

GREEN GATES EAST NATURE RESERVE, ST ASAPH



BASIS OF DESIGN – CIVIL ENGINEERING

IDENTIFICATION TABLE

Client/Project owner	Denbighshire County Council
Project	Green Gates East Nature Reserve, St Asaph
Title of Document	Basis of Design – Civil Engineering
Date	01/06/2023
Reference number	23C33-RPT-01

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1. SITE LOCATION & BACKGROUND

1.1 Introduction

1.1.1 Denbighshire County Council (DCC) has commissioned SYSTRA Ltd in parallel with Biodiversity Advanced Ltd (BAL) to investigate the feasibility for a series of ponds on part of a proposed new nature reserve. SYSTRA will provide the civil engineering design elements and BAL will provide ecological design elements.

1.1.2 The site is on farmland between St Asaph and a business park to the west as shown in Figure 1. The land was latterly used for pasture but is vacant at present. A small un-named stream flowing northwards bounds the site along its western edge. The A55 runs beyond the northern boundary and Cwttir Lane forms the eastern boundary.

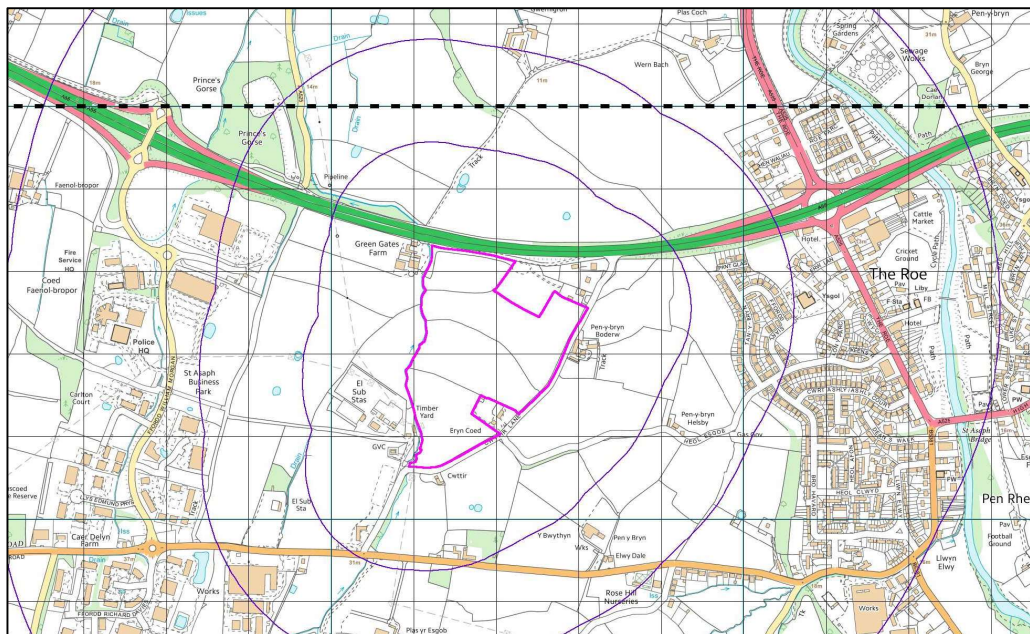
1.2 Site description

Structures and utilities

1.2.1 There are no above-ground structures on site apart from overhead power cables supported by telegraph poles or pylons. Two major 132kV cable sets run underground through the western half of the site: these are shown together with their easements on drawing 23C33-DWG-01 which is appended to this Note. The easements are described as follows.

- The Gwynt y Mor (western) easement is 40m wide as stated in the deed of agreement.
- The easement width for the Burbo Bank (eastern) cables is not so clearly stated in the deed of agreement but scales off an associated plan as 25m wide.

Figure 1. Site Location



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1.2.2 There are significant restrictions upon any excavation or intrusive activity within those easements.

1.2.3 A sewer (thought to be foul water) emanates from the Bryn Coed land towards the south end of the site and flows away westwards. Two minor (?) water mains cross the site broadly south to north and are thought to be supply pipes to nearby dwellings.

1.2.4 The proposed pond works will be restricted to the eastern half of the land, east of the Burbo Bank easement, in order to avoid any notion of excavations within the easements for this element of the reserve's creation.

Topography

1.2.5 The land generally falls from east to west down to the stream. The eastern boundary is generally the high point or only slightly downhill from it. A topographic survey has been undertaken for the site and SYSTRA drawing 23C33-DWG-02 showing the contours and directions of fall is appended to this Note.



- 1.2.6 There are a couple of places where this pattern is not followed. The north-east corner of the site falls partly towards Cwttir Lane in a north-east direction and partly in a north-west direction. Around pond PE4, which is located at a local high spot on site, some of the area also falls towards Cwttir Lane. There is a highway ditch alongside part of the Lane which in turn is also set down slightly into the landscape so that the road carriage way is lower than adjacent ground in places.

Ground conditions

- 1.2.7 The land was observed to be boggy and saturated in many places during a site walkover in April 2023 even though preceding weather had been relatively dry – though the walkover day was not. A site investigation (Geotechnics, 2019) of part of the land on its eastern side bordering Cwttir Lane recorded the superficial ground there as glacial till/boulder clay to depths of over 5m overlying sandstone/mudstone rocks. It described the till as ‘firm to stiff ... slightly sandy to sandy slightly gravelly to gravelly clay’. A sandy gravelly lens was encountered in one trial pit.
- 1.2.8 No persistent groundwater was encountered during the intrusive works and very little recharge was noted in standpipes installed for subsequent monitoring. The investigation considered it likely that the groundwater within the standpipes represented perched groundwater within the glacial till. Soakaway tests were carried out at three trial pits but none of these demonstrated any significant infiltration and none reached sufficient drawdown of water levels to meet the test process requirements.
- 1.2.9 A separate investigation (Smith Grant, 2016) of the farmland west of the stream opposite this site found the conditions there to be similar, comprising a firm clay with occasional sandy inclusions overlying a firm to stiff clay. This area also housed a number of historic ponds that had been filled in. Permeability testing showed the ground to be relatively impermeable.
- 1.2.10 Experience on other similar land around the nearby Business Park suggests that the site is likely to possess an agricultural land drain network outfalling into the former ponds or into shallow ditches in the hedgerows between the fields. No records are available to prove this for the site.

Water features

- 1.2.12 The only water features present on or adjacent to the site are an un-named stream along the western boundary and two shallow field ditches following hedgerows on the northern half of site, flowing down to the stream. Seven small ponds of varying size used to be present on site but have all been filled in. Marches Ecology recorded a shallow pool of water north of Bryn Coed during a site inspection earlier in 2023 which is interpreted as locating at the former pond PE4. The positions of these ponds are shown on drawing 23C33-DWG-01, numbered PE1 to PE7.
- 1.2.13 The stream floodplain is confined close to the watercourse by ground levels rising quickly away from the channel, particularly east of the stream. The nearest significant floodplain is associated with the Afon Elwy and is well away from the site beyond the A55 or to the east within St Asaph itself.

- 1.2.14 A narrow corridor of surface-flood risk is shown from National Resources Wales's (NRW) indicative mapping originating on the south side of Bryn Coed and flowing westwards down to the stream. No other such risk is mapped within the site.
- 1.2.15 Future effects of climate change upon flood risk will increase flood levels in the stream and the incidence of overland flow compared with equivalent events now but not to such a degree as to alter the proposed pond creation and restoration works. The stream's flood envelope will remain close to the watercourse, well away from the proposed wetlands area. Increased intensity of rainfall will in turn increase surface run-off in the future and the proposed combination of ponds and swales will in turn capture that run off and divert into the corresponding ponds.
- 1.2.16 There are no source protection zones within or close to the site. British Geological Survey mapping classes the superficial ground and underlying bedrock as secondary aquifers with no practical importance in terms of water supply.
- 1.2.17 The annual average rainfall at Green Gates is approximately 725mm (Flood Estimation Handbook data).

Other

- 1.2.18 There are no nearby sites of special scientific interest, scheduled monuments or other designations recorded that would constrain the proposed pond works. As stated in BAL's ecological report, the nearest statutory nature conservation site is over 2km from the site.
- 1.2.19 The quality of material used to fill in the historical ponds has been questioned in light of the finding of asbestos at one of the locations. The ponds proposed for restoration will need further investigation to check whether this is a widespread condition or an isolated occurrence. This should be carried out by a suitable specialist.

2. PROPOSED POND NETWORK

- 2.1.1 A scattered series of small ponds has been part of the landscape on and around the site for a considerable time, although latterly many of these have been filled in for reasons unknown. The nature of the ground is such that existing or new ponds would be expected to hold any water that reached them quite effectively and the main causes of water loss would be from evaporation or from evapo-transpiration of vegetation within and close to each pond itself.
- 2.1.2 A number of the historical ponds within the site have been excluded from restoration due either to location within the HV cable easements or from a perspective that alternative locations offer a better outcome. The treatment of each historical pond is proposed as follows.
- PE1: To remain abandoned and replaced by new ponds PN11 and PN12 close by to the north.
 - PE2: To be restored and enlarged compared to its historical size, considering proximity of a water supply pipe believed to pass close by.
 - PE3: To be restored and enlarged slightly subject to proximity of the boundary hedgerow and Cwttir Lane.
 - PE4: To be restored to its original size.

- PE5: To remain abandoned, replaced by PN17 nearby.
- PE6: To remain abandoned due cable easements.
- PE7: To remain abandoned due cable easements.

2.1.3 A number of new ponds are proposed in order to address the aspirations for such elements within the new nature reserve. Seven new ponds are proposed, the majority to be sized in line with the recommended optimal range for great crested newts (GCN). There will be two exceptions to this as noted below.

- PN11: New small pond or locally widened swale in north-east corner of site as part replacement of PE1.
- PN12: New pond in north-east corner of site as other component of replacing PE1. This and PN11 to be located close to the site boundary in this corner of the site in order to maximise the catchment feeding this mini-system.
- PN13: New large pond adjacent to HV cable easement, sized to act as a resource for community activities (e.g. pond dipping) and also to suit proximity of proposed informal access route through the wider reserve.
- PN14: New pond adjacent to HV cable easement in central field and on south side of hedgerow.
- PN15: New pond in central field and on south side of hedgerow.
- PN16: New pond adjacent to HV cable easement and on north side of treeline.
- PN17: New pond in southern field beside Bryn Coed, replacing PE5.

2.1.4 The pond positions are shown on drawing 23C33-DWG-01 which accompanies this Note. The approximate pond area so restored or created is 3,000m² (as measured at the wet-winter top water level). An overall length of 570m of swales will be formed to intercept and divert surface run-off together with any water seeping through the topsoil into the ponds.

2.1.5 The general detail of each pond has been designed to align with the guidance on newt-friendly features as set out in BAL's report. This comprises a peripheral 'shelf' 3m wide and sloping down from the water's edge at 1:10. At the outer edge of this shelf the slope steepens to 1:2 and falls by a further 0.9m or more to create an area of deep water in the centre of each pond that will not be choked by reed growth and which provides an important part of the pond habitat for GCN. A basic layout and cross-sections through the long and short axes of the 'standard' pond are shown on drawing 23C33-DWG-03.

2.1.6 The swales will be formed with a channel width of 4-5m and a depth of about 0.6m. This is intended to be deep enough to intercept any existing land drains and divert their water to the relevant pond. The swales will have an asymmetrical cross-section with a gentler slope (1:5) on the uphill side and a steeper slope (1:2) on the downhill side. The material dug from the ponds and swales will be spread along the downhill side of the earthworks to locally build up those sides to aid in water retention and to avoid the need for removing material from site.

2.1.7 A topsoil depth of 0.4m will be stripped from the earthworks' footprint. The volumes of excavation and fill will be developed during the detailed design stage. A preliminary estimate of key quantities is as follows:

- Footprint of pond earthworks: 5,200m²
- Footprint of swale earthworks: 2,900m²



○	Topsoil strip:	3,200m ³
○	Pond excavation:	1,500m ³
○	Swale excavation:	400m ³
○	General filling:	5,100m ³

2.1.8 During reinstatement, the topsoil coverage applied to the swale channels and to peripheral earthworks around the ponds will be limited to 0.2m in order to reduce the richness of the existing field soil and enable new species to colonise these areas without being out-competed. Some of the arisings may also be used to create mounds (hibernacula) or bunds elsewhere within the wetland site.

2.1.9 The only structures associated with the restored or new ponds will be dipping platforms at pond PN13. Future routes for maintenance vehicles moving through the reserve will pass around the ponds and swales at either end and no intermediate access crossings are currently planned.

2.1.10 A suggested timetable for the wetland works is included in Chapter 5 of the BAL report with the aim of completion by March 2024.

3. DRAWINGS LIST

SYSTRA drawings

23C33-DWG-01 *Historical and proposed ponds layout*

23C33-DWG-02 *Site topography contours*

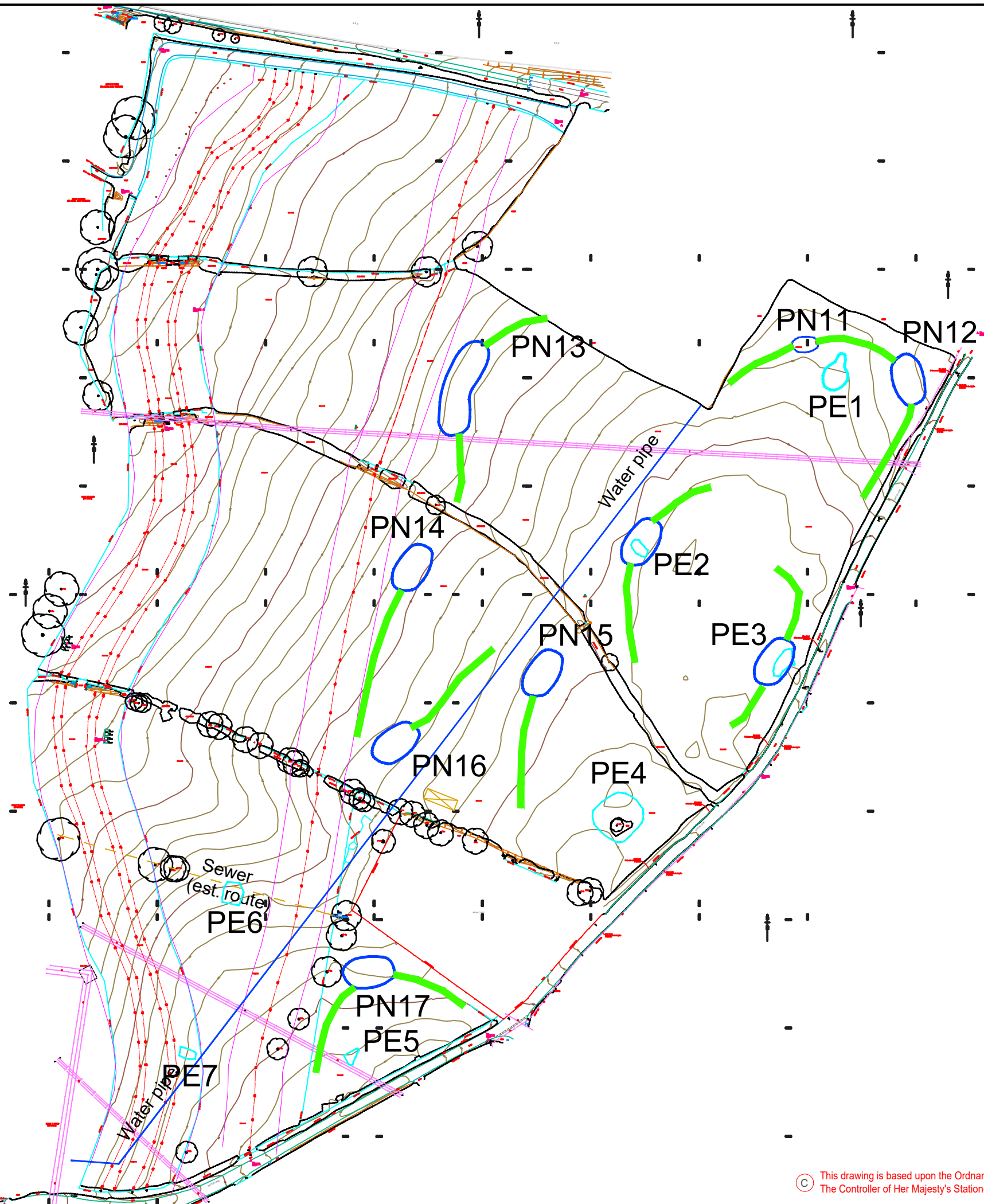
23C33-DWG-03 *Proposed pond general arrangement*



APPROVAL

Version	Name	Position	Date	Modifications	
1	Author	T Dawe	Associate	31/05/2023	First issue.
	Checked by	G Pellegrino	Associate	31/05/2023	
	Approved by	B Sharp	Assoc. Dir.	01/06/2023	
2	Author			DD/MM/YY	
	Checked by			DD/MM/YY	
	Approved by			DD/MM/YY	









NOTES

1. Do not scale from this drawing. Dimensions are shown in mm and levels in moD unless stated otherwise
2. Easements for underground HV cables shown as follows: Burbo Bank (east run) 25m wide centred on cable. Gwynt y Mor (west runs) 40m wide (based on 12m offset from eastern cable of quartet). Refer to formal title plans for these cables for detailed alignment.
3. Services routes are based on plans provided by others: exact alignments and levels should be proved on site.
4. See drawing 23C33-DWG-03 for preliminary pond layout and profiles.

KEY

- Historical pond 
- Proposed pond 
- Swales 
- Wildlife barn 

- Labels:
- PE: Historical pond
 - PN: Proposed pond

Rev	Date	Revision details	Drawn	Checked	Approved

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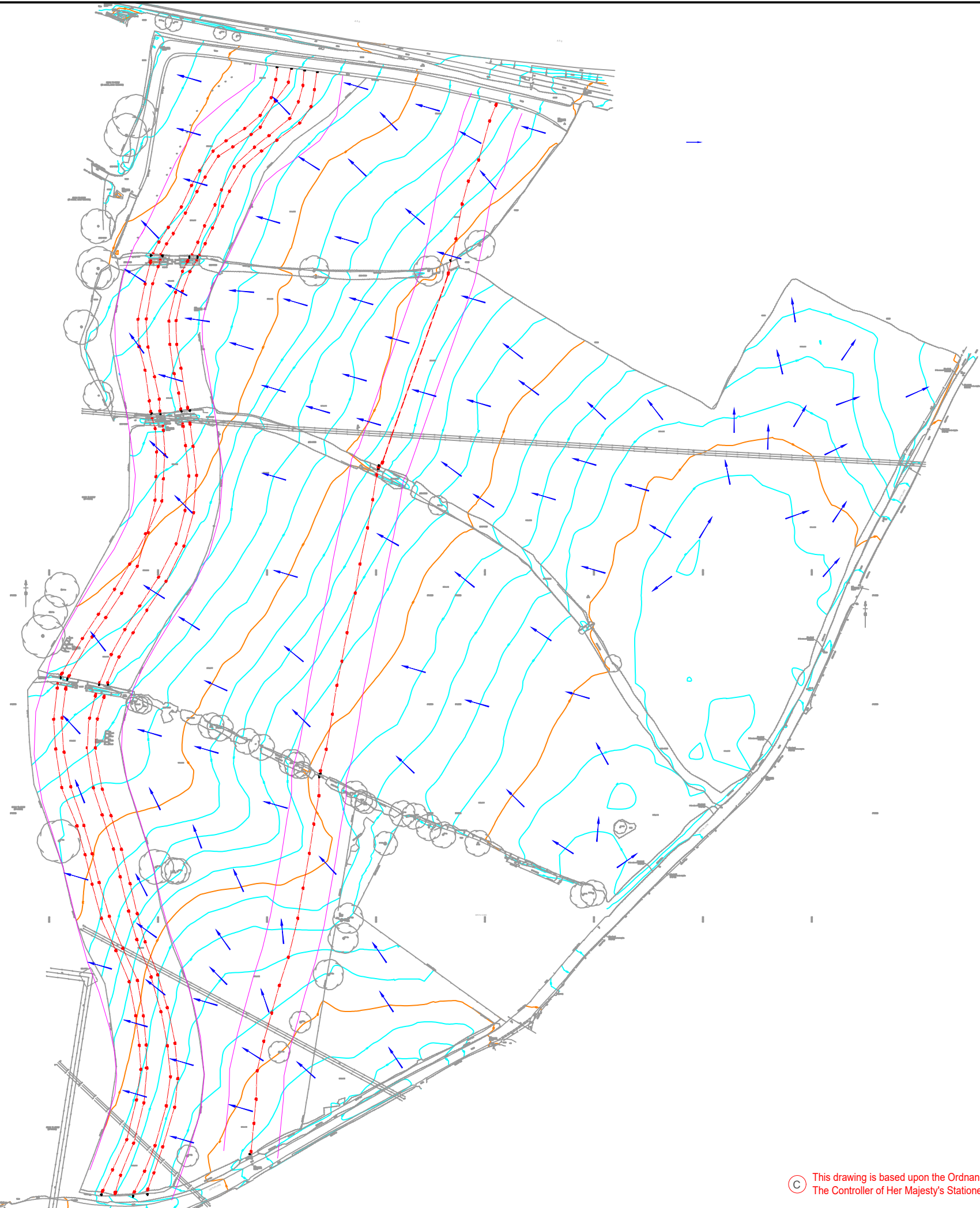
Client: Denbighshire County Council

Project: Green Gates East
St Asaph

Title: Historical and proposed
ponds layout

Drawn	Checked	Approved
TD	GP	BS
Original dwg. size	Date	Scale
A3	May '23	1:2,000
Drawing Status	Drawing Number	Rev.
Information	23C33-DWG-01	P01

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NOTES

1. Do not scale from this drawing.
2. Dimensions are shown in mm and levels in moD unless stated otherwise
3. Topographical survey by Malcolm Hughes, 2018.
4. Easements for underground HV cables shown as follows: Burbo Bank (east run) 25m wide centred on cable. Gwynt y Mor (west runs) 40m wide (based on 12m offset from eastern cable of quartet). Refer to formal title plans for these cables for detailed alignment.

KEY

- Topographical Survey
- Minor contour line (intervals of 0.5m)
- Major contour line (intervals of 2.5m)
- Slope Fall Direction
- Underground HV cables
- Easement estimates

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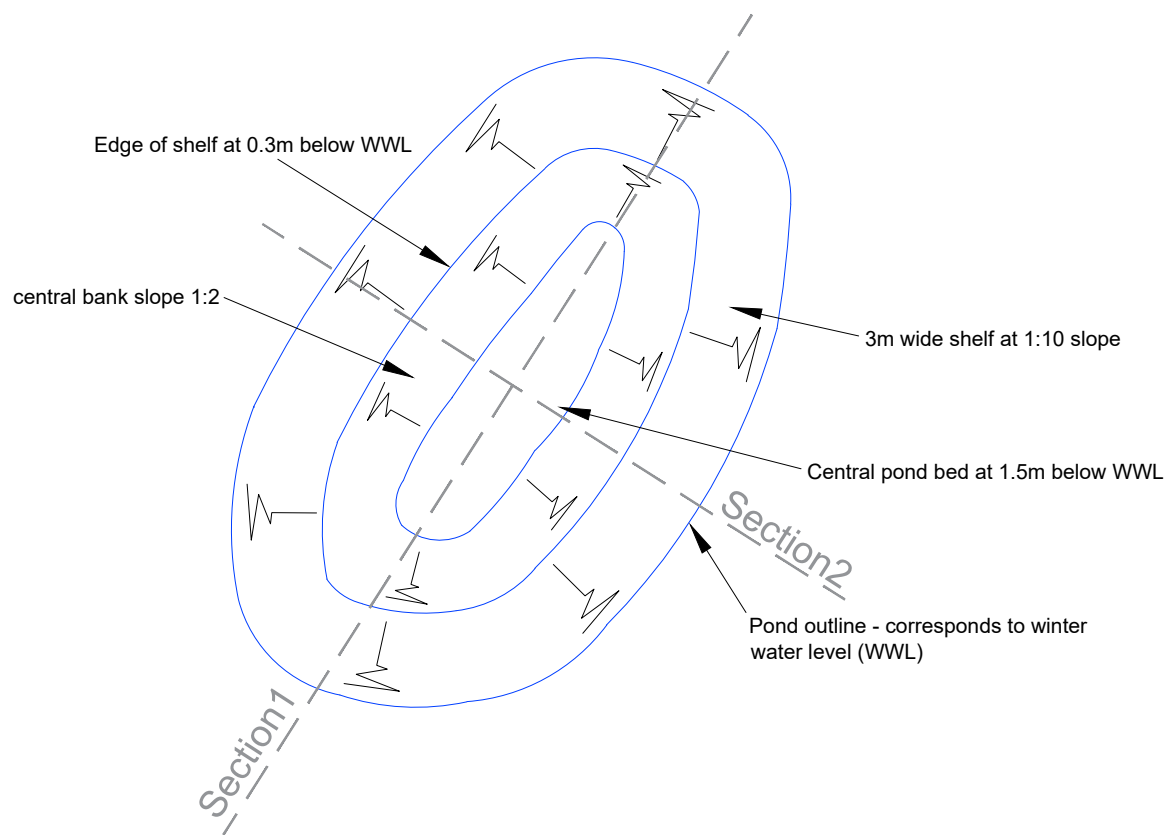
Title
Site topography contours
and HV cable routes & easements

Drawn	Checked	Approved
JF	TD	TD
Original dwg. size A3	Date May '23	Scale 1:2,000
Drawing Status Information	Drawing Number 23C33-DWG-02	Rev. P01

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TYPICAL POND LAYOUT

(SCALE 1:250)



NOTES

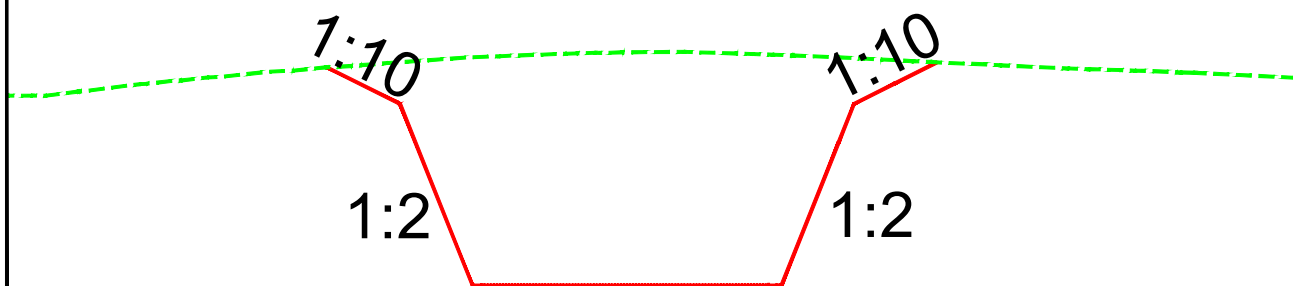
1. Do not scale from this drawing. Dimensions are shown in mm and levels in moD unless stated otherwise
2. Pond outline has nominal area of 280m² at WWL. WWL is set 0.4m below lowest ground level on pond perimeter as per depth of topsoil to be stripped from earthworks footprint.
3. Surplus clay from excavation to be used to line pond edge above WWL. Surplus topsoil may be placed alongside or above this: depth of soil for reinstatement purposes to be 0.2m.
4. See drawing 23C33-DWG-01 for preliminary pond layout.

Long section key

- - - - - Indicative sub-soil surface
- Typical pond profile

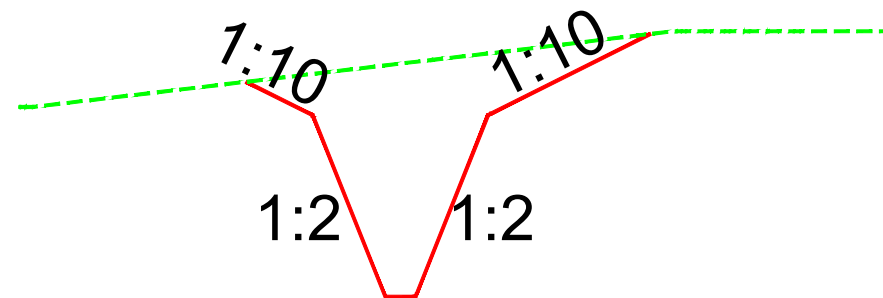
CROSS SECTION 1

(SCALE: H 1:250, V 1:50)



CROSS SECTION 2

(SCALE: H 1:250, V 1:500)



DRAFT

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Client: Denbighshire County Council

Project: Green Gates East
St Asaph

Title: Proposed pond profiles

Drawn	JF	Checked	TD	Approved	BS
Original dwg. size	A3	Date	May '23	Scale	As shown
Drawing Status	Information	Drawing Number	23C33-DWG-03	Rev.	P01