North Yorkshire Council

A59 KEX GILL DIVERSION

A59 Kex Gill Culvert (STR001) - Approval in Principle

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PUBLIC | WSP

PROJECT NO. 70049554

OUR REF NO. A59 KEX GILL CULVERT (STR001)

DATE: OCTOBER 2019

North Yorkshire Council

A59 KEX GILL DIVERSION

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WSP

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WSP.com

QUALITY CONTROL

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CONTENTS

APPENDICES

DESIGNERS RISK ASSESSMENT

APPENDIX F

CULVERTS FEASIBILITY STUDY

APPENDIX G

TAA CORRESPONDENCE

APPENDIX A

LIST OF RELEVANT DOCUMENTS FROM THE TAS

APPENDIX B

LOCATION PLAN

APPENDIX C

PROPOSED GENERAL ARRANGEMENT DRAWINGS

APPENDIX D

IDEALISED DIAGRAM

APPENDIX E

DESIGNERS RISK ASSESSMENT

APPENDIX F

CULVERTS FEASIBILITY STUDY

APPENDIX G

TAA CORRESPONDENCE

INTRODUCTION

The A59 provides a key strategic east-west connection in North Yorkshire, linking Harrogate and Skipton. There is a long history of landslips around this location. These landslips deposit material onto the road leading to unpredictable closures of the A59. Analysis of existing geotechnical information indicates that the primary cause of these landslips is heavy rainfall, coupled with relatively unstable land on the hillside slopes, leading to earthwork failures.

Various studies, site investigations, consultation events and the production of reports, such as the Option Appraisal Report, have resulted in the determination of the preferred new A59 road realignment. A detailed design of this preferred realignment is now being developed.

To accommodate the proposed A59 alignment, 8 new culverts shall be required. The new culverts will be used to carry existing watercourses beneath the proposed A59 road. This AIP document, prepared in accordance with BD2/12 Technical Approval of Highway Bridges, relates to the design of the new A59 Kex Gill Culvert (STR001) on the A59 Kex Gill diversion road (CH2582 – CH2685).

1. HIGHWAYS DETAILS

1.1. TYPE OF HIGHWAY

The proposed A59 diversion at the location of the new culvert (CH2582 – CH2685) is a rural all-purpose single carriageway road (S2) in accordance with TD27/05 with the following features:

- Eastbound/Westbound hardstrip = Varies
- Eastbound lane = 3.65m
- Westbound lane = 3.65m
- Ghost Island = Varies

Part of the culvert shall also be located under the existing North Moor Road.

1.2. PERMITTED TRAFFIC SPEED

A59 section over the structure – 60mph (96kph).

1.3. EXISTING RESTRICTIONS

Not Applicable.

2. SITE DETAILS

2.1. OBSTACLE CROSSED

The proposed A59 Kex Gill Culvert (STR001) carries the Hall Beck watercourse beneath the existing North Moor Road/proposed A59 junction between CH2582 – CH2685, refer to location plan in Appendix B.

3. PROPOSED STRUCTURE

3.1. DESCRIPTION OF STRUCTURE AND DESIGN WORKING LIFE

The proposed structure covered by this AIP includes:

- A59 Kex Gill Culvert (STR001)

The culvert shall comprise a precast concrete box structure together with precast concrete headwalls & wingwalls to each end. The existing pipe culvert structure A which runs beneath the current North Moor Road/A59 junction shall be demolished and replaced with the proposed culvert (STR001). Approximately half way along the length of the box structure, there is an outlet connection from A59 Kex Gill Culvert (STR011) (refer to document no. NYKGDD-WSP-SMN-STR011-RE-CB-0001 for further details).

A mortared stone wall (with locally sourced stonework and recessed joints to give the appearance of a drystone wall) shall be installed along the top of the headwalls and wingwalls at each end of the culvert. This is to prevent pedestrian falls from height into the watercourse during inspection and maintenance-based activities.

To satisfy heritage requirements, consideration shall be given to facing the culvert entrances, headwalls & wingwalls with locally sourced stone blockwork. This natural stone face finish will enhance the aesthetic appearance of the structure and the integration with the surrounding rural environment. Refer to Appendix C for general arrangement of the proposed culvert.

In accordance with Table A.1 of BD100/16, the design working life of the structure will be 120 years (Category 5). Replacement structural parts will have a design working life of up to 50 years (Category 2).

3.2. STRUCTURAL TYPE

The proposed structure is a single span precast concrete box culvert with precast concrete headwalls & wingwalls.

The wingwalls shall comprise freestanding cantilever type walls acting independently of the box culvert.

3.3. FOUNDATION TYPE

Spread footing foundations shall be provided for the precast box and wingwalls.

3.4. SPAN ARRANGEMENTS

The single span culvert shall comprise the following internal dimension: 2.1m wide by 1.7m high. The invert of the structure shall comprise a 300mm thick natural bed formation.

The approximate total length of the structure is 100m. The wingwalls shall be splayed with height/lengths to suit final embankment slope profiles.

3.5. ARTICULATION ARRANGEMENTS

The box culvert shall be formed from multiple precast concrete segments of a prescribed length positioned end to end. There will be interlocking joints (with Tok strip sealant) between each segment. The wingwalls shall be independent of the box culvert and separated by a vertical joint comprising expanded closed cell polyurethane joint filler with a polysulphide sealant.

The structure shall run in the SW – NE direction (following alignment of the existing Hall Beck) with a skew angle of approximately 74° to the proposed A59 road alignment.

3.6. CLASSES AND LEVELS

3.6.1 CONSEQUENCE CLASS

The whole structure shall be consequence class CC2 (medium) in accordance with Table A.2 of BD100/16.

3.6.2 RELIABILITY CLASS

The whole structure shall be reliability class RC2 in accordance with Table A.2 of BD100/16.

3.6.3 INSPECTION LEVEL

The structure shall have an Inspection Level IL2 in accordance with Table A.2 of BD100/16.

3.7. ROAD RESTRAINT SYSTEMS REQUIREMENTS

A VRS with containment class N2 shall be provided to the verges of the proposed A59 road alignment.

A mortared stone wall (with locally sourced stonework and recessed joints to give the appearance of a drystone wall) shall be installed along the top headwalls and wingwalls at each end of the culvert. This is to prevent pedestrian falls from height into the watercourse during inspection and maintenance-based activities.

3.8. PROPOSED ARRANGEMENTS FOR FUTURE MAINTENANCE AND INSPECTION

3.8.1 TRAFFIC MANAGEMENT

It is unlikely traffic management will be required to access the culvert structure during maintenance/inspection activities since both ends of the culvert are set back away from the carriageway.

Where traffic management is necessary then it will take the form of temporary single lane closure of the North Moor Road/A59 carriageway.

3.8.2 ARRANGEMENTS FOR FUTURE MAINTENANCE AND INSPECTION OF STRUCTURE. ACCESS ARRANGEMENTS TO STRUCTURE

Maintenance/inspection activities to the proposed culvert may be carried out on foot. The upstream headwall/wingwall may be accessed from North Moor road and the downstream headwall/wingwall may be accessed from the proposed A59 verge.

Access to inside of the culvert shall be via a 1200mm diameter precast concrete manhole shaft connected to the roof of the box culvert with a ladder on the side wall allowing entry. The manhole shaft will be located within the proposed A59 verge upstream of the pipe outlet connection. Access shall only be permitted when water levels are sufficiently low. Refer to Appendix C for further details.

The structure will be classified as a confined space with a suitable safe system of work expected to be in place during inspection and maintenance work.

3.9. ENVIRONMENT AND SUSTAINABILITY

Prior to construction, a construction environment management plan (CEMP) will be produced detailing methods to minimise the impact of the proposed structure. The CEMP will contain the following information (but not limited to):

- Careful planning of the construction sequence in consultation of hydraulic/drainage engineers to minimise disruption to the existing Hall Beck watercourse.
- Strategy to control construction noise, vibration, lighting and egress of mud and dust.
- A plan to prevent discharge of contaminated drainage into groundwater.
- Facilities for the storage of oils, fuels or chemicals.
- Methods to minimise waste and re-use onsite materials within requirements of the specification and use of materials which can be ultimately recycled.

To reduce environmental impact and improve sustainability, a precast concrete box culvert has been proposed to reduce the amount of on-site works and speed up construction.

An Ecology survey conducted by WSP on 22nd/23rd May 2019, confirmed no requirements to provide any additional ecological features within the proposed structure (mammal ledges, fish baffles etc.).

To satisfy heritage requirements, consideration shall be given to facing the concrete headwalls/wingwalls with locally sourced stone blockwork. This natural stone face finish will enhance the aesthetic appearance of the structure and the integration with the surrounding rural environment.

3.10. DURABILITY, MATERIALS AND FINISHES

3.10.1 MATERIALS

Refer to the table below for material information:

TABLE 1: Material Information	
Proposed A59 Kex Gill Culvert (STR001)	
Structural Concrete: Precast Box Culvert, Headwalls & Wingwalls	Minimum strength Class C40/50 (in accordance with series 1700 of MCHW)
Blinding Concrete	FND2 designated concrete in accordance with BS 8500-1:2015+A2:2019
Steel Reinforcement	Grade 500B to BS4449:2005
Waterproofing	A permitted waterproofing system (in accordance with series 2000 of the MCHW) shall be used on the top outer surface of the box culverts and be continued down the outside of the abutment to a level 200 mm below the soffit. All structure external buried surfaces (including the base) not protected by a permitted waterproofing shall be coated with two coats of bituminous paint (in accordance with series 2000 of MCHW) for below ground concrete structures.
Safety Barrier (at A59 verge level)	N2 containment steel safety barrier
Structural Backfill	Class 6N/6P (in accordance with series 600 of MCHW) Minimum effective angle of friction φ' = 35°, and effective cohesion c' = 0.
Stone Wall Facing Stone wall (to topside of headwalls & wingwalls)	Locally sourced gritstone blockwork. Specification requirements shall be confirmed during detail design.
Mortar for stonework	Mortared joints shall be high durability i.e. 1 part cement: 0.5 part lime: 4.5 parts sand: M6 designation mortar class (ii) to BS EN 1996-1-1:2005+A1:2012 modified by the UK National Annex and BS 5628 part 1. A proportion of sharp sand shall also be included.

3.10.2 EXPOSURE CLASSES FOR REINFORCED CONCRETE

All concrete exposure class designations shall be in accordance with BS 8500-1 and BS EN 206-1, see table below. The class designations ignore conservatively ignore surface protection provided by stone facing etc.

TABLE 2: Concrete Exposure Classes

Concrete Surface	XC	XD	XF	Comment(s)
All internal faces of the box culvert	XC3/4	XD2	XF1	• Concrete surfaces sheltered from, or exposed to, direct rain. • Concrete surfaces exposed to alternate wetting and drying. • Concrete surfaces not subject to de-icing salts.
Buried faces of box culvert, headwalls & wingwalls less than 1m below carriageway level	XC2	XD3	XF2	• Concrete buried in non-aggressive soil. • Concrete surfaces exposed to de-icing salts directly/indirectly.
Buried faces of box culvert, headwalls & wingwalls more than 1m below carriageway level	XC2	XD2	XF2	• Concrete buried in non-aggressive soil. • Concrete surfaces exposed to de-icing salts directly/indirectly.
Exposed faces of the box culvert, headwalls & wingwalls	XC3/4	XD3	XF4	• Concrete surfaces exposed to alternate wetting and drying. • Concrete surfaces within 10m of the carriageway. • Concrete surfaces subjected to frequent splashing with water containing de-icing agents and exposed to freezing.

Note: The specified cover to all buried concrete within the ground shall satisfy the ground condition classification to be confirmed upon completion of the GDR (refer to section 6).

3.10.3 CONCRETE FINISHES

TABLE 3: Concrete Finishes	
F1	All formed buried faces of box culvert, headwalls & wingwalls
F2	All formed exposed faces of box culvert All formed faces of the headwalls & wingwalls to receive stone cladding
F4	All formed exposed faces of the headwalls & wingwalls
U1	All unformed buried faces of box culvert, headwalls & wingwalls
U4	Faces of the box culvert to receive a permitted waterproofing system

3.10.4 DRAINAGE OF STRUCTURE

Weepholes are to be provided to the wingwalls, with a filter medium placed directly behind them to prevent backfill material loss. This shall assist in relieving the build-up of pore water pressures.

3.11. RISKS AND HAZARDS CONSIDERED FOR DESIGN, EXECUTION, MAINTENANCE AND DEMOLITION. CONSULTATIONS WITH AND/OR AGREEMENT FROM CDM CO-ORDINATOR

The Principal Designer will review the hazards and associated risks documented within the Designer's Risk Assessment contained within the pre-construction H&S file and documented on the relevant drawings as per CDM 2015.

Refer to the Designer's Risk Assessment in Appendix E for details of risks considered to date.

3.12. ESTIMATED COST OF PROPOSED STRUCTURE TOGETHER WITH OTHER STRUCTURAL FORMS CONSIDERED (INCLUDING WHERE APPROPRIATE PROPRIETARY MANUFACTURED STRUCTURE), AND THE REASONS FOR THEIR REJECTION (INCLUDING COMPARATIVE WHOLE LIFE COSTS WITH DATES OF ESTIMATES)

Details of the various structural forms considered are discussed in A59 Kex Gill Diversion – Culverts Feasibility Report dated September 2019. Refer to Appendix F.

A precast concrete box culvert was the preferred structural option as it was the most cost effective when considering capital as well as whole life cost. It also had the quickest construction time as all elements would be prefabricated and delivered/installed on site. This would significantly reduce duration for the diversion of the existing Hall Beck watercourse.

3.13. PROPOSED ARRANGEMENTS FOR CONSTRUCTION

3.13.1 CONSTRUCTION OF STRUCTURE

The final construction sequence shall be confirmed by the Principal Contractor. The design and installation of all temporary works to facilitate construction of the culvert will be the responsibility of the Principal contractor. The following construction sequence is assumed:

1. Set up site compound
2. Install Hall Beck watercourse diversion temporary works
3. Install temporary works to support excavation (up to North Moor Road/A59 junction)
4. Excavate to formation level of box culvert and wingwalls
5. Install precast concrete box culvert segments
6. Install wingwalls to NE elevation
7. Temporarily close existing North Moor Road/A59 junction to traffic
8. Install temporary works to support excavation (for both structure no.1 & 11)
9. Excavate and remove the existing pipe culvert A (including headwalls/wingwalls) beneath North Moor Road
10. Install pipe culvert structure no.11 including connection segment with structure no.1
11. Install wingwalls to upstream of pipe culvert structure no.11
12. Install remainder of precast concrete box culvert segments
13. Install wingwalls to SW elevation
14. Return watercourse to permanent channel
15. Backfill structure in a staged manner
16. Construct approach embankments and new A59 carriageway
17. Install stone walls to the ends of the new culvert
18. Install VRS to the new A59 verges
19. Open existing North Moor Road to traffic and commission new A59 road alignment

3.13.2 TRAFFIC MANAGEMENT

Temporary traffic management for construction of the A59 Kex Gill Culvert (STR001) shall be assessed by the Principal Contractor prior to commencement of the works.

It is likely that the current North Moor Road/A59 junction will need to be closed to traffic to enable demolition of existing pipe culvert structure A and construction of the proposed culvert. A diversion or alternate access route may need to be provided.

Majority of the proposed culvert is located offline from the existing A59 and therefore, it is anticipated traffic shall be maintained on the existing route as much as reasonably practical during the works.

3.13.3 SERVICE DIVERSIONS

The following existing services are located within the vicinity of the proposed A59 Kex Gill Culvert (STR001):

- Underneath existing A59 (CH2725): Buried Telecom Cable

Details of existing service(s) to be diverted or newly proposed services routed in the vicinity of the structure shall be confirmed during the C3/C4 consultations during detail design. It will be responsibility of the Principal Contractor to identify the location of all existing statutory undertaker's services which could be affected. A comprehensive utility search will be carried out and confirmed prior to construction.

3.13.4 INTERFACE WITH EXISTING STRUCTURES

The existing pipe culvert structure A, which runs beneath the current North Moor Road/A59 junction shall be demolished and replaced with the proposed culvert (STR001).

4. DESIGN CRITERIA

4.1. ACTIONS

4.1.1 PERMANENT ACTIONS

Materials densities and load factors shall be in accordance with BS EN 1990 and BS EN 1991-1-1. Selected values of material densities are shown below:

TABLE 4: Material Densities (KN/m^3)	
Unhardened Normal Weight Reinforced Concrete	26
Hardened Normal Weight Reinforced Concrete	25
Road Surfacing (hot rolled asphalt)	23
Normal Fill	18
6N/P Backfill	20
Steel	77
Fly Ash (PFA)	14

4.1.2 SNOW, WIND AND THERMAL ACTIONS

Snow actions - NA to BS EN 1990:2002+A1:2005 clause NA 2.3.3.3 – snow loads may generally be ignored in the UK, see NA to BS EN 1991-1-3.

Wind actions – If appropriate wind actions shall be applied in accordance with BS EN 1991-1-4:2005. Combination of wind and thermal actions - NA to BS EN 1990:2002+A12005 NA 2.3.3.4 - (The combination of wind and thermal actions may generally be ignored).

Thermal actions - Thermal action shall be applied in accordance with BS EN 1991-1-5:2003. Early thermal cracking will be controlled in accordance with CIRIA Document C766: Control of cracking caused by restrained deformation in concrete.

4.1.3 ACTIONS RELATING TO NORMAL TRAFFIC UNDER AW REGULATIONS AND C & U REGULATIONS

Load models LM1 – LM4 in accordance with BS EN 1991-2 modified by the UK National Annex.

4.1.4 ACTIONS RELATING TO GENERAL ORDER TRAFFIC UNDER STGO REGULATIONS

Load model LM3 in the form of SV80 & SV100 (Principal Roads) in accordance with BS EN 1991-2 modified by the UK National Annex and Table A.3 of BD100/16.

4.1.5 FOOTWAY OR FOOTBRIDGE VARIABLE ACTIONS

Not applicable.

4.1.6 ACTIONS RELATING TO SPECIAL ORDER TRAFFIC, PROVISION FOR EXCEPTIONAL ABNORMAL INDIVISIBLE LOADS INCLUDING LOCATION OF VEHICLE TRACK ON DECK CROSS-SECTION

Not applicable.

4.1.7 ACCIDENTAL ACTIONS

Accidental actions on the structure shall be considered in accordance with clause 4.7 of BS EN 1991-2 modified by the UK National Annex.

4.1.8 ACTIONS DURING CONSTRUCTION

The structure shall be designed for the actions in various temporary conditions taking into account changes in force distribution during the construction sequence. It is not envisaged that any unusual execution actions will occur during the construction phase.

All actions during execution shall be in accordance with Table 4.1 of BS EN 1991-1-6 modified by the UK National Annex.

Backfilling will be carried out in a staged manner so that fill levels between each culvert wall shall not differ by more than 0.5m.

4.1.9 ANY SPECIAL ACTION NOT COVERED ABOVE

BD100/16, Clause A.13 states: As the whole of the UK is considered to be an area of very low seismicity, the provision of BS EN 1998 need not apply unless otherwise specified by the TAA.

4.2. HEAVY OR HIGH LOAD ROUTE REQUIREMENTS AND ARRANGEMENTS BEING MADE TO PRESERVE THE ROUTE, INCLUDING ANY PROVISION FOR FUTURE HEAVIER LOADS OR FUTURE WIDENING

Not applicable.

4.3. MINIMUM HEADROOM PROVIDED

Approximate sizing of the proposed culvert has been based on outcome of the flood/drainage model analysis. The design assumes a 100year flood return period including a 50% climate change allowance in line with guidance given in LA 113: Road Drainage and the Water Environment.

4.4. AUTHORITIES CONSULTED AND ANY SPECIAL CONDITIONS REQUIRED

TABLE 5: Consultation Record	
AUTHORITY/STAKEHOLDER	**SPECIAL CONDITIONS REQUIRED**
North Yorkshire Council (NYC)	None to date.
Statutory Undertakers	None to date.

4.5. STANDARDS AND DOCUMENTS LISTED IN THE TECHNICAL APPROVAL SCHEDULE

Refer to Appendix A.

4.6. PROPOSED DEPARTURES RELATING TO DEPARTURES FROM STANDARDS GIVEN IN 4.5

None.

4.7. PROPOSED DEPARTURES RELATING TO METHODS FOR DEALING WITH ASPECTS NOT COVERED BY STANDARDS IN 4.5

None.

5. STRUCTURAL ANALYSIS

5.1. METHODS OF ANALYSIS PROPOSED FOR SUPERSTRUCTURE, SUBSTRUCTURE AND FOUNDATIONS

The structure shall be analysed as a 2D plane frame on a unit width basis using MIDAS Civil or equivalent linear elastic software.

Early thermal cracking will be controlled in accordance with CIRIA Document C766: Control of cracking caused by restrained deformation in concrete.

The independent wingwalls shall be analysed as free cantilevers and designed using hand calculation. All bridge elements and temporary works including concrete and steel will be designed to limit state philosophy at both ULS and SLS in accordance with Eurocodes using linear elastic methods.

The soil has inherent stiffness and will resist deformation as defined by its modulus of sub-grade reaction. Therefore, springs can be applied to the structural model to represent the sub-grade reaction in the vertical direction.

Ground investigation, testing and soil capacity, will be designed to limit state philosophy in accordance with Eurocodes.

5.2. DESCRIPTION AND DIAGRAM OF IDEALISED STRUCTURE TO BE USED FOR ANALYSIS

The analysis of the structure will be carried out using a 2-dimensional plane frame model using appropriate analysis software.

Refer to Appendix D for the Idealised diagram of the structure.

5.3. ASSUMPTIONS INTENDED FOR CALCULATION OF STRUCTURAL ELEMENT STIFFNESS

For the ultimate limit state analysis, gross uncracked sections properties shall be used for all concrete elements of the structure.

5.4. PROPOSED RANGE OF SOIL PARAMETERS TO BE USED IN THE DESIGN OF EARTH RETAINING ELEMENTS

Lateral earth pressures acting on the structure shall be in accordance with document PD6694-1:2011: Recommendation for the design of structures subject to traffic loading to BS EN 1997-1:2004, using directly determined values of earth pressure coefficients present in Annex B of the document for Class 6N backfill.

6. GEOTECHNICAL CONDITIONS

6.1. ACCEPTANCE OF RECOMMENDATIONS OF THE GEOTECHNICAL DESIGN REPORT TO BE USED IN THE DESIGN AND REASONS FOR ANY PROPOSED CHANGES

A combined Ground Investigation and Geotechnical Design Report was prepared in March 2020 ("A59 Kex Gill Diversion Geotechnical Report" Ref. 70049554-001) which summarises the findings of 3No. phases of ground investigation and the geotechnical design undertaken to date.

Additional ground investigation is proposed to supplement the information above, e.g. in areas where access was constrained by soft ground/dense woodland and where structure alignments have since altered. This is due to be completed in May 2023.

6.2. SUMMARY OF DESIGN FOR HIGHWAY STRUCTURE IN THE GEOTECHNICAL DESIGN REPORT

The investigation undertaken to date indicates that the ground conditions at the location of the proposed culvert consist of the following:

Colluvium – soft sandy gravelly clay with strata thickness up to 2.5m.

Highly weathered residual bedrock – Stiff sandy slightly gravelly silty clay with gravel components of mudstone and medium dense clayey fine to coarse mudstone gravel. Strata thickness between 2.0m and 4.0m.

Mudstone – Extremely weak to very weak laminated to thinly bedded highly fractured.

Sandstone – Very weak to medium strong laminated to thickly bedded with discontinuities and occasional joints.

The Geotechnical Report recommends the culvert be founded on spread footings. If founded within the Colluvium, the design bearing resistance for the box structure is anticipated to be approximately 100kPa (Design Approach 1, Combinaton 2). This value is based on the assumption that horizontal loading is no greater than 50% of the vertical force. Increased bearing resistance values may be possible if the structure is founded within weathered bedrock or if softer material encountered at formation level is excavated and replaced with granular fill material. A bearing resistance assessment should be undertaken once the loadings for the box structure and wing walls are known and supplementary ground investigation information is available.

6.3. DIFFERENTIAL SETTLEMENT TO BE ALLOWED FOR IN THE DESIGN OF THE STRUCTURE

The precast concrete box structure (and corresponding wingwalls) are expected to be founded within close proximity to weathered bedrock. Therefore, anticipated total and differential settlement of the culvert is expected to be minimal and should be limited to 50mm and 25mm respectively.

6.4. IF THE GEOTECHNICAL DESIGN REPORT IS NOT YET AVAILABLE, STATE WHEN THE RESULTS ARE EXPECTED AND LIST THE SOURCES OF INFORMATION USED TO JUSTIFY THE PRELIMINARY CHOICE OF FOUNDATIONS

Based on the information available as reported within the Geotechnical Report, the precast concrete box culvert is anticipated to be founded on a shallow foundation. This shall be reviewed once details of the supplementary ground investigation become available, expected May 2023.

7. CHECK

7.1. PROPOSED CATEGORY AND DESIGN SUPERVISION LEVEL

The whole structure is classed as Category 1.

This indicates design supervision level DSL2 (Normal Supervision – checking by different persons than those originally responsible and in accordance with the procedure of the organisation) in accordance with Table A.2 of BD100/16.

7.2. IF CATEGORY 3, NAME OF PROPOSED INDEPENDENT CHECKER

Not Applicable.

7.3. ERECTION PROPOSALS OR TEMPORARY WORKS FOR WHICH TYPES S AND P PROPOSALS WILL BE REQUIRED, LISTING STRUCTURAL PARTS OF THE PERMANENT STRUCTURE AFFECTED WITH REASONS

All associated temporary works are to be Type S in accordance with cl. 4.2 of BD2/12.

Temporary access and platforms may be required to allow for the use of heavy plant and machinery (cranes & excavators). Local roads, culverts and bridge network will need to be capable of taking loads from vehicles associated with construction activities otherwise strengthening works may be required.

Preliminary list of temporary works to construct the A59 Kex Gill Culvert (STR001) include:

- Installation of temporary crane platforms and ramps.
- Installation of temporary works to support existing ground during excavation works.

The Principal Designer shall be responsible for the coordination of safety critical design information, this includes temporary works.

8. DRAWINGS AND DOCUMENTS

8.1. LIST OF DRAWINGS (INCLUDING NUMBERS) AND DOCUMENTS ACCOMPANYING THE SUBMISSION

Appendix A: List of Relevant Documents from the TAS

Appendix B: Location Plan

Appendix C: Proposed General Arrangement Drawings

Appendix D: Idealised Diagram

Appendix E: Designers Risk Assessment

Appendix F: Structure Option Feasibility

Appendix G: TAA Correspondence

9. THE ABOVE IS SUBMITTED FOR ACCEPTANCE

Signed	………………………………………………..
Name	…… ………………………
Position held	…… …………………
Engineering Qualifications	…………………………………
Name of Organisation	…… …………………………………
Date	………………………………………………

10. THE ABOVE IS REJECTED/AGREED SUBJECT TO THE AMENDMENTS AND CONDITIONS SHOWN BELOW

Signed	………………………………………………..
Name	………………………………………………..
Position held	………………………………………………..
Engineering Qualifications	………………………………………………..
TAA	………………………………………………..
Date	………………………………………………..

Signed	………………………………………………..
Name	………………………………………………..
Position held	………………………………………………..
Engineering Qualifications	………………………………………………..
TAA	………………………………………………..
Date	………………………………………………..

Appendix A

LIST OF RELEVANT DOCUMENTS FROM THE TAS

TECHNICAL APPRAISAL SCHEDULE (TAS)		
1. STRUCTURAL EUROCODES		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
BS EN 1990:2002+A1:2005	Eurocode: Basis of structural design	✓
NA to BS EN 1990:2002+A1:2005	UK National Annex to Eurocode: Basis of structural design	✓
Eurocode 1: Actions on Structures		
BS EN 1991-1-1:2002	Eurocode 1: Actions on structures. General Actions. Densities, self-weight, imposed load for buildings	✓
NA to BS EN 1991-1-1:2002	UK National Annex to Eurocode 1: Actions on structures. General Actions. Densities, self-weight, imposed load for buildings	✓
BS EN 1991-1-3:2003+A1:2015	Eurocode 1: Actions on structures. General Actions. Snow loads	
NA+A2:18 to BS EN 1991-1-3:2003+A1:2015	UK National Annex to Eurocode 1: Actions on structures. General Actions. Snow loads	
BS EN 1991-1-4:2005+A1:2010	Eurocode 1: Actions on structures. General Actions. Wind actions	
NA to BS EN 1991-1-4:2005+A1:2010	UK National Annex to Eurocode 1: Actions on structures. General Actions. Wind actions	
BS EN 1991-1-5:2003	Eurocode 1: Actions on structures. General Actions. Thermal actions	✓
NA to BS EN 1991-1-5:2003	UK National Annex to Eurocode 1: Actions on structures. General Actions. Thermal actions	✓
BS EN 1991-1-6:2005	Eurocode 1: Actions on structures. General Actions. Actions during execution	✓
NA to BS EN 1991-1-6:2005	UK National Annex to Eurocode 1: Actions on structures. General Actions. Actions during execution	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BS EN 1991-1-7:2006+A1:2014	Eurocode 1: Actions on structures. General Actions. Accidental actions	✓
NA+A1 to BS EN 1991-1-7:2006+A1:2014	UK National Annex to Eurocode 1: Actions on structures. Part 1-7. Accidental actions	✓
BS EN 1991-2:2003	Eurocode 1: Actions on structures. Traffic loads on bridges	✓
NA to BS EN 1991-2:2003	UK National Annex to Eurocode 1: Actions on structures. Traffic loads on bridges	✓
Eurocode 2: Design of Concrete Structures		
BS EN 1992-1-1:2004+A1:2014	Eurocode 2: Design of concrete structures– Part 1-1: General rules and rules for buildings	✓
NA + A2:2014 to BS EN 1992-1-1:2004+A1:2014	UK National Annex to Eurocode 2: Design of concrete structures – Part 1-1: General rules and rules for buildings	✓
BS EN 1992-2:2005	Eurocode 2: Design of concrete structures – Part 2: Concrete bridges – Design and detailing rules	✓
NA to BS EN 1992-2:2005	UK National Annex to Eurocode 2: Design of concrete structure – Part 2: Concrete bridges – Design and detailing rules	✓
BS EN 1992-3:2006	Eurocode 2: Design of concrete structures – Part 3: Liquid retaining and containment structures	
NA to BS EN 1992-3:2006	UK National Annex to Eurocode 2: Design of concrete structures – Part 3: Liquid retaining and containment structures	
BS EN 1992-4:2018	Eurocode 2: Design of concrete structures – Part 4: Design of fastenings for use in concrete	
NA to BS EN 1992-4:2018	UK National Annex to Eurocode 2: Design of concrete structures – Part 4: Design of fastenings for use in concrete	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
Eurocode 3: Design of Steel Structures		
BS EN 1993-1-1:2005+A1:2014	Eurocode 3: Design of steel structures – Part 1-1 General rules and rules for buildings	
NA + A1:2014 to BS EN 1993-1-1:2005+A1:2014	UK National Annex to Eurocode 3: Design of steel structures – Part 1-1 General rules and rules for buildings	
BS EN 1993-1-3:2006	Eurocode 3: Design of steel structures – Part 1-3 General rules – Supplementary rules for cold-formed members and sheeting	
NA to BS EN 1993-1-3:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-3 Supplementary rules for cold-formed members and sheeting	
BS EN 1993-1-4:2006	Eurocode 3: Design of steel structures – Part 1-4 General rules – Supplementary rules for stainless steels	
NA to BS EN 1993-1-4:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-4 Supplementary rules for stainless steels	
BS EN 1993-1-5:2006+A1:2017	Eurocode 3: Design of steel structures – Part 1-5 Plated structural elements	
NA to BS EN 1993-1-5:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-5 Plated structural elements	
BS EN 1993-1-6:2007	Eurocode 3: Design of steel structures – Part 1-6 Strength and stability of shell structures	
BS EN 1993-1-7:2007	Eurocode 3: Design of steel structures – Part 1-7 Plated structures subject to out of plane loading	
BS EN 1993-1-8:2005	Eurocode 3: Design of steel structures – Part 1-8 Design of joints	
NA to BS EN 1993-1-8:2005	UK National Annex to Eurocode 3: Design of steel structures – Part 1-8 Design of joints	
BS EN 1993-1-9:2005	Eurocode 3: Design of steel structures – Part 1-9 Fatigue	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
NA to BS EN 1993-1-9:2005	UK National Annex to Eurocode 3: Design of steel structures – Part 1-9 Fatigue	
BS EN 1993-1-10:2005	Eurocode 3: Design of steel structures – Part 1-10 Material toughness and through-thickness properties	
NA to BS EN 1993-1-10:2005	UK National Annex to Eurocode 3: Design of steel structures – Part 1-10 Material toughness and through thickness properties	
BS EN 1993-1-11:2006	Eurocode 3: Design of steel structures – Part 1-11 Design of structures with tension components	
NA to BS EN 1993-1-11:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 1-11 Design of structures with tension components	
NA to BS EN 1993-1-12:2007	UK National Annex to Eurocode 3: Design of steel structures – Part 1-12 Additional rules for the extension of EN 1993 up to steel grades S 700	
BS EN 1993-2:2006	Eurocode 3: Design of steel structures – Part 2 Steel bridges	
NA+A1:2012 to BS EN 1993-2:2006	UK National Annex to Eurocode 3: Design of steel structures – Part 2 Steel bridges	
BS EN 1993-5:2007	Eurocode 3: Design of steel structures – Part 5 Piling	
NA+A1:2012 to BS EN 1993-5:2007	UK National Annex to Eurocode 3: Design of steel structures – Part 5 Piling	
Eurocode 4: Design of Composite Steel and Concrete Structures		
BS EN 1994-1-1:2004	Eurocode 4: Design of composite steel and concrete structures – Part 1-1 General rules and rules for buildings	
NA to BS EN 1994-1-1:2004	UK National Annex to Eurocode 4: Design of composite steel and concrete structures – Part 1-1 General rules and rules for buildings	
BS EN 1994-2:2005	Eurocode 4: Design of composite steel and concrete structures – Part 2 General rules and rules for bridges	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
NA to BS EN 1994-2:2005	UK National Annex to Eurocode 4: Design of composite steel and concrete structures – Part 2 General rules and rules for bridges	
Eurocode 5: Design of Timber Structures		
BS EN 1995-1-1:2004+A2:2014	Eurocode 5: Design of timber structures – Part 1-1 General – common rules and rules for buildings	
NA to BS EN 1995-1-1:2004+A1:2008	UK National Annex to Eurocode 5: Design of timber structures – Part 1-1 General – common rules and rules for buildings	
BS EN 1995-2:2004	Eurocode 5: Design of timber structures – Part 2 Bridges	
NA to BS EN 1995-2:2004	UK National Annex to Eurocode 5: Design of timber structures – Part 2 Bridges	
Eurocode 6: Design of Masonry Structures		
BS EN 1996-1-1:2005+A1:2012	Eurocode 6: Design of masonry structures – Part 1-1 General rules for reinforced and unreinforced masonry structures	✓
NA to BS EN 1996-1-1:2005+A1:2012	UK National Annex to Eurocode 6: Design of masonry structures – Part 1-1 General rules for reinforced and unreinforced masonry structures	✓
BS EN 1996-2:2006	Eurocode 6: Design of masonry structures – Part 2 Design considerations, selection of materials and execution of masonry	✓
NA to BS EN 1996-2:2006	UK National Annex to Eurocode 6: Design of masonry structures – Part 2 Design considerations, selection of materials and execution of masonry	✓
BS EN 1996-3:2006	Eurocode 6: Design of masonry structures – Part 3 Simplified calculation methods for unreinforced masonry structures	
NA+A1:2014 to BS EN 1996-3:2006	UK National Annex to Eurocode 6: Design of masonry structures – Part 3 Simplified calculation methods for unreinforced masonry structures	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
Eurocode 7: Geotechnical Design		
BS EN 1997-1:2004+A1:2013	Eurocode 7: Geotechnical design – Part 1 General rules	✓
NA+A1 to BS EN 1997-1:2004+A1:2013	UK National Annex to Eurocode 7: Geotechnical design – Part 1 General rules	✓
BS EN 1997-2:2007	Eurocode 7: Geotechnical design – Part 2 Ground investigation and testing	✓
NA to BS EN 1997-2:2007	UK National Annex to Eurocode 7: Geotechnical design – Part 2 Ground investigation and testing	✓
Eurocode 8: Design of Structures for Earthquake Resistance		
BS EN 1998-1:2004+A1:2013	Eurocode 8: Design of structures for earthquake resistance – Part 1 General rules, seismic actions and rules for buildings	
NA to BS EN 1998-1:2004	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 1 General rules, seismic actions and rules for buildings	
BS EN 1998-2:2005+A2:2011	Eurocode 8: Design of structures for earthquake resistance – Part 2 Bridges	
NA to BS EN 1998-2:2005	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 2 Bridges	
BS EN 1998-5:2004	Eurocode 8: Design of structures for earthquake resistance – Part 5 Foundations, retaining structures and geotechnical aspects	
NA to BS EN 1998-5:2004	UK National Annex to Eurocode 8: Design of structures for earthquake resistance – Part 5 Foundations, retaining structures and geotechnical aspects	
Eurocode 9: Design of Aluminium Structures		
BS EN 1999-1-1:2007+A2:2013	Eurocode 9: Design of aluminium structures– Part 1-1 General structural rules	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
NA to BS EN 1999-1-1:2007+A1:2009	UK National Annex to Eurocode 9: Design of aluminium structures – Part 1-1 General structural rules	
BS EN 1999-1-3:2007+A1:2011	Eurocode 9: Design of aluminium structures – Part 1-3 Structures susceptible to fatigue	
NA to BS EN 1999-1-3:2007+A1:2011	UK National Annex to Eurocode 9: Design of aluminium structures – Part 1-3 Structures susceptible to fatigue	
BS EN 1999-1-4:2007+A1:2011	Eurocode 9: Design of aluminium structures – Part 1-4 Cold formed structural sheeting	
NA to BS EN 1999-1-4:2007	UK National Annex to Eurocode 9: Design of aluminium structures – Part 1-4 Cold formed structural sheeting	
2. BSI PUBLISHED DOCUMENTS		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
PD 6688-1-1:2011	Recommendations for the design of structures to BS EN 1991-1-1	✓
PD 6688-1-4:2015	Background paper to the UK National Annex to BS EN 1991-1-4	✓
PD 6688-1-7:2009+A1:2014	Recommendations for the design of structures to BS EN 1991-1-7	✓
PD 6688-2:2011	Recommendations for the design of structures to BS EN 1991-2	✓
PD 6687-1:2010	Background paper to the UK National Annexes to BS EN 1992-1 and BS EN 1992-3	✓
PD 6687-2:2008	Recommendations for the design of structures to BS EN 1992-2:2005	✓
PD 6694-1:2011	Recommendations for the design of structures subject to traffic loading to BS EN 1997-1	✓
PD 6678:2005	Guide to the specification of masonry mortar	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
PD 6695-1-9:2008	Recommendations for the design of structures to BS EN 1993-1-9	
PD 6695-1-10:2009	Recommendations for the design of structures to BS EN 1993-1-10	
PD 6695-2:2008 + A1:2012 Incorporating Corrigendum No.1	Recommendation for the design of bridges to BS EN 1993	
PD 6696-2:2007+A1:2012	Background paper to BS EN 1994-2 and the UK National Annex to BS EN 1994-2	
PD 6698:2009	Recommendations for the design of structures for earthquake resistance to BS EN 1998	
PD 6702-1:2009	Structural use of aluminium. Recommendations for the design of aluminium structures to BS EN 1999	
PD 6703:2009	Structural bearings – Guidance on the use of structural bearings	
PD 6705-2:2010+A1:2013	Recommendations for the execution of steel bridges to BS EN 1090-2	
PD 6705-3:2009	Recommendations on the execution of aluminium structures to BS EN 1090-3	
PD CEN-TR 1295-2:2005	Structural design of buried pipelines under various conditions of loading Part 2: Summary of nationally established methods of design	
3. EXECUTION STANDARDS		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
BS EN 1090-1:2009+A1:2011	Execution of steel structures and aluminium structures. Requirements for conformity assessment of structural components	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BS EN 1090-2:2018	Execution of steel structures and aluminium structures. Technical requirements for the execution of steel structures	
BS EN 1090-3:2008	Execution of steel structures and aluminium structures. Technical requirements for the execution of aluminium structures	
BS EN 1536:2010+A1:2015	Execution of Special geotechnical works. Bored Piles	
BS EN 12063:1999	Execution of special geotechnical work. Sheet pile walls	
BS EN 13670:2009 Incorporating corrigenda October 2015 and November 2015	Execution of concrete structures	✓

4. PRODUCT STANDARDS

DOCUMENT REFERENCE	TITLE	Tick if required
BS EN 206:2013+A1:2016	Concrete. Specification, performance, production and conformity	✓
BS EN 10080:2005	Steel for the reinforcement of concrete — Weldable reinforcing steel - General	
BS EN 13369:2013	Common rules for precast concrete products	✓
BS EN 15050:2007+A1:2012	Precast concrete products. Bridge elements	✓
BS EN 14844:2006 (+A2:2011)	Precast concrete products - Box culverts	✓
BS EN 1317-1:2010	Road restraint systems – Part 1 Terminology and general criteria for test methods	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BS EN 1317-2:2010	Road restraint systems – Part 2 Performance classes, impact test acceptance criteria and test methods for safety barriers	✓
BS EN 998-2:2016	Specification for mortar for masonry – Part 2: Masonry mortar	✓
BS EN 1317-3:2010	Road restraint systems – Part 3 Performance classes, impact test acceptance criteria and test methods for crash cushions	
DD ENV 1317-4:2002	Road restraint systems – Part 4 Performance classes, impact test acceptance criteria and test methods for terminals and transitions of safety barriers	
BS EN 1317-5:2007+A2:2012	Road restraint systems – Part 5 Product requirements and evaluation of conformity for vehicle restraint systems	
PD CEN/TR 16949:2016	Road restraint systems – Part 6 Pedestrian restraint systems. Pedestrian Parapets	
Draft prEN 1317-7	Road restraint systems – Part 7 Performance classes, impact test acceptance criteria and test methods for terminals of safety barriers	
PD CEN/TR 17081:2018	Design of fastenings for use in concrete – Plastic design of fastenings with headed and post-installed fasteners	
BE EN 1317-8:2012	Road restraint systems – Part 8 Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers	
BS EN 1337-1:2000	Structural Bearings – Part 1 General Design Rules	
BS EN 1337-2:2004	Structural Bearings – Part 2 Sliding Elements	
BS EN 1337-3:2005	Structural Bearings – Part 3 Elastomeric Bearings	
BS EN 1337-4:2004	Structural Bearings – Part 4 Roller Bearings	
BS EN 1337-5:2005	Structural Bearings – Part 5 Pot Bearings	
BS EN 1337-6:2004	Structural Bearings – Part 6 Rocker Bearings	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BS EN 1337-7:2004	Structural Bearings – Part 7 Spherical and cylindrical PTFE bearings	
BS EN 1337-8:2007	Structural Bearings – Part 8 Guide bearings and Restraint bearings	
BS EN 1337-9:1998	Structural Bearings – Part 9 Protection	
BS EN 1337-10:2003	Structural Bearings – Part 10 Inspection and Maintenance	
BS EN 1337-11:1998	Structural Bearings – Part 11 Transport, storage and installation	
BS EN 1794-1:2018	Road traffic noise reducing devices. Non-acoustic performance. Mechanical performance and stability requirements	
BS EN 1794-2:2011	Road traffic noise reducing devices. Non-acoustic performance. General safety and environmental requirements	
BS EN 10025-1:2004	Hot rolled products of structural steels – Part 1 General technical delivery conditions	
BS EN 10025-2:2004	Hot rolled products of structural steels – Part 2 Technical delivery conditions for non-alloy structural steels	
BS EN 10025-3:2004	Hot rolled products of structural steels – Part 3 Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels	
BS EN 10025-4:2004	Hot rolled products of structural steels – Part 4 Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels	
BS EN 10025-5:2004	Hot rolled products of structural steels – Part 5 Technical delivery conditions for structural steels with improved atmospheric corrosion resistance	
BS EN 10025-6:2004+A1:2009	Hot rolled products of structural steels – Part 6 Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BS EN 10080:2005	Steel for the reinforcement of concrete. Weldable reinforcing steel. General	
BS EN 10210-1:2006	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 1 Technical delivery requirements	
BS EN 10210-2:2006	Hot finished structural hollow sections of non-alloy and fine grain steels – Part 2 Tolerances, dimensions and sectional properties	
BS EN 10248-1:1996	Hot rolled sheet piling of non-alloy steels – Part 1 Technical delivery conditions	
BS EN 10248-2:1996	Hot rolled sheet piling of non-alloy steels – Part 2 Tolerances on shape and dimensions	
BS EN 14388:2005	Road traffic noise reducing devices	
BS EN 1295-1:1997	Structural design of buried pipelines under various conditions of loading Part 1: General requirements	
BS EN 1916:2002	Concrete pipes and fittings, unreinforced, steel fibre and reinforced	
5. BRITISH STANDARDS		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
BS 4449:2005 +A3:2016	Steel for the reinforcement of concrete	✓
BS 5896:2012	Specification of high tensile steel wire and strand for the prestressing of concrete	
BS 7818:1995	Specification for pedestrian restraint systems in metal	
BS 8002:2015	Code of practice for earth retaining structures	✓
BS 8004:2015	Code of practice for foundations	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BS 8006-1:2010+A1:2016	Code of practice for strengthened/reinforced soils and other fills	
BS 8500-1:2015+A2:2019	Concrete – Complementary British Standard to BS EN 206 Part 1 – Method of specifying and guidance for the specifier	✓
BS 8500-2:2015+A2:2019	Concrete – Complementary British Standard to BS EN 206 Part 2 – Specification for constituent materials and concrete	✓
BS 8666:2005	Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete	✓
BS 5628-1:1992	Code of practice for use of masonry Part 1: Structural use of unreinforced masonry	✓
BS 5911-1:2002	Concrete pipes and ancillary concrete products Part 1: Specification for unreinforced and reinforced concrete pipes (including jacking pipes) and fittings with flexible joints	
BS 9295:2010	Guide to the structural design of buried pipelines	
6. DESIGN MANUAL FOR ROADS AND BRIDGES (DMRB)		
6.1 ADVICE NOTES – BRIDGES AND STRUCTURES (BA SERIES)		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
BA 9/81	The Use of BS 5400 Part 10: 1980 - Code of Practice for Fatigue [Incorporating Amendment No.1 dated November 1983	
BA 19/85	The Use of BS 5400: Part 3: 1982	
CD 357	Bridge Expansion Joints	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
CD 355	Application of whole-life costs for design and maintenance of highway structures	✓
BA 35/90	Inspection and Repair of Concrete Highway Structures Not applicable for use in Scotland Northern Ireland Addendum applicable for use in Northern Ireland	
BA 36/90	The Use of Permanent Formwork	
BA 37/92	Priority Ranking of Existing Parapets	
BA 38/93	Assessment of the Fatigue Life of Corroded or Damaged Reinforcing Bars	
BA 39/93	Assessment of Reinforced Concrete Half-joints	
BA 40/93	Tack Welding of Reinforcing Bars	
BA 41/98	The Design and Appearance of Bridges	✓
BA 51/95	The Assessment of Concrete Structures Affected by Steel Corrosion	
BA 52/94	The Assessment of Concrete Structures Affected by Alkali Silica Reaction	
CS 463	Load Testing for Bridge Assessment	
CS 459	The Assessment of bridge substructures, retaining structures and buried structures	
BA 57/01	Design for Durability	✓
CD 356	Design of highway structures for hydraulic actions	✓
CD 362	Enclosure of Bridges	
BA 68/97	Crib Retaining Walls	
BA 72/03	Maintenance of Road Tunnels	
BA 74/06	Assessment of Scour at Highway Bridges	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BA 82/00	Formation of Continuity Joints in Bridge Decks	
CD 370	Cathodic Protection for Use in Reinforced Concrete Highway Structures	
BA 85/04	Coatings for Highway Structures and Ancillary Structures	✓
CS 464	Non-Destructive Testing of Highway Structures	
CS 460	Management of Corrugated Steel Buried Structures	
BA 88/04	Management of Buried Concrete Box Structures	✓
BA 92/07	The Use of Recycled Concrete Aggregates in Structural Concrete	✓
BA 93/09	Structural Assessment of Bridges with Deck Hinges	
6.2 STANDARDS – BRIDGES AND STRUCTURES (BD SERIES)		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
BD 2/12	Technical Approval of Highway Structures	✓
BD 9/81	Implementation of BS 5400: Part 10: 1980 - Code of Practice for Fatigue	
CD 361	Weathering Steel for Highway Structures	
BD 13/06	Design of Steel Bridges. Use of BS 5400-3:2000	
CD 365	Portal and cantilever signs/signals gantries	
CD 375	Design of corrugated steel buried structures	
CS 454	Assessment of Highway Bridges and Structures	
BD 29/17	Design Criteria for Footbridges	
BD 31/01	The Design of Buried Concrete Box and Portal Frame Structures	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BD 33/94	Expansion Joints for Use in Highway Bridge Decks	✓
CG 303	Quality Assurance Scheme for Paints and Similar Protective Coatings	
BD 36/92	Evaluation of Maintenance Costs in Comparing Alternative Designs for Highway Structures	✓
BD 41/97	Reinforced Clay Brickwork Retaining Walls of Pocket Type and Grouted Cavity Type Construction	
BD 43/03	The Impregnation of Reinforced and Prestressed Concrete Highway Structures using Hydrophobic Pore-Lining Impregnants	✓
BD 44/15	The Assessment of Concrete Highway Bridges and Structures	
BD 45/93	Identification Marking of Highway Structures	✓
CD 358	Waterproofing and Surfacing of Concrete Bridge Decks	✓
BD 48/93	The Assessment and Strengthening of Highway Bridge Supports	
BD 49/01	Design Rules for Aerodynamic Effects on Bridges	
BD 54/15	Management of Post-Tensioned Concrete Bridges	
BD 53/95	Inspection & Records for Road Tunnels	
BD 56/10	The Assessment of Steel Highway Bridges and Structures	
BD 57/01	Design for Durability	✓
BD 60/04	Design of Highway Bridges for Vehicle Collision Loads	
BD 61/10	The Assessment of Composite Highway Bridges and Structures	
BD 62/07	As Built, Operational and Maintenance Records for Highway Structures	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BD 63/17	Inspection of Highway Structures	✓
BD 65/14	Design Criteria for Collision Protector Beams	
BD 78/99	Design of Road Tunnels	
BD 79/13	The Management of Sub-standard Highway Structures	
CD 360	Use of Compressive Membrane Action in Bridge Decks	
BD 82/00	Design of Buried Rigid Structures	
BD 84/02	Strengthening of Concrete Bridge Supports for Vehicle Impact Using Fibre Reinforced Polymers	
BD 85/08	Strengthening Highway Structures Using Externally Bonded Fibre Reinforced Polymer	
BD 86/11	The Assessment of Highway Bridges and Structures For The Effects of Special Types General Order (STGO) and Special Order (SO) Vehicles	
BD 87/05	Maintenance Painting of Steelwork	
BD 89/03	The Conservation of Highway Structures English Addendum applicable for use in England Northern Ireland Addendum applicable for use in Northern Ireland Scottish Addendum applicable for use in Scotland Welsh Addendum applicable for use in Wales	
BD 90/05	Design of FRP Bridges and Highway Structures	
BD 91/04	Unreinforced Masonry Arch Bridges	
BD 94/17	Design of Minor Structures	✓
BD 95/07	Treatment of Existing Structures on Highway Widening Schemes	
BD 97/12	The Assessment of Scour and Other Hydraulic Actions at Highway Structures	✓
BD 100/16	The Use of Eurocodes for the Design of Highway Structures	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
BD 101/11	Structural Review and Assessment of Highway Structures	
6.3 TECHNICAL MEMORANDA – BRIDGES (BE SERIES)		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
BE 5/75	Technical Memorandum (Bridges) Rules for the Design and Use of Freyssinet Concrete Hinges in Highway Structures	
6.4. STANDARDS - GENERAL REQUIREMENTS (GD SERIES)		
GG 101	Introduction to the Design Manual for Roads and Bridges	✓
GG 102	Quality Management Systems for Highway Works	
GG 104	Requirements for Safety Risk Assessment	✓
GD 02/16	Quality Management Systems for Highway Design	
GD 5/16	Asbestos Management in Trunk Road Assets	
GD 300	Requirements for new and upgraded all-purpose trunk roads (expressways)	
6.5 ADVICE NOTES - HIGHWAYS (HA SERIES)		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
HA 40/01	Determination of Pipe Bedding Combinations for Drainage Works	
HA 59/92	Mitigating against Effects on Badgers (Incorporating Amendment No. 1 dated February 1997)	✓
HA 65/94	Design for Environmental Barriers	
HA 66/95	Environmental Barriers – Technical Requirements	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
HA 74/07	Treatment of Fill and Capping Materials Using Either Lime or Cement or Both	
HA 75/01	Trunk Roads and Archaeological Mitigation	
CD 521	Hydraulic design of road edge surface water channels and outlets	
HA 80/99	Nature Conservation Advice in Relation to Bats	✓
HA 81/99	Nature Conservation Advice in Relation to Otters	✓
HA 84/01	Nature Conservation and Biodiversity	✓
HA 97/01	Nature Conservation Management Advice in Relation to Dormice	✓
HA 98/01	Nature Conservation Management Advice in Relation to Amphibians	✓
HA 106/04	Drainage of Runoff from Natural Catchments	✓
HA 107/04	Design of Outfall and Culvert Details	✓
HA 116/05	Nature Conservation Advice in Relation to Reptiles and Roads	
HA 117/08	Cultural Heritage Asset Management Plans	
HA 200/08	Aims and Objectives of Environmental Assessment	
HA 201/08	General Principles and Guidance of Environmental Impact Assessment	✓
HA 202/08	Environmental Impact Assessment	
HA 204/08	Scoping of Environmental Impact Assessments	
HA 205/08	Assessment and Management of Environmental Effects	
HA 207/07	Air Quality	
HA 208/07	Cultural Heritage	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
HA 212/08	Glossary of Terms Used in The Design Manual for Roads and Bridges Volume 11 Sections 1 and 2	
CD 523	Determination of pipe roughness and assessment of sediment deposition to aid pipeline design	
6.6 STANDARDS - HIGHWAYS (HD SERIES)		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
CD 622	Managing Geotechnical Risk	✓
HD 33/16	Design of Highway Drainage Systems	✓
HD 41/15	Maintenance of Highway Geotechnical Assets	✓
HD 44/09	Assessment of Implications (of Highways and/or Roads Projects) on European Sites (Including Appropriate Assessment)	
LA 113	Road Drainage and the Water Environment	✓
HD 47/08	Screening of Projects for Environmental Impact Assessment	
HD 48/08	Reporting of Environmental Impact Assessments	
HD 49/16	Highway Drainage Design Principal Requirements	
HD 50/16	The Certification of Drainage Design	
HD 213/11	Noise and Vibration	
6.7 STANDARDS – TRAFFIC ENGINEERING AND CONTROL (TD SERIES)		
DOCUMENT REFERENCE	**TITLE**	**Tick if required**
TD 9/93	Highway Link Design (Incorporating Amdt No 1 dated February 2002)	

TECHNICAL APPRAISAL SCHEDULE (TAS)		
TD 19/06	Requirement for Road Restraint Systems	✓
TD 27/05	Cross Sections and Headroom	✓
TD 36/93	Subways for Pedestrians and Pedal Cyclists, Layout and Dimensions	
CD 169	The design of lay-bys, maintenance hardstandings, rest areas, service areas and observation platforms	

7. MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS (MCDHW)

DOCUMENT TITLE	**Tick if required**
Volume 1: Specification for Highway Works (May 2017)	✓
Volume 2: Notes for Guidance on the Specification for Highway Works (May 2017)	✓
Volume 3: Highway Construction Details (February 2017)	✓

8. INTERIM ADVICE NOTES

(Which may be used with additional guidance and/or requirement as in BD 100)

IAN 69/15	Designing for Maintenance	✓
IAN 83/06	Principal and General Inspection of Sign/Signal Gantries, and Gantries with low handrails or open mesh flooring	
IAN 97/07	Assessment and upgrading of existing parapets	
IAN 104/15	The Anchorage of Reinforcement & Fixings in Hardened Concrete	✓
IAN 105/08	Implementation of construction (Design and Management) 2007 and the withdrawal of SD 10 and SD 11	✓
IAN 117/08r2	Certification of combined kerb and drainage products	
IAN 124/11 Annex C	Use of Eurocodes for the design of highway structures	✓

TECHNICAL APPRAISAL SCHEDULE (TAS)		
IAN 127/10r1	The use of foamed concrete	
IAN 131/11	Deflection of Permanent Formwork	
IAN 136/10	Structural safety reporting	
IAN 149/17	Existing Motorway Minimum Requirements	
IAN 161/15	Smart Motorways	
IAN 173/13	Implementation of BD97/12 The Assessment of Scour and Other Hydraulic Actions at Highway Structures	✓
IAN 184/16	Highways Agency Data & CAD Standard	✓

9. HA PUBLICATIONS (TSE)	
DOCUMENT TITLE	**Tick if required**
TRH 1679 Issue A July 1997 Controlled Motorway – Controlled Motorway Indicator Approval (Structures)	
TR 2196 Issue B January 1999 Message Signs and Motorway Signals MK 3 (MS3) Requirements for Enclosures and Mounting Brackets	
TR 2198 Issue B January 1999 Message Signs and Motorway Signals MK 3 (MS3) Requirements for Portal Gantry Interface Frames	
TRH 1642 Issue C July 1999 Message Signs and Motorway Signals MK 3 (MS3) Infrastructure Design Guide	
DETR/HA List of Drawings, Specifications and Instruction: Traffic Systems and Lighting, MCS 206	

10. MISCELLANEOUS PUBLICATIONS	
DOCUMENT TITLE	**Tick if required**
CHE Memorandum 227/08: The Impregnation of Reinforced and Prestressed Concrete Highway Structures using Hydrophobic Pore Lining Impregnants	

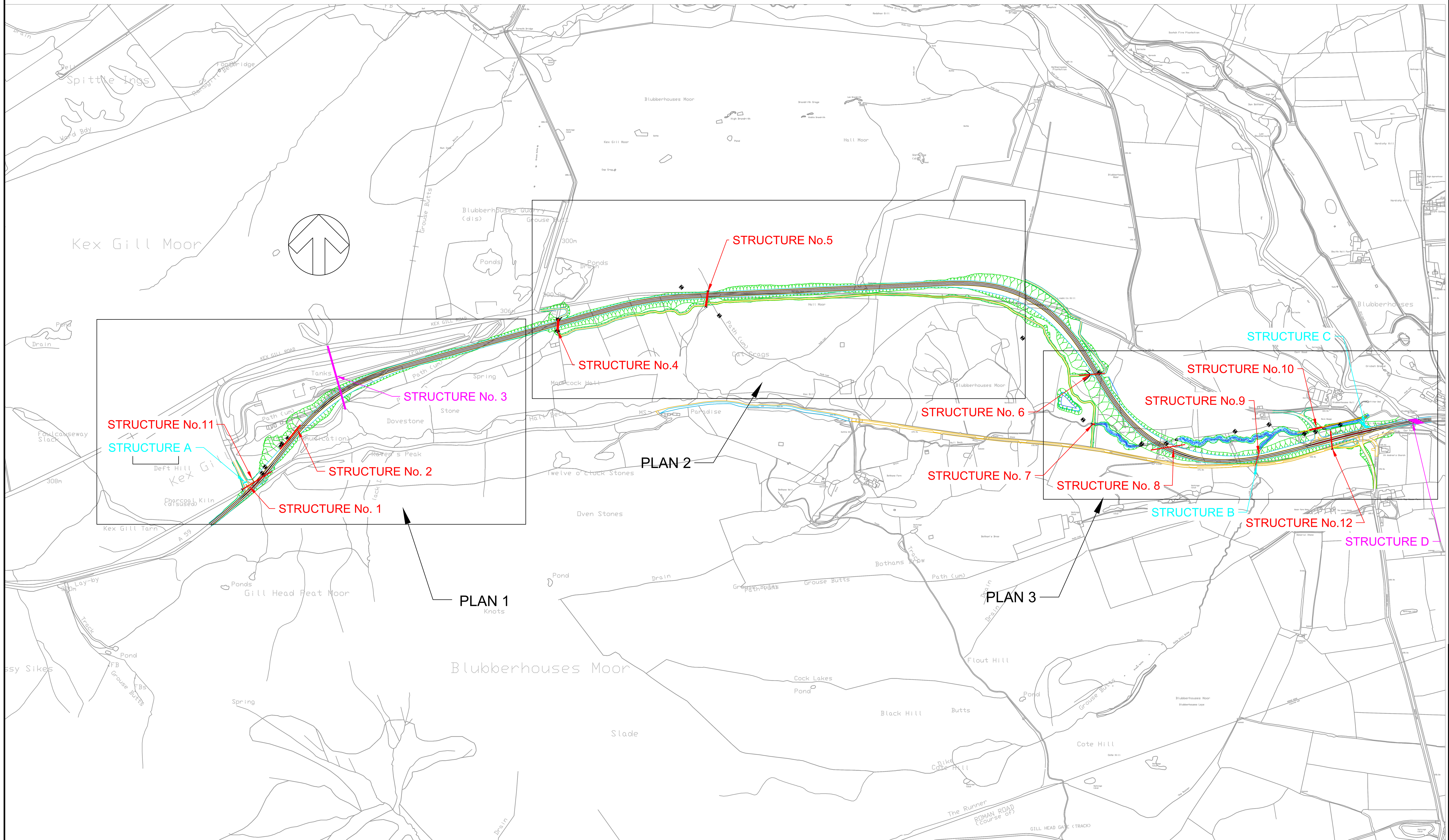
TECHNICAL APPRAISAL SCHEDULE (TAS)	
CIRIA Document C524: Cladding Fixings	✓
CIRIA Document C543: Bridge Detailing Guide	✓
CIRIA Document C579: Retention of Masonry Facades – best practice guide	✓
CIRIA Document C641: EC7 – Implications for UK Practice	✓
CIRIA Document C660: Early-age thermal crack control in concrete	✓
CIRIA Document C686: Safe Access for Maintenance and Repair	✓
CIRIA Document C689: Culvert Design and Operation Guide	✓
CIRIA Document C760: Guidance on Embedded Retaining Wall Design	
CIRIA Document C766: Control of cracking caused by restrained deformation in concrete	✓
CIRIA Document C777: General Fixings – Guidance on Selection and whole-life Management	
CIRIA Document C778: Management of Safety-critical fixings	
Circular Roads No. 61/72 – Routes for Heavy and High Abnormal Loads	
The Traffic Signs Regulations and General Directions 1994 (S.I. 1994 No. 1519)	
Simplified Tables of External Loads on Buried Pipelines (1986) – TRRL	
Health and Safety at Work Act 1974	✓
The Construction (Design and Management) Regulation 2007 (HSE)	✓
Control of Substances Hazardous to Health Regulations 1994 (HSE)	

Appendix B

LOCATION PLAN

Millimetres 0 10 100

DO NOT SCALE



NOTES:

1. THIS DRAWING PROVIDES OUTLINE LOCATIONS OF THE PROPOSED STRUCTURES REQUIRED FOR THE A59 KEX GILL IMPROVEMENT SCHEME.
2. THE DIVERSION SHALL AFFECT 5NO. EXISTING STRUCTURES AS INCLUDE PROPOSALS FOR 11NO. NEW STRUCTURES COMPRISING:
   - 3NO. EXISTING CULVERTS
   - 2NO. EXISTING BRIDGES
   - 2NO. PROPOSED UNDERPASSES
   - 8NO. PROPOSED CULVERTS
   - 1NO. PROPOSED RETAINING WALLS

KEY:

- NEW STRUCTURE DESIGN (red)
- EXISTING STRUCTURE TO BE RETAINED (magenta)
- EXISTING STRUCTURE TO BE REMOVED (cyan)

Rev.	Date	Description	By	Chk'd	App'd
P08	15/05/2023	UPDATED FOR AIP REVISION	SH	DM	DM

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Client

North Yorkshire County Council

Project Title

A59 KEX GILL DIVERSION

Drawing Title

STRUCTURES LOCATION PLAN (SHEET 1 OF 3)

Scale	Drawn	Checked	Approved	Authorised
NTS	L. Slinn	I.Mulla	H.Mistry	H.Mistry
Original Size	Date	Date	Date	Date
A1	31/01/2020	31/01/2020	31/01/2020	31/01/2020

Drawing Status	Suitability
FOR INFORMATION	S2

Drawing Number

Project	Originator	Volume	Project Ref. No.
NYKGDD	WSP	SGN	

Location	Type	Role	Number	Revision
0000	DR	CB	0001	P08

DO NOT SCALE

Millimetres 0 10 100

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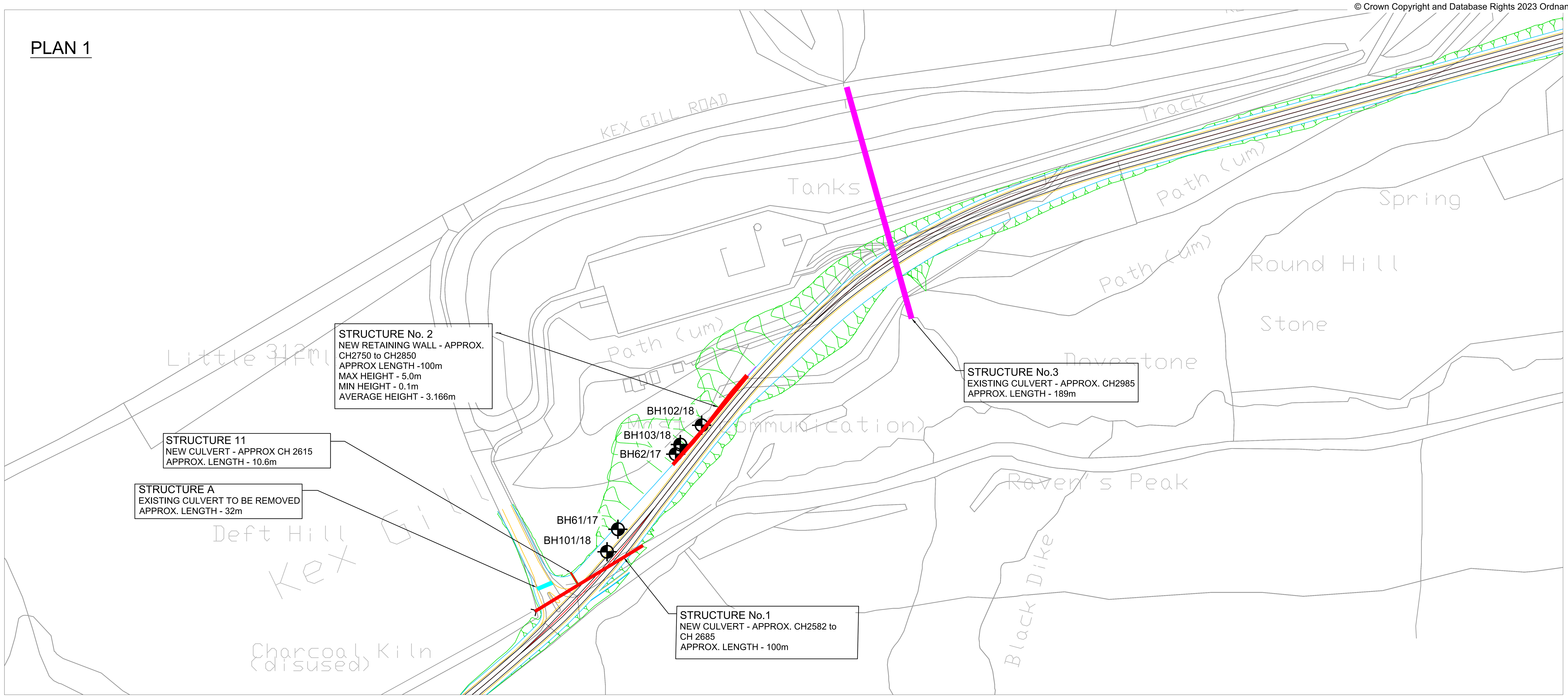
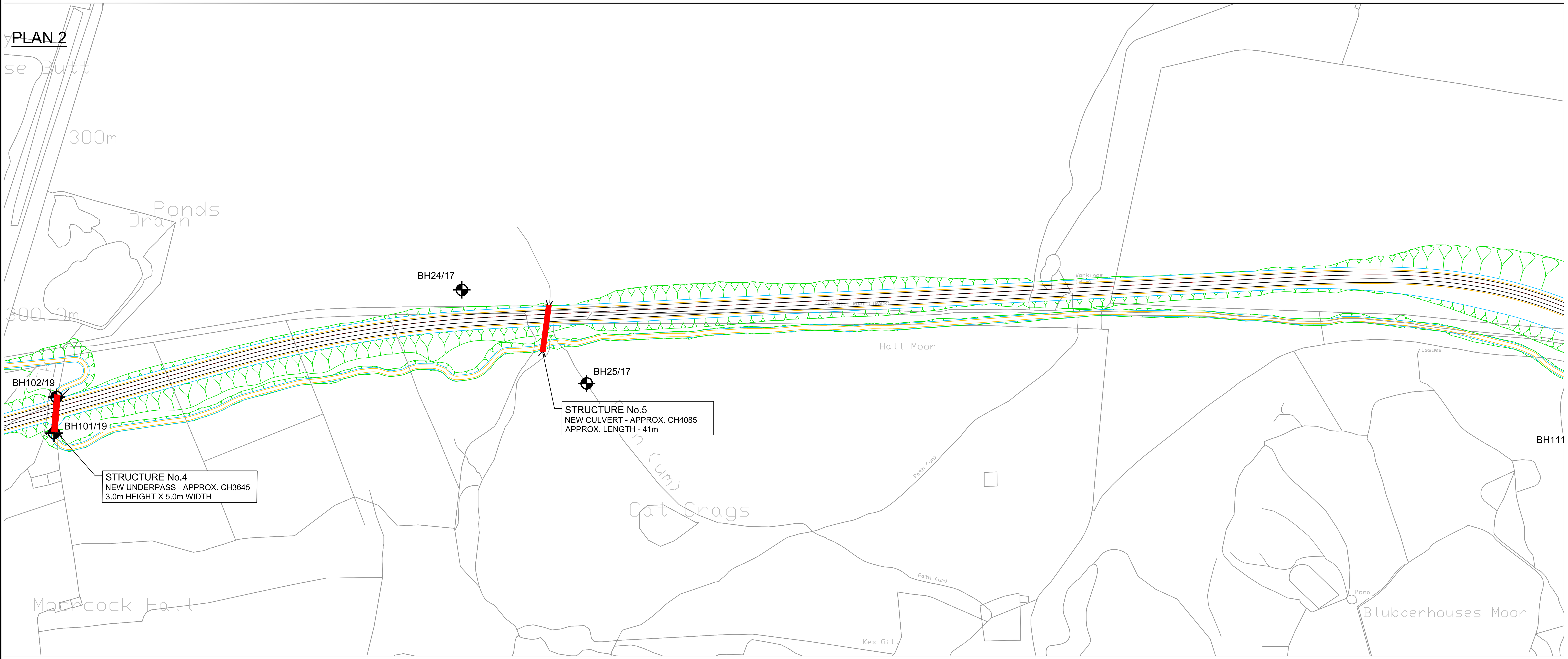
PLAN 1



PLAN 2



NOTES:

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   - 2NO. EXISTING BRIDGES
   - 2NO. PROPOSED UNDERPASSES
   - 8NO. PROPOSED CULVERTS
   - 1NO. PROPOSED RETAINING WALLS

KEY:

- (red) - NEW STRUCTURE DESIGN
- (magenta) - EXISTING STRUCTURE TO BE RETAINED
- (cyan) - EXISTING STRUCTURE TO BE REMOVED
- (symbol) - BOREHOLE

Rev.	Date	Description	By	Chk'd	App'd
P08	15/05/2023	UPDATED FOR AIP REVISION	SH	DM	DM

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Project Title: A59 KEX GILL DIVERSION

Drawing Title: STRUCTURES LOCATION PLAN (SHEET 2 OF 3)

Scale	Drawn	Checked	Approved	Authorised
N/A	L. Slinn	I.Mulla	H.Mistry	H.Mistry
Original Size	Date	Date	Date	Date
A1	31/01/2020	31/01/2020	31/01/2020	31/01/2020

Drawing Status: FOR INFORMATION — Suitability: S2

Drawing Number:

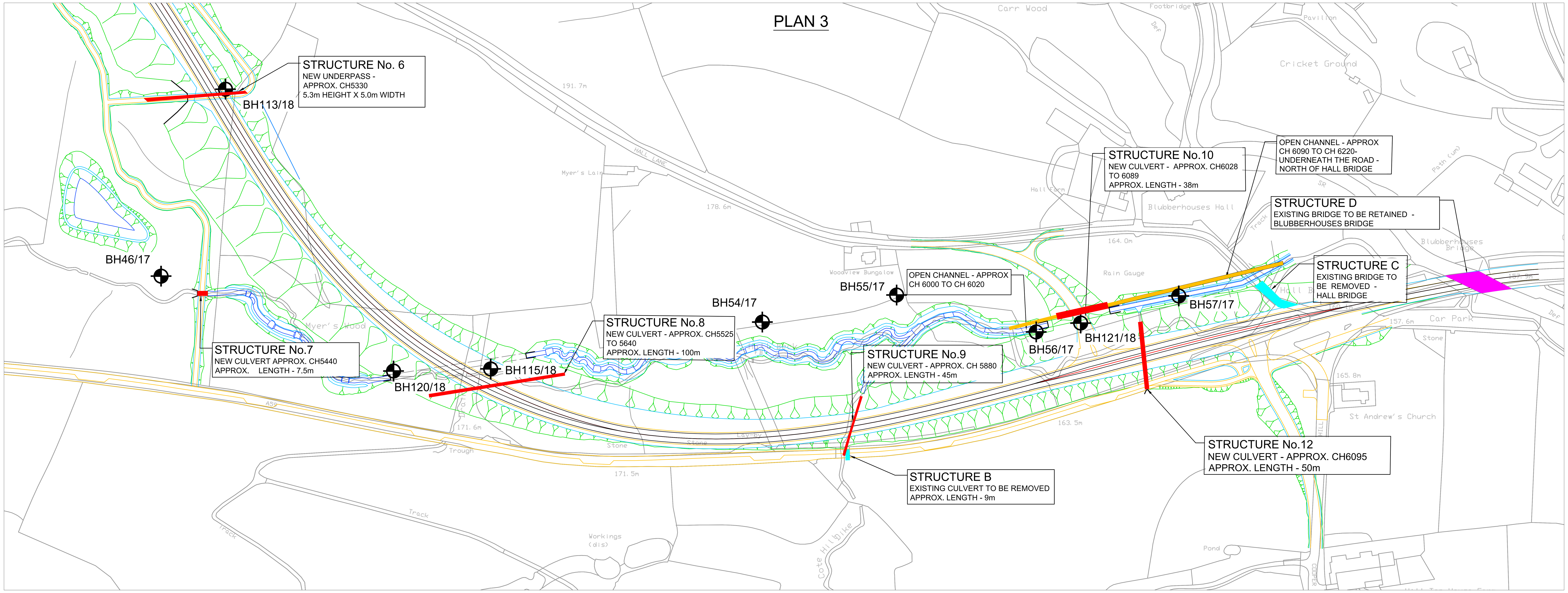
Project	Originator	Volume	Location	Type	Role	Number
NYKGDD	WSP	SGN	0000	DR	CB	0002

Project Ref. No.:

Revision: P08

DO NOT SCALE

Millimetres 0 10 100



NOTES:

1. THIS DRAWING PROVIDES OUTLINE LOCATIONS OF THE PROPOSED STRUCTURES REQUIRED FOR THE A59 KEX GILL IMPROVEMENT SCHEME.
2. THE DIVERSION SHALL AFFECT 5NO. EXISTING STRUCTURES AS INCLUDE PROPOSALS FOR 11NO. NEW STRUCTURES COMPRISING:
   - 3NO. EXISTING CULVERTS
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   - 2NO. PROPOSED UNDERPASSES
   - 8NO. PROPOSED CULVERTS
   - 1NO. PROPOSED RETAINING WALLS

KEY:

- (red) - NEW STRUCTURE DESIGN
- (magenta) - EXISTING STRUCTURE TO BE RETAINED
- (cyan) - EXISTING STRUCTURE TO BE REMOVED
- (symbol) - BOREHOLE

Rev.	Date	Description	By	Chk'd	App'd
P08	15/05/2023	UPDATED FOR AIP REVISION	SH	DM	DM

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Project Title: A59 KEX GILL DIVERSION

Drawing Title: STRUCTURES LOCATION PLAN (SHEET 3 OF 3)

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Original Size: A1	Date: 31/01/2020	Date: 31/01/2020	Date: 31/01/2020	Date: 31/01/2020

Drawing Status: FOR INFORMATION | Suitability: S2

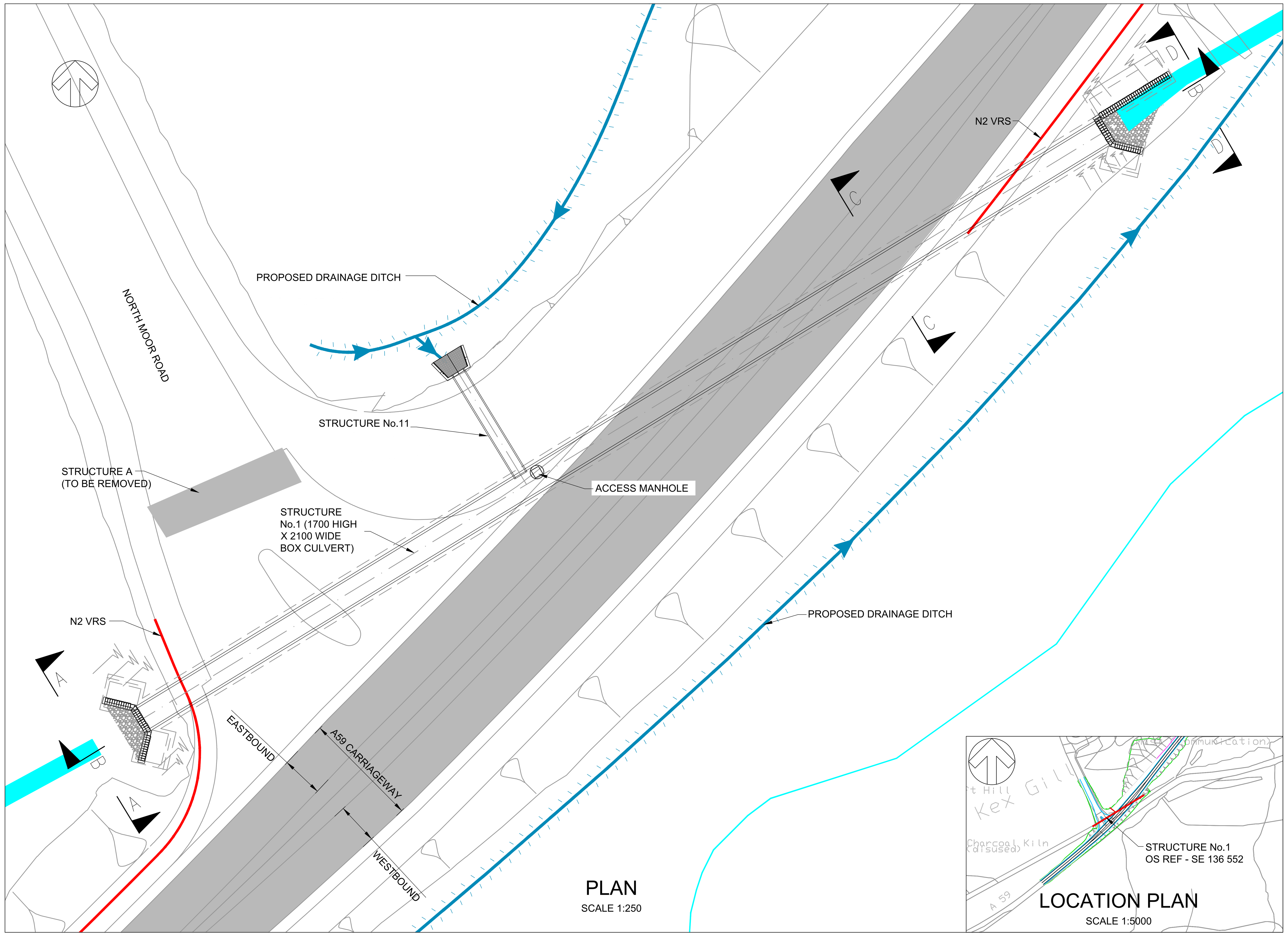
Drawing Number Project	Originator	Volume	Project Ref. No.
NYKGDD	WSP	SGN	

Location	Type	Role	Number	Revision
0000	DR	CB	0003	P08

Appendix C

PROPOSED GENERAL ARRANGEMENT DRAWINGS

DO NOT SCALE

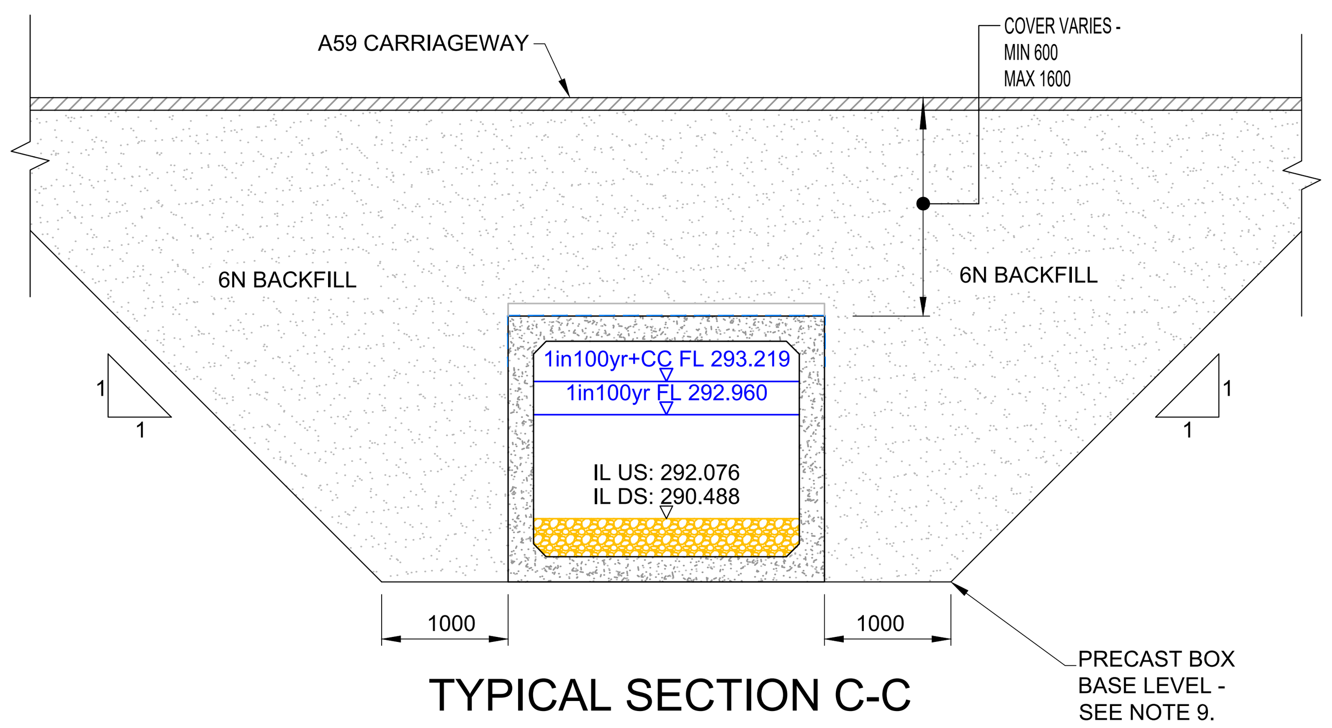


PLAN

SCALE 1:250

004 006 007 009

DRAWING SCHEDULE	
DRAWING NUMBER	TITLE
NYKGDD-WSP-SMN-ST001-DR-CB-0001	GENERAL ARRANGEMENT SHEET 1 OF 2
NYKGDD-WSP-SMN-ST001-DR-CB-0002	GENERAL ARRANGEMENT SHEET 2 OF 2
NYKGDD-WSP-SMN-ALL-DR-CB-0001	TYPICAL CULVERT DETAILS SHEET 1 OF 2
NYKGDD-WSP-SMN-ALL-DR-CB-0002	TYPICAL CULVERT DETAILS SHEET 2 OF 2



TYPICAL SECTION C-C

SCALE 1:50

NOTES

GENERAL

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AOD UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING.
4. THE DRAWING TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS, CONTRACT-SPECIFIC APPENDICES, DRAWINGS NYKGDD-WSP-SMN-ALL-DR-CB-0001, AND NYKGDD-WSP-SMN-ALL-DR-CB-0002, AND THE DRAWINGS LISTED IN THE SCHEDULE ON THIS DRAWING.
5. THE CONTRACTOR SHALL MEASURE AND CONFIRM ALL DIMENSIONS/LEVELS THAT HAVE A DIRECT IMPACT ON THE WORKS PRIOR TO EXECUTION. IN CASE OF DOUBTS, OMISSIONS, OR ERRORS, THE CONTRACTOR NEEDS TO SEEK CLARIFICATION FROM THE NEC4 PROJECT MANAGER.
6. FOR THE AFFECTED AREAS PRIOR TO WORKS, THE CONTRACTOR SHALL OBTAIN UP-TO-DATE UTILITY PLANS AND CARRY OUT SURVEYS TO POSITIVELY IDENTIFY AND MARK-UP ANY UTILITY APPARATUS. REFER TO APPENDIX 1/16 FOR FURTHER INFORMATION.

GEOTECHNICAL

7. FORMATION INSPECTIONS SHALL BE UNDERTAKEN BY THE DESIGNER'S SITE REPRESENTATIVE WHO SHALL BE A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER. THE STRUCTURE IS ASSUMED TO FOUND ON WEATHERED BEDROCK. ANY SOFT SPOTS SHALL BE EXCAVATED AND REPLACED IN ACCORDANCE WITH THE RELEVANT STANDARD EARTHWORKS DETAILS AND IN ACCORDANCE WITH THE SERIES 600 SPECIFICATION. THE DESIGNER SHALL BE INFORMED IMMEDIATELY IF FORMATION MATERIAL DIFFERS FROM THAT ASSUMED WITHIN THE DESIGN.
8. PRECAST UNITS FOUNDED ON OTHER THAN HARD MATERIAL (E.G.: NOT ON BEDROCK OR PILED SLABS) SHALL BE LAID ON EITHER:
   - A GRANULAR BED WITH THE LOWER 150MM BEING 6N MATERIAL AND THE UPPER 50MM BEING CLASS 6L MATERIAL AS PER MCHW SERIES 600, EXCEPT FOR CLASS 6L, ONLY THE GRADING REQUIREMENT APPLIES AND NOT THE OTHER MATERIAL PROPERTIES LISTED IN TABLE 6/1 OF MCHW (BUT THE SULPHATE REQUIREMENTS OF CLAUSE 601 STILL APPLY).
   - ALTERNATIVELY, THE LOWER 150MM MAY BE REPLACED BY A 75MM MINIMUM THICKNESS BLINDING CONCRETE COMPRISING DESIGNATED CONCRETE FND2.
   - EITHER BEDDING OPTION TO BE A MIN 300MM WIDER THAN THE PRECAST ELEMENTS AT OUTER EDGES.
9. THE LEVEL OF THE BOTTOM OF PRECAST UNITS TO BE ADJUSTED BASED ON THICKNESS OF CONTRACTOR DESIGNED PRECAST BOX BOTTOM SLAB IN ORDER TO ACHIEVE STATED INVERT LEVELS (ASSSUMED 200MM SLAB THICKNESS WITH 300MM NATURAL BED SHOWN ON THIS DRAWING).

STONE FACING AND STONE WALLS

10. REFER TO DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0002 AND SPECIFICATION APP 24/1 FOR DETAILS.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS

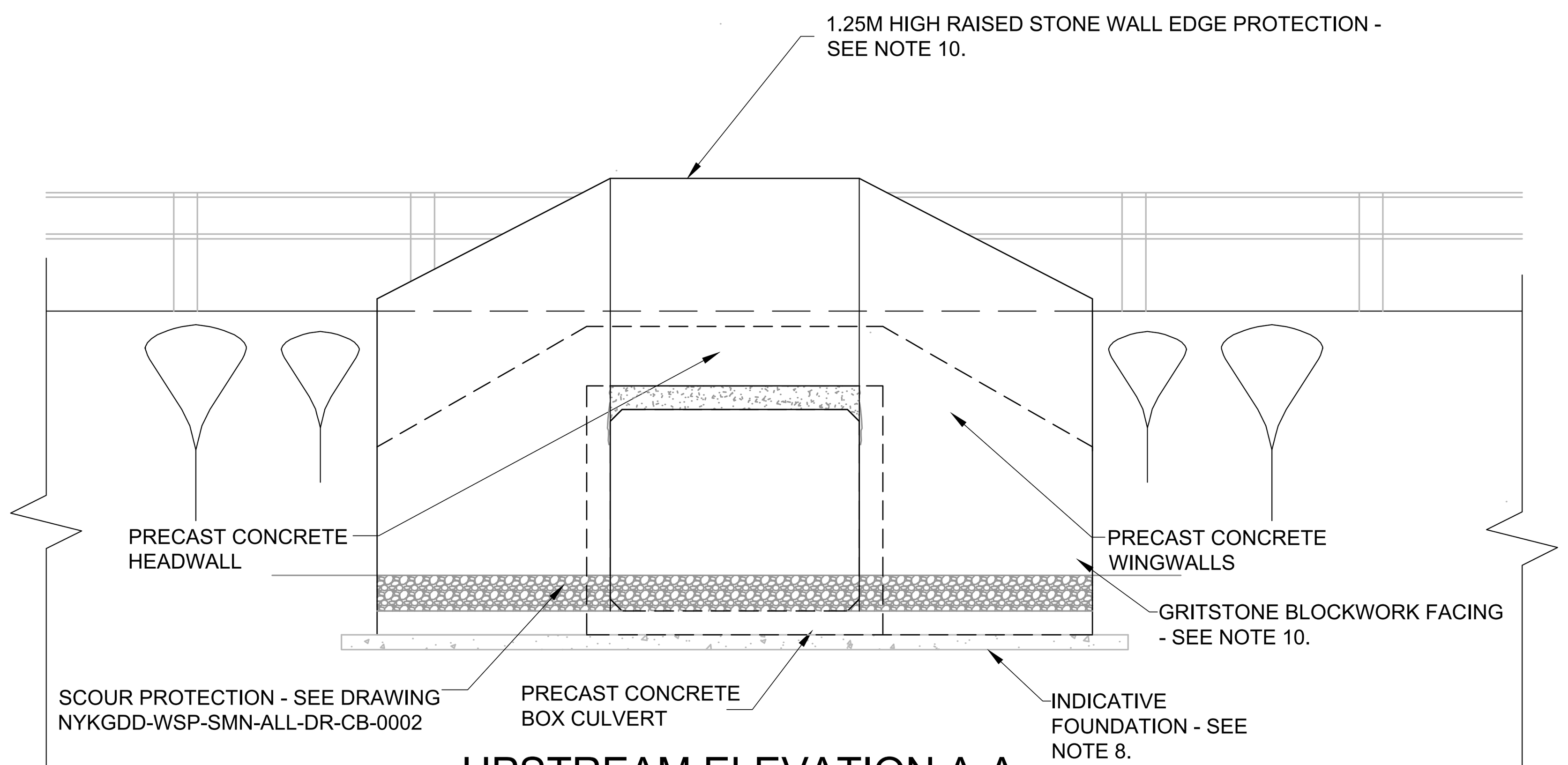
CONSTRUCTION
- REF 004 - WORKING IN CONFINED SPACE
- REF 006 - BACKFILLING OF THE BOX CULVERT STRUCTURE
- REF 007 - WORKING WITH LIFTING PLANT DURING INSTALLATION OF PRECAST UNITS
- REF 009 - DAMAGE TO EXISTING STATUTORY SERVICES

SAFETY, HEALTH AND ENVIRONMENTAL SYMBOL LEGEND

INDICATES A RESIDUAL RISK AS A WARNING

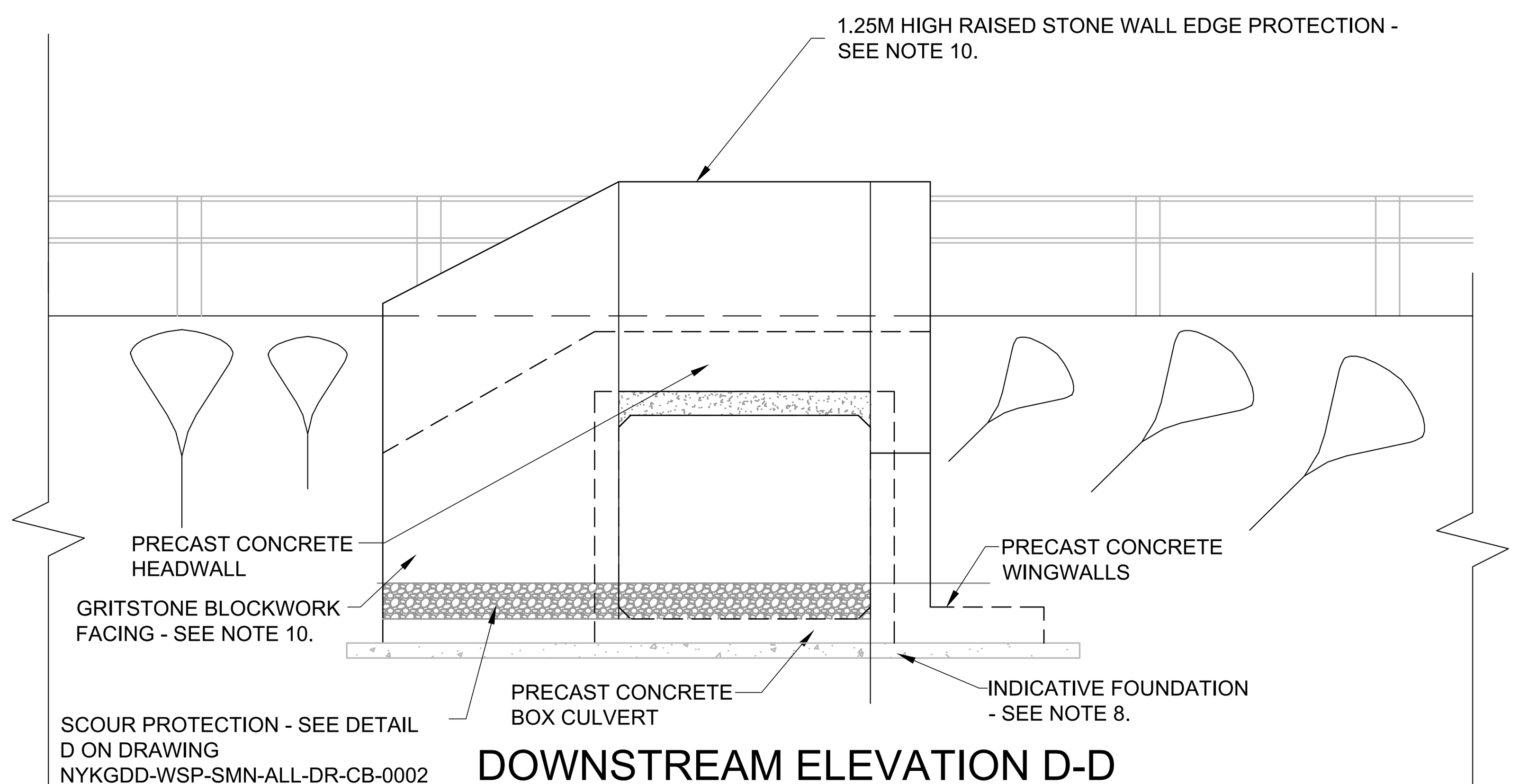
INDICATIVE CONSTRUCTION SEQUENCE:

1. SET UP SITE COMPOUND
2. INSTALL HALL BECK WATERCOURSE DIVERSION TEMPORARY WORKS
3. INSTALL TEMPORARY WORKS TO SUPPORT EXCAVATION (UP TO NORTH MOOR ROAD/A59 JUNCTION)
4. EXCAVATE TO FORMATION LEVEL OF BOX CULVERT AND WINGWALLS
5. INSTALL PRECAST CONCRETE BOX CULVERT SEGMENTS
6. INSTALL WINGWALLS TO NE ELEVATION
7. INSTALL NATURAL BED AS WORK PROGRESS TO REDUCE CONFINED SPACE WORKING
8. TEMPORARILY CLOSE EXISTING NORTH MOOR ROAD/A59 JUNCTION TO TRAFFIC
9. INSTALL TEMPORARY WORKS TO SUPPORT EXCAVATION (FOR BOTH STRUCTURE NO.1 & 11)
10. EXCAVATE AND REMOVE THE EXISTING PIPE CULVERT A (INCLUDING HEADWALLS/WINGWALLS) BENEATH NORTH MOOR ROAD
11. INSTALL PIPE CULVERT STRUCTURE NO.11 INCLUDING CONNECTION SEGMENT WITH STRUCTURE NO.1
12. INSTALL WINGWALLS TO UPSTREAM OF PIPE CULVERT STRUCTURE NO.11
13. INSTALL REMAINDER OF PRECAST CONCRETE BOX CULVERT SEGMENTS
14. INSTALL WINGWALLS TO SW ELEVATION
15. RETURN WATERCOURSE TO PERMANENT CHANNEL
16. BACKFILL STRUCTURE IN A STAGED MANNER
17. CONSTRUCT APPROACH EMBANKMENTS AND NEW A59 CARRIAGEWAY
18. INSTALL RAISED STONE WALL TO THE ENDS OF THE NEW CULVERT
19. INSTALL VRS TO THE NEW A59 VERGES
20. OPEN EXISTING NORTH MOOR ROAD TO TRAFFIC AND COMMISSION NEW A59 ROAD ALIGNMENT



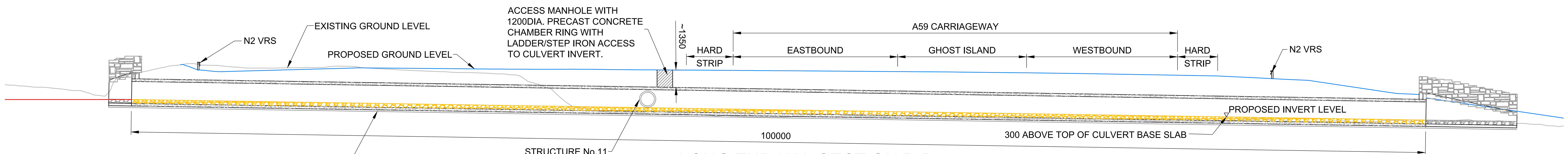
UPSTREAM ELEVATION A-A

SCALE 1:50



DOWNSTREAM ELEVATION D-D

SCALE 1:50



LONGITUDINAL SECTION B-B

SCALE 1:200

P05	11/05/2023	UPDATED FOR AIP REVISION	SH	DM	DM
Rev.	Date	Description	By	Chk'd	App'd

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Client: North Yorkshire County Council

Project Title: A59 KEX GILL DIVERSION

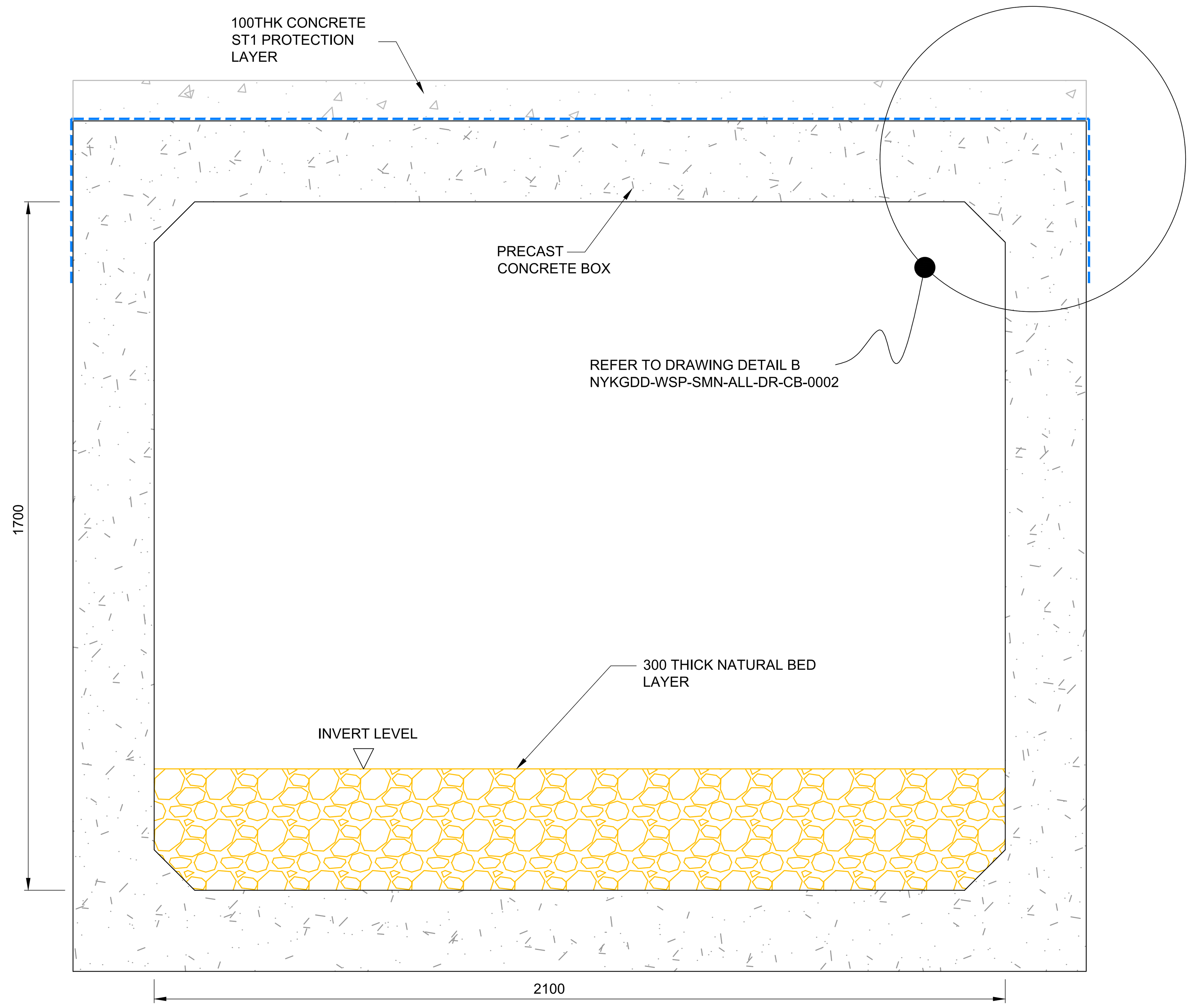
Drawing Title: A59 KEXGILL CULVERT (STR001) GENERAL ARRANGEMENT SHEET 1 OF 2

Scale	Drawn	Checked	Approved	Authorised
AS SHOWN	A	IM	HM	HM
Original Size	Date	Date	Date	Date
A1	05/05/20	05/05/20	05/05/20	05/05/20

Drawing Status	Suitability
FOR INFORMATION	S2

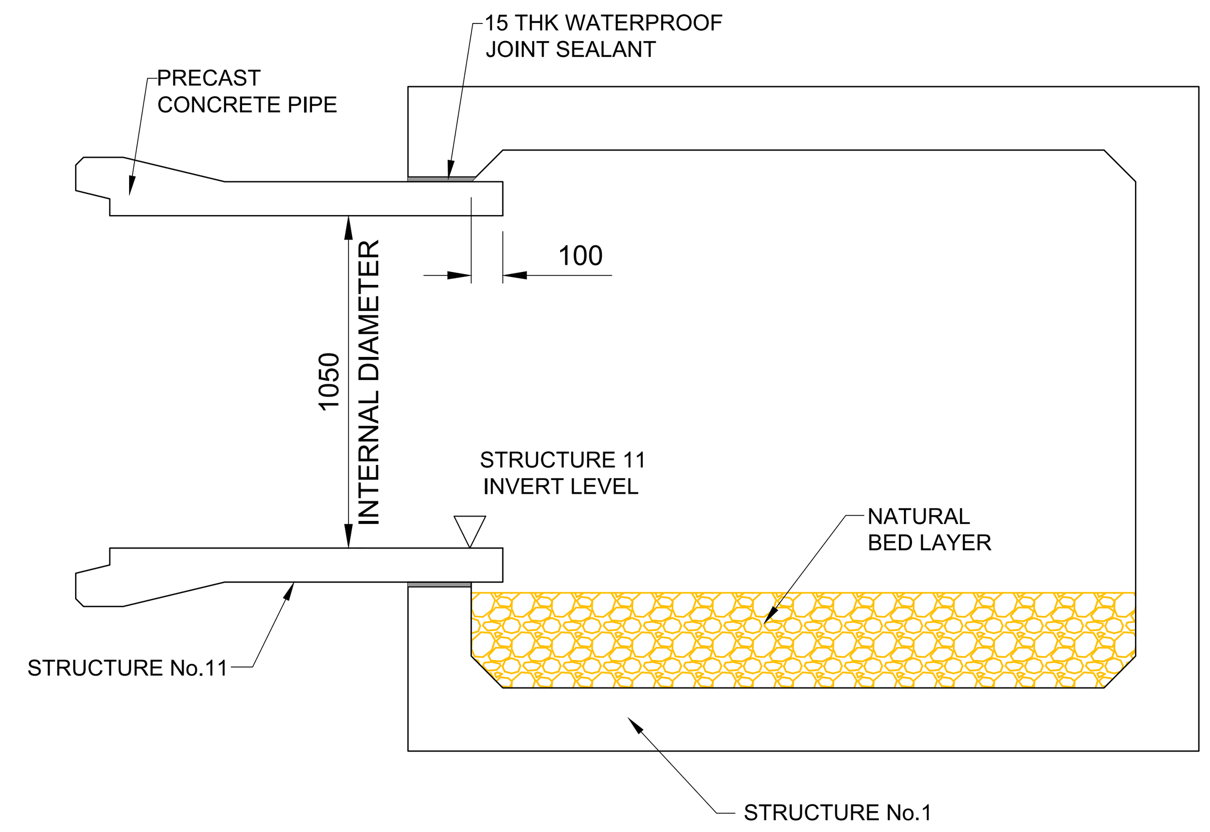
Drawing Number				Project Ref. No.
Project: NYKGDD	Originator: WSP		Volume: SMN	Revision
Location: ST001	Type: DR	Role: CB	Number: 0001	P05

DO NOT SCALE



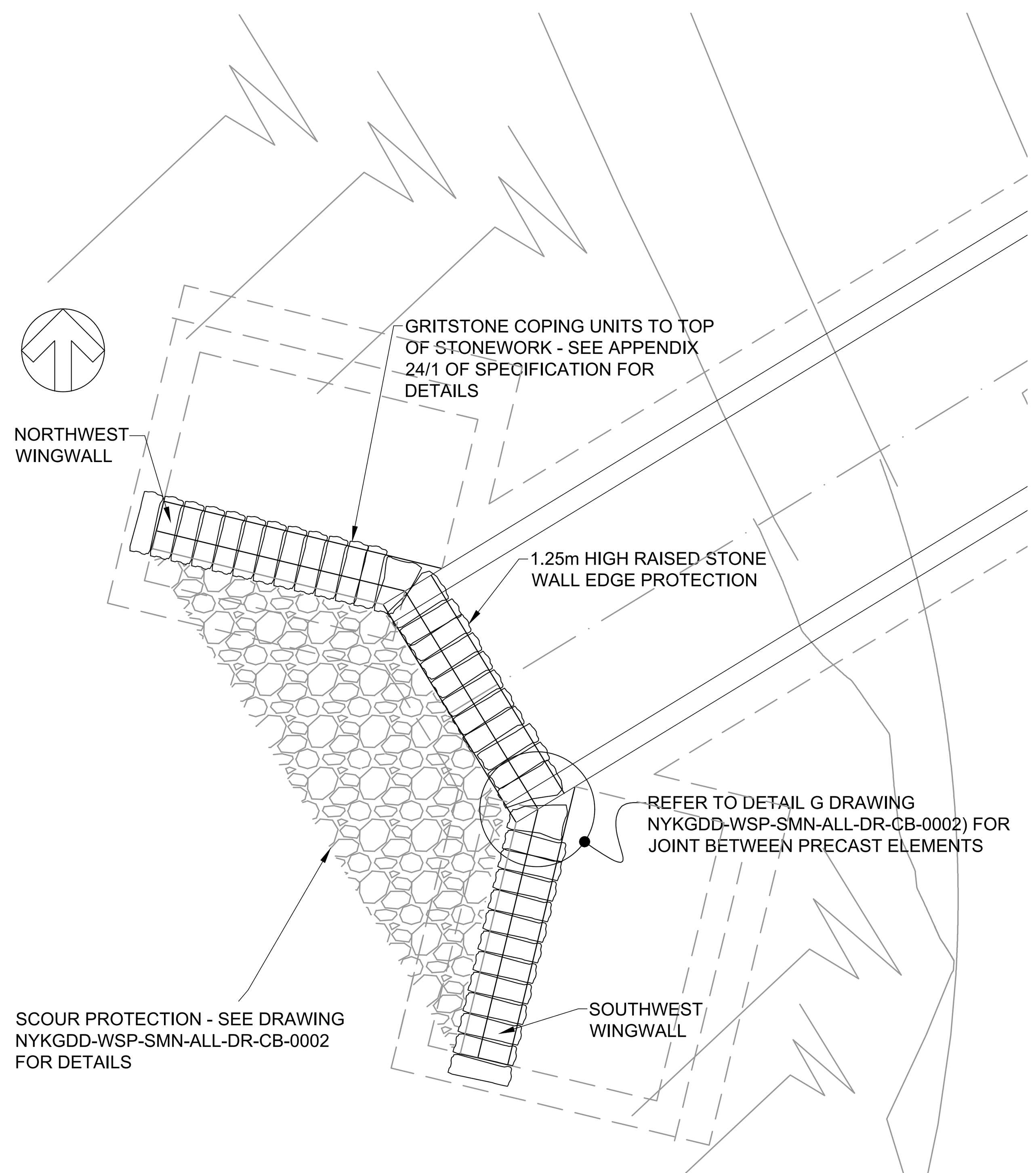
TYPICAL SECTION THROUGH CULVERT STRUCTURE

SCALE 1:10



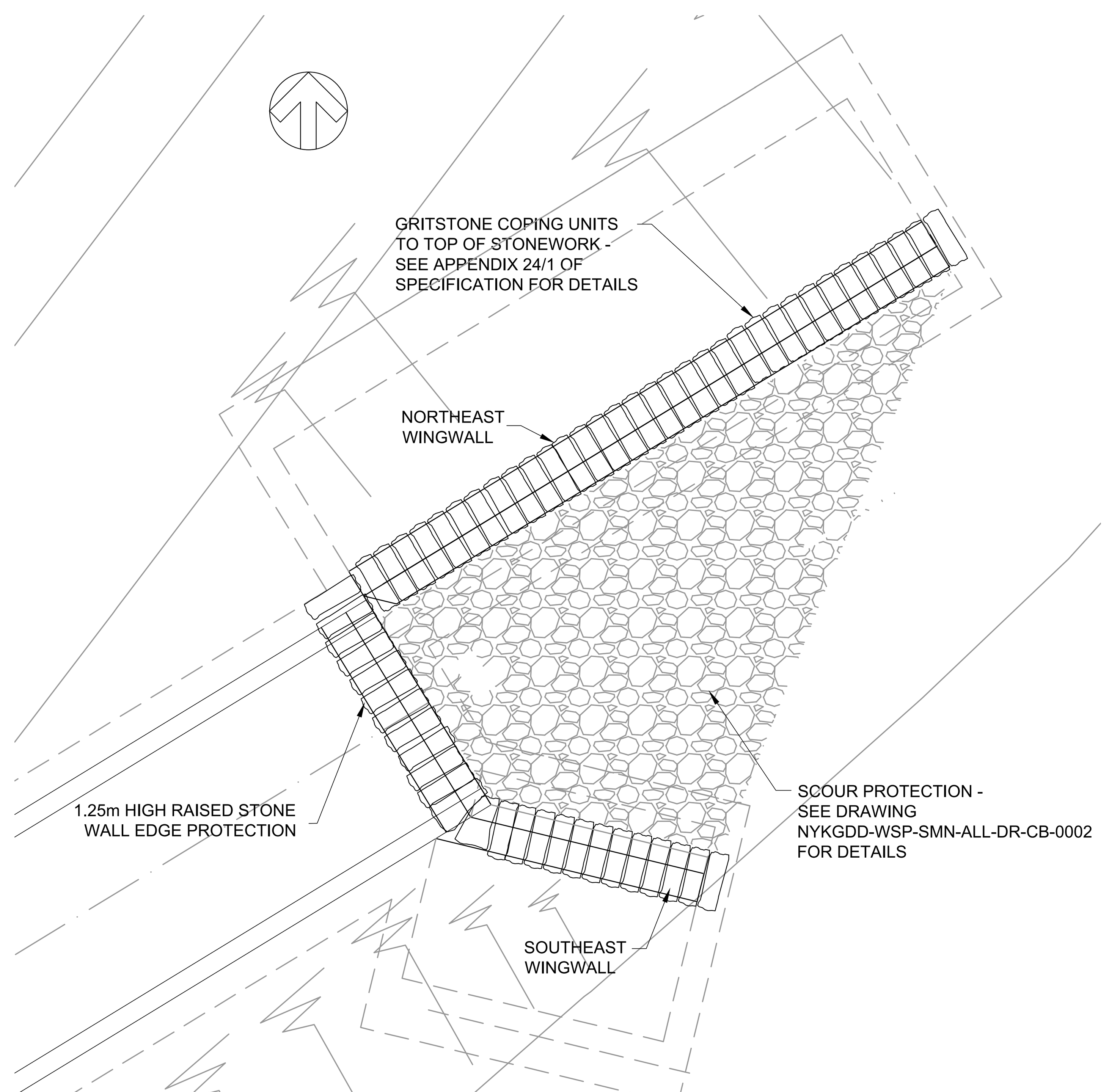
SECTION A-A

SCALE 1:20



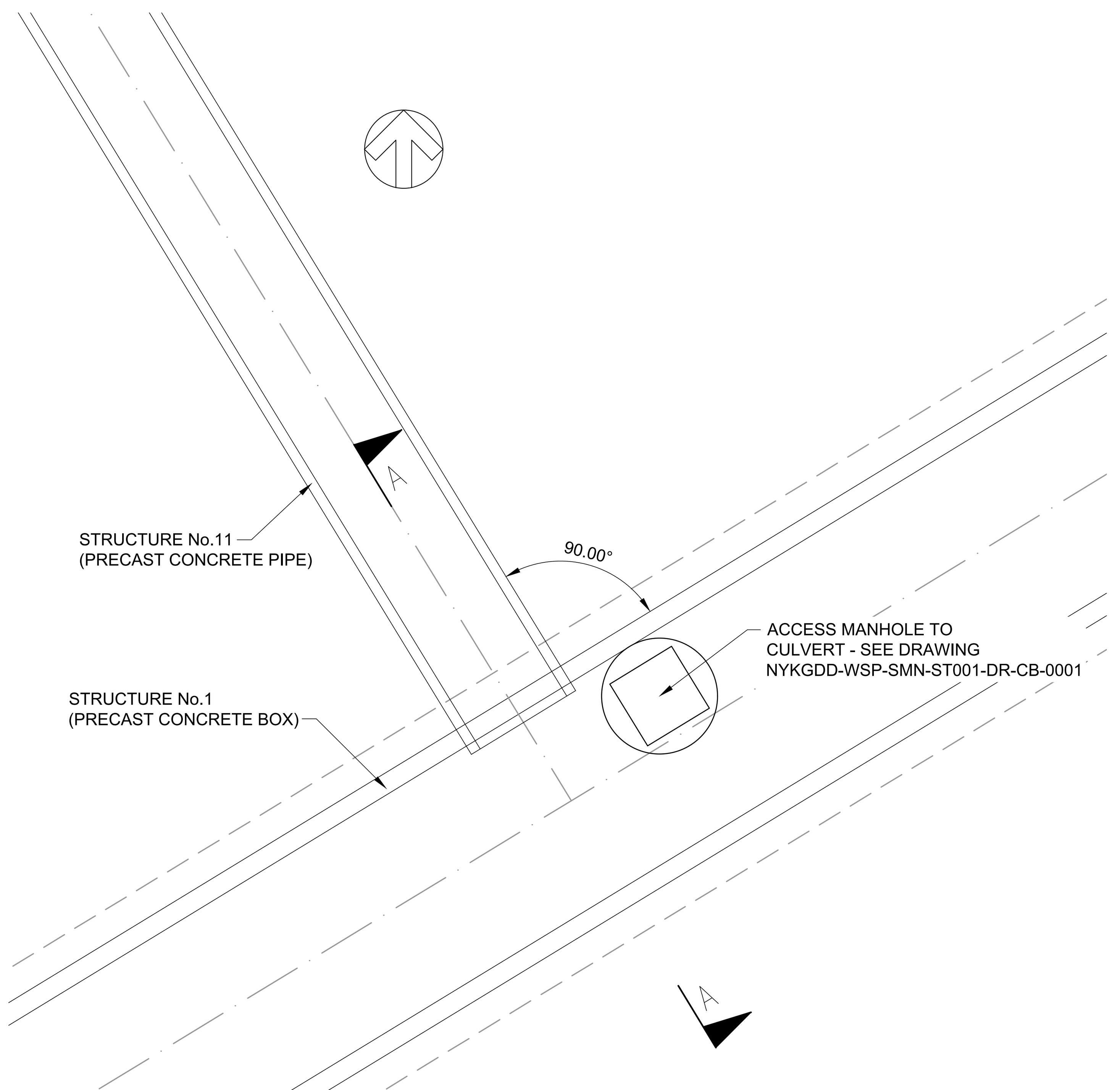
PLAN ON WESTERN UPSTREAM WINGWALLS

SCALE 1:50



PLAN ON EASTERN DOWNSTREAM WINGWALLS

SCALE 1:50



PLAN ON STRUCTURE No.1 AND STRUCTURE No.11 JOINT

SCALE 1:50

NOTES

GENERAL

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AOD UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING.
4. THE DRAWING TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS, CONTRACT-SPECIFIC APPENDICES, DRAWINGS NYKGDD-WSP-SMN-ALL-DR-CB-0001, AND NYKGDD-WSP-SMN-ALL-DR-CB-0002, AND THE DRAWINGS LISTED IN THE SCHEDULE ON DRAWING NYKGDD-WSP-SMN-STR001-DR-CB-0001.
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6. FOR THE AFFECTED AREAS PRIOR TO WORKS, THE CONTRACTOR SHALL OBTAIN UP-TO-DATE UTILITY PLANS AND CARRY OUT SURVEYS TO POSITIVELY IDENTIFY AND MARK-UP ANY UTILITY APPARATUS. REFER TO APPENDIX 1/16 FOR FURTHER INFORMATION.

CONTRACTOR DESIGNED ELEMENTS

7. PRECAST ELEMENTS SHOWN ON THIS DRAWING ARE INDICATIVE. WINGWALL DIMENSIONS AND SPLAY ANGLES SHOWN ARE SUBJECT TO FINAL EARTHWORK PROFILE ARE TO BE DETERMINED BY THE CONTRACTOR FOR THEIR DESIGN.

Rev.	Date	Description	By	Chk'd	App'd
P05	11/05/2023	UPDATED FOR AIP REVISION	SH	DM	DM

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Client: North Yorkshire County Council

Project Title: A59 KEX GILL DIVERSION

Drawing Title: A59 KEXGILL CULVERT (STR001) GENERAL ARRANGEMENT SHEET 2 OF 2

Scale	Drawn	Checked	Approved	Authorised
AS SHOWN	LS	IM	HM	HM
Original Size: A1	Date: 05/05/20	Date: 05/05/20	Date: 05/05/20	Date: 05/05/20

Drawing Status: FOR INFORMATION — Suitability: S2

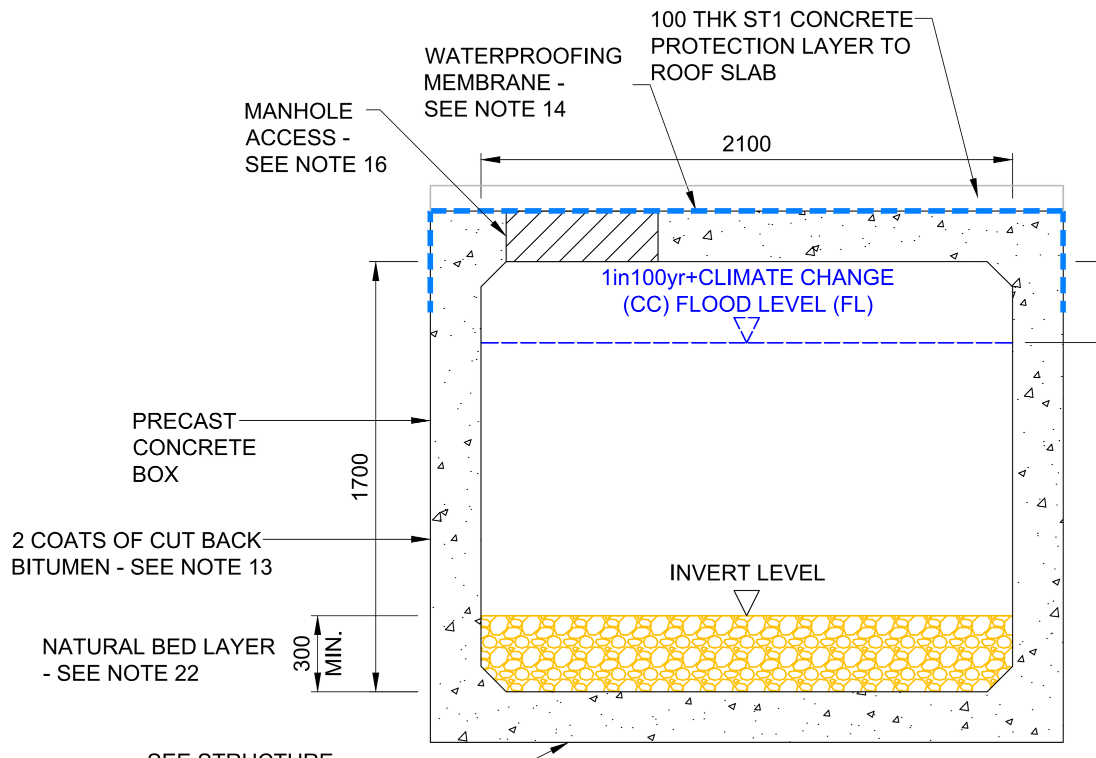
Project	Originator	Volume
NYKGDD	WSP	SMN
Location: ST001	Type: DR	Role: CB — Number: 0002

Project Ref. No.:

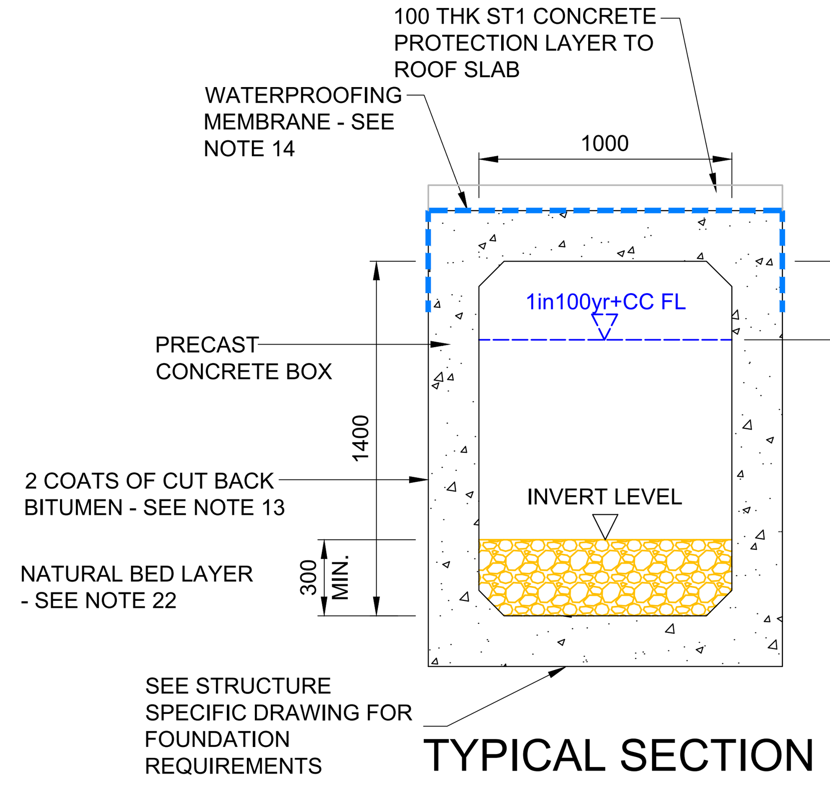
Revision: P05

DO NOT SCALE

Millimetres



TYPICAL SECTION
STRUCTURE No.1
SCALE 1:25



TYPICAL SECTION
STRUCTURE No.5
SCALE 1:25

ELEMENT TYPE	DETAILS	STRUCTURES
PRECAST REINFORCED CONCRETE BOX	STANDARD UNITS	5 & 9
	BOX CULVERT WITH INTEGRATED MAMMAL LEDGES	7 & 10
	BOX CULVERT WITH SINGLE MANHOLE ACCESS TO ROOF	1
	BOX CULVERT WITH SINGLE MANHOLE ACCESS TO ROOF AND INTEGRATED MAMMAL LEDGES	8
PRECAST REINFORCED CONCRETE WINGWALLS AND HEADWALL	STANDARD WINGWALLS AND HEADWALLS	1 & 9
	INTEGRATED MAMMAL LEDGES TO WINGWALL	7, 8 & 10
PRECAST REINFORCED CONCRETE PIPES	STANDARD UNITS	11 & 12
PRECAST REINFORCED CONCRETE INLET/OUTLET UNITS	STANDARD UNITS	5, 11, & 12

CONTRACTOR DESIGNED ELEMENTS - SEE NOTE 7

STONE FACING AND STONE WALLS:

18. PRECAST CONCRETE ELEMENTS AT INLETS AND OUTLETS TO BE FACED WITH STONEWORK WHERE SHOWN ON STRUCTURE SPECIFIC DRAWINGS.
19. 1.25M RAISED STONE WALLS ATOP CULVERT WINGWALLS AND HEADWALLS TO BE PROVIDED WHERE SHOWN ON STRUCTURE SPECIFIC DRAWINGS.
20. ALL STONEWORK TO BE IN ACCORDANCE WITH APPENDIX 24/1 OF THE SPECIFICATION AND DETAILS SHOWN ON DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0002.

VEHICLE RESTRAINT SYSTEMS:

21. N2 VEHICULAR RESTRAINT SYSTEMS ADJACENT TO THE PROPOSED A59 CARRIAGEWAY TO BE INSTALLED AT LOCATIONS SHOWN IN APPENDIX 4/1.

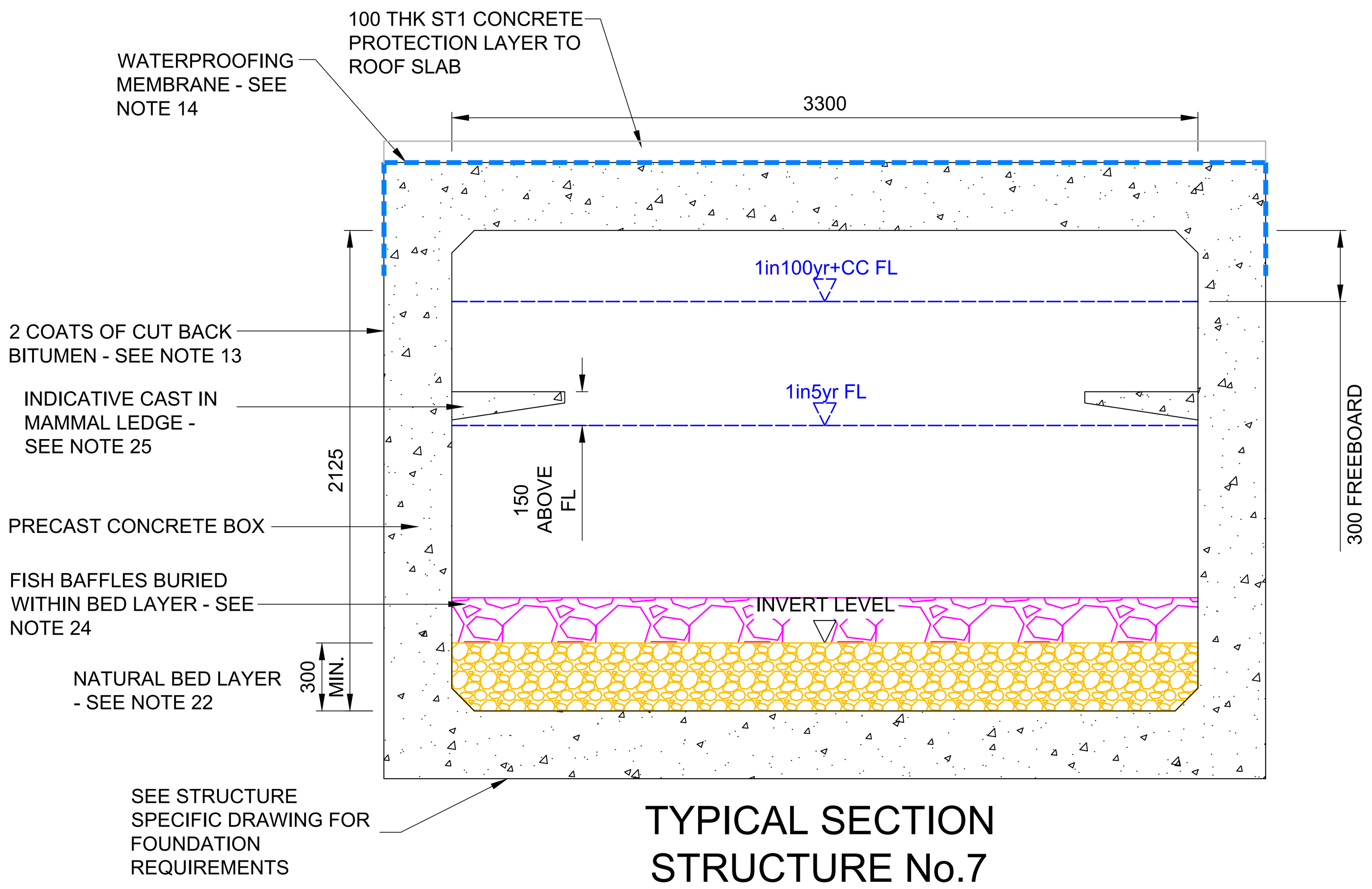
CULVERT BEDING AND SCOUR PROTECTION:

22. REDUNDANT EXCAVATED SITE ROCK AND WOODY DEBRIS TO BE RE-USED TO FORM THE 300 MIN THICK NATURAL WATERCOURSE BED WITHIN PRECAST BOX CULVERTS. IF SUFFICIENT MATERIAL IS NOT AVAILABLE, OR ADDITIONAL MATERIAL IS REQUIRED, THEN UNCONTAMINATED MATERIAL SUITABLY GRADED TO MATCH THE EXISTING WATERCOURSE BED SHOULD BE USED. ADDITIONAL MATERIALS TO BE AGREED WITH THE NEC4 PROJECT MANAGER.
23. SCOUR PROTECTION AT INLETS AND OUTLETS TO BE PROVIDED WHERE SHOWN ON STRUCTURE SPECIFIC DRAWINGS AND IN ACCORDANCE WITH DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0002.

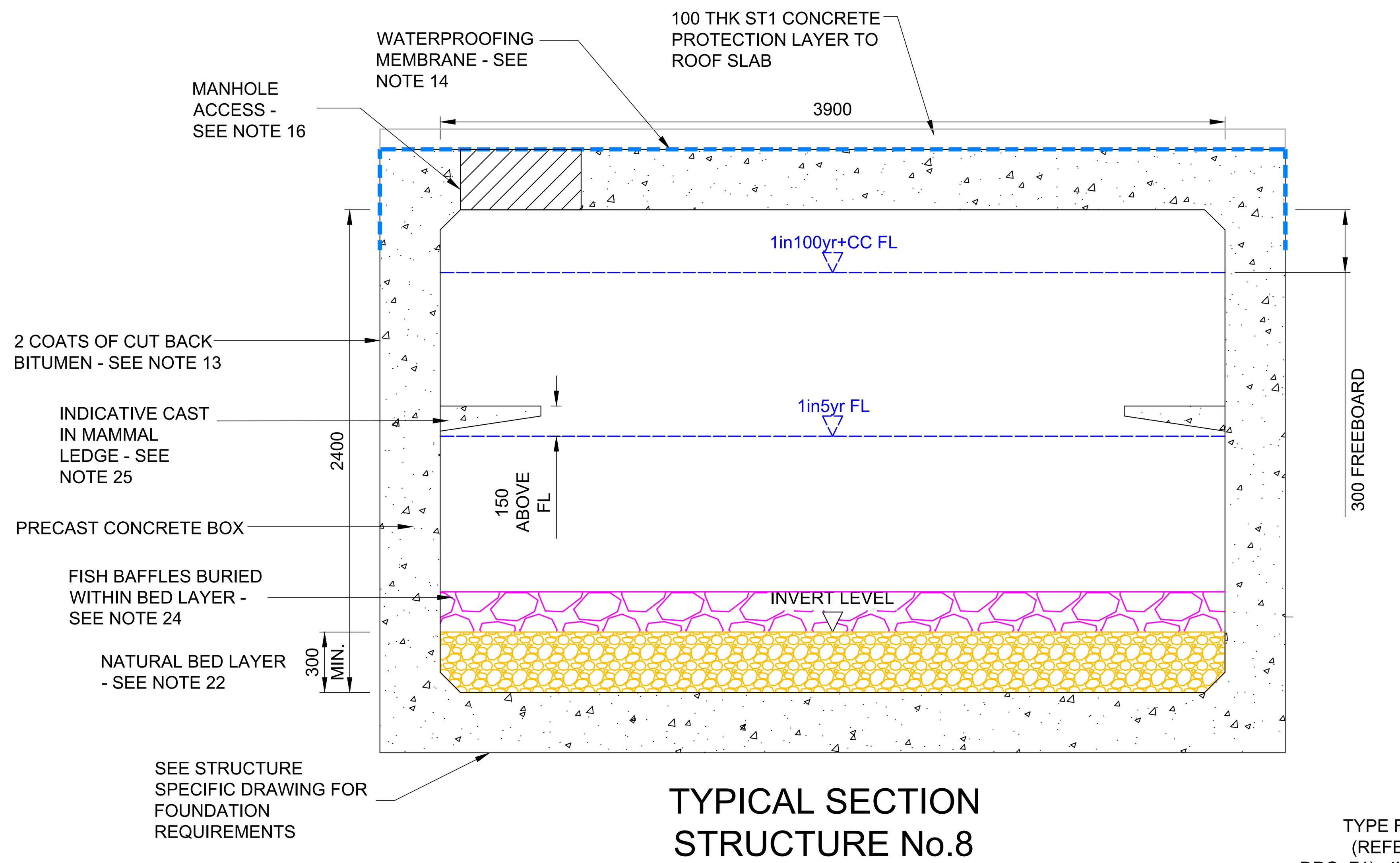
ENVIRONMENTAL:

24. TO ALLOW SAFE AND UNDISTURBED PASSAGE OF FISH (I.E.: BROWN TROUT LESS THAN 25CM AND COURSE FISH BETWEEN 25 - 50CM) FISH BAFFLES HAVE BEEN PROVIDED IN ACCORDANCE WITH THE ENVIRONMENT AGENCY FISH PASS MANUAL (GEHO 0910 BTBP-E-E: NOV. 2010) - SEE STRUCTURE SPECIFIC DRAWINGS FOR FURTHER DETAILS.
25. TO ALLOW SAFE AND UNDISTURBED PASSAGE OF OTTERS, MAMMAL LEDGES HAVE BEEN SPECIFIED - SEE STRUCTURE SPECIFIC DRAWINGS FOR FURTHER DETAILS.
26. OTTER FENCING TO BE PROVIDED AS DETAILED ON STRUCTURE SPECIFIC DRAWINGS.

004 006 007 009



TYPICAL SECTION
STRUCTURE No.7
SCALE 1:25



TYPICAL SECTION
STRUCTURE No.8
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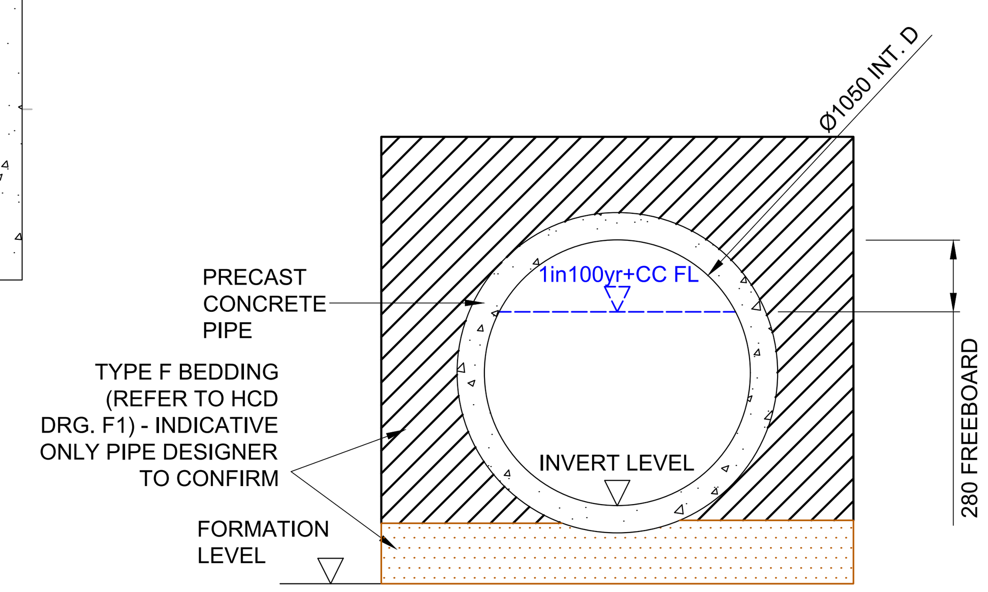
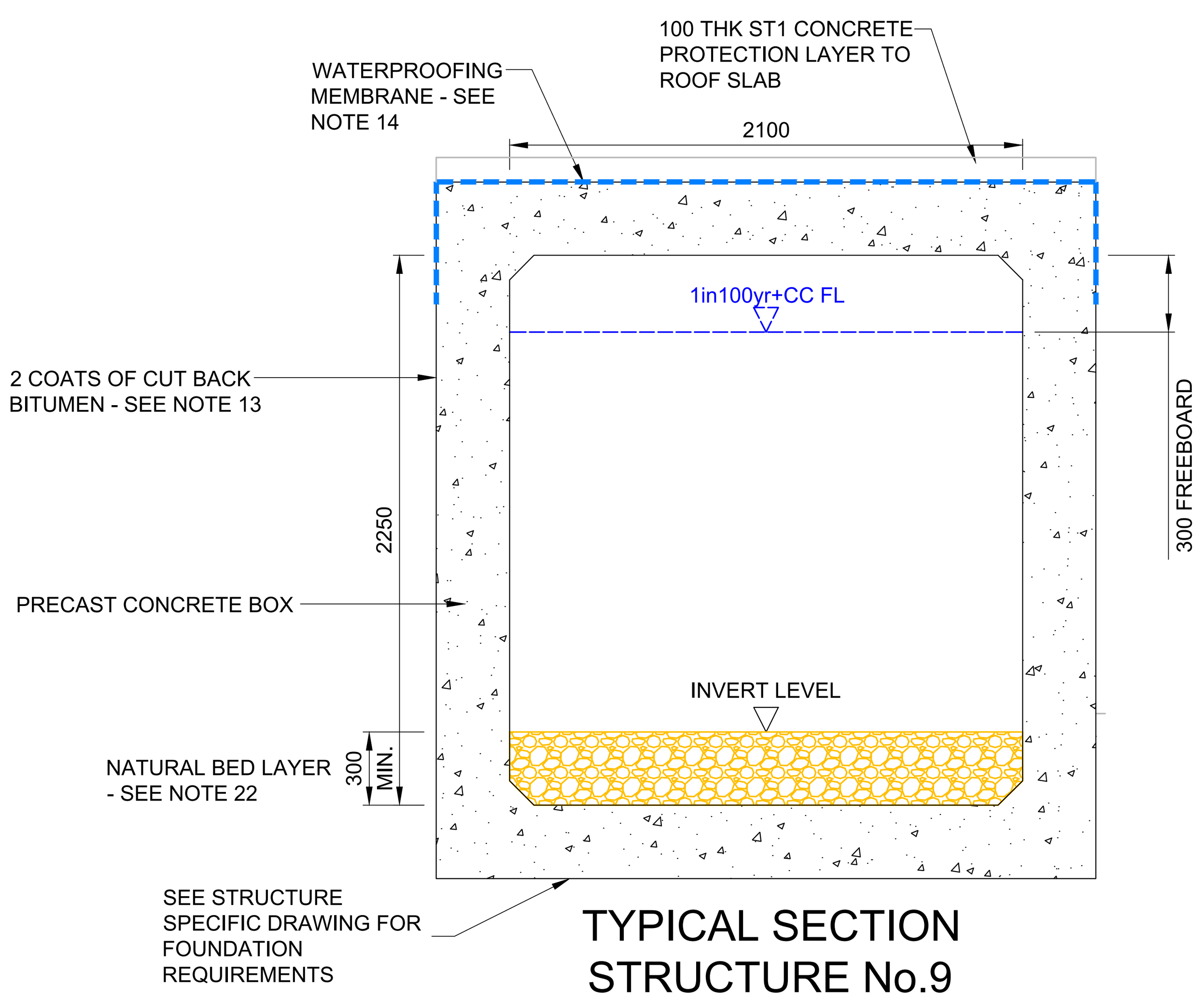


TYPICAL SECTION
STRUCTURE No.11
SCALE 1:25



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STRUCTURE No.9
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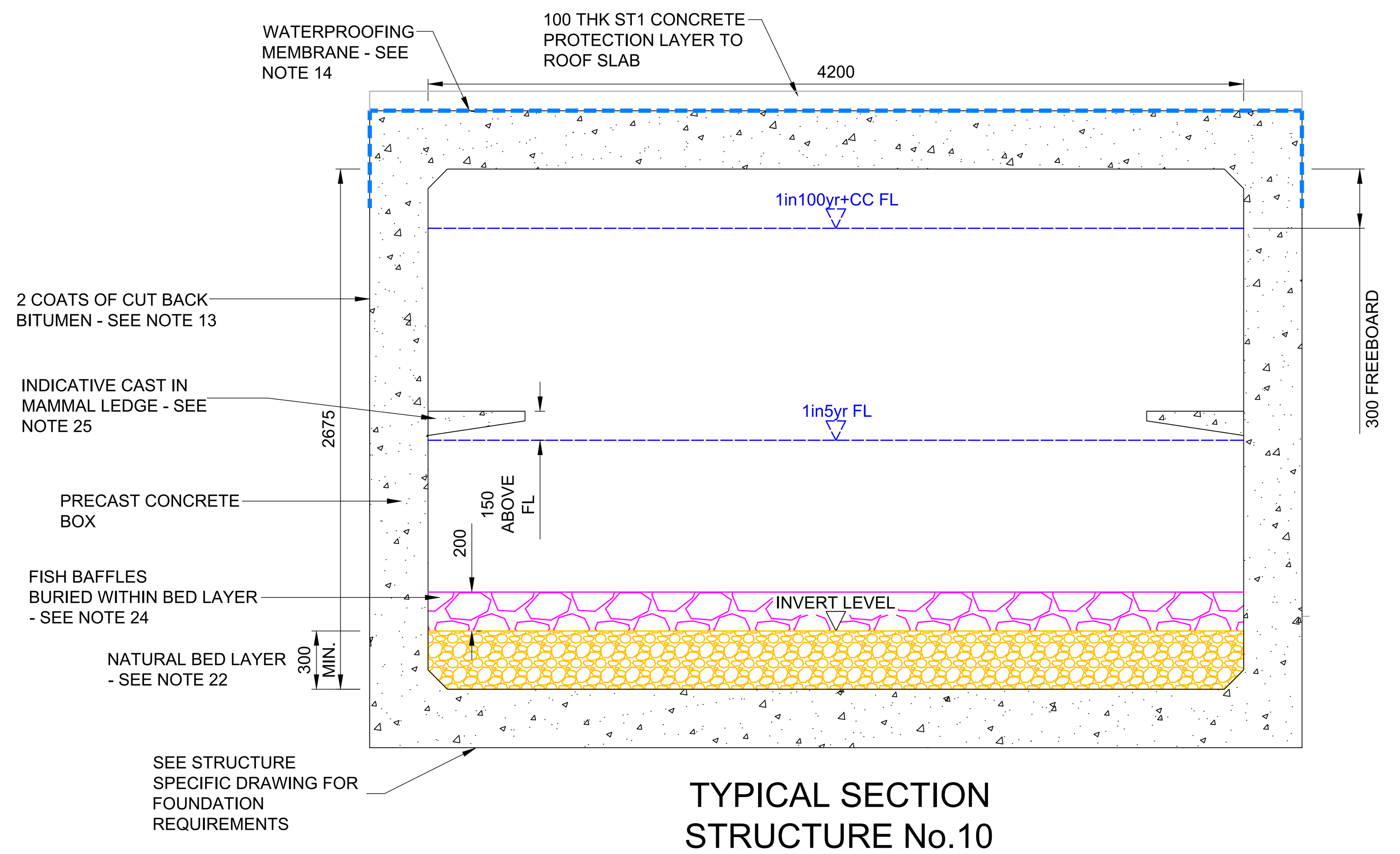
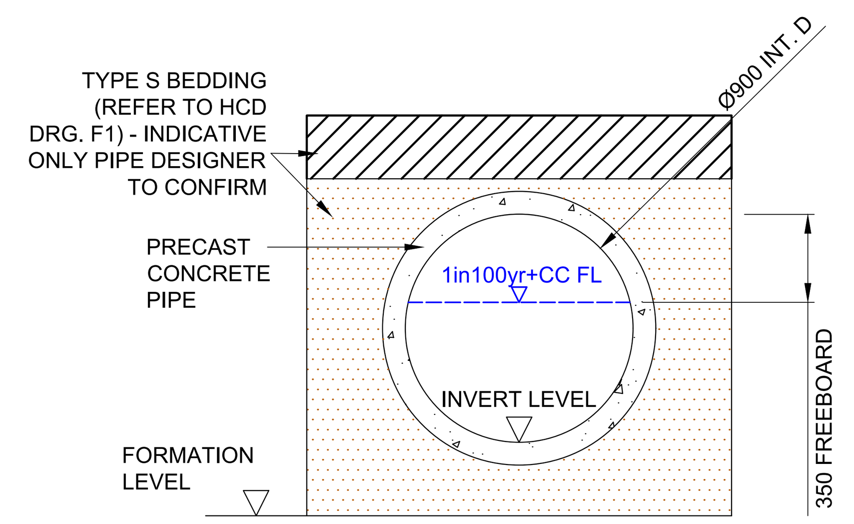


TYPICAL SECTION
STRUCTURE No.10
SCALE 1:25



TYPICAL SECTION
STRUCTURE No.12
SCALE 1:25

NOTES

GENERAL:

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AOD UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING.
4. THE DRAWING TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS, CONTRACT SPECIFIC APPENDICES, DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0002, AND WITH THE SPECIFIC DRAWINGS FOR EACH STRUCTURE
5. THE CONTRACTOR SHALL MEASURE AND CONFIRM ALL DIMENSIONS/LEVELS THAT HAVE A DIRECT IMPACT ON THE WORKS PRIOR TO EXECUTION. IN CASE OF DOUBTS, OMISSIONS OR ERRORS, CONTRACTOR TO SEEK CLARIFICATION FROM THE NEC4 PROJECT MANAGER.
6. FOR THE AFFECTED AREAS PRIOR TO WORKS THE CONTRACTOR SHALL OBTAIN UP-TO-DATE UTILITY PLANS AND CARRY OUT A SURVEYS TO POSITIVELY IDENTIFY AND AVOID ANY UTILITY APPARATUS. REFER TO APPENDIX 1/16 FOR FURTHER INFORMATION.

CONTRACTOR DESIGNED ELEMENTS:

7. THE CONTRACTOR IS RESPONSIBLE FOR DESIGNING THE PRECAST REINFORCED CONCRETE ELEMENTS LISTED IN ACCORDANCE WITH NYCC AIP DOCUMENTATION. SEE APPENDIX 1/10 FOR FURTHER DETAILS.
8. UNLESS NOTED OTHERWISE EXTERNAL ARRISES AND INTERNAL CORNERS OF REINFORCED CONCRETE ELEMENTS TO HAVE MINIMUM 25 X 25 CHAMFER.

GEOTECHNICAL:

9. FORMATION INSPECTIONS SHALL BE UNDERTAKEN BY THE NEC4 SUPERVISOR BEFORE COVERING WITH ANY PLACED MATERIAL. ANY SOFT SPOTS SHALL BE EXCAVATED AND REPLACED WITH WELL COMPACTED GRANULAR MATERIAL IN ACCORDANCE WITH SERIES 600 OF THE SPECIFICATION FOR HIGHWAY WORKS.
10. SEE STRUCTURE SPECIFIC DRAWINGS FOR CULVERT FOUNDATION AND BEDDING REQUIREMENTS.
11. EMBANKMENT SLOPES WHERE THEY INTERFACE WITH INLETS AND OUTLETS TO BE OF A MAXIMUM OF 1 IN 3.
12. PRECAST BOX CULVERT TO BE BACKFILLED WITH 6N OR 6P STRUCTURAL FILL IN ACCORDANCE WITH SERIES 600 OF THE SPECIFICATION FOR HIGHWAY WORKS OVER EXTENTS SHOWN ON STRUCTURE SPECIFIC DRAWINGS.

WATERPROOFING AND DRAINAGE:

13. BURIED CONCRETE ELEMENTS SHALL BE PAINTED WITH 2 COATS OF CUT BACK BITUMEN IN ACCORDANCE WITH SPECIFICATION CLAUSE 2004 & 2006, WITH THE EXCEPTION OF AREAS TO RECEIVE A WATERPROOFING MEMBRANE.
14. SURFACES TO RECEIVE WATERPROOFING MEMBRANE TO HAVE U4 FINISH IN ACCORDANCE WITH SERIES 1700 OF THE SPECIFICATION FOR HIGHWAY WORKS. WATERPROOFING MEMBRANE TO BE IN ACCORDANCE WITH APPENDIX 20/1 OF THE SPECIFICATION AND DETAILS SHOWN ON DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0002.
15. WEEPHOLES TO BE PROVIDED TO CULVERT WINGWALLS IN ACCORDANCE WITH THE DETAILS SHOWN ON DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0002.

MANHOLE ACCESS:

16. MANHOLE ACCESS TO BE PROVIDED AS DETAILED ON STRUCTURE SPECIFIC DRAWINGS.

TIMBER FENCING:

17. TIMBER POST AND RAIL FENCING TO BE INSTALLED AS SHOWN ON STRUCTURE SPECIFIC DRAWINGS AND IN ACCORDANCE WITH DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0002.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS

CONSTRUCTION
REF 004 - WORKING IN CONFINED SPACE
REF 006 - BACKFILLING OF THE STRUCTURE
REF 007 - WORKING WITH LIFTING PLANT DURING INSTALLATION OF PRECAST UNITS
REF 009 - DAMAGE TO EXISTING STATUTORY SERVICES

SAFETY, HEALTH AND ENVIRONMENTAL SYMBOL LEGEND
INDICATES A RESIDUAL RISK AS A WARNING

Rev.	Date	Description	By	Chk'd	App'd
P07	15/05/2023	UPDATED FOR AIP REVISION	SH	DM	DM

wsp
Three White Rose Office Park, Millshaw Park Lane, Leeds, LS11 0DL, UK
T+ 44 (0) 113 395 6200, F+ 44 (0) 113 395 6201
wsp.com

Client
North Yorkshire County Council

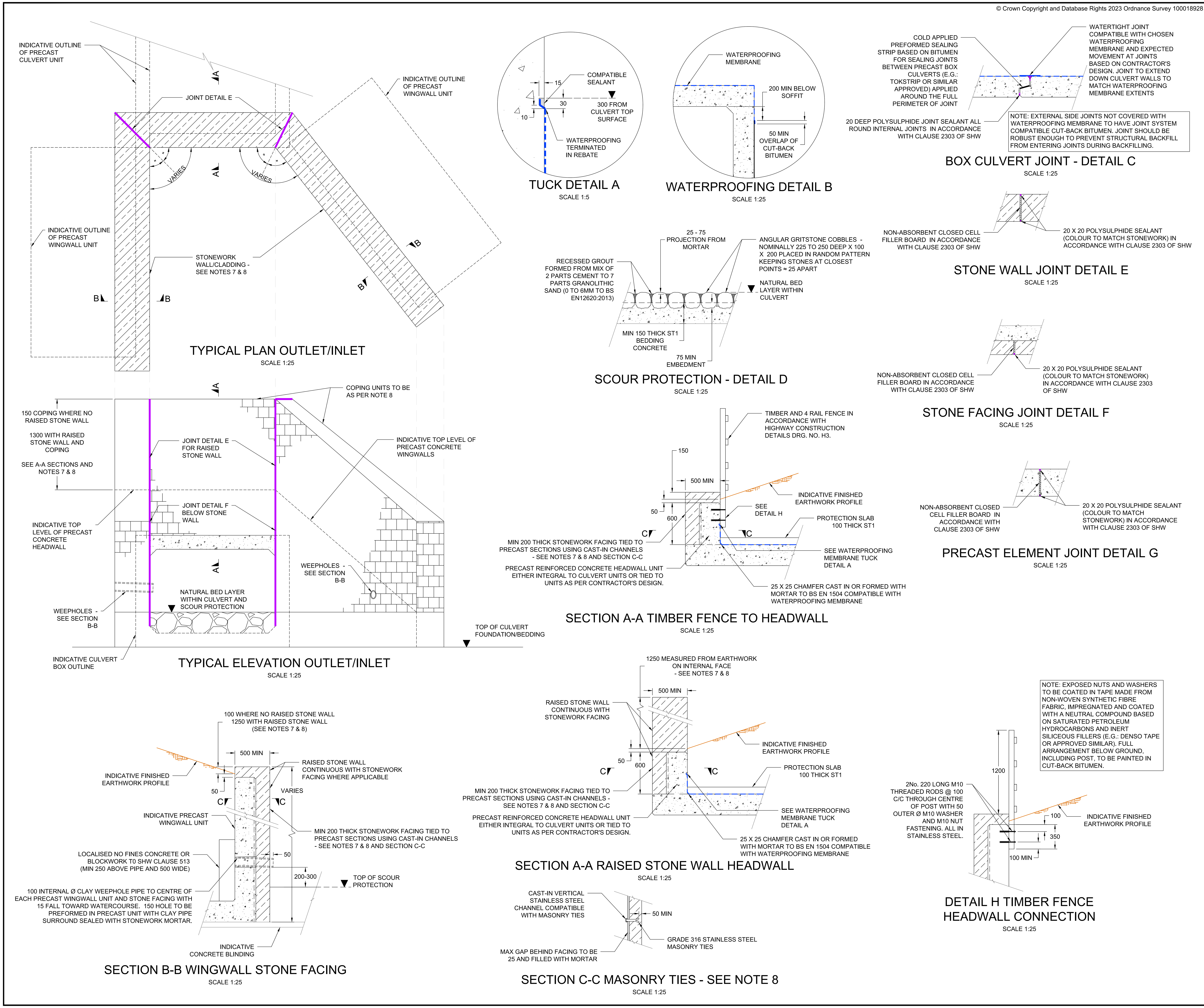
Project Title
A59 KEX GILL DIVERSION

Drawing Title
TYPICAL CULVERT DETAILS
SHEET 1 OF 2

Scale	Drawn	Checked	Approved	Authorised
AS SHOWN	LS	IM	HM	HM
Original Size	Date	Date	Date	Date
A1	31/01/20	31/10/20	31/10/20	31/10/20

Drawing Status	Suitability
FOR INFORMATION	S2

Drawing Number				Project Ref. No.
Project: NYKGDD	Originator: WSP		Volume: SMN	
Location: ALL	Type: DR	Role: CB	Number: 0001	Revision: P07



NOTES

GENERAL:
1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AOD UNLESS NOTED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING.
4. THE DRAWING TO BE READ IN CONJUNCTION WITH THE SPECIFICATION FOR HIGHWAY WORKS, CONTRACT SPECIFIC APPENDICES, AND DRAWING NYKGDD-WSP-SMN-ALL-DR-CB-0001.

TIMBER FENCING:
5. TIMBER POST AND RAIL FENCING TO BE INSTALLED AS SHOWN ON STRUCTURE SPECIFIC DRAWINGS.
6. OTTER FENCING TO BE PROVIDED AS DETAILED ON STRUCTURE SPECIFIC DRAWINGS.

STONE FACING AND STONE WALLS:
7. 1.25M RAISED STONE WALLS ATOP CULVERT WINGWALLS AND HEADWALLS TO BE PROVIDED WHERE SHOWN ON STRUCTURE SPECIFIC DRAWINGS.
8. ALL STONEWORK TO BE IN ACCORDANCE WITH APPENDIX 24/1 OF THE SPECIFICATION.

Rev.	Date	Description	By	Chk'd	App'd
P07	15/05/2023	UPDATED FOR AIP REVISION	SH	DM	DM

wsp

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wsp.com

Client: North Yorkshire County Council

Project Title: A59 KEX GILL DIVERSION

Drawing Title: TYPICAL CULVERT DETAILS (SHEET 2 OF 2)

Scale	Drawn	Checked	Approved	Authorised
AS SHOWN	LS	IM	HM	HM
Original Size: A1	Date: 18/05/20	Date: 18/05/20	Date: 18/05/20	Date: 18/05/20

Drawing Status: FOR INFORMATION — Suitability: S2

Drawing Number: Project NYKGDD | Originator WSP | Volume SMN | Location ALL | Type DR | Role CB | Number 0002

Project Ref. No.

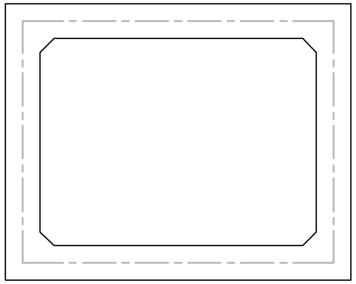
Revision: P07

Appendix D

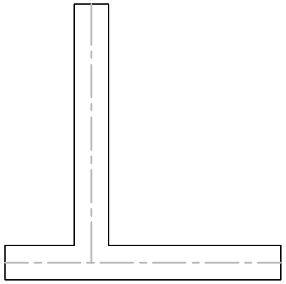
IDEALISED DIAGRAM

A59 KEX GILL CULVERT (STRUCTURE no.1)
IDEALISED STRUCTURE FOR 2D PLANE FRAME

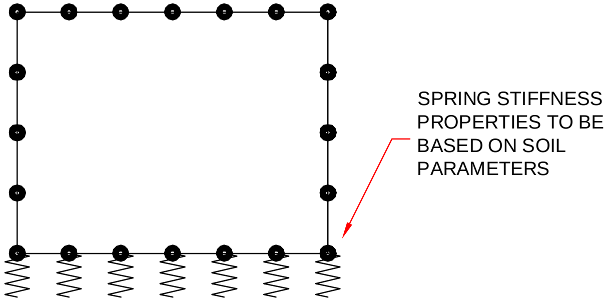
REFER TO RELEVANT PROPOSED GENERAL ARRANGEMENT DRAWING FOR DIMENSION DETAILS



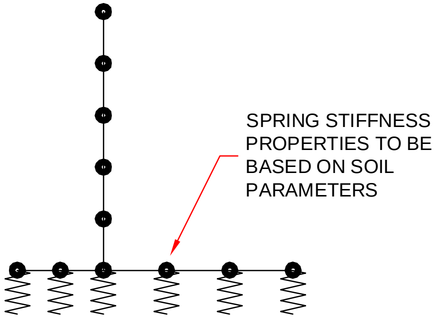
CULVERT CROSS SECTION



WINGWALL CROSS SECTION



CULVERT IDEALISED DIAGRAM



WINGWALL IDEALISED DIAGRAM

Appendix E

DESIGNERS RISK ASSESSMENT

T446: Design Risk Management Schedule

Project No	70049554	Project Name	A59 KEX GILL DIVERSION - A59 Kex Gill Culvert (STR001)

Guidance Notes (see guidance notes page for more details)
Design risk management should be an integral part of the overall design development and designers should think of it in terms of considering constructability, maintainability, etc. Designers only need to document their consideration of risks in this simple risk management schedule format. There is no requirement for quantative design risk assessments to be carried out/documented and these should be avoided
* Risks should be considered in a logical sequence relating to the location/operational environment, constructability/installability, operability (normal/emergency), maintainability (inc routine cleaning, replacement, etc.), and alteration/decommissioning/dismantling/demolition, and should be categorised against those headings, CIRIA guidance documents C755, C756, C686, C607, etc. provide a useful checklist and detailed guidance on the identification of risks to be considered during design and how those risks might be addressed - see detailed guidance notes for more details
§ Significant residual risks are those which are unusual, not obvious, difficult to manage, or where critical design assumptions apply. The documentation by designers of residual risks that cover well-known and understood hazards should be avoided.

Ref	Risk Category* & Phase where appropriate, *e.g. location/environment, construction, operation, maintenance, alteration/demolition*	Work Element/Location (where appropriate)	Hazard or Risk Issue Identified	Risk Management Owner	Design ERIc Action Required *(e.g. hazard elimination/risk mitigation action, information to be provided to others)*	Significant Temporary Works Requirements/Management Arrangements and/or any Special Erection/Installation Sequences or Requirements	Design Action Status/Final Resolution Notes *(e.g. traceability of ERIc action, communication of significant residual risk, critical design criteria, etc.)*	Significant Residual Risk§	Date Logged/ Reviewed	Raised By
001	Design	A59 Kex Gill Culvert (STR001)	Handling of large volumes of concrete including erection of shuttering which requires significant temporary works. Large reinforcement cages also introduces risks associated with impaling/ heavy lifting of bars, working at heights etc.	Designer	Prefabricated/precast structural units have been selected to eliminate insitu works and associated temporary works.	None.	None.	No	02.07.19	Imtiaz Mulla
002	Design	A59 Kex Gill Culvert (STR001)	Presence of protected species of wildlife.	Designer	Ecology survey to be carried out prior to works to determine presence of any protected flora/fauna within the area. Provision of mammal ledges, fish baffles etc. within structure to be confirmed.	None.	Designer to highlight any special ecological features on design drawings.	No	02.07.19	Imtiaz Mulla
003	Design/ Construction	A59 Kex Gill Culvert (STR001)	Existing infrastructure capability to take heavy goods vehicles for materials and plant import & export to site. Damage to infrastructure/vehicles if infrastructure deteriorates.	Designer / Contractor	Designer shall assess any affected existing structures on the scheme with a view to identifying if strengthening/modification work needs to be carried out as part of the scheme. Prefabricated/precast structural elements shall be sized to ease their transportation along existing infrastructure network. Local Authority to be informed of any abnormal loads to be transported to site well in advance of their delivery to enable careful planning. Contractor to carefully plan all delivery routes.	Contractor to consider TM measures or delivery of materials/plant during off-peak traffic hours. Contractor to confirm and set up a safe system of working during construction activities.	Designer shall show weight of all significant structural elements on design drawings and clearly identify any abnormal loads. Any specific structural requirements (existing structures) to be communicated to contractor prior to any construction work being carried out.	No	02.07.19	Imtiaz Mulla
004	Design / Construction / Operation	A59 Kex Gill Culvert (STR001)	Size of culvert stucture opening creating confined space working on site.	Designer / Contractor / Maintainer	Sizing of culvert dictated by flood/drainage model analysis. Where possible, dimensions of culvert shall be increased to allow greater working space inside the structure.	Only trained site personnel to be allowed entry and working within a confined space including correct PPE and apparatus. Contractor to confirm and set up a safe system of working during construction as well as future maintenance activities.	Confined space working shall be identified on all design drawings.	Yes	02.07.19	Imtiaz Mulla
005	Design/ Construction	A59 Kex Gill Culvert (STR001)	Unknown ground conditions.	Designer / Contractor	Design to take into account the results of the ground investigation. Geotechnical Engineers to conduct sensitivity analysis where uncertainty exists.	None.	Ground Investigation Report to be provided. Design to take account of anticipated ground conditions.	No	02.07.19	Imtiaz Mulla
006	Construction	A59 Kex Gill Culvert (STR001)	Backfilling of box culvert structure.	Designer / Contractor	Backfilling of the structure shall be carried out in a staged manner to avoid imbalance of fill pressures. Maximum differential fill height between each box wall shall be limited to 0.5m.	None.	Backfilling procedure to be detailed on all design drawings.	Yes	02.07.19	Imtiaz Mulla
007	Construction	A59 Kex Gill Culvert (STR001)	Working with lifting plant during installation of precast units.	Designer / Contractor	Temporary works design to be carried out by a competent contractor including independent design check. Geotechnical designer to confirm proposed methods of working in relation to location of temporary footings for the crane. Areas of loose material to be confirmed in the GI.	Contractor to confirm and set up a safe system of working during construction activities. Temporary works contractor is responsible for providing a certified temporary works design.	Designer to highlight any special temporary works requirements on design drawings.	Yes	02.07.19	Imtiaz Mulla
008	Construction	A59 Kex Gill Culvert (STR001)	Instability/collapse of temporary works supporting excavations.	Contractor	Temporary works design to be carried out by a competent contractor including independent design check. Geotechnical designer to confirm proposed methods of working and adequacy of temporary works design. Areas of loose material to be confirmed in the GI. Any overdig to be approved by geotech team prior to works being carried out.	Contractor to confirm and set up a safe system of working during construction activities. Geotech engineer to advise on suitability of construction methods. All earthwork slopes to be benched back minimum 1:3 gradient. Temporary works contractor is responsible for providing a certified temporary works design.	Designer shall highlight any special temporary works requirements on design drawings.	No	02.07.19	Imtiaz Mulla

T446: Design Risk Management Schedule

Project No	70049554	Project Name	A59 KEX GILL DIVERSION - A59 Kex Gill Culvert (STR001)

Guidance Notes (see guidance notes page for more details)
Design risk management should be an integral part of the overall design development and designers should think of it in terms of considering constructability, maintainability, etc. Designers only need to document their consideration of risks in this simple risk management schedule format. There is no requirement for quantative design risk assessments to be carried out/documented and these should be avoided
* Risks should be considered in a logical sequence relating to the location/operational environment, constructability/installability, operability (normal/emergency), maintainability (inc routine cleaning, replacement, etc.), and alteration/decommissioning/dismantling/demolition, and should be categorised against those headings, CIRIA guidance documents C755, C756, C686, C607, etc. provide a useful checklist and detailed guidance on the identification of risks to be considered during design and how those risks might be addressed - see detailed guidance notes for more details
§ Significant residual risks are those which are unusual, not obvious, difficult to manage, or where critical design assumptions apply. The documentation by designers of residual risks that cover well-known and understood hazards should be avoided.

Ref	Risk Category* & Phase where appropriate, *e.g. location/environment, construction, operation, maintenance, alteration/demolition*	Work Element/Location (where appropriate)	Hazard or Risk Issue Identified	Risk Management Owner	Design ERIc Action Required *(e.g. hazard elimination/risk mitigation action, information to be provided to others)*	Significant Temporary Works Requirements/Management Arrangements and/or any Special Erection/Installation Sequences or Requirements	Design Action Status/Final Resolution Notes *(e.g. traceability of ERIc action, communication of significant residual risk, critical design criteria, etc.)*	Significant Residual Risk§	Date Logged/ Reviewed	Raised By
009	Construction	A59 Kex Gill Culvert (STR001)	Damage to existing statutory services.	Contractor	Statutory undertaker's searches/consultation to be undertaken prior to detail design. This is to enable requirements for diversion/protection to be determined. This should be reviewed by contractor prior to undertaking works.	Area to be scanned by trained and competent contractor. Contractor to locate all services using hand tools before mechanical excavation can commence. Contractor to also liaise with statutory undertakers and other stakeholders to locate all services prior to undertaking any excavation works. All excavations to be examined prior to use. Contractor to confirm and set up a safe system of working during construction activities.	Designer to highlight location of any statutory services on design drawings.	Yes	02.07.19	Imtiaz Mulla
010	Construction / Operation	A59 Kex Gill Culvert (STR001)	Working at height.	Contractor / Maintainer	Prefabricated/precast structural units have been selected to reduce activities carried out at height. Timber fence provided to top of headwalls and wingwalls to prevent falls during routine inspection/maintenance works.	Contractor to confirm and set up a safe system of working during construction as well as inspection/maintenance activities.	None.	No	02.07.19	Imtiaz Mulla
011	Construction / Operation	A59 Kex Gill Culvert (STR001)	Working near an existing watercourse.	Contractor / Maintainer	Watercourse will be temporarily diverted for duration of construction works. Prefabricated/precast structural units have been selected to reduce amount of on-site activity. Inspection/maintenance activities to be carried out only when culvert water levels are sufficiently low. Design flood level to be identified on drawings.	Only trained site personnel to be allowed entry and working within a confined space including correct PPE and apparatus. Contractor to confirm and set up a safe system of working during construction as well as inspection/maintenance activities.	Design flood level to be identified on drawings.	No	02.07.19	Imtiaz Mulla
012	Construction / Operation	A59 Kex Gill Culvert (STR001)	Working near live traffic.	Contractor / Maintainer	Identify access/exit location of construction traffic. Where required, determine and set up traffic management prior to works commencing. Contractor to conside delivery of materials/plant during off-peak traffic hours. Wheel washing facility to be used on site to minimise mud tracked onto existing road network.	Contractor to confirm and set up a safe system of working during construction as well as inspection/maintenance activities.	None.	No	02.07.19	Imtiaz Mulla

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Issue 3.0

Appendix F

CULVERTS FEASIBILITY STUDY

TECHNICAL MEMO

TO	North Yorkshire Country Council	**FROM**	Imtiaz Mulla
DATE	12 September 2019	**REVIEWED**	Hitan Mistry
		APPROVED	Philip Santos / David Wilson
		CONFIDENTIALITY	Internal
SUBJECT	A59 Kex Gill Diversion – Culvert Feasibility Report_P02		

Background

The A59 provides a key strategic east-west connection in North Yorkshire, linking Harrogate and Skipton.

The A59 at Kex Gill passes through a rural and open landscape, designated as the Nidderdale Area of Outstanding Natural Beauty (AONB). In addition, large parts of the area are designated as Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Special Area of Conservation (SAC).

There is a long history of landslips around this location. These landslips deposit material onto the road leading to unpredictable closures of the A59. Analysis of existing geotechnical information indicates that the primary cause of these landslips is heavy rainfall, coupled with relatively unstable land on the hillside slopes, leading to earthwork failures. The most recent landslip occurred in May 2018, and has resulted in a road closure for several weeks. In addition, the cost to North Yorkshire County Council (NYCC) for emergency slope stabilisation and associated carriageway work are becoming significant with an estimated £1.6million expenditure to date (this figure excludes the most resent May 2018 closure).

Proposed Alignment

Various studies, site investigations, consultation events and the production of reports, such as the Option Appraisal Report, have resulted in the determination of the preferred new A59 road realignment. Detail design of this preferred realignment is now being developed and shall affect 5 existing structures as well as include proposals for 11 new structures as listed below with requirements for further structures to be confirmed as the design is developed:

- 3No. Existing Culverts
- 2No. Existing Bridges
- 2No. Proposed Underpasses
- 8No. Proposed Culverts
- 1No. Proposed Retaining Wall
- 1No. Proposed open channel watercourse

Refer to the scheme structure location plan in Appendix A for further details.

Report Objective

WSP has been commissioned to progress the Detailed Design of the A59 Kex Gill Diversion, including modifications to North Moor Road and Church Hill Junctions. The scheme involves diverting the existing 2-lane single carriageway and including provision for a climbing lane in the westbound direction.

To accommodate diversion to the proposed A59 alignment, 3 existing culvert structures shall be affected, and 8 new culverts shall be required. The proposed culverts will carry existing watercourses beneath the road and bridleway crossings. This technical memo has been prepared to assess structural forms for the proposed culvert structures throughout the scheme. A summary of the aforementioned structures are listed in table 1:

Table 1 – Culvert Structure Details

REFERENCE	NEW / EXISTING	MAINLINE CHAINAGE	LOCATION	APPROX. LENGTH (M)	INTERNAL WIDTH (MM)	INTERNAL HEIGHT (MM)
Structure A	Existing culvert to be removed	2+596 to 2+620	NORTH MOOR ROAD	32	2no. 700 dia. circular concrete pipes	
Structure No.1	New	2+582 to 2+686	A59 MAINLINE	104	2100	1700
Structure No.3	Existing to be retained	2+985	A59 MAINLINE	189	700 dia. circular concrete pipe	
Structure No.5	New	4+085	A59 MAINLINE	60	1000	1400
Structure No.7	New	5+440	PROPOSED HALL BECK BRIDLEWAY	9.5	3300	1950
Structure No.8	New	5+525 to 5+645	A59 MAINLINE	121	3900	2125
Structure B	Existing culvert to be removed	5+880	A59 MAINLINE	9	Circa. 900 x 900 stone arch	
Structure No.9	New	5+880	A59 MAINLINE	60	2100	2250
Structure No.10	New	6+028 to 6+089	HALL LANE	61	4200	2550
Structure No.11	New	2+615	NORTH MOOR ROAD	15	1050 dia. circular concrete pipe	
Structure No.12	New	6+095	A59 MAINLINE	60	900 dia. circular concrete pipe	

Existing Culverts

There are 3 existing culverts which will be directly impacted by the proposed A59 diversion alignment.

Structure A is culvert structure approximately 32m long with 2no. 700mm diameter circular concrete pipes carrying Hall Beck under North Moor Road at the existing A59 junction. The inlets/outlets are located either side of the road with dry stone headwalls to both openings. The eastern headwall has an additional 3no. circular pipes of 150mm, 250mm & 550mm diameters and the western headwall has an additional 1no. circular pipe of 300mm diameter all of which outfall into Hall Beck. There are no structural records confirming the structure's current condition. As part of the scheme, this structure is to be removed and replaced with a single culvert structure no.1 which will carry the watercourse beneath both North Moor Road as well as the re-aligned A59.

Figure 1 – Photo showing eastern headwall of existing Structure A

Structure 3 is a 700mm diameter concrete pipe culvert approximately 189m long which carries a watercourse with an inlet located to the north of North Moor Road and an outlet located in between the quarry access track and north of the existing A59. Headwalls are unavailable but there is a manhole located approximately at the halfway point of the culvert. There are no structural records of the structure, however NYCC provided details of a CCTV survey carried out on the culvert on 19.02.19. The survey confirmed the concrete pipe culvert to be in fair condition with only minor cracking noted. It was also confirmed there were no additional pipe connection outlets into the culvert from the surrounding area. As part of the scheme, this culvert is to be retained and any proposed works to this structure will be confirmed at detail design stage.

Structure B is a circa. 900mm x 900mm stone arch culvert approximately 9m long which carries Cote Hill Dike under the existing A59. It has an inlet/outlet located either side of the road with stone & mortar headwalls to both openings. There are no structural records confirming the structure's current condition. As part of the scheme, this culvert is to be removed and replaced with culvert structure no.9 which will carry the watercourse beneath the re-aligned A59.

Figure 2 – Photo showing typical elevation on existing Structure B

Proposed Culverts

As part of the scheme, 8no. new culvert structures are proposed to maintain flow of the existing watercourses. Requirements for these structures has been largely dictated by the flood/drainage model of the project catchment area. The modelling works carried out by WSP to date has been able to determine design flood levels, expected water flows as well as approximate sizing of the culverts. Details of the flood/drainage modelling including methodology and design assumptions are contained within the flood/drainage model report. Refer to the scheme structure location plan in Appendix A for further details.

DESIGN CONSIDERATIONS

The following assumptions/constraints, have been considered when assessing structural forms for the proposed culvert structures:

- Provision cost effective/simple solutions.
- Minimise land take to ensure this is as low as reasonably practical.

- Foundation requirements (ground bearing, piles etc.) shall be based on the ground profile at each discreet structure location.
- Sizing of the culverts to ensure ease with their associated future inspection and maintenance as well as future increase in capacity.
- Ensure disruption to local environment is as low as reasonably practical.
- Statutory services potentially impacting the works shall be protected or diverted accordingly.
- Gradient of the highway embankments are currently based on the provision of 1:3 slopes.
- A proprietary timber post and rail fence shall be provided on the headwall/wingwall at the culvert openings
- Sourcing materials from local sources to minimise transportation requirements.
- Ensure construction can be carried out in a safe and efficient manner. Consideration was given to utilising precast elements which could be delivered and installed quickly thereby reducing insitu works.
- Provision of aesthetic details such as cladding fascia (masonry, stonework etc.) to the culvert openings is still to be confirmed. There is scope to re-use stonework from the 2 existing culverts which are proposed to be removed. Liaison with Key stakeholders (NYCC Heritage team and AONB/Natural England) is currently under progression.
- An Ecology survey carried out by WSP on 22nd/23rd May 2019, confirmed mammal ledges and fish baffles will be required to be accommodated within structure no. 8, 9 & 10 only.
- Requirements for any additional hydraulic features (flow control mechanisms, scour protection, plunge pools etc.) shall be confirmed during the detail design.

STRUCTURE TECHNICAL APPROVALS

Current DMRB requirements for structures (BD 2/12) states any culvert with an internal diameter of less than 900mm does not constitute a 'structure'. This means that it would not be required to go through a structure technical approval process and would instead go through the relevant drainage TAA process.

Design of the proposed culverts identified in this memo will be subject to a structure technical approval process. All other proposed drainage pipes, channels etc. required as part of the scheme (<900mm dia.) will be subject to drainage design only.

STRUCTURAL FORM OPTIONS CONSIDERED

The following structural options for the proposed culverts have been considered:

- Option A – Precast Concrete Box
- Option B – Corrugated Steel Pipe
- Option C – Insitu Concrete Portal
- Option D – Precast Concrete Pipe

This memo provides a high-level overview of the above. A recommendation is also provided regarding the option considered most feasible at each of the 8 proposed structure locations. Refer to options sketches in Appendix B for further details.

OPTION A – PRECAST CONCRETE BOX

Option A comprises a Precast Concrete Box solution and details of its advantages & disadvantages are tabulated below:

Table 2 – Option A: Precast Concrete Box

OPTION A	**PRECAST CONCRETE BOX**
ADVANTAGES	▪ Fabrication of box units in a controlled environment ensures a high-quality surface finish can be achieved. Units are cast in the factory under comprehensive quality control eliminating the drawbacks imposed by weather and site conditions. ▪ Precast box units can be manufactured in a variety of bespoke internal profiles and sizes. ▪ Precast box units are most cost effective compared to cast insitu concrete boxes which require temporary works and more labour which increases construction programme time. ▪ Speed/ease of installation – can be easily positioned in shallow or deep filled installations. ▪ Precast box units can be delivered to site and installed thereby reducing on site works. ▪ Temporary diversion of watercourse is minimised due to rapid installation. ▪ Concrete does not require additional treatments to prolong their life or improve performance. The surface will not rust and the smooth internal finish ensures optimum flow of water through the structure. ▪ Minimum maintenance liability (compared to equivalent steel structure). ▪ Loading can be applied onto the box units as soon as they are installed.
DISADVANTAGES	▪ Lifting of heavy box units into position may require use of large craneage which may not be practical on a constricted site. ▪ Box unit sizes are limited as there is an upper limit to what can practically be fabricated in the factory and delivered to site. ▪ Transportation costs are increased if location of the fabrication factory is some distance from the construction site.

OPTION B – CORRUGATED STEEL PIPE

Option B comprises a Corrugated Steel Pipe solution and details of its advantages & disadvantages are tabulated below:

Table 3 – Option B: Corrugated Steel Pipe

OPTION B	CORRUGATED STEEL PIPE
ADVANTAGES	▪ Amount of temporary works required compared to insitu concrete is significantly less and thereby expedites construction programme. ▪ Sections forming the pipe can be delivered to site as sheets and be installed on site by lifting into position and splicing. ▪ Speed/ease of installation – can be easily positioned in shallow or deep filled installations. ▪ Temporary diversion of watercourse is minimised due to rapid installation. ▪ Pipes can be manufactured in a variety of bespoke internal profiles and sizes. ▪ Due to their lighter weight, transportation costs associated with delivering steel sheets forming the pipe are less compared to their similar concrete counterparts since they are much lighter. ▪ Lifting of steel sheets into position to fabricate the pipe will require use of smaller craneage compared to lifting precast concrete units. ▪ Due to their flexibility, steel pipes can withstand ground settlements much more effectively than concrete sections which are prone to cracking.
DISADVANTAGES	▪ Steel pipes require additional corrosion protective treatments to prolong their life otherwise they will deteriorate. This is an additional maintenance item to be addressed during its design life and hence an additional cost. ▪ Loading onto the pipe cannot be applied until the structure is completely backfilled. ▪ Temporary works is still required when fabricating pipe sections. ▪ Waterproofing around pipe is still required. ▪ Pipe joint connections susceptible to failure during its design life if not installed correctly. ▪ Staged method of backfilling is required to ensure the pipe does not suffer premature warping.

OPTION C – INSITU CONCRETE PORTAL

Option C comprises an Insitu Concrete Portal solution and details of its advantages & disadvantages are tabulated below:

Table 4 – Option C: Insitu Concrete Portal

OPTION C	**INSITU CONCRETE PORTAL**
ADVANTAGES	▪ Does not require large craneage for lifting compared to precast concrete box units. ▪ No limit to the size of the structure that can be achieved as the structure can be built in stages with construction joints. ▪ Transportation costs are simply limited to delivery of concrete to site. ▪ Structure can be cast in a variety of bespoke internal profiles and sizes. ▪ Concrete does not require additional treatments to prolong their life or improve performance. The surface will not rust and the smooth internal finish ensures optimum flow of water through the structure. ▪ Minimum maintenance liability (compared to equivalent steel structure).
DISADVANTAGES	▪ Requires significant temporary works (formwork etc.) to cast concrete and thereby increases construction programme time compared to precast units. ▪ Loading onto the structure cannot be applied until the concrete has achieved full strength. ▪ High quality surface finish cannot be guaranteed on site and workmanship is variable. ▪ Curing of concrete dependent on site climate conditions. ▪ Due to its increased construction time, temporary diversion of the watercourse is also increased.

OPTION D – PRECAST CONCRETE PIPE

Option D comprises a Precast Concrete Pipe solution and details of its advantages & disadvantages are tabulated below:

Table 5 – Option D: Precast Concrete Pipe

OPTION D	PRECAST CONCRETE PIPE
ADVANTAGES	▪ Fabrication of pipe units in a controlled environment ensures a high-quality surface finish can be achieved. Units are cast in the factory under comprehensive quality control eliminating the drawbacks imposed by weather and site conditions. ▪ Precast pipe units can be manufactured in a variety of sizes. ▪ Precast pipe units are most cost effective compared to cast insitu concrete which require temporary works and more labour which increases construction programme time. ▪ Speed/ease of installation – can be easily positioned in shallow or deep filled installations. ▪ Temporary diversion of watercourse is minimised due to rapid installation. ▪ Concrete does not require additional treatments to prolong their life or improve performance. The surface will not rust and the smooth internal finish ensures optimum flow of water through the structure. ▪ Minimum maintenance liability (compared to equivalent steel structure). ▪ Loading can be applied onto the pipe units as soon as they are installed.
DISADVANTAGES	▪ Lifting of heavy pipe units into position may require use of large craneage which may not be practical on a constricted site. ▪ Transportation costs are increased if location of the fabrication factory is some distance from the construction site. ▪ Pipe units will still require insitu concrete bedding foundations to be cast prior to their installation. ▪ Has a lower hydraulic capacity compared to its equivalent sized box shaped unit.

Geotechnical Information

EXISTING GROUND CONDITIONS

A Geotechnical Design Report is not yet available for the project and will be prepared following completion of all design elements. The GDR will define suitable parameters for the design and acceptable solutions. Table 1 below provides a summary of ground conditions anticipated at the 8 new culvert locations. This is based on data acquired from the 2017, 2018 & 2019 ground investigations. There may be variations in the ground conditions, and a worse case ground model will be assumed. Refer to the scheme structure location plan in Appendix A for borehole locations.

Table 6 – Anticipated ground conditions at the proposed culvert locations

CULVERT	GROUND CONDITIONS	BOREHOLE REF.
STRUCTURE NO.1	▪ Soft to stiff sandy slightly gravelly clay of highly weathered mudstone and sandstone between 1.05m and 3.0m thickness overlying 2.8m to 5.55m of extremely weak to weak laminated mudstone overlying 0.98m to 3.2m of very weak to medium strong sandstone. This in turn overlies another layer of extremely weak to very weak mudstone with a thickness of 0.43m to 2.15m which overlies medium strong sandstone varying from 1.6m to an unproven thickness. The 1.6m thick sandstone is underlain by unproven extremely weak to very weak mudstone.	BH 61/17 & BH 101/18
STRUCTURE NO.5	▪ A thin layer of peat (0.4m to 0.5m thickness) overlying highly weathered bedrock reduced to a slightly sandy slightly gravelly clay and sand with a recorded thickness of 0.2m to 1.6m overlying 3.9m of extremely weak to strong coarse sandstone which in turn overlies a very weak thinly laminated silty mudstone of unproven depth.	BH 24/17 & BH 25/17
STRUCTURE NO.7	▪ Anticipated ground at this location is approximately 2.0m of soft slightly sandy clay (alluvium) overlying the highly weathered bedrock reduced to a slightly clayey very sandy gravel and a stiff sandy slightly gravelly clay to unproven depth. No ground investigation data is available at this location.	BH 46/17 & BH 111/18
STRUCTURE NO.8	▪ Alluvium comprising soft slightly sandy slightly gravelly clay ranging in thickness between 4.45m to over 5.5m overlying weak to medium strong medium to coarse grained sandstone with a thickness of 2.2m which in turn overlies very weak to weak mudstone to unproven depth.	BH 115/18 & BH 120/18
STRUCTURE NO.9	▪ Anticipated soft slightly clayey sand (alluvium) over highly weathered bedrock reduced to a firm to stiff slightly sandy slightly gravelly clay and sand. No ground investigation data is available at this location.	BH 54/17 & BH 55/17
STRUCTURE NO.10	▪ Soft clay and soft sandy gravelly clay (alluvium) between 2.65m and 4.4m thick overlying 1.0m of weathered bedrock of gravelly clayey cobbles of sandstone and mudstone. This in turn overlies alternating layers of weak to strong, fine to coarse sandstone between 0.55m to 1.9m thick and extremely weak to weak mudstone between 0.6m and 1.5m thick. Unproven weak to strong sandstone was encountered at 4.05m BGL in BH56/17.	BH 56/17 & BH 121/18
STRUCTURE NO.11	▪ Refer to ground conditions for structure no.1 as above.	BH 61/17 & BH 101/18
STRUCTURE NO.12	▪ Soft clay and soft sandy gravelly silty clay (alluvium) between 0.4m and 6.0m thick overlying 0.3m of weak to medium strong fine-grained sandstone. This in turn overlies 0.86m of extremely weak to very weak mudstone which overlies 1.5m of medium strong sandstone overlying unproven very weak to medium strong mudstone and siltstone.	BH 55/17 & BH 57/17

RISKS ASSOCIATED WITH CULVERT WORKS

The geotechnical risks for the wider site are detailed below in Table 7. These risks have been reviewed and further assessed in the 'Live' Project Risk Registers.

Table 7 – Geotechnical risks of the proposed culverts

RISK CAUSE	RISK EVENT	PRIMARY RISK IMPACT	RISK RATING
ENGINEERING PROPERTIES OF THE GROUND	▪ Risk that the ground model and associated engineering properties are worse than anticipated.	TBC	Low - medium
INSTABILITY OF EXISTING EARTHWORKS	▪ Failure of earthworks may impact or undermine the proposed culvert structures. Failure of culverts may impact existing or proposed earthworks.	TBC	Low - medium
GROUNDWATER	▪ Risk that the ground water profile is worse than that identified on site.	TBC	Low - medium
CONTAMINATED SOILS	▪ Risk of unknown / unidentified contaminated soils.	TBC	Low
INSTABILITY CAUSED BY SHALLOW MINE WORKINGS	▪ Risk that the culvert would be impacted by unknown mine workings which may require grouting during construction phase.	TBC	Low
CONSTRUCTABILITY OF CHOSEN CULVERT SOLUTION	▪ Risk that the proposed culvert structures are no longer suitable due to the uncertainty of the ground model such as the rockhead being at a higher elevation, deeper alluvium, boulders and other obstructions being present.	TBC	Medium
UNEXPLODED ORDNANCE (UXO)	▪ The site is located within an area of low risk.	TBC	Very low
BURIED SERVICES	▪ Encountering buried services during excavation.	TBC	Low

High Level Option Appraisal

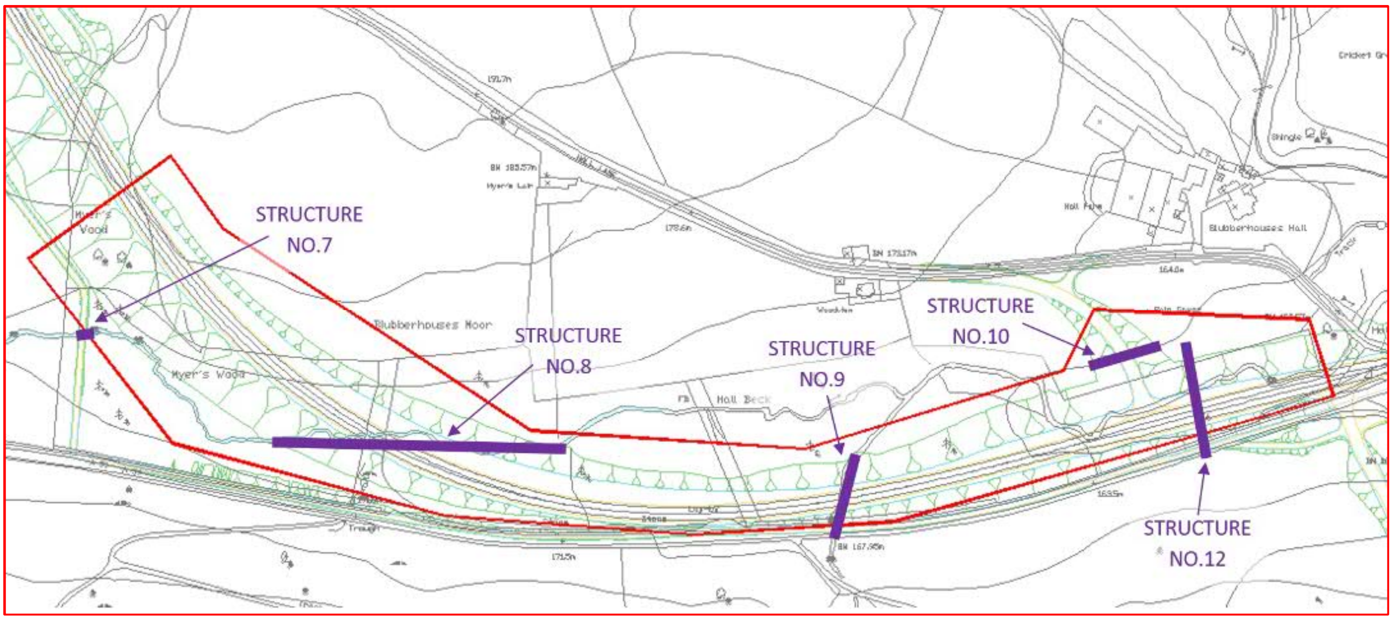
As all the culvert structures are buried with limited access, any extensive maintenance works required to be carried out during their design life will be challenging. On this basis, concrete solutions are generally preferred over their steel counterparts due to their lower overall maintenance liabilities.

The smaller internal dimensions of structure no. 1 and 5 lend themselves to selection of a prefabricated solution. An insitu concrete option would require temporary formwork and a corrugated steel pipe option would require segments to be spliced together. Both these options would involve significant confined space working which would expose the labour force to additional health and safety risks during their construction. A precast concrete box (option A) would be the most appropriate solution for structure no. 1 and 5 as it would remove the risk of confined space working as well as simultaneously expediting their construction.

Structure no. 11 serves flows coming in from 2 open channel drainage ditches and outfalls into structure no.1 which in turn carries the water beneath the proposed A59. It shares a physical connection with structure no.1. Due to its relatively short 15m length and internal size, a precast concrete pipe (option D) would be the most suitable solution. The concrete pipe (structure no.11) would terminate into a bespoke insitu concrete segment (structure no.1) constituting a box with a circular cut-out to the wall to enable the pipe to be received.

At the eastern end of the project catchment up to existing Hall Lane junction, borehole data identified a large area of alluvium present up to 6m below existing ground level. The proposed A59 highway alignment runs through this area with structures no. 7, 8, 9, 10 & 12 due to be located in this section (refer to figure 3).

Figure 3 – Plan showing proposed A59, proposed structures and approximate area of existing alluvium (identified as the zone within the red line; circa 0.066km² / 66,000m²)



As alluvium is considered to be soft material, the risk of ground settlement is likely to be high unless some form of ground improvement is carried out. To put this into context, expected settlements under the max 8.5m high highway embankment are going to be in the order of 550mm if no piling or ground improvement is carried out. Settlements under the culvert structures will be less but conservative estimates are in the region of around 380mm based on 2.5m clear internal height of the culvert. Therefore, the culvert structures will not work without pile foundations or some other alternative form of ground improvement.

A number of ground improvement options were considered which are summarised below:

1. Piled embankment with a load transfer platform

This method would involve insertion of numerous driven pre-cast concrete piles into the existing ground with pilecaps and geogrid membrane tied together creating a load transfer platform. The highway embankment can then be built on top of the platform. Residual settlements would likely be within manageable limits without negatively impacting construction programme. This option is a well-established approach covered by standards (BS 8006-1) and offers the high degree of confidence in buildability, programme, and performance of the finished works. To maintain compatibility with the piled embankment, all culvert structures would also need to be constructed on piled foundations.

2. Partial dig out and replacement of Alluvium say to 2m below ground level

This would still leave a residual settlement of approximately 370mm below the embankment or 250mm below the culvert. In the absence of verification through detailed analysis, long term stability of the culvert structures are likely to be questionable. Costs of disposal of excavated material and import of granular fill are likely to exceed the costs of the piled option.

3. Full depth dig out and replacement of Alluvium with Structural Fill

This will require excavation to around 6m depth mostly below ground water level. This is doable but costly and will create a huge fill surplus plus requirement for import of granular material. Costs of disposal of excavated material and import of granular fill are likely to substantially greater than the costs of the piled option. It is likely to have substantial environmental impacts such as loss of woodland etc. It should however eliminate most of the settlement and overall ground stability should be good.

4. Deep Soil Mixing

Stabilisation of the soft ground by mixing with cement/lime. This option is costly but will deal with the settlement and stability issues. The earthworks balance would remain largely as existing however there would be environmental impacts associated with the use of cement. This is a proprietary process with a limited number of suppliers. It is possible that this option may be offered by tenderers as a value engineering option and may be considered if costs are favourable and performance similar to piled foundations can be demonstrated.

5. Vibro Stone Columns

This option is considered more cost effective than deep soil mixing but ruled out on the basis of the low strength of Alluvium may prevent satisfactory installation of the stone columns. Also, will only reduce settlements by around 50% and there is much less certainty regarding performance compared with a piled solution.

6. Staged construction with preloading

For this option the construction sequence likely to be as follows:

- Install vertical band drains over embankment footprint
- Construct embankment to say 3m.
- Wait 3 months
- Construct embankment to say 6m
- Wait 3-6 months
- Excavate embankment within culvert footprint
- Build culvert structures
- Complete embankment to finished road level
- Wait 3-6 months
- Complete road pavement and drainage

This is likely a lot cheaper than options 2 to 4 and maintains the current earthworks balance. Drain spacings and sequence can be optimised to reduce programme time but overall it will take a lot longer to construct. There may also be some significant residual settlements of the culvert structures in the unload/reload periods.

7. Part Lightweight Fill embankment

Potential sequence as follows:

- Install vertical band drains over embankment footprint
- Construct embankment to say 3m (or 1m above flood level).
- Wait 6 months
- Reduce embankment height by 1m generally and to founding level within culvert footprint
- Build culvert structures
- Complete embankment to 1m below FRL using expanded polystyrene
- Complete road pavement and drainage

This is a bit better than option 6 in terms of programme but still slow. Material costs are high for expanded polystyrene fill and it will create a big surplus of fill material.

8. Viaduct Structure (constructed on piled foundations)

This option is included for completeness, but considering the cost and time penalties with other options, it is likely to be unfeasible. This option leaves a fill surplus but may help reduce impact on woodland. The viaduct structure however, will introduce a considerable maintenance liability for the asset manager.

Option 1 was selected as the preferred ground improvement solution and the current proposal includes piling the embankment directly affected by the proposed A59 alignment. It should be noted that the current embankment area identified for piling is a conservative estimate subject to being refined as the detail design progresses.

Following on from this, any solution choice for structures no.7 – 10 would require robust foundations mitigating against the likely effects of ground settlement i.e. piles. Due to their large size, a piped solution is considered unfeasible. A piled box or portal solution is viable with the latter preferred as this would provide a structurally efficient solution.

A precast concrete portal is not preferred as this would require a longitudinal joint along the top of the pilecap that would be difficult to access, inspect and maintain. In addition, insitu construction would allow for a corbel to be incorporated as part of the design to readily facilitate mammal access requirements. For this reason, an insitu concrete portal (option C) will piled foundations is the preferred solution for structure no. 7 – 10.

Structure no.12 is associated with low flows and is also located within the proposed piled embankment zone. Due to its small internal diameter, a precast concrete pipe (option D) appears to be the most practical solution. A type Z pipe bedding (concrete surround) in accordance with the DMRB Highway Construction Details is considered suitable for this location.

Refer to proposed structure general arrangement in Appendix C for further details.

Conclusion & Recommendation

Based on a high-level assessment and geotechnical information to date, it is recommended that consideration be given to the development of the following:

- Option A (Precast Concrete Box) for Structure no.1 & 5
- Option C (Insitu Concrete Portal) with piled foundations for Structure no. 7, 8, 9 & 10
- Option D (Precast Concrete Pipe) for Structure no. 11 & 12

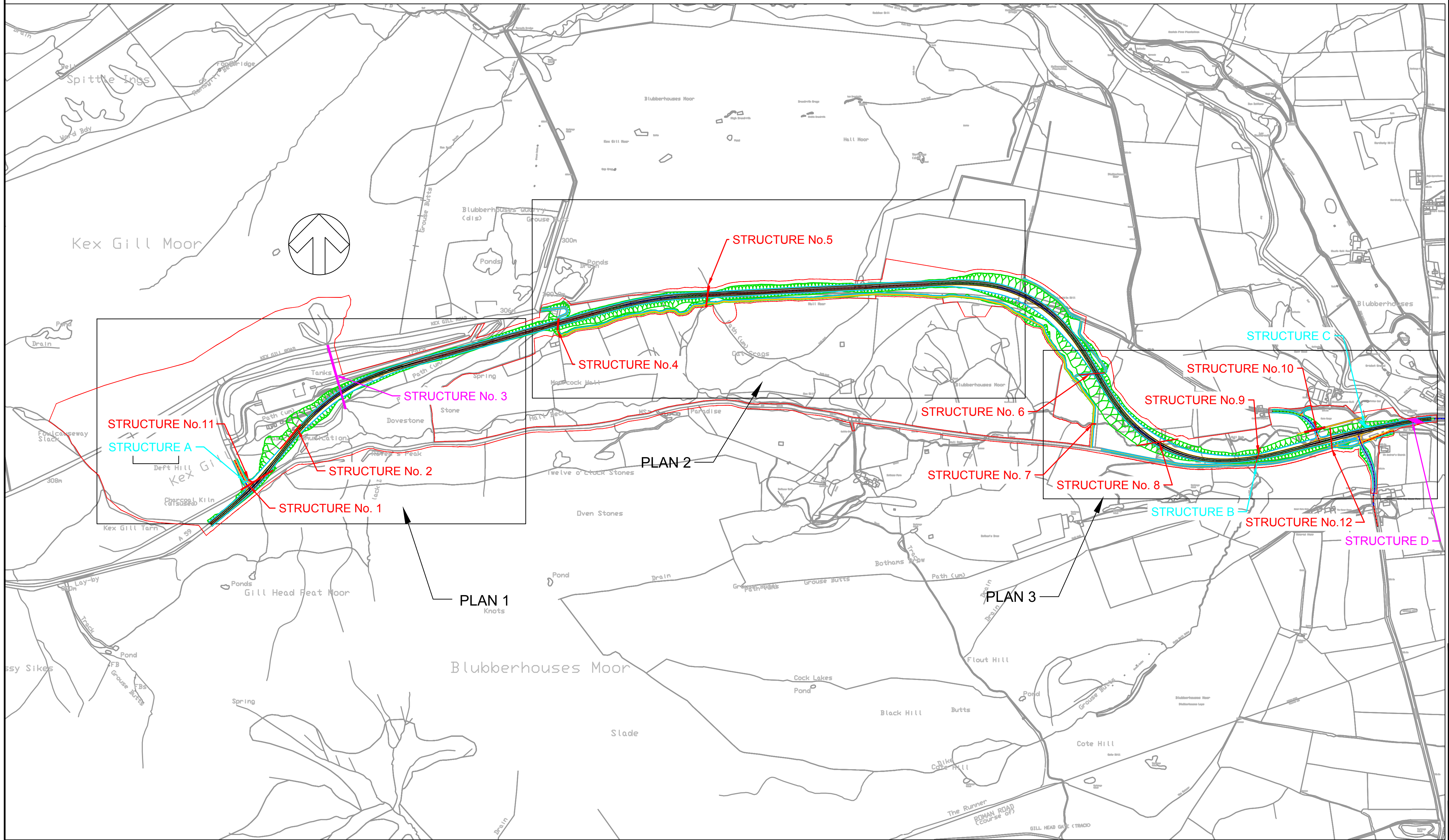
Following initial discussions with NYCC, all 8no. culvert structures are to be classified as Category 1 in accordance with BD2/12 with requirement for Approval In Principles (AIP) and TAA approval. The following will also be required in order to progress to the detailed design stage:

- Confirmation of new culvert structure locations.
- Confirmation of existing statutory undertaker's services at culvert locations.
- Structural finish/fascia/cladding requirements to the headwall/wingwalls.
- Provision of any specific environmental features.
- Requirement for any additional hydraulic features (flow control mechanisms, scour protection, plunge pools etc.) to be installed to any of the structures.
- Any other additional site investigation information.
- Geotechnical design report (GDR).

APPENDIX A – STRUCTURE LOCATION PLAN

DO NOT SCALE

Millimetres 0 10 100



NOTES:

1. THIS DRAWING PROVIDES OUTLINE LOCATIONS OF THE PROPOSED STRUCTURES REQUIRED FOR THE A59 KEX GILL IMPROVEMENT SCHEME.
2. THE DIVERSION SHALL AFFECT 5NO. EXISTING STRUCTURES AS INCLUDE PROPOSALS FOR 11NO. NEW STRUCTURES COMPRISING:
   - 3NO. EXISTING CULVERTS
   - 2NO. EXISTING BRIDGES
   - 2NO. PROPOSED UNDERPASSES
   - 8NO. PROPOSED CULVERTS
   - 1NO. PROPOSED RETAINING WALLS
   - 1NO. PROPOSED OPEN CHANNEL WATERCOURSE
3. REQUIREMENTS FOR FURTHER STRUCTURES TO BE CONFIRMED AS THE DESIGN IS DEVELOPED.
4. DETAILS SHOWN ON THIS DRAWING ARE SUBJECT TO FINAL CONFIRMATION OF THE ALIGNMENT AND DRAINAGE DESIGN.
5. THE FOLLOWING IS REQUIRED TO PROGRESS THE DETAIL DESIGN OF THE STRUCTURES:
   - CONFIRMATION OF SERVICES/SPARE DUCTS TO BE RETAINED WITHIN STRUCTURE VERGES

KEY:

- (red) - NEW STRUCTURE DESIGN
- (magenta) - EXISTING STRUCTURE TO BE RETAINED
- (cyan) - EXISTING STRUCTURE TO BE REMOVED
- (red line) - REDLINE BOUNDARY

Rev.	Date	Description	By	Chk'd	App'd
P02	09/08/2019	STRUCTURES NO. 11&12 ADDED	LS	MT	HM
P01	06/03/2019	FOR INFORMATION	LS	MT	HM

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Client

North Yorkshire County Council

Project Title

A59 KEX GILL DIVERSION

Drawing Title

STRUCTURES LOCATION PLAN
(SHEET 1 OF 3)

Scale	Drawn	Checked	Approved	Authorised
NTS	L. Slinn	M.Tziolas	H.Mistry	H.Mistry
Original Size	Date	Date	Date	Date
A1	09/08/2019	09/08/2019	09/08/2019	09/08/2019

Drawing Status: FOR INFORMATION

Suitability: S1

Drawing Number Project	Originator	Volume		Project Ref. No.
70049554	WSP	SBR		
ALL (Location)	SK (Type)	CB (Role)	0001 (Number)	Revision: P02

APPENDIX B – STRUCTURE OPTION SKETCHES

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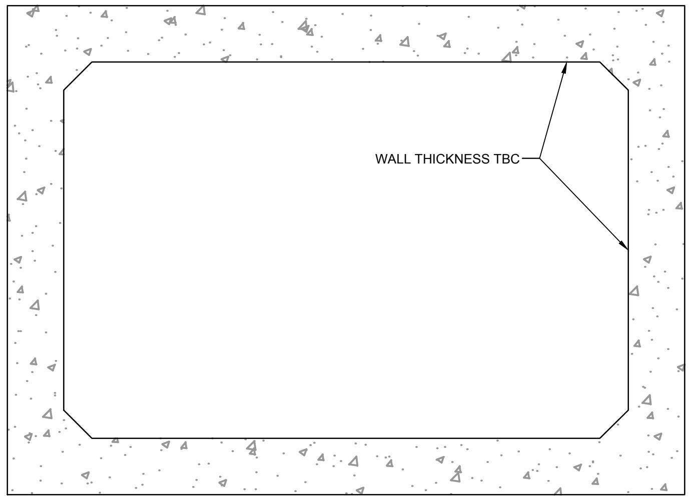
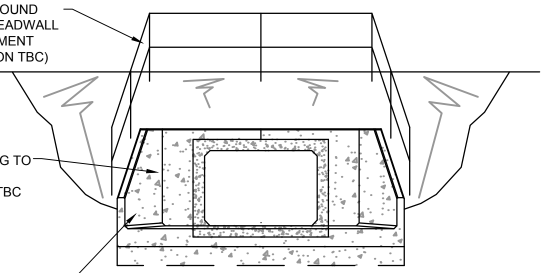
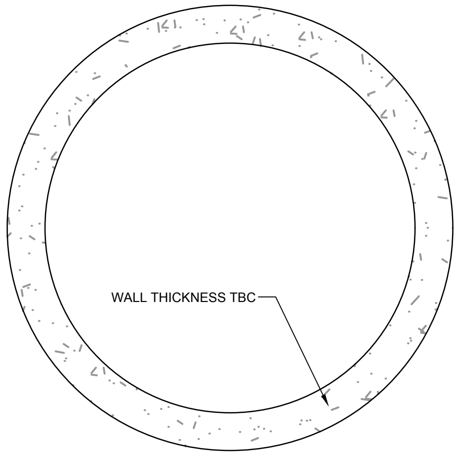


OPTION A: TYPICAL CROSS SECTION THROUGH
PRECAST CONCRETE BOX CULVERT
SCALE 1:20

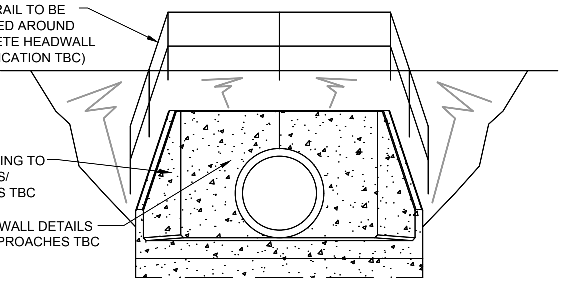


OPTION A: TYPICAL ELEVATION OF
PRECAST CONCRETE BOX CULVERT
SCALE 1:100

TYPICAL IMAGE OF PRECAST
CONCRETE BOX CULVERT

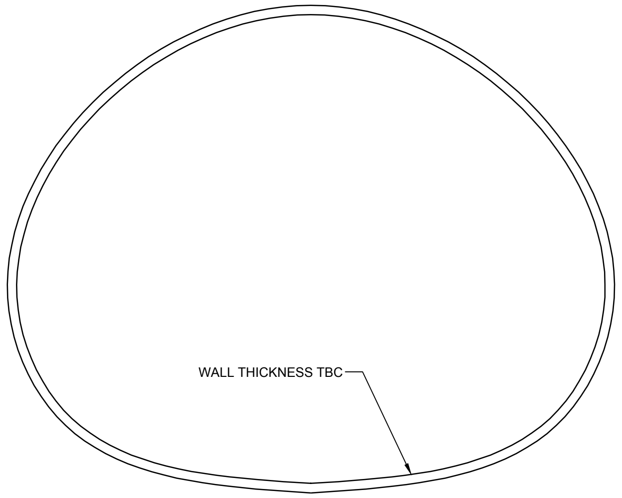


OPTION D: TYPICAL CROSS SECTION THROUGH
PRECAST CONCRETE PIPE CULVERT
SCALE 1:20

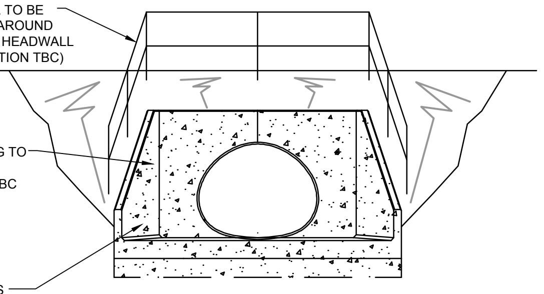


OPTION D: TYPICAL ELEVATION OF
PRECAST CONCRETE PIPE CULVERT
SCALE 1:100

TYPICAL IMAGE OF PRECAST
CONCRETE PIPE CULVERT

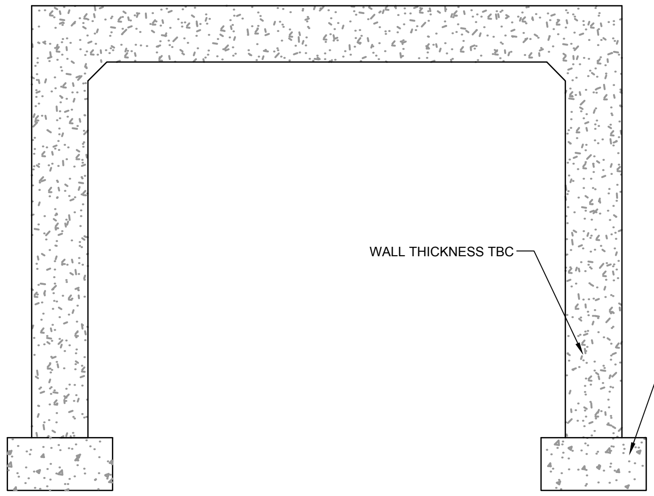


OPTION B: TYPICAL CROSS SECTION THROUGH
CORRUGATED STEEL PIPE CULVERT
SCALE 1:20

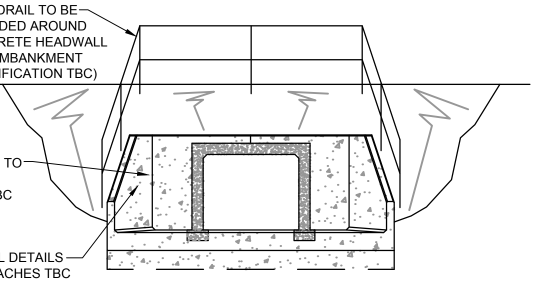


OPTION B: TYPICAL ELEVATION OF
CORRUGATED STEEL PIPE CULVERT
SCALE 1:100

TYPICAL IMAGE OF CORRUGATED
STEEL PIPE CULVERT



OPTION C: TYPICAL CROSS SECTION THROUGH
INSITU CONCRETE PORTAL CULVERT
SCALE 1:20



OPTION C: TYPICAL ELEVATION OF
INSITU CONCRETE PORTAL CULVERT
SCALE 1:100

TYPICAL IMAGE OF INSITU
CONCRETE PORTAL CULVERT

CULVERT INFORMATION TABLE

REFERENCE	NEW / EXISTING	MAINLINE CHAINAGE	LOCATION	APPROX. LENGTH (m)	APPROX. WIDTH (m)	APPROX. HEIGHT (m)
STRUCTURE A	EXISTING TO BE REMOVED	2+596 TO 2+620	NORTH MOOR ROAD	32	2NO. 700 DIAMETER CIRCULAR CONCRETE PIPES	
STRUCTURE NO. 1	NEW	2+582 TO 2+686	A59 MAINLINE	104	2100	1700
STRUCTURE NO. 3	EXISTING TO BE RETAINED	2+985	A59 MAINLINE	189	700 DIAMETER CIRCULAR CONCRETE PIPE	
STRUCTURE NO. 5	NEW	4+085	A59 MAINLINE	60	1000	1400
STRUCTURE NO. 7	NEW	5+440	PROPOSED HALL BECKBRIDLEWAY	9.5	3300	1950
STRUCTURE NO. 8	NEW	5+525 TO 5+645	A59 MAINLINE	121	3900	2125
STRUCTURE B	EXISTING TO BE REMOVED	5+880	A59 MAINLINE	9	900 x 900 STONE ARCH	
STRUCTURE NO. 9	NEW	5+880	A59 MAINLINE	60	2100	2250
STRUCTURE NO. 10	NEW	6+028 TO 6+089	HALL LANE	61	4200	2550
STRUCTURE NO. 11	NEW	2+615	NORTH MOOR ROAD	15	1050 DIAMETER CIRCULAR CONCRETE PIPE	
STRUCTURE NO. 12	NEW	6+095	A59 MAINLINE	60	900 DIAMETER CIRCULAR CONCRETE PIPE	

(REFER TO STRUCTURE LOCATION PLAN FOR FURHTER DETAILS)

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT STRUCTURES, EARTHWORKS AND ROADWORKS DRAWINGS.
2. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
3. ALL LEVELS, CHAINAGES AND SETTING OUT POINTS ARE IN METERS UNLESS NOTED OTHERWISE.
4. ALL FORMATION LEVELS TO BE CONFIRMED ON SITE. THE FORMATION SHALL BE CHECKED FOR THE PRESENCE OF SOFT OR LOOSE SPOTS AND REPLACED WITH ACCEPTABLE COMPACTED GRANULAR MATERIAL.
5. CONSTRUCTION SEQUENCE TO BE DETERMINED AT DETAILED DESIGN STAGE.

Rev.	Date	Description	By	Chk'd	App'd
P01	09/08/19	FOR INFORMATION	LS	IM	HM

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Client: North Yorkshire County Council

Project Title: A59 KEX GILL DIVERSION

Drawing Title: CULVERT STRUCTURE FEASIBILITY OPTION SKETCHES (SHEET 1 OF 2)

Scale	Drawn	Checked	Approved	Authorised
AS SHOWN	L. Slinn	I.Mulla	H.Mistry	H.Mistry
Original Size: A1	Date: 09/08/19	Date: 09/08/19	Date: 09/08/19	Date: 09/08/19

Drawing Status: FOR INFORMATION — Suitability: S1

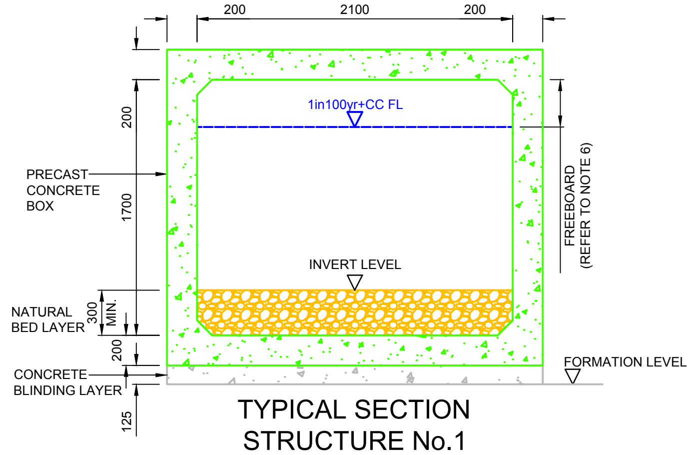
Drawing Number — Project: 70049554 | Originator: WSP | Volume: SMN | Location: ALL | Type: DR | Role: CB | Number: 0001

Project Ref. No.

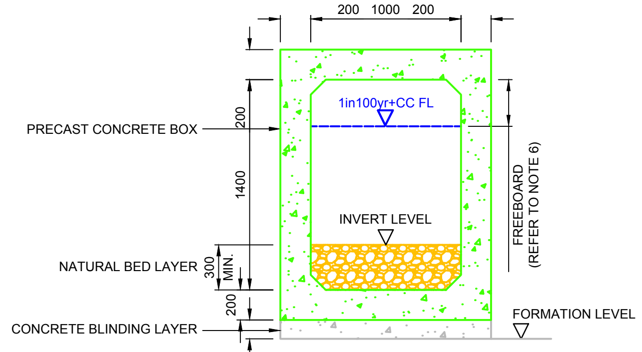
Revision: P01

APPENDIX C – PROPOSED GENERAL ARRANGEMENT

Millimetres
DO NOT SCALE



TYPICAL SECTION
STRUCTURE No.1
SCALE 1:25



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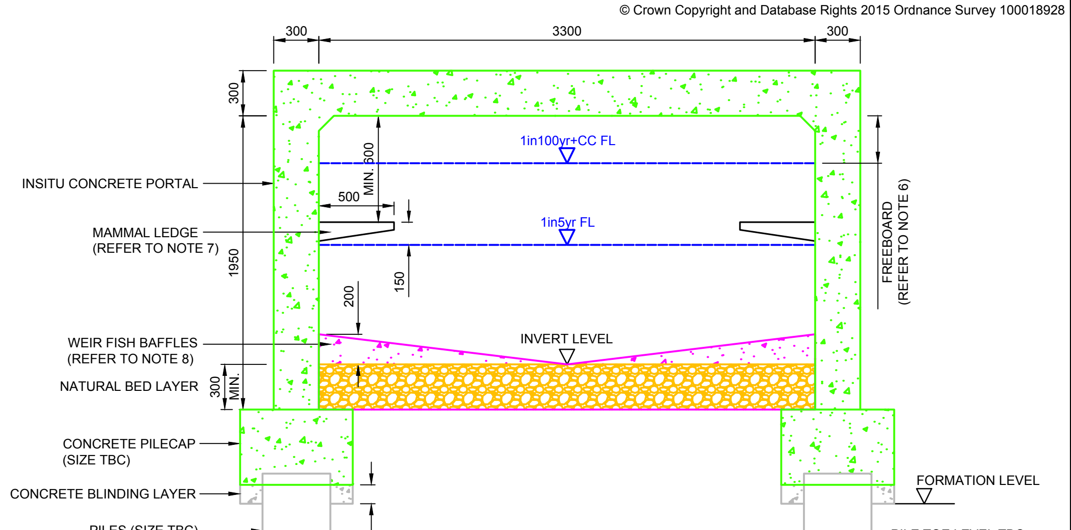
STRUCTURE No.5
SCALE 1:25



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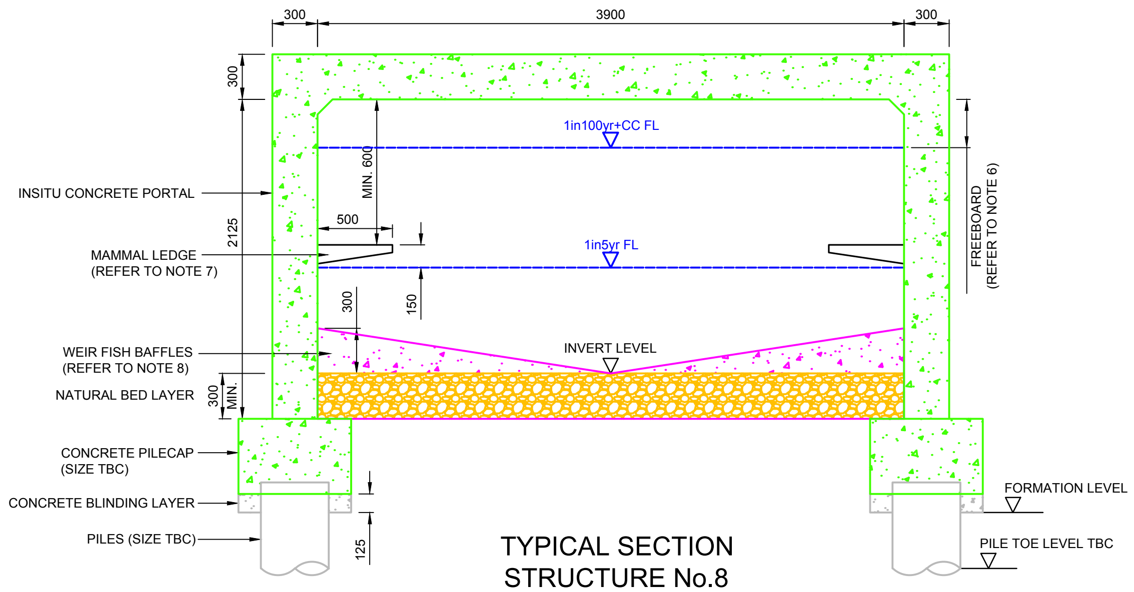
STRUCTURE No.7
SCALE 1:25



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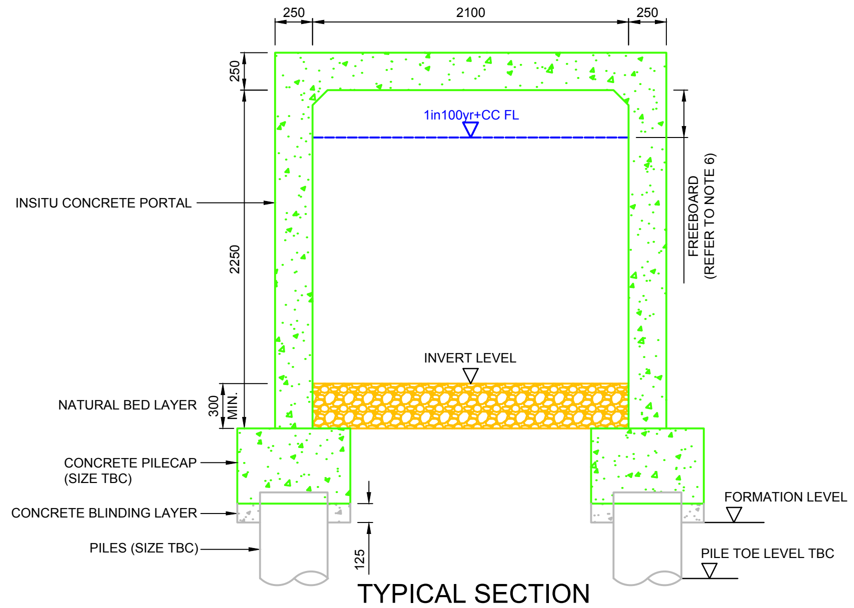
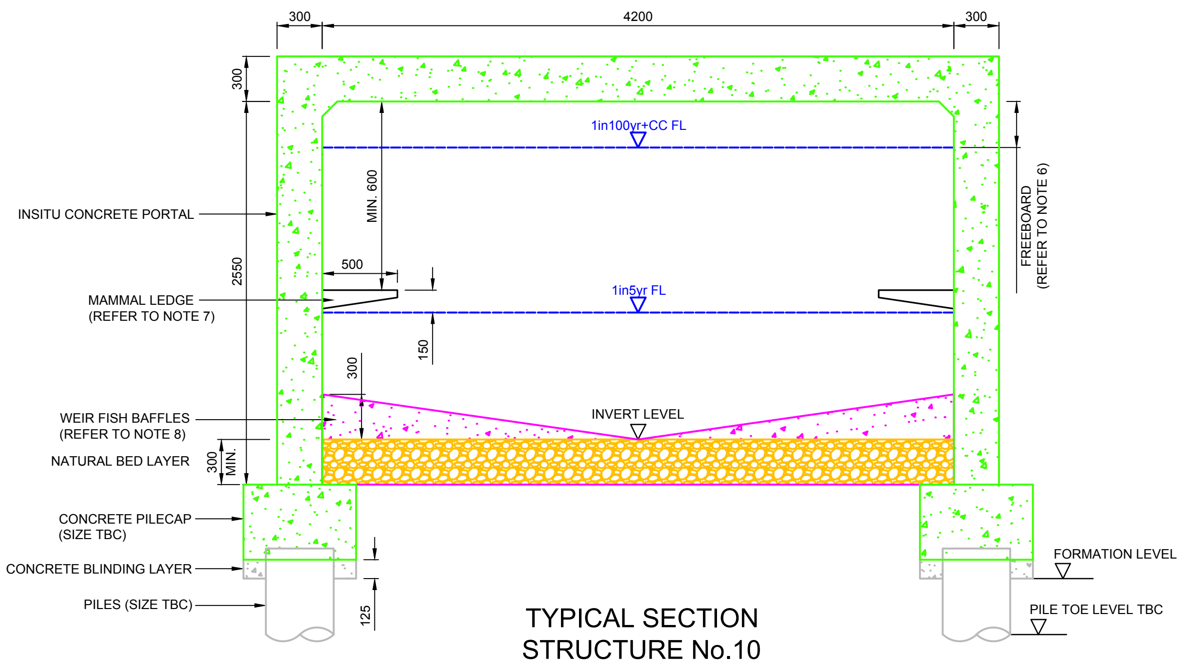
STRUCTURE No.8
SCALE 1:25



TYPICAL SECTION
STRUCTURE No.9
SCALE 1:25

004 006 007 009



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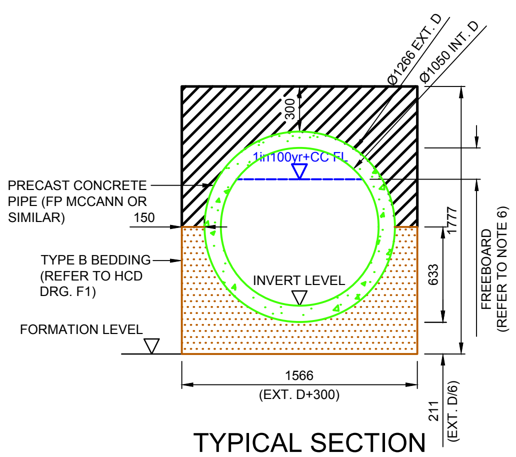
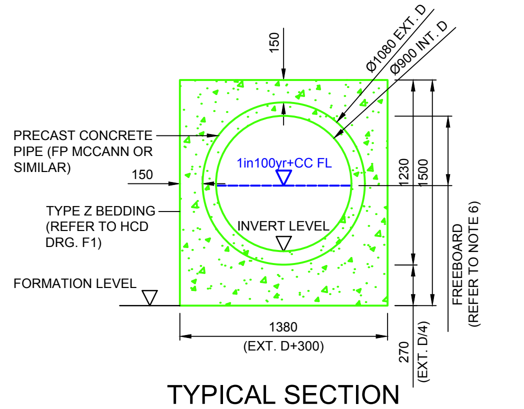
STRUCTURE No.10
SCALE 1:25



TYPICAL SECTION
STRUCTURE No.11
SCALE 1:25



TYPICAL SECTION
STRUCTURE No.12
SCALE 1:25

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT STRUCTURES, EARTHWORKS AND ROADWORKS DRAWINGS.
2. ALL DIMENSIONS ARE IN MILLIMETRES, UNLESS NOTED OTHERWISE.
3. ALL LEVELS, CHAINAGES AND SETTING OUT POINTS ARE IN METERS UNLESS NOTED OTHERWISE.
4. ALL FORMATION LEVELS TO BE CONFIRMED ON SITE. THE FORMATION SHALL BE CHECKED FOR THE PRESENCE OF SOFT OR LOOSE SPOTS AND REPLACED WITH ACCEPTABLE COMPACTED GRANULAR MATERIAL.
5. CONSTRUCTION SEQUENCE TO BE DETERMINED AT DETAILED DESIGN STAGE.
6. SUBJECT TO CONFIRMATION FROM NYCC, FREEBOARD PROVISION HAS BEEN BASED ON GUIDANCE SET OUT IN fig.9.14 OF CIRIA C689 (CULVERT DESIGN & OPERATION GUIDE) ASSUMING IT IS MEASURED FROM THE 1in100yr + CC WATER LEVEL (WORST CASE SCENARIO).
7. DESIGN CRITERIA FOR MAMMAL LEDGES HAS BEEN DETERMINED FROM clause.10.14 OF HA81/99 DESIGN STANDARD (NATURE CONSERVATION ADVICE IN RELATION TO OTTERS) TOGETHER WITH THE NRA PUBLICATION - GUIDELINES FOR THE TREATMENT OF OTTERS PRIOR TO THE CONSTRUCTION OF NATIONAL ROAD SCHEMES.
8. DESIGN CRITERIA FOR FISH BAFFLES HAS BEEN DETERMINED FROM THE ENVIRONMENT AGENCY FISH PASS MANUAL (GEHO 0910 BTBP-E-E: NOV. 2010).
9. ALL DATA PROVIDED IN THE TABLE/SKETCHES ARE SUBJECT TO FINAL CONFIRMATION OF THE FLOOD/DRAINAGE MODEL AND SUBSEQUENT STRUCTURAL/GEOTECHNICAL DETAIL DESIGN.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS

CONSTRUCTION
REF 004 - WORKING IN CONFINED SPACE
REF 006 - BACKFILLING OF THE STRUCTURE
REF 007 - WORKING WITH LIFTING PLANT DURING INSTALLATION OF PRECAST UNITS
REF 009 - DAMAGE TO EXISTING STATUTORY SERVICES
MAINTENANCE/CLEANING
NONE
USE
NONE
DECOMMISSIONING/DEMOLITION
NONE

SAFETY, HEALTH AND ENVIRONMENTAL SYMBOL LEGEND
INDICATES A RESIDUAL RISK AS A WARNING

Rev.	Date	Description	By	Chk'd	App'd
P01	09/08/19	FOR INFORMATION	LS	IM	HM

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Client
North Yorkshire County Council

Project Title
A59 KEX GILL DIVERSION

Drawing Title
CULVERT STRUCTURE FEASIBILITY
(SHEET 2 OF 2)
GENERAL ARRANGEMENT

Scale	Drawn	Checked	Approved	Authorised
AS SHOWN	L. Slinn	I.Mulla	H.Mistry	H.Mistry
Original Size: A1	Date: 09/08/19	Date: 09/08/19	Date: 09/08/19	Date: 09/08/19

Drawing Status: FOR INFORMATION
Suitability: S1

Drawing Number
Project	Originator	Volume
70049554	WSP	SMN
Location: ALL	Type: DR / Role: CB	Number: 0002

Project Ref. No.
Revision: P01

Appendix G

TAA CORRESPONDENCE

APPROVAL IN PRINCIPLE	Name of Project:	A59 Kex Gill Diversion
(Bridge and other Highway Structures)	Name of Bridge/Structure: Structure Ref. No.:	A59 Kex Gill Culvert (Structure no.1) STR001

AIP Comments Record Sheet

Scheme Name: A59 Kex Gill Diversion

Document Ref: NYKGDD-WSP-SMN-STR001-RE-CB-0001

AIP Version: P01

AIP Submission Date: 03 October 2019

Comment Sheet Document Control

Comment Sheet Version	Date NYCC Comment Sent	Date Designer's Reply Sent	Notes
A	16.10.2019	18.10.2019	
B	22.10.2019		

No.	AIP Section	Initial Comment (NYCC Response), and further comments on Designer's reply	Designer's Reply	Accepted by NYCC
1	Drawing	Access (600x600) to the box culvert is required in the verge just upstream of the pipe connection	Noted. We consider this 'access' to be in the form of a manhole chamber allowing access into the box culvert (STR001). Can the TAA please confirm our understanding is correct to permit the drawings to be updated accordingly?	Won't be a manhole chamber, just an access and ladder rungs in the side wall of the box.
2	Drawing	The box culvert receiving the 1050 pipe must be designed or formed to receive the pipe with a small allowance for a mortar plug all the way around	Noted. Drawing shall be updated to show a plug detail at the box culvert (STR011) and pipe culvert (STR001) connection location.	Ok
3	3.5	Tok strip should be used at the precast box culvert joints rather than hydrophilic sealant	Noted. Section will be updated to replace hydrophilic sealant with Tok strip sealant.	Ok

APPROVAL IN PRINCIPLE	Name of Project:	A59 Kex Gill Diversion
(Bridge and other Highway Structures)	Name of Bridge/Structure: Structure Ref. No.:	A59 Kex Gill Culvert (Structure no.1) STR001

AIP Comments Record Sheet

Scheme Name: A59 Kex Gill Diversion

Document Ref: NYKGDD-WSP-SMN-STR001-RE-CB-0001

AIP Version: P03

AIP Submission Date: 05/05/2023

Comment Sheet Document Control

Comment Sheet Version	Date NYCC Comment Sent	Date Designer's Reply Sent	Notes
A	-	05/05/2023	Updates for value engineering

No.	AIP Section	Initial Comment (NYCC Response), and further comments on Designer's reply	Designer's Reply	Accepted by NYCC
1	3.5		Deleted "creating a monolithic integral structure" at end of first sentence as it is misleading, the box culverts are interlocked but not monolithic.	
2	3.10.1		Table 1 – structural concrete. Added "Minimum strength" as most precast suppliers typically use higher classes than C40/50.	
3	3.10.1		Table 1 – blinding concrete. Corrected type of concrete to "designated concrete in accordance with BS 8500-1:2015+A2:2019" rather than "prescribed standard concrete".	

APPROVAL IN PRINCIPLE	Name of Project:	A59 Kex Gill Diversion
(Bridge and other Highway Structures)	Name of Bridge/Structure: Structure Ref. No.:	A59 Kex Gill Culvert (Structure no.1) STR001

No.	AIP Section	Initial Comment (NYCC Response), and further comments on Designer's reply	Designer's Reply	Accepted by NYCC
4	3.10.1		Table 1 – waterproofing Added "A permitted waterproofing system (in accordance with series 2000 of the MCHW) shall be used on the top outer surface of the box culverts and be continued down the outside of the abutment to a level 200 mm below the soffit." Edited the second paragraph to read (edits underlined): - "All structure <u>external</u> buried surfaces <u>(including the base) not protected by a permitted waterproofing system</u> shall be coated with two coats of bituminous paint (in accordance with series 2000 of MCHW) for below ground concrete structures."	
5	3.10.1		Table 1 – structural backfill Added parameters that are in specification. "Minimum effective angle of friction φ' = 35°, and effective cohesion c' = 0."	
6	3.10.3		Table 3 – U4 Clarified which areas need U4 finish.	
7	3.10.4		References to back of wall drainage to culvert units has been removed, paragraph now reads: - "Weepholes are to be provided to the wingwalls, with a filter medium placed directly behind them to prevent backfill material loss. This shall assist in relieving the build-up of pore water pressures."	

APPROVAL IN PRINCIPLE	Name of Project:	**A59 Kex Gill Diversion**
(Bridge and other Highway Structures)	Name of Bridge/Structure: Structure Ref. No.:	**A59 Kex Gill Culvert (Structure no.1)** **STR001**

No.	AIP Section	Initial Comment (NYCC Response), and further comments on Designer's reply	Designer's Reply	Accepted by NYCC
8	6		Section updated to reflect current GI information	
9	9		Updated WSP signature panel.	
10	10		Added additional signature box for NYCC as requested.	
11	App A - TAS		Added "BS EN 14844:2006 (+A2:2011) Precast concrete products - Box culverts" to Section 4 Product Standards. This standard leads to the CE marking for box culverts. This is a 'harmonized' standard and fully encompasses the requirements of the Eurocodes.	
12	App C – GA DWG		Updated	
13	3.2		Changed: "The wingwalls shall comprise freestanding L-shaped cantilever wall acting independent of the box culvert. " To: "The wingwalls shall comprise freestanding cantilever type walls acting independently of the box culvert. "	

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