds and Reservoirs
Irrigation Canals & Ditches
Site Levelling and Optimisation
Land Profiling
Ha-has and Deer Leap Platforms

ADVANTAGES & DESIGNATIONS

Installs in 2/3 the time compared to traditional systems
Flex MSE is lightweight and easy to transport
Typically 60% of the cost of traditional systems
ASTM-rated design life of 120 years
75-year manufacturer's warranty
Flex MSE walls are easy to construct & maintain
BREEAM compatible
BBA Stage 3 attained
Recommended for SSSIs by the Environment Agency

VEGETATION

Flex MSE accepts almost all types of vegetatio er
100% of the face. Installations can be hydro
live planted or brush-layered.

TESTING

Weight (typical) ASTM D5261	=128.8 g/m2
Grab Tensile ASTM D4632	= 401 N
Grab Elongation ASTM D4632	= 50%
Trap Tear ASTM D4533	= 178 N
CBR Puncture ASTM D6241	= 1113N
Mullen Burst ASTM D6786 (modified to ASTM D6241)	
A.O.S. ASTM D4751	= 0.25mm
Permittivity ASTM D4491	= 2.00 SEC-1
Water Flow ASTM D4491	= 5907 l/min/m2
UV Resistance ASTM D4355	= 70%
IPIRP ASTM D256	= 1.07J/cm

PRODUCT DATA SHEET

FlexMSE® Vegetated Wall System

FLEX MSE® PLATE

Made from 100% recycled material.

Designed to bridge the gap between GTX Bags to create an interlocking mechanical connection.

Engineered with Friction Strips for greater bag to bag mechanical connection and Geogrid Hooks to connect to reinforcement systems.

PLATE DIMENSIONS

Height	42mm (1.65”)
Length	285mm (11.22”)
Width	99mm (3.90”)
Spikes	11
Hooks	2
Weights	63g (2.2oz)

FLEX MSE® GTX BAG

An ideal ‘planter block’ for many types of vegetation.

Bags have filtering functionality to prevent soil particle seepage while permitting water and root permeability.

Flexible enough to create almost any contour or angle.

BAG DIMENSIONS Unfilled:

Length	890mm (35”)
Width	380mm (15”)

Filled (optimum):

Height	
Length	
Width	300mm (12”)

INSTALLATION

Place Flex MSE Plates 760mm (30”) apart in a shallow, relatively level trench.

Centre a Flex MSE GTX Bag on top of each Plate, laid end to end (subject to design).

Place a single Flex MSE Plate over each Bag joint, in a 1:1 ratio.

Lay each row of Bags squarely over the Flex MSE Plates, creating an offset ‘running bond’ pattern. Plates should be completely covered.

Tamp or lightly compact the Bags to create a level course.

Place and compact backfill every two courses or as required.

Repeat this process until the desired height is reached, adding reinforcement as required.

When using Geogrid, the Flex MSE Plate’s patented Grid Hooks secure geogrid at the select layers.