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Cherry Cobb Sands Wet Grassland Detailed Design

For

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Contents

DRAWINGS

DRAWING REFERENCE	DRAWING TITLE
NABL104/12591/1	Figure 1: Site Location
NABL104/12592/1	Figure 2: Existing Site Conditions & Topography
NABL104/12593/1	Figure 3: Finished Layout
NABL104/12594/1	Figure 4: Finished Topography
NABL104/12595/1	Figure 5: Embankment Cross-Sections and Detail
NABL104/12596/1	Figure 6: Open Water, Island, Scrape and Vegetated Waterway Cross-Sections
NABL104/12597/1	Figure 7: Drainage Structures
NABL104/12598/1	Figure 8: Wind Pumps
NABL104/12599/1	Figure 9: Cut and Fill Locations

1. Summary

1.1.1 As part of the compensation for the loss of functional feeding habitat associated with the construction of the Able Marine Energy Park (AMEP), it is proposed to create wet grassland. The proposed site for wet grassland creation is immediately adjacent to the Cherry Cobb Sands Regulated Tidal Exchange (RTE) site. This wet grassland site is approximately 38.5ha and known as the Cherry Cobb Sands Wet Grassland Site (CCSWGS). The CCSWGS currently comprises arable farmland on reclaimed estuary.

1.1.2 This document sets out the detailed design for the CCSWGS. The key features of the CCSWGS are shown on drawing NABL104/12593/1 and are summarised as follows:

- Creation of an area of open water 5ha in size, with an average depth of 0.7m and a maximum depth of 1.4m. The depth of the open water area is to provide water for irrigation and to limit the extent of reed growth within the open water area;
- Creation of two islands within the open water area with a total area of 0.25ha. The islands will have a maximum height of 0.55m above the water level when the open water area is at full capacity;
- Levelling of the site by infilling low spots and removing high spots where these would impede run-off, and reinforcing the north to south fall across the site;
- Creation of one wader scrape, approximately 1.3ha in size and 0.15m below the re-profiled site levels, making use of existing low spots within the site. The wader scrape will include a low island in the centre of just over 0.1ha;
- Creation of a central vegetated waterway running through the site to facilitate movement of water through the site towards the open water area, plus reducing the depth and partially infilling two of the existing ditches on the site (Ditches 2 and 3 on drawing NABL104/12597/1)
- Piling up of earth along the inside boundary of the CCSWGS, with the sole purpose of using spoil from the creation of the open water area. The size of the earth mounds will vary to fit the landscape, ranging in height from 0m to about 1m above the existing ground level, and from 12m to 30m wide. Importantly, the mounds will not be used to retain water, either during normal conditions or during flood events;
- Creating one new ditch and constructing sluices at the downstream end of this ditch and two existing ditches so that water levels within the site can be controlled;
- Blocking, or adding control structures to, three outlets of the underground field drain system to prevent loss of water during normal conditions from the site into the surrounding ditch network;
- Retaining one outlet of the underground field drain system and creating two more. These will be connected to the ditches upstream of the sluices and will to enable sub-surface irrigation of the wet grassland fields;
- Installation of two wind pumps to enable irrigation of the site during the late summer and early autumn period. These will pump water from the Keyingham Drain or the open water area, as appropriate, and discharge the water into irrigation channels running along the embankments created on either side of the CCSWGS; and
- After preparing the soil, sowing the fields with an appropriate seed mixture for wet grassland.

2. Introduction

2.1 Development Background

2.1.1 Able Humber Ports Ltd propose to build the Able Marine Energy Park (AMEP), which will be located on the south bank of the Humber Estuary, (see Figure 1).

2.1.2 As part of the compensation package for AMEP, a wet grassland will be constructed at the 'Cherry Cobb Sands Wet Grassland Site' or CCSWGS (see Figure1). The CCSWG is the subject of a separate planning permission, consented by the East Riding of Yorkshire Council., (DC/12/04154/STPLF/STRAT). The planning permission is based on an outline design, as set out in AMEP Final Compensation Proposals: Part 4: Wet Grassland and Roosting Site. This document sets out the detailed design for CCSWG.

2.1.3 This document must be read in conjunction with the Construction Environmental Management Plan.

2.2 The Brief and Objectives

2.2.1 Able UK Ltd commissioned Thomson Ecology on 13th September 2012 to produce a design for the wet grassland at Cherry Cobb Sands Wet Grassland Site. The brief for the detailed design was to provide:

- Detailed cross-sections for the perimeter embankments, showing the finished levels, structure, width, slopes, compaction rates, and aspect;
- Detailed cross-sections for the islands, showing the finished levels, structure, width, slopes, compaction rates, aspect and materials;
- A series of cross sections for the whole site, showing planned levels and details of cut and fill locations;
- Levels and gradients for the high carrier ditches, shallow vegetated waterway and earthworks required to facilitate operation of the water collection and irrigations systems;
- Specification for model of pump and finalised locations for pumps, including the extraction points (subject to EA approval);
- Design and production of detailed plans for all water control structures and pumps, with measurements, diameters, materials and excavation depths and dam heights; and
- Specification for the grassland creation, including seed mix, application rate, location and methodology.

2.3 Limitations

2.3.1 All types and volumes of cut and fill material given in this document are an estimate based on third party topographical data and an independent Site Investigation Report, which has been used in good faith. The data was procured from suitably qualified and experienced organisations.

3. Site Objectives

3.1.1 The aim is to create wet grassland at CCSWGS that is suitable feeding resource for black-tailed godwits and other wetland birds. The objectives upon which the design is based are as follows:

- Objective 1: The site should contain wide, open expanses of wet grassland habitat with unobscured views of the surrounding area.
- Objective 2: The site should contain open water with at least one island suitable for use by roosting black-tailed godwits at high tide.
- Objective 3: The soil should be moist throughout the months of August to April to concentrate invertebrates at the surface and to ensure that the soil remains soft enough to be probed by waders.
- Objective 4: The site should be largely free of winter flooding to prevent floodwaters from killing soil invertebrates.
- Objective 5: The site should have a high density of macro-invertebrate fauna to provide food for wading birds.
- Objective 6: The wet grassland should be managed to give a suitable sward for wading birds throughout the months of August to March.

3.1.2 Further information on management and monitoring has been set out in the Compensation Environmental Management and Monitoring Plan for AMEP.

4. General Layout and Topography

4.1.1 The location of the CCSWGS is shown on Drawing NABL104/12591/1.

4.1.2 The existing (pre-construction) site layout and topography is shown on Drawing NABL104/12592/1. As can be seen from the drawing, the site comprises three fields, the North Field, the Middle Field and the South Field.

4.1.3 The finished layout of the CCSWGS is shown on Drawing NABL104/12593/1.

4.1.4 The finished topography is shown on Drawing NABL104/12594/1.

5. Open Water Area

5.1.1 A single open water area, covering approximately 5 hectares, will be created by excavating down from existing ground levels.

5.1.2 The open water area will have a maximum depth of 1.4m and an average depth of 0.7m.

5.1.3 At capacity, the water level will be around 2.35m AOD, giving a maximum storage capacity of around 35,000m^3

5.1.4 The soil won from the excavation for the open water area will be re-used on the site to create islands, embankments, ditch dams etc.

5.1.5 The water storage area will be over-dug by 0.3m and lined with a bentonite clay liner in accordance with the manufacturer's instructions. The liner will be covered with 0.3m of soil and lightly rolled to achieve the finished depth and profile.

5.1.6 See Drawings NABL104/12593/1 (layout), NABL104/12596/1 (cross-sections) and NABL104/12596/1 (cut and fill locations).

6. Island Creation

6.1.1 Two islands to be created with surface area of 0.15ha and 0.10ha, when the open water storage area is at capacity.

6.1.2 Islands to be created by retaining existing soil and then capping with soil excavated during construction of the open water area. This should have high clay content and need not be topsoil. The soil capping must be compacted sufficiently to remove voids and form a coherent mass.

6.1.3 The sides of the island are to have a gentle slope from the edge of the islands to the full depth of the open water area. The sides of the islands are to be lined with the bentonite clay liner, as set out in 5.1.5 above.

6.1.4 On both islands, the finished soil profile is to be capped with impermeable lining designed to stop vegetation growth e.g. butyl rubber.

6.1.5 On both islands, the impermeable lining is to be capped with 10-50mm sized shingle/cobbles at minimum 100mm thickness.

6.1.6 On both islands, the shingle/cobbles to be retained in position using 120mm wide recycled plastic wood planks, staked at 2m intervals with recycled plastic stakes, or a similar approved method. The stakes can be allowed to penetrate the impermeable lining.

6.1.7 See Drawings NABL104/12593/1 (layout) and NABL104/12596/1 (cross-sections).

7. Vegetated Waterway

7.1 General Construction

7.1.1 A shallow, vegetated waterway will be created through the centre of the CCSWG, with a length of approximately 700m.

7.1.2 At the northern end, the vegetated waterway will be 5m wide and its width will increase gradually, reaching 10m at the southern end, where it will meet the open water area.

7.1.3 The vegetated waterway will be parabolic in shape with the depth below ground level at the centre being no more than 0.3m.

7.1.4 The base of the vegetated waterway will exhibit a shallow but steady fall from north to south along its entire length. The lowest central point at the northern end will be approximately 2.2m AOD and lowest central point at the southern end will be approximately 2.1m AOD, with an approximate gradient of 1:7000.

7.1.5 The land either side of the vegetated waterway will be levelled towards the vegetated waterway to improve overland flow, see 8.1.1 and 8.1.2 below.

7.1.6 See Drawings NABL104/12593/1 (layout) and NABL104/12596/1 (cross-section).

7.2 Ditch 2 Crossing

7.2.1 A length of 150mm diameter plastic pipe will be installed at the base of the ditch at the point where Ditch 2 bisects the vegetated waterway. The ditch will then be infilled to enable the vegetated waterway to pass over Ditch 2. The fill material will be compacted clay, constructed in the manner of the ditch dams described in paragraphs 13.1.1 to 13.1.3. The length of the ditch infilled at the top will be equivalent to the width of the vegetated waterway plus a minimum of 3m on either side. The pipe should protrude 0.3m from the faces of the infill material.

7.2.2 See Drawings NABL104/12593/1 (layout) and NABL104/12596/1 (cross-section).

7.3 Ditch 3 Crossing

7.3.1 The Ditch 3 crossing will be constructed as set out for Ditch 2 above.

7.3.2 See Drawings NABL104/12593/1 (layout) and NABL104/12596/1 (cross-section).

8. Levelling

8.1.1 Some high spots will be removed, with the material used for levelling elsewhere.

8.1.2 Some low spots will be in-filled, using material won from high spots and the open water area.

8.1.3 See Drawing NABL104/12592/1 for existing levels and Drawing NABL104/12594/1 for finished levels. Cut and fill locations are shown on NABL104/12599/1.

9. Scrape

9.1.1 One scrape of 1.3ha in size will be constructed through very minor excavations of no more than 0.15m below ground level, following levelling.

9.1.2 In the centre of the scrape will be a small island which will be just over 0.1ha in size and the same height as the surrounding the wet grassland.

9.1.3 See Drawing NABL104/12599/1.

10. Embankments

10.1 General Construction

10.1.1 The embankments are non-structural and serve only to accommodate soil extracted from the open water area. The lower layers should comprise subsoil, capped with minimum 0.2m of topsoil. The embankments should be compacted during construction to remove voids and form a coherent mass.

10.2 The Northern Embankment

10.2.1 The Northern Embankment will be created along the southern edge of Ditch 1. The Northern Embankment will be up to 12m wide and its height will be approximately 2.9m AOD, or about 0.2m to 0.3m above the existing bank top height of Ditch 1.

10.2.2 A gap will be created in this embankment, with width 60m. The base of the gap will be at the existing ground level.

10.2.3 See Drawings NABL104/12593/1 (layout) and NABL104/12595/1 (cross-section).

10.3 The Western Embankment

10.3.1 The Western Embankment will run alongside Cherry Cobb Sands Road. The Western Embankment will be up to 12m wide and its height will be approximately 3.3m AOD, or about 0.3m above the height of Cherry Cobb Sands Road.

10.3.2 Four gaps will be created in this embankment, with width 20m. The base of these gaps will be at the existing ground level. The slope of the embankment adjoining bank will have a 1:2 slope.

10.3.3 See Drawings NABL104/12593/1 (layout) and NABL104/12595/1 (cross-section).

10.4 The Southern Embankment

10.4.1 The Southern Embankment will be a continuation of the Western Embankment, with similar dimensions.

10.4.2 See Drawings NABL104/12593/1 (layout) and NABL104/12595/1 (cross-section).

10.5 The Eastern Embankment

10.5.1 The Eastern Embankment will be located on an existing elevated area within the CCSWGS, running along the west side of the Keyingham Drain.

10.5.2 The Eastern Embankment will effectively extend the existing embankment along the Keyingham Drain into the CCSWGS without increasing the height of the embankment. The Eastern

Embankment will be 25 - 30m wide with a height of up to 4.0m AOD, but no higher than the existing embankment.

11. Ditch System

11.1 General Arrangement

11.1.1 The ditch system is shown on Drawing NABL104/12593/1.

11.2 Ditch 1

11.2.1 Ditch 1 is an existing ditch to be protected in accordance with CEMP.

11.2.2 No re-profiling or infilling.

11.2.3 No water control structures (except as set out in 12.1).

11.3 Ditch 2

11.3.1 Ditch 2 is an existing ditch to be protected in accordance with CEMP.

11.3.2 It will be infilled to approximately 50% of current depth, giving a bed level of 1.75m AOD, between eastern end and 2m east of North Field Outlet 2.

11.3.3 Pipe sluice to be installed as set out in 13.2.

11.3.4 Ditch 2 will also be infilled fully along a short section to enable vegetated waterway to be installed as set out in 7.2.

11.3.5 Culvert under Western Embankment to be installed as set out in 14.1.

11.3.6 See Drawing NABL104/12597/1.

11.4 Ditch 3

11.4.1 Ditch 3 is an existing ditch to be protected in accordance with CEMP.

11.4.2 It will be infilled to approximately 50% of current depth, giving a bed level of 1.7m AOD between eastern end and Ditch 3 Sluice.

11.4.3 Pipe sluice to be installed as set out in 13.3.

11.4.4 Ditch 3 will also be infilled fully along a short section to enable vegetated waterway to be installed as set out in 7.3.

11.4.5 A culvert under Western Embankment is to be installed as set out in 14.1.

11.4.6 See Drawing NABL104/12597/1.

11.5 Ditch 4

11.5.1 Ditch 4 is a new ditch to be constructed.

11.5.2 Pipe sluice to be installed as set out in 13.4.

11.5.3 Culvert under Western Embankment to be installed as set out in 14.2.

11.5.4 See Drawing NABL104/12597/1.

11.6 Ditch 5

11.6.1 To be protected in accordance with CEMP.

11.6.2 No re-profiling or infilling.

11.6.3 See Drawing NABL104/12593/1.

12. Field Drain Outlets/Inlets

12.1 General Arrangement

12.1.1 The field drain outlets and Inlets system is shown in drawings NABL104/12593/1 and NABL104/12597/1.

12.2 North Field Outlet 1

12.2.1 The outlet which discharges from the North Field into Ditch 1 will be fitted with a water control mechanism to control sub-surface drainage from the North Field into Ditch 1.

12.2.2 The water control mechanism will comprise a penstock set into a pre-cast concrete headwall with 800mm backfall height. The diameter of headwall outlet will be 150mm. The headwall is to be excavated into the bank of Ditch 1.

12.2.3 See Drawing NABL104/12597/1.

12.3 North Field Outlet 2

12.3.1 The existing outlet which discharges from the North Field into Ditch 2 will be blocked. This will be achieved by removing any existing headwall and removing a 0.5m length of existing pipe and surrounding soil. The resultant excavation will be back-filled with clay soil to create a plug.

12.3.2 A new outlet for the field drain system under the North Field will be created further upstream within Ditch 2. This will enable the outlet to be positioned upstream from the sluice to be constructed within Ditch 2.

12.3.3 The new outlet will be set into a headwall with 800mm backfall height. The diameter of headwall outlet will be 150mm. The headwall is to be excavated into bank of Ditch 2, with soil built up to provide flowing contours around the headwall.

12.3.4 The new outlet will be connected to the existing sub-surface drains by means of new lengths of 0.15m and 0.075m diameter plastic pipe, as required, and two three-way socket connectors or one four-way connector and one reducer. This will require excavation of the soil along the new pipe route to expose the existing field drains, removal of up to 0.5m of existing pipe in each direction and replacement with new.

12.3.5 See Drawing NABL104/12597/1.

12.4 Middle Field Outlet

12.4.1 To be retained and protected.

12.4.2 See Drawing NABL104/12593/1

12.5 South Field Outlet1

12.5.1 The existing single outlet for this field will be located and blocked so as to prevent drainage of the open water area. This will be achieved by excavating downwards to locate the pipe and removing a 0.5m length of existing pipe and surrounding soil. The resultant excavation will be back-filled with clay soil to create a plug.

12.5.2 The location for the excavation is shown on Drawing NABL104/12593/1.

12.6 South Field Outlet 2

12.6.1 A new outlet will be constructed where the existing underground field drains meets with Ditch 4 (to be constructed). The new outlet will be set into a headwall with 800mm backfall height. The diameter of headwall outlet will be 150mm. The headwall is to be excavated into bank of Ditch 4.

12.6.2 The outlet will be connected to the existing underground field drainage system by means of a 0.5m length of 0.15m diameter plastic pipe. It is only necessary to connect with the north-south pipe; the east west pipe in the same location can be disregarded.

12.6.3 See Drawing NABL104/12597/1.

13. Sluices

13.1 General Construction

13.1.1 Top soil and vegetation will be stripped from the ditch banks at the position of the dam. The exposed subsoil will be scarified.

13.1.2 A compacted clay dam will be installed across the full width of the ditch, joining the scarified subsoil. The clay must be built up in 0.15m thick layers, with each layer compacted before the next is applied. The final layer will be topsoil. The top of the dam will be 2m in length and flush with the surrounding ground level (except for Ditch 4 Sluice, see below). The upstream (eastern) and downstream (western) faces of the dam will have a 2 in 1 slope.

13.1.3 During construction of the dam, a plastic pipe (black or brown in colour) will be laid through the centre of the dam, parallel with the ditch banks. The pipe is to exit the dam at approximately 0.3m above ditch bed level at both ends, which may result in the pipe being level or falling towards the downstream end.

13.1.4 The upstream end of the pipe will protrude from the dam face and will have a ninety degree bend, created by bending a flexible pipe. The upstream mouth of the pipe, when set in the vertical position, is to extend to 0.2m above the level of the surrounding field. The upstream mouth of the pipe will be secured into position using a rope and stake, driven into the ground.

13.1.5 The downstream end of the pipe will protrude approximately 0.3m from the dam face.

13.2 Ditch 2 Sluice

13.2.1 The Ditch 2 Sluice will be constructed as set out in 13.1 to 13.5, and have a pipe diameter of 0.15m. The upstream mouth of the pipe set at 2.4m AOD when in the upright position. The downstream end of the pipe will be fixed at 0.3m above existing bed level.

13.2.2 See Drawing NABL104/12597/1.

13.3 Ditch 3 Sluice

13.3.1 The Ditch 3 Sluice will be constructed as set out in 13.1 to 13.5, and have a pipe diameter of 0.15m. The upstream mouth of the pipe set at 2.4m AOD when in the upright position. The downstream end of the pipe will be fixed at 0.3m above existing bed level.

13.3.2 See Drawing NABL104/12597/1.

13.4 Ditch 4 Sluice

13.4.1 The Ditch 4 Sluice will be constructed as set out in 13.1 to 13.5, and have a pipe diameter of 0.25m. The upstream mouth of the pipe set at 2.4m AOD when in the upright position. The downstream end of the pipe will be fixed at 0.3m above existing bed level. A spillway will be created by levelling off the top of this ditch dam at 2.4m AOD.

13.4.2 See Drawing NABL104/12597/1.

14. Culverts

14.1 General Arrangement

14.1.1 The culvert system is shown in drawings NABL104/12597/1.

14.2 Western Embankment Culverts 2 and 3

14.2.1 Lengths of 450mm diameter pipe will be laid in the bed of each ditch to preserve water flow through Ditches 2 and 3 following construction of the Western Embankment.

14.3 Western Embankment Culvert 4

14.3.1 A length of 600m diameter pipe will be laid in the bed of Ditch 4 to preserve water flow following construction of the Western Embankment. This culvert will link directly to Cherry Cobb Sands Road Culvert 4, forming one structure.

14.4 Cherry Cobb Sands Road Culverts 1 -3

14.4.1 To be protected and retained.

14.5 Cherry Cobb Sands Road Culvert 4

14.5.1 A new culvert will be installed under Cherry Cobb Sands Road connecting Ditch 4 to Cherry Cobb Sands Drain. The culvert pipe diameter is 600mm and will be located at a minimum of 0.5m under the Cherry Cobb Sands Road and positioned such that the outfall is 0.3m above the bed level of the Cherry Cobb Sands Drain. The outfall will be located in 1.1m headwall installed in the bank of the Cherry Cobb Sands Drain.

14.5.2 Prior to undertaking excavations it must be confirmed that any services running beneath the Cherry Cobb Sands Road will not be affected by the installation of culvert.

14.5.3 See Drawing NABL104/12597/1.

15. Wind Pumps

15.1.1 The two wind powered pumps will be installed each being 5m in diameter, standing 11.5m tall and having an output of 5m Head.

15.1.2 The installation of the pumps will require the construction of two underground chambers (one for each pump) and the installation of extraction pipes linking the chamber to the Keyingham Drain and the Open Water Area.

15.1.3 A system of valves will be attached to the inlet and outlet pipes to allow two sources of inlet (Open Water Area and Keyingham Drain) and two outlets (Open Water Area and irrigation system).

15.1.4 See Drawing NABL104/12598/1.

16. High Carrier Ditches

16.1 Western Embankment High Carrier Ditch

16.1.1 A high carrier ditch is to be constructed in the Western Embankment. This will carry irrigation water pumped from the open water area. The bed level of the Western Embankment high carrier ditch at the southern end will be 2.8m AOD and the bed level at the northern end will be 2.6m AOD, giving an approximate fall of 1:3500.

16.1.2 The inside lip of the high carrier ditch must be dead level along its entire length, at 2.95m AOD. The outside lip of the high carrier ditch must be higher than the inside lip, around 3.1mAOD.

16.1.3 The high carrier ditch will be lined with butyl rubber along its entire length. The northern end will be blocked with clay, slightly proud of the inside lip.

16.1.4 The high carrier ditch must cross the 4 gaps in the embankment. This will be achieved using a 0.15m diameter pipe aqueducts, with the top of the pipe set below the level of the inside lip of the high carrier ditch. The base of the pipe should be supported on compacted clay pads, or pipe supports, at 3m intervals to level and support the pipe.

16.1.5 See Drawing NABL104/12595/1.

16.2 Eastern Embankment High Carrier Ditch

16.2.1 A high carrier ditch is also to be constructed in the Western Embankment. This will also carry irrigation water pumped from the open water area, be lined with butyl rubber along its entire length and have northern end will be blocked with clay, slightly proud of the inside lip.

16.2.2 The bed level of the Eastern Embankment high carrier ditch at the southern end will be 2.8m AOD and the bed level at the northern end will be 2.6m AOD, giving an approximate fall of 1:3500.

16.2.3 The inside lip of the high carrier ditch must be dead level along its entire length, at 2.95m AOD. The outside lip of the high carrier ditch must be higher than the inside lip, around 3.1mAOD

16.2.4 See Drawing NABL104/12595/1.

17. Soil Cut-fill Balance

17.1.1 The volume of soil removed for the construction of the open water area will be approximately 35,000m^3 and a further 2,000m^3 will be derived from construction of the scrape. Much or all of this will be accommodated as set out below.

Location	Approximate Fill Volume (m^3)
North Island	680
South Island	300
Eastern Embankment	13600
Western Embankment	6700
Northern Embankment	250
Southern Embankment	1200
Top of North Field	8050
Wetland Embankment	3900
Ditches	750

17.1.2 The remainder can be used for site levelling or additional material deposited at the top of the north field. A cut-fill balance will therefore be achievable for the site.

17.1.3 See Figure NABL104/12599/1.

18. Soil Preparation

18.1.1 Once the earthworks are complete, the grassland areas of the Middle Field and South Field, and any areas of the North Field disturbed by the works, will be top dressed with organic matter at a minimum rate of 15 tonnes per hectare. This could be untreated silage or crop waste or similar. Wherever possible, the North field will be left undisturbed to allow the continued development of the present grassland, seeded October 2012.

18.1.2 The remaining areas will then be ploughed, ensuring that the biomass is sufficiently incorporated into the soil and then subject to light harrowing prior to seeding.

19. Sowing Seed Mixture

19.1.1 Once the site has been prepared, it will be sown with suitable seed mixtures, see paragraph below, which contain wild flowers and grasses suitable for clay soils. The sowing rate will be around $4g/m^2$ or in accordance with the supplier's recommendation.

19.1.2 For the wet grassland, an appropriate seed mix is EM8 – Meadow mixture for wetlands from Emorsgate Seeds, supplemented with creeping bent (*Agrostis stolonifera*) and marsh foxtail (*Alopecurus geniculatus*), if available. The plant species list for EM8 is given in Appendix 1. Suitable alternatives for wet grassland are also available.

19.1.3 The area will be lightly rolled after sowing to improve seed contact and germination.

20. Animal Husbandry

20.1.1 Four-strand barb wire stock fencing will be installed around the site perimeter, inside the embankments. Strainer posts are to be installed at every 50m or as appropriate, with

intermediate posts installed every 3m. Barbed wire is to be galvanized and secured using nails. All timber is to be FSC certified and with a minimum 15 year life. Additional fencing is required to protect pipework and other irrigation infrastructure.

20.1.2 Stock fencing of the same specification will be used to enclose the gaps in the Western Embankment and protect the pipe aqueducts. One stile will be installed to allow maintenance.

20.1.3 One metal 6ft field gate on hanging posts are to be installed at the specified location.

20.1.4 See Drawing Figure NABL104/12595/1.

21. Health and Safety Measures

21.1.1 Four boards are to be attached to the boundary stock fencing to warn the public that the open water area contains deep water.

21.1.2 Life buoys are to be installed around the perimeter of the open water area at a spacing of every one hundred meters.

22. Temporary Infrastructure

22.1.1 A contractor's compound can be established in the middle field adjacent to Cherry Cobbs Road. The gaps in the western embankment can be used for entry and exit to the site.

Appendix 1: Seed Mix

Latin name	Common name
Agrostis capillaris	Common Bent
Alopecurus pratensis	Meadow Foxtail
Anthoxanthum odoratum	Sweet Vernal-grass
Cynosurus cristatus	Crested Dogstail
Deschampsia cespitosa	Tufted Hair-grass
Festuca rubra	Slender-creeping Red-fescue
Achillea millefolium	Yarrow
Stachys officinalis	Betony
Centaurea nigra	Common Knapweed
Filipendula ulmaria	Meadowsweet
Galium verum	Lady's Bedstraw
Leucanthemum vulgare	Oxeye Daisy
Lotus pedunculatus	Greater Birdsfoot Trefoil
Plantago lanceolata	Ribwort Plantain
Primula veris	Cowslip
Prunella vulgaris	Selfheal
Ranunculus acris	Meadow Buttercup
Rhinanthus minor	Yellow Rattle
Rumex acetosa	Common Sorrel
Silaum silaus	Pepper Saxifrage
Lychnis flos-cuculi	Ragged Robin
Succisa pratensis	Devil's-bit Scabious
Vicia cracca	Tufted Vet

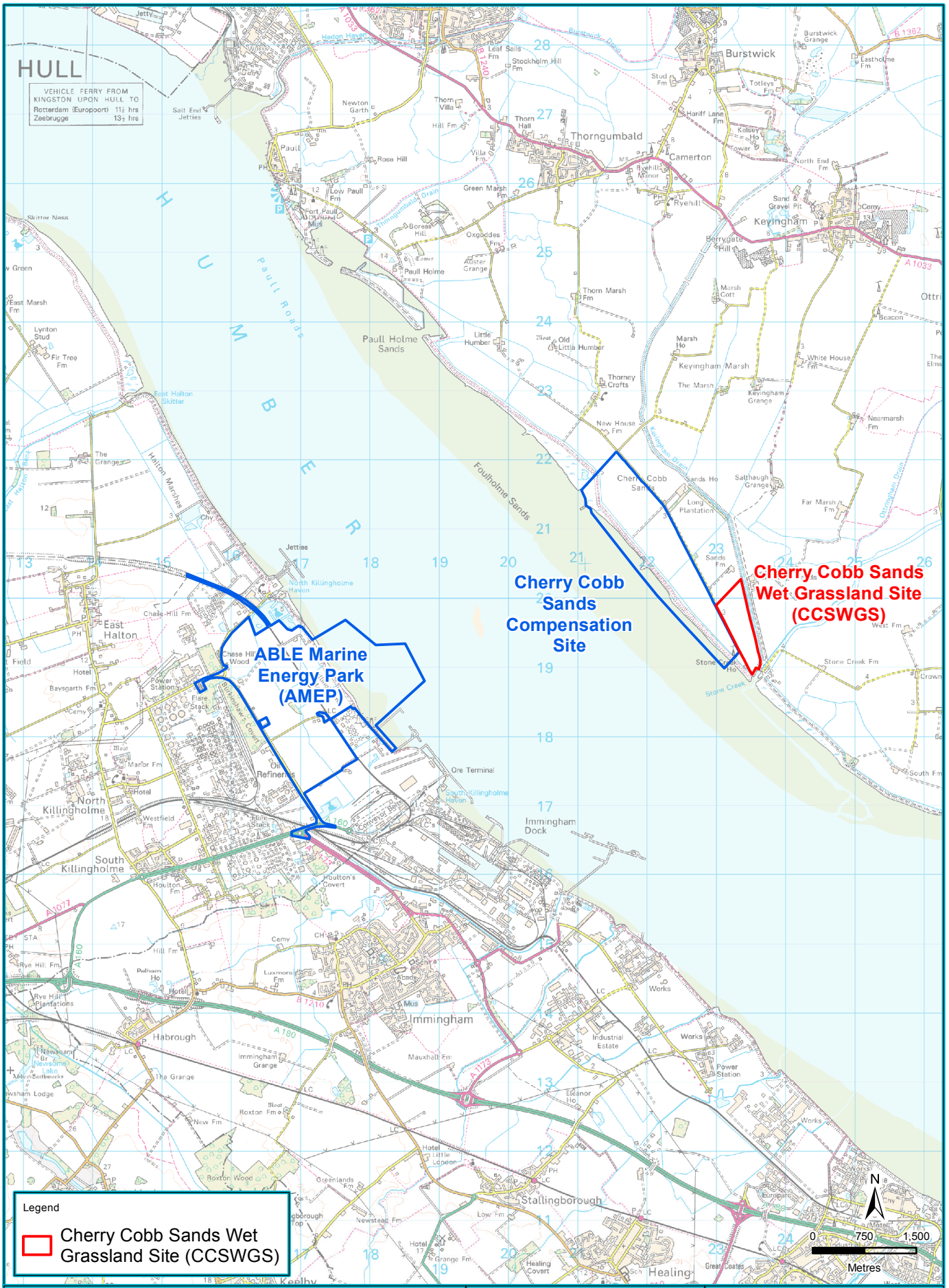

Figure Number: 1	Drawing Ref: NABL104/12591/1	
	Scale at A4: 1:75,000	
Figure Title: Site Location	Drawn: TD	Checked: KM
	Date: 17/07/2013	Date: 17/07/2013

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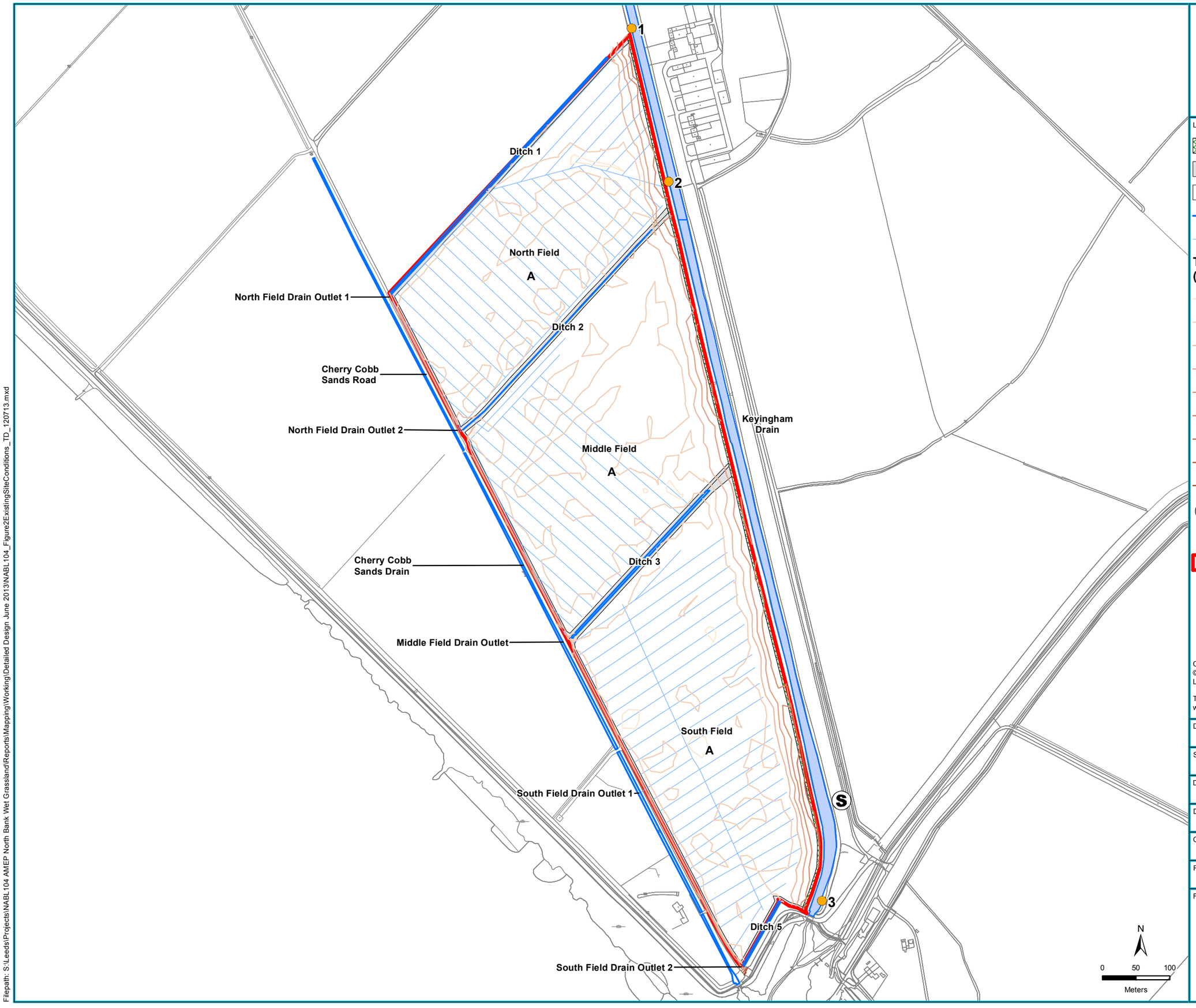

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Legend

- Dense Scrub
- Coarse Grassland (*rank*)
- Arable (*A*)
- Surface Water Drain
- Field Drain

Topographic Survey Contour (mAoD)

- 2.25
- 2.50
- 2.75
- 3.00
- 3.25
- 3.50
- 3.75
- 4.00
- 4.25

- Services Marker
- Salinity Reading Location
- Site Boundary

Drawing Ref	NABL104/12592/1
Scale at A3	1:5,250
Drawn: TD	Checked: RA
Date: 17/07/2013	Date: 17/07/2013
Client	Able UK
Figure Number	2
Figure Title	Existing Site Conditions

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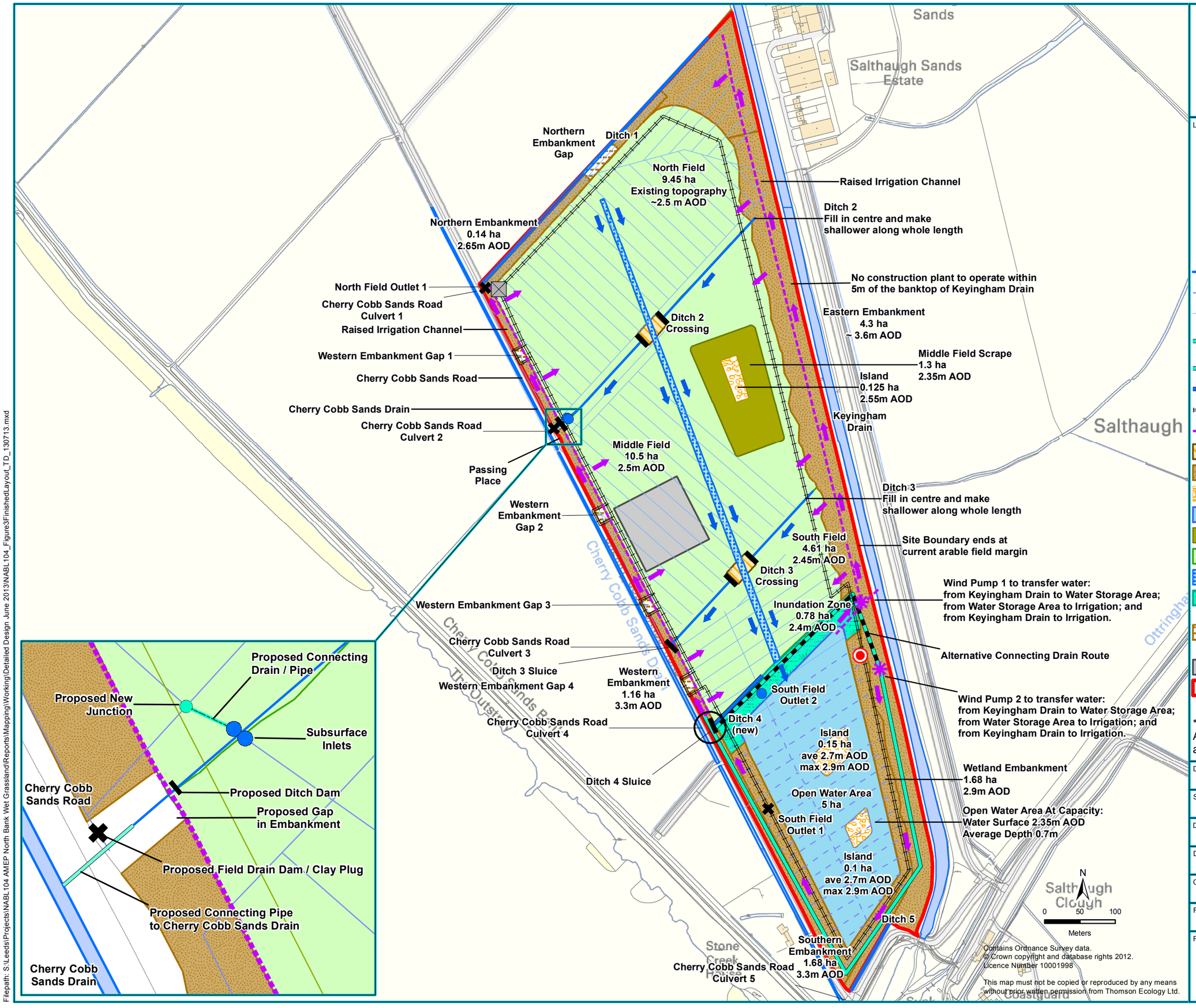

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Legend

- Wind Pump Locations
- Proposed Ditch Dam
- Proposed Field Drain Dam
- Proposed Subsurface Inlet
- Location of Safety Sign
- Access Gate
- Surface Water Drain
- Field Drain to be Removed
- Field Drain to be Retained
- Proposed Connecting Drain / Pipe
- Alternative Connecting Drain
- Proposed Ditch
- Stock Fencing
- Proposed Irrigation Channels
- Proposed Ditch Filling In
- Proposed Embankment*
- Proposed Island
- Proposed Open Water Area
- Proposed Scrape
- Proposed Wet Grassland
- Shallow Vegetated Waterway
- Proposed Inundation Zone
- Proposed Gap in Perimeter Embankment Allowing Water Flow To / From The Site
- Construction Compound
- Site Boundary

* Soil deposit only, not for water retention
All heights and measurements are approximate

Drawing Ref	NABL104/12593/1
Scale at A3	1:5,000
Drawn: TD	Checked: RA
Date: 17/07/2013	Date: 17/07/2013
Client	Able UK
Figure Number	3
Figure Title	Finished Layout

Filepath: S:\Leeds\Projects\NABL104 AMEP North Bank Wet Grassland\Reports\Mapping\Working\Detailed Design June 2013\NABL104_Figure3FinishedLayout_TD_130713.mxd

Filepath: S:\Leeds\Projects\NABL104 AMEP North Bank Wet Grassland\Reports\Mapping\Working\Detailed Design June 2013\NABL104_Figure4FinishedTopography_TD_120713.mxd

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Legend

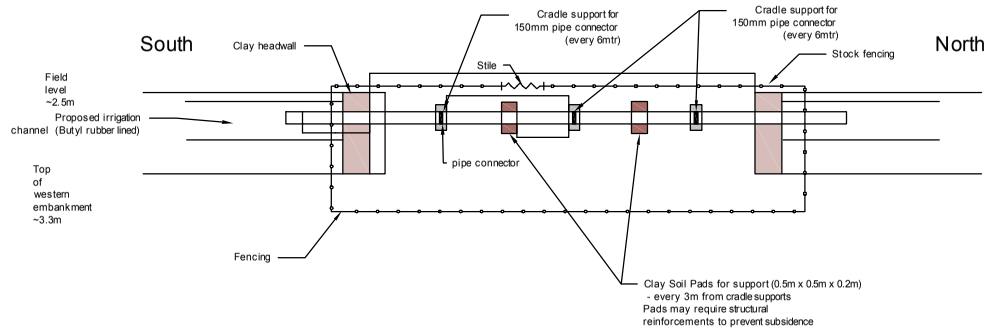
Site Boundary

Finished Topography (m AOD)

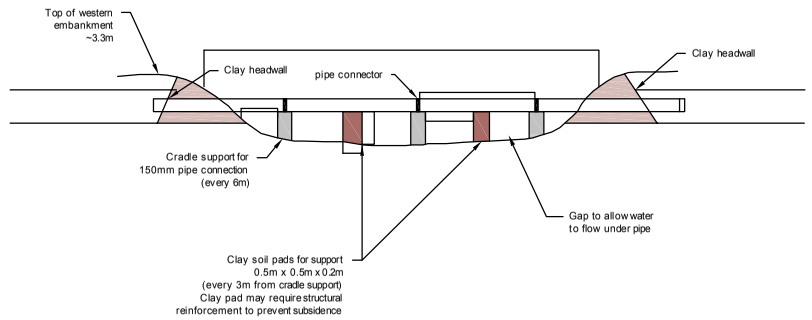
3.6m AOD

1.0 m AOD

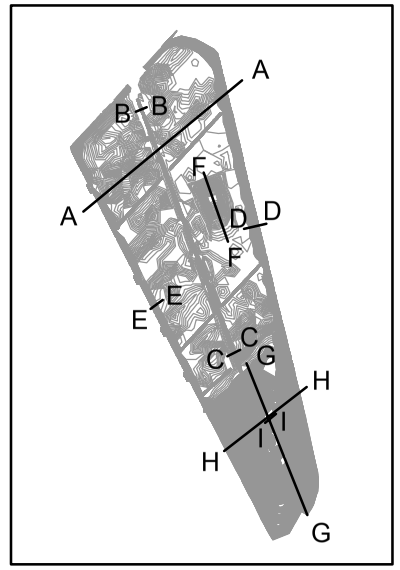
Drawing Ref	NABL104/12594/1
Scale at A3	1:5,000
Drawn: TD	Checked: NS
Date: 12/07/2013	Date: 12/07/2013
Client	Able UK
Figure Number	4
Figure Title	Finished Topography



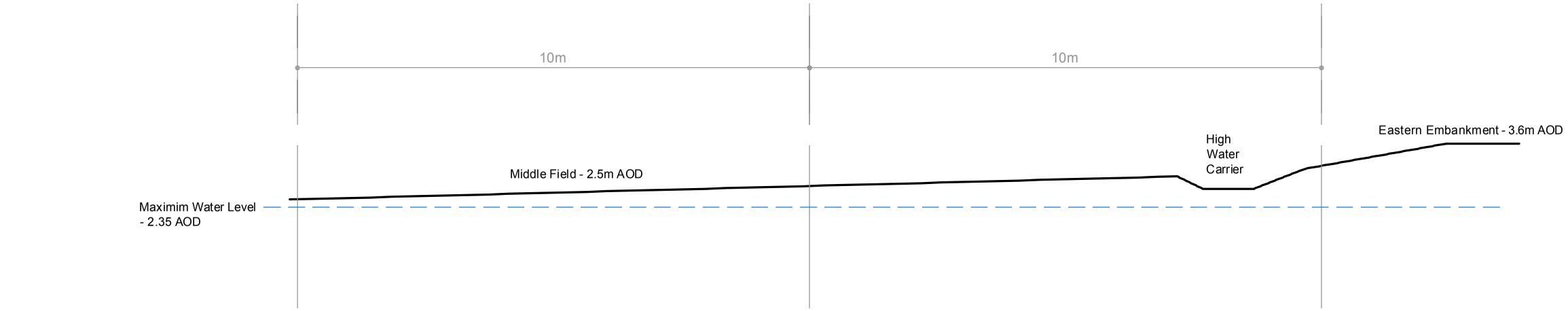
Plan View (1:50)



Section (1:50)



Site Plan



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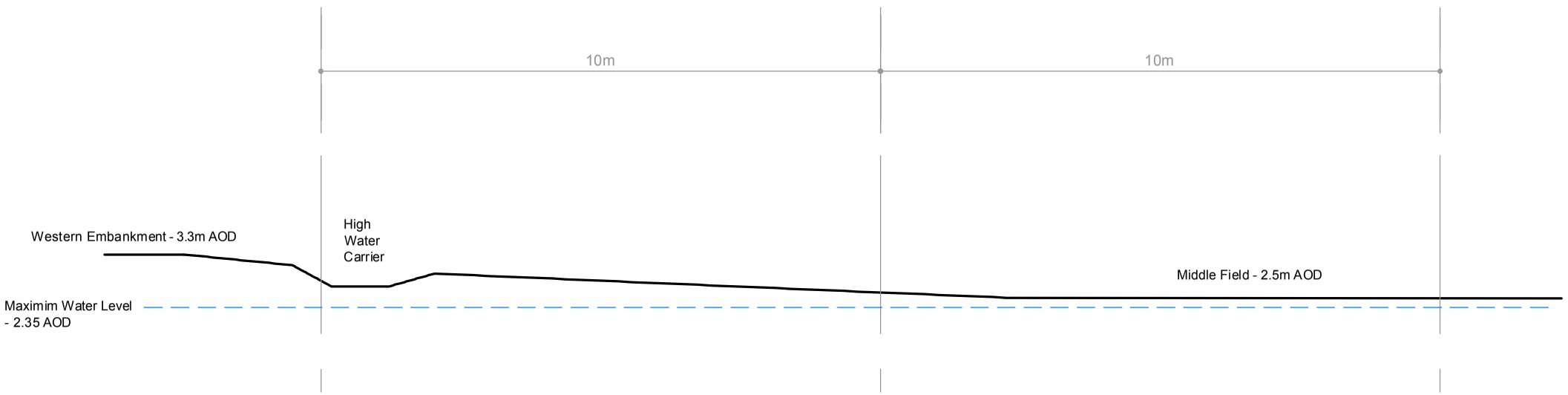

Section E-E (1:50)

NOTES:

KEY:

Revision	Date

Client:

Thomson Ecology
Compass House
Surrey Research Park
Guildford
GU2 7AG

Project:

Cherry Cobbs Sands
Wet Grassland Design

Title:

Embankment Cross-Sections and Detail

Date: 18/07/2013 Scale: Not to Scale @ A1

Drwg Nº: NABL104 / 12595 / 1

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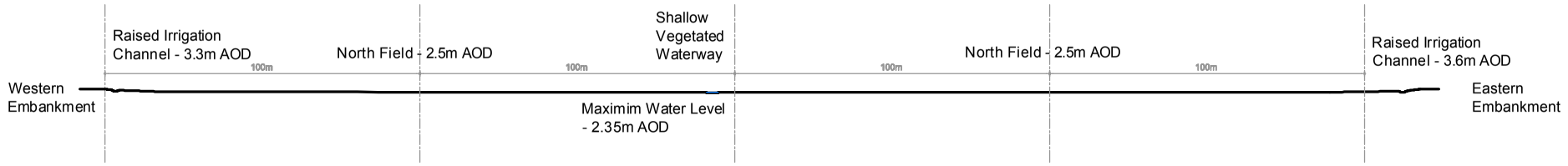

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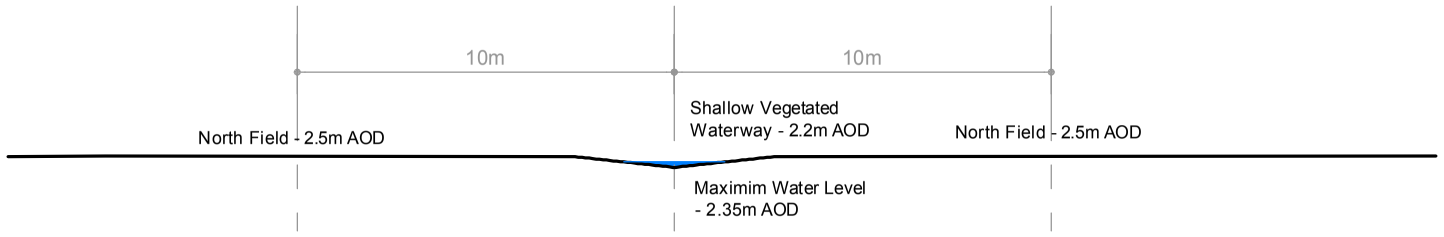

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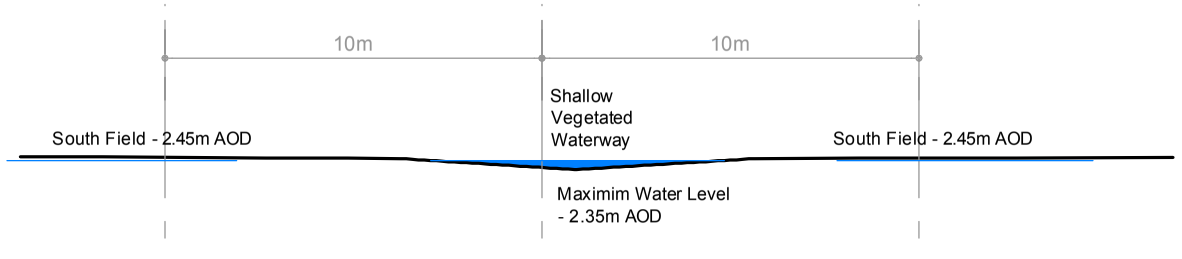

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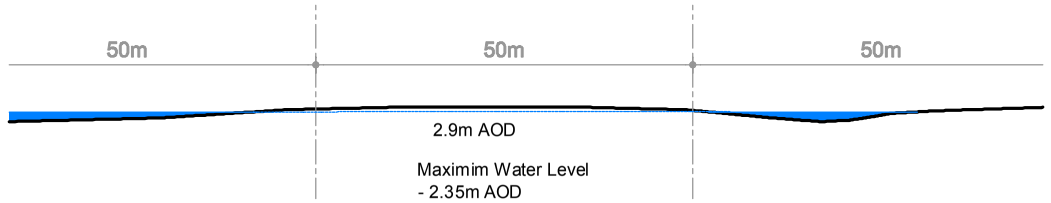
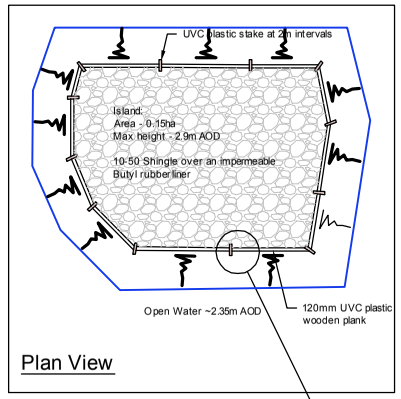
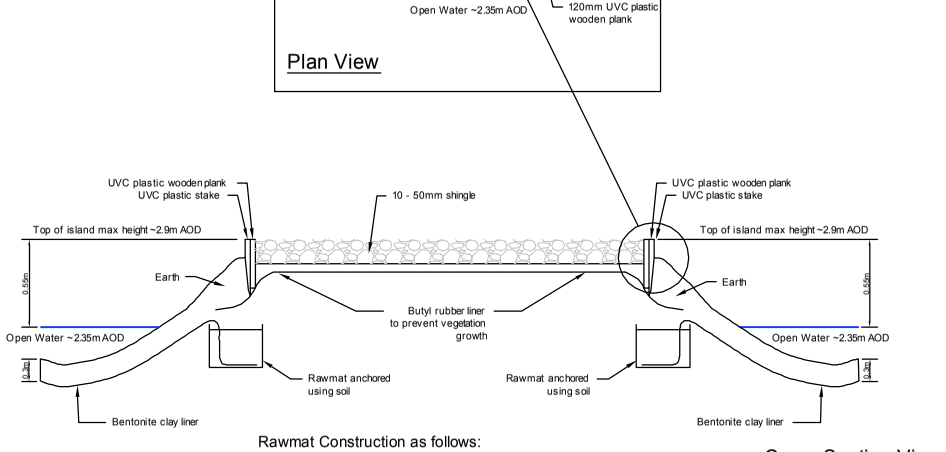


Section I-I (1:500)

Open Water Island Detail

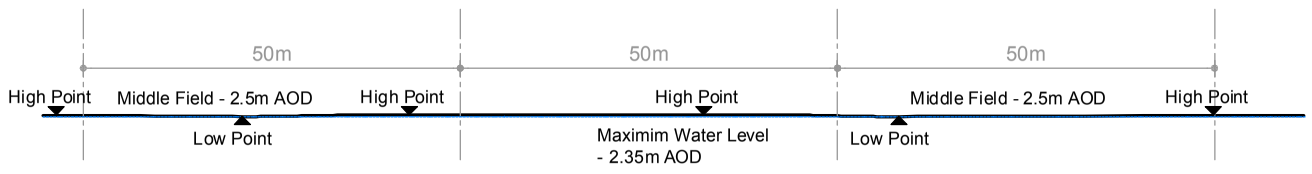


Plan View



Cross Section View

Rawmat Construction as follows:
1. Following island formation, excavate trench around island.
2. Lay Bentonite clay liner.
3. Back fill with clay soil and compress to anchor liner.
4. Lay Butyl rubber liner over the top.
5. Complete the shingle and cobbles cap.



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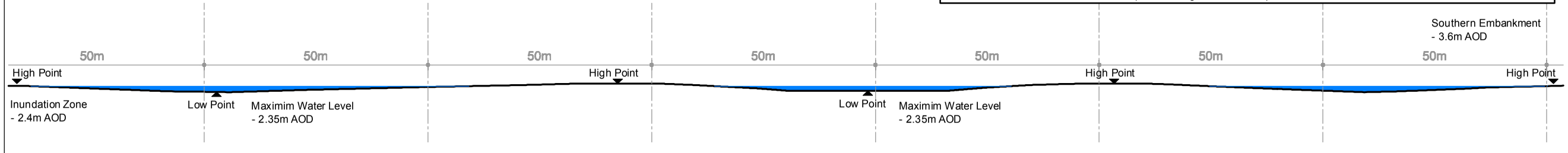

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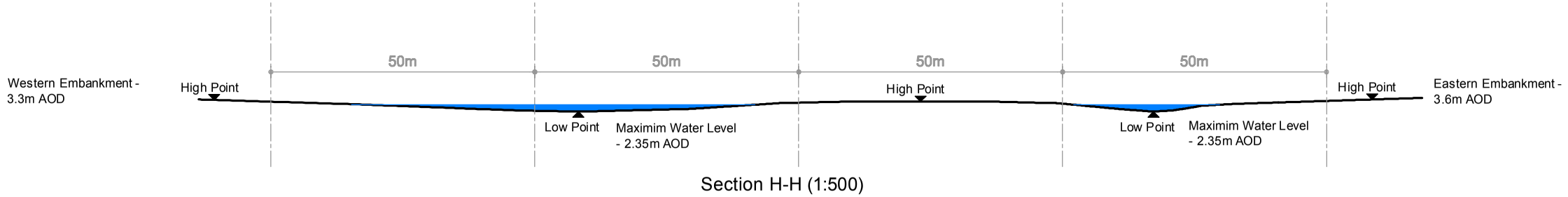
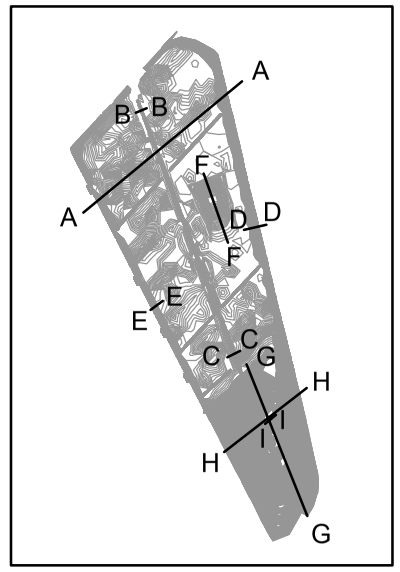


Section H-H (1:500)

NOTES:

KEY:



Site Plan

thomson ecology

Date

Thomson Ecology
Compass House
Surrey Research Park
Guildford
GU2 7AG

Project:
Cherry Cobbs Sands
Wet Grasslands Design

Title:
Open Water, Island, Scrape and Vegetated Waterway Cross-Sections

Date: 18/07/2013 Scale: Not to Scale @ A1

Drwg Nº: NABL104 / 12596 / 1

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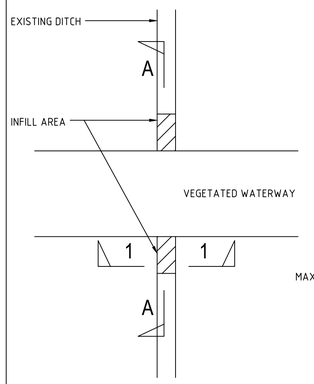

PLAN
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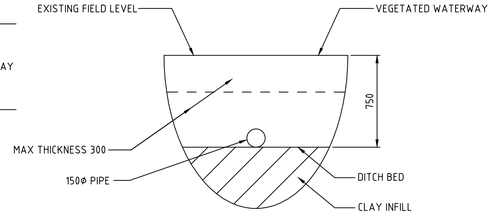
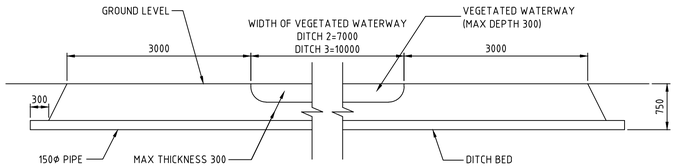
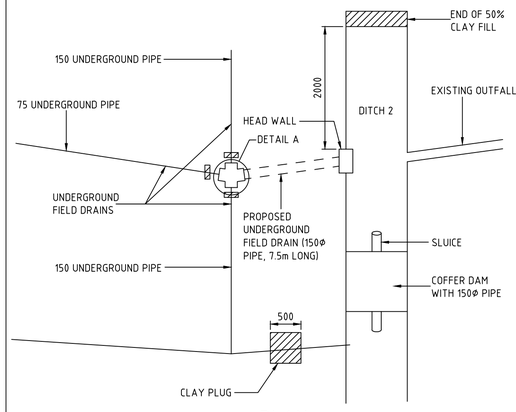


SECTION 1-1
SCALE 1:25



ELEVATION A-A
SCALE 1:50

PROPOSED DITCH FILLING (DITCHES 2 & 3)



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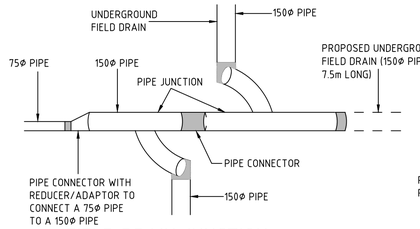
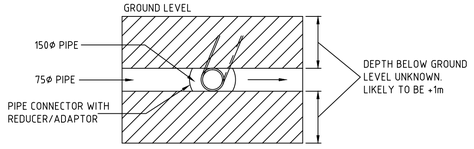
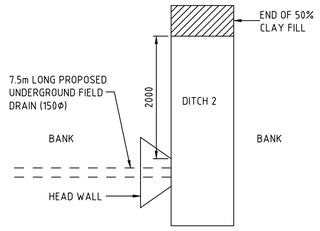


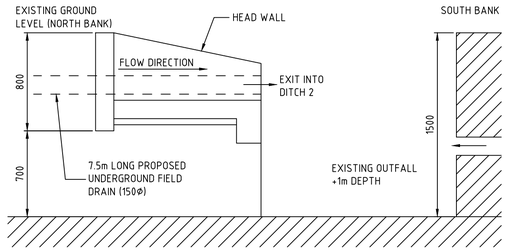
FIELD DRAIN JUNCTION
SCALE 1:25



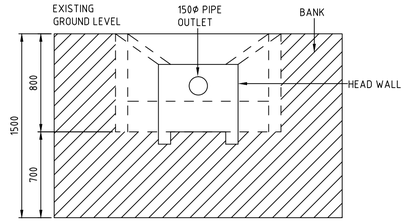
FIELD DRAIN JUNCTION
CROSS SECTION
SCALE 1:10



HEADWALL PLAN
SCALE 1:50

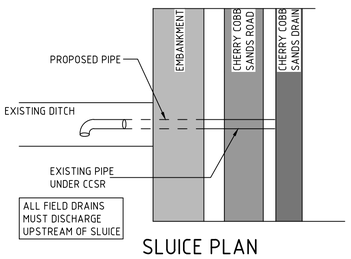


HEADWALL CROSS SECTION
SCALE 1:25

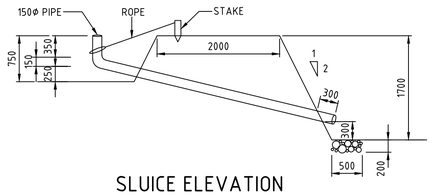


HEADWALL ELEVATION
SCALE 1:25

FIELD DRAIN 2



SLUICE PLAN
SCALE 1:50



SLUICE ELEVATION
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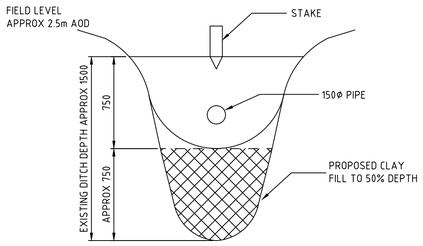
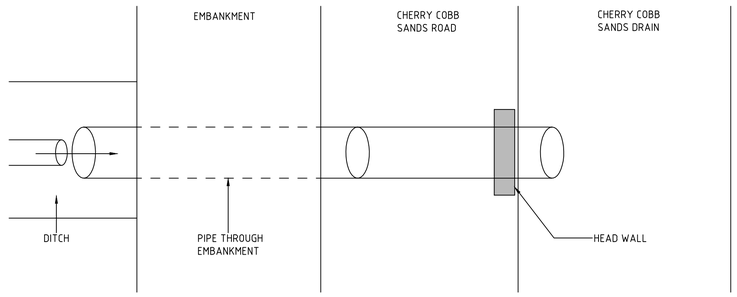


SLUICE CROSS SECTION
SCALE 1:25

SLUICE DITCH 3



PLAN
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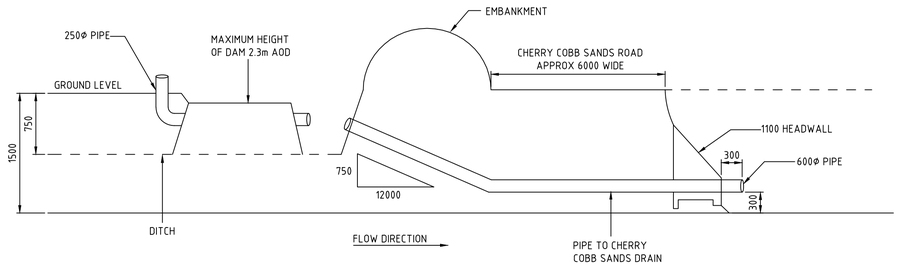


CROSS SECTION
NOT TO SCALE

DRAINAGE UNDER CHERRY COBB SANDS ROAD - DITCH 4

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES, ALL LEVELS, CHAINAGES AND CO-ORDINATES ARE IN METRES UNLESS OTHERWISE STATED.

Revision	Details	By / Chk	Date	Suffix

Drawing Number: NABL104/12597/1
Revision:

CHERRY COBB SANDS
WET GRASSLAND DESIGN

Drawing Title
FIGURE 7
DRAINAGE STRUCTURES

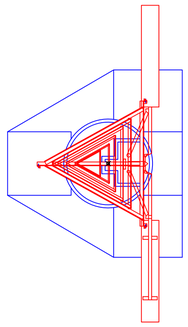
Scale at A1
AS SHOWN

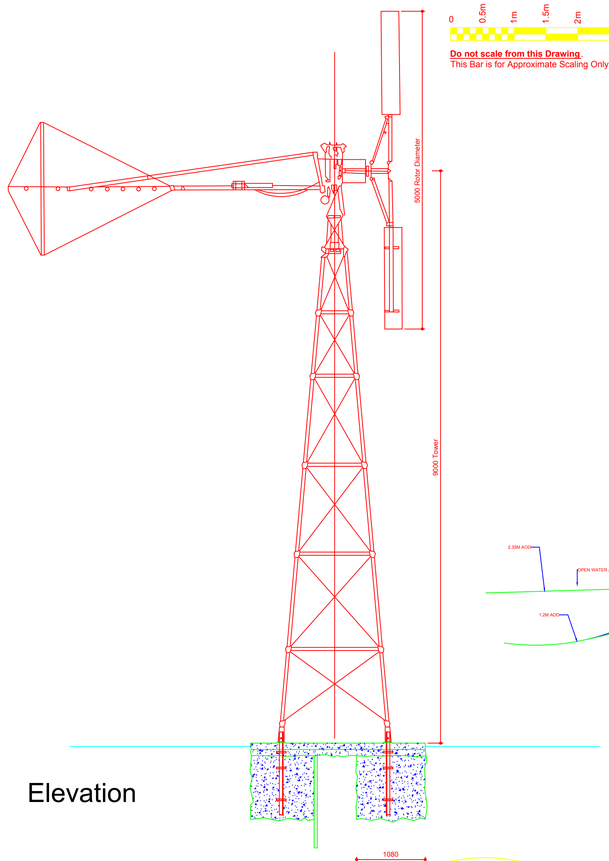
Drn	Det		Appd
STB			
Chk	Tech Chk	Det Chk	Date
TD			16/07/13

Thomson Ecology Ltd
Compass House,
Surrey Research Park,
Guildford,
GU2 7AG.
Tel: 01483 466000
www.thomsonecology.com

Plot Date :
AutoCAD File Name :
DB1V

Windpump Plan

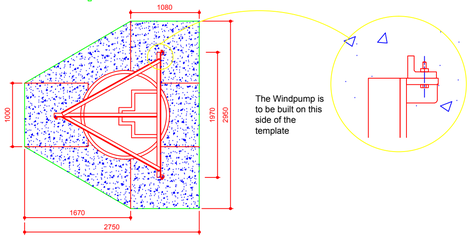




0 0.5m 1m 1.5m 2m 3m 4m 5m

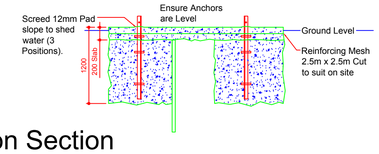
Do not scale from this Drawing.
This Bar is for Approximate Scaling Only.

Elevation



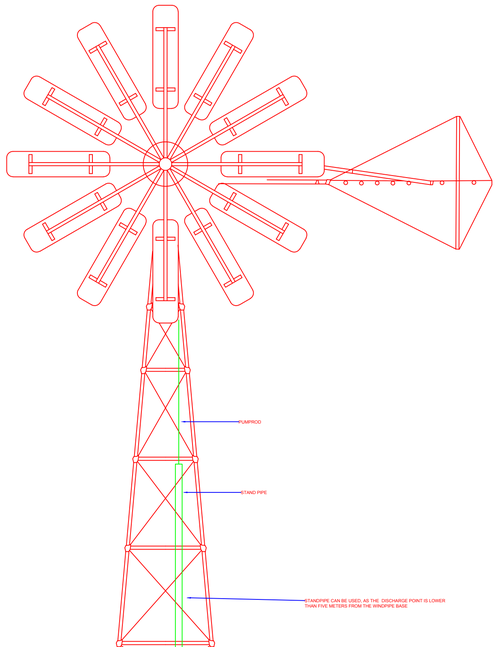
The Windpump is to be built on this side of the template

Foundation Plan



Notes;
1. Concrete Quantity Approx. 4.5 Cubic metres

Foundation Section

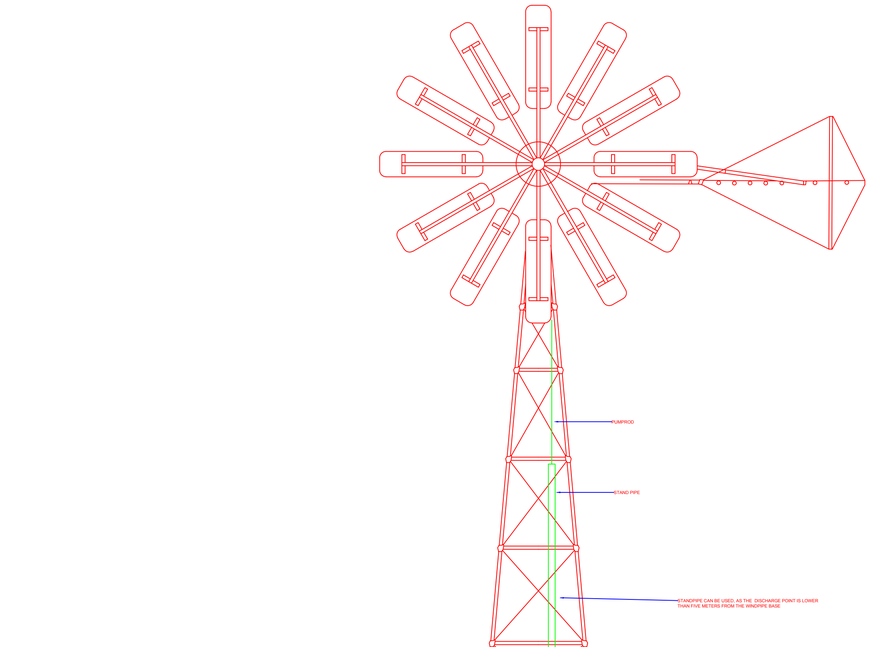


Windpump 1

Setting out (523542,419442)

0 0.5m 1m 1.5m 2m 3m 4m 5m

Do not scale from this Drawing.
This Bar is for Approximate Scaling Only.



Windpump 2

Setting out (523569,419349)

0 0.5m 1m 1.5m 2m 3m 4m 5m

Do not scale from this Drawing.
This Bar is for Approximate Scaling Only.

Notes:

THIS DRAWING IS NOT TO BE SCALED.
ALL DIMENSIONS ARE TO BE CHECKED ON SITE.

Rev.	Description.	Date.

Client: Thomson Ecology

Job: Cherry Cobb Sands

Drawing Title: Windpump Details Windpump 1 & Windpump 2

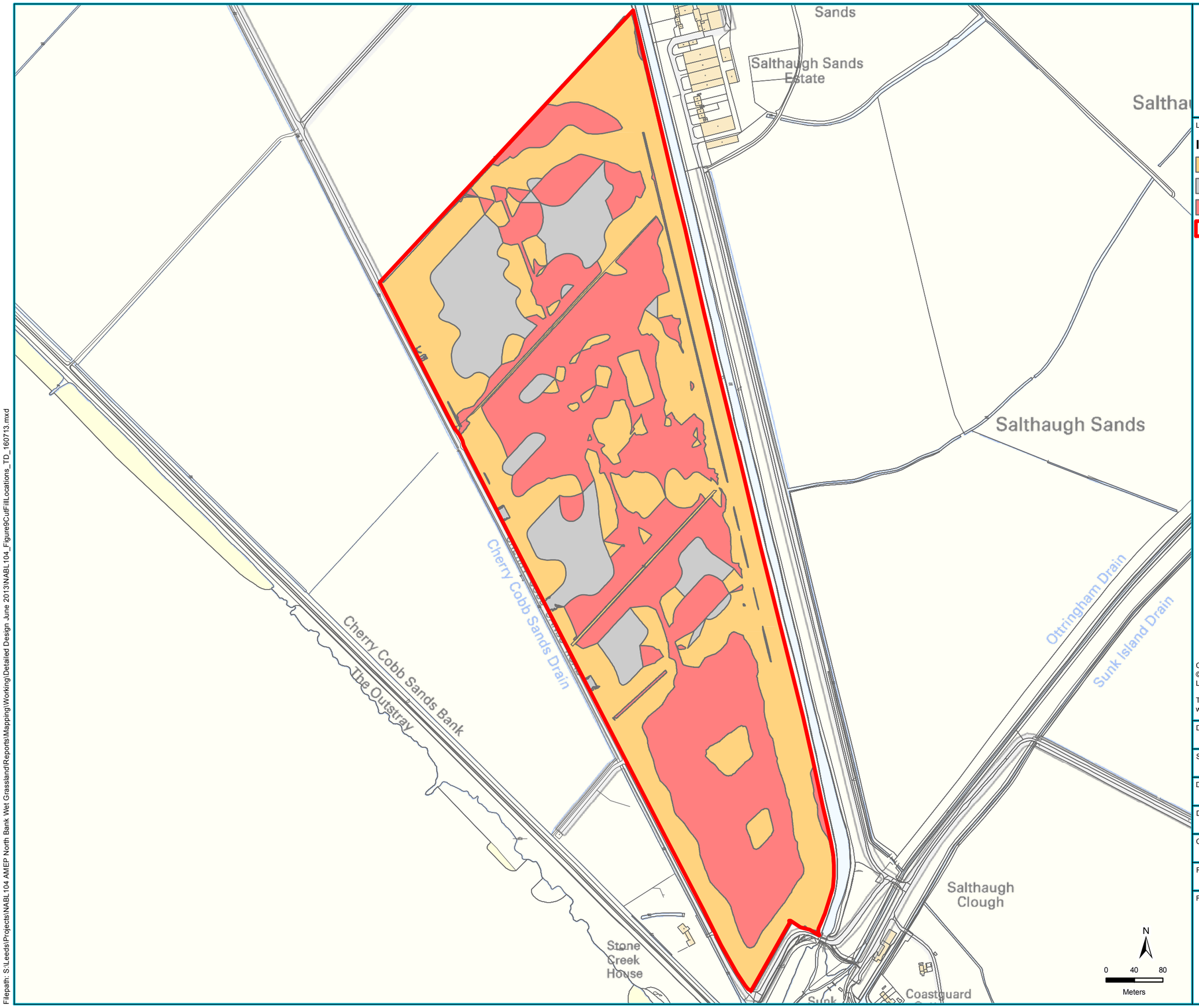
Client Logo:

ENTERPRISE
ARCHITECTURE & DESIGN CONSULTANTS
70 The Furlongs
Ingatestone
Essex
CM4 0AJ
t: 01277 350866
f: 01277 350866
m: 07711 349 068
e: phil@cad-enterprise.co.uk
w: www.cad-enterprise.co.uk

Date:	16.07.2013	Plot Date:	16.07.2013
Scale:	1:50 @ A1	CAD File:	windpump-001

Drawing Number: NABL104/12598/1

Rev. .



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Legend

Indicative Soil Cut/Fill Balance

- Fill
- No Change
- Cut
- Site Boundary

Drawing Ref	NABL104/12599/1
Scale at A3	1:5,000
Drawn: TD	Checked: NS
Date: 17/07/2013	Date: 17/07/2013
Client	Able UK
Figure Number	9
Figure Title	Cut and Fill Locations

Filepath: S:\Leeds\Projects\NABL104 AMEP North Bank Wet Grassland\Reports\Mapping\Working\Detailed Design June 2013\NABL104_Figure9CutFillLocations_TD_160713.mxd