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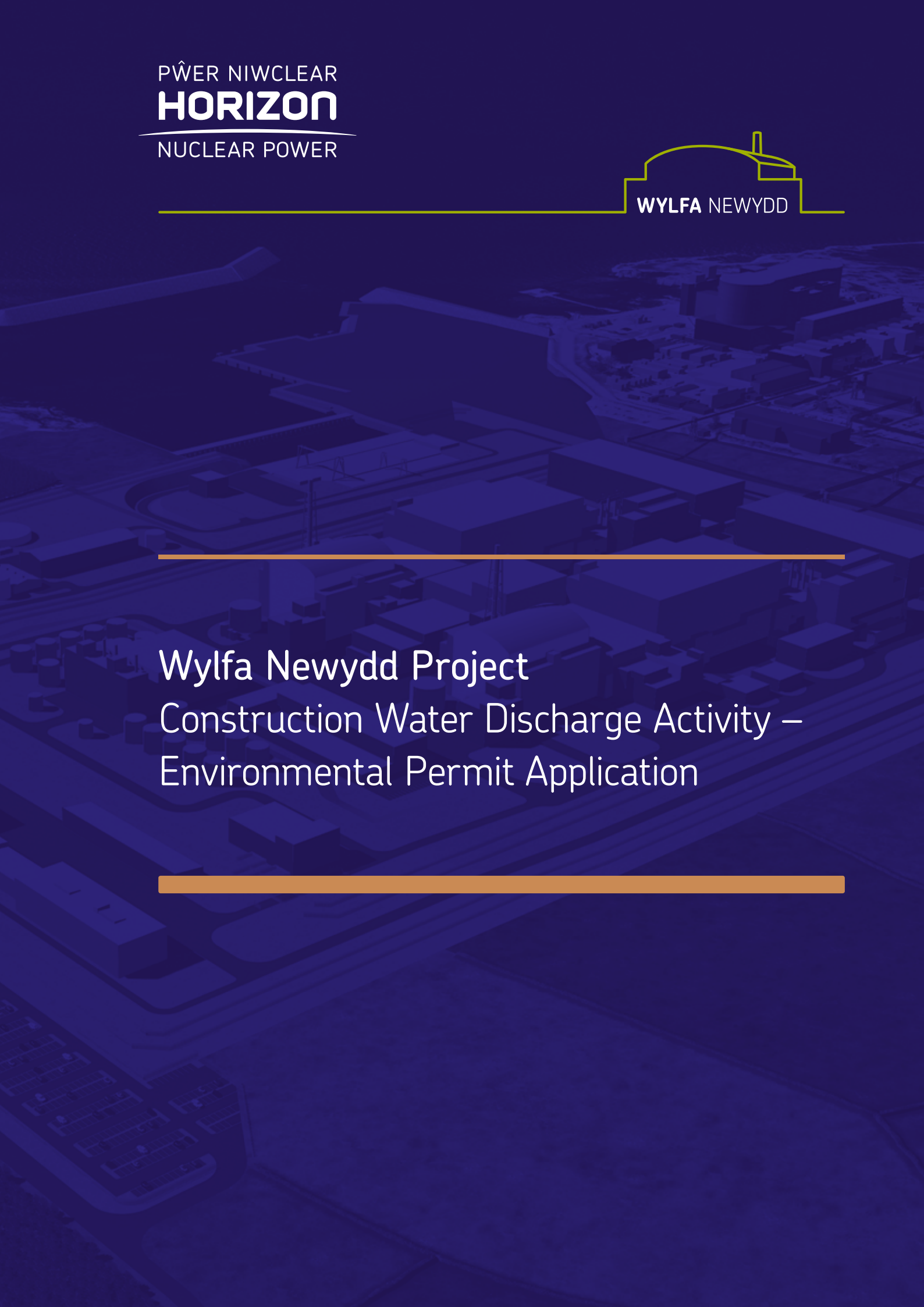
NUCLEAR POWER

WYLFA NEWYDD



Wylfa Newydd Project
Construction Water Discharge Activity – Environmental Permit Application

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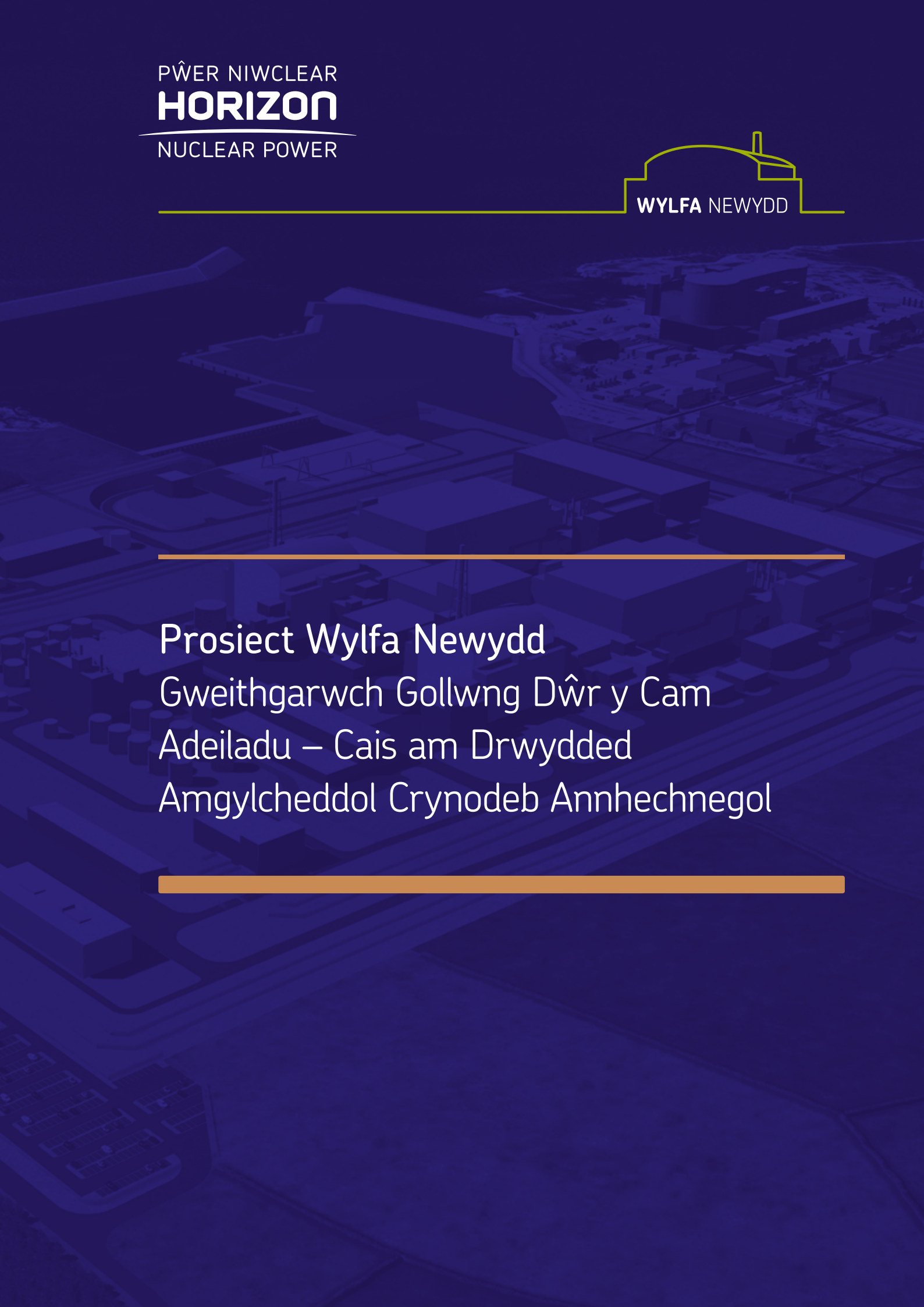

Prosiect Wylfa Newydd

Gweithgarwch Gollwng Dŵr y Cam Adeiladu – Cais am Drwydded Amgylcheddol Crynodeb Annhechnegol

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1 Cyflwyniad

1.1 Cyflwyniad cyffredinol

1. Mae Horizon Nuclear Power Wylfa Limited (Horizon) wedi gwneud cais i Gyfoeth Naturiol Cymru am Drwydded Amgylcheddol i gynnal "gweithgareddau gollwng dŵr" yn ystod cam adeiladu gorsaf bŵer niwclear Wylfa Newydd ar arfordir gogledd Ynys Môn.

2. Y gweithgareddau gollwng dŵr dan sylw ydy'r gweithgareddau adeiladu a'r trefniadau safle adeiladu a fydd yn arwain at ollwng i gyrsiau dŵr wyneb yn Ardal Datblygu Wylfa Newydd[1] a dyfroedd arfordirol cyfagos elifion masnach ac elifion carthion a fydd wedi cael eu trin (i ddyfroedd arfordirol yn unig). Mae'r gweithgareddau yn cynnwys y canlynol:

   - **Draenio dŵr wyneb Ardal Datblygu Wylfa Newydd** i'r cyrsiau dŵr wyneb lleol a'r môr;
   - **Gollyngiadau o sychu gwaith cloddio dwfn** i'r môr;
   - **Gollyngiadau o sychu'r Argae Coffr Bwnd[2]** i'r môr;
   - **Gollyngiadau o sychu Argae Coffr y Strwythur Gollwng Dŵr Oeri** i'r môr;
   - **Gollyngiadau o sychu'r Twneli Gollwng Dŵr Oeri** i'r môr;
   - **Dŵr ffo wyneb o'r ardal o'r ardal sydd o amgylch yr offer gwneud concrit** i'r môr;
   - **Gollyngiadau o Olchi Olwynion Cerbydau** i'r môr; a,
   - **Gollyngiadau elifion wedi'u trin o Waith Trin Dŵr Gwastraff y Safle Adeiladu** i'r môr.

3. Gan fwyaf mae'r elifion masnach yn ddŵr glaw sydd wedi disgyn ar y safle, ynghyd â llai o ddŵr daear a dŵr môr a fydd yn ymdreiddio, ac o ganlyniad yn cael ei bwmpio allan o ardaloedd adeiladu. Bydd y dŵr yn cynnwys solidau mewn daliant, a halogyddion sydd yn bresennol ar hyn o bryd ym mhridd a dŵr daear Ardal Datblygu Wylfa Newydd.

4. Ar ôl i Gyfoeth Naturiol Cymru ddyfarnu'r Drwydded Amgylchedd Gollwng Dŵr Adeiladu, bydd yn caniatáu gollyngiadau i'r amgylchedd yn amodol ar drin, rheoli a chydymffurfio ag amodau'r drwydded.

1.2 Crynodeb o Brosiect Wylfa Newydd

5. Mae Horizon yn bwriadu adeiladu a gweithredu Gorsaf Bŵer ar Ynys Môn. Bydd gan yr Orsaf Bŵer ddau Adweithydd Dŵr Berwedig Uwch y DU (ABWR) a bydd yn gallu cynhyrchu 3.1 gigawat nominal o drydan dros oes weithredol a fwriedir o 60 mlynedd.

6. Bydd y prif weithgareddau adeiladu yn dechrau ar ôl dyfarnu'r prif ganiatâd sydd ei angen i adeiladu'r Orsaf Bŵer. Ar ôl i waith adeiladu'r adweithydd cyntaf gyrraedd pwynt datblygedig, bydd yn cael ei gomisiynu (disgwylir i hyn bara dwy flynedd) er mwyn sicrhau bod yr holl systemau a phrosesau'n gweithio'n unol â'r bwriad. Bydd yr adweithydd cyntaf

[1] Ardal Datblygu Wylfa Newydd ydy'r ardal o dir a môr, gan gynnwys safle'r Orsaf Bŵer, a fydd yn cael ei ddefnyddio i adeiladu a gweithredu'r Orsaf Bŵer. Mae hyn yn cynrychioli'r ardal fwyaf y byddai prif weithgareddau adeiladu'r Orsaf Bŵer yn effeithio arni'n ffisegol. Caiff Ardal Datblygu Wylfa Newydd ei dangos yn Ffigur 2-2.

[2]Mae argae coffr yn wal dros dro sy'n cael ei hadeiladu mewn corff o ddŵr – y môr yn yr achos yma – er mwyn gallu pwmpio'r rhan sydd wedi cael ei hamgáu yn sych, sy'n golygu bod modd gwneud gweithgareddau adeiladu ar lawr y môr. Ar ôl gorffen y gwaith adeiladu mae modd llenwi'r ardal yn ôl gyda dŵr a symud yr argae coffr oddi yno.

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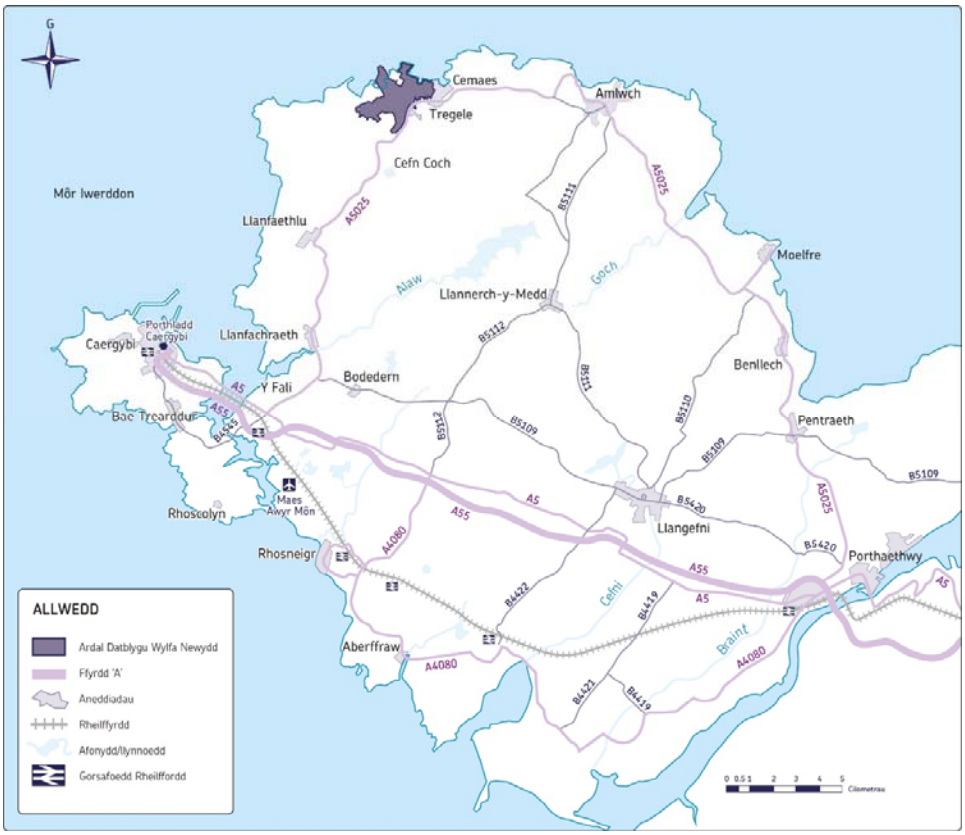
wedyn yn weithredol. Bydd hyn yn cael ei ddilyn gan yr ail adweithydd tua un deg chwech o fisoedd wedyn.

2 Yr Orsaf Bŵer a chyd-destun y safle

2.1 Lleoliad yr Orsaf Bŵer

7. Bydd yr Orsaf Bŵer yn cael ei datblygu ar Ynys Môn i'r gorllewin o bentref Cemaes ac i'r de o'r Orsaf Bŵer Bresennol (gweler Ffigur 2-1).

Ffigur 2-1 Lleoliad Ardal Datblygu Wylfa Newydd



2.2 Ardal Datblygu Wylfa Newydd

8. Caiff Ardal Datblygu Wylfa Newydd ei dangos yn Ffgur 2-2, gyda Ffin Cyfleuster wedi'i Reoleiddio Trwydded Amgylcheddol Gollwng Dŵr Adeiladu. Mae'r arfordir ar ei ffin i'r gogledd ynghyd â'r Orsaf Bŵer Bresennol. I'r dwyrain, mae'n cael ei wahanu oddi wrth Gemaes gan goridor o dir amaethyddol. Mae'r A5025 ac eiddo preswyl yn diffinio rhan o'r ffin de ddwyreiniol, gyda pharsel bach o dir yn ymestyn o'r ffordd i'r gogledd ddwyrain o Dregele. I'r de ac i'r gorllewin, mae Ardal Datblygu Wylfa Newydd yn cydffinio â thir amaethyddol, ac i'r gorllewin mae'n cynnwys tir y tu ôl i Fae Cemlyn, lle mae Ardal Datblygu Wylfa Newydd yn cynnwys rhan o'r eiddo o'r enw Gerddi Cestyll. Mae Ardal Datblygu Wylfa Newydd tua 407 ha.

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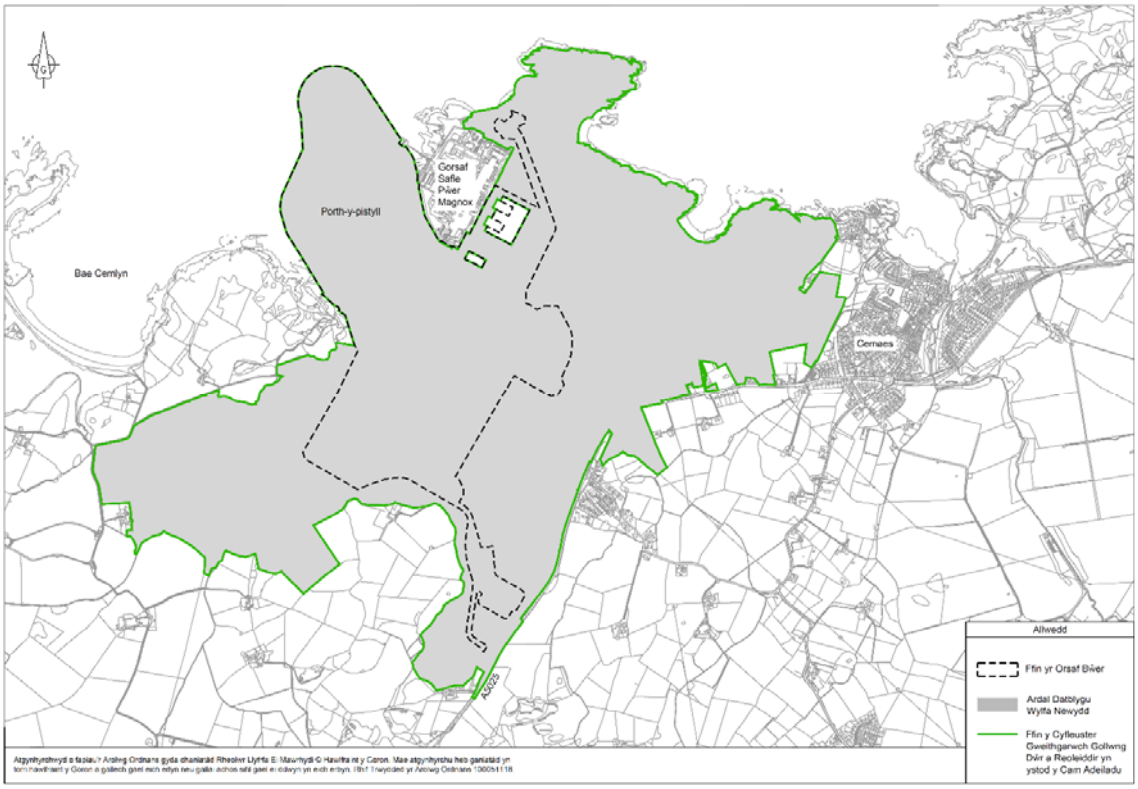
Ffigur 2-2 Ardal Datblygu Wylfa Newydd



3 Trosolwg o'r gweithgareddau gollwng dŵr

10. Mae'r gweithgareddau gollwng dŵr yn cael eu disgrifio isod. Mae wyth gyda'i gilydd. Ar gyfer pob gweithgaredd, ac eithrio trin carthion, bydd y dŵr yn cael ei gasglu a'i drosglwyddo drwy system drin a fydd wedi cael ei dylunio i dynnu solidau mewn daliant. Bydd y dŵr wedi'i glirio wedyn yn cael ei ryddhau naill ai i gwrs dŵr wyneb yn Ardal Datblygu Wylfa Newydd (lle bydd yn llifio'n naturiol i'r môr), neu'n syth i'r môr. Bydd yr elifion o nifer o'r gweithgareddau gollwng yn cael eu llwybro drwy systemau trin cyffredin, fel y dangosir yn Ffigur 3-1. Mae'r pwyntiau gollwng i'r amgylchedd yn cael eu dangos yn y diagram yn Ffigur 3-2.

11. Mae trin carthion yn wahanol i'r gweithgareddau eraill oherwydd ei fod wedi cael ei ddylunio i drin carthion domestig a thynnu nifer o lygryddion gwahanol. Bydd y system trin yn gollwng yn syth i'r môr.

3.1 Draenio Dŵr Wyneb Ardal Datblygu Wylfa Newydd

12. Bydd y gwaith cloddio a fydd yn cael ei wneud yn ystod y cam adeiladu yn golygu cloddio tua naw i ddeg miliwn metr ciwbig (mewn swmp) o ddeunyddiau, a bydd rhywfaint yn mynd i greu twmpathau ar y safle a fydd wedyn yn cael eu gorchuddio ag uwchbridd wedi'i stripio. Yn y pen draw bydd pum twmpath yn Ardal Datblygu Wylfa Newydd (A i E) fel sy'n cael eu dangos yn Ffigur 3-3.

13. Mae'n bosibl y bydd y dŵr glaw a fydd yn disgyn ar y twmpathau pridd a'r ardaloedd lle mae'r llystyfiant a'r pridd wedi cael eu stripio yn codi sylweddau o'r pridd, gan arwain at ddŵr ffo a fydd yn cynnwys mwy o ddyddodion a halogyddion wedi'u trwytholchi. Felly, er mwyn rheoli'r dŵr ffo bydd System Draenio Cynaliadwy yn cael ei gosod er mwyn casglu'r dŵr ar draws Ardal Datblygu Wylfa Newydd, gan gynnwys y twmpathau, a'i gyfeirio i systemau trin gwaddod (pyllau setlo gwaddod a gwahanwyr lamela[3]). Os bydd angen, bydd modd ychwanegu polyelectrolyt[4] yn y gwahanwyr lamela i wella'r gwaddodi a thynnu solidau mewn daliant a fydd yn dod i mewn.

14. Bydd y dŵr wedi'i glirio o'r systemau trin yn cael ei ollwng i gyrsiau dŵr lleol (Nant Caerdegog, Afon Cafnan, Nant Cemaes a draeniau Tre'r Gof), ac mewn un achos yn syth i'r môr dros adran fer o dir. Mae Ffigur 3-1 yn dangos yr wyth pwynt gollwng dŵr o'r draeniau (wedi'u labelu WA1 i WE2) a'u systemau trin cysylltiedig.

3.2 Gollyngiadau o sychu gwaith cloddio dwfn

15. Mae rhannau o adeiladau'r prif offer wedi cael eu dylunio i fod wedi'u mewnosod yn y ddaear, wedi'u hadeiladu ar graig solet. Bydd felly angen gwneud gwaith cloddio dwfn yn ystod y cam adeiladu i hwyluso gosod y sylfeini adeiladu. Er mwyn gallu cloddio o dan lefel trwythiad dŵr daear a rheoli mynediad dŵr glaw, bydd angen sychu. Bydd y dŵr a fydd yn cael ei bwmpio o'r gwaith cloddio yn cael ei lwybro i ddwy system trin gwaddod ac

[3] Mae gwahanydd lamela (*lamella clarifier*) yn declyn sy'n cynnwys pentwr o blatiau ar osgo a chaiff dŵr ei basio drwyddynt yn araf. Mae'r gronynnau solet sydd yn y dŵr yn setlo ar y platiau ac felly'n cael eu tynnu o'r llif. Mae'r solidau'n cael eu casglu mewn cynwysyddion casglu ar waelod y teclyn ac mae modd gwagio'r rheini o bryd i'w gilydd.

[4] Mae polyelectrolytau yn gemegau sy'n achosi gronynnau solet gwasgaredig i lynu at ei gilydd yn agregau mwy sy'n setlo'n haws y tu allan i'r ffrwd dŵr. Felly mae eu defnyddio'n clirio'r dwr yn gyflymach.

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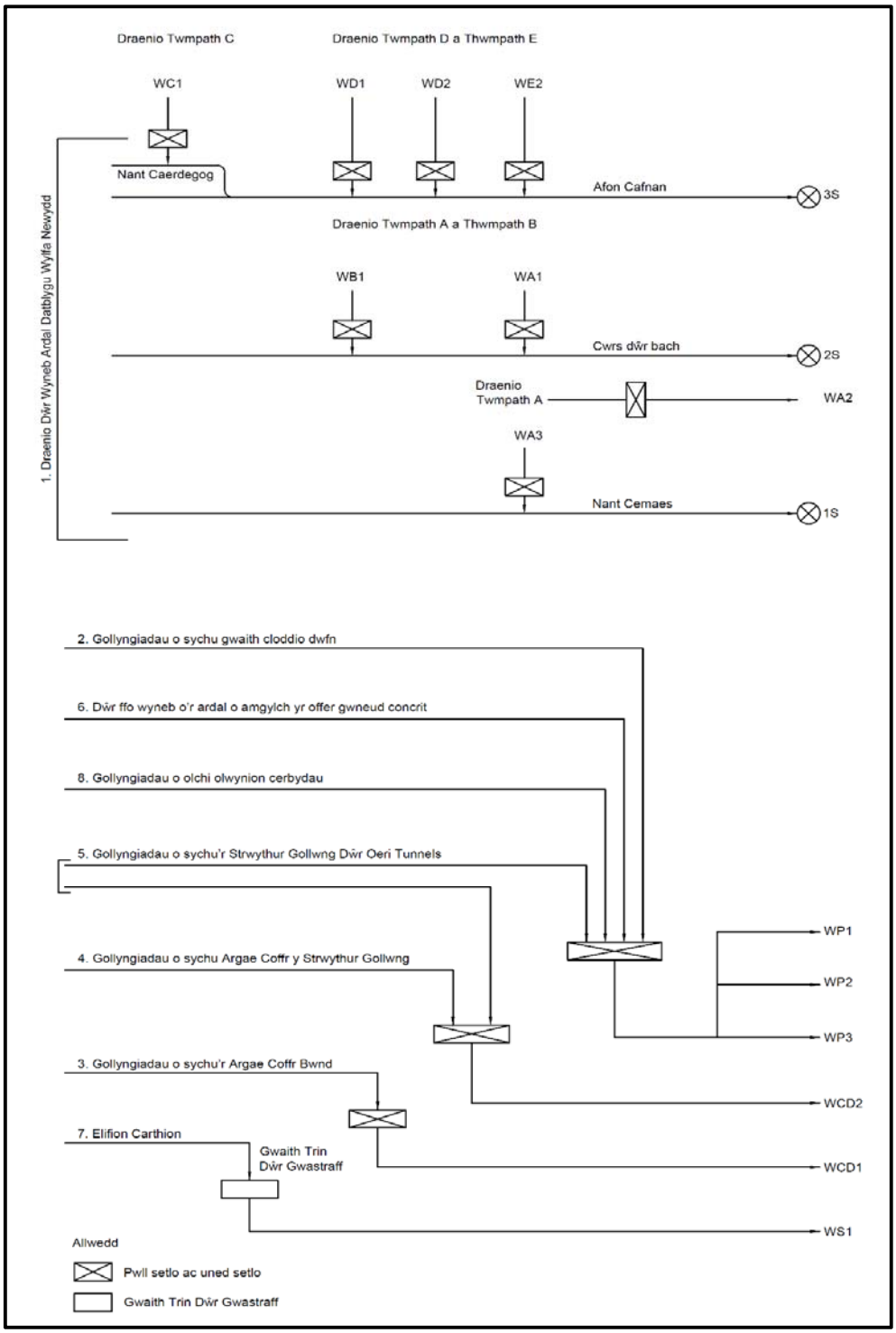
o fan honno bydd y dŵr wedi'i glirio yn cael ei ollwng i'r môr. O fewn y system draenio/trin bydd darpariaeth i gywiro pH, pan fydd angen.

Ffigur 3-1 Diagram o'r ffynonellau gollwng a'r pwyntiau gollwng



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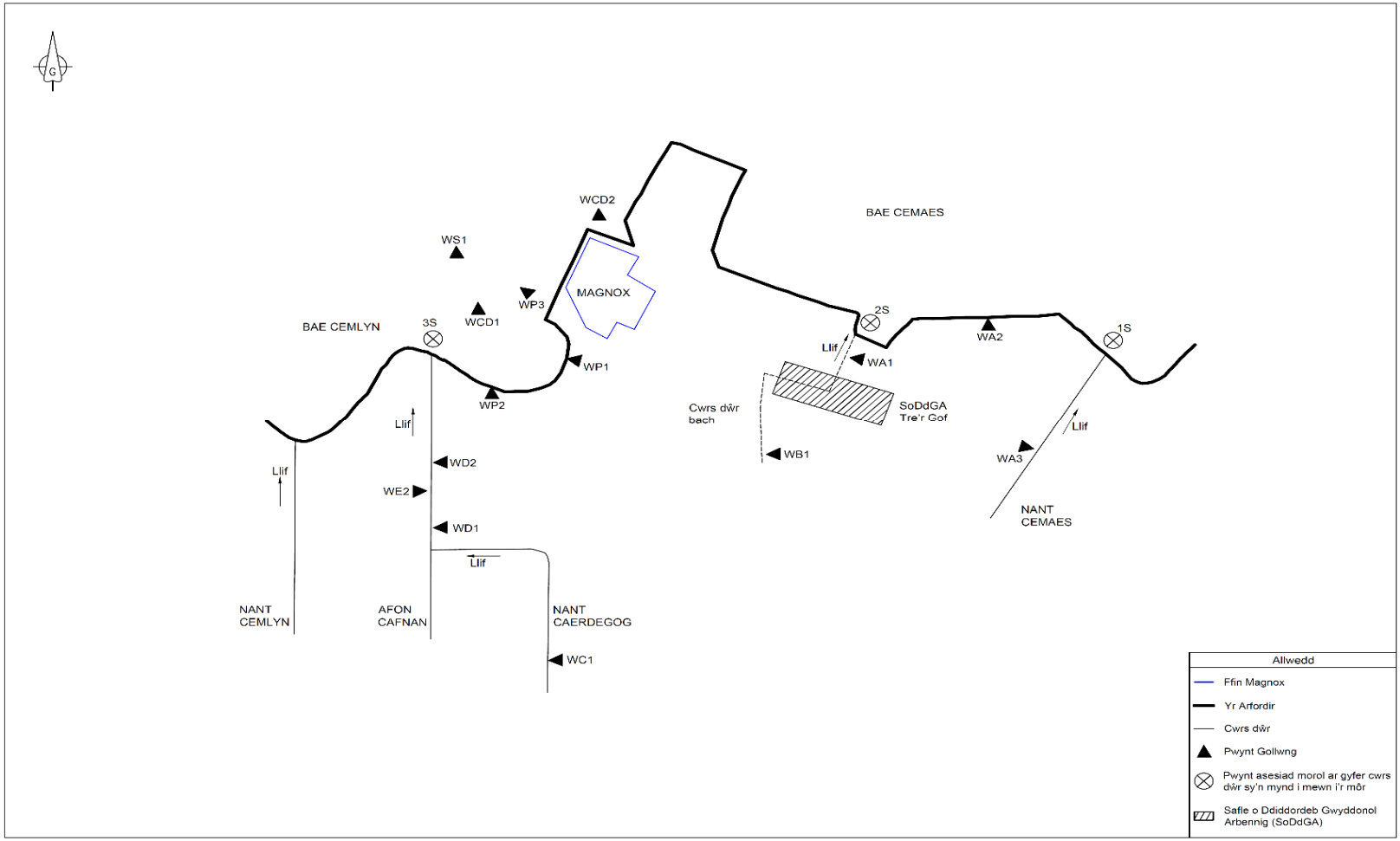
Ffigur 3-2 Diagram o'r pwyntiau gollwng dŵr



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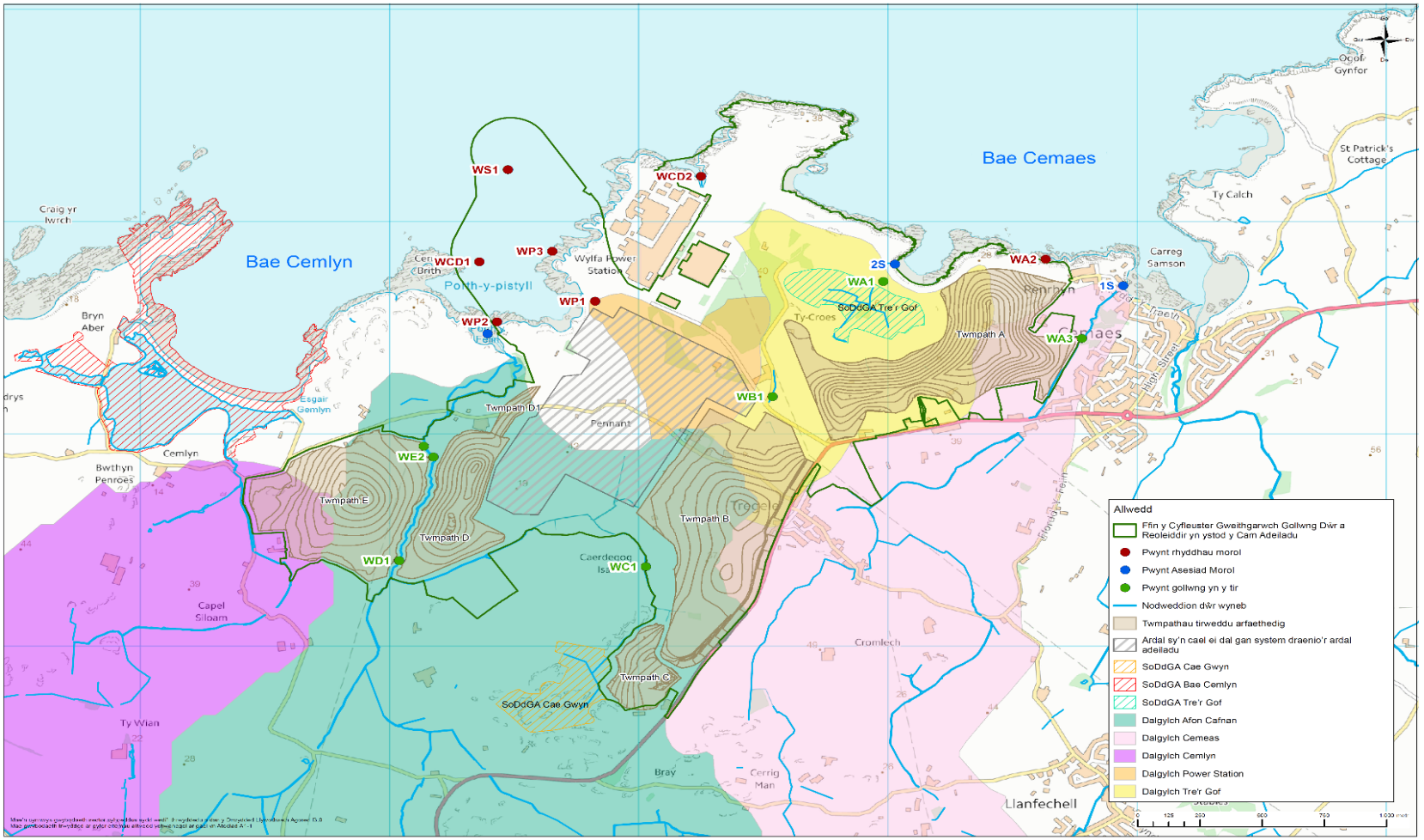
Ffigur 3-3 Twmpathau Ardal Datblygu Wylfa Newydd



16. Bydd y ddwy system trin gwaddod hefyd yn cymryd dŵr o dri gweithgaredd gollwng dŵr arall, sef: i) Dŵr ffo wyneb o'r ardal o amgylch yr offer gwneud concrit, ii) Gollyngiadau o olchi olwynion cerbydau, a iii) Gollyngiadau o sychu'r Twneli Gollwng Dwr Oeri. Mae'r trefniant hwn yn cael ei ddangos yn Ffigur 3-1.

17. Defnyddir tri phwynt gollwng (o'r enw WP1, WP2 a WP3) dros gyfnod y gwaith adeiladu. Bydd defnyddio'r pwyntiau gollwng hyn yn amrywio yn ôl trefn y gwaith adeiladu ac felly mae'n bosibl y byddant yn newid. Fodd bynnag, ar hyn o bryd, disgwylir y byddai pwynt gollwng WP1 yn cael ei ddefnyddio i ddechrau (am oddeutu blwyddyn), gyda WP2 yn cael ei ddatblygu er mwyn caniatáu gwaith morol (gan ddibynnu ar drefn y gwaith cloddio dwfn). WP3 fyddai'r pwynt gollwng olaf a fyddai'n cael ei ddefnyddio ar gyfer gweddill y cam adeiladu a byddai'n cael ei gadw fel pwynt gollwng dŵr draenio wyneb parhaol.

3.3 Gollyngiadau o sychu'r Argae Coffr Bwnd

18. Bydd Argae Coffr Bwnd dros dro yn cael ei adeiladu ym Mhorth-y-pistyll er mwyn hwyluso'r gweithgareddau adeiladu yn yr ardal honno. Ar ôl ei osod bydd yr ardal y tu ôl i'r argae coffr yn cael ei sychu er mwyn creu amgylchedd gwaith sych. I ddechrau, bydd yr argae coffr yn cael ei sychu'n syth i'r môr drwy falfiau a phibelli draenio yn wal yr argae coffr. Fodd bynnag, tua diwedd y gwaith sychu (wrth ddod yn nes at lawr y môr) ac yn ystod gwaith sychu parhaus (i wneud iawn am ddŵr môr, dŵr daear a dŵr glaw a fydd yn dod i mewn) bydd y dŵr yn cael ei drin er mwyn rheoli lefelau gwaddod cyn ei ryddhau i'r môr drwy bwynt gollwng WCD1.

19. Nid ydy'r trefniadau terfynol ar gyfer rheoli solidau mewn daliant ar gyfer yr Argae Coffr Bwnd wedi'u llunio eto (cynigir y bydd y rhan fwyaf o'r gwaddod yn cael ei gludo allan yn yr ardal sych y tu ôl i'r argae coffr). Fodd bynnag, bydd yr hyn sy'n cael ei ollwng i'r môr yn cydymffurfio ag amodau gollwng y Drwydded Amgylcheddol.

3.4 Gollyngiadau o sychu Argae Coffr y Strwythur Gollwng Dŵr Oeri

20. Bydd Argae Coffr dros dro ar gyfer y Strwythur Gollwng Dŵr Oeri yn cael ei adeiladu ar draws ardal strwythur gollwng dŵr oeri presennol Magnox. Bydd y trefniadau sychu fel y disgrifir uchod, a bydd y dŵr yn cael ei drin drwy system trin gwaddod. Bydd y system trin hefyd yn derbyn dŵr o sychu'r Twneli Gollwng Dŵr Oeri a ddisgrifir isod. Bydd y dŵr yn cael ei ollwng i'r môr drwy'r pwynt gollwng WCD2.

3.5 Gollyngiadau o sychu'r twneli Gollwng Dŵr Oeri

21. Bydd y twneli Gollwng Dŵr Oeri yn cael eu cloddio rhwng y safle ac adeiladau tyrbin arfaethedig yr UK ABWR a strwythur gollwng dŵr oeri presennol Magnox. Bydd dŵr a fydd yn codi o'r gwaith o adeiladu'r twneli (o fynediad dŵr daear) yn cael ei gasglu mewn swmpau ac yn cael ei bwmpio i bwyntiau dal dŵr ym mhorth y twnnel lle caiff ei fonitro, ei addasu o ran pH, os bydd angen, a'i drin mewn system trin gwaddodion (bydd y dŵr yn cael ei bwmpio i'r system trin agosaf). Gan ddibynnu ar y system trin a fydd yn derbyn, bydd y dŵr wedi'i glirio'n cael ei ryddhau i'r môr drwy bwynt gollwng WCD2 neu WP3 a/neu WP2.

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3.6 Dŵr wyneb ffo o'r ardal o amgylch yr offer gwneud concrit

22. Yn ystod y cyfnod adeiladu bydd concrit yn cael ei gynhyrchu mewn offer gwneud concrit ar y safle. Bydd yr offer gwneud concrit yn cynhyrchu dwy ffrwd dŵr gwastraff:

- Dŵr proses, a fydd yn cael ei greu fel rhan o'r broses o gynhyrchu concrit ac o olchi cerbydau cymysgwr concrit; a,
- Dŵr ffo wyneb o'r ardal o'r ardal sydd o amgylch yr offer gwneud concrit.

23. Bydd yr holl ddŵr proses a fydd yn cael ei ddefnyddio yn yr offer gwneud concrit naill ai'n cael ei ailgylchu yn y system neu, pan fydd gormod, bydd yn cael ei gludo oddi ar y safle mewn tanceri i'w drin a'i waredu. Fydd dŵr proses ddim yn cael ei waredu ar y safle.

24. Bydd yr offer gwneud concrit a'r ardaloedd prosesu sydd yn union wrth ymyl yn cael eu gorchuddio â wyneb caled a fydd yn draenio glawiad i danciau casglu. Bydd dŵr o'r tanciau casglu yn cael ei ddefnyddio yn y broses cynhyrchu concrit ac ni fydd yn cael ei ollwng i'r system draenio dŵr wyneb.

25. Bydd y dŵr ffo o'r ardal sydd o amgylch yr offer gwneud concrit (y tu allan i'r ardal prosesu) yn cael ei gasglu, ei gadw mewn pyllau ac yn cael ei brofi am pH. Bydd yn cael ei drin pan fydd angen cyn cael ei ryddhau i system draenio dŵr wyneb y prif safle. Bydd y dŵr ffo yn cael ei lwybro i system trin gwaddod ac o fan honno caiff ei ollwng i'r amgylchedd morol (gweler Adran 3.2).

3.7 Gollyngiadau o olchi olwynion cerbydau

26. Bydd olwynion cerbydau'n cael eu golchi mewn ardaloedd penodol a bydd y dŵr golchi'n cael ei ailddosbarthu, i'r graddau sy'n rhesymol ymarferol. Bydd dŵr gwastraff o'r ardaloedd hyn yn cael ei gasglu a'i basio drwy drapiau silt a seiffonau olew, cyn cael ei ryddhau i system trin gwaddod. O fan honno bydd yn cael ei ollwng i'r amgylchedd morol (gweler Adran 3.2).

3.8 Gollyngiadau elifion wedi'u trin o waith trin dŵr gwastraff y safle adeiladu

27. Amcangyfrifir yn ystod y cam adeiladu y bydd y prif safle adeiladu yn cynnwys uchafswm o 9,000 o weithwyr a fydd yn cyrraedd ei anterth yn 2023/24. Nes i nifer y personél ar y safle gyrraedd tua 350, bydd y sgil-gynhyrchion carthion yn cael eu cludo i ffwrdd mewn tanceri a'u trin mewn cyfleuster allanol. Ar ôl mynd dros y nifer yma, bydd carthion y safle adeiladu yn cael eu trin yng Ngwaith Trin Dŵr Gwastraff y Safle Adeiladu, a bydd yr elifion a fydd wedi cael eu trin yn cael eu gollwng i'r amgylchedd morol drwy bibell gollwng gwasgaru a fydd ym mhen y morglawdd gorllewinol (pwynt gollwng WS1).

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4 Nodweddion y gollyngiadau

28. Mae nodweddion yr elifion a fydd yn deillio o'r gweithgareddau sy'n cael eu disgrifio uchod yn cael eu crynhoi yn Nhabl 4-1.

Tabl 4-1 Nodweddion yr elifion

Ffynhonnell	Cyfeirnod Gollwng	Halogyddion a Allai fod yn Bresennol yn y Gollyngiadau
Draenio dŵr wyneb	WA1–WE2	• Cyfanswm Solidau mewn Daliant; • Cyfansoddion organig ac anorganig, a metelau a fydd wedi trwytholchi o'r pridd; • Maetholion (nitradau a ffosffadau) sy'n bresennol o ddefnydd blaenorol y tir fel porfa amaethyddol; a • Polyelectrolyt gweddilliol o weithredu'r systemau trin gwaddod.
Gwaith cloddio dwfn + dŵr ffo wyneb llwyfannau adeiladu + dŵr ffô offer gwneud concrit + golchi olwynion cerbydau + twneli	WP1/2/3	• Cyfanswm Solidau mewn Daliant; • Cyfansoddion organig ac anorganig, maetholion a metelau a fydd wedi trwytholchi o'r pridd; • Llygryddion yn bresennol yn nŵr daear y safle; a, • Mwy o pH o ddŵr ffo concrit.
Argae Coffr Bwnd	WCD1	• Cyfanswm Solidau mewn Daliant; • Llygryddion yn bresennol yn nŵr daear y safle; a, • Mwy o pH o ddŵr ffo concrit.
Argae Coffr y Strwythur Gollwng + twneli	WCD2	• Cyfanswm Solidau mewn Daliant; a, • Mwy o pH o ddŵr ffo concrit.
Gwaith Trin Dŵr Gwastraff y Safle Adeiladu	WS1	• Cyfansoddion nitrogen; • Maetholion; • Y galw am ocsigen biocemegol (BOD); • Y galw am ocsigen cemegol (COD); • Cyfanswm Solidau mewn Daliant; a, • *Escherichia coli* ac *Enterococci* coluddol.

5 Asesiad o'r risg amgylcheddol

29. Cafodd asesiadau risg amgylcheddol eu gwneud o'r gollyngiadau canlynol sy'n gysylltiedig â gweithgareddau gollwng dŵr y Cam Adeiladu.

- Dŵr daear a dŵr wyneb halogedig a fydd yn cael ei ollwng i gyrsiau dŵr wyneb yn Ardal Datblygu Wylfa Newydd ac i'r amgylchedd morol;
- Gollyngiadau cyfanswm solidau mewn daliant i ddŵr wyneb ac i'r amgylchedd morol;

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- Gollyngiadau carthion wedi'u trin i'r môr mewn perthynas â chyfansoddion nitrogen, organebau dangosydd ymgarthol[5], maetholion, a'r galw am ocsigen biolegol a chemegol; a,
- Gollyngiadau i ddraeniau Tre'r Gof a'u heffaith bosibl ar Safle o Ddiddordeb Gwyddonol Arbennig (SoDdGA) Tre'r Gof.

30. Cafodd asesiadau hefyd eu cynnal o effeithiau posibl gollyngiadau dwr ar gyrff dŵr y Gyfarwyddeb Fframwaith Dŵr yn agos at Ardal Datblygu Wylfa Newydd a Safleoedd Dynodedig Ewropeaidd a ddaw o dan yr Asesiad Rheoliadau Cynefinoedd. Caiff prif ganfyddiadau'r holl asesiadau hyn eu cyflwyno isod.

5.1 Gollyngiadau dŵr daear a dŵr wyneb (heb gynnwys cyfanswm solidau mewn daliant)

31. Cafodd asesiad ei gynnal o'r risg amgylcheddol a oedd ynghlwm wrth ollwng dŵr daear a dŵr wyneb i gyrsiau dŵr Ardal Datblygu Wylfa Newydd ac i'r môr. Roedd hyn yn cynnwys asesiad sgrinio (H1) gan ddefnyddio arweiniad Asiantaeth yr Amgylchedd ar "Asesiad risg llygredd dŵr wyneb ar gyfer eich trwydded amgylcheddol", a mwy o waith modelu manwl am lygryddion a allai fod yn sylweddol er mwyn canfod beth fyddai'r effeithiau tebygol ar gyrsiau dŵr wyneb ac ar yr amgylchedd morol. Yn y naill achos a'r llall cafodd y gwerthusiad o'r effaith amgylcheddol ei wneud gan gyfeirio at Safonau Ansawdd Amgylcheddol tymor hir (Cyfartaledd Blynyddol) a thymor byr (Crynodiad Blynyddol Uchaf).

32. Roedd effeithiau'r halogyddion sydd ar hyn o bryd yn nŵr daear ac ym mhridd Ardal Datblygu Wylfa Newydd yn seiliedig ar ddadansoddiad o sampl o ddŵr daear ac, yn achos y priddoedd, profion trwytholch. Wrth ystyried yr achos gwaethaf tybiwyd na fydd y crynodiadau o halogyddion a bennwyd gan y profion trwytholch yn newid gyda chyfraddau glawiad nac yn gostwng dros amser.

5.1.1 Gollyngiadau i gyrsiau dŵr wyneb

33. Ar gyfer gollyngiadau o system draenio Ardal Datblygu Wylfa Newydd i gyrsiau dŵr wyneb – hy ar gyfer pwyntiau gollwng WA1 i WE2 ond heb gynnwys WA2 (sy'n gollwng yn syth i'r môr) – roedd canlyniad y gwaith modelu ac asesu fel y ganlyn:

- Ar gyfer y mwyafrif o'r gollyngiadau a'r halogyddion, nid ydy'r crynodiad yn y gollyngiadau yn golygu mynd dros y Safonau Ansawdd Amgylcheddol;
- Yr eithriad i hyn ydy orthoffosffad, lle'r eir dros y Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol yn yr holl ddŵr sy'n derbyn, a phlwm toddedig, lle mae'r gollyngiadau o WB1 yn achosi'r crynodiad 95^{fed} canradd a ddisgwylir yn y cwrs dŵr (draeniau Tre'r Gof) i fynd dros y Safon Ansawdd Amgylcheddol Crynodiad Blynyddol Uchaf tymor byr;
- Mae nifer o ollyngiadau, er nad ydynt yn achosi mynd dros Safonau Ansawdd Amgylcheddol Cyfartaledd Blynyddol, sydd yn dirywio ansawdd y dŵr mwy na'r cefndir a 10% o'r Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol. Dyma'r gollyngiadau dan sylw:

[5] Mae organebau dangosydd ymgarthol – E.coli ac Enterococci coluddol – yn bresennol yn ysgarthion anifeiliaid gwaed cynnes. Mae modd eu dangos fel dangosydd o ansawdd glanweithdra dŵr.

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- WA1 ar gyfer plwm bio-argael;
- WB1 (sydd yn y pen draw yn gollwng drwy SoDdGA Tre'r Gof[6]) ar gyfer copr bio-argael, haearn, plwm a pholyelectrolyt anionig gweddilliol; a,
- WC1 (Nant Caerdegog Isaf) a phwyntiau gollwng dilynol i Afon Cafnan ar gyfer plwm bio-argael.

- Byddai gollyngiadau o WB1, WC1, a WA3 hefyd yn achosi cynnydd mewn crynodiadau plwm toddedig o fwy na 10% o'r Safon Ansawdd Amgylcheddol Crynodiad Blynyddol Uchaf.

34. Yn achos orthoffosffad, disgwylir mynd dros y Safon Ansawdd Amgylcheddol oherwydd cyfuniad o'r crynodiadau uchel yn y cefndir o'r llygrydd hwn yn y cyrsiau dŵr a fydd yn derbyn – a fesurir rhwng 62 a 83 µg/l (mewn nifer o achosion mae'r crynodiad i fyny'r afon eisoes yn uwch na'r Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol [78 µg/l]) – a'r crynodiad uchel yn y trwytholch (133 µg/l).

35. Mae Horizon yn ystyried bod y prawf trwytholch yn debyg o oramcangyfrif crynodiadau ffosffad yn y dŵr ffo wyneb. Felly, hyd yn oed pan na fydd y lefelau ffosffad ym mhriddoedd wyneb Ardal Datblygu Wylfa Newydd yn newid yn ystod y gweithgareddau adeiladu, credir na fyddai dŵr ffo yn newid yr amodau cyfredol yn sylweddol yn y cyrsiau dŵr wyneb. Fodd bynnag, y cynllun ar hyn o bryd ydy symud anifeiliaid pori o Ardal Datblygu Wylfa Newydd am o leiaf flwyddyn cyn dechrau'r gweithgareddau adeiladu. Bydd hyn yn arwain at ostyngiad sylweddol yn y defnydd o unrhyw wrtaith a phresenoldeb tail yn yr ardal. Bydd y ffosffadau hynny sy'n bresennol yn dal i gael eu golchi i gyrsiau dŵr wyneb ac allan i'r môr; heb eu disodli, bydd crynodiadau ar briddoedd wyneb ac yn y cyrsiau dŵr yn dechrau disgyn yn naturiol. Am y naill reswm a'r llall credir, pan fydd disgwyl i'r gwaith adeiladu ddechrau, na fyddai'r gweithgareddau gollwng dŵr yn torri'r Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol ar gyfer othoffosffad dŵr croyw.

36. O ran y plwm toddedig, mae modd priodoli mynd dros y Safon Ansawdd Amgylcheddol Crynodiad Blynyddol Uchaf ar gyfer y gollyngiad WB1, wrth gymharu â phwyntiau eraill yn system draenio Ardal Datblygu Wylfa Newydd i gyfradd llif isel iawn y cwrs dŵr sy'n derbyn.

37. Ar ben hynny, ystyrir ei fod yn asesiad rhy besimistaidd, oherwydd amcangyfrifwyd y byddai'r crynodiad cymedr o blwm toddedig yn y dŵr ffo wyneb yn 6.5 µg/l, ar sail canlyniadau'r prawf trwytholch. Mae'r crynodiad yma tua hanner Crynodiad Blynyddol Uchaf dŵr croyw sef 14 µg/l. Mae'r crynodiad o blwm toddedig yng nghyrsiau dŵr Ardal Datblygu Wylfa Newydd wedi cael ei fesur rhwng 1.27 a 1.39 µg/l. Mae'r rhagori ymddangosiadol ar y Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol oherwydd nifer bach o ganlyniadau prawf trwytholch (y chwe gwerth crynodiad plwm toddedig uchaf a fesurwyd oedd 22, 29, 35, 42, 44 a 59 µg/l). Fodd bynnag, nid ydy'r dadansoddiad hwn yn ystyried y cymysgu a fydd yn digwydd yn Ardal Datblygu Wylfa Newydd – cymysgu priddoedd wrth iddyn nhw gael eu symud o amgylch y safle, cymysgu dŵr glaw wrth iddo redeg oddi ar bridd wyneb, a chymysgu dŵr wrth iddo gasglu mewn pyllau setlo – a fydd yn gwneud i grynodiad plwm toddedig mewn dŵr ffo wyneb wyro at y gwerth cymedr.

38. O ran yr asesiadau o ddirywiad yn ansawdd y dŵr, credir ei bod hi'n debygol bod y rhain yn rhy besimistaidd hefyd oherwydd:

[6] Yn achos gollyngiadau WB1 dylid nodi bod disgwyl i'r gollyngiadau basio drwy sianeli draenio yn SoDdGA Tre'r Gof gan ryngweithio prin dim â'r gors.

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- Goramcangyfrif o grynodiadau llygrydd fel y pennir gan y profion trwytholch; ac,
- Y dybiaeth achos gwaethaf fod crynodiadau trwytholch yn gyson ac yn annibynnol ar gyfraddau dŵr ffo wyneb. Mewn gwirionedd, y bydd crynodiadau'r llygryddion yn is pan fydd glawiad uchod, a byddant yn lleihau'n naturiol dros amser wrth i lygryddion gael eu trwytholchi allan o briddoedd wyneb ac ailblannu'r twmpathau i atal dŵr ffo.

39. Sylwir hefyd bod y gofyniad i beidio ag achosi cynnydd mewn lefelau llygryddion cefndirol o fwy na 10% o'r Safon Ansawdd Amgylcheddol yn ffordd o ddarparu "clustog" ar gyfer unrhyw ollyngiadau pellach i lawr yr afon yn y dalgylch. Fodd bynnag, bydd gollyngiadau Ardal Datblygu Wylfa Newydd yn digwydd ar ddiwedd y dalgylchoedd dŵr, ac ni fydd dim gollyngiadau pellach i lawr yr afon a allai ddylanwadu ar gydymffurfiad â Safonau Ansawdd Amgylcheddol.

40. Mae'r casgliadau uchod yn pwyso, yn rhannol, ar y dybiaeth fod y profion trwytholch yn amcangyfrifon rhy geidwadol o lefelau halogiad y dŵr ffo wyneb. Er mwyn ymchwilio i'r mater hwn yn well bydd Horizon yn cynnal dau ddarn arall o waith, a bydd y ddau yn cael eu cwblhau yn ystod y cyfnod a ddefnyddir i benderfynu ar y Cais ac yn cael eu rhoi i Gyfoeth Naturiol Cymru:

- Bydd samplau dŵr yn cael eu cymryd i fyny ac i lawr oddi wrth y dyfeisiau rheoli gwaddod sy'n cael eu defnyddio ar y safle ar hyn o bryd ac yn cael eu dadansoddi i weld beth ydy crynodiadau go iawn yr halogyddion yn y dŵr ffo. Bydd y dadansoddiad o'r asesiad o'r effaith yn cael ei ddiweddaru ar sail y data yma; a,
- Bydd samplau o briddoedd wyneb o Ardal Datblygu Wylfa Newydd yn cael profion trwytholch droeon i sefydlu cromliniau dadfeiliad trwytholch. Bydd hyn yn rhoi arwydd o grynodiadau trwytholch dros amser.

41. Ac ystyried y ffactorau a amlinellir uchod, a'r gwaith ychwanegol sy'n cael ei gynnig i gael dealltwriaeth well o lefel ceidwadaeth y gwerthoedd sydd wedi cael eu defnyddio yn y gwaith modelu ac asesu, mae Horizon yn credu na fydd y gollyngiadau dŵr sy'n codi o weithgareddau'r Cam Adeiladu ar lefelau a fyddai'n arwain at fynd dros y Safonau Ansawdd Amgylcheddol dŵr croyw yn y cyrsiau dŵr sy'n derbyn.

5.1.2 Gollyngiadau i ddŵr morol

42. Cafodd model Delft3d Horizon ei redeg er mwyn deall sut byddai'r gollyngiadau dŵr daear a dŵr wyneb yn gwasgaru ac yn gwanedu wrth ymuno â'r amgylchedd morol yn y pwyntiau gollwng morol yn Ardal Datblygu Wylfa Newydd. Cafodd y model ei redeg am un cylch llanw isel gwanwyn cyfan a chafodd ei ddefnyddio i ragweld y crynodiadau uchaf tymor byr a thymor hir yn yr amgylchedd morol, lle'r oedd y crynodiadau tymor hir yn gysylltiedig â gollyngiadau cyfartaledd blynyddol, a'r crynodiadau tymor byr â stormydd 1 mewn 2 flynedd ac 1 mewn 30 mlynedd.

43. Mae canlyniadau'r gwaith modelu morol yn dangos y canlynol:

- Ni eir dros Safonau Ansawdd Amgylcheddol Cyfartaledd Blynyddol;
- 2S (gollyngiadau draeniau Tre'r Gof i Fae Cemaes). Byddid yn mynd dros Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol plwm toddedig dros ardal o 0.16 a Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol copr toddedig dros 0.11 ha; a,
- 3S (gollyngiadau Afon Cafnan i Borth-y-pistyll). Byddid yn mynd dros Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol plwm toddedig dros ardal o 0.33 ha.

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44. Er y disgwylir mynd dros Safon Ansawdd Amgylcheddol cyfartaledd blynyddol plwm a chopr o 2S a 3S, mae'r crynodiadau cyfartalog uchaf (a gofnodir fel gwerth ar gyfer unrhyw gell sy'n cael ei modelu) yn dal yn gymharol isel, a ddim ond yn ymestyn dros barthau cymysgu bach. Felly ni ystyrir y bydd y gollyngiadau i'r amgylchedd morol yn arwain at unrhyw effeithiau amgylcheddol sylweddol.

45. Yn ymarferol, mae'n annhebygol iawn y byddai gollyngiadau go iawn yn arwain at fynd dros y Safonau Ansawdd Amgylcheddol plwm a chopr dros yr ardaloedd a ragwelir gan y model, oherwydd:

- Mae'r cyfraddau gollwng llygryddion yn gynnyrch i lifoedd dŵr a'r crynodiadau o'r profion trwytholch. Fel y nodwyd yn gynharach mae'r prawf trwytholch yn debygol o fod wedi goramcangyfri'r crynodiadau;
- Mae hi'n annhebygol iawn na fydd crynodiadau'r llygryddion yn y trwytholch ddim yn newid dros gyfnod o flwyddyn. Byddent yn disgyn yn naturiol dros amser wrth i ddeunyddiau symudol gael eu golchi o briddoedd wyneb, a llystyfiant y twmpathau'n gweithredu i atal gwaddod yn y dŵr ffo; a,
- Mae'r gwaith modelu morol yn tybio amodau heb wynt ac felly heb donnau; ni fyddai'r amodau hyn yn digwydd dros gyfran sylweddol o unrhyw flwyddyn, ac mae hyn yn golygu bod canlyniadau'r gwaith modelu yn geidwadol, gan fod gwynt a thonnau'n debygol o helpu'r cymysgu a'r gwasgaru.

5.2 Gollyngiadau Cyfanswm Solidau mewn Daliant

46. Roedd yr asesiad o'r effaith amgylcheddol sy'n gysylltiedig â gollyngiadau cyfanswm solidau mewn daliant yn seiliedig ar y crynodiadau gollwng arfaethedig a roddir yn Nhabl 5-1.

Tabl 5-1 Crynodiadau Gollyngiadau Cyfanswm Solidau mewn Daliant Arfaethedig

Ffynhonnell	Crynodiadau Gollyngiadau Cyfanswm Solidau mewn Daliant (mg/l)
WS1	30
WA1, WA3, WD1, WD2 a WE2	40
WA2, WB1, WC1, WP1/2/3, WCD1, WCD2	70

5.2.1 Gollyngiadau i gyrsiau dŵr wyneb

47. Nid oes dim Safonau Ansawdd Amgylcheddol wedi'u sefydlu ar gyfer Cyfanswm Solidau mewn Daliant ar gyfer dŵr croyw, ac nid oes dim methodoleg wedi'i diffinio'n glir i'w dilyn i asesu effeithiau llwyth gwaddod ar gyrsiau dŵr sy'n derbyn. Yng ngoleuni'r ffaith hon mae system draenio dŵr wyneb Ardal Datblygu Wylfa Newydd wedi cael ei dylunio i gyflawni crynodiadau cyfanswm solidau mewn daliant – hy crynodiadau ar y pwynt rhyddhau o'r systemau trin gwaddod – sydd ym mhen isaf y gwerthoedd cefndirol sy'n cael eu mesur yng nghyrsiau dŵr Ardal Datblygu Wylfa Newydd. Caiff hyn ei ystyried gan Horizon fel y dull gweithredu mwyaf priodol er mwyn lleihau'r effeithiau ar y derbynyddion ecolegol i lawr

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yr afon, ansawdd y dŵr sy'n derbyn a threfn gwaddod. Mae gwaith yn parhau i ddarparu rhagor o ddata i gefnogi gosod terfynau gollwng cyfanswm solidau mewn daliant.

5.2.2 Gollyngiadau i ddŵr morol

48. Cafodd yr effeithiau posibl a oedd yn deillio o ryddhau cyfanswm solidau mewn daliant i'r amgylchedd model yn ystod y cam adeiladu eu modelu drwy ddefnyddio model Delft3d Horizon ar gyfer llifoedd cyfartaledd blynyddol, llifoedd 1 mewn 2 flynedd, ac ar gyfer storm 24 awr gan ddefnyddio llifoedd 1 mewn 30 mlynedd. Cafodd y gwaith modelu yma ei wneud dros gylch llanw isel gwanwyn.

49. Canfuwyd mai 4 mg/l oedd y crynodiad solidau mewn daliant uchaf a ragwelwyd uwch lefel yr amgylchedd ar ddiwedd y modelu gollwng blynyddol. Mewn cymhariaeth, mae'r Gyfarwyddeb Fframwaith Dŵr yn dosbarthu bod gan ddŵr clir gyfanswm crynodiad solidau mewn daliant o dan 10 mg/l. Cafodd crynodiadau solidau mewn daliant isel eu rhagweld gan y model dros yr ardal ehangach gan adlewyrchu'r fflwcs cymharol isel o silt o ollyngiadau'r draeniau ar lefelau uchel o wanedu yn y baeau ar y naill ochr a'r llall o Drwyn Wylfa.

50. Ystyrir mai'r crynodiadau wedi'u modelu ydy'r achos gwaethaf. Mae hyn oherwydd y defnyddiwyd data llif uchaf a data gollyngiadau cyfanswm solidau mewn daliant uchaf, ynghyd â'r tybiaethau bod pob gollyngiad yn barhaus dros gylch llanw isel gwanwyn, eu bod yn cael eu rhyddhau ar yr un pryd, ac nad oes dim llystyfiant ar y twmpathau yn Ardal Datblygu Wylfa Newydd. Hefyd, roedd y model wedi defnyddio amodau heb unrhyw wynt na thonnau, byddai'r naill a'r llall yn helpu gyda'r gwasgaru.

51. Ar ôl y digwyddiad storm 1 mewn 30 mlynedd mae cynnydd yng ngraddfa ardaloedd crynodiad solidau mewn daliant uwch wrth ymyl y pwyntiau gollwng, a'r crynodiad solidau mewn daliant uchaf (115 mg/l), er y bydd yr ail yn dal o fewn pen isaf un dosbarthiad tyrfedd y Gyfarwyddeb Fframwaith Dŵr (gyda'i gilydd mae'r ardal yn y dosbarthiad hwn yn 0.22 ha).

5.3 Gollwng elifion carthion wedi'u trin i'r môr

52. Cafodd asesiadau eu gwneud o'r risgiau amgylcheddol sy'n gysylltiedig â gollyngiadau carthion wedi'u trin i'r môr mewn perthynas â chyfansoddion nitrogen, organebau dangosydd ymgarthol, y galw am ocsigen biolegol a'r galw am ocsigen cemegol. Yn achos organebau dangosydd ymgarthol, ystyriwyd y gollyngiadau cyfun o Waith Trin Dŵr Gwastraff y Safle Adeiladu a'r Gwaith Trin Dŵr Gwastraff pecyn a weithredir gan Dŵr Cymru.

53. Cafodd effeithiau posibl gollyngiadau o'r Gwaith Trin Dŵr Gwastraff o nitrogen amoniaidd, amonia heb ei ïoneiddio, a nitrogen anorganig toddedig eu gwerthuso drwy sgrinio yn erbyn y Safonau Ansawdd Amgylcheddol:

- 0.016 mg/l fel N ydy'r cyfraniad proses cyfartaledd blynyddol gwaethaf o nitrogen amoniaidd yn deillio o ollyngiadau o'r Gwaith Trin Dŵr Gwastraff ym mhwynt WS1 ar ôl y gwanedu cychwynnol cyfartalog. Felly caiff y Safon Ansawdd Amgylcheddol Cyfartaledd Blynyddol a argymhellir ar gyfer safleoedd y Gyfarwyddeb Cynefinoedd ei ddiwallu i raddau helaeth ar ôl y gwanedu cychwynnol;

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- Mae crynodiad yr amonia heb ei ïoneiddio ar ôl y gwanedu cychwynnol yn llai na 1.57 µg/l. Mae hyn yn gyfforddus o fewn y Safon Ansawdd Amgylcheddol ar gyfer dyfroedd arfordirol 21 µg/l; a,
- Y gollyngiadau sefyllfa waethaf o nitrogen anorganig toddedig o'r Gwaith Trin Dŵr Gwastraff ydy 0.025 mg/l fel N. Mae hyn yn cynrychioli 10% o'r Safon Ansawdd Amgylcheddol.

54. Roedd y gwaith modelu'n dangos y byddai'r elifion carthion wedi'u trin a fyddai'n cael eu rhyddhau i'r gogledd o Borth-y-pistyll yn cael eu gwasgaru'n gyflym. O dan y Gyfarwyddeb Dyfroedd Ymdrochi, er mwyn cael dosbarthiad da mae'n rhaid i'r crynodiad *enterococci* coluddol fod yn ddim mwy na 200 CFU (Unedau Ffurfio Cytref)/100 ml fel 95^{ain} canradd. Yn y sefyllfa waethaf, byddai'r crynodiad wedi'i fodelu o golifform ymgarthol sy'n cyrraedd y dŵr ymdrochi yng Nghemaes yn arwain at gynnydd mewn 29.3 CFU/100 ml (11.8 CFU/100ml o bwynt gollwng Gwaith Trin Dŵr Gwastraff y Safle Adeiladu a 17.5 CFU/100 ml o fan gollwng Gwaith Trin Dŵr Gwastraff Dŵr Cymru). Mae'r cyfraniad hwn yn debygol o ddigwydd yn anaml gan ei fod yn seiliedig ar ollwng parhaus wedi'i fodelu o 18.5 l/s, ond mewn gwirionedd byddai'r gollyngiadau'n digwydd mewn sypiau ac yn digwydd dim ond dros gyfnod o 12 neu 15 awr. Ar ben hynny, mae'r ychwanegiad bach ymhell o dan y crynodiad uchaf sydd ei angen i gyflawni dosbarthiad "da".

55. Caiff y galw am ocsigen biolegol a'r galw am ocsigen cemegol eu gollwng o'r Gwaith Trin Dŵr Gwastraff ar grynodiadau trin sy'n safonol yn y diwydiant i amgylcheddol morol deinamig iawn lle mae'r dŵr yn cymysgu ac yn ocsigenu'n dda. Ni ystyrir bod unrhyw effeithiau niweidiol yn debygol ar yr amgylchedd sy'n derbyn.

5.4 Yr Effaith ar SoDdGA Tre'r Gof

56. Mae SoDdGA Tre'r Gof mewn basn draenio bach 'mewndirol'. Cafodd ei ddynodi oherwydd ei ddiddordeb biolegol fel enghraifft gynrychioladol o gynefin corsiog cyfoethog yng ngogledd orllewin Cymru. Mae ansawdd y dŵr sy'n llifo i mewn yn un o'r amodau cefnogol hydrolegol allweddol ar gyfer y gwlyptir; yn ôl mynegai'r SoDdGA, mae nodweddion arbennig Tre'r Gof yn dibynnu ar fewnbwn dŵr sy'n gyfoethog o ran calsiwm ac yn dlawd o ran maetholion.

57. Mae pwynt gollwng WB1 tua 500 m i fyny'r afon o SoDdGA Tre'r Gof a bydd yn cynnwys draenio safle, a fydd yn llifo dros dir moel yn ystod y Cam Adeiladu, gan arwain at lwyth gwaddod uwch ac yn cynnwys maetholion a metelau wedi'u trwytholchi cysylltiedig. Mae asesiad o effaith y llif draenio hwn wedi dod i'r casgliad na fydd yr effeithiau'n sylweddol. Hefyd, nid ydy'r brif sianel sy'n llifo drwy SoDdGA Tre'r Gof yn rhyngweithio llawer â safle Tre'r Gof yn ehangach. Ni ddisgwylir unrhyw effeithiau sylweddol ar SoDdGA Tre'r Gof a fydd yn deillio o newidiadau i ansawdd dŵr yn ystod y cam adeiladu.

5.5 Cyfarwyddeb Fframwaith Dŵr

58. Cynhaliwyd Asesiad Cydymffurfiad Cyfarwyddeb Fframwaith Dŵr ar gyfer y Prosiect. Daeth i'r casgliad na fyddai'r gweithgareddau a ddaw o dan y Cais am Drwydded Amgylcheddol Gollyngiadau Dŵr Adeiladu yn dirywio cyrff dŵr y Gyfarwyddeb Fframwaith Dŵr ar sail nad yw dros dro, ac ni fyddai'n rhwystro cyrff dŵr y Gyfarwyddeb Fframwaith Dŵr rhag ennill Statws Ecolegol Da/Potensial Ecolegol Da.

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5.6 Asesiad Rheoliadau Cynefinoedd

59. Mae Asesiad Rheoliadau Cynefinoedd Cysgodol wedi cael ei gynnal i asesu effeithiau posibl adeiladu, gweithredu a datgomisiynu'r Prosiect cyfan ar Safleoedd Dynodedig Ewropeaidd. Mae'r safleoedd hyn yn cynnwys Ardaloedd Cadwraeth Arbennig, Ardaloedd Gwarchodaeth Arbennig a safleoedd sydd yn y broses o gael eu dynodi yn Ardaloedd Cadwraeth Arbennig ac yn Ardaloedd Gwarchodaeth Arbennig. Roedd yr asesiad yn cynnwys ystyried effeithiau gollyngiadau dŵr y Cam Adeiladu.

60. Canlyniad yr Asesiad Rheoliadau Cynefinoedd Cysgodol oedd na ddisgwylir Effaith Niweidiol ar Integriti oherwydd Gweithgareddau Gollwng Dŵr y Cam Adeiladu wrth ystyried y gweithgareddau hynny ar eu pen eu hunain neu ar y cyd â gweithgareddau Prosiect ehangach a chynlluniau a phrosiectau perthnasol eraill.

6 Trefniadau monitro

61. Bydd Horizon yn monitro ac yn samplo gollyngiadau dŵr er mwyn dangos ei fod yn cydymffurfio ag amodau a therfynau'r Drwydded Amgylcheddol Gollyngiadau Dŵr Adeiladu. Ni phenderfynwyd yn derfynol eto ar y technegau monitro/samplo arfaethedig a manylebau'r offer cyfatebol. Fodd bynnag, bydd y trefniadau'n cael eu datblygu yn unol ag arweiniad gan Gyfoeth Naturiol Cymru ac Asiantaeth yr Amgylchedd, a defnyddir technegau a dulliau monitro MCERTS pan fydd hynny'n briodol a phan fyddant ar gael.

7 Rheoli'r gweithgareddau gollwng dŵr

62. Mae hi'n debygol y bydd y gweithgareddau adeiladu, gan gynnwys y gweithgareddau gollwng dŵr a ddaw o dan y cais hwn, yn cael eu gwneud ar ran Horizon gan gontractwr fel Menter Newydd. Mae Menter Newydd yn fenter ar y cyd rhwng Hitachi Nuclear Energy Europe, Bechtel Management Company, a JGC Corporation (UK). Fodd bynnag, Horizon fydd yn dal i weithredu'r gollyngiadau dŵr ac yn atebol am gydymffurfio ag unrhyw amodau a roddir ar y cwmni.

8 Blaengynllun Gwaith

63. Mae Horizon wedi paratoi Blaengynllun Gwaith ar gyfer y Cais am Drwydded Amgylcheddol Gollyngiadau Dŵr Adeiladu. Mae hwn yn nodi rhagor o wybodaeth mae Horizon wedi ymrwymo i'w chynhyrchu a'i chyflwyno i Gyfoeth Naturiol Cymru yn ystod y cyfnod o benderfynu ar y cais a chyn dechrau ar y Cam Adeiladu, wrth i'r gwaith o ddylunio a rheoli gweithgareddau'r Cam Adeiladu ddatblygu.

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Os oes gennych chi unrhyw gwestiwn neu adborth ynghylch Prosiect Wylfa Newydd gallwch chi gysylltu â ni ar ein llinell gymorth radffôn Wylfa Newydd arbennig a'n cyfeiriad e-bost, drwy ffonio **0800 954 9516** neu e-bostio **ymholiadauwylfa@horizonnuclearpower.com**

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Wylfa Newydd Project

Water Discharge Activity – Environmental Permit Application Non-technical Summary

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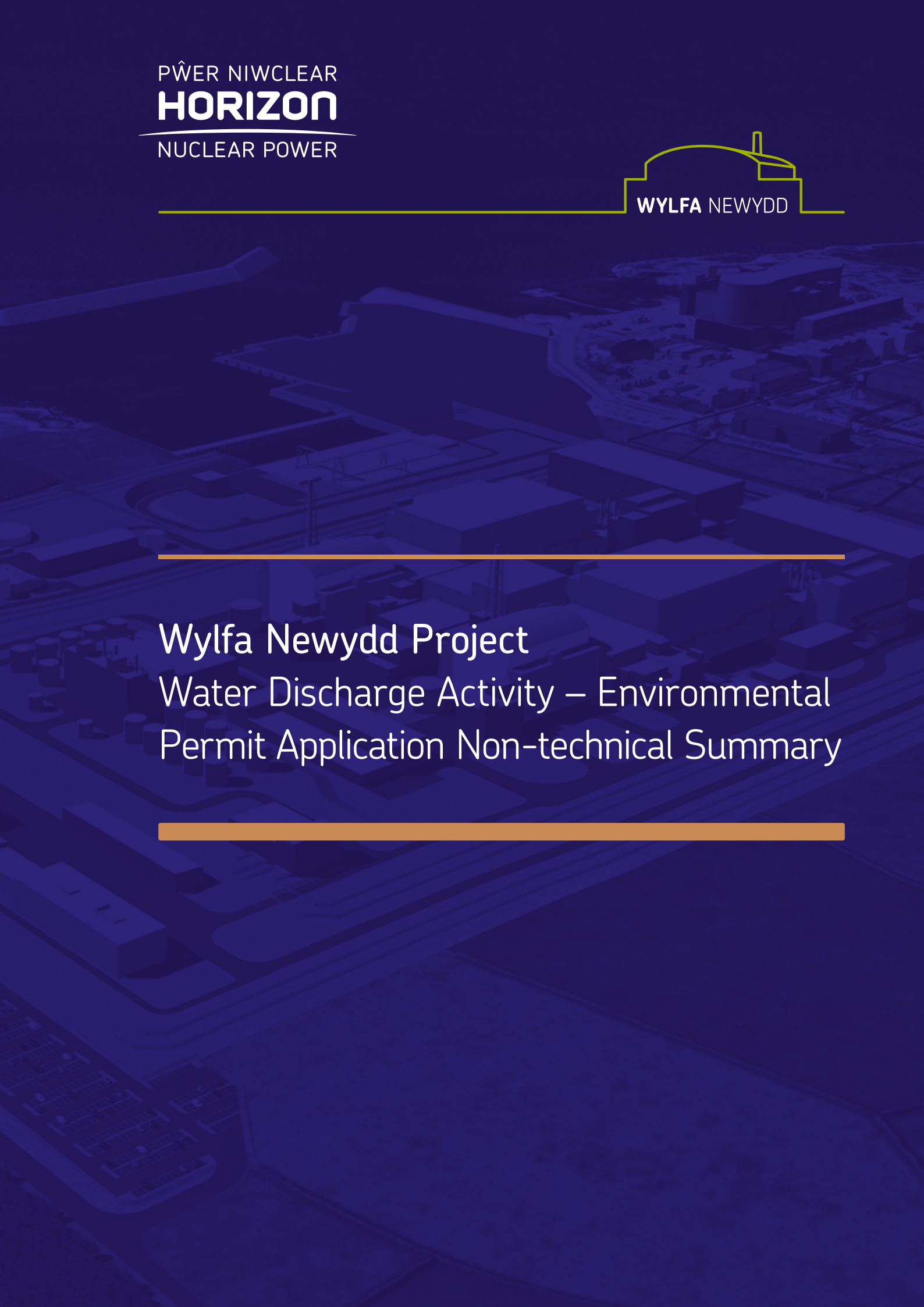

Wylfa Newydd Project

Water Discharge Activity – Environmental Permit Application Non-technical Summary

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1 Introduction

1.1 General introduction

1. Horizon Nuclear Power Wylfa Limited (Horizon) has applied to Natural Resources Wales (NRW) for an Environmental Permit (EP) to undertake "water discharge activities" during the construction of the Wylfa Newydd nuclear power station on the north coast of Anglesey.

2. The water discharge activities in question are the construction activities and construction site arrangements which will result in the discharge to the surface watercourses within the Wylfa Newydd Development Area[1] (WNDA) and adjacent coastal waters of trade effluent and treated sewage effluent (to coastal waters only). The activities include the following:

   - **WNDA surface water drainage** to local surface watercourses and sea;
   - **Discharge from the dewatering of deep excavations** to sea;
   - **Discharge from the dewatering of the Bund Cofferdam[2]** to sea;
   - **Discharge from the dewatering of the Outfall Cofferdam** to sea;
   - **Discharge from the dewatering of the Cooling Water Discharge Tunnels** to sea;
   - **Surface run-off from the area surrounding the concrete batching plant** to sea;
   - **Discharge from Vehicle Wheel Wash** to sea; and,
   - **Treated effluent discharge from the Construction Site WwTW** (Wastewater Treatment Works) to sea.

3. The trade effluent is principally rainwater falling on the site, along with smaller volumes of groundwater and sea water which will infiltrate, and will consequently be pumped out of construction areas. The waters will contain suspended solids, and contaminants currently present in the soil and groundwater on the WNDA.

4. The Construction Water Discharge (CWD) EP, once granted by NRW, will allow the release of the discharges to the environment subject to treatment, control, and compliance with permit conditions.

1.2 Summary of the Wylfa Newydd Project

5. Horizon is planning to construct and operate a Power Station on the island of Anglesey. The Power Station will have two UK Advanced Boiling Water Reactors (ABWRs) and will be capable of generating a nominal 3.1 gigawatts of electricity over a planned operational life of 60 years.

6. Principal construction activities will start after the major permissions required to build the Power Station have been granted. Once construction of the first reactor has reached an advanced stage, it will be commissioned (expected to last two years) to ensure all systems

[1] The Wylfa Newydd Development Area is the area of land and sea, including the Power Station site, that will be used for the construction and operation of the Power Station. This represents the maximum area that would be physically affected by Power Station main construction activities. The WNDA is shown in Figure 2-2.

[2] A cofferdam is a temporary wall constructed within a body of water – in this case the sea – to enable the resulting enclosure to be pumped dry, thereby permitting construction activity to proceed on the sea floor. Once the construction is complete the enclosed area can be reflooded and the cofferdam removed.

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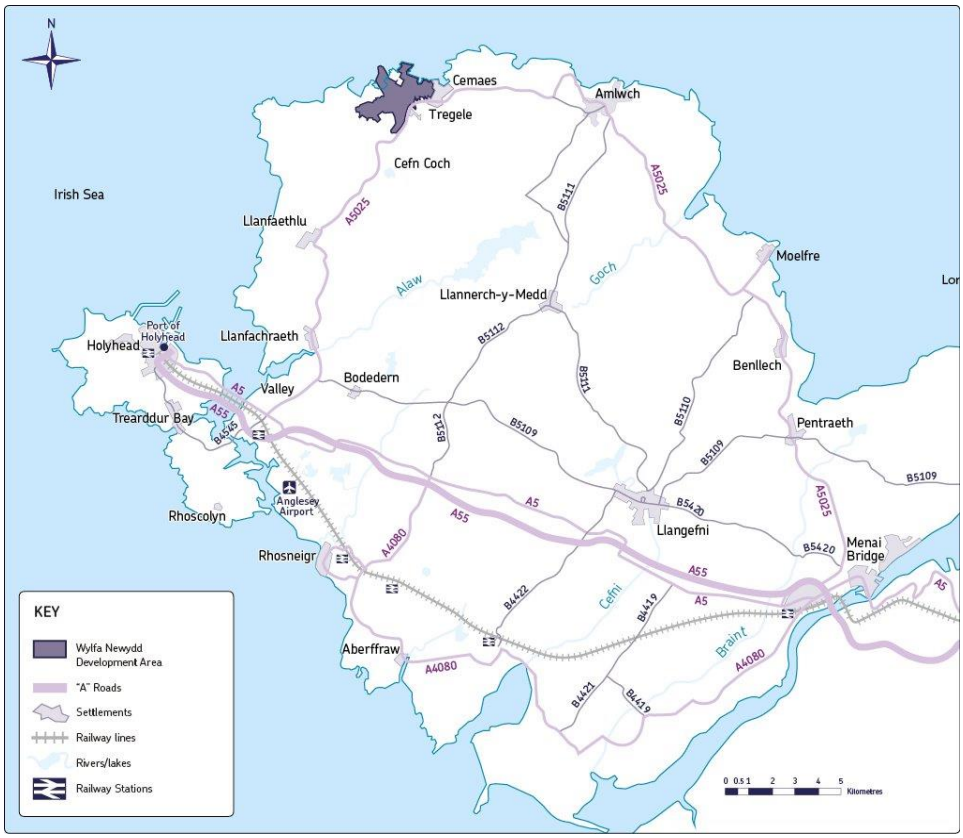
and processes operate as intended. The first reactor will then become operational. This will be followed by the second reactor approximately sixteen months later.

2 The Power Station and site setting

2.1 Power Station location

7. The Power Station will be developed on the island of Anglesey to the west of the village of Cemaes and south of the Existing Power Station (see Figure 2-1).

Figure 2-1 Location of Wylfa Newydd Development Area



2.2 Wylfa Newydd Development Area

8. The WNDA is shown in Figure 2-2, along with the CWD-EP Regulated Facility Boundary. It is bounded to the north by the coast and the Existing Power Station. To the east, it is separated from Cemaes by a corridor of agricultural land. The A5025 and residential properties define part of the south-east boundary, with a small parcel of land spanning the road to the north-east of Tregele. To the south and west, the WNDA abuts agricultural land, and to the west it includes land behind Cemlyn Bay, where the WNDA includes part of the property known as Cestyll Garden. The size of the WNDA is about 407 ha.

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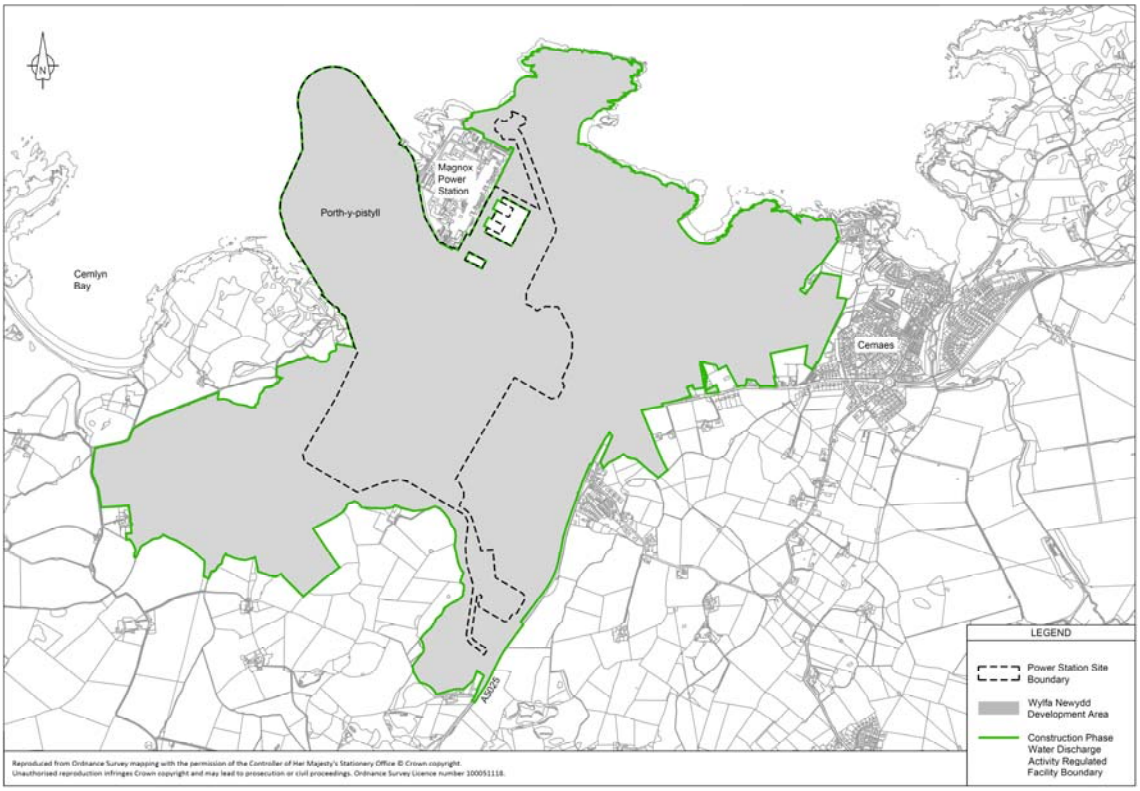
Figure 2-2 Wylfa Newydd Development Area



9. Land within and surrounding the WNDA is predominantly agricultural, used for grazing sheep or cattle. There are five existing surface water catchments and associated watercourses located within the WNDA, as listed in Table 2-1 and shown on Figure 3-3.

Table 2-1 WNDA water catchments

Catchment	Watercourse
Tre'r Gof	Tre'r Gof drains
Afon Cafnan	Afon Cafnan, Nant Caerdegog Isaf, and wetted ditches and field drains
Cemlyn	Nant Cemlyn and Nant Plas Cemlyn
Cemaes	Nant Cemaes
Power Station Catchment	Nant Porth-y-pistyll

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3 Overview of water discharge activities

10. The water discharge activities are described below. There are eight in total. For each activity, other than that of sewage treatment, the water will be collected and transferred through a treatment system designed to remove suspended solids. The clarified water will then be discharged either to surface watercourse within the WNDA (by which means it will flow naturally to sea), or direct to sea. The effluent from a number of the discharge activities will be routed through common treatment systems, as illustrated in Figure 3-1. The discharge points to the environment are shown in the schematic presented in Figure 3-2.

11. The sewage treatment is distinct from the other activities in that it is designed to treat domestic sewage and remove a number of different pollutants. The treatment system will discharge direct to sea.

3.1 WNDA surface water drainage

12. Earthworks undertaken during construction will give rise to around nine to ten million cubic metres (bulked) of excavated materials, some of which will be formed into mounds on site and covered with stripped top soil. There will ultimately be a total of five mounds within the WNDA (designated A to E) as illustrated in Figure 3-3.

13. Rainwater falling onto the soil mounds and the areas where vegetation and soil have been stripped will have the potential to pick up substances from within the soils, resulting in run-off containing elevated sediment and leached contaminants. Therefore, to control the run-off a Sustainable Drainage System (SuDS) will be installed to collect water from across the WNDA, including the mounds, and direct it into sediment treatment systems (settlement ponds and lamella clarifiers[3]). If required, polyelectrolyte[4] can be added in the lamella clarifiers to improve the settlement and removal of the incoming suspended solids.

14. Clarified water from the treatment systems will be discharged to local watercourses (Nant Caerdegog, Afon Cafnan, Nant Cemaes, and the Tre'r Gof drains), and in one case directly to the sea over a short section of land. The eight drainage water discharge points (labelled WA1 to WE2) and their associated treatment systems are shown in Figure 3-1.

3.2 Discharge from the dewatering of deep excavations

15. Parts of the main plant buildings are designed to be embedded in the ground, constructed on solid rock. There will thus be a requirement for deep excavations during construction to facilitate the installation of building foundations. In order to enable excavation below the groundwater table and control rainwater ingress, dewatering will be required. Water pumped from the excavations will be routed to two sediment treatment systems from where the clarified water will be discharged to sea. Within the drainage/treatment system provision will be made for pH correction, where required.

[3] A lamella clarifier is a vessel which contains a stack of inclined plates through which water is passed at low velocity. Solid particles present in the water settle onto the plates and are thereby removed from the flow. The solids accumulate in collection hoppers at the bottom of the vessel from where they are periodically removed.

[4] Polyelectrolytes are chemicals which cause dispersed solid particles to bind into larger aggregates which settle more readily out of the water stream. Their use thus increases the degree of water clarification.

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Figure 3-1 Schematic of discharge sources and discharge points

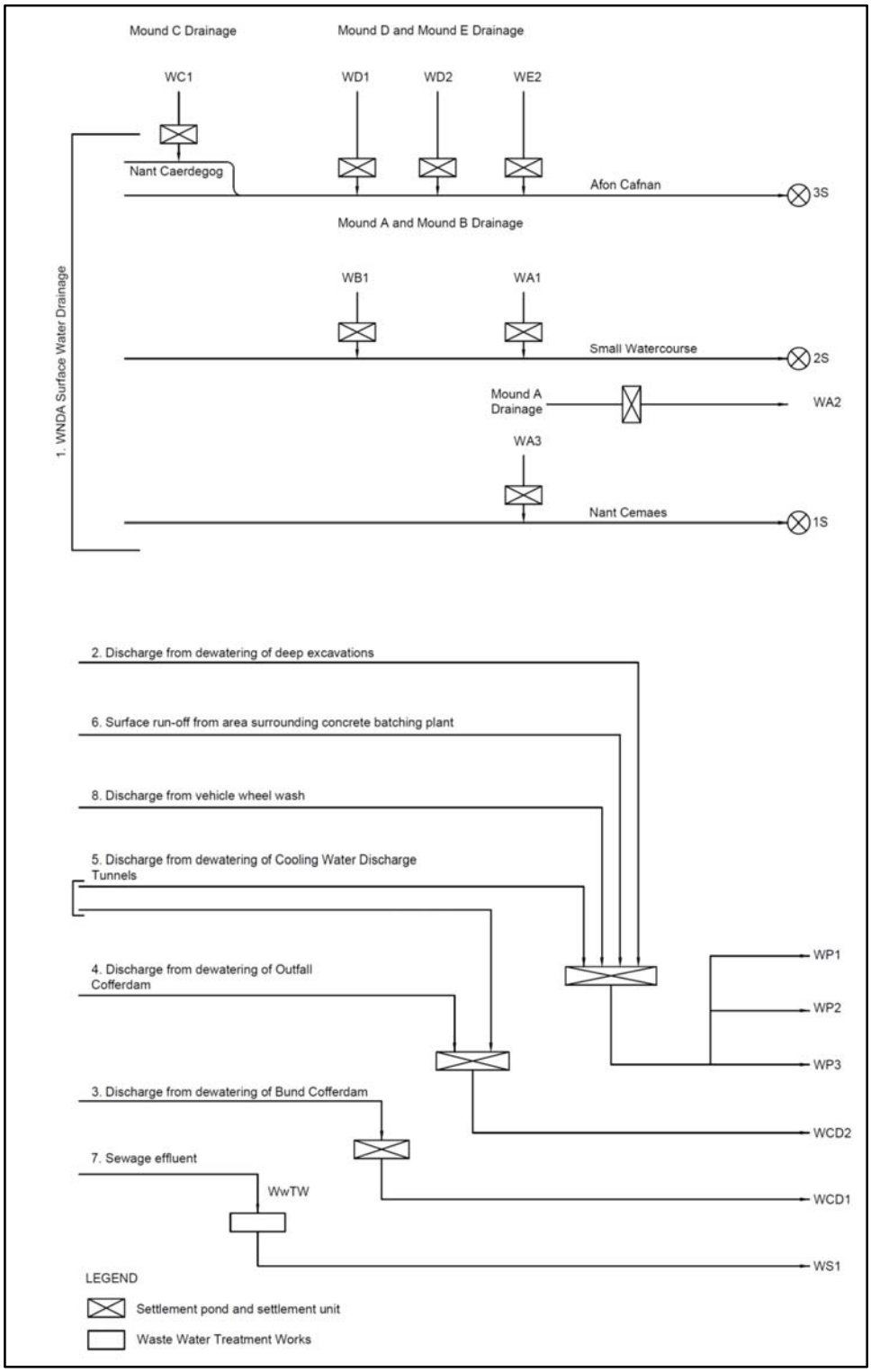

Figure 3-2 Water discharge points schematic

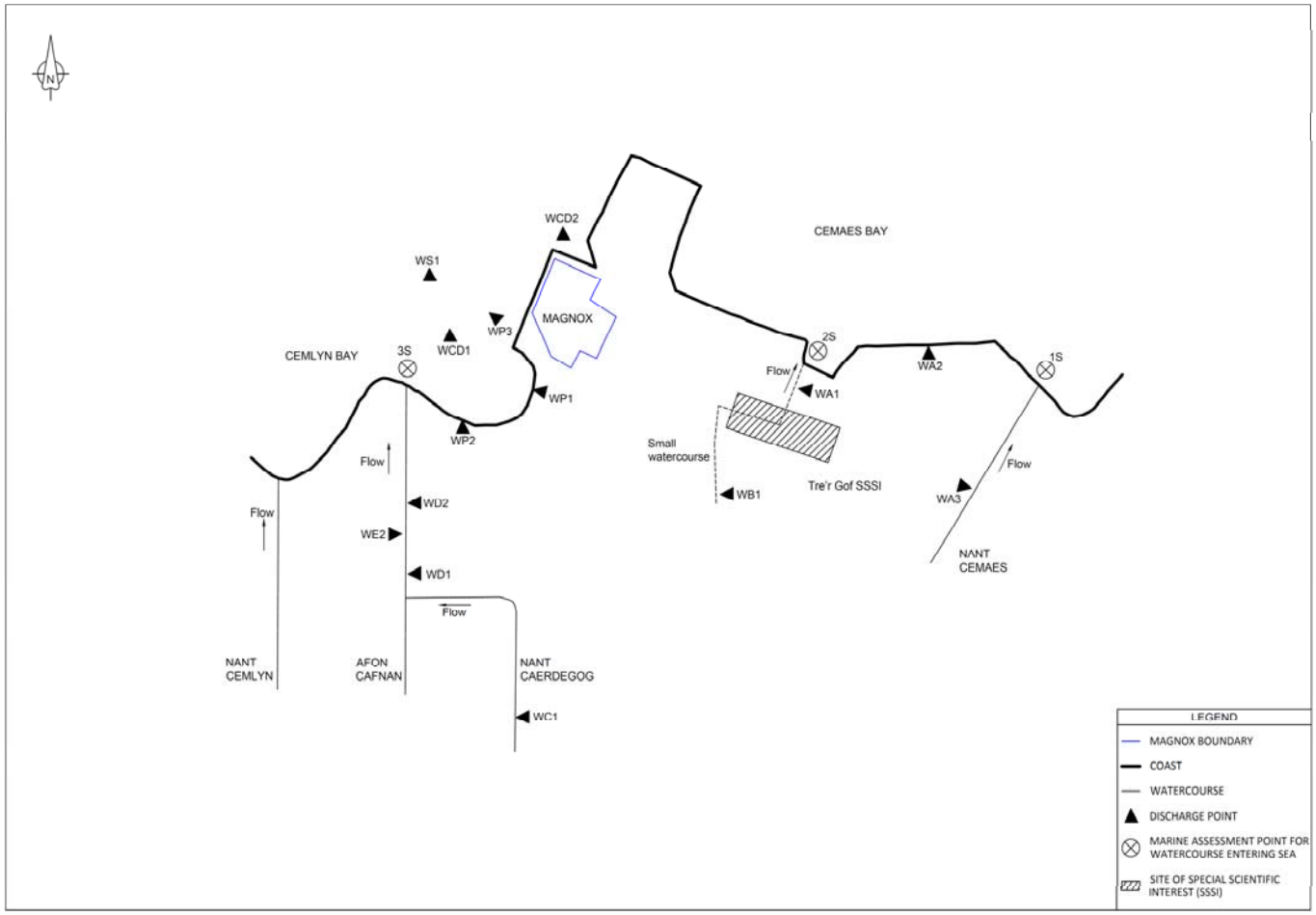

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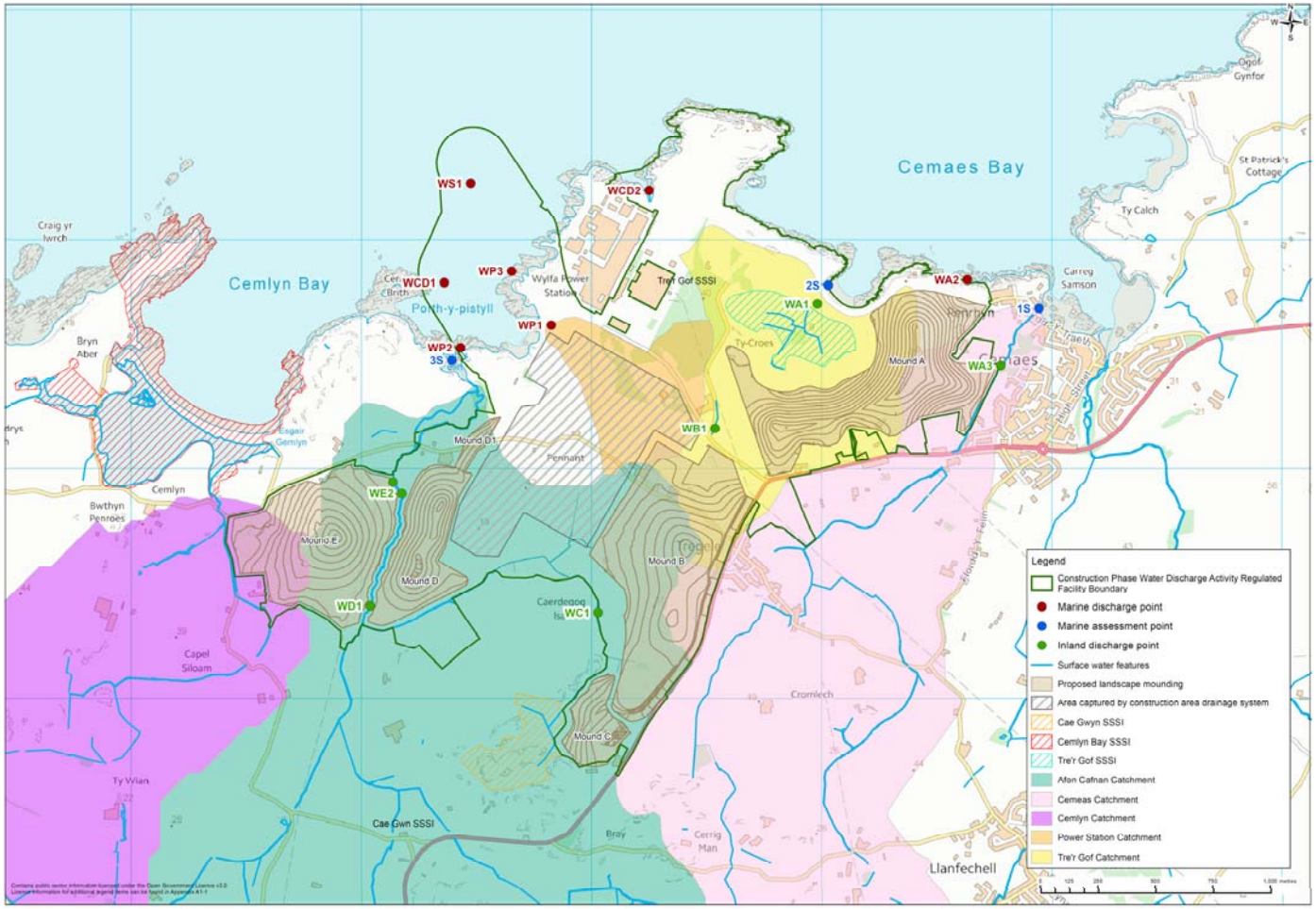
Figure 3-3 WNDA mounds



16. The two sediment treatment systems will also take water from three other water discharge activities, namely: i) Surface run-off from the area surrounding the concrete batching plant, ii) Discharge from vehicle wheel wash, and iii) Discharge from the dewatering of the Cooling Water Discharge Tunnels. This arrangement is illustrated in Figure 3-1.

17. Three discharge points (referred to as WP1, WP2 and WP3) will be employed over the period of the construction works. The use of these discharge points will vary depending on the sequence of construction and therefore may be subject to change. However, at this stage it is anticipated that discharge WP1 would be used initially (for approximately one year), with WP2 developed to allow marine works (dependent on the deep excavation sequence). WP3 would be the final discharge brought into use for the remainder of construction and would be retained as a permanent surface water drainage discharge point.

3.3 Discharge from the dewatering of the Bund Cofferdam

18. A temporary Bund Cofferdam will be constructed in Porth-y-pistyll to facilitate construction activities in that area. Once installed the area behind the cofferdam will be dewatered to create a dry working environment. Initially, the cofferdam will be dewatered direct to sea through drain pipes and valves installed within the cofferdam wall. However, during the end point of dewatering (as the sea floor is approached) and during on-going dewatering (to counter the ingress of seawater, groundwater and rainfall) the water will be treated to control levels of sediment prior to its discharge to sea via discharge point WCD1.

19. The suspended solids control arrangements for the Bund Cofferdam have not yet been finalized (it is proposed that the majority of the settlement will be carried out within the dewatered area behind the cofferdam). However, the discharge to sea will be compliant with EP discharge conditions.

3.4 Discharge from the dewatering of the Outfall Cofferdam

20. A temporary Outfall Cofferdam will be constructed across the area of the existing Magnox cooling water outfall. Dewatering arrangements will be as described above, with water treatment provided by a sediment treatment system. The treatment system will also receive water from the dewatering of the Cooling Water Discharge Tunnels described below. Discharge to sea will be via discharge point WCD2.

3.5 Discharge from the dewatering of the Cooling Water Discharge tunnels

21. Two Cooling Water Discharge tunnels will be excavated between the site of the proposed UK ABWR turbine buildings and the existing Magnox cooling water outfall. Water arising during tunnel construction (from groundwater ingress) will be collected in sumps and pumped to attenuation points located at either tunnel portal where it will be monitored, pH adjusted, if required, and treated in a sediment treatment system (the water will be pumped to the nearest treatment system). Depending on the receiving treatment system, the clarified water will be discharged to sea either via discharge point WCD2 or WP3 and/or WP2.

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3.6 Surface run-off from the area surrounding the concrete batching plant

22. During the construction period concrete will be produced in on-site concrete batching plants. The concrete batching plants will produce two wastewater streams:

- Process water, generated as part of the concrete production process and from concrete mixer vehicle wash-out; and,
- Surface water run-off from the area surrounding the batching plant.

23. All process water used in the concrete batching plant will be either recycled within the system or, where there is excess, tankered off site for treatment and disposal. There will be no on-site discharge of process water.

24. The concrete batching plant and the immediately surrounding process areas will be covered by hard surfacing which will drain rainfall to collection tanks. Water from the collection tanks will be used in the concrete production process and will not be discharged to surface water drainage system.

25. Run-off from the area surrounding the concrete batching plant (outside the processing area) will be collected, held in ponds and tested for pH. It will be treated where required before being released into the main site surface water drainage system. The run-off will be routed to a sediment treatment system from where it will be discharged to the marine environment (see Section 3.2).

3.7 Discharge from vehicle wheel wash

26. Vehicle wheel washing will take place in designated areas with the wash water recirculated, as far as reasonably practical. Waste water from these areas will be collected and passed through silt traps and oil interceptors, before discharge to a sediment treatment system. From there it will be discharged to the marine environment (see Section 3.2).

3.8 Treated effluent discharge from the construction site WwTW

27. It is estimated that during construction the main construction site will host up to a maximum of 9,000 personnel, peaking in 2023/24. Until the number of on-site personnel reaches around 350, sewage arisings will be removed by tanker and treated in an external facility. Above this number, the construction site sewage will be treated in the Construction Site WwTW, and the treated effluent discharged to the marine environment via a diffuser outfall pipe located at the end of the west breakwater (discharge point WS1).

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4 Discharge characteristics

28. The characteristics of the effluents resulting from the above described activities are summarised in Table 4-1.

Table 4-1 Effluent characteristics

Source	Discharge Ref.	Contaminants Potentially Present in Discharge
Surface water drainage	WA1 – WE2	• Total Suspended Solids (TSS); • Organic and inorganic compounds, and metals leached from the soil; • Nutrients (nitrates and phosphates) present as a result of the land's previous use for agricultural grazing; and, • Residual polyelectrolyte from the operation of the sediment treatment systems.
Deep excavations + construction platform surface water run-off + concrete batching plant run-off + vehicle wheel wash + tunnels	WP1/2/3	• TSS; • Organic and inorganic compounds, nutrients and metals leached from the soil; • Pollutants present within the site groundwater; and, • Elevated pH from concrete run-off.
Bund Cofferdam	WCD1	• TSS; • Pollutants present within the site groundwater; and, • Elevated pH from concrete run-off.
Outfall Cofferdam + tunnels	WCD2	• TSS; and, • Elevated pH from concrete run-off.
Construction Site WwTW	WS1	• Nitrogen compounds; • Nutrients; • Biochemical oxygen demand (BOD); • Chemical oxygen demand (COD); • TSS; and, • *Escherichia coli* & Intestinal *enterococci.*

5 Environmental risk assessment

29. Environmental risk assessments were made of the following discharges associated with the Construction Phase water discharge activities:

- Contaminated groundwaters and surface waters discharged to the surface watercourses within the WNDA, and to the marine environment;
- Total suspended solids discharges to surface waters and the marine environment;

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- Treated sewage discharges to sea in respect of nitrogen compounds, faecal indicator organisms (FIOs)[5], nutrients, and biological and chemical oxygen demand; and,
- Discharges into Tre'r Gof drains and their potential impact upon the Tre'r Gof Site of Special Scientific Interest (SSSI).

30. Assessments were also made of the potential effects of water discharges on Water Framework Directive water bodies in the vicinity of the WNDA, and European Designated Sites covered by the Habitats Regulations Assessment. The key findings of all of these assessments are given below.

5.1 Groundwater and surface water discharges (excluding TSS)

31. An assessment was made of the environmental risk associated with the discharge of groundwaters and surface waters to the WNDA watercourses and to sea. This included a screening (H1) assessment using the Environment Agency's guidance on "Surface water pollution risk assessment for your environmental permit", and further more detailed modelling for potentially significant pollutants to establish likely impacts on surface watercourses and the marine environment. In both cases the evaluation of environmental impact was made with reference to both long term (Annual Average – AA) and short term (Maximum Annual Concentration – MAC) Environmental Quality Standards (EQS).

32. The impacts of contaminants currently present in the WNDA groundwater and soils were based upon groundwater sample analysis and, in the case of the soils, leachate tests. As a worst case it was assumed that contaminant concentrations determined by the leachate tests do not change with rainfall rates or decrease over time.

5.1.1 Discharges to surface watercourses

33. For discharges from the WNDA drainage system to surface watercourses – i.e. for discharge points WA1 to WE2 but excluding WA2 (which discharges direct to sea) – the outcome of the modelling and assessment was as follows:

- For the majority of discharges and contaminants, the concentration in the discharge does not cause the EQS to be exceeded;
- The exceptions to this are orthophosphate, where the AA EQS is exceeded in all receiving waters, and dissolved lead, where the discharge from WB1 causes the predicted 95th percentile concentration in the watercourse (Tre'r Gof drains) to exceed the short term MAC EQS;
- A number of discharges, whilst not causing exceedances of AA EQSs, do cause a deterioration of water quality of greater than background plus 10% of the AA EQS. The discharges in question are:
  - WA1 for bioavailable lead;
  - WB1 (which ultimately discharges through Tre'r Gof SSSI[6]) for bioavailable copper, iron, lead and residual anionic polyelectrolyte; and,

[5] Faecal indicator organisms – E.coli and intestinal enterococci – are present in the faeces of warm-blooded animals. They can thus be used as an indicator of the sanitary quality of water.

[6] In the case of the WB1 discharge it should be noted that the discharges are expected to pass though drainage channels within the Tre'r Gof SSSI with minimal interaction with the fen.

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  - WC1 (Nant Caerdegog Isaf) and subsequent discharge points to the Afon Cafnan for bioavailable lead.
- Discharges from WB1, WC1, and WA3 would also cause an increase in dissolved lead concentrations of more than 10% of the MAC EQS.

34. In the case of orthophosphate, the predicted EQS exceedances are due to a combination of the high background concentrations of this pollutant in the receiving watercourses – measured at between 62 and 83 µg/l (in a number of cases the upstream concentration already exceeds the AA EQS [78 µg/l]) – and the high concentration within the leachate (133 µg/l).

35. Horizon considers that the leachate test is likely to overestimate phosphate concentrations in the surface run-off. So, even were phosphate levels in the WNDA surface soils to remain unchanged during construction activity, it is believed that run-off would not significantly alter present day conditions within the surface watercourses. However, the current plan is to remove grazing animals from the WNDA at least one year prior to the commencement of construction activities. This will result in a significant reduction in the use of any fertilizers and the presence of manure within the area. Those phosphates present will continue to be flushed into surface watercourses and out to sea; without their replacement, concentrations on surface soils and within watercourses will naturally begin to decline. For both of these reasons it is believed that, at the time when construction is due to commence, water discharge activities would not cause a breach of the freshwater orthophosphate AA EQS.

36. Regarding the dissolved lead, the exceedance of the MAC EQS for discharge WB1, compared with the other points in the WNDA drainage system, can be ascribed to the very low flow rate in the receiving watercourse.

37. In addition, it is considered to be an overly pessimistic assessment, as the mean concentration of dissolved lead within the surface water run-off has been estimated as 6.5 µg/l, based upon the leachate test results. This concentration is around half the freshwater MAC of 14 µg/l. The concentration of dissolved lead in the WNDA watercourses has been measured at between 1.27 and 1.39 µg/l. The apparent exceedance of the MAC EQS is due to a small number of leachate test results (the six highest dissolved lead concentration values measured were 22, 29, 35, 42, 44 and 59 µg/l). However, this analysis takes no account of the mixing which will occur within the WNDA – mixing of soils as they are moved around the site, mixing of rainwater as it runs of the surface soils, and mixing of water as it collects within the settlement ponds – which will cause the concentration of dissolved lead within surface water run-off to tend towards the mean value.

38. Regarding the assessments of water quality deterioration, it is thought likely that these too are overly pessimistic due to:

- Over-estimation of pollutant concentrations as determined by the leachate tests; and,
- The worst case assumption that leachate concentrations are constant and independent of surface water run-off rates. In reality, the pollutant concentrations will actually be lower in high rainfall events, and will naturally decrease over time as pollutants are leached out of the surface soils and revegetation of the mounds acts to impede run-off.

39. It is also observed that the requirement not to cause an increase in background pollutant levels of more than 10% of the EQS is a means by which "headroom" is given for any further discharges downstream in the catchment. However, the WNDA discharges will

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occur at the end of the water catchments, and there are no further discharges downstream which might influence compliance with EQSs.

40. The above conclusions rest, in part, on the assertion that the leachate tests provide an unduly conservative estimate of contaminant levels of surface run-off. In order to investigate this issue Horizon will undertake two pieces of further work, both of which will be completed during the Application's determination period and supplied to NRW:

- Water samples will be taken upstream and downstream of sediment control devices currently in use on site and analysed to determine actual contaminant concentrations within the run-off. The impact assessment analysis will be updated based upon these data; and,
- Samples of surface soils from within the WNDA will be subjected to repeated leachate tests to establish leachate decay curves. This will give an indication of leachate concentrations over time.

41. Given the factors outlined above, and the further work proposed to gain a better understanding of the level of conservatism in the values used in the modelling and assessment work, Horizon considers that water discharges arising from the Construction Phase activities will not be at levels that would result in exceedances of the freshwater EQSs in receiving watercourses.

5.1.2 Discharges to marine waters

42. Horizon's Delft3d model was run to understand how both the surface water and groundwater discharges would disperse and dilute upon entering the marine environment at the marine discharge points within the WNDA. The model was run for one complete spring-neap tidal cycle and was used to predict both long term and short term maximum concentrations in the marine environment, where the long term concentrations were associated with annual average discharges, and the short term concentrations with surface water flows arising during 1 in 2 year and 1 in 30 year storms.

43. The marine modelling results show the following:

- There are no exceedances of MAC EQSs;
- 2S (Tre'r Gof drains discharge to Cemaes Bay). The dissolved lead AA EQS would be exceeded over an area of 0.16 ha and the dissolved copper AA EQS over 0.11 ha; and,
- 3S (Afon Cafnan discharge to Porth-y-pistyll). The dissolved lead AA EQS would be exceeded over 0.33 ha.

44. Although there are predicted exceedances of lead and copper annual average EQS from 2S and 3S, the highest average concentrations (reported as the value for any modelled cell) are still relatively low, and only extend over small mixing zones. The discharges to the marine environment are therefore not considered to give rise to any significant environmental effects.

45. In practice, it is highly unlikely that actual discharges would result in exceedances of the lead and copper EQSs over the areas predicted by the model, as:

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- The pollutant discharge rates are the product of water flows and the concentrations derived from the leachate tests. As noted earlier the leachate test is likely to have overestimated the concentrations;
- It is highly unlikely that the concentrations of pollutants within the leachate will remain unchanged over a period of a year. They would naturally decline over time as mobile materials are flushed from the surface soils, and the vegetation of the mounds acts to prevent sediment run-off; and,
- The marine modelling assumes windless conditions with no waves; these conditions would not prevail for over a substantial portion of any year, and make the modelled results conservative, as wind and wave action are likely to aid mixing and dispersion.

5.2 Total Suspended Solids discharges

46. The assessment of environmental impact associated with TSS discharges was based upon the proposed discharge concentrations given in Table 5-1.

Table 5-1 Proposed TSS discharge concentrations

Source	TSS Discharge Concentration (mg/l)
WS1	30
WA1, WA3, WD1, WD2 & WE2	40
WA2, WB1, WC1, WP1/2/3, WCD1, WCD2	70

5.2.1 Discharges to surface watercourses

47. There is no established EQS for TSS for freshwaters, and no clearly defined methodology to follow in assessing the effects of sediment load on receiving watercourses. In light of this fact the WNDA surface water drainage system is being designed to achieve discharged TSS concentrations – i.e. concentrations at the point of discharge from the sediment treatment systems – which are at the lower end of background values measured within the WNDA watercourses. This is considered by Horizon to be the most appropriate approach to minimise effects on the downstream ecological receptors, receiving water quality and sediment regime. Work is on-going to provide further data to support the setting of TSS discharge limits.

5.2.2 Discharges to marine waters

48. The potential effects resulting from the release of TSS to the marine environment during construction were modelled using Horizon's Delft3d model for annual average flows, 1 in 2 year flows, and for a 24 hour storm event using 1 in 30 year flows. The modelling was carried out over a spring-neap tidal cycle.

49. It was found that the maximum predicted suspended solids concentration above ambient at the end of the annual discharge model simulation was 4 mg/l. By comparison, the Water Framework Directive classifies clear water as having a TSS concentration of below 10 mg/l. Low suspended solids concentrations were predicted by the model over the wider area

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reflecting the relatively low flux of silt from the drainage discharges and the high levels of dilution in the bays either side of Wylfa Head.

50. The modelled concentrations are considered to be worst case. This is due to the use of peak flow and peak TSS discharge data, along with the assumptions that all discharges are continuous over a spring-neap tidal cycle, are released simultaneously, and that there is no vegetation on the mounds within the WNDA. Also, the model simulated conditions with no wind or waves, both of which would aid dispersion.

51. After the 1 in 30 year storm event there is an increase in both the extent of areas of elevated suspended solids concentration adjacent to the discharge points, and the maximum suspended solids concentration (115 mg/l), although the latter is still within the extreme lower end of the WFD turbid classification (the area within this classification totals 0.22 ha).

5.3 Discharge of treated sewage effluent to sea

52. Assessments were made of the environmental risks associated with treated sewage discharges to sea in respect of nitrogen compounds, FIOs, nutrients, biological oxygen demand (BOD), and chemical oxygen demand (COD). In the case of FIOs consideration was given to the combined discharges from the Construction Site WwTW and the package WwTW operated by Dŵr Cymru Welsh Water (DCWW).

53. The potential impact of discharges from the WwTW of ammoniacal nitrogen, non-ionized ammonia, and dissolved inorganic nitrogen were evaluated by screening against the EQS:

- The worst case annual average (AA) process contribution of ammoniacal nitrogen resulting from the discharge from the WwTW at point WS1 following the average initial dilution, is 0.016 mg/l as N. Thus the recommended AA EQS for Habitats Directive sites of 1 mg/l is met by a large factor immediately after initial dilution;
- The concentration of non-ionised ammonia after initial dilution is less than 1.57 µg/l. This is well within the EQS for coastal waters of 21 µg/l; and,
- The worst case discharge of dissolved inorganic nitrogen from the WwTW is 0.025 mg/l as N. This represents 10% of the EQS.

54. Modelling showed that the treated sewage effluent discharged in the north of Porth-y-pistyll would be quickly dispersed. Under the Bathing Water Directive, to achieve good classification the intestinal *enterococci* concentration must not exceed 200 CFU (Colony Forming Units)/100 ml as a 95th percentile. In a worst case scenario, the modelled concentration of faecal coliforms reaching the bathing water at Cemaes would result in an increase in 29.3 CFU/100 ml (11.8 CFU/100ml from the Construction Site WwTW outfall and 17.5 CFU/100 ml from the DCWW WwTW outfall). This contribution is likely to occur infrequently as it is based on a modelled continuous discharge of 18.5 l/s, when in reality the discharge would be batched and would occur only over a 12 or 15-hour period. Furthermore, the small addition is well below the maximum concentration required to achieve “good” classification.

55. BOD and COD are discharged from the WwTW at industry standard treatment concentrations to a highly dynamic marine environment with good mixing and oxygenation of the water. No adverse effects on the receiving environment are considered likely.

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5.4 Impact on Tre'r Gof SSSI

56. The Tre'r Gof SSSI is located in a small 'inland' drainage basin. It was designated for its biological interest as a representative example of rich-fen habitat in north-west Wales. The quality of inflowing water is one of the key hydrological supporting conditions for the wetland; according to the SSSI citation, the special features of Tre'r Gof rely on nutrient-poor calcium-rich water inputs.

57. Discharge point WB1 is approximately 500 m upstream of Tre'r Gof SSSI and will comprise site drainage, which will flow over bare earth during the Construction Phase, resulting in an elevated sediment load and contain associated leached metals and nutrients. Assessment of the impact of this drainage flow has concluded that effects will not be significant. Also, the main channel flowing through Tre'r Gof SSSI has limited interaction with the wider Tre'r Gof site. No significant effects on the Tre'r Gof SSSI arising from changes to water quality in construction are predicted.

5.5 Water Framework Directive

58. A Water Framework Directive (WFD) Compliance Assessment has been carried out for the Project. It concluded that the activities covered by the CWD EP Application would not cause deterioration in WFD water bodies on a non-temporary basis, and would not prevent WFD water bodies from attaining Good Ecological Status (GES)/Good Ecological Potential (GEP).

5.6 Habitats Regulations Assessment

59. A Shadow Habitats Regulations Assessment (HRA) has been carried out to assess the potential effects of the construction, operation and decommissioning of the entire Project on European Designated Sites. These sites include Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and sites that are in the process of designation as SACs and SPAs. The assessment included a consideration of the effects of Construction Phase water discharges.

60. The outcome of the Shadow HRA is that an Adverse Effect on Integrity from the Construction Phase Water Discharge Activities is not predicted whether the activities are considered alone or in combination with wider Project activities and other relevant plans and projects.

6 Monitoring arrangements

61. Horizon will carry out monitoring and sampling of the water discharges in order to demonstrate compliance with CWD EP limits and conditions. Proposed monitoring/sampling techniques and corresponding equipment specifications have yet to be finalized. However, arrangements will be developed in line with NRW and Environment Agency guidance, and MCERTS monitoring techniques and methods will be used wherever appropriate and available.

7 Managing the water discharge activity

62. It is likely that construction activities, including the water discharge activities covered by this application, will be undertaken on behalf of Horizon by a contractor such as Menter Newydd. Menter Newydd is a joint venture of Hitachi Nuclear Energy Europe, Bechtel

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Management Company, and JGC Corporation (UK). However, Horizon will continue to be the operator of the water discharges and will hold accountability for compliance with any conditions placed upon the company.

8 Forward Work Plan

63. Horizon has prepared a Forward Work Plan (FWP) for the CWD EP Application. This identifies further information which Horizon has committed to produce and supply to NRW during the permit Application determination period and prior to the commencement of the Construction Phase, as the design and management of the Construction Phase activities develops.

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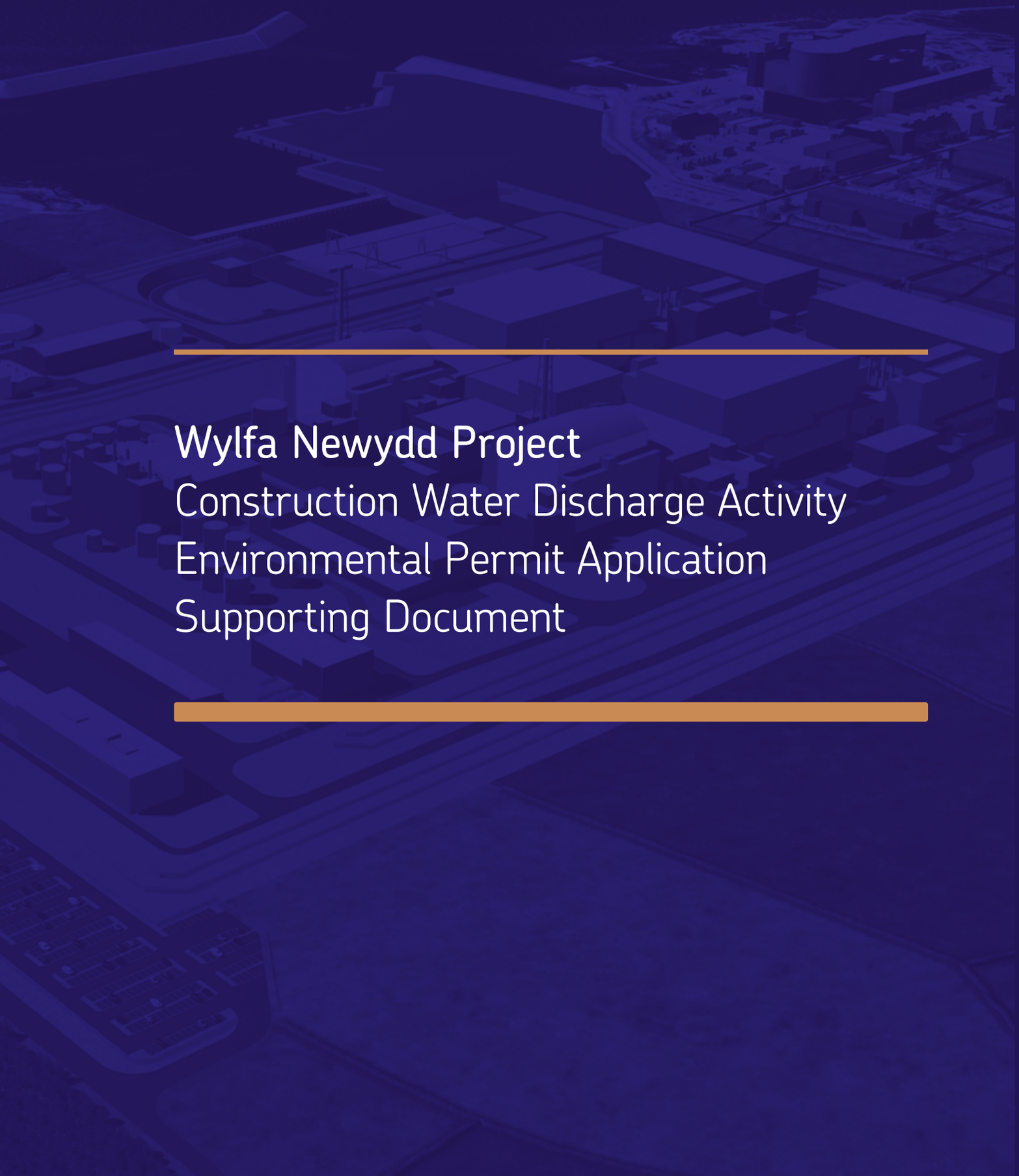

Wylfa Newydd Project
Construction Water Discharge Activity
Environmental Permit Application
Supporting Document

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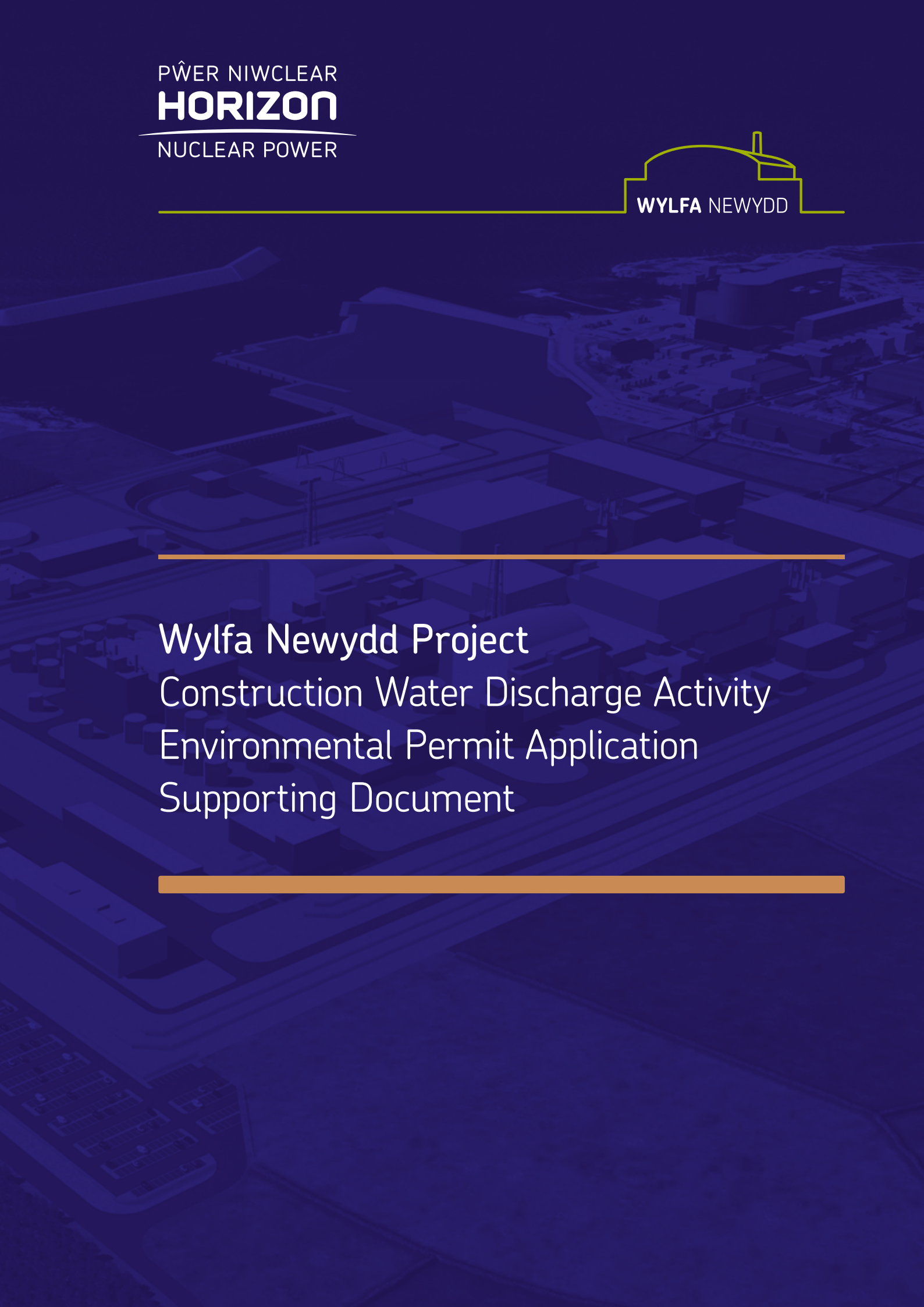

Wylfa Newydd Project
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1 Introduction

1.1 General introduction

1. This document is the technical submission which has been produced in support of an Application for an Environmental Permit covering the “water discharge activities” that will occur during the construction of the new nuclear power station (Wylfa Newydd Power Station – hereafter referred to as the “Power Station”) which will be built on the north coast of Anglesey.

2. During construction, water discharges will occur from the run-off of rainwater from earthworks and the area surrounding the concrete batching plant; from the dewatering of excavations, cofferdams and tunnels; and the operation of the sewage treatment plant. The Construction Water Discharge (CWD) Environmental Permit (EP) would allow the release of these discharges to the environment subject to treatment, control, and compliance with EP conditions.

3. This document has been prepared in line with Schedule 21 of the Environmental Permitting (England and Wales) Regulations 2016 (EPR16) [RD1], and is being submitted to Natural Resources Wales (NRW) in order to supplement the information provided in completed application forms Part A, B2, B6 and F2 (the completed forms are presented in Appendix A).

4. This Application provides an overview of the Wylfa Newydd Project (the Project) and its environmental setting. A description is given of those Construction Phase activities which will result in wastewater generation, and their alignment with best practice. A characterization is provided of the water discharges, post treatment, in terms of both the hazardous and non-hazardous substances present and their likely concentration ranges, volumetric flow rates, and other pertinent data.

5. The Application presents an assessment of the environmental risk associated with the water discharges, and sets out how these releases will be monitored to ensure on-going compliance with the CWD-EP conditions. It gives an overview of the arrangements which will be employed at the Power Station development to manage the water discharge activities during the Construction Phase. Finally, it presents a Forward Work Plan (FWP) to address those areas where further work is still required. Where the requirements for further work are first introduced in the Application they are identified with the tag [FA_{CWD}-1], [FA_{CWD}-2], and so on. The requirements are reproduced in Chapter 9.

1.2 The applicant

6. This Application is being made by **Horizon Nuclear Power Wylfa Limited** (hereafter called Horizon), the company responsible for developing and subsequently operating the Power Station. It will develop the Power Station using technology purchased from Hitachi-GE Nuclear Energy Limited, a joint venture between Hitachi Limited and General Electric Corporation.

7. Horizon Nuclear Power Wylfa Limited (company registration number 06811987) is headquartered at Sunrise House, 1420 Charlton Court, Gloucester Business Park, Gloucester, GL3 4AE and has a site office in Anglesey. It is owned by Horizon Nuclear Power Wylfa Holdings Limited. Along with Horizon Nuclear Power Oldbury Limited, and the parent company Horizon Nuclear Power Limited, it forms part of the Horizon group of

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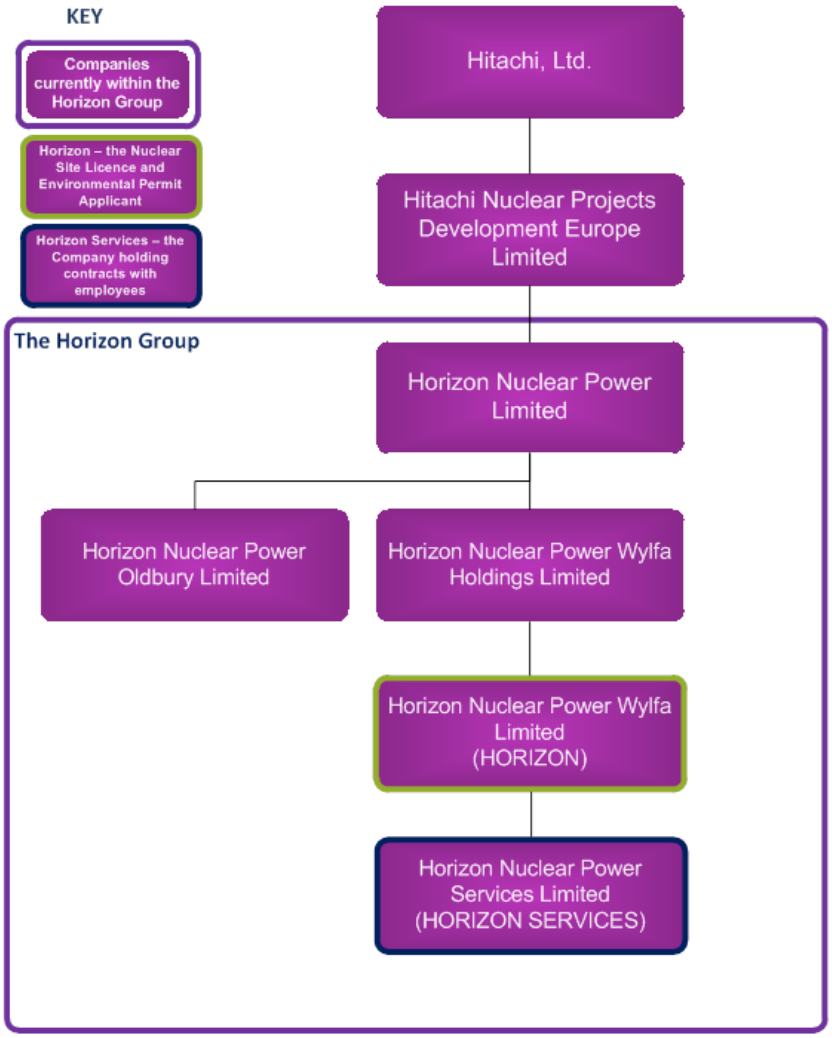
companies. These companies are UK-registered and owned by the Japanese corporation Hitachi Limited. The corporate structure is outlined in Figure 1-1.

Figure 1-1 Overview of Corporate Structure



1.3 The Wylfa Newydd project

1.3.1 Project outline

8. Horizon is planning to construct and operate the Power Station on the island of Anglesey. It will be located to the west of the village of Cemaes and to the south of the existing Magnox power station (the "Existing Power Station"). The Power Station will have two UK Advanced Boiling Water Reactors (ABWRs) with a nominal total gross generating capacity of 3.1 GWe (3,100 MWe).

9. Principal construction activities will start after the major permissions required to build the Power Station have been granted. Once construction of the first reactor has reached an advanced stage, it will be commissioned (expected to last two years) to ensure all systems and processes operate as intended. The first reactor will then become operational. This

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will be followed by the second reactor becoming operational approximately sixteen months later. The expected operational life of each reactor is 60 years. At the end of operations the Power Station will be decommissioned.

1.4 Environmental permit requirement – qualifying criteria

10. Discharges of trade effluent, sewage and other polluting materials to inland freshwaters, coastal waters or relevant territorial waters require a Permit under EPR16 [RD1]. Regulation 12(1)(b) states:

"A person must not, except under and to the extent authorised by an environmental permit, cause or knowingly permit a water discharge activity or groundwater activity"

11. Water discharge activities are defined in Schedule 21 of EPR16:

3. (1) A "water discharge activity" means any of the following-

- *(a) the discharge or entry to inland freshwaters, coastal waters or relevant territorial waters of any-*

  (i) poisonous, noxious or polluting matter,

  (ii) waste matter, or

  (iii) trade effluent or sewage effluent.

1.5 Scope of this application

12. The scope of this Application includes the following activities which will occur during the Construction Phase of the Project and which will qualify as water discharge activities (the names of the effluents from the activities have been highlighted in bold):

- **Wylfa Newydd Development Area (WNDA) surface water drainage** to local surface watercourses and sea[1];
- **Discharge from the dewatering of deep excavations** to sea;
- **Discharge from the dewatering of the Bund Cofferdam** to sea;
- **Discharge from the dewatering of the Outfall Cofferdam** to sea;
- **Discharge from the dewatering of the Cooling Water Discharge Tunnels** to sea;
- **Surface run-off from the area surrounding the concrete batching plant** to sea;
- **Discharge from Vehicle Wheel Wash** to sea; and,
- **Treated effluent discharge from the WNDA Construction Site WwTW** (Wastewater Treatment Works) to sea (hereafter called the Construction Site WwTW).

[1] The Wylfa Newydd Development Area (WNDA) is the area of land and sea, including the Power Station Site, that will be used for the construction and operation of the Power Station. This represents the maximum area that would be physically affected by Power Station main construction activities. The WNDA is shown in Figure 2.2.

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13. The Application does not cover:

- Operational Phase water discharge activities. These are covered by a separate permit application (see Section 1.7.3);
- Process water discharges from the concrete batching plant. The process waters will be tankered off site for treatment;
- Sewage from the Site Campus[2]. Sewage arisings from the Site Campus will be treated in a separate package WwTW operated by Dŵr Cymru Welsh Water (DCWW) and the treated effluent discharged under a separate Environmental Permit held by DCWW, and,
- Commissioning effluents. The details of the commissioning programme are yet to be developed; if there are any proposed discharges from the discharge points covered in this permit application, they will be subject to a separate, later application to vary the Environmental Permit. Any such discharges are expected to be from the early phase of commissioning, and the impact of these discharges is expected to be minimal.

1.6 Assessments provided to address specific legislative requirements

14. Horizon has provided NRW with information to support the determination of the CWD-EP Application under specific legislation. The information includes a Habitats Regulations Assessment (HRA) and a Water Framework Directive (WFD) Assessment, as described below.

1.6.1 Habitats Regulations Assessment

15. The Habitats Directive [RD4] is transposed into Welsh legislation by the Conservation of Habitats and Species Regulations 2017 [RD5] and the Conservation of Offshore Marine Habitats and Species Regulations 2017 [RD6]. The HRA process helps meet the requirements of Article 6(3) of the Habitats Directive which states that any plan or project, that is not directly connected with or necessary to the management of a European Designated Site, but would be likely to have a significant effect on such a site, either on its own or in combination with other plans or projects, will be subject to an Appropriate Assessment of its implications for the European Designated Site in view of its conservation objectives.

16. Appropriate Assessment is carried out by the Competent Authority determining the permission in question. NRW is the Competent Authority for this CWD-EP Application. Horizon has prepared a 'Shadow HRA' for the Project[3] (Appendix M). This considers the implications of the entire Project for European and internationally designated nature conservation sites, and is included as a separate document supporting this CWD-EP Application. Horizon has also prepared an HRA Signposting Document (included in

[2] The Site Campus will be used during the Project's Construction Phase to accommodate up to 4,000 construction workers. It will occupy around 15 ha of land situated to the north-east of the Power Station Site, east of the Existing Power Station. It is expected that the campus will be operational between 2021 and 2026, with peak occupation levels between 2023 and 2024.

[3] The HRA is carried out by the decision maker as the Competent Authority under the Habitats Regulations. The developer is required to submit sufficient scientific evidence to enable the authority to complete the HRA and this evidence is submitted in the form of a 'report to inform' or 'shadow' HRA.

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Appendix L) which identifies the key sections of the HRA Shadow Report relevant to this CWD-EP Application.

1.6.2 Water Framework Directive assessment

17. The Water Framework Directive (WFD) (2000/60/EC) [RD7] is implemented in Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 [RD8]. The primary aim of the WFD is to improve/maintain the ecological status/potential of all WFD water bodies. The directive also requires that there be no deterioration in overall status or in the status of individual biological, physico-chemical and hydromorphological quality elements.

18. An overarching WFD Compliance Assessment [RD9] has been made for all of the relevant permit applications which will be made for the Project under different legislation. It assesses the effects of the Project on relevant water bodies, and determines whether the Project is compliant with the objectives of the WFD. Horizon has prepared a WFD Signposting Document (included in Appendix G) which identifies the key sections of the WFD Compliance Assessment Report relevant to this CWD-EP Application.

19. The WFD Compliance Assessment along with the Environmental Statement (ES) and HRA Shadow Report also provide the baseline details and results for the CWD-EP Application, and thereby ensure a common set of data and assessment for the Project as a whole.

1.7 Other applications and submissions

20. In addition to the CWD-EP, Horizon requires a number of other permissions, licences and consents related to the Construction Phase of the Power Station. These are as follows.

1.7.1 Development Consent Order

21. A nuclear power station is a Nationally Significant Infrastructure Project (NSIP) under the Planning Act 2008 [RD2] and its construction and operation must be authorised by a Development Consent Order (DCO) granted by the relevant Secretary of State. Horizon currently anticipates that its application for a DCO for the Power Station will be made in 2018.

22. A nuclear power station is also classified as an “Environmental Impact Assessment (EIA) development” under Schedule 1 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [RD3]. This means that the Power Station will be subject to a mandatory EIA. The outcomes of this process will be reported in an ES which will accompany the application for a DCO.

1.7.2 Marine Licence

23. A Marine Licence is required under the Marine & Coastal Access Act 2009 [RD10] for a range of licensable marine activities to be undertaken at the Power Station Site that are located seawards of the current line of mean high water on spring tides (MHWS). These activities include or are associated with the construction and operation of the Project’s major marine infrastructure items, notably the Marine Off-Loading Facility (MOLF), the Cooling Water Intake structure, the Cooling Water Outfall structure, and the breakwaters.

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1.7.3 Environmental Permits

24. In addition to the CWD-EP the following environmental permits are required under EPR16 for discharges to the environment:

- Water discharge activity during operation (under Schedule 21 of EPR16). Commissioning and operation of the Power Station will involve making discharges of non-radioactive aqueous effluent to the Irish Sea;
- Combustion activity during operation (under Schedule 1 of EPR16). Steam-raising boilers and standalone emergency power supply will be required to support the UK ABWR units at the Power Station. As the aggregated thermal input of the combustion units will be in excess of 50 MW, an environmental permit will be required; and,
- Radioactive waste disposal activity during late commissioning activities and operation (under Schedule 23 of EPR16). The Power Station is designed and will be operated to minimise the volume and activity of radioactive wastes generated throughout its life, and to prevent, and where that is not possible, minimise radioactive discharges to the environment. An application has been made for an Environmental Permit to authorise the discharge and transfer of radioactive wastes from the Power Station.

1.8 Guidance used in the preparation of this document

25. The information presented in this Application document has been produced with regard to the following environmental permitting guidance:

- NRW Application Form Guidance [RD11], [RD12], [RD13], [RD14];
- How to comply with your environmental permit [RD15];
- How to comply with your environmental permit, Additional guidance for: Water discharge and groundwater (EPR 7.01) [RD16];
- Horizontal Guidance Notes [RD17], [RD18];
- Risk assessments for specific activities: environmental permits NRW Technical Guidance Note M18 - Monitoring of discharges to water and sewer [RD20];
- Environment Agency Protect Groundwater And Prevent Groundwater Pollution Guidance [RD22];
- British Ready-Mixed Concrete Association (BRMCA) Best Practice: Managing Concrete Wash Waters on Site [RD23];
- Construction Industry Research and Information Association (CIRIA) C532 Control of water pollution from construction sites: guidance for consultants and contractors [RD24];
- CIRIA C753 Sustainable Drainage Systems (SuDS) manual [RD25]; and,
- CIRIA C741 Environmental good practice on site guide. 4th edition [RD26].

1.9 Document structure

26. This Application is set out in 10 separate chapters and 15 appendices as described in Table 1.1. A non-technical summary (NTS), which forms part of the Application, has been prepared as separate, stand-alone documents in Welsh and English.

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Table 1.1 List of Sections in the CWD-EP Application

Section Number	Section	Content
1	Introduction	General background information including the purpose and scope of this Application, its context with respect to other submissions and applications, and a cross-reference of the Application content against NRW requirements.
2	The Power Station and Site Setting	General background information about Horizon, the environmental setting of the Power Station, and an overview of construction activities.
3	Construction Phase Activities and Water Discharges	A description of the water discharge activities which will occur during the Construction Phase of the Project, and the handling and treatment techniques which will be employed to minimise the discharge of pollutants to the environment. A list is provided of discharge locations and the corresponding receiving waters.
4	Discharge Estimates	Characterisation of each of the Construction Phase water discharges in terms of volumetric flow rates and pollutant concentrations.
5	Pollution Control Measures and Good Practice	A review of the Construction Phase pollution control techniques described in Chapter 3 with current good practice.
6	Environmental Risk Assessment	An assessment of the environmental risks associated with the Project's Construction Phase water discharge activities. The risk assessment comprises a screening evaluation based upon the Environment Agency's H1 methodology, and more detailed marine modelling looking at the potential for exceedances of Environmental Quality Standards (EQS). Separate assessments are made for the potential impacts of total suspended solids (TSS) and discharges from the Construction Site WwTW. The implications for the Project-wide Habitats Regulations Assessment and Water Framework Directive Assessment are also addressed.
7	Monitoring Arrangements	Information on Horizon's proposed sampling and monitoring arrangements.
8	Managing the Water Discharge Activity	Information on Horizon's management system for the operational management of activities during the Construction Phase to ensure compliance with permit conditions.
9	Forward Work Plan	Information on Horizon's commitment to the implementation of further management arrangements pertinent to this Permit Application during the determination period.
10	References	A listing of the Application references.
Appendix A		CWD-EP Application completed forms.
Appendix B		Application Form B6 calculations.
Appendix C		Company Certificates.
Appendix D		Correspondence with sewerage undertaker.
Appendix E		Marine hydrodynamic modelling report (ES Appendix D13.8) and Annex (Construction Drainage Re-modelling Memorandum).
Appendix F		Assessment of Appropriate Suspended Sediment Concentrations for Water Discharge Locations.
Appendix G		WwTW Effluent Modelling Report (memo).
Appendix H		Tre'r Gof Hydroecological Assessment.

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Section Number	Section	Content
Appendix I		H1 Environmental Risk Assessment (ES Appendix D13.14).
Appendix J		Main Site Construction Phase Foul Water Design Report.
Appendix K		Bulk Earthworks & drainage: Summary of Preliminary Design for Construction Surface Water Drainage
Appendix L		Signposting document to the HRA Shadow Report.
Appendix M		Habitats Regulations Assessment.
Appendix N		Signposting document to the WFD Compliance Assessment.
Appendix O		Water Framework Directive Compliance Assessment and Article 4(7).

1.10 Cross-reference of application content with NRW requirements

27. A correlation between the requirements of the NRW application forms (completed forms are contained in Appendix A) and the information presented in this Application is set out in Table 1.2.

Table 1.2 Schedule of Requirements

NRW Requirement	Reference	Location in this Application
About you	Part A, Q1	Part A Application form – Appendix A.
Applications from individuals	Part A, Q2	Not applicable.
Applications from an organisations of individuals	Part A, Q3	Not applicable.
Applications from public bodies	Part A, Q4	Not applicable.
Applications from a registered company or other corporate body	Part A, Q5	Part A Application form – Appendix A.
Your address	Part A, Q6	Part A Application form – Appendix A.
Contact details	Part A, Q7	Part A Application form – Appendix A.
About the permit	Part B2, Q1	Part B2 Application form – Appendix A.
About the site (not mobile plant)	Part B2, Q2	Part B2 Application form – Appendix A.
Your ability as an operator	Part B2, Q3	Part B2 Application form – Appendix A. A summary of the Horizon Environmental Management System is given in Section B
Consultation	Part B2, Q4	Part B2 Application form – Appendix A.
Supporting information	Part B2, Q5	A plan marking the site boundary and discharge points, both in green, is presented in Chapter 3. A non-technical summary of the Application is given in the stand-alone NTS.
Environmental risk assessment	Part B2, Q6	An assessment of the risks to the environment of the water discharge activities is presented in Chapter 6.

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NRW Requirement	Reference	Location in this Application
About the effluent	Part B6, Q1	Part B6 Application forms (one form per discharge) – Appendix A.
How long will you need to discharge?	Part B6, Q2	Part B6 Application forms – Appendix A.
Discharges to sewer	Part B6, Q3	Appendix D.
How much do you want to discharge?	Part B6, Q4	Appendix B.
Intermittent sewage discharges	Part B6, Q5	Not applicable.
How will the effluent be treated?	Part B6, Q6	Effluent treatment processes are described in Chapter 3. Final effluent discharge quality is detailed in Chapter 4.
What will be in the effluent?	Part B6, Q7	Final effluent discharge quality is detailed in Chapter 4. The H1 assessment is summarised in Chapter 6. The full H1 report is presented in Appendix I.
Monitoring arrangements	Part B6, Q8	Part B6 Application forms – Appendix A, and Chapter 7.
Emissions of substances not controlled by emission limits management plan	Part B6, Q9	Not applicable.
Design criteria	Part B6, Q10	The H1 assessment and further marine modelling is summarised in Chapter 6. The full H1 report is presented in Appendix I.
Where will the effluent discharge to?	Part B6, Q11	Effluent discharge points and corresponding receiving waters are described in Chapter 3.
More information from you	Part B6, Q12	Part B6 Application forms – Appendix A.
Working out charges	Part F2, Q1	Part F2 Application form – Appendix A.
Water discharge activity and groundwater activity point source discharges	Part F2, Q2	Part F2 Application form – Appendix A.
Payments	Part F2, Q3	Part F2 Application form – Appendix A.
Confidentiality and national security	Part F2, Q5	Part F2 Application form – Appendix A.
Application checklist	Part F2, Q6	Part F2 Application form – Appendix A.
Declaration	Part F2, Q7	Part F2 Application form – Appendix A.

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1.11 Abbreviations

28. A list of abbreviations is presented in Table 1.3.

Table 1.3 List of Abbreviations

AA	Annual Average
ABWR	Advanced Boiling Water Reactor
AEOI	Adverse Effect on Integrity
AONB	Area of Outstanding Natural Beauty
ASP	Activated Sludge Plant
atu	Allylthiourea
BAT	Best Available Techniques
BC	Background Concentration
BOD	Biochemical Oxygen Demand
BOD_5	BOD resulting from the incubation of a sample of water or effluent for a period of five days
BRMCA	British Ready-Mixed Concrete Association
CAP	Corrective Action Programme
CAPEX	Capital expenditure
CD	Chart Datum
CEMP	Construction Environmental Management Plan
CEN	Comité European de Normalization
CEO	Chief Executive Officer
CFU	Colony Forming Units
CIRIA	Construction Industry Research and Information Association
CoCP	Code of Construction Practice
COD	Chemical Oxygen Demand
COU	Construction Oversight Unit
cSAC	Candidate SAC
CWD	Construction Water Discharge
DCO	Development Consent Order
DCWW	Dŵr Cymru Welsh Water
EA	Environment Agency
EIA	Environmental Impact Assessment
EIMT	Examination, Inspection and Maintenance, and Testing
EFR	Effluent Flow Rate
EMS	Environmental Management System
EP	Environment Permit
EPC	Engineering, Procurement and Construction

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EPR16	Environmental Permitting (England and Wales) Regulations 2016 (SI 2016 No.1154)
EQS	Environmental Quality Standard
ES	Environmental Statement
FIO	Faecal Indicator Organisms
FRA	Flood Risk Activity
FWP	Forward Work Plan
GEP	Good Ecological Potential
GES	Good Ecological Status
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystem
ha	Hectare
HLT	Horizon Leadership Team
HMS	Horizon Management System
HRA	Habitats Regulations Assessment
IEM	Integrated Emergency Management
ISO	The International Organization for Standardization
kg/d	Kilogrammes per day
kg/m^3	Kilogrammes per cubic metre (equivalent to 1,000 mg/l)
l/hd.d	Litres per head per day
l/s	Litres per second
m^3	Cubic metres
m^3/d	Cubic metres per day
m^3/s	Cubic metres per second
MAC	Maximum Allowable Concentration
MCERTS	Monitoring Certification Scheme
mg/l	Milligrams per litre
MHWS	Mean High Water on Spring tides
mm	Millimetre
MOLF	Marine Off-Loading Facility
MW	Megawatt
N	Nitrogen
NH_3	Ammonia
NH_4^+	Ammonium ion.
NIEA	Northern Ireland Environment Agency
NO_3^-	Nitrate
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project

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NTS	Non-technical Summary
OHSAS	Occupational Health and Safety Assessment Series
OPEX	Operational expenditure
OS	Ordnance Survey
P	Phosphorus
PC	Process Contribution
PE	Population equivalent
PEC	Predicted Environmental Concentration
PPG	Pollution Prevention Guidance
Q_{95}	The flow which is equalled or exceeded for 95% of the flow record
QA	Quality assurance
RC	Release Concentration
RFR	River Flow Rate
RQP	River Quality Planning
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SPA	Special Protection Area
SPC	Site Preparation and Clearance
SS	Suspended solids
SSSI	A Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TSS	Total Suspended Solids
UK	United Kingdom
UKABWR	United Kingdom Advanced Boiling Water Reactor
UV	Ultraviolet
WDA	Water Discharge Activity
WFD	Water Framework Directive (2000/60/EC)
WNDA	Wylfa Newydd Development Area
WQTAG	Water Quality Technical Advisory Group
WwTW	Wastewater Treatment Works
µg/l	Microgrammes per litre
°C	Degrees centigrade

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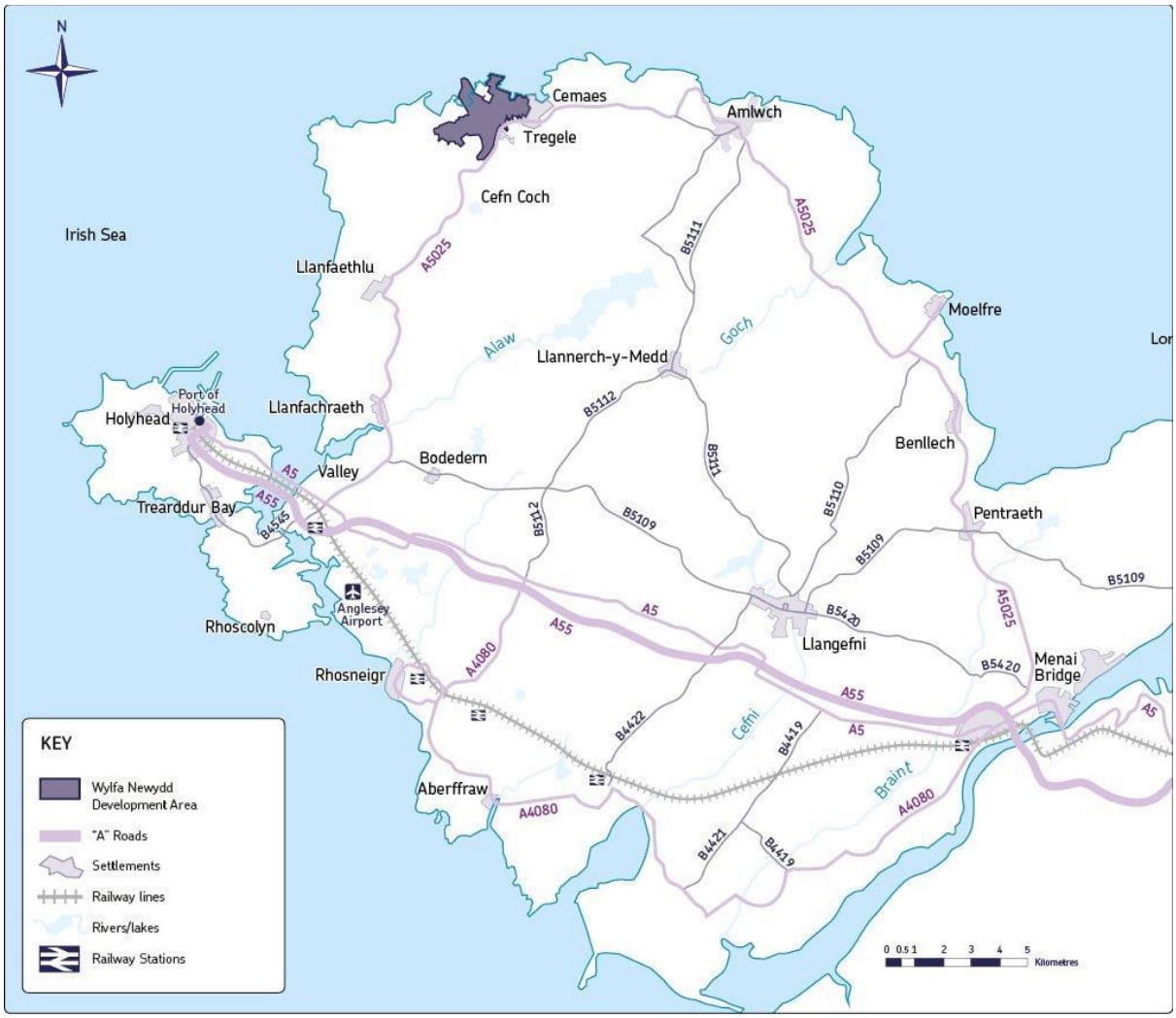
2 The power station and site setting

29. This chapter provides details regarding the Power Station's location, the WNDA and the surrounding environment. It also presents an overview of the Power Station layout, and outlines those construction activities relevant to this Permit Application.

2.1 Power station location

30. The Power Station will be developed on the island of Anglesey to the west of the village of Cemaes and south of the Existing Power Station (see Figure 2-1). The geographical centre of the Power Station Site is at 53.409122º latitude, -4.4850277º longitude, Ordnance Survey (OS) grid reference SH 34917 93134.

Figure 2-1 Location of Wylfa Newydd Site



2.2 Environmental setting

2.2.1 Wylfa Newydd Development Area

31. The WNDA – the area of land which will include the Power Station Site and the surrounding areas which will be used for its construction and operation – is shown in Figure 2-2, overleaf, along with the National Policy Statement Area site for Wylfa and the CWD-EP Regulated Facility Boundary.

32. The WNDA is bounded to the north by the coast and the Existing Power Station. To the east, it is separated from Cemaes by a corridor of agricultural land. The A5025 and residential properties define part of the south-east boundary, with a small parcel of land spanning the road to the north-east of Tregele. To the south and west, the WNDA abuts agricultural land, and to the west it includes land behind Cemlyn Bay, where the WNDA includes part of the property known as Cestyll Garden.

33. The area of the Power Station Site (only those parts within the permanent security fence demarcating the operational Power Station) is about 145 ha (including about 10 ha of marine area enclosed by the breakwaters). The WNDA covers 407 ha.

34. The Existing Power Station, which started operating in 1971, sits directly to the north of the proposed siting of the Power Station. The Existing Power Station has two Magnox reactors and associated turbine generators; Reactor 2 was shut down in 2012 and Reactor 1 in 2015. The process of decommissioning the site has now commenced [RD27].

35. Land within and surrounding the WNDA is predominantly agricultural, used for grazing sheep or cattle, contained by hedgerows and crossed by a network of roads, rural lanes, watercourses and overhead electricity infrastructure. The local coastline is used for various recreational activities including walking, dog-walking, bird-watching, picnicking, water sports and other beach activities. A number of public rights of way, including the Wales Coast Path and the Copper Trail (national cycle route) cross the WNDA. However, these will be diverted prior to the start of the Construction Phase for reasons of security and safety.

36. Land on the west of the WNDA is within the Anglesey Area of Outstanding Natural Beauty (AONB) and the North Anglesey Heritage Coast. The WNDA also lies within the locally designated Anglesey Special Landscape Area, a designation which applies to the whole of Anglesey outside of the AONB.

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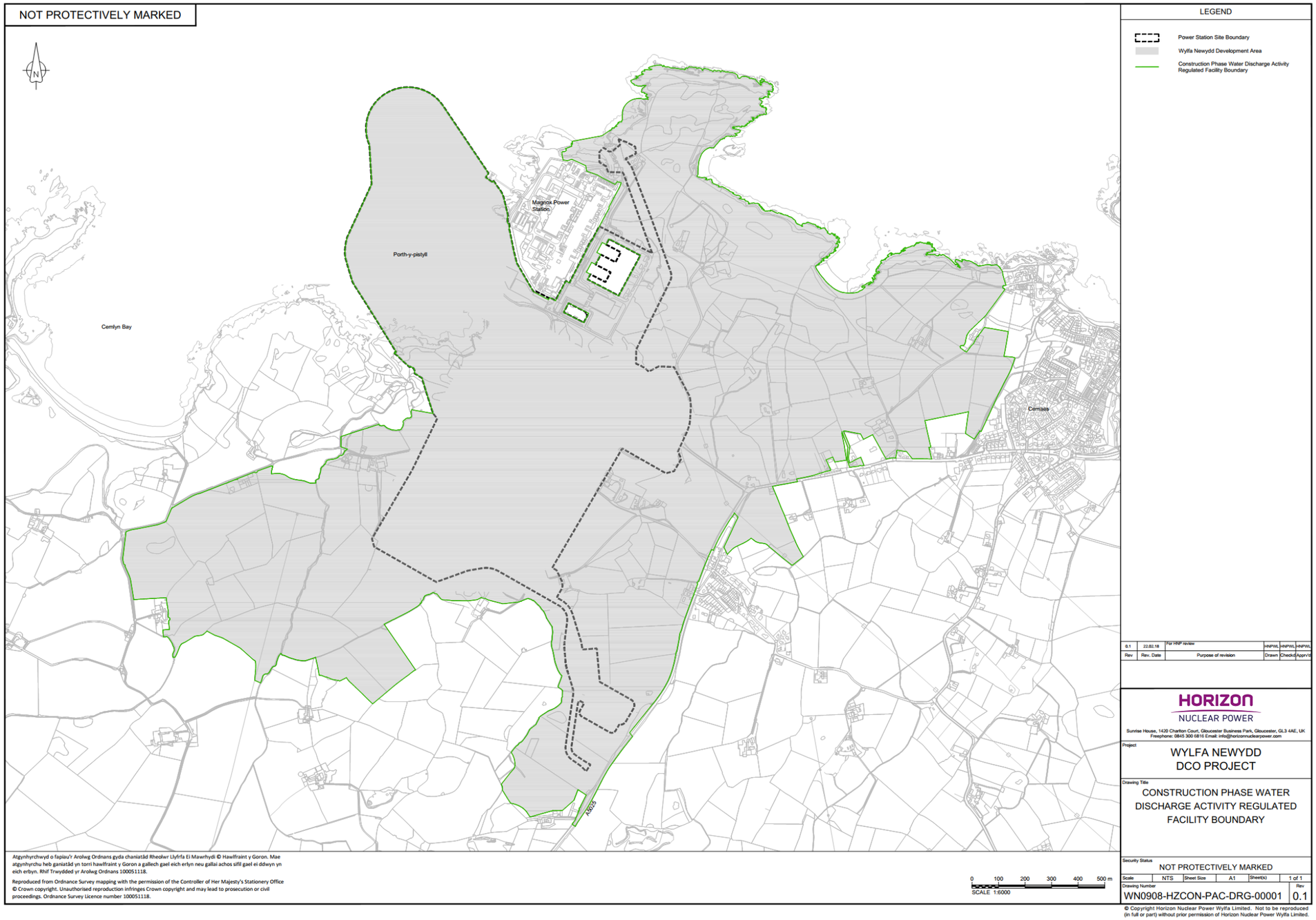
Figure 2-2 Wylfa Newydd Development Area



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2.2.2 Ecological designations

37. There are a number of sites subject to ecological conservation designations of international, national and local importance within and in the immediate vicinity of the WNDA:

- Tre'r Gof and Cae Gwyn Sites of Special Scientific Interest (SSSIs);
- Cemlyn Bay SSSI and Cemlyn Bay Special Area of Conservation (SAC), which lie within the area covered by the Anglesey Terns Special Protection Area (SPA); and,
- North Anglesey Marine Candidate SAC (cSAC).

38. The Tre'r Gof SSSI is located completely within the WNDA while Cae Gwyn SSSI is adjacent to and just within the southern part of the WNDA. These designated sites are shown in Figure 3.1. Cemlyn Bay SAC and SSSI is located approximately 55 m north west of the WNDA. The site is designated for its coastal lagoon habitat and perennial vegetation of stony banks. Cemlyn Bay also supports breeding colonies of four species of tern and forms part of the Anglesey Terns SPA, which also includes all of the marine parts of the WNDA. The North Anglesey Marine cSAC, which is proposed for harbour porpoise (*Phocoena phocoena*), also includes all of the marine parts of the WNDA.

39. There are three coastal water bodies designated under the WFD in close proximity to the Power Station:

- Anglesey North;
- Skerries; and,
- Cemlyn Lagoon.

40. The Anglesey North water body is currently achieving 'moderate' ecological status and the Skerries water body is at 'high' ecological status. These water bodies are characterised by strong tidal currents and a tidal range in excess of 7.5 m. Cemlyn Lagoon water body is located approximately 55 m north west of the WNDA. The lagoon habitat is separated from the coastal waters by a permeable shingle bank, with a narrow channel at the western end. It is fed by water from the Cemlyn catchment and from the sea. This water body is currently achieving 'good' ecological status.

2.2.3 Surface water catchments

41. There are five existing surface water catchments and associated watercourses located within the WNDA, as shown in Figure 3.1, namely:

- Tre'r Gof Catchmant – Tre'r Gof drains;
- Afon Cafnan Catchment – the Afon Cafnan, Nant Caerdegog Isaf, and wetted ditches and field drains;
- Cemaes Catchment – Nant Cemaes;
- Cemlyn Catchment – Nant Cemlyn and Nant Plas Cemlyn; and,
- Power Station Catchment – Nant Porth-y-pistyll.

42. The Tre'r Gof Catchment has an estimated area of 1 km^2 and is almost entirely located within the north-east corner of the WNDA. The catchment drains into the Tre'r Gof SSSI, situated to the east of the Power Station Site, via small watercourses and ditches. The Tre'r Gof SSSI drains to sea via a culvert and outfall at Porth y Wylfa. It is noted that the

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drainage system in Tre'r Gof , as well as the culvert leading to the sea, is artificial having been installed to drain the wetland area several hundred years ago.

43. Tre'r Gof SSSI is a naturally complex hydrological system which has interactions between direct rainfall, surface water, soil and sub-soil water and shallow (and to a lesser degree deep) groundwater. There are substantial variations in recharge and stream flow through the SSSI and therefore significant changes in water quality across the area caused by the different water sources and flow routes.

44. The Afon Cafnan Catchment has an estimated area of 9.9 km^2 and comprises the Afon Cafnan and its tributaries, including Nant Caerdegog Isaf. The Cae Gwyn SSSI is situated within this catchment at the head of the Nant Caerdegog Isaf. The majority of the catchment is located to the south of the WNDA. The Afon Cafnan and the Nant Caerdegog Isaf are classified by NRW as main rivers.

45. The Cemaes Catchment drains an area of 3.0 km^2 that is mostly situated to the east and south-east of the WNDA. Nant Cemaes, which is classified as a main river by NRW, flows in a generally northern direction through Tregele and to the west of Cemaes before discharging to Cemaes Bay via a culvert.

46. The Cemlyn Catchment drains an area of 2.3 km^2 situated mostly beyond and to the south-west of the WNDA. The Nant Cemlyn flows in a northerly direction along the western boundary of the WNDA prior to draining into Cemlyn Lagoon which forms part of the Cemlyn Bay SSSI, and SAC and Anglesey Terns SPA. Flow monitoring results show that Nant Cemlyn has a 'flashy' flow regime, and indicate that both surface water run-off and groundwater contribute to the watercourse.

47. The Power Station Catchment drains a small area of approximately 0.3 km^2 immediately to the south of the Existing Power Station. The small channel within this catchment is unnamed although referred to here as Nant Porth-y-pistyll. The upper reaches of this channel are culverted, and the channel is a large flush (wetland) across a field that drains in a westward direction and discharges to the sea at Porth-y-pistyll.

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2.3 Site layout

48. The Power Station will have two UK ABWRs along with all supporting infrastructure. The main plant and structures of each of the UK ABWR generating units are shown in Figure 2-3 and listed in Table 2.1. It is highlighted that the layout shown in the figure is for illustrative purposes only and may change.

Figure 2-3 Layout of the Power Station Site

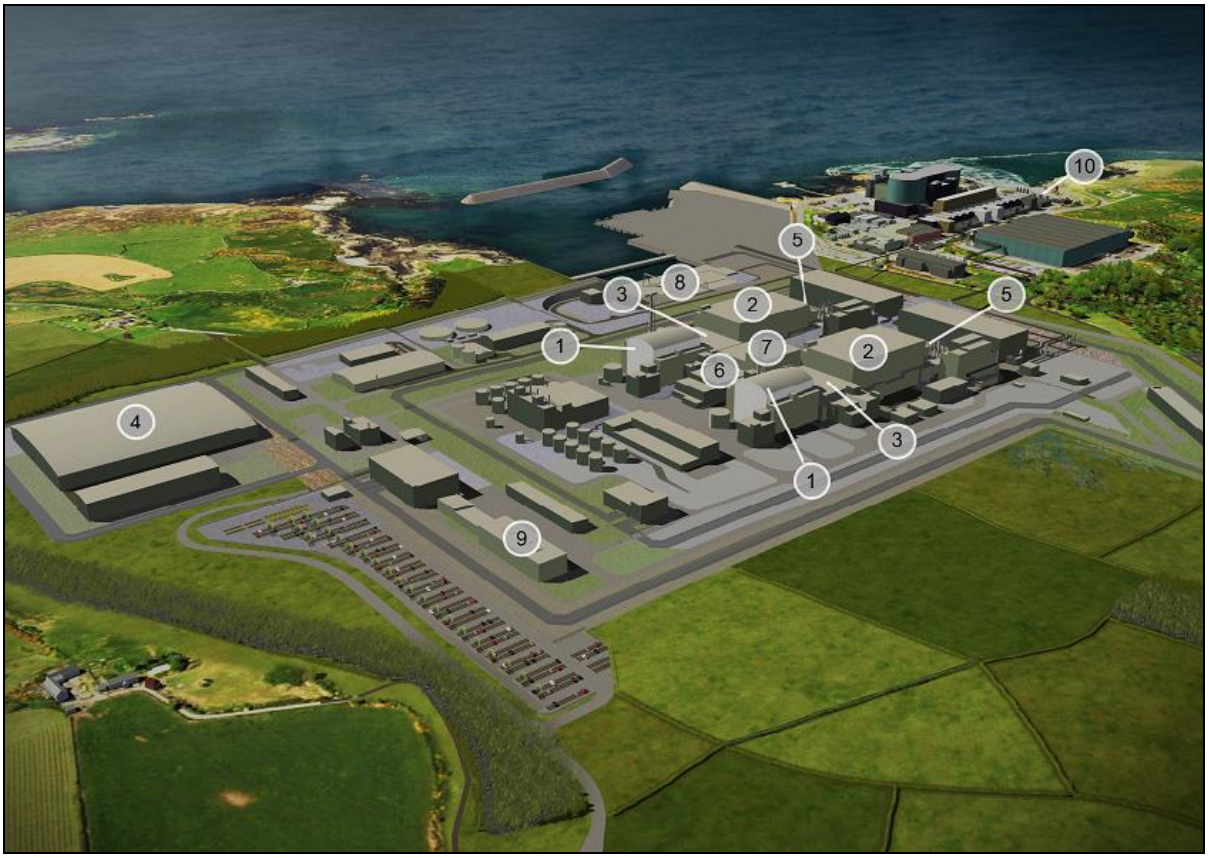

Table 2.1 Main Buildings and Structures on the Power Station Site

Building/Structure	Number	Building/Structure	Number
Reactor Building	1	Turbine Building	2
Control Building	3	ILW Storage Facility and Spent Fuel Storage Facility	4
Heat Exchanger Building	5	Service Building	6
Radioactive Waste Building	7	Cooling Water Intake Structures	8
Administrative and Support Buildings	9	Cooling Water Discharge Outfall	10

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2.4 Overview of project construction activities

49. The overall programme for the construction of the Project is anticipated to be from 2018 to 2027, approximately 10 years. The high-level construction schedule is shown in Figure 2.4; the construction schedule is baselined to DCO Grant, which is termed Year 1 (DCO Grant is expected towards the end of 2019). The dates included in the following description follow this convention.

- Bulk earthworks and grading activities would commence in Q1 Year 1 and run through to Q2 Year 2;
- Construction of the MOLF is expected to start in Q1 Year 1;
- Construction of the main Power Station buildings would commence in Q1 Year 3; and,
- Commercial Operation is anticipated to commence for Unit 1 at the end of Q3 Year 8 with Unit 2 Commercial Operation commencing during Q4 Year 9.

50. Site Preparation and Clearance (SPC) works will be undertaken prior to the grant of the DCO. It will involve preparatory activities such as the establishment of the Construction Site and material compounds, formalisation of road crossings, erection of perimeter fencing, clearance of buildings and other existing above-ground structures, and clearance of trees and shrubs vegetation (grass cover will be left). The work undertaken during SPC is not within the scope of this CWD EP Application.

51. Mobilisation for the construction works will commence after the grant of the DCO. This phase of activities will include:

- Installation of the main concrete batching plant (a temporary plant will be required to support the initial phase of the Project and will be located in the same area as the main batching plant);
- Construction of the intake, outfall, and bund cofferdams;
- Development of the cooling water discharge tunnels;
- Deep excavation;
- Earthworks and site profiling. Construction works could give rise to around nine to 10 million cubic metres (bulked) of excavated materials. A significant proportion of this would be used to create the level conditions for the construction compounds and haul roads and some would also be used when creating the Power Station building platform. The remaining excavated material would be used within the WNDA to create an appropriate landscape setting for the Power Station and help to mitigate potential noise and visual effects; and,
- Installation of the Construction Site WwTW.

Each of these activities is associated with a water discharge, as described in Chapter 3, and it is these discharges which require permitting.

52. The construction site, as it is anticipated to appear midway through Year 2, is illustrated in Figure 2.5. Work would have commenced on the cooling water intake facilities, and the Unit 1 and 2 deep excavation would be well developed. The western breakwater can be seen in the north west corner of the WNDA. This is considered to represent the largest extent of the construction works and is used to derive the worst case discharges included in this CWD-EP Application.

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Figure 2-4 High Level Construction Schedule

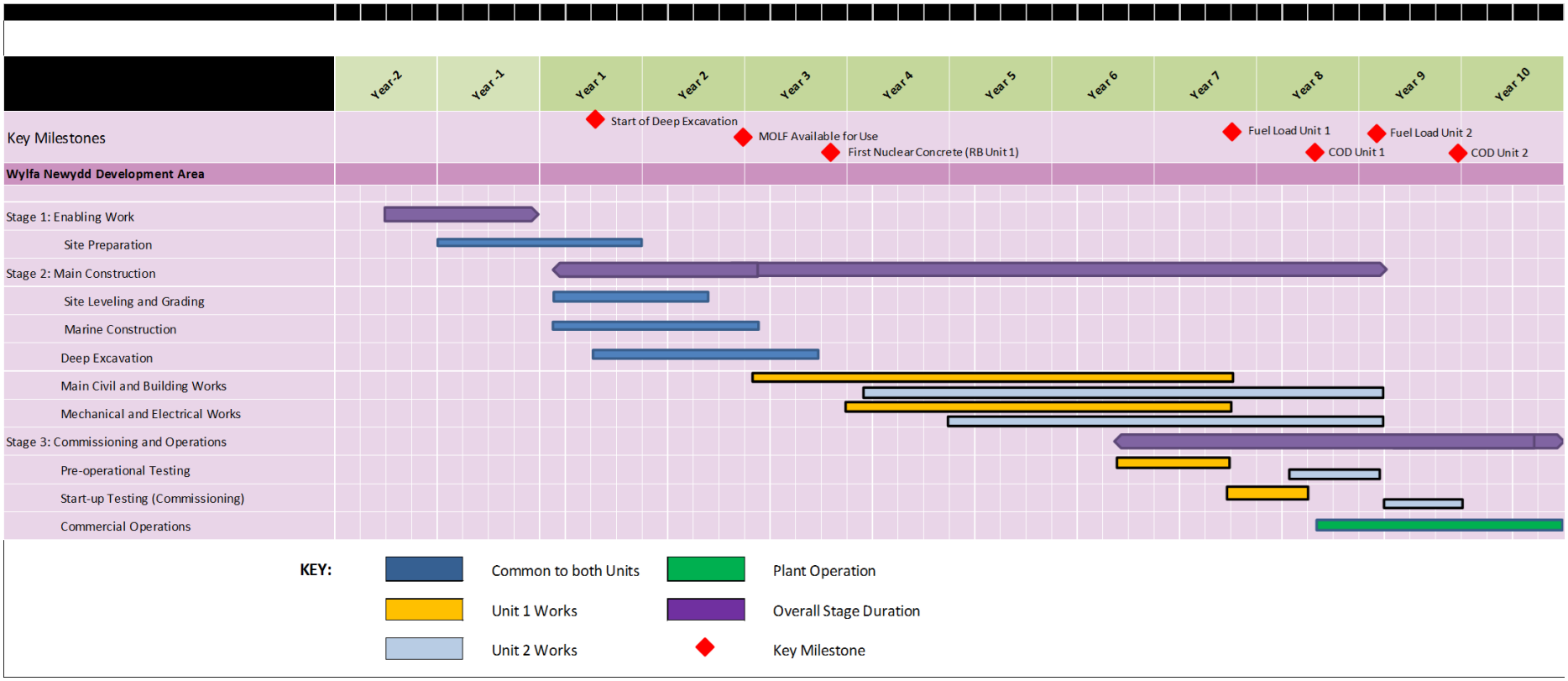

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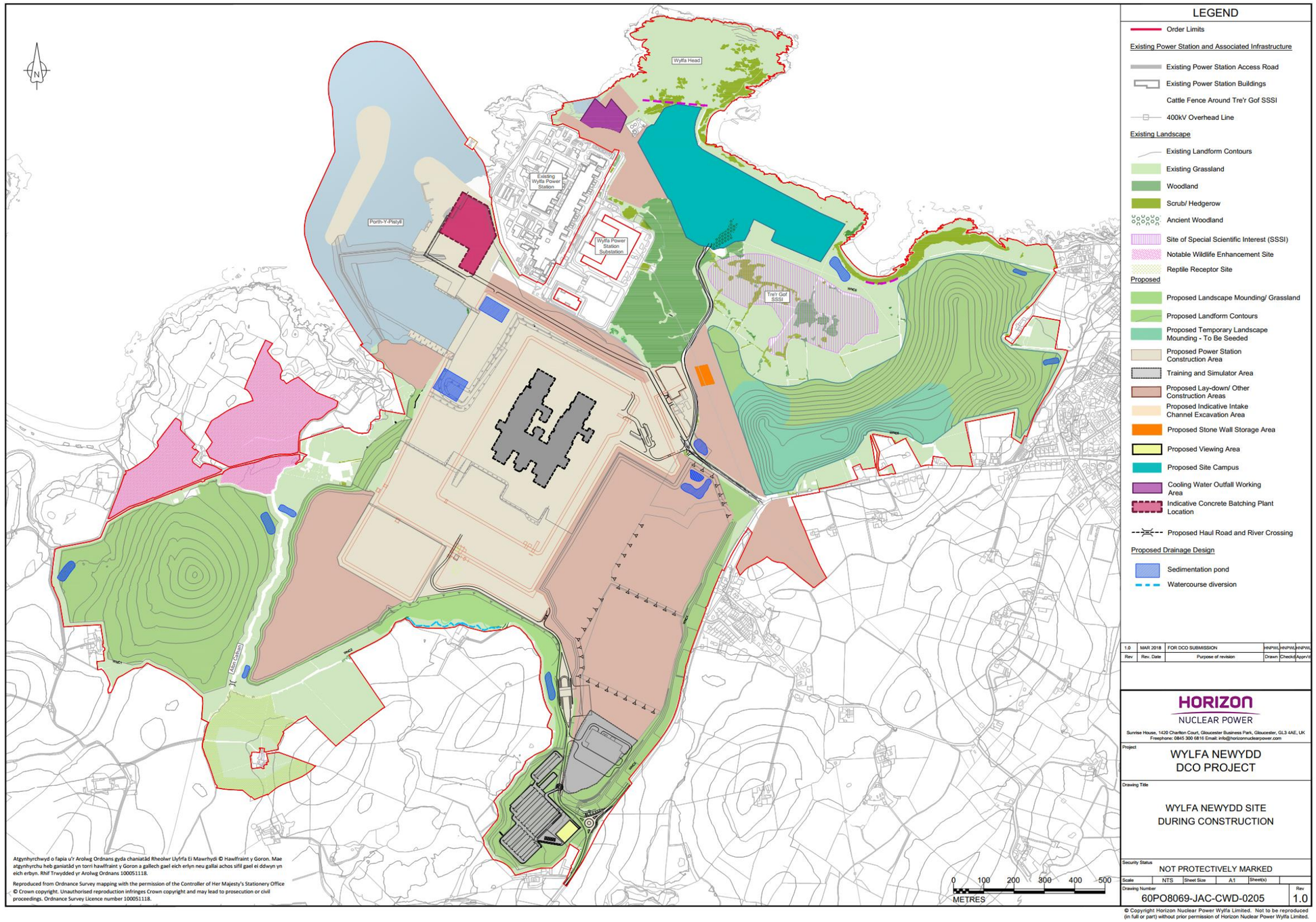
Figure 2-5 WNDA During Construction



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3 Construction phase activities and water discharges

53. This chapter describes the water discharge activities which will occur during the Construction Phase of the Project, and the handling and treatment techniques which will be deployed to minimise the discharge of pollutants to the environment. It identifies the locations of the discharges to local surface watercourses and the marine environment. Estimates of both flow rates and discharge compositions are presented in Chapter 4.

3.1 Bulk earthworks (WNDA Surface Water Drainage)

54. The initial stage of construction work will involve the stripping of topsoil from areas of the WNDA to a typical depth of 0.3 m and stockpiling the soil in mounds at various locations around the site. Earthworks will then be undertaken within the WNDA in order to develop the platforms necessary to accommodate the Power Station and its associated infrastructure. The material excavated during construction of the platforms will be retained on site and formed into mounds which will subsequently be covered with the stripped soil. There will ultimately be a total of five permanent landscaping mounds within the WNDA (designated A to E) as illustrated in Figure 3.1.

55. Rainwater falling onto the soil mounds and the areas where vegetation and soil have been stripped will have the potential to pick up polluting substances, resulting in run-off containing elevated sediment and leached contaminants (these are naturally occurring substances in the soils). Therefore, to control the run-off a drainage system will be installed to collect water from across the WNDA construction area (including the mounds) and direct the water into settlement ponds. Water in these settlement ponds will then be discharged to local watercourses, or in one case, effectively directly to the sea over a short section of land. The surface water drainage system will be installed progressively, as part of the earthworks and will remain in place throughout the Construction Phase.

56. In order to aid settlement of suspended solids and to reduce concentrations at the outfalls, a treatment system (a modular arrangement of lamella clarifiers housed in portable tanks – hereafter referred to as a “settlement unit”) will be installed between the outflow from each settlement pond and the discharge to surface water. If required, chemicals would be added in the settlement unit to act as a flocculent or coagulant. Tests have been undertaken to determine what may be suitable substances to use and, based on performance and potential environmental impacts, a polyelectrolyte has been determined to be the most suitable coagulant.

57. It is likely that over time, once the mounds and soil surfaces remain undisturbed, the concentrations of substances in the drainage water would reduce as soils become more compacted and vegetation establishes itself such that percolation through the soils follows established flowpaths and there is less loose soil material on the surface to enter the suspended solids phase. Furthermore, as there is a finite amount of each substance in the soil within the mounds, the concentrations of substances in the dissolved phase are likely to reduce over time as the more easily leached material is removed.

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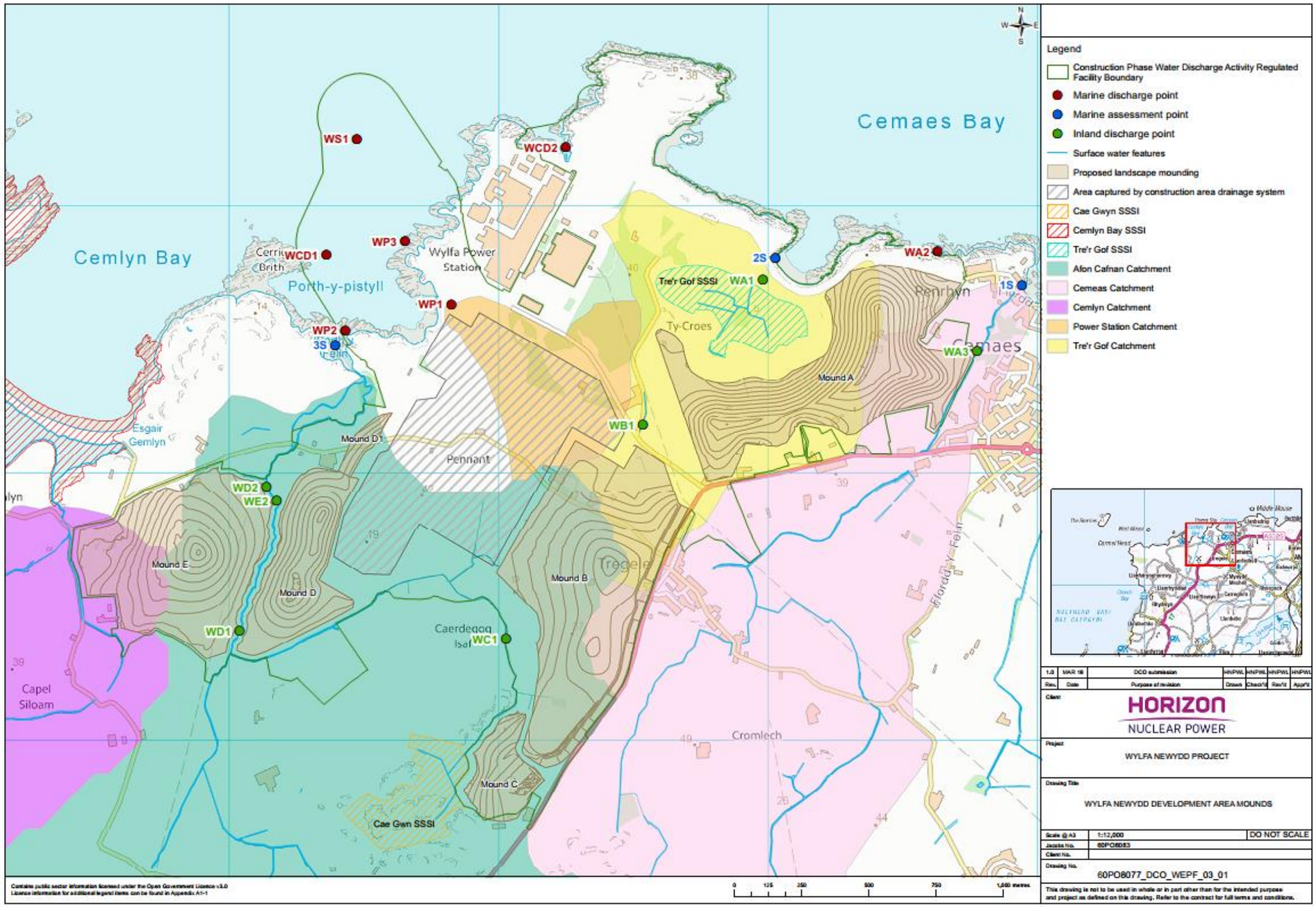
Figure 3-1 WNDA Mounds



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58. The WNDA has been subject to extensive pre-development ground investigations. These have established that there are a small number of areas of ground contamination within the WNDA, comprising made ground, asbestos and asbestos containing materials, trichloroethene (an organic solvent) and other hydrocarbon contamination. These areas of ground contamination are considered to be a result of activities carried out during the construction of the existing Wylfa Power Station. Areas of contaminated ground will be remediated at the start of the Construction Phase; this will remove the potential pollutants at source, and they have therefore not been considered further in the assessment of discharges.

3.1.1 Sustainable drainage system

59. The WNDA landscaped areas will be served by a Sustainable Drainage System (SuDS) designed in line with current planning policy [RD28], [RD29]. The aim of the drainage system will be to maintain the overall surface water balance within existing drainage catchments with key focus on minimising impacts to the SSSIs and European-designated sites located within, or close to, the WNDA. In particular, it is designed to:

- Protect against short term peaks in total suspended solids (TSS) concentrations in the surface flow from the mounds;
- Treat and reduce finer particles in the flow such as clays and silts; and,
- Ensure that TSS limits are met whilst taking consideration of existing baseline conditions and the variability of the mound environment throughout its construction.

60. SuDS work by slowing and holding back the water that runs off from a site whilst allowing natural processes to break down pollutants and/or remove sediment. The proposed drainage system and settlement ponds will be sized so that it is capable of managing increased flows from extreme storm events (up to the 1 in 100 year event) to ensure that flood risks are managed to an acceptable level throughout the lifetime of the development.

61. The proposed SuDS will capture the majority of suspended sediments generated as a result of construction activities. To ensure that there are sufficient safeguards in place to manage risks across a range of storm events additional measures have been incorporated into the drainage system. These include:

- Soil management techniques;
- Use of artificial barriers to capture/trap sediments; and,
- Settlement units employing coagulant or flocculant dosing, where necessary, to reduce suspended sediment concentrations downstream of the settlement ponds. These units are designed to treat discharges up to the 1 in 2 year rainfall event and would be kept in place until vegetation on the mounds matures and the risk from elevated levels of suspended solids decreases.

These measures are described further below.

3.1.2 Soil management techniques

62. Soil erosion during and after construction will be managed in accordance with the Code of Construction Practice (CoCP) [RD30]. As part of soil management it is proposed that any mounds that will remain undisturbed for more than 60 days will be grass seeded at the earliest opportunity.

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3.1.3 Suspended sediment controls

63. Soil erosion and subsequent suspended sediment controls include the following measures:

- Silt fences at the toe of unvegetated earthwork mounds and/or erosion control matting on the face of the mounds. Soil management and silt fences will, at source, provide an initial defence against the migration of sediment into the drainage system. Silt fences are used at the toe of exposed ground and stockpiles to reduce silt transport. They are made from geotextiles (a permeable synthetic textile material);
- Silt traps, and vegetated channels. These can be used at intervals along ditches to support localized silt removal principally by slowing the velocity of the flow, promoting settlement. Silt traps use sized wells, below an outlet, which collect rainwater and allow the deposition of silt and sand;
- Swales. These are shallow, broad and vegetated channels designed to store and/or convey run-off and remove pollutants; and,
- Settlement ponds. Ponds incorporating permeable berms and silt forebays have been sized to attenuate surface water flows. They will be sufficiently large to allow for suspended sediment to settle prior to discharge into the receiving watercourse.

3.1.4 Polyelectrolyte coagulant dosing

64. The SuDS and sediment control measures described above will capture the majority of sediments down to a particle size of approximately 0.002 mm (below this size there will still be some sediment removal, however, it becomes less effective due to the time required to settle out very small particles). The excavated material from the site will include clay, the particles of which are typically less than 0.002 mm. Therefore, additional mitigation, in the form of polyelectrolyte coagulant dosing, is proposed alongside the SuDS to provide treatment for fine particles within surface water run-off, should it be required.

65. It is envisaged that dosing will only be used to respond to rapid increases in TSS concentrations from within the WNDA construction areas, and will be designed to treat discharges arising from rainfall events (i.e. storms) up to and including the 1 in 2 year return period (plus a 20% allowance for climate change). Increased release of fine particles in surface water run-off would typically be expected during construction activities and whilst mounds are not vegetated. The SuDS on its own would manage TSS at all other times (i.e. post mound construction and vegetation).

66. A settlement unit employing polyelectrolyte coagulant dosing system will be established at each surface water discharge location to treat surface water run-off particulates less than 0.002 mm based on the TSS limit imposed (see Chapter 4). Treatment by dosing can, if required, reduce TSS concentrations to a practical limit of 25 mg/l, although it should be recognised that these lower limits are achieved through the use of larger volumes of coagulant, and also to require more space for treatment units and consume additional energy.

67. The settlement units will be installed between the SuDS settlement pond outfalls and the eventual discharge point. Intake to the unit would be controlled either using a weir, hydrobrake penstock gate and/or by pumping. Flow would enter a mixer tank where polyelectrolyte dosing would take place prior to discharge into the clarifier tank (where the water would be treated).

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68. A flow proportional system of dosing is proposed, i.e. dosing will be directly proportional to the water quality of the incoming flow. This method of treatment is considered to be more efficient than methods which rely on dissolving polyelectrolyte into solution. Each dosing unit will have a limiting capacity. A typical unit has a capacity of 200 m^3/hr (55 l/s). Multiple units are thus expected to be required at each discharge point to accommodate the predicted flows.

69. Where monitoring of outflows from the settlement ponds indicates that TSS concentrations are raised and have the potential to exceed permitted limits then the dosing system will automatically be engaged. Dosing of coagulant will be undertaken proportional to flow (up to and including the 1 in 2 year flow) in order to achieve the permitted TSS limit. Once sediment concentrations have been shown to be below the permitted limit the dosing system would then cease to operate. It should also be noted that in the vast majority of storms, it is likely that the 'first flush' contains the majority of the pollutants, including TSS[4]. Once this 'first flush' has passed, it is likely that the natural SuDS system will suffice.

70. For flows above the 1 in 2 year event, the dosing of the discharge will continue at the rate set for the 1 in 2 year flow; but will not be increased to treat the additional component of the flow. (see section 5.4.1).

3.1.5 Activity phasing and design specifics

Mound A

71. Mound A is in close vicinity to the Tre'r Gof SSSI (see Figure 3.1). In order to mitigate against potential impacts to the SSSI, it is planned to complete all associated earthworks on the northern and western side of the mound within the first earthworks season of the construction programme, or full year working within the drier months only. The proposals include reinstatement of topsoil and re-establishment of vegetation.

72. Vegetation on the western side of Mound A may be accelerated through the implementation of appropriate surface binding techniques, such as hydroseeding[5], or impregnated matting, thereby reducing the likelihood of elevated and/or uncontrolled sediment run-off from unvegetated surfaces.

73. The drainage system design has also incorporated the following features to minimise impacts on the Tre'r Gof SSSI:

- The use of a permeable drainage blanket made up of inert rock material beneath Mound A to the south and east of the Tre'r Gof SSSI. This will allow the shallow groundwater and surface water run-off flowing from the south and east of Mound A to flow under the mound into the SSSI as it currently does. The use of inert rock will seek to ensure that the shallow groundwater chemistry does not change appreciably from the baseline conditions; and,

[4] "The initial runoff from a site or catchment following the start of a rainfall event. As runoff travels over a catchment it will collect or dissolve pollutants, and the 'first flush' portion of the flow may be the most contaminated as a result. This is especially the case for intense storms and in small or more uniform catchments. In larger or more complex catchments pollution wash-off may contaminate runoff throughout a rainfall event" CIRIA C753 Sustainable Drainage Systems (SuDS) manual [RD25]

[5] Hydroseeding is a planting process that uses a slurry of seed and mulch. It is often used as an alternative to traditional sowing of dry seed because it offers a shorter and more successful germination period.

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- The use of overflows along the drainage ditch to the north and west of Mound A. This will mean that during times of higher rainfall, water will flow from the ditch to the ground adjacent to the drain, allowing overland flow to the Tre'r Gof SSSI to be maintained.

74. It is intended that, post construction, the drainage systems associated with Discharge WA1 (see Table 3.2) will be removed and returned to its original and natural form. However, to enable this it will be essential that the existing flow regime is matched and this can only be confirmed during the detailed design stage.

Mound B

75. Surface water drainage to Mound B will be provided principally by means of ditches that will drain in a northerly direction. As Mound B will be used as a laydown area the drainage ditches positioned for the construction stage will be temporary and will be repositioned prior to forming the final mound profile at the end of the Construction Phase.

Mound C

76. Mound C is located to the northeast of the Cae Gwyn SSSI. It includes a 1,100 space temporary car park during construction that will be significantly reduced to a smaller and permanent Visitor Centre car park on completion. The majority of surface water run-off from the temporary car park will be drained northwards and will be discharged into the Nant Caerdegog Isaf, located to the west of the mound.

77. The presence of a car park will introduce a risk of pollution from hydrocarbons entering the drainage system. While the overall risk of a significant pollution incident is considered low, the design of both car parks will incorporate appropriate mitigation to prevent downstream pollution of the aquatic environment (this may include features such as bio-retention strips, ponds incorporating reed beds, permeable paving and/or the use of oil separators). The details have yet to be finalized, and a Forward Work Plan item [FA_{CWD}-1] has been included in Chapter 9 for Horizon to provide NRW details of the proposed measures prior to the start of the Construction Phase.

Mound D

78. Mound D will be used as a laydown area and most of the drainage ditches positioned for the construction stage will be permanent although there are areas where the drainage ditch will be relocated. Surface water run-off from Mound D will be discharged to the Afon Cafnan to the west. A minimum 15 m vegetated construction buffer zone will be established and maintained immediately adjacent to the river edge to reduce the risk of uncontrolled sediment migration into the river.

Mound E

79. In order to avoid discharge to Cemlyn Bay lagoon, via Nant Cemlyn, drainage from the western side of Mound E will be collected in settlement pond E1 (shown in Figure 3.7 on the western extreme of the WNDA) and transferred to the Afon Cafnan via discharge point WE2.

80. It is planned to complete all associated earthworks on the western side of Mound E within the first earthworks season of the construction programme (assuming favourable weather conditions), or a full year working within the drier months only. The works would include the reinstatement of topsoil and re-establishment of vegetation.

81. Vegetation on the western side of Mound E will be accelerated through the implementation of appropriate surface binding techniques, such as hydroseeding, or impregnated matting,

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thereby reducing the likelihood of elevated and uncontrolled sediment run-off from unvegetated surfaces.

82. There is an intention, post construction, to remove the over-pumping and drainage systems associated with the western side of Mound E, with the land being returned to its original and natural form (the discharge will not need to be permitted once the vegetation is established). However, to enable this it is important that the existing flow regime is matched as far as reasonably practicable and this can only be confirmed during the detailed design stage.

3.2 Dewatering of deep excavations

83. Parts of the main Power Station buildings are designed to be embedded in the ground, constructed on solid rock. There will thus be a requirement for deep excavations in the "Platform Area" (see Figure 3.2) during construction to facilitate the installation of building foundations. In order to enable excavation below the groundwater table, dewatering will be required.

84. Water pumped from the excavations will be routed to settlement ponds (shown in Figure 3.2), each connected in series to settlement units, the design of which will be similar to that employed in the WNDA drainage system (shown in red). This arrangement will control TSS levels within permitted limits. Facilities will be provided to allow pH adjustment to ensure discharges are within permit limits for pH (the pH control method is to be determined, but may be achieved by CO_2 sparging, or a similar technique – see FA_{CWD}-2. The discharge from the settlement units will then be routed to sea via an outfall point.

85. After the early stage of construction, the settlement ponds will also receive water from:

    i) The main construction site surface water drainage system which forms a perimeter around the Platform Area (for the purposes of this Application the water is considered to be part of the discharge from the dewatering of deep excavations);

    ii) Discharge from the dewatering of the Cooling Water Discharge Tunnels (see section 3.4); and,

    iii) Surface water run-off from the concrete batching plant.

86. Three discharge points (referred to as WP1, WP2 and WP3) will be employed over the period of the construction works. The use of these discharge points will vary depending on the sequence of construction and therefore may be subject to change. However, at this stage it is anticipated that discharge WP1 would be used initially (for approximately 1 year), with WP2 developed to allow marine works (dependent on the deep excavation sequence). WP3 would be the final discharge brought into use for the remainder of construction and would be retained, along with WP2, as permanent surface water drainage points. It should be noted that there is likely to be some overlap, with discharges being made from WP2 and WP3 during the same period (i.e. the total discharge may be made via one or other or both discharge points).

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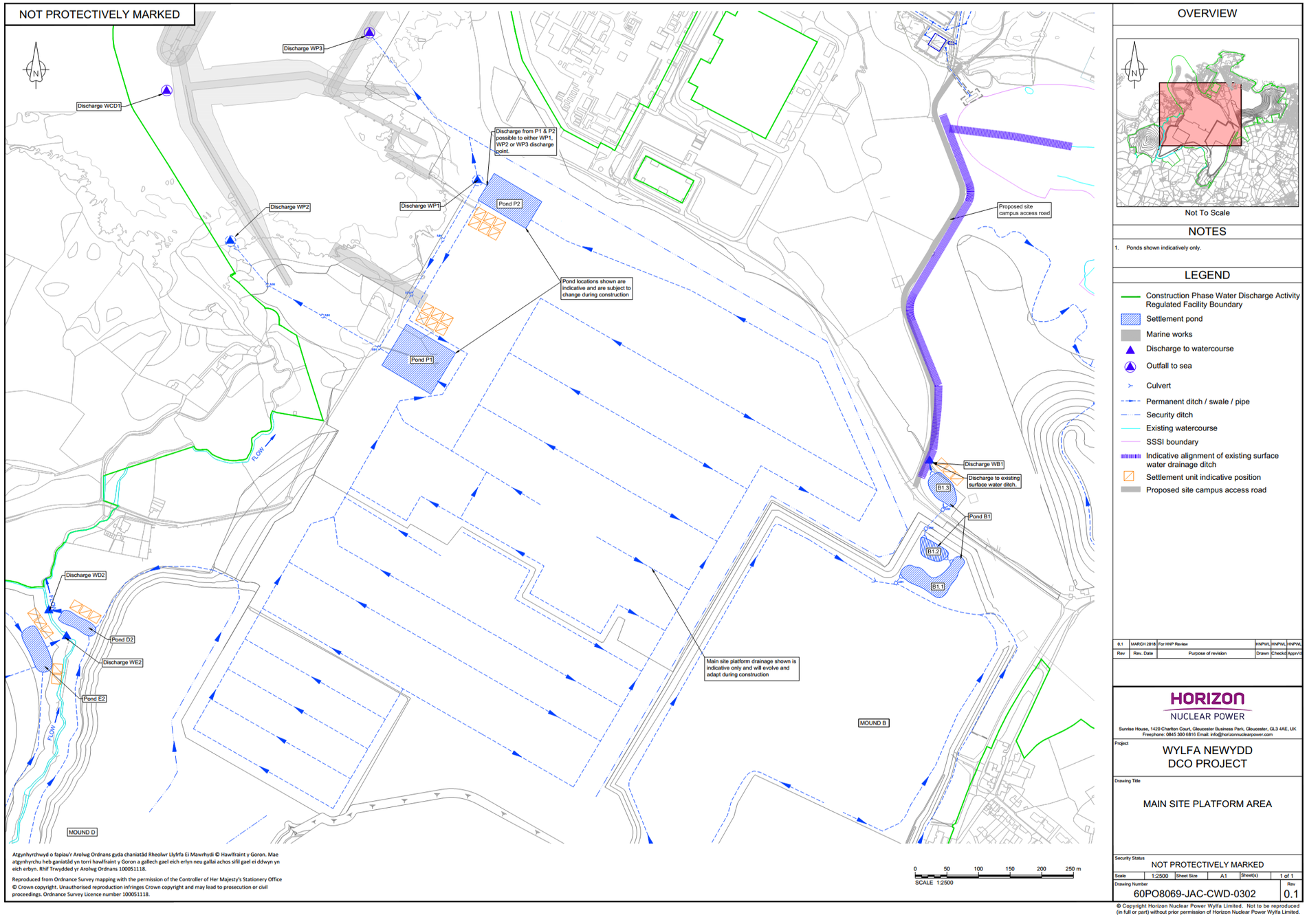
Figure 3-2 Platform Area



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87. Water pumped for the initial dewatering would predominantly comprise groundwater from the higher permeability fractured zone at the top of the bedrock. Ongoing dewatering to maintain a dry working area will then consist of continued groundwater ingress plus rainfall. To minimise groundwater inflow to the excavation, particularly through fractures, the walls of the deep excavations would be lined as the excavation deepens. To minimise surface water inflows running into the excavations, a bund and surface water drainage system would be installed around the periphery of the excavation to prevent surface water from entering the excavation.

3.3 Dewatering of cofferdams

88. In order to allow construction work to proceed at the Power Station Site, two temporary cofferdams will be constructed and then de-watered to create a dry working environment[6]:

- Bund cofferdam; and,
- Outfall cofferdam.

89. Initially, the cofferdams will be dewatered direct to sea by the twin techniques of natural drainage and pumping. Seawater levels allowing, valved pipes within the cofferdam structure will be opened, at appropriate states of tide, allowing the water within the cofferdam to flow back out to sea. The seawater will also be pumped from the land side of the cofferdam to the sea side until the water level inside the cofferdam approaches ground level.

90. For the Outfall Cofferdam a settlement pond/settlement unit arrangement will be used to control TSS in the discharge to sea. The TSS control arrangements for the Bund Cofferdam have not yet been finalised (it is proposed that the majority of the settlement will be carried out within the dewatered area behind the cofferdam). However, regardless of the technique(s) ultimately selected, the discharge to sea will be compliant with the TSS discharge limits given in Chapter 4.

91. Throughout the construction period, rainfall together with seawater and groundwater seepages will collect within the cofferdams. It will therefore be necessary to dewater the cofferdams on an on-going basis. The water will be pumped to sea via the settlement pond/settlement unit arrangement. As the works behind the Outfall Cofferdam will not extend below the existing rock surface, groundwater ingress is not anticipated.

3.4 Dewatering of cooling water discharge tunnels

92. There will be one Cooling Water Discharge Tunnel per UK ABWR, or two in total at the Wylfa Newydd site, as illustrated in Figure 3.3. The development of each tunnel design is ongoing and final arrangements are yet to be established. However, the tunnels will be driven sequentially, and the construction activities will broadly be as described below.

[6] A third cofferdam, the Intake Cofferdam, will be constructed inside the Bund Cofferdam after the latter has been dewatered. The Intake Cofferdam will remain in place after the Bund Cofferdam is removed, to allow construction of the intake structure to be completed. The area behind the Intake Cofferdam will be dewatered and discharged to sea after settling. However, the volume of discharge will be substantially less than the discharge from the Bund Cofferdam (which encloses a much larger area). The location and discharge volumes from the Intake Cofferedam dewatering are yet to be established. Horizon proposes to make an application to vary the CWD-EP when this information is known.

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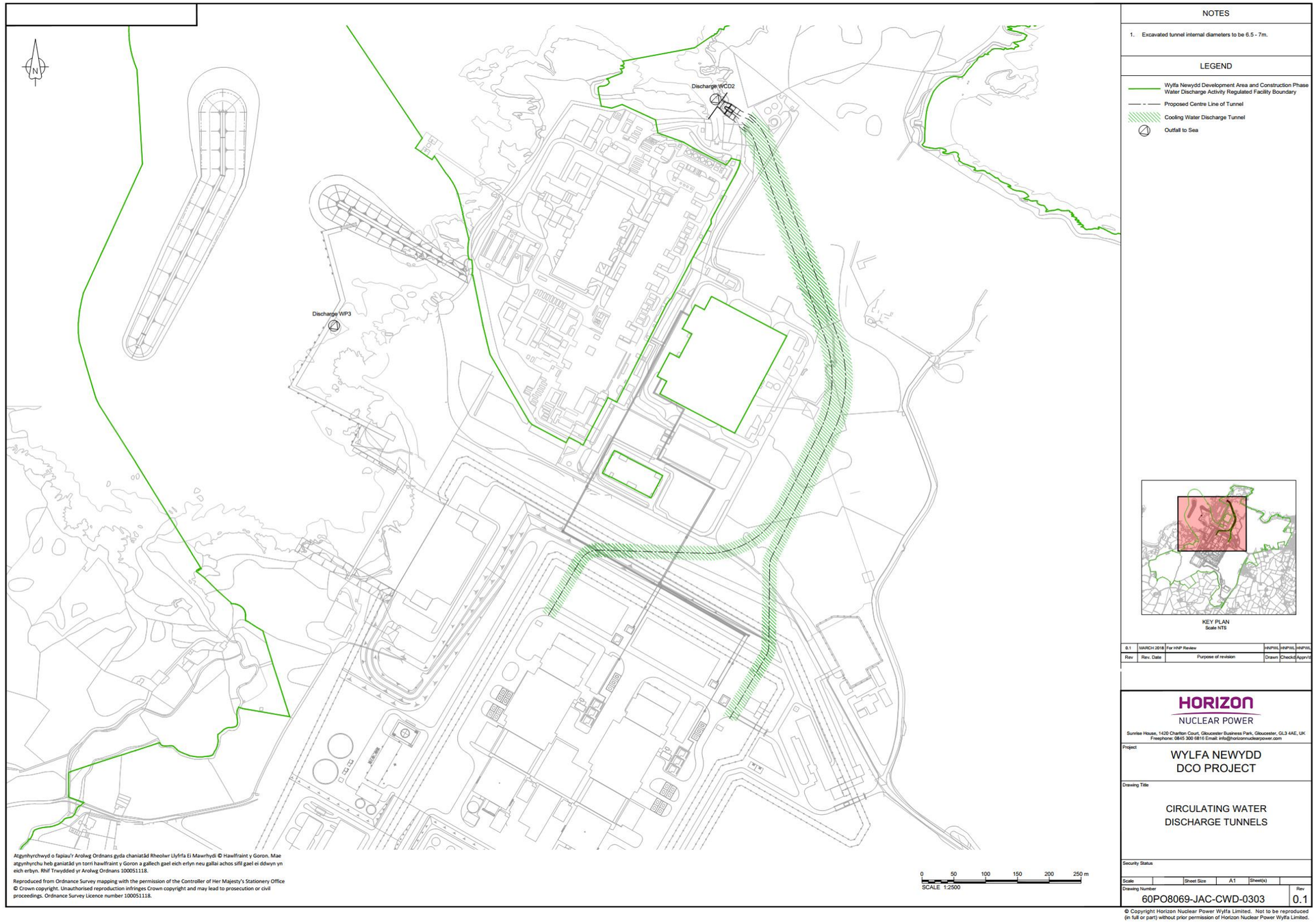
Figure 3-3 Cooling Water Discharge Tunnels



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93. Initially, probe-hole drilling of the tunnel route will be undertaken to verify rock quality and assess the potential for groundwater ingress. If required, pre-excavation grouting will be carried out through the probe-holes in order to limit groundwater flow rates such that they do not impact construction.

94. A heading (a smaller tunnel) will be excavated to advance the main tunnel. The length of the heading is yet to be determined and will be partially dependent on the rock quality encountered, however is likely to be up to 20 m. Initial tunnel support will be installed in the heading prior to driving the next section. The initial tunnel support will incorporate a lining which will be designed to resist hydrostatic pressure. On completion of the full tunnel a permanent lining will be installed.

95. Preliminary calculation from Horizon's groundwater model indicates a maximum water in-flow rate of 70 l/s for a 20 m open heading at the tunnel face, with the tunnel lined behind the 20 m opening. This is the maximum flow rate which it is currently assumed will need to be dealt with during tunnel construction. The assumed flow rate is conservative, and may well be reduced by ground conditions being better than worst case assumptions, grouting or the use of a reduced heading length.

96. Water arising during tunnel construction will be collected in sumps and pumped to attenuation points located at either tunnel portal where it will be monitored, pH adjusted, if required, and treated in a settlement pond/settlement unit to ensure compliance with TSS limits. It will then be routed to sea either over the Outfall Cofferdam (Discharge Point WCD2) or via WP3 and/or WP2.

3.5 Concrete batching plant operation

97. During the construction period concrete will be produced in on-site concrete batching plants. Peak concrete production is expected to be around 35,000 m^3 per month which would require four or five batching plants, with the largest being capable of producing 200 m^3 per hour down to the smallest unit producing 60 m^3 per hour. The concrete batching plant would have a total footprint of up to 3.6 ha, and will be located at the north of the site to allow for easy unloading of concrete materials from the MOLF (see Figure 3.4).

98. The concrete batching plants will produce two wastewater streams:

- Process water, generated as part of the concrete production process and from concrete mixer vehicle wash-out; and,
- Surface water run-off from the batching plant area.

99. All process water used in the concrete batching plant will be either recycled within the system or, where there is excess, tankered off site for treatment and disposal. There will be no on-site discharge of process water.

100. The concrete batching plant and the immediately surrounding process areas will be covered by hardsurfacing which will drain rainfall to collection tanks. Concrete mixer lorry wash-out will be carried out within the batching plant area, and the drainage collected in the same collection tanks. Water from the collection tanks will be used in the concrete production process and will not be discharged to surface water drainage system.

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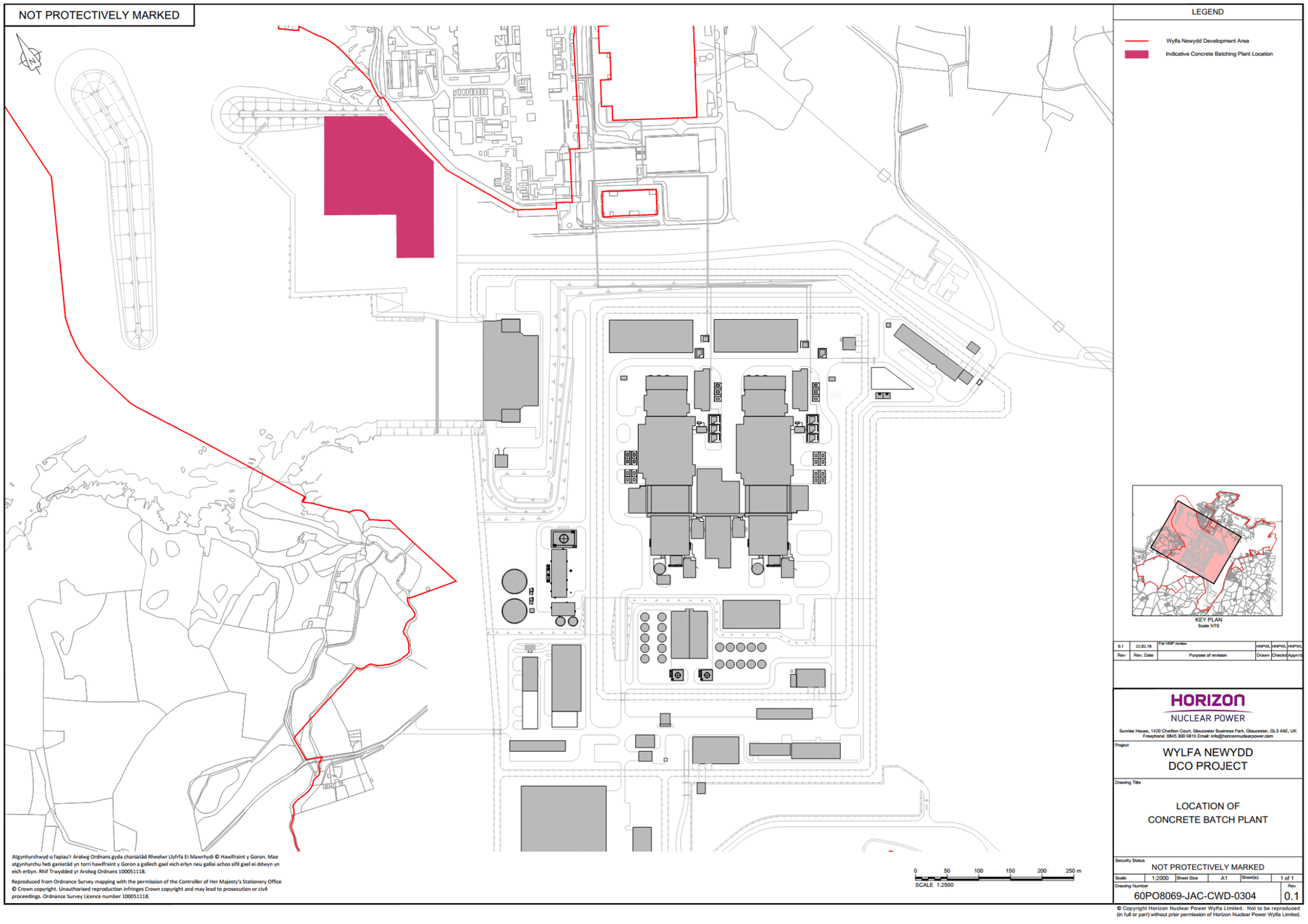
Figure 3-4 Location of Concrete Batch Plant



Note. The location of the concrete batching plant is subject to final resolution of the positioning of adjacent drainage facilities.

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101. Run-off from the area surrounding the concrete batching plant (outside the processing area) will be collected, held up in ponds and tested for pH before being released into the main site surface water drainage system. In the event that the effluent is measured at above the permit pH limits it would be treated prior to discharge (see FWP_{CWD}-2) from WP3.

102. In order to minimise the amount of cement dust present in the run-off, the concrete batching plant will include measures to prevent or reduce emissions of dust. These include enclosing the various parts of the plant, silos, material storage areas and cement powder delivery systems fitted with suitable dust mitigation systems, and regularly cleaning hard-surfaced areas.

3.6 Discharge from vehicle wheel wash

103. Vehicle wheel washing will take place in designated areas with the wash water recirculated, as far as reasonably practical. Wastewater from these areas will be collected and passed through silt traps and oil interceptors, before discharge to a sediment treatment system. From there it will be discharged to the marine environment (see Section 3.2).

3.7 Wastewater treatment works operation

104. It is estimated that during construction the WNDA construction site will host up to a maximum of 9,000 personnel peaking in 2023/24. Until the number of on-site personnel reaches approximately 350, sewage arisings will be removed by tanker and treated in an external facility. Above this number, it is proposed that the construction site sewage will be treated in the temporary, modular Construction Site WwTW, and the treated effluent discharged to the marine environment via a diffuser outfall pipe located at the end of the west breakwater. The design basis of the WwTW is given in Table 3.1.

Table 3.1 Characteristics of Raw Sewage Input to the Construction Site WwTW

Parameter	Flow Related	Concentrations (mg/l)	Loads (kg/d)
Population	9,000		
Population equivalent (PE)	5,700		
Daily flow (including 10% infiltration)	990 m^3/d		
Daily operating time	12 hours		
Number of days per week	7		
Maximum instantaneous flow	22.9 l/s		
Biochemical oxygen demand (atu) (BOD_5)		345	342
Chemical oxygen demand (COD)		760	752
Total suspended solids (TSS)		432	428
Total nitrogen (as N)		69	68
Total ammoniacal nitrogen (as N)		45	45
Total phosphorus (as P)		17	17
Phosphates (as P)		6	6

105. The Construction Site WwTW is designed to achieve a “conventional” treated final specification of 20 mg/l BOD and 30 mg/l TSS, with microbial contamination of 3.0 x 10^6

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Colony Forming Units (CFU)/100 ml. The treatment plant is based on four streams to allow adequate turndown of treatment as the site population increases/decreases over the construction period. The WwTW design for the preferred solution is based on secondary treatment provided by the activated sludge process, which provides a minimum footprint and can be supplied by a wide range of process contractors. Whilst disinfection is not currently deemed to be required, an allowance has been made to enable duty/standby ultraviolet (UV) units to be retrofitted should it become necessary..

106. For discharge at the end of the west breakwater it has been calculated from hydrodynamic modelling that, for an effluent flow of 18.5 l/s[7], the mean initial dilution factor (i.e. dilution occurring as the buoyant effluent rises to the sea surface) is 2,764 (the 95th percentile initial dilution is 722). For lower flows the dilution would be greater. The calculation takes account of the water depth at discharge point WS1.

3.8 Locations of water discharge points

107. There are 14 water discharge points associated with construction works as listed in Table 3.2 and illustrated in Figures 3.5, 3.6 and 3.7. Figure 3.8 shows the phasing of these discharge points. Seven of these discharge points – WA1, WA3, WB1, WC1, WD1, WD2, and WE2 – are initially to freshwater watercourses, including WB1 which discharges to a stream that flows into the Tre'r Gof SSSI. The remaining discharge points – WA2, WP1/2/3, WCD1, WCD2 and WS1 – are direct to sea. Discharge points WP1, WP2 and WP3 are located to the north west of the construction area and their use will vary depending upon the sequence of construction. In addition, there are three assessment points, 1S, 2S and 3S, which where the surface watercourses discharge into the sea.

108. Discharge points WC1, WD1, WE2, and WD2 are consecutive discharges to the same watercourse, the Afon Cafnan (WC1 discharges to the Nant Caerdegog Isaf which is a tributary of the Afon Cafnan). Similarly, discharge points WB1 and WA1 are consecutive discharges to the Tre'r Gof drains, with WB1 entering upstream of the SSSI and WA1 entering the watercourse downstream of the Tre'r Gof SSSI before it discharges to the sea.

109. The discharge from the dewatering of deep excavations and surface water run-off from the construction platform area will be discharged at point WP1/2/3. The two discharge streams are conveyed separately to the settlement ponds, from where they are discharged at points WP1/2/3. The discharge point for the WwTW (WS1) is situated at the end of the west breakwater.

[7] Note that there will be buffer tanks in the WwTW design, and the maximum discharge rate is lower than the maximum design inflow.

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Table 3.2 Discharge Locations and Receiving Waters

Effluent Name	Source	Discharge Ref.	Grid Reference	Treatment	Receiving Waters
WNDA Surface Water Drainage	Mound A and Site Campus	WA1	SH 35983 93781	SuDS, settlement pond/settlement unit	Unnamed watercourse which forms the discharge from the Tre'r Gof SSSI
	Mound A	WA2	SH 36633 93779	SuDS, settlement pond/settlement unit	Cemaes Bay
	Mound A	WA3	SH 36772 93447	SuDS, settlement pond/settlement unit	Nant Cemaes
	Mound B	WB1	SH 35539 93117	SuDS, settlement pond/settlement unit	Small watercourse into north west of the Tre'r Gof SSSI
	Mound C	WC1	SH 35026 92379	SuDS, settlement pond/settlement unit	Nant Caerdegog Isaf (tributary to Afon Cafnan)
	Mound D – South	WD1	SH 34042 92407	SuDS, settlement pond/settlement unit	Afon Cafnan
	Mound D – North	WD2	SH 34145 92938	SuDS, settlement pond/settlement unit	Afon Cafnan
	Mound E – East and West	WE2	SH 34174 92897	SuDS, settlement pond/settlement unit	Afon Cafnan
Discharge from the dewatering of deep excavations	• Main construction site surface water (early stages of construction) • Vehicle wheel washing	WP1	SH 34825 93626	SuDS, settlement pond/settlement unit	Porth-y-pistyll (sea)
Discharge from the dewatering of deep excavations + **Discharge from the dewatering of the Cooling Water Discharge Tunnels**	• Main construction site surface water • Deep excavation dewatering • CW Tunnel dewatering • Vehicle wheel washing	WP2	SH 34435 93528	SuDS, settlement pond/settlement unit	Porth-y-pistyll (sea)

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Effluent Name	Source	Discharge Ref.	Grid Reference	Treatment	Receiving Waters
Discharge from the dewatering of deep excavations + **Discharge from the dewatering of the Cooling Water Discharge Tunnels** + **Surface run-off from the concrete batching plant**	• Main construction site surface water • Surface water run-off from concrete batching plant area • Deep excavation dewatering • CW Tunnel dewatering • Vehicle wheel washing	WP3(1)	SH 34653 93861	SuDS, settlement pond/settlement unit pH adjustment (concrete batching plant area drainage)	Porth-y-pistyll (sea)
Discharge from the dewatering of the Bund Cofferdam	• Surface water from Bund Cofferdam • Dewatering from Bund Cofferdam	WCD1	SH 34354 93780	SuDS, settlement pond/settlement unit	Sea
Discharge from the dewatering of the Outfall Cofferdam + **Discharge from the dewatering of the Cooling Water Discharge Tunnels**	• Surface water from Outfall Cofferdam • CW Tunnel dewatering	WCD2(1)	SH 35225 94242	SuDS, settlement pond/settlement unit	Sea
Treated effluent discharge from the Construction Site WwTW	Wastewater Treatment Works	WS1	SH 34475 94323	Conventional active sludge treatment process.	Sea

Note. (1) Water from the Cooling Water Discharge Tunnels can either be discharged via WP2/3 or WCD2 (along with water from the Outfall Cofferdam).

(2) The current Horizon assumption is that the WCD1 and WCD2 discharge locations will be over the respective cofferdam wall. In the absence of further information Horizon has assumed this to be at the centre of each cofferdam wall.

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Figure 3-5 Water Discharge Points Schematic

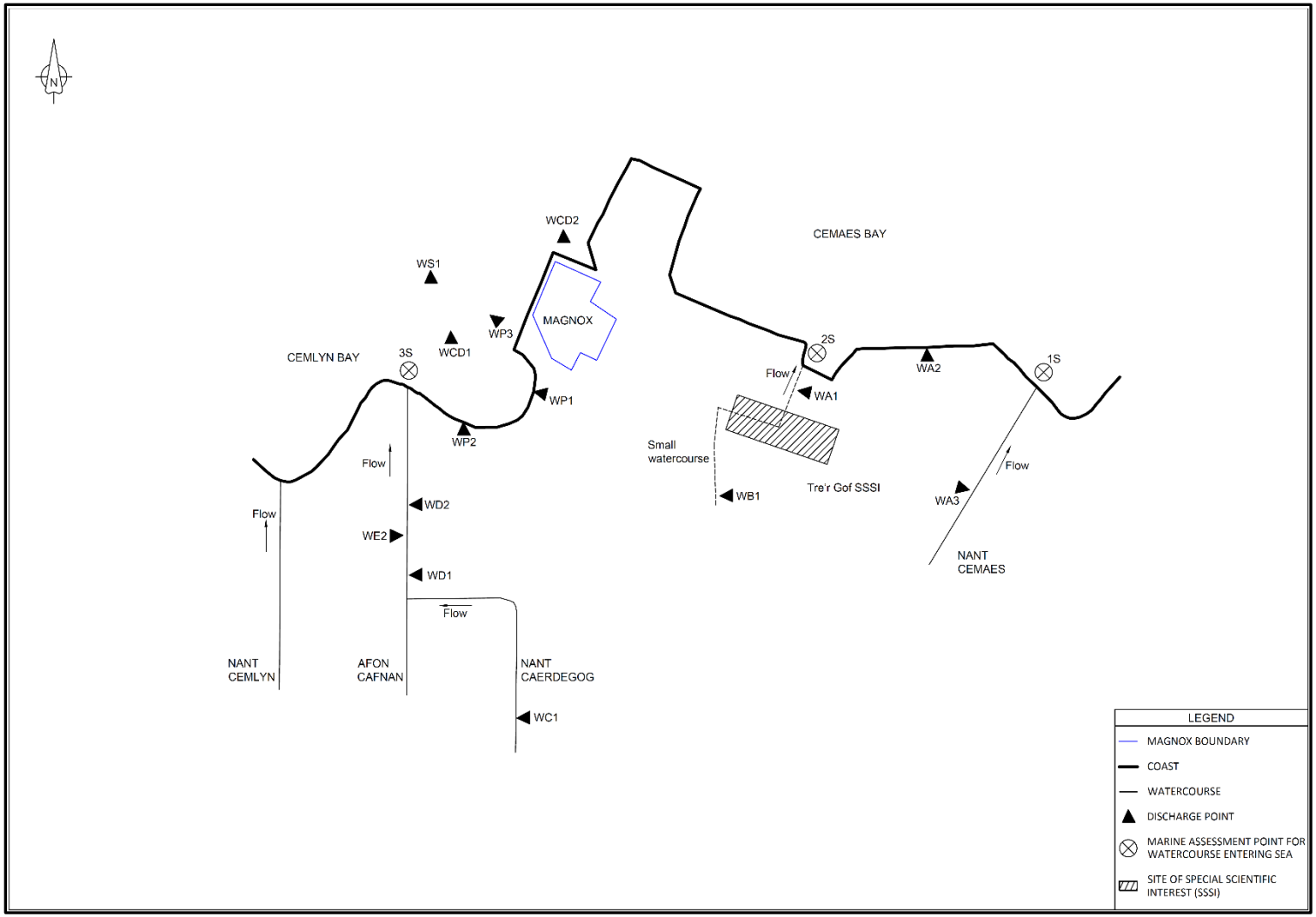

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Figure 3-6 Schematic of Discharge Sources and Discharge Points

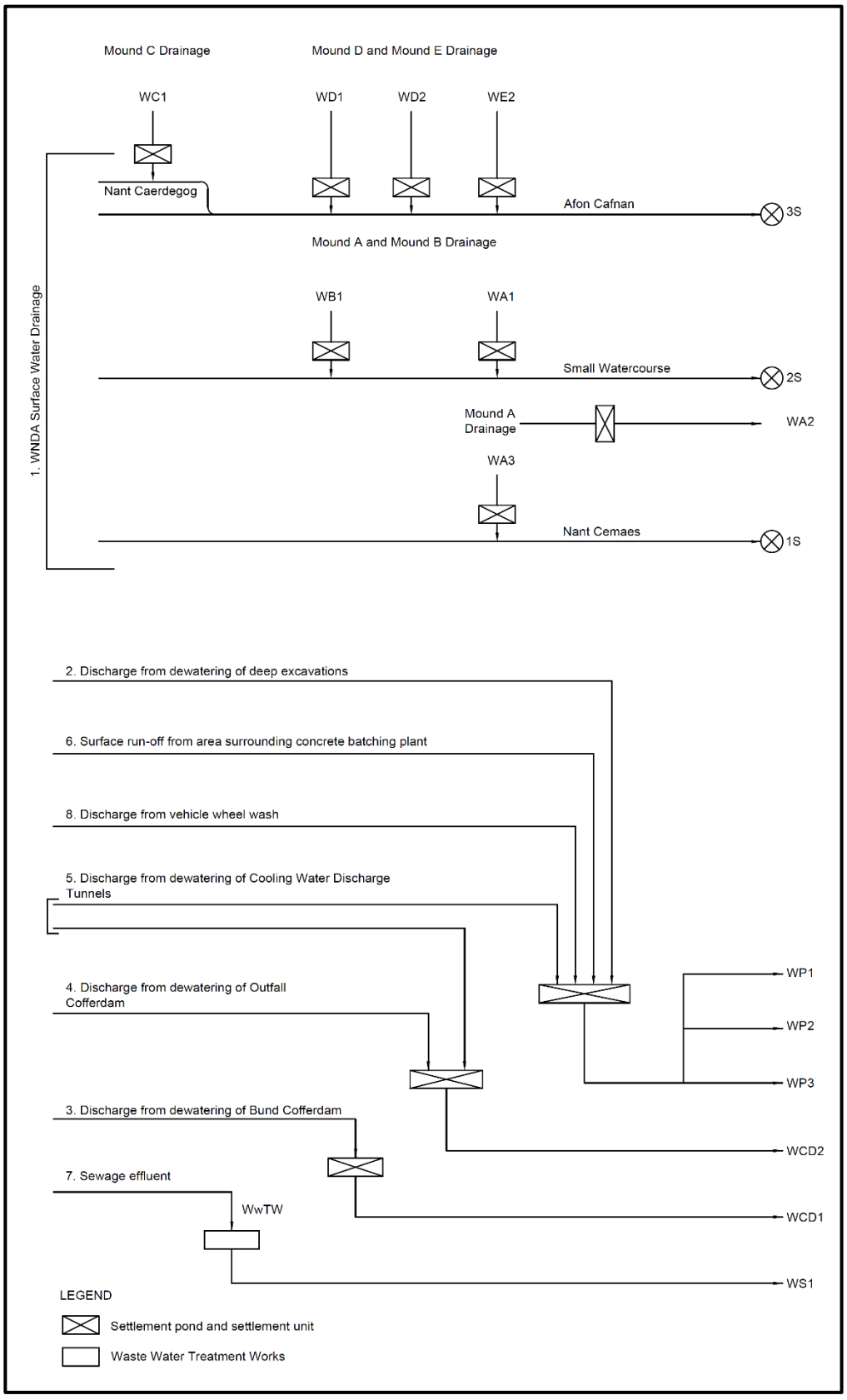


Figure 3-7 Water Discharge Points

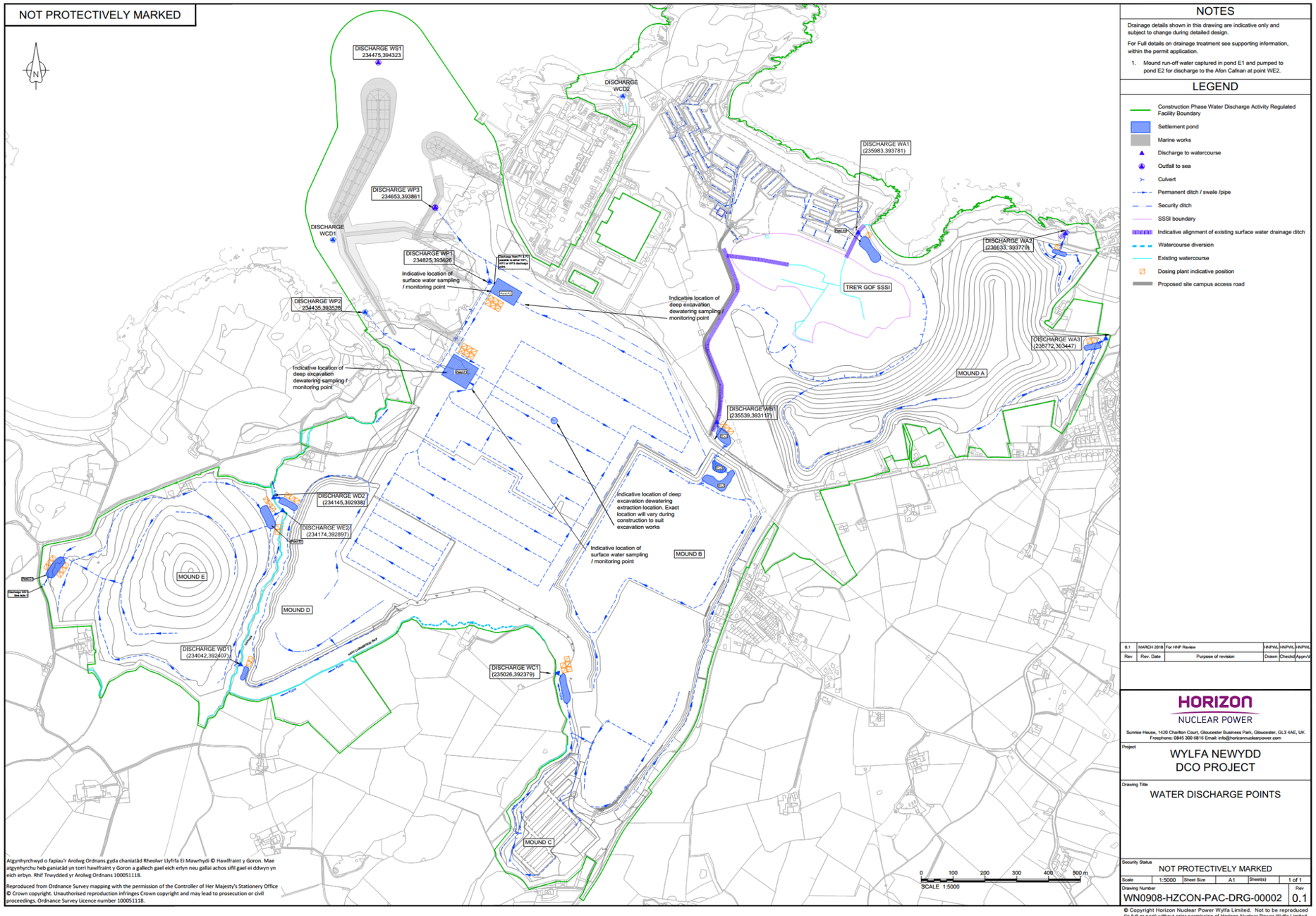
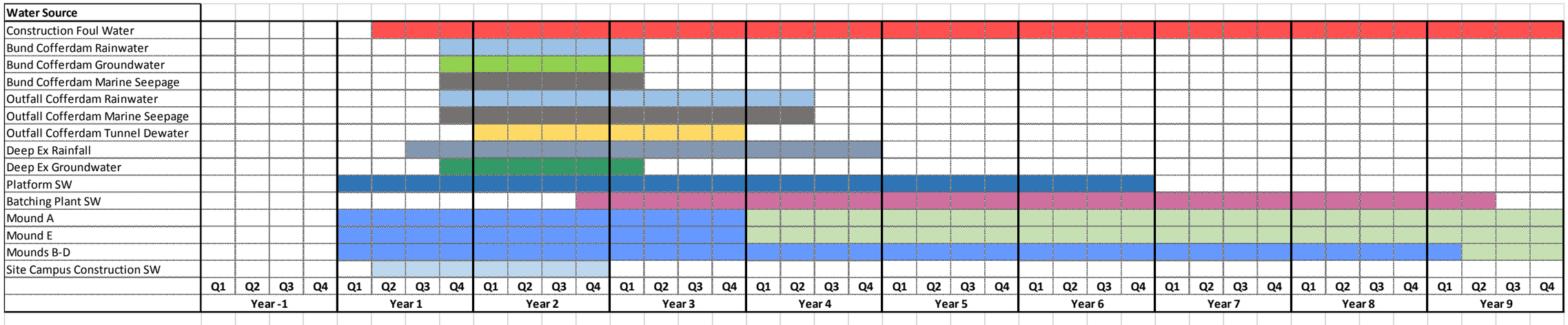


Figure 3-8 Provisional Durations of Construction Phase Discharges



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4 Discharge estimates

110. This chapter presents estimates of the flow rates and compositions of the following water discharges which will result from the activities described in Chapter 3:

- WNDA surface water drainage[8];
- Discharge from the dewatering of deep excavations;
- Discharge from the dewatering of the Bund Cofferdam;
- Discharge from the dewatering of the Outfall Cofferdam;
- Discharge from the dewatering of the Cooling Water Discharge Tunnels;
- Surface Run-off from the area surrounding the concrete batching plant; and,
- Treated effluent discharge from the Construction Site WwTW.

111. The data have been used as input to the screening environmental risk assessment and detailed marine dispersion modelling described in Chapter 6.

4.1 WNDA surface water drainage

4.1.1 Discharge flow rates

112. Annual average, 1 in 2 year return period, and maximum (1 in 30 year return period, plus climate change) flow rates for the discharges from the WNDA Surface Water Drainage System to the surface watercourses are presented in Table 4.1. The flow rates have been estimated using the 4Rs Model (4R) for shallow groundwater and surface water flows. The 4Rs model results provide an estimate of daily flows for each surface water discharge based on simulations using rainfall and other meteorological data from 1960 to 2016.

Table 4.1 WNDA Drainage System – Discharge Flow Rates to Watercourses

Source	Discharge Ref.	Discharge Volumetric Flow Rate (m^3/s)		
		Annual Average	1 in 2 Year Storm	Maximum (1 in 30 year)
Mound A and Site Campus	WA1	0.006	0.038	0.787
Mound A	WA2	0.0009	0.079	0.146
Mound A	WA3	0.0012	0.147	0.274
Mound B	WB1	0.0041	0.189	0.527
Mound C	WC1	0.0025	0.375	0.924
Mound D – South	WD1	0.0005	0.092	0.178
Mound D – North	WD2	0.0011	0.209	0.419
Mound E – East and West	WE2	0.0039	0.775	1.731

[8] Water from wheel washes is included in the site drainage discharge flows. However, as the volume of water from this source is negligible, it has not been separately identified.

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113. The H1 assessment of discharges to surface watercourses and from surface watercourses to sea is based on annual average and maximum (1 in 30 year) flow rates.

114. Annual average, 1 in 2 year and 1 in 30 year (maximum) flow rates for the discharges from the WNDA surface watercourses to sea are presented in Table 4.2. These flow rates were estimated using the 4Rs and Flood Models. The flow rates in Table 4.2 were used in the modelling and assessment of metals and TSS presented in Section 6, and the 1 in 2 year flows are identified as the maximum reasonably expected flow rates reported in Application Form B6.

115. Note that the marine discharge modelling and assessment has been based solely on the discharged flow into the watercourses (therefore the assessment is based on the concentration of discharged pollutants and does not take account of dilution by water already present in the watercourse: this is a conservative assumption).

Table 4.2 WNDA Drainage System – Discharge Flow Rates to Sea

Source	Discharge Ref.	Discharge Volumetric Flow Rate (m^3/s)		
		Annual Average	1 in 2 Year Storm	Maximum (1 in 30 year)
WA3 via Nant Cemaes	S1	0.0213	1.53	2.85
WA1 and WB1 via Tre'r Gof outlet channel	S2	0.01	0.50	0.80
WC1, WD1, WD2, and WE2 via Afon Cafnan	S3	0.0640	5.62	7.83

4.1.2 Discharge characterisation

116. The pollutants associated with the WNDA surface water drainage discharge will arise from the existing WNDA surface soils which will be used to cover the mounds. They will include:

- Total Suspended Solids (TSS);
- Naturally occurring organic and inorganic compounds, and metals leached from the soil;
- Nutrients (nitrates and phosphates) present as a result of the land's previous use for agricultural grazing; and,
- Residual polyelectrolyte from operation of settlement units.

117. Estimates of the potential concentrations of these pollutants in the discharges is described below.

Total Suspended Solids

118. TSS discharges from the WNDA surface water drainage system will be controlled by the settlement pond and settlement unit arrangements described in Chapter 3. The settlement ponds and units will be operated (as described in Chapter 5) to ensure that TSS discharges will be within background levels in the receiving watercourses.

119. Limits are proposed for the TSS discharges occurring in all events up to and including the flow in the 1 in 2 year rainfall event. This covers conditions which are likely to prevail for

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the majority of the time up to relatively infrequent rainfall events occurring, on average, once in every two years. Beyond the 1 in 2 year event, the sediment control measures described in Chapters 3 and 5 will continue to apply, but their design bases will be progressively exceeded as rainfall increases. Sediment loads in the discharge will increase, but flow and sediment loads in the receiving watercourses will also have increased. This approach is described in section 5.4.1.

120. The background to the development of the limits is set out in the report "Assessment of Appropriate Suspended Sediment Concentrations for Water Discharge Locations" presented in Appendix F. The proposed limits are presented in Table 4.3.

Table 4.3 WNDA Drainage System – Proposed TSS Discharge Concentrations

Discharge Ref.	Receiving Waters	TSS Discharge Concentration (mg/l)
WA1	Tre'r Gof outfall channel	40
WA2	Sea (Cemaes Bay)	70
WA3	Nant Cemaes	40
WB1	Small watercourse into the Tre'r Gof SSSI	70
WC1	Nant Caerdegog	70
WD1	Afon Cafnan	40
WD2	Afon Cafnan	40
WE2	Afon Cafnan	40

121. It should be noted that polyelectrolyte dosing is likely to be required to meet the proposed 40 mg/l TSS discharge limits in some circumstances. However, there is a balance to be struck between minimising TSS discharges and the use of polyelectrolyte. Horizon has therefore proposed a FWP item (see FA_{CWD}-7) to collect additional data and carry out further analysis in order to determine whether the 40 mg/l provides an appropriate balance between these objectives.

Leachate

122. The pollutants which will potentially leach from the WNDA mound soils, and their likely concentration within the leachate, have been determined by means of soil leaching tests undertaken as part of ground investigations. The approach to the testing, along with underlying assumptions, is described in Section 4.3.2 of the H1 Assessment report presented in Appendix I. The discharge concentration data thus determined are set out in Appendix A Table 1 to the same report.

123. These data were subsequently "cleaned up" to correct for the effect of outliers and the inclusion of data below limits of detection (the clean-up followed published Environment Agency procedures). The resulting discharge concentrations are presented in Table 4.4.

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Table 4.4 Leachate Pollutants

Substance	Concentration(1) (µg/l)
Orthophosphate (as P)	133
Nitrate (as NO_3)	15,006
Copper (bioavailable)	0.3
Copper (dissolved)	9.3
Chromium III	1.5
Iron	394
Lead (bioavailable)	0.7
Lead (dissolved)	6.5
Zinc (bioavailable)	3.6
Zinc (dissolved)	11.4

Note (1) The reported concentrations are mean values from a series of leaching tests.

Polyelectrolyte

124. Under the proposed operational conditions with flow proportional polyelectrolyte dosing, it is very unlikely that there will be any notable concentrations of residual polyelectrolytes present in the discharge from the settlement units. Dosing is expected to be in the range of 0.1 – 1.0 mg/l. Therefore, any accidental releases or over-dosing of the polyelectrolyte would be in concentrations of less than 1 mg/l; this value has been used in the H1 assessment.

4.2 Discharge from the dewatering of deep excavations

125. The discharge from the dewatering of the deep excavations will comprise groundwater, rainwater, run-off from the application of concrete, and land drainage from around the platform area.

126. The treated discharge will be released to the environment via WP1/2/3. Discharge point WP1 will only be used during the initial construction period (one year). WP2 and WP3 will be used together thereafter throughout the construction period. The discharge flow at any one time may be via a single point or split between both in combination.

4.2.1 Discharge flow rates

127. Average and maximum flow rates for the discharges from the dewatering of deep excavations are presented in Table 4.5. The flow rates have again been estimated using the 4Rs Model (4R) for shallow groundwater and surface water flows.

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Table 4.5 Deep Excavation Discharge Flow Rates

Source	Discharge Volumetric Flow Rate (m^3/s)		
	Annual Average	1 in 2 Year Storm	Maximum (1 in 30 year)
Surface water drainage	0.005	0.019	1.174
Groundwater infiltration	0.0014		
Total	**0.0064**	**0.0204**	**1.1754**

4.2.2 Discharge characterisation

128. The pollutants associated with the deep excavation discharge will include:

- Total Suspended Solids (TSS);
- Pollutants present within the groundwater; and,
- Potential for elevated pH arising from the shotcrete (sprayed concrete) applied to the excavations and other concrete use in construction.

129. Estimates of the potential discharge concentrations of these pollutants is described below.

Total Suspended Solids

130. The discharge from deep excavation de-watering will pass through a settlement pond/settlement unit before being routed to the marine environment. This arrangement will ensure that the TSS in the final discharge does not exceed 70 mg/l in rainfall events up to and including the 1 in 2 year return period.

Groundwater

131. Groundwater dewatering discharge quality has been based on groundwater quality sampling carried out in the area in which dewatering will take place. Groundwater pollutant concentration data is presented in Appendix A Table 2 of the H1 Assessment report contained in Appendix I. These data were subsequently "cleaned up"[9], and the resulting discharge concentrations are presented in Table 4.6. It should be noted that the concentrations are prior to dilution with rain water, etc.

Table 4.6 Groundwater Pollutants

Substance	Concentration(1) (µg/l)
Nickel (dissolved)	13.8
Zinc (dissolved)	38

Note (1) The reported concentrations are mean values from a series of sample tests.

[9] The data "clean-up" follows the H1 methodology, and is described in Appendix I.

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pH

132. The pH will be controlled to between 6 and 10. This is within the range of background values monitored in the sea around Wylfa, reported in the Project Environmental Statement.

4.3 Discharge from the dewatering of the bund cofferdam

133. After initial dewatering, ongoing dewatering will be required to maintain a dry working area behind the Bund Cofferdam wall. The discharge from the dewatering will comprise groundwater seepage, seawater seepage, and rainwater. It will be routed to sea via WCD1.

4.3.1 Discharge flow rate

134. Average and maximum flow rates for the discharges from the dewatering of the Bund Cofferdam are presented in Table 4.7. The flow rates have again been estimated using 4R for shallow groundwater and surface water flows.

Table 4.7 Bund Cofferdam Discharge Flow Rates

Source	Discharge Volumetric Flow Rate (m^3/s)		
	Annual Average	1 in 2 Year Storm	Maximum (1 in 30 year)
Surface water drainage	0.0023	0.0434	0.0787
Seawater infiltration	0.0083		
Groundwater infiltration	0.0023		
Total	**0.0129**	**0.054**	**0.0894**

4.3.2 Discharge characterisation

135. The pollutants associated with the Bund Cofferdam dewatering will be TSS and the groundwater contaminants shown in Table 4.6. TSS will be limited to a discharge concentration of 70 mg/l in rainfall events up to and including the 1 in 2 year return period. As can be seen by the flow data in Table 4.7, the discharge will be dominated by seawater seepage and rainfall. The seawater seepage will be constant, and will continue in dry weather spells, the groundwater component can been seen to only account for 25% of the discharge in dry weather (in wet weather it will account for a smaller proportion of the discharge). The significance of the groundwater component is therefore considered to be small, and is not further assessed in Chapter 6.

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4.4 Discharge from the dewatering of the outfall cofferdam

136. The discharge from the dewatering of the Outfall Cofferdam will comprise rainwater and seawater seepage. It will be routed to sea via WCD2.

4.4.1 Discharge flow rates

137. Average and maximum flow rates for the discharge from the dewatering of the Outfall Cofferdam are presented in Table 4.8. The flow rates have again been estimated using 4R.

Table 4.8 Outfall Cofferdam Discharge Flow Rates

Source	Discharge Volumetric Flow Rate (m^3/s)		
	Annual Average	1 in 2 Year Storm	Maximum (1 in 30 year)
Surface water drainage	0.00005	0.0010	0.0018
Seawater infiltration	0.0056		
Total	**0.0056**	**0.0066**	**0.0074**

4.4.2 Discharge characterisation

138. The Outfall Cofferdam excavation will not be sufficiently deep to become susceptible to groundwater in-flow. Therefore, the only pollutant of concern within the discharge is TSS which will be controlled to a maximum of 70 mg/l in rainfall events up to and including the 1 in 2 year return period.

4.5 Discharge from the dewatering of the cooling water discharge tunnels

139. Water arising from the tunnelling work will be routed to the nearest discharge point for northern or southern excavations, i.e. either over the Outfall Cofferdam (WCD2) or via WP3 (and may also be routed to discharge at WP2).

4.5.1 Discharge flow rates

140. The maximum predicted flow rate for tunnel dewatering has been estimated as 0.07 m^3/s.

4.5.2 Discharge characterisation

141. Samples of groundwater taken from the vicinity of the tunnelling do not contain metals above Environmental Quality Standards (EQS) levels. Therefore, the only pollutant of concern within the discharge is TSS. The TSS will be controlled to 70 mg/l in rainfall events up to and including the 1 in 2 year return period.

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4.6 Surface run-off from the concrete batching plant

142. The rate of run-off from the concrete batching plant will be rainfall dependent. The annual average surface run-off rate is estimated as 0.0015 m^3/s, and the 1 in 2 year storm event flow as 0.006 m^3/s. The water will be corrected for pH (to achieve pH 6-10) and routed to Settlement Pond P1/P2 from where it would be discharged to the marine environment via WP3. The TSS will be controlled to 70 mg/l in rainfall events up to and including the 1 in 2 year return period.

4.7 Treated effluent discharge from the construction site WwTW

4.7.1 Discharge flow rates

143. The proposed Construction Site WwTW design is based on the British Water Code of Practice for Flows and Loads [RD30] for sites with provision of good welfare and canteen facilities which equates to a flow of 100 litres per head (person) per day (l/hd/d). The maximum number of people on the WNDA site is anticipated to be 9,000. Therefore, the maximum flow is assumed to be 990 m^3/d which includes a 10% allowance for infiltration. See Appendix J for further information on the WwTW design.

4.7.2 Discharge characterisation

144. The WwTW is based upon a conventional design and will meet the treatment specification set out in Table 4.9. It has no specific provisions to achieve nitrification.

Table 4.9 Treated Effluent Specification

Treatment Parameter	Concentration
Biochemical oxygen demand (atu) (BOD)	20 mg/l
Chemical oxygen demand (COD)	120 mg/l
Total suspended solids (TSS)	30 mg/l
Escherichia coli/ Intestinal enterococci	3×10^6 CFU/100 ml

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5 Pollution control measures and good practice

145. The Construction Phase water discharges arising from the activities described in Chapter 3, were they not properly controlled, would have the potential to cause environmental impacts from:

- TSS;
- Contaminants in soil and groundwater;
- Elevated nutrient levels (mostly during vegetation clearance and topsoil stripping);
- Discharge of nutrients and faecal indicator organisms from sewage; and,
- Materials spills and accidents (oils and chemicals, and concrete wash waters).

146. This chapter discusses the good practice measures that have been selected by Horizon to prevent and, where not possible, reduce contamination of waters at source, and treat effluents prior to their discharge, thereby minimizing environmental impacts. The chapter also identifies the options assessed for sewage treatment, including the selection of on-site treatment, treatment techniques and discharge locations. The selected control measures will be included in Horizon's construction management arrangements as outlined in Chapter 8.

5.1 Relevant good practice guidance

147. Discharges to water are governed by good practice, which is primarily based upon an acceptable environmental impact, rather than Best Available Techniques (BAT). Sources of good practice which guide Horizon's proposed approach include:

- Environment Agency guidance on the protection of groundwater [RD32];
- Environment Agency Protect Groundwater And Prevent Groundwater Pollution Guidance [RD22];
- NRW, Northern Ireland Environment Agency (NIEA), Scottish Environment Protection Agency (SEPA) and EA Pollution Prevention Guidance Notes (PPG) and Guidance for Pollution Prevention (GPP) including:
  - PPG 1: Understanding your environmental responsibilities - good environmental practices [RD33];
  - GPP 2: Above ground oil storage tanks [RD34];
  - PPG 3: Use and design of oil separators in surface water drainage systems [RD35];
  - GPP 5: Works and maintenance in or near water [RD36];
  - PPG 6: Working at construction and demolition sites [RD37];
  - PPG 7: Safe storage - The safe operation of refuelling facilities [RD38];
  - GPP 8: Safe storage and disposal of used oils [RD39];
  - GPP 13: Vehicle washing and cleaning [RD40];
  - PPG 18: Managing fire water and major spillages [RD41];
  - GPP 21: Pollution incident response planning [RD42];
  - PPG 22: Incident response - dealing with spills [RD43];

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  - PPG 26: Safe storage - drums and intermediate bulk containers [RD44].
- Construction Industry Research and Information Association (CIRIA) Reports:
  - Environmental Handbook for Building and Civil Engineering Projects. Part 1: Design and Specification (C512) [RD45];
  - Environmental Handbook for Building and Civil Engineering Projects. Part 2: Construction (C528) [RD46];
  - Environmental Handbook for Building and Civil Engineering Projects. Part 3: Demolition and Site Clearance (C529) [RD47];
  - Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors (C532) [RD24];
  - Environmental Good Practice on Site Guide (C741) [RD26];
  - The SuDS Manual (C753) [RD25];
  - Coastal and Marine Environmental Site Guide (C744) [RD48].
- Other publications:
  - Construction Code of Practice for the Sustainable Use of Soils on Construction Sites [RD49].

5.2 WNDA surface water drainage system design principles

148. The Construction Phase drainage system is described in Chapter 3. The good practice objectives which informed the design of the system included the need to:

- Establish a drainage system which will develop throughout the Construction Phase of the Project and into the operational phase;
- Match the layout of existing catchments within the WNDA, as far as practicable; and,
- Provide run-off rates that match the existing catchments, as far as is practicable, by incorporating SuDS principles, thereby reducing both flooding risk and controlling erosion and sediment transport.

149. The drainage system design incorporates a multi-stage treatment approach using good practice techniques for soil management, SuDS and treatment prior to discharge, where required. The system incorporates the following key principles [RD25]:

- Using surface water run-off as a resource;
- Managing rainwater close to where it falls;
- Managing run-off on the surface;
- Promoting evapotranspiration;
- Slowing and storing run-off to mimic natural run-off characteristics;
- Reducing contamination of run-off through pollution prevention, and controlling run-off at source;
- Treating run-off to reduce the risk of construction contaminants causing environmental pollution; and,
- Providing a flexible and adaptable system capable of replicating, as far as practicable, existing conditions within the existing drainage catchments.

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150. The drainage system will be installed as the construction works progress and will contain the sediment and pollution control measures outlined below. This will include sediment treatment and the inclusion of oil separators where necessary. The drainage system with its associated channels, ponds, tanks, bunds, silt fences or barriers will be appropriately maintained throughout the Construction Phase, to ensure it operates efficiently.

5.3 Controlling pollutants at source

151. The good practice measures which will be used to control pollution at source, to protect watercourses and groundwater, include:

- Erosion and sediment controls; and,
- Materials control.

These measures are discussed below.

5.3.1 Erosion and sediment

152. Erosion and sediment control methods include:

- Soil management;
- Silt fences;
- Silt traps; and,
- Vegetated channels and swales.

Soil Management

153. Ground will be left with vegetation cover for as long as possible. Soil stripping will be carried out in a phased manner, proceeding ahead of bulk earthworks to minimise the length of time that bare ground is exposed, as far as practicable, to reduce overland flow, run-off rates and erosion. In order to protect the most sensitive receptors, no soil stripping or works will be undertaken in:

- Wylfa Head; and,
- Tre'r Gof SSSI.

154. Stripped topsoil and subsoils will be stockpiled and used to cover mounds and for other landscaping purposes. Where soil is stockpiled for longer than 60 days, the stockpiles will be seeded to reduce sediment run-off.

155. The landscaping mounds A-E will be revegetated as soon as practicable; the aim is that the western side of Mound E is revegetated within one construction season, and Mound A is predicted to be revegetated within three years of the start of the Construction Phase. Other mounds will continue to be used intermittently for materials storage; the amount of re-work of stored material will be minimised to reduce construction costs and programme. Where mounds are likely to remain undisturbed for a period, Horizon will consider whether they can be temporarily seeded and vegetated to reduce sediment load in run-off. However, the details of the mound vegetation phasing has not been developed yet (see FA_{CWD}-3).

156. Vegetated buffer zones will be left in the following areas, to provide protection to watercourses, in line with CIRIA Guidance C741 Environmental Good Practice on Site Guide [RD26].

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- 15 m either side of watercourses;
- 10 m inside of the WNDA boundary; and,
- 50 m around Tre'r Gof SSSI.

157. Horizon will carry out a risk assessment for any proposed works within 15 m of watercourses, including, but not limited to, clearance adjacent to watercourses, construction of bridges and drainage outfalls. Furthermore, a risk assessment will be undertaken for use of any cementitious materials within 50 m of any watercourse. The risk assessments will identify the appropriate controls which will be applied to the works.

Silt Fences/Erosion Control Matting

158. An initial defence against the migration of sediment from the mounds into the drainage system will be provided by silt fences and/or erosion control matting.

159. Silt fences comprise a geotextile membrane supported perpendicular to the flow by means of stakes, and located down slope of the disturbance area. Within the WNDA they will be installed at the base of unvegetated earthworks mounds. The fences work by allowing the passage of water while slowing the water flow and retaining fine particles. Over time the fabric can become blocked, and the fences thus require periodic disturbance to dislodge clogging and once again permit the passage of water.

160. Erosion control matting is a synthetic or natural stabilization fabric which is installed over a disturbed area to provide soil reinforcement and erosion control prior to the development of natural vegetation. The matting will be used, as required, on the face of unseeded mounds.

Silt Traps, Vegetated Channels, and Swales

161. The installation of silt traps, and vegetated/ channels may be used at intervals along drainage channels to support localised silt removal, principally by slowing the velocity of flow. The silt traps use fixed wells below an outlet, which collects rainwater and allows the deposition of silt and sand. Vegetated channels and swales (broad, shallow vegetated channel to store and/or convey run-off and remove sediment) impede or slow the flow of water, allowing sediment to be deposited and preventing further erosion. It should be noted that vegetated channels will take some time to become established, and can only be developed once the earthworks in a particular area have progressed to the point that the drainage channel will not need to be re-routed.

5.3.2 Nutrient run-off

162. Due to the agricultural nature of the land within and surrounding the WNDA, elevated nitrates and phosphates may be present in the surface water run-off from the earthworks mounds. However, as the WNDA has predominantly been used as pastureland for low-density grazing with only a small fraction of the land used for crop agriculture, fertilisers or manures would not have been intensively applied to the majority of the land in the last few years. In order to minimize the nutrient levels within the run-off, grazing animals will be removed from the majority of the WNDA (excluding low intensity grazing for nature conservation reasons at Tre'r Gof SSSI and Wylfa Head) at least one year before the commencement of earthwork activities, which would allow sufficient time for animal faeces to biodegrade naturally.

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5.3.3 Other materials

Fuels, Oils and Other Liquids

163. All fuels, oils and other potentially polluting liquids will be stored in tanks or other secure containers within secondary containment. Horizon will comply with relevant legislative requirements (including the Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 [RD50]), technical standards and good practice guidance in the design of fuel and oil storage areas. No fuel, oil or chemicals will be stored within 15 m of a watercourse.

164. Secondary containment of above ground storage tanks will meet good practice requirements [RD51],where key requirements are that the secondary containment will:

- Be impermeable and resistant to the stored materials;
- Have no outlet (no drains or taps) and drain to a blind collection point;
- Have pipework routed within bunded areas with no penetration of contained surfaces;
- Be designed to catch leaks from tanks or fittings;
- Have a capacity greater than 110% of the largest tank or 25% of the total tankage, whichever is the larger;
- Have tanker connection points within the bund where practicable (otherwise adequate containment should be provided at the connection point);
- Be regularly inspected for their condition;
- Be fitted with a high-level probe and an alarm, where not frequently inspected; and,
- Storage areas will be adequately protected from vehicle impact, where necessary.

165. Dedicated areas will be designated for fuel and oil deliveries. They will be on hardstanding, will drain via an oil interceptor, and will be capable of isolation to contain fuel and oil in the event of a spill. All plant refuelling and maintenance will take place either at dedicated maintenance and refuelling areas, with sealed drainage and an oil interceptor, or above drip trays or over temporary surfaces (e.g. absorbent mat) which provide protection to ground and watercourses. Refuelling and maintenance will be undertaken away from drainage channels and watercourses, wherever practicable. Spill kits will be provided at appropriate locations.

166. During the construction works a variety of other chemical substances may be used, such as paints, solvents, flocculating agents (for settlement ponds), and explosive pre-mix (used for rock blasting). Potentially polluting materials used on-site would be suitably stored and pollution prevention measures deployed as outlined by the relevant/applicable guidance.

Cement and Other Raw Materials

167. Cement and aggregate will be brought on to site, primarily through the MOLF, and delivered to storage silos and containers in the batching plant. Cement storage silos will be fitted with filtration systems to minimise dust emissions, and materials storage and handling will be carried out in contained areas to minimise dust emissions, thereby minimising dust deposition in the surrounding area, which in turn will control the amount of sediment and alkalinity of the run-off.

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Wastes

168. All waste and materials arising from construction works will be stored securely to prevent the escape of wastes (both wind-blown and liquid drainage) and to reduce the risk of causing pollution. Waste will be transferred from the construction site by registered carriers to appropriately licensed facilities, using the correct written information, i.e. hazardous waste consignment notes for hazardous waste and waste transfer notes for non-hazardous controlled wastes.

Vehicle Wash-down

169. All washing-down of vehicles (including wheel washing) and equipment will take place in designated areas and wash water will be recirculated as far as is practicable. Discharged water will be prevented from passing untreated into watercourses and groundwater in accordance with NRW's GPP 13 [RD40]. Detergents will not be used, and water will be passed through silt traps and oil interceptors before discharge into the platform drainage system to be discharges via WP1, WP2 and/or WP3.

5.4 Treatment systems

170. There are three principal treatment systems associated with the water discharge activities described in Chapter 3, namely:

- Control of TSS;
- pH control; and,
- Sewage treatment.

The issues surrounding the selection and specification of these systems are discussed below.

171. Oils (from spillages, etc) will be prevented from entering the WNDA drainage system through the use of interceptors, and the use of absorbents, as described above. Any oils collected by the interceptors will be removed and sent off-site for treatment and disposal. They will not be treated at the Wylfa Newydd site.

5.4.1 Control of suspended solids

172. The drainage system design uses a series of treatment systems to control suspended sediment in the discharges water; these systems and their operation are described below.

Settlement Ponds

173. The generation of sediment from the development of the WNDA mounds will be controlled through the soil management techniques, etc described in section 5.3.1. Once sediment particles have been mobilized, good practice for their removal from site drainage is through the use of settlement ponds.

174. Settlement ponds are designed to attenuate the incoming surface water runoff for sufficient time in non-turbulent conditions to allow the entrained suspended solids to settle naturally out of the flow. The ponds have few moving parts and require little maintenance other than occasional desilting (see FA_{CWD}-4). The settlement ponds and, if required, associated additional retention areas proposed for the Project will achieve the required flow

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attenuation to accommodate a 1 in 100 year storm event. This will provide a level of suspended solids settlement down to a particle size of 0.002 mm (to clay-size particles).

Lamella Settlers

175. Although settlement ponds are effective at removing larger sediment particles, they are less effective at removing very small clay-size particles below 0.002 mm, which may remain in suspension. The removal of these particles can require further physical and/or chemical measures, particularly where the size of a settlement pond is constrained by the availability of space.

176. There are a range of mechanical measures which can be used to remove suspended solids. Of these, lamella settlers are commonly used on construction sites as they have the advantages of being simple to operate and maintain, with low energy use in operation. Lamella settlers operate by passing the incoming water flowing through a series of closely arrayed inclined plates, which slow the speed of flow and, as the depth of flow is shallow, allow sediment to drop out of suspension over a short distance. The sediment is collected and the clarified water is then discharged. It is envisaged that lamella settlers may be required to achieve sediment discharge limits at some locations and under some rainfall conditions on the WNDA.

Coagulant Dosing

177. The performance of the lamella settlers, where required, can be further enhanced by the addition of coagulants (or flocculants). These are commonly used in water treatment to control and enhance the coagulation or flocculation of suspended particulate matter, and thereby further reduce suspended solids levels in the treated water.

178. There are a range of substances which can be used, including iron and aluminium-based flocculants and polyelectrolytes. In pre-application discussions with NRW, it was identified that metals-based flocculants generate higher amounts of waste, which give rise to a higher environmental concern than polyelectrolytes. When considering polyelectrolytes, there are two main types, cationic and anionic/non-ionic polyelectrolytes. NRW Guidance Document EPR7.01 [RD16] identifies that anionic or non-ionic polyelectrolytes are preferred over cationic polyelectrolytes, which can have a higher environmental impact. Due to this anionic/non-ionic polyelectrolyte flocculants have been proposed for use at WNDA.

179. A review of polyelectrolytes undertaken for the Environment Agency [RD55] found that the impact of polyelectrolytes on the aquatic environment is low due to the strong adsorbing (or binding) to suspended and dissolved organic matter, losses due to hydrolysis and biodegradation (processes to breakdown substances) and a low potential to bioaccumulate (accumulation of substances within an organism). The study mainly focussed on impacts to a freshwater environment.

180. The majority of proposed discharge locations within the WNDA outflow into a freshwater environment. Impacts to brackish and marine environments are not as widely studied as those to freshwater environments. However, in assessing the reasons given in the Environment Agency (EA) report [RD55] it is considered that any potential impact in a brackish or marine environment would not greatly differ from those found in a freshwater body. For example, if additional binding in the marine environment were to occur due to residue of polyelectrolyte, this would lead to some additional settlement of suspended

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solids in the immediate vicinity of the outfall and as such may be managed as part of the wider monitoring and mitigation of the system.

181. Empirical testing has been undertaken using various ionic strength polyelectrolytes (jar testing). The results indicated that there were no clear effects on the following parameters /substances (in comparison to tests where no polyelectrolyte had been added): alkalinity, biological oxygen demand, chloride, nitrate, potassium, sulphate, electrical conductivity and pH. Slight effects were observed on the following: calcium, magnesium, dissolved organic carbon and total organic carbon. The results of this test suggest that there is likely to be only a limited impact to the aquatic environment from polyelectrolyte dosing at the construction site.

182. An automatic flow-proportional dosing system is proposed, i.e. dosing will be directly proportional to the incoming flow. This method of treatment is considered to be more efficient than other treatment methods that are available; for example a "floc-block" system, which uses a solid block of a flocculant continually releasing small amounts into the water.

183. The proposed flow proportional polyelectrolyte dosing system is very unlikely to result in any notable concentrations of residual polyelectrolytes being present in the discharged water. Dosing is expected to be in the range of 0.1 – 1.0 mg/l, so any accidental releases or over-dosing of the polyelectrolyte would be in concentrations of less than 1 mg/l. In addition, it is anticipated that the effects of any residual polyelectrolytes will be significantly reduced by losses due to sorption and degradation within the aquatic environment. Dilution would also reduce the concentration of any residual polyelectrolytes.

Proposed Operation of the Suspended Solids Treatment System

184. The suspended solids treatment system comprises a hierarchy of control measures, designed to ensure the sediment loads in the discharged waters do not give rise to significant adverse effects on the receiving watercourses.

185. Rainfall draining from the earthworks mounds within the WNDA site will be collected and entrained sediment will be removed by the SuDS features, comprising silt fences, silt traps, swales and settlement ponds. Lamella clarifiers will be installed as an offline control for further reduction of sediment if required. In the vast majority of situations, the surface water run-off will then be discharged with sediment concentrations below permitted limits, which will have been set to be within the background concentrations in the receiving watercourses. Polyelectrolyte dosing is not expected to be required in the majority of conditions.

186. Elevated suspended solids concentrations in the outflow from the settlement ponds, most likely as a result of a rainfall event coinciding with bulk earthworks activities, will be detected by turbidity monitors (as a proxy for TSS). Polyelectrolyte will be automatically dosed to ensure that the water discharge remains within the TSS discharge limits set in the permit, up to and at the flow rate associated with a 1 in 2 year rainfall event.

187. For flow rates above the 1 in 2 year rainfall event, polyelectrolyte dosing will continue at the 1 in 2 year flow dosing rate. Excess flow will either by-pass the dosing chamber, or the excess flow will go through the dosing chamber without additional dosing (i.e. the dosing will continue at the rate for 1 in 2 year flows). This will mean that the first component of run-off from any storm will receive polyelectrolyte dosing up to the point that it reaches the 1 in 2 year rainfall event flow rate (and thus the "first flush" of any storm receives polyelectrolyte dosing).

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188. The additional flow, above the 1 in 2 year flow, will not, in effect, receive polyelectrolyte dosing. It will, however, have been subject to the other sediment controls in the system, including measures to prevent sediment from becoming entrained, in-channel controls, as well as treatment in settlement ponds and lamella clarifiers. For this reason, it is proposed that numeric suspended sediment limits apply up to and including the flow rate for the 1 in 2 year rainfall event: for flow rates beyond this, the suspended sediment concentrations will be controlled by the operation of the equipment and measures identified in the sediment management system, up to their rated design performance.

189. The number and capacity of lamella settlers will be designed to meet the peak flow and volume associated with a 1 in 2 year rainfall event (as defined by the Flood Studies Report rainfall estimation method). In practice, although the 1 in 2 year event is the design basis, as the settlement ponds have a large capacity (up to the 1 in 100 year rainfall event), flows from lower frequency events entering the settlement ponds are likely to benefit from some flow balancing. This is due to the large storage capacity, and it is expected that in many cases the discharge flow from the sediment pond will be substantially below the design flow rate for a given rainfall event. Note that this effect will also apply to the flow through the polyelectrolyte dosing units.

190. Beyond the 1 in 2 year rainfall event the lamella separators will also be by-passed (noting the point made above that, in practice, flow from much lower frequency events is likely to be attenuated at or below the 1 in 2 design flows rates) and the sediment control system will be based on sediment entrainment control measures, in-channel control measures and the operation of the settlement ponds.

191. This series of sediment control measures ensures that in the most common rainfall events, up to and including the 1 in 2 year event, sediment concentrations in the discharge are controlled to levels within background values in the receiving watercourses. In more infrequent rainfall events, the controls continue to be applied, but as rainfall and the run-off flows increase, the design capacity of the sediment control equipment will be progressively exceeded, and sediment concentrations in the additional discharge flows will increase. This is likely to mirror the sediment concentrations in the receiving waters which will also increase with rainfall intensity and duration.

192. The principle behind the sediment management approach is that the collected run-off is treated as much as it can practicably be treated for a long as is practicable. The operation of the sediment management system is shown in Figure 5-1.

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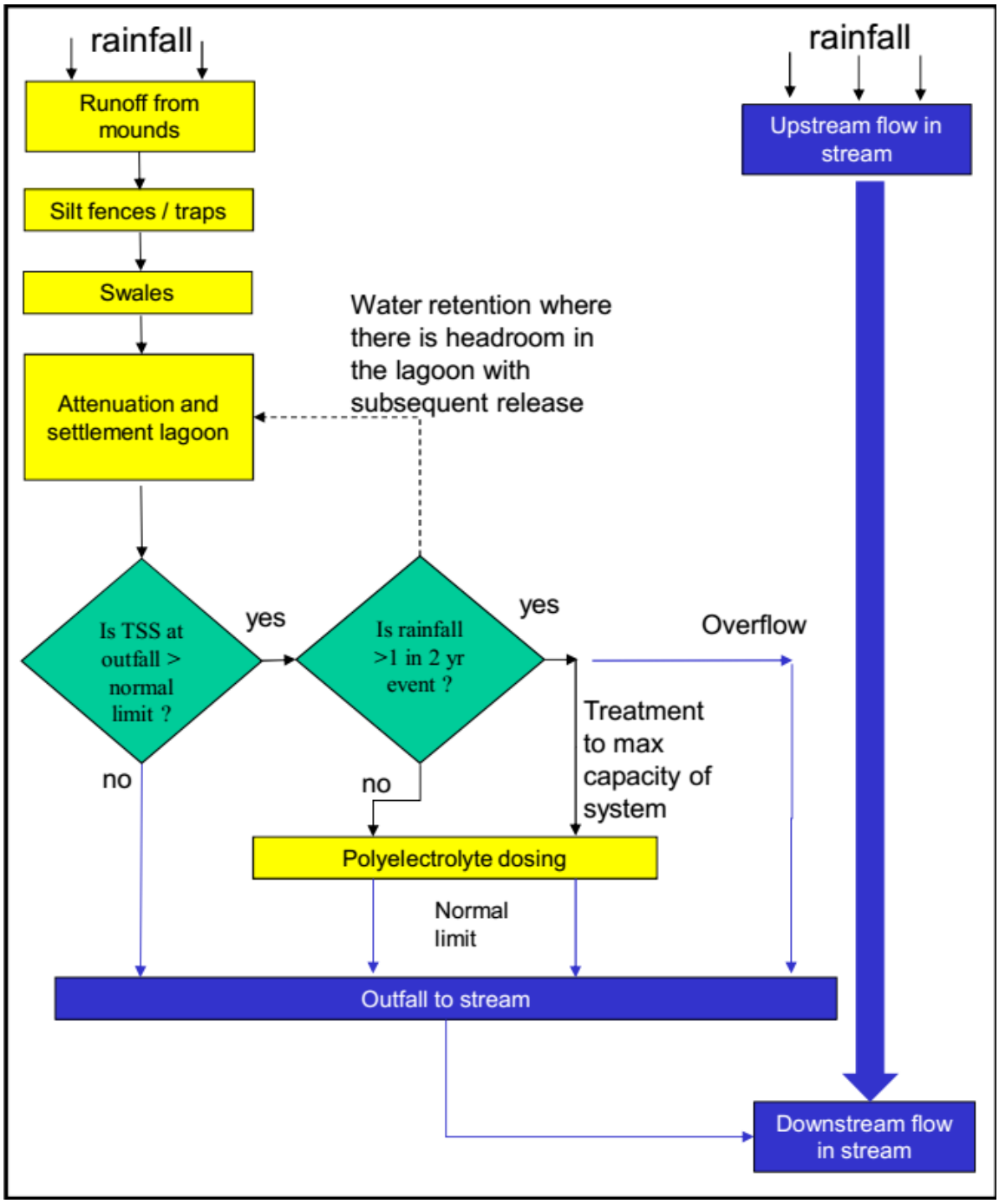
Figure 5-1 Operation of the Sediment Management System



Basis for the Suspended Solids Management System Design Performance

193. The suspended solids management system will be designed to achieve a high level of suspended solids control through a combination of active and passive elements. Any system designed for the control and treatment of site run-off has to be specified for the range of flows it can treat.

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194. In the development of the suspended solids management system, the 1 in 2 year event was selected as the cut-off for treatment of suspended sediment for all of the flow for the following reasons:

- It is anticipated that dosing units will only be required during bulk earthwork operations until vegetation on the mounds has become established. As such, the annual probability of a large return period storm (e.g. the 1 in 30 year event) being experienced is low (approximately 3%); the 1 in 2 year event is therefore considered representative of the rainfall event that is likely to be experienced prior to the establishment of the mound vegetation. In addition, some mounds or parts of mounds may only be worked for short time periods (e.g. one earthworks summer period) before being vegetated and left dormant before being worked on again, perhaps several years later.
- Multiple dosing units will be provided to treat surface water run-off at every proposed outfall from the drainage system. The number of units required has been estimated based on the design event considered. Notwithstanding this, there will be limited space within the construction area, adjacent to drainage outfalls and ponds within which to site a large number of dosing units to treat run-off from higher frequency storm events. Only having sufficient units to treat up to the 1 in 2 year storm event is therefore an approach based on the practicality of design and operation.
- Very low frequency high magnitude events would require a very large number of treatment units, most of which would remain inactive for the majority of the time, and in some instances may never be used. The cost and space requirements for these would be disproportionate to the level of treatment that they would provide.

195. The sediment management system is designed for the run-off flow rates predicted for the 1 in 2 year rainfall event, based on hydrological modelling. The 1 in 2 year rainfall event will define the transition point between numerical sediment limits and control based on the operation of the sediment management system within its design basis. The detailed design of the sediment management system, and the calculation of flow rates for the 1 in 2 year event for each catchment will be provided to NRW as a FWP item (FA_{CWD}-2 and FA_{CWD}-5).

196. The proposed suspended sediment concentration limits for events up to the 1 in 2 year event are identified in Table 4.3; justification for the selection of these limits is set out in Appendix F. Horizon proposes carrying out further monitoring in watercourses for TSS, turbidity and flow rate at proposed discharge locations (FA_{CWD}-6) to obtain further data; this will be reviewed to identify whether any changes to the proposed discharge limits are necessary (FA_{CWD}-7).

5.4.2 Control of pH

197. The majority of the site drainage water is not expected to require any pH control. Drainage from the area immediately surrounding the concrete batching plant has the potential to have elevated pH due to deposited cement fines. This will be controlled by the use of dust filters and appropriate management techniques.

198. Water draining from the area surrounding the batching plant will be separately collected and drained to a collection pond, where sediments will be settled out and pH monitored prior to discharge. If required, there will be a facility to carry out pH adjustment, either by sparging carbon dioxide gas through the water, or by acid addition. The precise methods

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for pH control will be agreed with NRW as part of the development of Construction Environmental Management Plans (CEMPs) [FA_{CWD}-2].

199. The batching plant process water will be recirculated within the process, as described in Chapter 3, with a small fraction of the process water being taken for off-site disposal.

200. Water from the bulk excavation, coffer dams and tunnelling areas also have the potential to have elevated pH from the use of concrete in construction and to line excavation and tunnel walls. Water draining from these areas will be collected and drained to collection ponds, where they will be tested for pH, and, where necessary, treated to ensure pH remains within discharge limits. Methods for pH control from these areas will also be agreed with NRW as part of the development of CEMPs [FA_{CWD}-2].

5.4.3 Sewage treatment

201. A number of aspects were considered with respect to the WwTW, namely:

- The requirement for the WwTW versus disposal of site effluent to an existing foul sewer system/wastewater treatment plant;
- The most suitable location for the WwTW outfall;
- The WwTW treated effluent specification; and,
- The most suitable treatment technology.

These aspects are discussed below.

Requirement for a Wastewater Treatment Works

202. During *operation* of the Power Station it is proposed that foul water (sewage) will be pumped to the Dŵr Cymru Welsh Water (DCWW) Cemaes WwTW near Wylfa Head, where DCWW will manage the foul water treatment and its disposal. Consideration was also given to the use of a sewage pumping station, during the Construction Phase of the Project, to pump foul water to the DCWW Cemaes WwTW. However, this option was deemed impracticable for two key reasons, excluding cost concerns and any upgrade requirements to nearby sewers:

- The dynamic nature of the construction site will prevent any semi-permanent construction drainage being installed without hindering, and in some cases preventing, construction operations. Conveying pipework and pumping stations will require relocating on a regular basis to suit construction operations, thereby interrupting a robust foul water drainage scheme. Moreover, the construction of the deep excavations and cooling water outfall tunnel construction will prevent a riser main route from connecting to the Cemaes WwTW; and,
- The high variability in worker numbers on site during the Construction Phase will also lead to an impracticable pumping station and riser main design, as well as making it difficult to adapt existing DCWW infrastructure to accommodate fluctuating foul water treatment demands.

203. These two key issues have driven the proposal to install the modular, and packaged-style Construction Site WwTW within the WNDA to treat and dispose of the foul water much closer to the foul water source. This proximity will vastly improve the flexibility of the foul water network when coordinating with construction activities. Also, the modular nature of

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the WwTW will enable the varying foul water inflow rates arising from the variations in construction workforce numbers to be accommodated.

204. All optioneering was undertaken in consultation and agreement with DCWW, and DCWW has issued a letter to Horizon stating that they consider that the construction sewage should be treated on the Construction Site in a dedicated Construction Site WwTW, rather than being sent for treatment at the DCWW WwTW (see Appendix D).

205. The Site Campus will be constructed to the north of the WNDA, close to Wylfa Head, relatively early in the construction programme in order to provide accommodation for up to 4,000 construction workers. The Site Campus is likely to be in use for approximately five years, and will be decommissioned at the end of the Construction Phase. As the Site Campus accommodation will be located at the edge of the construction site, and can be connected to the existing public sewerage system without causing conflicts during the Construction Phase, there is a clear benefit in connecting into the public sewer.

206. The Site Campus foul water drainage will be treated in an extension to the existing Cemaes WwTW operated by DCWW, who will manage the foul water treatment and disposal under their own Environmental Permit. The Site Campus foul water drainage is therefore excluded from this CWD-EP Application.

Location of the Construction Site WwTW Outfall

207. Horizon carried out an optioneering assessment to determine the location of the Construction Site WwTW outfall (see Appendix J). The assessment considered seven potential locations for discharges into the sea, shown in Figure 5.2. The location options included direct discharge to sea at the closest point to the WwTW (point 0), various locations off the MOLF and breakwater, and a location off the north of Wylfa Head (point 1). The potential discharge locations were assessed in an optioneering assessment meeting, with representation from relevant disciplines, including engineering, environmental permitting, and marine modelling and assessment specialists.

208. Information on initial dilution concentrations for discharge points 1, 2 and 5, together with hydrodynamic modelling results using the model's particle tracking module were considered in the assessment. The modelling provided information on dispersion at discharge locations 1,2 and 5 as well as estimates of the contributions to bacterial loadings in Cemaes bathing water. This information, together with modelled mid-flood and mid-ebb vector plots, allowed the likely dispersion characteristics for the other intermediate discharge points to be inferred.

209. The optioneering assessment considered the different location options against assessment criteria, using a scoring system from 1 to 5 (1 being most negative/least acceptable and 5 the most beneficial/most acceptable), with weightings then applied. The assessment criteria considered were:

- Environmental constraints – mainly based on compliance with environmental quality standards (EQS);
- Permitting – based on likelihood of obtaining relevant environmental permits (for water discharge activity (WDA) and possibly flood risk activity (FRA)) and marine licences;
- Engineering – considering construction, operation and maintenance and health & safety; and,

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- Cost – taking account of both capital expenditure (CAPEX) and operational expenditure (OPEX) for the outfall and, for locations which would only be acceptable with additional treatment, extra costs of such additional treatment.

The results of the optimisation are summarised in Table 5.1.

Figure 5-2 WwTW Outfall Locations Considered

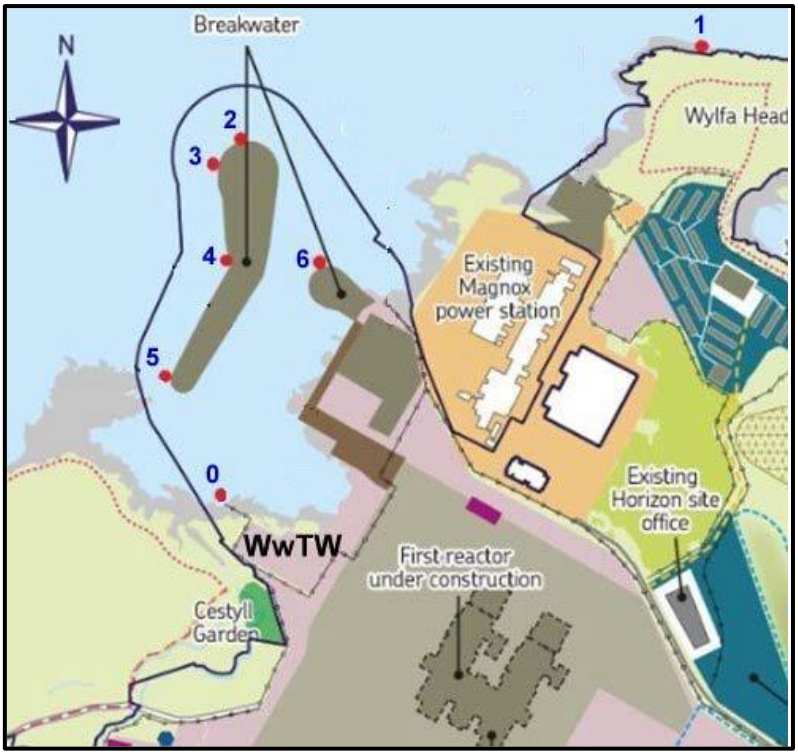

Table 5.1 Outfall Location Optimisation Results

Attribute	Outfall Location						
	0	1	2	3	4	5	6
Overall score	1.65	2.5	3.55	3.05	2.05	1.55	2.2
Overall ranking	6	3	1	2	5	7	4

210. The optimisation concluded that the most suitable location for the Construction Site WwTW is at Point 2 (termed WS1 in this Application), immediately off the north end of the west breakwater, with the outfall extending at least 50 m beyond the level of lowest tides (Chart Datum (CD)) and in a water depth of at least 1 m below CD. A diffuser will be fitted to the outfall to achieve good dispersion and prevent intrusion of sand, mud, debris and salt water into the outfall.

211. Further detail on the optioneering process is contained in the Main Site Construction Phase Foul Water Design Report in Appendix J.

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Construction Site WwTW Specification

212. Horizon carried out a further optioneering assessment to select the level of sewage treatment required of the Construction Site WwTW. Three levels of treatment were considered (where the figures in brackets are concentrations in mg/l):

- Conventional treatment (20:30 BOD:SS), with no specific provision to achieve nitrification;
- Extended treatment providing nitrification (providing at least 20:30:20 BOD:SS:ammoniacal nitrogen). In practice nitrification would probably achieve 20:30:10; and,
- Treatment including nutrient (N and P) removal to Urban Wastewater Treatment Directive sensitive area standards.

In each case, the need for ultraviolet (UV) disinfection to reduce concentrations of faecal bacteria was considered as a separate issue, as disinfection can be added to any of the other forms of treatment. The alternative levels of treatment considered are summarised in Table 5.2, along with associated effluent standards.

Table 5.2 Potential Standards for Treated Effluent from the Construction Site WwTW

Parameter	Treatment Technique					
	Conventional	Conventional + Disinfection	Nitrifying*	Nitrifying* + Disinfection	Nutrient Removal	Nutrient Removal + Disinfection
Biochemical oxygen demand (atu) (BOD) (mg/l)	20	20	20	20	20	20
Chemical oxygen demand (COD) (mg/l)	120	120	120	120	120	120
Total suspended solids (TSS) (mg/l	30	30	30	30	30	30
Total nitrogen (as N) (mg/l)	N/A	N/A	N/A	N/A	15	15
Total ammoniacal nitrogen (as N) (mg/l)	N/A	N/A	20**	20**	5	5
Total phosphorus (as P) (mg/l)	N/A	N/A	N/A	N/A	2	2
Escherichia coli (CFU/100 ml)	3×10^6	2×10^3	3×10^6	2×10^3	3×10^6	2×10^3
Escherichia coli (log10 CFU/100 ml)	6.5	3.3	6.5	3.3	6.5	3.3

Note * - default standard

** - note typical nitrifying treatment will in practice reduce ammoniacal nitrogen concentrations to 10 mg/l (as N)

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213. The assessment considered the following key factors as influencing the level of treatment required:

- Faecal bacteria. In relation to compliance with bathing water standards at Cemaes bathing water, this was relevant to whether disinfection would be required;
- Ammoniacal nitrogen. In relation to the EQS set for all coastal waters for non-ionised ammonia of 21 µg/l (as N) as an annual average (AA) and the proposed EQS for total ammoniacal nitrogen set by the UK's Water Quality Technical Advice Group (WQTAG) for designated Habitats Directive sites (1 mg/l (as N) annual average (AA) and 8 mg/l (as N) maximum allowable concentration (MAC)); this was relevant to whether nitrification would be required; and,
- Nutrients. In relation to standards for dissolved inorganic nitrogen as a winter average for 'clear' waters, where the EQS is 0.25 mg/l for 'good' status, this was relevant to whether nutrient removal would be required.

214. The options assessment reached the following conclusions.

- The worst case contribution of the discharge located at Point 2 to bacterial counts at Cemaes bathing water, assuming conventional treatment only, is an increase in 7.9 CFU/100ml (as a 95%ile), which is a negligible concentration compared with the bathing water standards (200 CFU/100ml as a 95%ile) and does not indicate a need for disinfection of the treated sewage discharge. However, it is possible, bearing in mind that there have been some exceedances at Cemaes bathing waters, that even these small contributions may need to be minimised;
- With the outfall at Point 2, based on initial dilution calculations for conventional treatment only (no nitrification), the EQS for total ammoniacal nitrogen within Habitats Directive sites and the WFD EQS for non-ionised ammonia would be met by a large margin immediately after initial dilution. Therefore, there is no requirement for nitrification; and,
- With the outfall located at Point 2, based on initial dilution calculations for conventional treatment only (no nutrient removal), the EQS for dissolved inorganic nitrogen would be met immediately after initial dilution. Therefore, there is no requirement for nutrient removal.

215. The overall conclusion is that at outfall location 2 the conventional treatment will provide adequate protection to the environment. The results of the optioneering exercise provide no justification for disinfection, nitrification or nutrient removal. However, it is possible that circumstances at Cemaes bathing water may result in a requirement to minimise bacterial loads and the current design leaves space for possible future retrofitting of a UV disinfection unit.

216. Further detail on the treatment assessment process is contained in the Main Site Construction Phase Foul Water Design Report in Appendix J, Section 3.4.

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WwTW Technology Selection

217. Following the outfall location and treatment selection optioneering assessments, Horizon developed an outline design for the WwTW, based on achieving the conventional treatment standards (see Table 5.2). The outline design was developed on the anticipated worker profile over the construction period:

- Population (construction peak) 9,000
- Population Equivalent (PE) 5,700
- Daily Operating Time 12 h/d, 7 d/week
- Flow 990 m^3/d
- Temperature 10 – 25°C

218. Data on raw sewage input was derived from British Water guidance for determining population equivalent and the associated loads of the sanitary determinands. Microbiological contamination levels are based on common industry practice values adopted for disinfection analysis. The characteristics thus established for the raw sewage are presented in Table 3.1 (also in Appendix J).

219. A high level concept for the treatment works was developed, based on a packaged treatment plant containing four streams, to ensure the treatment capacity can be sized to match the construction workforce profile. Key elements of the design are:

- 6 mm screens;
- Balance Tank;
- Screened effluent pumping station;
- Flow Splitter box(es);
- Primary settlement;
- Biological treatment;
- Secondary settlement;
- Disinfection (possible);
- Sludge treatment (thickening);
- Ancillaries – service water, polyelectrolyte, blowers;
- Building with switchgear, welfare, sludge and office/lab;
- Odour treatment; and,
- Treated wastewater pumping station.

220. There are a range of secondary treatment processes available to treat the proposed sewage flows. These were identified in Table 5.3 as a long-list of options, together with their advantages and disadvantages.

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Table 5.3 Long List of Biological Secondary Treatments

Biological Treatment Technology	Advantages	Disadvantages
Activated Sludge Plant (ASP)	• Low footprint • Not vendor specific	Increased operator input
Oxidation Ditch	• Not vendor specific • Simple operation	• Larger footprint • No process guarantee
Sequencing Batch Reactor	Low footprint	More complicated control
Nereda	Low footprint	• More complicated control • Unproven technology in UK • Vendor specific
Biological Filter	Simple technology	Large footprint
Submerged Aerated Filter Package plant	Process guarantee lies with vendor	Vendor specific
Rotating Biological Contactor	• Package plant • Process guarantee lies with vendor	• Vendor specific • Large footprint
Integrated fixed-film activated sludge	More compact than conventional activated sludge	Vendor specific
Membrane Bio Reactor Compact technology	Process guarantee lies with vendor	• Known to have operational issues • UK water companies have removed from process selection matrices
Moving Bed Biofilm Reactor	• Package plant • Process guarantee lies with vendor	Vendor specific

221. From an assessment of the long list, a short-list of solutions was selected for a more detailed assessment:

- Activated Sludge Plant;
- Submerged Aerated Filter; and,
- Rotating Biological Contactor.

222. These three technologies represent the most common package-type treatment technologies utilised in the UK, and are available from a number of vendors. The short-listed technologies were assessed against a series of project success criteria, and the Activated Sludge Plant (ASP) was selected as the preferred solution. Particular attributes of the ASP technology are that it minimises land-take/footprint and odour emission.

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6 Environmental risk assessment

6.1 Approach

223. This section presents an assessment of the environmental risk associated with the Project's Construction Phase water discharge activities. The risk assessment has been undertaken in a number of areas, as listed below and summarised in Table 6.1:

- The discharges from the WNDA Surface Water Drainage System and the dewatering of the deep excavations have been subject to a screening (H1) assessment using the NRW/Environment Agency's guidance on "Surface water pollution risk assessment for your environmental permit" [RD53]. The assessment provided a preliminary evaluation of the significance of surface water run-off and groundwater discharges on the surface watercourses within the WNDA and the marine environment;
- Potentially significant pollutant discharges identified by the H1 assessment were, following clean-up of the available input data, subject to further modelling to establish likely impacts on surface watercourses and the marine environment. The evaluation of environmental impact was made with reference to both long term (Annual Average – AA) and short term (Maximum Annual Concentration – MAC) Environmental Quality Standards (EQS);
- One of the principal pollutants present within all of the discharges, TSS, is not ascribed an EQS. For this reason, the impact of this pollutant on marine waters was assessed separately by comparison with measured background concentrations of TSS;
- Discharge of treated effluent from the Construction Phase WwTW will be direct to sea in the north of Porth-y-pistyll. This discharge is distinct in character from the other surface water and dewatering discharges. Consequently, a separate assessment has been undertaken for this discharge. The assessment considered the cumulative effects of discharges from both the WwTW and the new DCWW-operated package WwTW which will serve the Site Campus;
- An assessment was made of the potential impacts on the SSSI in hydrological connection with the discharges from the WNDA Surface Water Drainage System (Tre'r Gof SSSI); and,
- Finally, the implications for compliance with the Water Framework Directive and the Habitats Regulations are discussed.

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Table 6.1 Summary of Environmental Risk Assessment

Discharge / Assessment Point	H1 Assessment (excluding TSS)	Further Modelling		Modelling of Sewage Discharges	Modelling of TSS
		To Surface Watercourse (RQP)	To Marine Environment (Delft3d)		
WA1	✓ S	✓			
WA2	✓ M		✓		✓
WA3	✓ S	✓			
WB1	✓ S	✓			
WC1	✓ S	✓			
WD1	✓ S	(1)			
WD2	✓ S	(1)			
WE2	✓ S	(1)			
1S	✓ M		✓		✓
2S	✓ M		✓		✓
3S	✓ M		✓		✓
WP2/3[(2)]	✓ M		✓		✓
WCD1[(3)]			✓		✓
WCD2[(4)]					✓
WS1				✓	✓

Notes S – For discharge to surface watercourse.

M – For discharge to the marine environment.

(1) The discharges are into the same watercourse (Afon Cafnan). The River Quality Planning (RQP) modelling was applied at the most upstream discharge point (WC1) as this is where there would be the greatest change in concentration.

(2) Discharge point WP1 was not subject to assessment as it will primarily discharge rainwater. WP1 will only be used for approximately one year, and it will take lower quantities of water than WP2 and WP3 (as excavations will not have extended down to their full depth). Impacts of TSS will be bounded by those from WP2/3.

(3) The discharge from the Bund Cofferdam is dominated by seawater seepage and rainfall. The significance of the groundwater component is small, and the discharge was thus not considered in the H1 assessment, however, it was included in the marine modelling for completeness.

(4) The Outfall Cofferdam excavation will not be sufficiently deep to become susceptible to groundwater in-flow. The principal pollutant within the discharge will be TSS.

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6.2 Screening (H1) assessment

224. The H1 screening assessment was undertaken with the purpose of identifying whether there are likely to be any potentially significant hazardous pollutants – i.e. specific pollutants, priority hazardous substances, priority substances, and other pollutants as defined by the Environment Agency [RD53] – within the water discharges to surface watercourses and the marine environment within/local to the WNDA.

6.2.1 Methodology

225. The H1 assessment was carried out by screening for the following, as required by the Environment Agency methodology:

- Surface water run-off to fresh waters;
- Surface water run-off to marine waters;
- Groundwater discharges to marine waters; and,
- Priority hazardous pollutants.

226. The screening was based on a number of 'tests', of increasing complexity, designed to evaluate the effect of dilution within the receiving waters. These are described below. The results of the tests were compared with the AA EQS and MAC EQS to evaluate, respectively, the long term and short term impacts of the pollutant discharges.

Discharges to Fresh Waters

227. For discharges to fresh waters the tests are as follows:

Test 1 Check whether the concentration of the pollutant in the discharge is more than 10% of the EQS. If it is less than 10%, the hazardous pollutant is not a risk to the environment and no further action is required. If it is more than 10%, carry out Test 2.

Test 2 Check whether the process contribution (PC) of the pollutant is more than 4% of the EQS. If it is less than 4%, the hazardous pollutant is not a risk to the environment and no further action is required. If it is more than 4%, carry out Test 3 and Test 4.

The PC is the concentration of a discharged pollutant in the water after it has been diluted. It is calculated as follows:

$PC = \frac{(EFR \times RC)}{(EFR + RFR)}$	Eq. 6.1

where EFR is the effluent flow rate, RC is the release concentration of the pollutant in the effluent, and RFR is the river flow rate.

Test 3 Check whether the discharge increases the background concentration (BC) of the pollutant in the river downstream of the discharge by more than 10% of the pollutant's EQS. If it is less than 10% of the EQS, carry out Test 4. If it is more than 10% of the EQS, then modelling is likely to be required.

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The predicted environmental concentration (PEC) in the water downstream of the discharge is a combination of the PC and BC, and is calculated as follows:

$PEC = \frac{(EFR \times RC) + (RFR \times BC)}{(EFR + RFR)}$	Eq. 6.2

Test 4 Check whether the PEC is higher than the EQS. If it is then modelling is likely to be required.

Discharges to Marine Waters

228. For discharges to the marine environment (referred to within the H1 guidance as estuaries and coastal waters) the tests are as follows:

Test 1 Check whether the level of pollutant is more than the EQS limits. If it is lower than the EQS, the hazardous pollutant is not a risk to the environment and no further action is required. If it is more than the EQS, carry out Test 2.

Test 2 Check whether the discharge is into the low water channel in the upper parts of an estuary where the water is mainly fresh. If the discharge is direct to the low water channel, carry out the screening tests for freshwater starting at Test 2. If not, carry out Test 3.

Test 3 If you are discharging to water where the dilution or dispersion is restricted, then modelling is required. If not, carry out Test 4.

Test 4 If the water receiving the discharge does not have restricted dilution or dispersion and the discharge is submerged at all states of the tide, measure the minimum distance between the discharge point and the point (or line) where the water depths are shown on nautical charts as zero (which is known as chart datum).

Carry out modelling if the discharge contains pollutants at concentrations above EQS and either of the following apply:

- the discharge location is less than 50 m offshore from where the sea bed is at chart datum
- the sea bed at the discharge location is less than 1 m below chart datum

If these do not apply to the discharge site, carry out Test 5.

Test 5 If the discharge is buoyant, check the pollutants against MAC as well as AA. If the effective volume flux is more than the allowable effective volume flux for the discharge location then modelling is required. If it is less then no further action is required.

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Priority Hazardous Pollutants

229. The H1 methodology requires that additional screening is carried out for all priority hazardous pollutants for both fresh waters and marine waters, even if the pollutants are not identified by the foregoing tests as requiring modelling.

230. The purpose of the priority hazardous pollutant assessment is to establish whether annual significant load limits set in the NRW/Environment Agency guidance [RD53] are likely to be exceeded. If the calculated annual mass release of a pollutant for all discharges exceeds the significant load limit then the assessment is repeated using cleaned-up data. If the load again exceeds the limit, NRW will ultimately include an emissions limit in the CWD EP setting out how the pollutant must be controlled.

6.2.2 H1 input data

Discharges to Fresh Waters

231. The sources of the input data necessary to undertake the H1 assessment for surface water discharges to fresh waters are listed in Table 6.2. The H1 assessment is presented in Appendix I. The appendices listed in Table 6.2 are those of the H1 assessment.

Table 6.2 H1 Assessment Input Data Sources – Fresh Water Discharges

Parameter	Ref	Data Source
Characterisation of the discharges	RC	H1 Assessment, Appendix A, Table 1
Surface water drainage flow rates	EFR	H1 Assessment, Table 4.3
Average concentration of the pollutants in the water upstream of the discharge point	BC	H1 Assessment, Appendix B, Table 1
The 95% exceedance river flow (Q_{95})	RFR	H1 Assessment, Table 4.6
Environmental Quality Standards	EQS	H1 Assessment, Appendix C, Table 1

Discharges to Marine Waters

232. Sources WA2, WCD2, 1S, 2S and 3S discharge surface water run-off to Cemaes Bay, while sources WP2/3 and WCD1 discharge groundwater (as well as rainwater) to Cemlyn Bay. The sources of the input data necessary to undertake the H1 assessment for these discharges are listed in Table 6.3.

Table 6.3 H1 Assessment Input Data Sources – Marine Discharges

Parameter	Ref	Data Source
Characterisation of the discharges	RC	H1 Assessment, Appendix A, Table 1 (surface discharges) and Table 2 (groundwater discharges)
Surface water drainage flow rates	EFR	H1 Assessment, Table 4.3
Environmental Quality Standards	EQS	H1 Assessment, Appendix C, Table 1

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6.2.3 H1 results

Discharges to Fresh Waters

233. The preliminary results of the screening risk assessment for surface water run-off to freshwaters within the WNDA are presented in H1 Assessment Appendix D, Tables 1 through 4 (the results are also summarised in Table 5.1 and 5.2 of the H1 Assessment). For each pollutant subject to assessment the tables indicate whether further modelling is required, based upon the four tests for fresh water discharges.

234. The results are based upon the raw input data determined from soil leaching tests. The results were subsequently revised following clean-up of the input data, in line with NRW/Environment Agency requirements [RD53]. The revised results, identifying potentially significant pollutants which require further modelling, are presented in Table 6.2 of the H1 report and are summarised in Table 6.4 below. Different pollutants are identified as being potentially significant for different discharge points. This is due to variations in the background pollutant levels in the receiving watercourses, and watercourse and discharge flow rates.

Table 6.4 Potentially Significant Pollutants – Discharges to Freshwaters

Pollutant	Relevant Discharge Points	
	Long Term Assessment	Short Term Assessment
Anionic polyelectrolyte	WB1 and WC1	-
Copper (bioavailable)	WB1 and WC1	-
Iron	WB1	-
Nitrate (NO_3)	WC1	-
Orthophosphate (as P)	All	-
Chromium (III)	WB1 and WC1	-
Lead (bioavailable)	All	-
Lead (dissolved)		WA3, WB1 and WC1
Zinc (bioavailable)	WC1	-

Discharges to Marine Waters

235. The results of the preliminary screening risk assessment for surface water run-off to marine waters are presented in H1 Assessment Appendix D, Table 1, and summarised in Table 5.3 of the same document. The results are for Test 1 only: neither Test 2 nor Test 3 apply, and Test 4 establishes that the pollutant discharges failing Test 1 should be subject to further modelling and assessment. The revised results following data clean-up are presented in Table 6.2 of the H1 report and are summarised in Table 6.5 below.

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Table 6.5 Potentially Significant Pollutants – Surface Water Run-off to Marine Waters

Pollutant	Relevant Discharge Points	
	Long Term Assessment	Short Term Assessment
Copper (dissolved)	WA2, 1S, 2S and 3S	-
Lead (dissolved)	WA2, 1S, 2S and 3S	-
Zinc (dissolved)	WA2, 1S, 2S and 3S	-

236. A summary of the preliminary results of the screening risk assessment for groundwater discharges to marine waters is presented in Table 5.4 of the H1 report (Appendix I). The results are again for Test 1 only. The revised results following data clean-up are presented in Table 6.3 of the H1 report and are summarised in Table 6.6 below.

Table 6.6 Potentially Significant Pollutants – Groundwater Discharges to Marine Waters

Pollutant	Relevant Discharge Points	
	Long Term Assessment	Short Term Assessment
Nickel (dissolved)	WP2/3	-
Zinc (dissolved)	WP2/3	-

Data Summary for Potentially Significant Pollutants

237. A summary of pertinent data for those pollutants assessed to be potentially significant is presented in Table 6.7. The table gives the concentration ranges of the pollutants measured in the receiving watercourses, their concentrations in the leachate and groundwater, and the corresponding AA and MAC EQSs for the freshwater and marine environments.

Priority Hazardous Pollutants

238. The results of the priority hazardous pollutants risk assessment are presented in Appendix F of the H1 assessment (Appendix I). Calculations show that none of the individual discharges nor the total aggregated discharge from the site exceeds the prescribed annual significant load limits for priority substances.

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Table 6.7 Summary of H1 Data for Potentially Significant Pollutants

Substance	Concentration (µg/l)					Environmental Quality Standard (µg/l)			
	Receiving Watercourses	Leachate		Ground Water		Freshwater		Marine	
		Un-cleaned-up Data	Cleaned-up Data	Un-cleaned-up Data	Cleaned-up Data	AA	MAC	AA	MAC
Orthophosphate (as P)	62 – 83	138	133	ND		78	-	-	-
Nitrate (as NO_3)	6,980 – 13,250	15,036	15,006	ND		50,000	-	-	-
Anionic Polyelectrolyte	-	-		-		7,500	-	7,500	
Copper (bioavailable)	0.05 – 0.10	0.35	0.3	ND		1.0	-	-	-
Copper (dissolved)	1.59 – 2.49	9.26		1.32		-	-	3.76	-
Chromium (III)	1.21 – 1.53	2.02	1.52	1.48		4.7	32	0.6	32
Iron	110 – 870	395		36.13		1,000	-	1,000	-
Lead (bioavailable)	0.01 – 0.02	1.44	0.7	ND		1.2	-	-	-
Lead (dissolved)	1.27 – 1.39	13.0	6.5	1.00		-	14	1.3	14
Nickel (dissolved)	1.01 – 1.33	1.61		16.52	13.8	-	34	8.6	34
Zinc (bioavailable)	1.07 – 4.18	4.38	3.6	ND		13.9	-	-	-
Zinc (dissolved)	5.08 – 6.99	14.1	11.4	37.76		-	-	7.9	-

Note. Grey shading indicates a substance which is considered unlikely to be present in the discharge due to the number of samples below the limit of detection (LoD).

ND – No data.

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6.3 Further modelling

6.3.1 Methodology

Discharges to Fresh Waters

239. For discharges to fresh waters, further modelling of the Potentially Significant Pollutants identified by the H1 assessment was carried out using the Monte Carlo RQP (River Quality Planning) software (version 2.5) provided by the Environment Agency [RD54]. The model was used to assess whether a discharge is "liable to cause pollution", and to determine the quality of discharge required to maintain current water quality or to meet a specific quality target. The model was thus used to address two tests:

Test 1 Risk to EQS. Assess whether the proposed, or permitted, load could cause failure of the receiving water EQS.

Test 2 Significant deterioration of receiving water quality. Determine whether the discharge causes downstream deterioration with the watercourse quality deteriorating by more than 10% of the EQS.

240. For the Afon Cafnan and the Nant Caerdegog Isaf where there will be consecutive discharges to the same watercourse (at points WC1, WD1, WE2 and WD2) the RQP modelling assessment has been applied at the most upstream discharge point (WC1) to the Nant Caerdegog Isaf. The predicted environmental concentrations for the substances that require modelling assessment are similar at each discharge point and at this point (WC1) the upstream flow, and consequently dilution potential, is lowest and the greatest increase over natural background concentrations is expected.

Discharges to Marine Waters

241. Further modelling of discharges to the marine environment was carried out using a hydrodynamic model (Appendix E) which simulates the marine environment around the WNDA. The model was developed by Horizon to aid understanding of the potential influence of the Power Station's structures and discharges on the marine environment during construction and operation. It is based on the Dutch Continental Shelf Model, developed by Deltares, which includes the Irish Sea and has been used extensively to model marine and coastal infrastructure developments. The model utilises bathymetric (depth of the seabed) data collected during targeted surveys and from marine charts. The model was run to emulate one complete spring-neap tidal cycle.

242. Modelling was based on a worst case scenario which assumed the following:

- All discharges from settlement ponds would occur at the same time. In reality the removal of topsoil, bulk earthworks, dewatering and mound creation would be phased and works would be carried out in different areas and times during construction across the WNDA; and,
- The predicted concentration at the point furthest downstream along a watercourse is the same as the concentration that would enter the sea. In reality, for four of the six discharges there would be further dilution in the watercourses prior to reaching the sea. Only WA2 and WP2/3 discharge directly into the sea.

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6.3.2 Input data

Discharges to Fresh Waters

243. The input data necessary to undertake the modelling of surface water discharges to fresh waters include:

- Outfall discharge flow rate;
- Outfall discharge concentration;
- Upstream river flow rate (mean and Q_{95});
- Upstream river quality; and,
- River quality target downstream of discharge.

The data are presented in H1 Assessment (Appendix N). The sources of the data are listed in Table 6.6 of the H1 assessment. Discharge flow rates are also provided in Table 4.1.

Discharges to Marine Waters

244. The input data used for the marine modelling are set out in Table 6.8 below. Modelling to predict long-term concentrations in the receiving waters was based upon annual average discharge flow rates. Short-term concentrations in receiving waters were modelled using 1 in 2 year flow rates for discharges from water courses, and annual average flows for the surface water component of discharges from excavations (WP2 and WP3)[10], with a 1 in 30 year flow event (lasting for a duration of 24 hours) randomly assigned within the 1 in 2 year modelling run. Groundwater discharge rates were assumed to be constant. Discharge flow rates are provided in Chapter 4.

[10] Discharges from WA2 were also based on annual average flows as the discharge from the settlement pond is made direct to sea down a short channel.

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Table 6.8 Marine Modelling Input Data

Discharge Point	Outfall Number and Pathway to Discharge Point	Discharge Concentrations (µg/l)			
		Copper (dissolved)	Lead (dissolved)	Zinc (dissolved)	Nickel (dissolved)
Marine AA EQS (µg/l)		**3.76**	**1.3**	**7.9**	**8.6**
1S	WA3 via Nant Cemaes	4.3	2.9	7.0	1.4
WA2	WA2 direct to sea	9.3	6.5	11.4	1.6
2S	WA1 and WB1 via Tre'r Gof outfall channel	9.3	6.5	11.4	1.6
3S	WC1, WD1, WD2 & WE2 via Afon Cafnan	8.5	6.0	10.9	1.6
WP2/3 (ground water component)	WP2/3 direct to sea	1.3	-[1]	37.8	13.8
WP2/3 (surface water component)	WP2/3 direct to sea	9.3	6.5	11.4	1.6
WCD1 (ground water component)	WCD1 direct to sea	1.3	-[1]	37.8	13.8

Notes. Discharge concentrations below the marine AA EQS are shaded grey. All discharge concentrations are below corresponding marine MAC EQSs, where published.

1. Lead in groundwater was screened out in the H1 assessement (see Table 6.6).

6.3.3 Results

Discharges to Fresh Waters

245. The results for the RQP modelling of the discharges to fresh waters are presented in Table 6.9 (long term) and Table 6.10 (short term). Test 1 of the assessment indicates that for the majority of discharges and substances, the concentration in the discharge does not cause the EQS to be exceeded. The exceptions to this are:

- Orthophosphate, where the AA EQS is exceeded in all catchments (exceedances are highlighted in yellow); and,
- Dissolved lead, where the discharge from WB1 (Tre'r Gof) causes the predicted 95th percentile concentration in the watercourse to exceed the short term MAC EQS.

246. The assessment results for Test 2 show that a number of discharges, whilst not causing exceedances of AA EQSs, do cause a deterioration of water quality of greater than 10% of the AA EQS. Levels of exceedance are given in Table 6.11:

- WA1 for bioavailable lead;
- WB1 (which ultimately discharges through Tre'r Gof SSSI[11]) for bioavailable copper, iron, lead and anionic polyelectrolyte; and,
- WC1 (Nant Caerdegog Isaf) for bioavailable lead (note that this also relates to the other discharges lower down the catchment into the Afon Cafnan).

[11] In the case of the WB1 discharge it should be noted that the discharges are expected to pass though drainage channels within the Tre'r Gof SSSI with minimal interaction with the fen.

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247. The discharges from WB1, WC1, and WA3 would also cause an increase in dissolved lead concentrations of more than 10% of the MAC (see also Table 6.12).

Discussion

248. With regard to predicted breaches of EQSs, in the case of orthophosphate, the exceedances are due to a combination of the high background concentrations of this pollutant in the receiving watercourses – measured at between 62 and 83 µg/l (in a number of cases the upstream concentration already exceeds the AA EQS) – and the even higher concentration (133 µg/l) within the leachate (derived from the leachate test results).

249. In mitigation, the leachate test is considered likely to overestimate phosphate concentrations in the surface run-off. The supernatant resulting from the 24 hour agitation of a soil sample under leachate test conditions will inherently contain higher concentrations of a particular pollutant than would be the case with a rainwater flow passing across and through the same sample material. It is therefore believed that the concentrations of orthophosphates in the run-off would not be at the levels indicated by the leachate test results.

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Table 6.9 Summary of RQP Modelling Results – Long Term

Discharge Point	Substance	Freshwater AA EQS	Mean Upstream Quality	Test 1		Test 2	
				Mean Predicted Concentration in Receiving Stream	Mean Discharge Concentration Required to Ensure AA EQS in Receiving Stream is not Breached	Upstream Concentration + 10% of AA EQS	Mean Predicted Concentration in Receiving Stream
		(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
WA1	Orthophosphate (as P)	78	62	**103**	88	70	**103**
	Lead (bioavailable)	1.2	0.01	0.39	2.1	0.13	**0.39**
WA3	Orthophosphate (as P)	78	80	**84**	44	88	84
	Lead (bioavailable)	1.2	0.02	0.07	17	0.14	0.07
WB1	Orthophosphate (as P)	78	62	**125**	80	70	**125**
	Copper (bioavailable)	1.0	0.05	0.23	1.1	0.15	**0.23**
	Chromium (III)	4.7	1.53	1.56	5.2	2.0	1.6
	Iron (dissolved)	1,000	110	367	1,129	210	**367**
	Lead (bioavailable)	1.2	0.01	0.60	1.4	0.13	**0.60**
	Anionic polyelectrolyte	7,500	0	870	8,619	750	**870**
WC1	Orthophosphate (as P)	78	80	**107**	75	88	**107**
	Copper (bioavailable)	1.0	0.06	0.16	1.9	0.16	0.16
	Chromium (III)	4.7	1.27	1.42	8.1	1.7	1.4
	Lead (bioavailable)	1.2	0.01	0.35	2.4	0.13	**0.35**
	Zinc (bioavailable)	13.9	1.99	2.84	11.1	3.4	2.8
	Anionic polyelectrolyte	7,500	0	497	15,078	750	497
	Nitrate (as NO_3)	50,000	6,980	11,241	91,850	11,980	11,241

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Table 6.10 Summary of RQP Modelling Results – Short Term

Discharge Point	Substance	MAC EQS	Mean Upstream Quality	Test 1		Test 2	
				95%ile Predicted Concentration in Receiving Stream	Mean Discharge Concentration Required to Ensure MAC EQS in Receiving Stream is not Breached	Upstream Concentration + 10% of MAC EQS	95%ile Predicted Concentration in Receiving Stream
		(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)	(µg/l)
WA3	Lead (dissolved)	14	1.27	3.9	49	2.7	**3.9**
WB1	Lead (dissolved)	14	1.39	**21**	4.4	2.8	**21**
WC1	Lead (dissolved)	14	1.39	13	7.0	2.8	**13**

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Table 6.11 Increase in Pollutant Concentrations in Surface Watercourses – Long Term

Discharge Point	Substance	AA EQS	Mean Upstream Quality	Mean Predicted Concentration in Receiving Stream	Increase in Pollutant Concentration
		(µg/l)	(µg/l)	(µg/l)	(% AA EQS)
WA1	Orthophosphate (as P)	78	62	103	52.6
	Lead (bioavailable)	1.2	0.01	0.39	31.7
WA3	Orthophosphate (as P)	78	80	84	5.1
	Lead (bioavailable)	1.2	0.02	0.07	4.2
WB1	Orthophosphate (as P)	78	62	125	80.8
	Copper (bioavailable)	1.0	0.05	0.23	18.0
	Chromium (III)	4.7	1.53	1.6	1.5
	Iron (dissolved)	1,000	110	367	25.7
	Lead (bioavailable)	1.2	0.01	0.60	49.2
	Anionic polyelectrolyte	7,500	0	870	11.6
WC1	Orthophosphate (as P)	78	80	107	34.6
	Copper (bioavailable)	1.0	0.06	0.16	10.0
	Chromium (III)	4.7	1.27	1.4	2.8
	Lead (bioavailable)	1.2	0.01	0.35	28.3
	Zinc (bioavailable)	13.9	1.99	2.8	5.8
	Anionic polyelectrolyte	7,500	0	497	6.6
	Nitrate (as NO_3)	50,000	6,980	11,241	8.5

Table 6.12 Increase in Pollutant Concentrations in Surface Watercourses – Short Term

Discharge Point	Substance	MAC EQS	Mean Upstream Quality	95%ile Predicted Concentration in Receiving Stream	Increase in Pollutant Concentration
		(µg/l)	(µg/l)	(µg/l)	(% MAC EQS)
WA3	Lead (dissolved)	14	1.27	3.9	18.8
WB1	Lead (dissolved)	14	1.44	21	140
WC1	Lead (dissolved)	14	1.39	13	82.9

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250. It should be noted that the current plan is to remove grazing animals from the WNDA at least one year prior to the commencement of construction activities. This will result in a significant reduction in the use of any fertilizers and the presence of manure within the area. Those phosphates present will continue to be flushed into surface watercourses and out to sea, but without their replacement, concentrations on surface soils and within watercourses will naturally begin to decline. For both of these reasons it is considered that, at the time when construction is due to commence, water discharge activities should not cause an exceedance of the freshwater orthophosphate AA EQS.

251. Regarding the dissolved lead, the flow rate in the Tre'r Gof drains upstream of discharge point WB1 is very low, with a Q95 of just 0.00003 m^3/s. As a worst case, therefore, at WB1 the water flow in the drains can be considered to be almost entirely that of the WB1 discharge, as can the mass flow rate and concentration of the dissolved lead (i.e. upstream flows do not materially dilute the WB1 discharge).

252. Based upon the leachate test results the mean ("cleaned-up") concentration of dissolved lead within the surface water run-off has been estimated as 6.5 µg/l, around half the freshwater MAC of 14 µg/l, although once again, the concentration is considered to be a substantial overestimate. From Table 6.7 it can be seen that the measured concentration of dissolved lead in the WNDA watercourses was between 1.27 and 1.39 µg/l, a factor of five lower than the assumed concentration in the leachate. This assertion is supported by groundwater sampling data where, for the 25 samples analysed, none were found to have dissolved lead above the limit of detection (and thus ascribed a default concentration of 1.0 µg/l).

253. The RQP analysis shows that, for the cleaned-up data, were discharges made at the lead concentrations reported in 90% of the leachate results, there would not be a predicted exceedance of the MAC EQS even under the modest flow conditions within Tre'r Gof drains. The apparent exceedance reported in Table 6.10 is down to a small number of sample results (the six highest dissolved lead concentration values measured were 22, 29, 35, 42, 44 and 59 µg/l). But this analysis takes no account of the mixing which will occur within the WNDA, due to the mixing of soils as they are moved around the site, the mixing of rainwater as it runs off the surface soils, and the mixing of water as it collects within the settlement ponds. In reality, the concentration of dissolved lead within surface water run-off from the site will naturally tend to the mean value. It is therefore thought highly unlikely that the discharge of surface run-off at point WB1 will cause an exceedance of the MAC EQS for lead.

254. With respect to the results from Test 2 of the RQP, which give a measure of the change in quality of the receiving waters, it is thought likely that these too are overly pessimistic due to:

- Over-estimation of pollutant concentrations as determined by the leachate tests; and,
- The worst case assumption that leachate concentrations are constant and independent of surface water run-off rates. In reality, the leachate concentrations will actually be lower in high rainfall events, and will naturally decrease over time as pollutants are leached out of the surface soils and revegetation of the mounds acts to attenuate run-off.

255. It is also observed that the requirement not to cause an increase in background pollutant levels of more than 10% of the EQS is a means by which "headroom" is given for any further discharges downstream in the catchment. However, the WNDA discharges will

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occur at the end of the water catchments, and there are no further discharges downstream which might influence compliance with EQSs.

256. Given the factors outlined above, and the further work proposed in FA_{CWD}-8 and FA_{CWD}-9 to gain a better understanding of the level of conservatism in the values used in the modelling and assessment work, Horizon considers that water discharges arising from the Construction Phase activities will not be at levels that would result in exceedances of the freshwater EQSs in receiving watercourses.

Further Investigation

257. The above discussion and conclusions rest, in part, on the assertion that the leachate tests provide an unduly conservative estimate of contaminant levels of surface run-off. In order to investigate this issue Horizon will undertake two pieces of further work, both of which will be completed during the early stages of the Application's determination period and supplied to NRW:

- FA_{CWD}-8: Surface water run-off from areas of on-going archaeological investigation within the WNDA is currently subject to sediment control. Water samples will be taken both upstream and downstream of the control devices and analysed to determine actual contaminant concentrations within the run-off; and,
- FA_{CWD}-9: Samples of surface soils from within the WNDA will be subjected to repeated leachate tests to establish leachate decay curves. This will give an indication of leachate concentrations over time.

Discharges to Marine Waters

258. The Delft3d model was run to understand how both the surface water and groundwater discharges would disperse and dilute upon entering the marine environment at the marine discharge points within the WNDA. Model runs emulated one complete spring neap tidal cycle and, as a worst case, assumed the temporary cofferdam and causeway were in place. The predicted discharge concentrations and water flows[12] from each discharge point were modelled to predict maximum concentrations in the marine environment which were then assessed by comparison against marine EQSs. The results of the marine modelling are summarised in Tables 6.13 and 6.14.

[12] Annual average and short-term flow rates were modelled (see paragraph 240). The results for annual average discharges were compared against annual average EQSs and the results for 1 in 2 year and 1 in 30 year flows were compared with MAC EQSs

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Table 6.13 Maximum Long Term Pollutant Concentrations in Marine Environment

Discharge Point	Discharge Flow Rate (m^3/s)	Copper (dissolved) AA EQS = 3.8 µg/l		Lead (dissolved) AA EQS(1) = 1.3 µg/l		Zinc (dissolved) AA EQS = 7.9 µg/l		Nickel (dissolved) AA EQS(1) = 8.6 µg/l	
		Max AA Conc (µg/l)	Area of AA EQS Exceedance (ha)	Max AA Conc (µg/l)	Area of AA EQS Exceedance (ha)	Max AA Conc (µg/l)	Area of AA EQS Exceedance (ha)	Max AA Conc (µg/l)	Area of AA EQS Exceedance (ha)
1S	0.0213	0.109	-	0.072	-	0.177	-	0.034	-
WA2	0.0009	0.002	-	0.001	-	0.002	-	0.0003	-
2S	0.01	5.572	**0.11**	3.916	**0.16**	6.867	-	0.97	-
3S	0.064	3.251	-	2.268	**0.33**	4.154	-	0.602	-
WP2 (2)	0.0064	0.053	-	0.036	-	0.12	-	0.03	-
WP3 (2)	0.0064	0.009	-	0.006	-	0.011	-	0.002	-
WCD1	0.0129	0.028	-	-	-	0.789	-	0.288	-

Note (1) In the absence of AA EQSs for dissolved lead and nickel, bioavailable AA EQSs have been used instead.

(2) Combined Groundwater and Surface Water discharges

Yellow highlighting denotes the area over which the EQS is exceeded.

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Table 6.14 Maximum Short Term Pollutant Concentrations in Marine Environment

Discharge Point	Max Conc (µg/l)			
	Copper (dissolved) No MAC(1)	Lead (dissolved) MAC EQS(2) = 14 µg/l	Zinc (dissolved) No MAC(1)	Nickel (dissolved) MAC EQS(2) = 34 µg/l
1S	4.3	2.9	7.0	1.4
WA2	0.1	0.0	0.1	0.0
2S	9.2	6.5	11.4	1.6
3S	8.5	6.0	10.9	1.6
WP2 (SW)	9.1	6.3	11.2	1.6
WP2 (GW)	0.4	0.3	10.4	4.5
WP3 (SW)	0.1	0.1	0.1	0.0
WP3 (GW)	0.0	0.0	0.3	0.1
WCD1 (GW)	0.0	0.0	0.8	0.3

Note (1) There are no MAC EQSs for dissolved or bioavailable copper and zinc.

(2) In the absence of MAC EQSs for dissolved lead and nickel, bioavailable MAC EQSs have been used instead.

259. The marine modelling results show the following:

- There are no exceedances of MAC EQSs;
- 2S (Tre'r Gof drains discharge to Cemaes Bay). The dissolved lead AA EQS would be exceeded over an area of 0.16 ha and the dissolved copper AA EQS over 0.11 ha; and,
- 3S (Afon Cafnan discharge to Cemlyn Bay). The dissolved lead AA EQS would be exceeded over 0.33 ha.;

260. Although there are predicted exceedances of lead and copper AA EQS from 2S and 3S, the highest average concentrations (the highest value for any modelled cell is reported) are still relatively low, only extend over small mixing zones, and are therefore not regarded as giving rise to any significant environmental impacts

261. It is thought highly unlikely that actual discharges would result in exceedances of either the lead or copper EQSs over the areas predicted by the model, as:

- The pollutant discharge rates are the product of water flows and the concentrations derived from the leachate tests. As noted earlier, the leachate test is thought likely to be an overestimate;
- It is highly unlikely that the concentrations of pollutants within the leachate will remain unchanged over a period of a year. They would naturally decline over time as mobile materials are flushed from the surface soils, and the vegetation of the mounds acts to prevent sediment run-off; and,

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- The marine modelling assumes windless conditions with no waves; these conditions would not prevail for over a substantial portion of any year, and make the modelled results conservative, as wind and wave action are likely to aid mixing and dispersion.

262. While the effect of these factors cannot be readily quantified, it is thought probable that together they will ensure that discharges are well below the AA EQS values after initial dilution, or, where existing background values are high, will minimise the extent of any mixing zone. Environmental impact from the discharges into the marine environment would not be anticipated.

6.4 Assessment of total suspended solids discharges

6.4.1 Effects on freshwaters

263. The WNDA Surface Water Drainage System has been designed to achieve discharge sediment concentrations which are at the lower end of background values. This is considered by Horizon to be the most appropriate approach to minimise effects on the downstream ecological receptors, receiving water quality and sediment regime, given that there is no established EQS for TSS for freshwaters, and no clearly defined methodology for assessing the effects of sediment load on receiving watercourses.

6.4.2 Effects on marine waters

264. In order to quantify potential effects resulting from the release of TSS to the marine environment during the Construction Phase of the Project, 3D modelling of the discharges was undertaken using Horizon's Delft3d model. There are currently uncertainties regarding the sequencing of the discharges during the Construction Phase. It was therefore assumed that all discharges are continuous over a spring-neap tidal cycle, and are released simultaneously.

265. A summary of the modelling input data, including discharge flow rates, suspended solid concentrations and general assumptions is presented in Table 6.15. Surface water flows have been modelled using the annual average flows, the 1 in 2 year flows, and a 24 hour storm event using the 1 in 30 year flows. The model results are summarised in this section and are presented in Appendix E (and in the Annex to Appendix E). It should be noted that dredging activities are not within the scope of the CWD EP Application and are therefore not included in the assessments.

266. The mid-depth suspended solids concentrations determined by the model are presented in three figures below. Figure 6.1 shows the TSS concentrations, arising from annual average discharges, at the end of the model simulation, Figure 6.2 shows TSS concentrations at the end of the 1 in 2 year flow model simulation, and Figure 6.3 shows the TSS concentrations at the end of a 1 in 30 year storm event.

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Table 6.15 TSS Modelling Input Data

Discharge Point	Source	Annual average		1 in 2 Year Storm		1 in 30 Year Storm		Comment
		Flow	TSS Conc.	Flow	TSS Conc.	Flow	TSS Conc.[1]	
		(m^3/s)	(mg/l)	(m^3/s)	(mg/l)	(m^3/s)	(mg/l)	
1S	WA3 via Nant Cemaes	0.0213	40	1.53	40	2.85	110	
WA2	WA2 direct to sea	0.0009	70	0.0009	70	0.146	300	
2S	WA1 and WB1 via Tre'r Gof outfall channel	0.01	70	0.5	70	0.80	400	

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<table>
<tr><th rowspan="3">Discharge Point</th><th rowspan="3">Source</th><th colspan="2">Annual average</th><th colspan="2">1 in 2 Year Storm</th><th colspan="2">1 in 30 Year Storm</th><th rowspan="3">Comment</th></tr>
<tr><th>Flow</th><th>TSS Conc.</th><th>Flow</th><th>TSS Conc.</th><th>Flow</th><th>TSS Conc.[1]</th></tr>
<tr><th>(m³/s)</th><th>(mg/l)</th><th>(m³/s)</th><th>(mg/l)</th><th>(m³/s)</th><th>(mg/l)</th></tr>
<tr><td>WP2/3</td><td>WP2/3 direct to sea</td><td>WP2: 0.0764
WP3: 0.0779</td><td>70</td><td>WP2: 0.0064
WP3: 0.0764</td><td>70</td><td>WP2: 1.1754
WP3: 1.2454</td><td>300</td><td>Flow rates comprise: Surface water drainage, ground water from excavation dewatering, and groundwater from tunnelling and batching plant drainage (WP3 only) [Note 2].
<table>
<tr><th rowspan="2">Stream</th><th colspan="3">Flow Rate (m³/s)</th></tr>
<tr><th>AA</th><th>1:2 Year Storm</th><th>1:30 Year Storm</th></tr>
<tr><td>S/W drainage</td><td>0.005</td><td>0.005</td><td>1.174</td></tr>
<tr><td>Groundwater from excavation dewatering</td><td>0.0014</td><td>0.0014</td><td>0.0014</td></tr>
<tr><td>WP2</td><td>-</td><td>0.0064</td><td>1.1754</td></tr>
<tr><td>Groundwater from tunnelling &</td><td>0.07</td><td>0.07</td><td>0.07</td></tr>
<tr><td>WP2</td><td>0.0764</td><td></td><td></td></tr>
<tr><td>S/W from batching plant</td><td>0.0015</td><td></td><td></td></tr>
<tr><td>WP3</td><td>0.0779</td><td>0.0764</td><td>1.2454</td></tr>
</table></td></tr>
<tr><td>3S</td><td>WC1, WD1, WD2, & WE2 via Afon Cafnan</td><td>0.064</td><td>40</td><td>5.62</td><td>40</td><td>7.83</td><td>200</td><td></td></tr>
</table>

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Discharge Point	Source	Annual average		1 in 2 Year Storm		1 in 30 Year Storm		Comment
		Flow	TSS Conc.	Flow	TSS Conc.	Flow	TSS Conc.[1]	
		(m^3/s)	(mg/l)	(m^3/s)	(mg/l)	(m^3/s)	(mg/l)	
WCD2	Outfall cofferdam direct to sea	0.0757	70	0.0765	70	0.0773	300	Flow rates comprise: Rain water from Outfall Cofferdam, seawater infiltration to cofferdam, and groundwater from tunnelling.

Stream	Flow Rate (m^3/s)		
	AA	1:2 Year Storm	1:30 Year Storm
Drainage from cofferdam	0.00005	0.0010	0.0018
Seawater infiltration	0.0056	0.0056	0.0056
Groundwater from tunnelling	0.07	0.07	0.07
Total	**0.0757**	**0.0765**	**0.0773**

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Discharge Point	Source	Annual average		1 in 2 Year Storm		1 in 30 Year Storm		Comment
		Flow	TSS Conc.	Flow	TSS Conc.	Flow	TSS Conc.[1]	
		(m^3/s)	(mg/l)	(m^3/s)	(mg/l)	(m^3/s)	(mg/l)	
WCD1	Bund cofferdam direct to sea	0.0129	70	0.0541	70	0.0894	300	Flow rates comprise: Rain water from Bund Cofferdam, seawater infiltration to cofferdam, and groundwater infiltration to cofferdam.
WS1	Main Site WwTW discharge direct to sea	0.0185	30	0.0185	30	n/a	n/a	Discharge duration 15 hours.
	DCWW package WwTW discharge direct to sea	0.0185	30	0.0185	30	n/a	n/a	Discharge duration 12 hours. Discharge point assumed to be just east of the Outfall Cofferdam.

Stream	Flow Rate (m^3/s)		
	AA	1:2 Year Storm	1:30 Year Storm
Drainage from cofferdam	0.0023	0.0434	0.0787
Seawater infiltration	0.0083	0.0083	0.0083
Groundwater infiltration	0.0023	0.0023	0.0023
Total	**0.0129**	**0.0541**	**0.0894**

Note: (1) Higher TSS concentration values in the discharges were assumed for the 1 in 30 year event, as this is beyond the point at which the proposed numeric limits will apply.

(2) The groundwater arisings from the tunnelling were not included in the WP2 discharges for the 1 in 2 year and 1 in 30 year modelling runs, but were included in the annual average modelling run. Similarly runoff from the batching plant area was not included in the 1 in 2 and 1 in 30 year modelling for WP3, but was included in the annual average modelling. This is a result of design development; it is now intended that tunnelling dewatering effluents can be discharged via either WP2 or WP3 for operational flexibility, and runoff from the batching plant area will be discharged to WP3. It is not considered that the addition of tunnel dewatering discharges via WP2 would cause any environmental impact, as the

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groundwater sampling in the tunnelling area did not show any marine EQS exceedances, and the surface water drainage from the batching plant would have a negligible effect as it represents only a small part of the total surface water drainage discharges.

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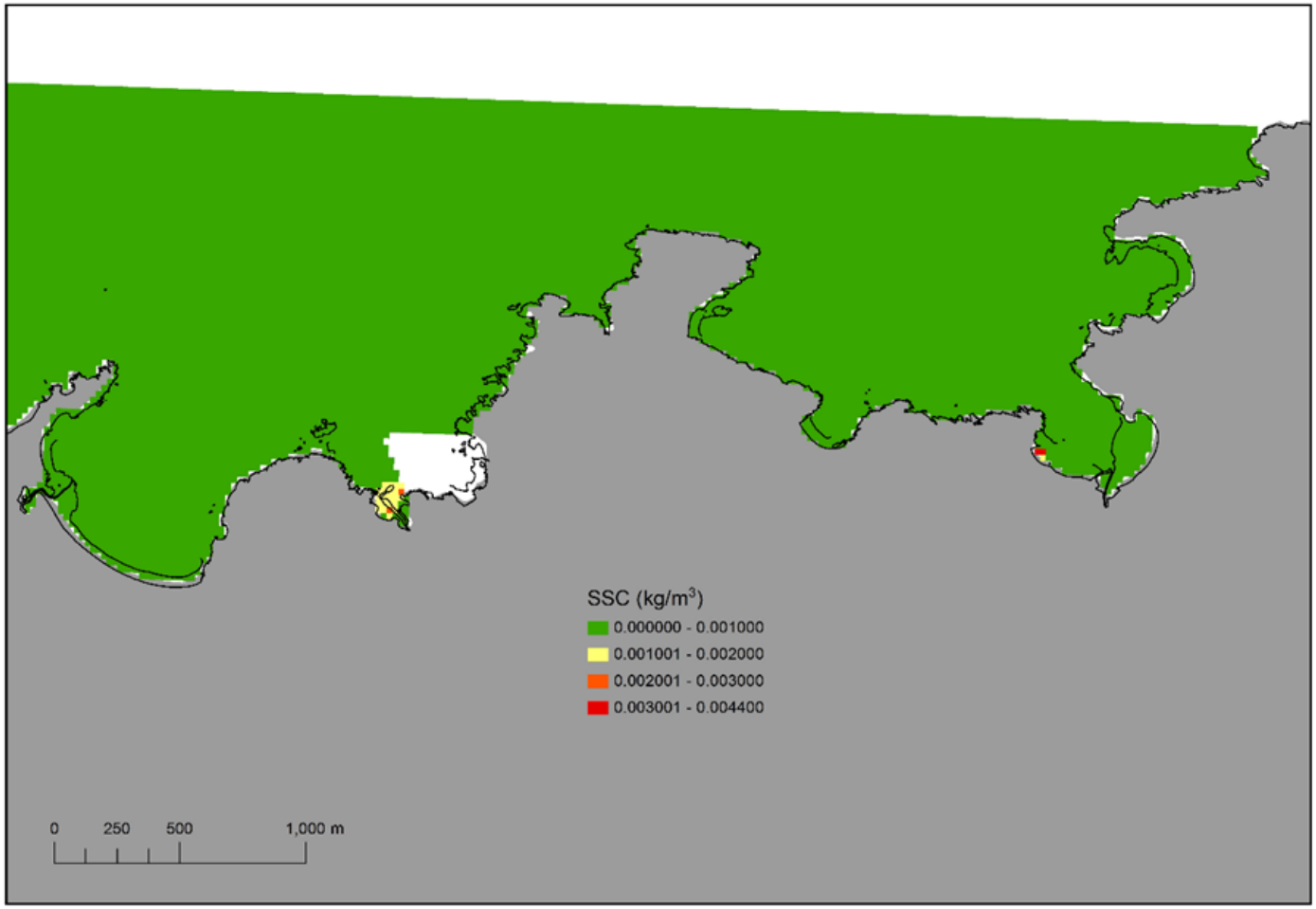
Figure 6-1 TSS Concentration at the End of the Spring-Neap Tidal Cycle Simulation (Annual Average Discharge Flow Rates)



Note. Blanked out area depicts dry working area.

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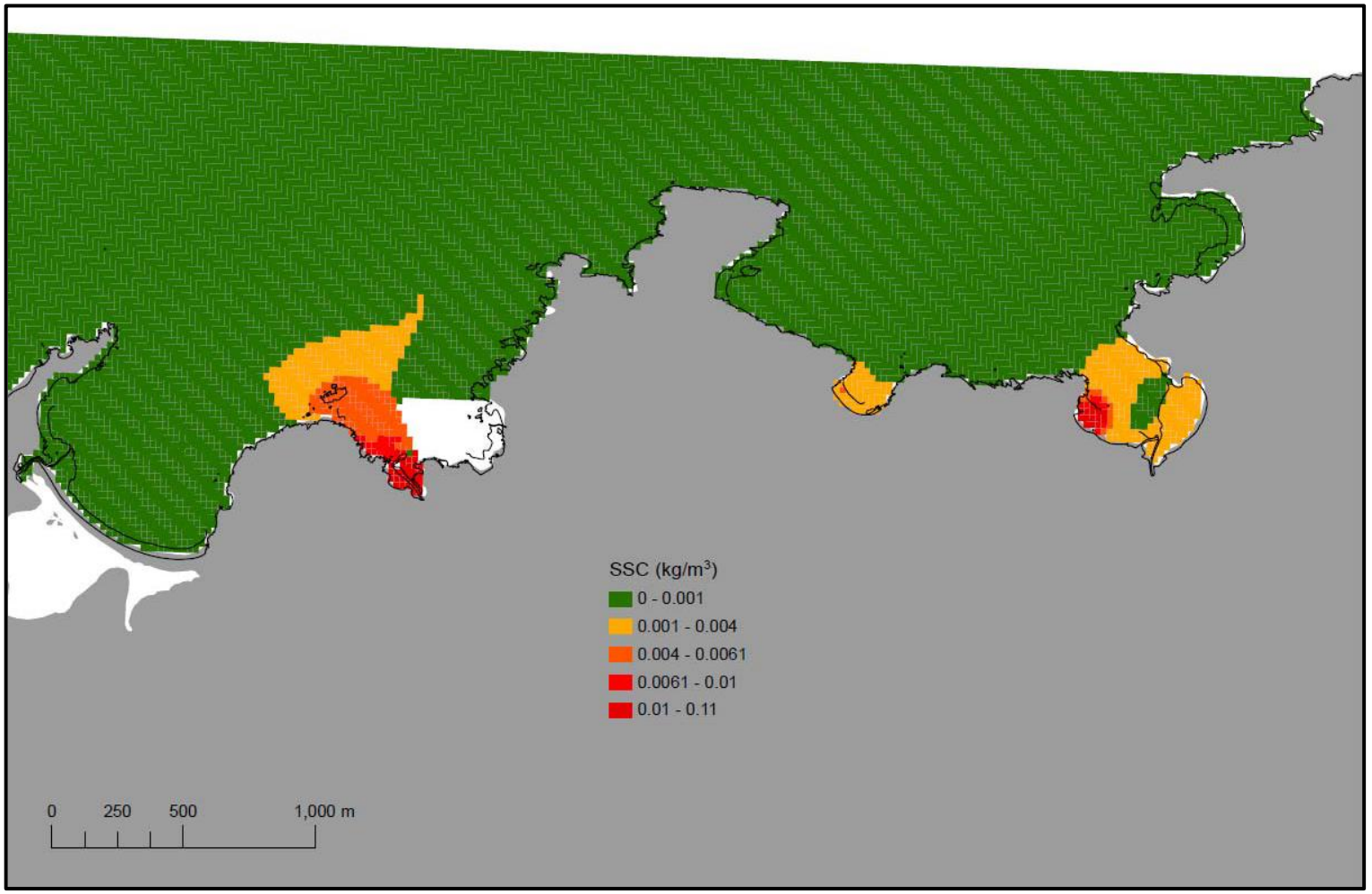
Figure 6-2 TSS Concentration at the End of the 1 in 2 Year Flows Spring-Neap Tidal Cycle Simulation



Note. Blanked out area depicts dry working area.

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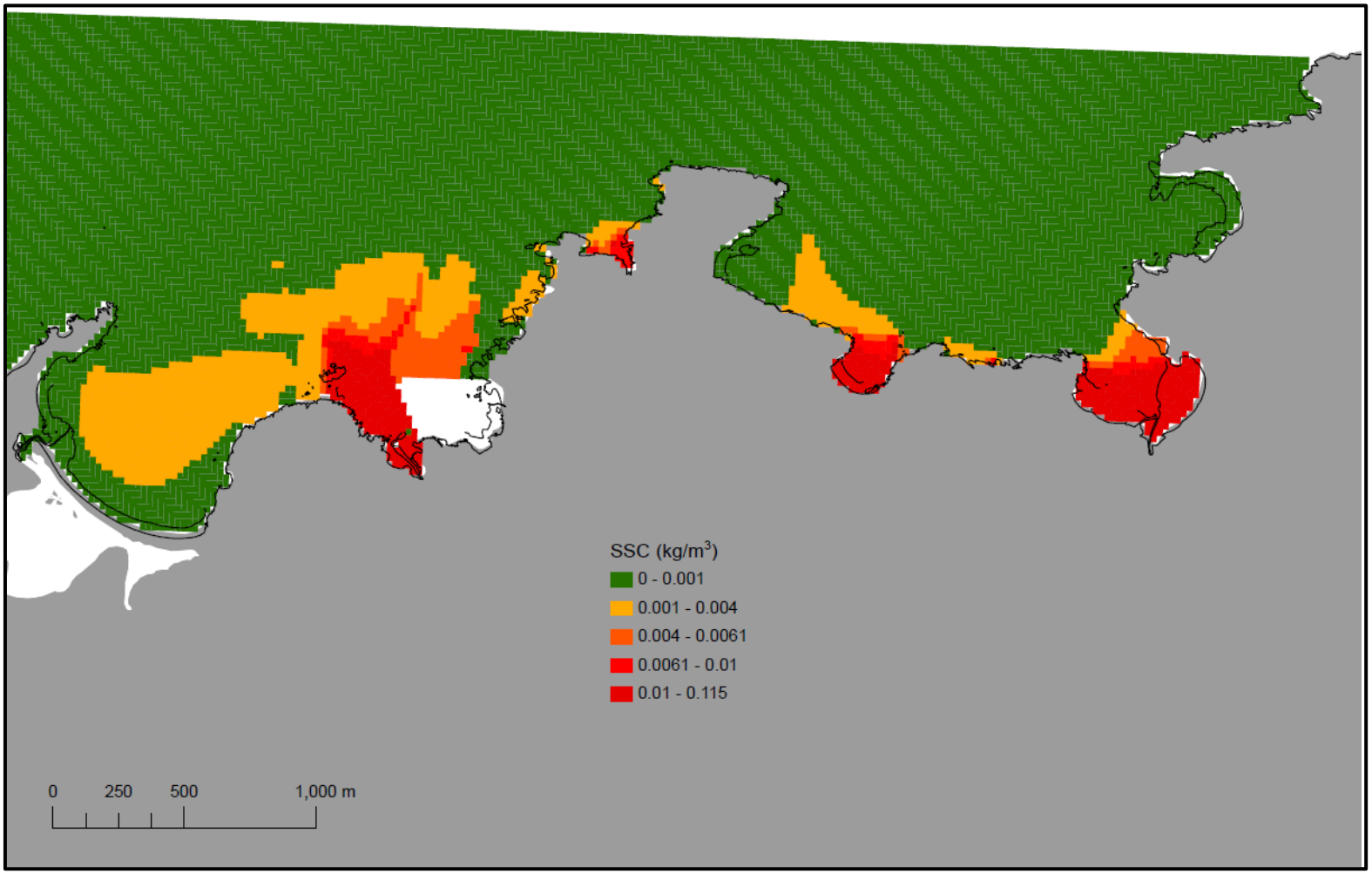
Figure 6-3 TSS Concentration at the End of the 1 in 30 Year Storm Event Simulation



Note. Blanked out area depicts dry working area.

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267. The model predicted a maximum annual average suspended solids concentration, above ambient, of 4 mg/l (0.004 kg/m^3). Background monitoring of suspended solids showed annual average concentrations between 4.6 and 7 mg/l in 2010-2012, 13.0 mg/l in 2014, and samples in winter 2015/16 produced a mean concentration of 16.5 mg/l. These background values fall within the Water Framework Directive classification of clear (<10 mg/l) to intermediate turbid (10<100mg/l) water. The contribution predicted by the annual average modelling is low, and would maintain TSS levels within the clear to the lower end of the intermediate turbid classifications. The low suspended solids concentrations predicted by the model over the wider area reflect the relatively low flux of silt from the drainage discharges and the high levels of dilution in the bays either side of Wylfa Head.

268. The maximum suspended solids concentration above ambient, after the 1 in 2 year flows model simulation is 106 mg/l, which falls at the extreme lower end of the Water Framework Directive classification of turbid water (i.e. 6 mg/l outside the intermediate turbidity classification boundary). The area classified as turbid is on the western side of Porth-y-pistyll and covers an area of 0.05ha.

269. After a 1 in 30 year storm event (Figure 6.3) there is an increase in both the extent of areas of elevated suspended solids concentration adjacent to the discharge points, and the maximum suspended solids concentration increment (115 mg/l), although the latter is still within the extreme lower end of the WFD turbid classification (the area within this classification totals 0.22 ha), and it is noted that a 1 in 30 year return period storm is an extreme event.

270. It should also be noted that the modelled concentrations are considered to be worst case. This is due to the use of peak flow and peak TSS discharges,along with the assumptions that all discharges are continuous over a spring-neap tidal cycle, are released simultaneously, and that there is no vegetation on the mounds within the WNDA. Also, the model simulated conditions with no wind or waves.

6.5 WwTW discharge modelling and assessment

271. Discharges from the WwTW were assessed using dilution factors derived from the hydrodynamic model for discharge point WS1 (see Appendix G). Discharged concentrations of substances are identified in Table 3.1.

6.5.1 Ammoniacal nitrogen and dissolved inorganic nitrogen

272. The potential impact of discharges from the WwTW of ammoniacal nitrogen, non-ionized ammonia, and dissolved inorganic nitrogen (given in Table 3-1) were evaluated by screening against the EQS presented in Table 6.15. Details are set out below.

Table 6.16 EQS in Seawater

Parameter	Standard	Expressed as
Non-ionized ammonia (as N) (filtered)	21 µg/l	AA
Total ammoniacal nitrogen (as N) (filtered)	1 mg/l	AA
	8 mg/l	MAC
Dissolved inorganic nitrogen (as N) (November to February only)	0.252 mg/l(1)	Winter mean

Note. (1) Standard for “good” status applicable in “clear” waters (with annual mean TSS <10 mg/l).

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Ammoniacal Nitrogen

273. The worst case annual average (AA) process contribution of ammoniacal nitrogen resulting from the discharge from the WwTW (based on conventional treatment) at point WS1 at the end of the west breakwater, following the average initial dilution, is 0.016 mg/l as N (i.e. the inlet concentration of 45 mg/l – see Table 3.1 – diluted by a factor of 2,764). The average total ammoniacal nitrogen concentration measured in the vicinity of the discharge point after initial dilution is 0.076 mg/l, thus the recommended EQS (AA) for Habitats Directive sites of 1 mg/l is met by a large factor immediately after initial dilution. When the 95% initial dilution (factor of 722) is applied, the short-term process contribution is 0.062 mg/l as N, thus the MAC EQS of 8 mg/l is met by an even larger factor.

Non-ionised Ammonia

274. Non-ionised ammonia (NH_3) exists in equilibrium with the ammonium ion (NH_4^+), and the position of the equilibrium is affected by temperature, pH and salinity. Assuming a worst case temperature (maximum from baseline was 16.7°C), maximum pH (8.25) and salinity (34 g/l) the combined total ammonia concentration (baseline of <0.021 mg/l plus the process contribution of 0.016 mg/l as worst case) would result in a non-ioinised ammonia concentration after initial dilution of <1.57 µg/l[13]. This is well within the EQS for coastal waters of 21 µg/l.

Dissolved Inorganic Nitrogen

275. The worst case discharge of dissolved inorganic nitrogen from the WwTW (based on conventional treatment) at point WS1, and following the average initial dilution is 0.025 mg/l as N (i.e. the inlet concentration of 69 mg/l – see Table 3.1 – diluted by a factor of 2,764). This represents 10% of the EQS.

6.5.2 Faecal indicator organisms

276. The treated sewage discharged from the WwTW at a design maximum rate of 18.5 l/s would have E.coli and intestinal enterococci concentrations of 3 x 10^6 CFU/100 ml. Modelling was carried out to predict how the sewage effluent will disperse within the marine environment, with the sensitive receptor in terms of bacteriological water quality being the EU-designated bathing water at Cemaes, which currently receives discharge from Nant Cemaes[14]. The modelling considered both the discharges from the Construction Phase WwTW and the discharges from the DCWW WwTW arising from the Site Campus sewage (both discharges were assumed to have the same discharge flows and faecal coliform counts).

[13] The calculation is undertaken using a spreadsheet tool supplied by the Environment Agency into which the values of temperature, pH, salinity and total ammoniacal nitrogen concentration are entered.

[14] Changes to bacteriological water quality could result from the mobilisation of soil during topsoil clearance and storage, as well as from and general site drainage. However, it is highlighted that the Cemaes catchment will drain through the SuDS and will be discharged to Nant Cemaes via the suspended solids treatment system. Grazing would be excluded from the catchment area for a sufficient time (over 1 year for the majority of the WNDA) prior to construction to allow animal faeces to biodegrade naturally, and reduce the risk of run-off containing E.coli and intestinal enterococci. SuDs drainage systems, particularly swales, are effective in reducing concentrations of faecal indicator organisms (FIOs). Also, the proposed TSS discharges will not significantly affect turbidity in the receiving waters; there are insignificant changes in water transparency, which might otherwise retard the destruction of FIOs through the action of UV light, thus increasing survival times. Changes to bacteriological water quality due to surface run-off are therefore anticipated to be effectively controlled.

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277. The modelling showed that the treated sewage discharged in the north of Porth-y-pistyll would be quickly dispersed. Under the Bathing Water Directive, to achieve good classification the intestinal enterococci concentration must not exceed 200 CFU/100 ml in 95% of samples. In a worst case scenario, the modelled concentration of faecal indicator organisms reaching the bathing water at Cemaes would result in an increase in 29.3 CFU/100 ml (11.8 CFU/100ml from the Construction Phase WwTW outfall and 17.5 CFU/100 ml from the DCWW WwTW outfall). This contribution is likely to occur infrequently as it is based on a modelled continuous discharge of 18.5 l/s, when in reality the discharge would be batched and would occur only over a 12 or 15-hour period. Furthermore, the small addition is well below the maximum concentration required to achieve “good” classification.

6.5.3 Other

Phosphorus

278. Phosphorus (as phosphates) in discharges is not anticipated to be as high as it would be in general domestic sewage as there is likely to be less laundry effluent in the discharge to the main WwTW, as accommodation does not discharge to the WwTW. It is also noted that phosphates are not the limiting nutrient in the marine environment. For this reason nitrogen based nutrients were assessed.

Biological Oxygen Demand and Chemical Oxygen Demand

279. Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are discharged at industry standard treatment concentrations to a highly dynamic marine environment with good mixing and oxygenation of the water. No adverse effects on the receiving environment are considered likely.

Total Suspended Solids

280. TSS concentrations in the discharge from the WwTW (30 mg/l) are well below those proposed for other discharges into sea. No adverse effects are predicted (see Section 6.5).

Summary

281. Discharges of ammoniacal nitrogen, non-ionized ammonia, and dissolved inorganic nitrogen at WS1, following initial dilution, will not cause exceedances of corresponding EQS within the marine environment. BOD, COD, phosphates and TSS are similarly assessed as not giving rise to significant adverse environmental effects in the receiving marine environment.

6.6 Effects of nutrient run-off

282. The key nutrients in soils which could contribute to enrichment of freshwaters, and subsequently marine waters, are nitrates and phosphates which are present in the topsoil that would be removed during construction. Their significance in the surface water run-off has been assessed in the foregoing H1 Assessment.

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283. The WNDA is predominantly used as pastureland for low-density grazing with only a small fraction of the land used for crop agriculture. Fertilisers or manures would not have been intensively applied to the majority of the land in the last few years, and grazing animals will be removed from the area at least one year prior to the commencement of earthwork activities (with the exception of the low intensity grazing on Tre'r Gof SSSI and the Wylfa headland, carried out for nature conservation purposes). Levels of nitrates in soils are therefore likely to be low. It is anticipated that there would be no significant change to the nutrient concentrations in the run-off reaching the marine environment. The magnitude of change is predicted to be negligible and it is considered that there would be no significant effects on water quality in coastal WFD water bodies as a result of increased nutrient levels.

6.7 Impact on Tre'r Gof SSSI

284. The Tre'r Gof SSSI is in hydrological connection with the proposed discharge to be made into the unnamed watercourse at point WB1. The unnamed watercourse flows through Tre'r Gof SSSI and discharges into the sea at point 2S.

285. The Tre'r Gof SSSI is located in a small 'inland' drainage basin. It was designated for its biological interest as a representative example of rich-fen habitat in north-west Wales. The SSSI citation states that it is a lime-rich wetland with associated plant communities that are characterised by blunt flowered rush, black bog rush, great fen-sedge and the nationally scarce marsh fern. Other associated flora and fauna include swamp, wet willow woodland habitats and notable invertebrate species. The quality of inflowing water is one of the key hydrological supporting conditions for the wetland; according to the SSSI citation, the special features of Tre'r Gof SSSI rely on nutrient-poor calcium-rich water inputs.

286. NRW has confirmed that the Tre'r Gof SSSI is in unfavourable condition. The condition survey undertaken in 2014 found the site had been under-grazed for several years, although since this condition survey was carried out grazing has been reinstated on the site.

287. Horizon carried out a hydroecological assessment which established that the Tre'r Gof SSSI is a seasonal Groundwater Dependent Terrestrial Ecosystem (GWDTE) that is dependent on winter recharge by direct rainfall and groundwater flows which bring in mineral-enriched water (in comparison to rainwater) vital to the ecological interest of the SSSI. The EIA carried out as part of the DCO application identified that the main potential impact on the Tre'r Gof SSSI would be in maintaining and controlling the inflow of groundwater and maintaining the water levels in the peat, to ensure the hydrological regime was unaffected by the development. The EIA further notes that the drains (and the unnamed watercourse) appear to function as "through routes" for surface water flow which have relatively little interaction with the SSSI.

288. Discharge point WB1 is approximately 500 m upstream of Tre'r Gof SSSI and will comprise site drainage, which will flow over bare earth during the Construction Phase, potentially resulting in an elevated sediment load and contain associated leached metals and nutrients, as identified in Table 4.4.

289. As described in Chapter 4 and 5, good practice measures will be used to control sediment erosion and loads at source, and within the drainage channels which collect and transport surface water drainage to discharge. The site drainage will be settled to achieve TSS concentrations of less than 70 mg/l in the up to 1 in 2 year event prior to discharge at point WB1 (see Table 4.3).

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290. The SSSI is protected from diffuse overland flow by the 50 m vegetated buffer strip surrounding the SSSI, as well as by the 15 m buffer strips along the unnamed stream, and the sediment control systems used to minimise erosion and control sediment transport on the site (erosion matting, sediment fences, and in-channel controls).

291. The results of the RQP modelling predict that the annual average EQS for orthophosphate is likely to be exceeded in the receiving waters downstream of the discharge point WB1 (this is the case for all watercourses assessed). However, as the upstream concentration already exceeds the EQS and the discharge only slightly increases the concentration in the receiving watercourse, the effect of this change is not assessed as significant.

292. For Test 2 of the modelling assessment, the RQP modelling predicts that the downstream quality may deteriorate by more than 10% of the AA EQS for bioavailable copper, iron and lead in the Tre'r Gof drains. Anionic polyelectrolyte carry-over also potentially causes the downstream quality to deteriorate by slightly more than 10% of the AA EQS in the Tre'r Gof drains. However, this is based on a conservative assumption of continuous dosage at the maximum planned rate and takes no account of polyelectrolyte that would be fixed through binding to suspended solids in the discharge and watercourses. Therefore, considering also that the EQS is not approached by the planned discharge, polyelectrolyte is not expected to cause a significant environmental impact at the planned dosage rate.

293. With respect to exceedances of short-term EQSs, only lead shows as being potentially significant as identified from the screening assessment and clean-up of data. The RQP model output predicts that the 95th percentile concentration resulting from the discharge at WB1, would cause the short term MAC EQS to be exceeded by 150%. It should however, be noted that this short term result is for a worst case discharge associated with a rare rainfall event (1 in 30 year).

294. The results of the RQP model indicated that the water quality downstream of discharge point WB1 would deteriorate by more than 10% of the AA EQSs for bioavailable copper, iron and lead and the MAC EQS for lead. It should be noted that the leachate tests which inform the estimates of contaminant loads are likely to over-estimate the level of pollutants in the water, and any increases in leached metals will be temporary, primarily associated with periods where soil is being disturbed, reducing as the soil cover is re-established and vegetated. In addition, the assessment criteria are precautionary, and the predicted concentrations of substances in the discharges are well below the freshwater EQSs.

295. Given that the main channel flowing through Tre'r Gof SSSI has limited interaction with the wider Tre'r Gof site, no significant effects on the Tre'r Gof SSSI arising from changes to water quality during the Construction Phase are predicted.

6.8 Water Framework Directive

296. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (as amended) [RD8] require that an assessment be made of the impact of any works/modifications to Water Framework Directive (WFD) water bodies. A Project-wide WFD Compliance Assessment [RD9] (see Appendix O) has therefore been prepared to assess the effects of the Project on relevant water bodies, and to determine whether it is compliant with the objectives of the WFD. The intent is that the WFD Compliance Assessment provides support to all relevant permit applications. The findings relevant to this CWD EP Application are summarised in the WFD Signposting Document presented in Appendix N.

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297. The water bodies relevant to the CWD EP Application are:

- The Skerries (GB611010390000);
- Anglesey North (GB641010620000); and,
- Cemlyn Lagoon (GB610100083000).

298. The WFD Compliance Assessment determined that the activities covered by the CWD EP Application would not cause deterioration in WFD water bodies on a non-temporary basis, and would not prevent WFD water bodies from attaining Good Ecological Status (GES)/Good Ecological Potential (GEP).

6.9 Habitats Regulations Assessment

299. A Shadow Habitats Regulations Assessment (HRA) has been produced (Appendix M) that assesses the potential effects of the construction, operation and decommissioning of the entire Project on European Designated Sites[15]. It includes a consideration of the effects of Construction Phase water discharges. The findings of the Shadow HRA relevant to this CWD EP Application are summarised in the HRA Signposting Document presented in Appendix L.

300. The outcome of the Shadow HRA is that an Adverse Effect on Integrity (AEOI) from the Construction Phase water discharge activities is not predicted whether the activities are considered alone or in combination with wider Project activities and other relevant plans and projects.

[15] These sites include Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and sites that are in the process of designation as SACs and SPAs (i.e. proposed SACs (pSACs), candidate SACs (cSACs), potential SPAs (pSPAs), and Sites of Community Importance (SCIs).

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7 Monitoring arrangements

301. This chapter presents information on the sampling and monitoring which Horizon proposes to undertake with respect to the water discharge activities described in Chapter 3. It thereby addresses the requirements of the NRW application form B6 Part 8.

7.1 Discharge monitoring and sampling

302. An outline proposal for the monitoring and sampling of the water discharge activities is presented in Table 7.1. For each discharge point the table lists the parameters which will be measured, the proposed reference period – i.e. whether the monitoring/sampling will be continuous or an instantaneous spot sample – and the frequency with which it will be carried out. The monitoring will demonstrate compliance with CWD EP limits and conditions.

303. It is highlighted that details of the proposed monitoring/sampling techniques and corresponding equipment specifications have yet to be finalised. These will be developed as part of the Forward Work Plan (see [FA_{CWD}-10] in Chapter 9) and agreed with NRW prior to the commencement of the Construction Phase. Consultation with NRW will facilitate the incorporation of changes to monitoring methods between the point of Permit application and the start of the Construction Phase.

304. The monitoring/sampling arrangements will be developed in line with NRW and Environment Agency guidance including:

- How to comply with your environmental permit [RD15];
- How to comply with your environmental permit, Additional guidance for: Water Discharge and Groundwater (from point source) Activity Permits [RD16];
- H1 Risk Assessment (Appendix I); and,
- Technical Guidance Notes M18 (Monitoring) [RD56].

305. Monitoring will be performed in accordance with the Environment Agency's Monitoring Certification Scheme (MCERTS). Comité European de Normalization (CEN) monitoring standards, ISO standards, or national or international standards will be used where they provide data of equivalent scientific quality.

306. Monitoring points will be located after the last treatment stage before discharge to the receiving watercourse or sea. However, precise locations have yet to be defined, and will thus be agreed with NRW prior to the commencement of the Construction Phase, as part of the Forward Work Plan item [FA_{CWD}-10].

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Table 7.1 Monitoring and Sampling Proposal

Discharge Point	Parameter	Reference Period & Frequency	Monitoring Methodology	Comment
WA1, WA2, WA3, WB1, WC1, WD1, WD2, WE2.	Discharge flow rate	Instantaneous (spot sample) – weekly	TBD	
	Turbidity	Continuous	TBD	
	Suspended solids (measured after drying at 105°C)	Instantaneous (spot sample) – weekly	TBD	
	pH	Instantaneous (spot sample) – monthly	TBD	Frequency to be reviewed after 6 months' sampling.
	Visible oil or grease	Instantaneous (spot check) – weekly	TBD	Visual inspection proposed
	Metals (copper, lead, zinc & nickel, iron [WB1 only])	Instantaneous (spot sample) – monthly	TBD	Frequency to be reviewed after 6 months' sampling.
	Nutrients (phosphates, as P and nitrates, as NO_3)	Instantaneous (spot sample) – monthly	TBD	Frequency to be reviewed after 6 months' sampling.
	Polyelectrolyte	Instantaneous (spot sample) – monthly	TBD	Frequency to be reviewed after 6 months' sampling.
WP1/2/3	Discharge flow	Instantaneous (spot sample) – weekly	TBD	
	Suspended solids (measured after drying at 105°C)	Instantaneous (spot sample) – weekly	TBD	
	Turbidity	Continuous	TBD	
	pH	Instantaneous (spot sample) – weekly	TBD	
	Visible oil or grease	Instantaneous (spot check) – weekly	TBD	Visual inspection proposed
	Metals (copper, lead, zinc & nickel)	Instantaneous (spot sample) – monthly	TBD	Frequency to be reviewed after 6 months' sampling.
WCD1	Discharge flow	Instantaneous (spot sample) – weekly	TBD	

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Discharge Point	Parameter	Reference Period & Frequency	Monitoring Methodology	Comment
	Suspended solids (measured after drying at 105°C)	Instantaneous (spot sample) – weekly	TBD	
	Turbidity	Continuous	TBD	
	pH	Instantaneous (spot sample) – weekly	TBD	
	Visible oil or grease	Instantaneous (spot check) – weekly	TBD	Visual inspection proposed
	Metals (copper, lead, zinc & nickel)	Instantaneous (spot sample) – monthly	TBD	Frequency to be reviewed after 6 months' sampling.
WCD2	Discharge flow	Instantaneous (spot sample) – weekly	TBD	
	Suspended solids (measured after drying at 105°C)	Instantaneous (spot sample) – weekly	TBD	
	Turbidity	Continuous	TBD	
	pH	Instantaneous (spot sample) – weekly	TBD	
	Visible oil or grease	Instantaneous (spot check) – weekly	TBD	Visual inspection proposed
WS1	Discharge flow	Instantaneous (spot sample) – weekly	TBD	
	BOD	Instantaneous (spot sample) – monthly	TBD	Frequency to be reviewed after 6 months' sampling.
	COD	Instantaneous (spot sample) – weekly	TBD	Frequency to be reviewed after 6 months' sampling.
	Suspended solids (measured after drying at 105°C)	Instantaneous (spot sample) – weekly	TBD	Frequency to be reviewed after 6 months' sampling.
	Total ammoniacal nitrogen (as N)	Instantaneous (spot sample) – weekly	TBD	Frequency to be reviewed after 6 months' sampling.
	Intestinal enterococci	Instantaneous (spot sample) – weekly	TBD	Frequency to be reviewed after 6 months' sampling.

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7.2 Background environment sampling and monitoring

307. Horizon has proposed to develop and implement a programme of monitoring background TSS, turbidity and flow rate in receiving watercourses – see [FA_{CWD}-6].

308. No background monitoring of the marine environment is proposed.

7.3 Recording and reporting

309. All monitoring results will be recorded, processed and presented to allow transparent verification of compliance with the permit conditions. The data collected will meet the CWD EP required reference conditions and reference periods, and shall be retained for such period as is required by the permit.

310. NRW will be notified following the detection of:

- Discharge flow rates which exceed the 1 in 2 year return period flows, as agreed under FA_{CWD}-5;
- Any malfunction, breakdown or failure of equipment or techniques, accident, or emission of a substance not controlled by an emission limit which has caused, is causing or may cause significant pollution;
- The breach of a limit or condition specified in the permit; or,
- Any significant adverse environmental effects.

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8 Managing the water discharge activity

311. This chapter presents information on Horizon's organisational structure and management arrangements, and thereby addresses the requirements of the NRW application form B2, part 3d. It demonstrates that the company will have the capability to comply with the Construction Phase water discharge activity EP prior to commencement of construction operations.

312. It is highlighted that Horizon's compliance arrangements are still in development. NRW will therefore be provided with updates to the arrangements described hereunder as part of Horizon's commitments under the Forward Work Plan (see [FA_{CWD}-11] in Chapter 9).

8.1 Horizon policies and management system

313. Horizon controls and manages its activities through the implementation of the arrangements contained within its integrated Horizon Management System (HMS). The HMS has been established, implemented and developed to provide a single platform that integrates all aspects of the management of the company's business. The certifications granted for the HMS include:

- BS EN ISO 9001:2008 for quality management;
- BS EN ISO 14001:2004 for environmental management; and,
- BS OHSAS 18001:2007 for health and safety management.

314. In respect to each of the above certifications the company arrangements are presently being amended to transition to the new ISO standards, including the new environmental standard ISO14001: 2015. The transition is expected to be successfully completed before the deadline of September 2018.

315. At the top level of the HMS structure is a set of policies signed by the Chief Executive Officer, including a Safety, Health and Environment Policy. The policy requirements are applicable to all those working on behalf of the company, including the supply chain.

316. The policy requirements are discharged through a set of corporate, departmental and functional manuals and their associated management arrangements. Environmental Aspects and Regulatory Requirements

317. The HMS has arrangements for the identification and evaluation of the environmental aspects and impacts of Horizon's business as well as compliance with legal and other requirements. These arrangements will ensure the requirements of EPR16, included within the CWD EP are discharged through effective management arrangements. The arrangements are presently and will continue to be audited independently by competent auditors, as well as by a third party through the ISO14001 certification process.

8.1.1 Objectives and targets

318. In accordance with the requirements of ISO14001 Horizon sets objectives and targets, which are subsequently delivered through programmes. The setting of objectives and targets supports the aim of the company to ensure regulatory compliance and continual improvement in its environmental performance.

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8.1.2 Roles and responsibilities

319. The following sections describe the organisational structure in broad terms together with the key roles and responsibilities applicable to this application.

320. At the time of application, Horizon is in the process of transitioning to a revised structure which places a greater emphasis on site control. Since the company is a development company, further organisational changes are likely in the future. Such changes will continue to be undertaken taking full consideration of the regulatory and other requirements applicable to the business activities, will be controlled through the company formal management of change arrangements and will be undertaken in consultation with the appropriate regulatory authorities, including NRW.

Level 1: Board, Chief Executive Officer and Horizon Leadership Team

321. The Horizon Board of Directors ('the Board') is ultimately accountable for Horizon's activities, its corporate governance framework and all decisions taken within that framework. Day-to-day management of the business has been delegated to the Chief Executive Officer (CEO) and a leadership team principally of executive directors and functional directors.

322. The CEO is both Chair of the Board and an executive director. The CEO is responsible for:

- Day-to-day running of Horizon and developing and executing the Business Plan;
- Leadership of the Board, ensuring that it operates effectively;
- Setting Horizon's culture, vision, mission and values;
- Leading engagement with UK and Japanese Governments, shareholders and key industry stakeholders; and,
- Leading business operations.

323. The Board members maintain oversight of, and challenges, all aspects of the organisation's performance, including environmental performance. The Board members are responsible for making strategic decisions on major permissions (e.g. applications for EP and DCO), and are ultimately accountable for Horizon's compliance with the environmental permitting and planning regimes.

324. Within this structure, are two executive directorships which are particularly pertinent to this application:

- Safety, Licensing and Quality: Provides the corporate independent function for setting and assuring policies and standards for, amongst other things, non-radiological environmental protection; and,
- Operations: Accountable for the Wylfa site, ensuring day to day leadership of critical activities, supported by directorships responsible for the delivery of the Wylfa project at a site level.

Level 2: Operational and Functional Units

325. At Level 2, operational and functional units manage the day-to-day business of Horizon, these will be led by the Executive Director of Operations in the revised business structure. The directorates provide leadership in the implementation of Horizon's mission and

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Business Plan within a governance framework which enables risk to be assessed and effectively managed. The focus of these directorships is in the delivery of the Wylfa Newydd project. At this organisational level, the following directorships are particularly pertinent to this application:

- Project Planning: Provides planning and management of the integrated schedule, delivery of the applications for major permissions including this EP, ensuring that the requirements of received permissions are stipulated in commercial contracts, defining the scope of works required to deliver the Project programme, and producing a plan for construction.
- Nuclear Operations is responsible for all Wylfa Newydd construction and operational activity including compliance with the environmental permits, the management of stakeholder relationships in North Wales, Generation Readiness, and Operations Training;
- Technical Operations provides Engineering Management including design acceptance and configuration, Design Authority, and owns the nuclear safety and Best Available Techniques (BAT) cases.

Governance Boards

326. In addition to the senior management structure described above a number of other governance bodies have been, or are in the process of being established, which include decision-making, advisory and consultative committees or groups. These bodies include:

- Environment Committee, which provides independent advice on environmental matters to the CEO, ELT and Board. The Environment Committee is Chaired by the Executive Director for Safety, Licensing and Quality and is made up of relevant members of the Horizon management team and external independent members with conventional environment, nuclear environment and regulatory experience;
- Risk and Audit Committee, which reviews and considers the management of risk of all companies within the Horizon Group;
- Organisational Capability Board, which oversees the organisational capability of Horizon necessary to deliver the Wylfa Newydd project. This will include monitoring the development of the leadership capability across Horizon, overseeing the development of an appropriate culture and the requisite Intelligent Customer capability, approving the long-term resourcing strategy for Horizon, and co-ordinating training within Horizon at a strategic level;
- Corrective Action Programme (CAP) Screening Committee and Performance and Improvement forum , which provides a mechanism for reporting and resolving any conditions (reported by Condition Reports) that have affected or could affect safety and environment, to continually improve the organization; and;
- Process Development Group, which is responsible for providing oversight of the integration of management arrangements into the HMS, and fostering efficient practices with regard to the development, implementation and revision of management arrangements.

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8.1.3 Organisational baseline and competency

327. As part of being a responsible prospective operator Horizon ensures it has sufficient competent persons to carry out its activities in a compliant manner. All staff at Horizon have a Post Profile which involves a number of roles. Where a role is identified as contributing to environmental protection this is distinctly recognised and the competency requirements for the role is identified.

328. Horizon has overall responsibility for ensuring that all personnel on the Project that undertake activities covered by the scope of the EP (and all other regulatory permits, etc.) are competent to do so.

Horizon Employees

329. Horizon will ensure that:

- All persons responsible for delivering the requirements of the EP as well as those affected by the conditions of the EP receive appropriate training, including that required under the conditions of the EP; and,
- Competency assessment records are kept for each person responsible for delivering the requirements of the EP (demonstrating levels of skills, knowledge, experience and training).

Contractors

330. The permitted CWD activities will principally be undertaken by a single main contractor and its sub-contractors under Horizon's control. Horizon will ensure that:

- Horizon has its own arrangements in place to ensure oversight of any activities contractors are undertaking on our behalf, in particular in relation to the discharge of EP conditions;
- Contractors are made fully aware of all EP requirements specific to their activities and contract documents stipulate the relevant requirements of the EP;
- The main contractor and sub-contractors have in place appropriate environmental management arrangements to discharge the requirements stipulated in contracts and those arrangements will be operated in alignment with the requirements of the HMS;
- The contractors have in place document and records management systems;
- There are appropriate management arrangements in place to control the water discharge activities prior to commencement of activities; and,
- Contractors have carried out competency assessments on persons responsible for carrying out roles affected by the requirements of the EP.

8.1.4 Documents and records control

331. Horizon will develop and maintain documents and records pertinent to the EP in an electronic database. These will include but not be limited to:

- Issued Environmental Permits;
- Other legal requirements;
- Risk assessments;

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- Management system plans;
- Operating and maintenance procedures;
- Records of competence;
- Records of emissions and other monitoring undertaken;
- Compliance checks, findings of investigation and actions taken;
- Records of complaints made, findings of investigation and actions taken;
- Audits of management system, findings (reports) and actions taken;
- Management reviews and changes made to the management system; and,
- Certification audit reports and any actions carried out.

332. The database is and will continue to be available to all Horizon employees and embedded contractors. Where procedures and other documents are pertinent to those acting on behalf of Horizon but who are not embedded, the applicable management arrangements will be made available to them, including the provision of hard copies where necessary.

333. Contractors shall provide documents and records to Horizon relevant to the EP via an electronic document management system for retention in the Horizon electronic database.

8.1.5 Audits and inspections

334. Horizon shall carry out audits and inspections to ensure that EP activities are managed to meet the conditions of the EP.

335. Horizon requires contractors to share the results of audits and inspections carried out on their own management arrangements and activities to ensure ongoing compliance with the EP.

8.1.6 Non-Conformances, observations and continual improvement

336. Horizon operates a Corrective Action Programme (CAP) which has been developed in accordance with the standards ISO9001, ISO14001 and OHSAS18001 to drive continual improvement and share good practice. In addition to the reporting of good practice and other conditions (e.g. observations), the CAP is used to report, review and rectify non-compliance with legal requirements relating to the company activities and non-conformances against Horizon policies and arrangements.

337. Contractors will be required to implement a similar process for identifying non-conformances and good practices etc. and will be required to share information generated from that process with Horizon.

8.1.7 Routine reporting

338. Any routine reports, including forward work plan submissions and monitoring data will be made by the Nuclear Operations Director in accordance with commitments made in this application.

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8.2 Management arrangements during construction

8.2.1 Environmental management plans

339. Horizon and its contractors will prepare the following documents specific to environmental management during Construction Phase activities, and directly relevant to the CWD EP:

- Wylfa Newydd Code of Construction Practice (CoCP) and Main Site Sub-CoCP. The CoCP together with the Main Site Sub-CoCP will provide the overall framework for environmental management during construction, and will address requirements in connection with regulatory submissions.
- Construction Environmental Management Plan(s) (CEMPs). A CEMP is the delivery document produced by the contractors that details how the practical execution of the construction works will be planned, managed and controlled to comply with the requirements of the CoCPs, as well as other permissions, legislation and good practice. The CEMP(s) will include details of how water, soils, materials, waste and environmental emergencies and incidents will be managed. Horizon shall review and accept the contractor(s)'s CEMP(s) to ensure management arrangements are sufficient to meet the conditions of the EP.
- Specific arrangements will be developed to detail environmental monitoring, sampling, analysis, quality assurance (QA) and reporting requirements applicable to the Construction Phase of the Project. Some of these are detailed in the following section.

8.2.2 Procedures and work instructions

340. In support of the above environmental management documents the contractors will put in place procedures and work instructions covering all aspects of construction activities that may have an adverse impact upon the environment, including:

- Selection and procurement, factory acceptance testing, and the commissioning of equipment and systems;
- Operation of equipment;
- Maintenance of equipment;
- Material handling and waste management operations;
- Monitoring and measurement;
- Surveillance and inspection;
- Auditing and reporting; and,
- Contingency procedures.

341. The management arrangements will be subject to periodic review and will be revised where necessary. The arrangements will also be reviewed in response to:

- Changes in legislative requirements;
- Changes in activities and/or discharge trends;
- Updated best practice, continual improvement and the CAP process;
- An incident or near miss; and,
- The detection of adverse environmental impacts.

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8.3 Accident management

342. The Horizon key strategic focus for Emergency Preparedness is to ensure that the Public, Workers, Environment and the Plant are protected, and to maintain security of the site, during an event. To achieve this goal, Horizon is and will continue to develop Emergency Arrangements proportionate to the risk and hazard present at each phase of the Project lifecycle.

343. To achieve this integrated approach the Integrated Emergency Management (IEM) framework will be used. The underlying aim of IEM is to develop flexible and adaptable arrangements that will enable an effective joint response to and recovery from any emergency. Horizon will adopt the IEM philosophy to underpin development of Emergency Preparedness and Response across the company. This will enable a consistent approach throughout the lifecycle and will align with local emergency response structures, and meet the requirements of the EP and NRW Guidance.

344. Horizon will require its contractors to develop suitable accident management plans, with clear lines of accident response and reporting, which include notifying the Horizon site manager and staff in the event of an accident and ensuring they are involved in the accident response and any subsequent investigation.

8.3.1 Identification of accident hazards

345. Arrangements to identify environmental hazards, assess risks and manage identified risks during construction are in the process of being developed. The approach being applied meets that outlined in the “Risk assessments for your environmental permit” Guidance [RD53].

346. Ahead of the development of this process, Horizon has identified the key environmental hazards which are likely to be present at, and are relevant to, the water discharge activity in Table 8.1, and has provided information on the likely receptors, pathways as well as proposed mitigation measures that are likely to be applied. The probability of exposure and level of risk has not been assessed at this stage, as the assessment will need to be based on the detailed definition of management control and mitigation measures.

347. The information presented in Table 8-1 will be reviewed and updated as part of the FWP (FA_{CWD}-12, Table 9.1), particularly in relation to site-specific assessment of risk and control measures, before the start of construction activities, and will be made available for NRW review.

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Table 8.1 Accident Hazards Identified – Construction Water Discharge Activity

Hazard	Receptor	Pathway	Risk Management	Consequence (in relation to discharges)
Discharge of non-conforming effluent	• Sea • Surface watercourse	• Site drainage system.	• Drainage water hold up, settling, sampling, testing and sentencing process. • Pen-stocks, other valves and alarms.	• Contamination of surface watercourse or the sea.
Discharge of elevated concentrations of polyelectrolyte	• Surface watercourse • Sea	• Site drainage system.	• Regular examination, inspection, maintenance and testing (EIMT) of polyelectrolyte dosing system. • Secondary containment of dosing tank.	• Contamination of surface watercourse or the sea.
Loss of liquids (e.g. diesel fuel, water treatment chemicals) during delivery	• Sea • Surface watercourses • Groundwater	• Site drainage system, direct run-off. • Release to unmade ground (and groundwater).	• Delivery controls procedures. • Driver training and supervision. • Well-maintained delivery tankers. • Secondary containment around fuelling points and storage tanks. • Impervious hardstanding, sealed seams, isolation of surface water drains. • Effective tertiary containment (where practicable). • Regular EIMT, where relevant. • Availability of spill kits and emergency procedures, together with availability of emergency response and training in dealing with potential scenarios. • Use of level alarms, cut-off switches and sight gauges. • Site speed limits, vehicle routing and collision protection	• Contamination of surface watercourse or the sea. • Contamination of groundwater.

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Hazard	Receptor	Pathway	Risk Management	Consequence (in relation to discharges)
Loss of primary containment of liquids e.g., diesel fuel, water treatment chemicals.	• Surface watercourses • Sea • Groundwater	• Site drainage system, direct run-off. • Release to unmade ground (and groundwater).	• Use of secondary containment around tanks and storage areas which meets requirements of legislation and applicable Pollution Prevention Guidance Notes. • Impervious hardstanding, sealed seams, isolation of surface water drains around storage area (tertiary containment), where practicable. • Regular EIMT programme. • Availability of spill kits and emergency arrangements. • Site speed limits, vehicle routing and collision protection.	• Contamination of surface watercourse or the sea. • Contamination of ground.
Fire leading to generation of firewater	• Surface watercourses • Sea • Groundwater	• Airborne combustion products, smoke, odour. • Firewater escaping to site drainage system, direct run-off. • Firewater escaping to ground or groundwater.	• Fire assessment will identify areas with high fire risk and include control measures. • Fire plan. • Regular EIMT programme. • Firewater management plan.	• Contamination of surface watercourse or the sea with firewater if firewater not contained effectively. • Contamination of groundwater if firewater not contained effectively.
Vandalism or un-authorised site access - potential loss of containment of raw materials.	• Surface watercourses • Sea • Groundwater	• Surface watercourses • Sea • Groundwater	Construction site and storage compounds will be within security fencing with 24 hour policing and surveillance.	• Contamination of surface watercourse or the sea with escaped waste/firewater. • Contamination of ground/ groundwater.
Flooding - potential loss of containment of raw materials/wastes.	• Surface watercourses • Sea • Groundwater	• Surface watercourses • Sea • Groundwater	Construction Phase drainage system has been designed to manage a 1 in 30 year storm. Storage areas will be located well away from watercourses.	• Contamination of surface watercourse or the sea with escaped waste/firewater. • Contamination of ground/ groundwater.

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9 Forward Work Plan

348. This chapter presents a Forward Work Plan (FWP) which identifies further information which will be produced and supplied to NRW as the design and management of the Construction Phase activities develops. The FWP items which Horizon commits to provide NRW, and the timing for their provision, are presented in Table 9.1.

Table 9.1 Summary of Forward Work Plan Commitments

Ref.	Source	Commitment	Timescales
FA_{CWD}-1	3.1.5	Horizon shall provide NRW with layout plans for the Construction Phase on-site car parks, confirming the measures to control and mitigate any downstream pollution of the aquatic environment.	3 months before the start of the Construction Phase
FA_{CWD}-2	3.2	Horizon shall provide NRW with plans of the Construction Phase drainage system, as well as detailed design and operating information for equipment to control the quality of discharged waters, including: • Settlement ponds; • Lamella clarifiers; • Polyelectrolyte dosing stations; and, • pH control measures.	3 months before the start of the Construction Phase
FA_{CWD}-3	5.3.1	Horizon shall provide further detail to the programme to confirm when mounds A-E will be re-vegetated. The updated programme will be supplied to NRW prior to construction starting.	6 months before the start of the Construction Phase
FA_{CWD}-4	5.4.1	Horizon shall establish a programme of regular examination, inspection, maintenance and testing (EIMT) of sediment control measures. The EIMT programme will be supplied to NRW before the start of the Construction Phase and will be available for inspection throughout the Construction Phase.	3 months before the start of the Construction Phase
FA_{CWD}-5	5.4.1	Horizon shall provide NRW with design calculations to: • confirm the discharge flow rates arising from the 1 in 2 year event in each drainage catchment; and, • confirm that the drainage system design (including the provision of lamella clarifiers and polyelectrolyte dosing) achieves the TSS limits set in the issued EP for flows up to and including those arising from the 1 in 2 year event, for each drainage catchment.	6 months before the start of the Construction Phase

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Ref.	Source	Commitment	Timescales
FA_{CWD}-6	5.4.1	Horizon will undertake water monitoring at each of the proposed freshwater discharge locations (WA1, WA2, WA3, WB1, WC1, WD1, WD2, WE2). Monitoring will continue for the duration of the determination period and the generated data will be used to enhance the existing data or each of the discharge points and the associated receiving waterbodies. Water monitoring at each proposed freshwater discharge location will include: • turbidity; • flow rate; and, • pH. This will be undertaken in conjunction with periodic monitoring for TSS, metals and nutrient levels at the same locations.	During Permit Application determination period
FA_{CWD}-7	5.4.1	Horizon shall produce a report presenting the data collected from action FA_{CWD}-6 and review the proposed sediment discharge limits for the 1 in 2 year rainfall event to determine whether any changes are required. The report shall be submitted to NRW.	6 months before the start of the Construction Phase
FA_{CWD}-8	6.3.3	Horizon will sample and analyse surface water run-off from cleared areas of on-going archaeological investigation within the WNDA to determine actual contaminant concentrations within the run-off. The results will be supplied to NRW.	During Permit Application determination period
FA_{CWD}-9	6.3.3	Horizon will sample surface soils from within the WNDA and carry out a series of leachate tests on each sample to establish leachate decay curves. This will give an indication of leachate concentrations over time. The results will be supplied to NRW.	During Permit Application determination period
FA_{CWD}-10	7.1	Horizon shall prepare a report which confirms the sampling and monitoring arrangements for the Construction Phase water discharges described in Chapter 7. The report will include: • Figures showing the location of discharge points, as well as sampling and monitoring points; • Identify the sampling and monitoring methods to be undertaken and the determinants to be tested against for each of the water discharges; • Confirmation that the monitoring programme is compliant with NRW's Technical Guidance Note M18; • Identification of: - Recording and reporting procedures for each sampling and monitoring point; - Recording and reporting procedures for rainfall events over the 1 in 2 year return period; - Procedures for abnormal and emergency events; Procedure for no discharges.	3 months before the start of the Construction Phase

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Ref.	Source	Commitment	Timescales
FA_{CWD}-11	8.0	Horizon will implement management arrangements to control Construction Phase activities, together with Construction Environmental Management Plan(s). The management system will meet ISO14001 requirements. - The Horizon arrangements and CEMP(s) will be available for NRW inspection before the Construction Phase starts.	Horizon arrangements and CEMP(s) available for NRW inspection 3 months before the start of the Construction Phase
FA_{CWD}-12	8.3.1	Horizon shall ensure appropriate plans and management arrangements are prepared and implemented to identify potential accident hazards in the Construction Phase which may affect the Water Discharge Activity, assess the risks and identify appropriate management controls to prevent or mitigate accidents and to respond to an incident. The plans and management arrangements will include the elements outlined in 'How To Comply With Your Environmental Permit' guidance [RD15].	3 months before the start of the Construction Phase

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10 References

Table 10.1 Schedule of References

Ref. No.	Title
[RD1]	The Environmental Permitting (England and Wales) Regulations 2016, SI 2016/1154.
[RD2]	Planning Act 2008.
[RD3]	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, 2017 No.572.
[RD4]	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
[RD5]	The Conservation of Habitats and Species Regulations 2017, SI 2017/1012. http://www.legislation.gov.uk/uksi/2017/1012/contents/made
[RD6]	The Conservation of Offshore Marine Habitats and Species Regulations 2017, SI 2017/1013. http://www.legislation.gov.uk/uksi/2017/1013/contents/made
[RD7]	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.
[RD8]	The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, SI 2017/407.
[RD9]	Draft Water Framework Directive Compliance Assessment. EN010007, Doc Ref: 8.26 Revision 0.1. August 2017. Horizon.
[RD10]	http://www.legislation.gov.uk/ukpga/2009/23/contents
[RD11]	Guidance for environmental permit applications: Part A – About you. Version 1, July 2016. Natural Resources Wales.
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[RD15]	How to comply with your environmental permit. Version 8, October 2014. Natural Resources Wales.
[RD16]	How to comply with your environmental permit, Additional guidance for: Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01). 2014. Natural Resources Wales.
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[RD19]	Risk assessments for specific activities: environmental permits. https://www.gov.uk/government/collections/risk-assessments-for-specific-activities-environmental-permits.
[RD20]	https://naturalresources.wales/media/2109/technical-guidance-note-m18-monitoring-monitoring-of-discharges-to-water-and-sewer.pdf
[RD21]	Environmental Permitting Guidance. Groundwater Activities. For the Environmental Permitting (England and Wales) Regulations 2010. Version 1.0, December 2010. Department for Environment, Food and Rural Affairs.
[RD22]	https://www.gov.uk/government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution
[RD23]	BRMCA Best Practice – Managing Concrete Wash Waters on Site. 31 October 2012. BRMCA.
[RD24]	Control of water pollution from construction sites. Guidance for consultants and contractors. CIRIA C532. 2001. Construction Industry Research and Information Association.
[RD25]	https://www.ciria.org//Memberships/The_SuDs_Manual_C753_Chapters.aspx
[RD26]	CIRIA C741 Environmental good practice on site guide. 4th edition. January 2015. Charles, P, Edwards, P (eds).
[RD27]	https://magnoxsites.com/site/wylfa accessed 28/03/2017
[RD28]	Planning Policy Wales: Edition 9 November 2016: Welsh Assembly Government.
[RD29]	Technical Advice Note 15 (TAN15): Development & Flood Risk. 2004. Welsh Assembly Government.
[RD30]	Wylfa Newydd Power Station Development Consent Order, Wylfa Newydd Code of Construction Practice, Horizon Nuclear Power, March 2018
[RD31]	Code of Practice. Flows and loads – 4 Sizing Criteria, Treatment Capacity for Sewage Treatment Systems, 2013, British Water.
[RD32]	The Environment Agency's approach to groundwater protection. Version 1.1. November 2017. The Environment Agency.
[RD33]	https://www.sepa.org.uk/media/60060/ppg-1-general-guide-to-the-prevention-of-pollution.pdf
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[RD35]	https://www.sepa.org.uk/media/60086/ppg-3-use-and-design-of-oil-separators-in-surface-water-drainage-systems.pdf
[RD36]	Guidance for Pollution Prevention. Works and maintenance in or near water: GPP 5. February 2018. http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf?utm_source=website&utm_medium=social&utm_campaign=GPP5%2027112017
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[RD38]	https://www.sepa.org.uk/media/60138/ppg-7-safe-storage-the-safe-operation-of-refuelling-facilities.pdf
[RD39]	http://www.netregs.org.uk/media/1435/gpp-8-v3-swni.pdf
[RD40]	GPP13: Vehicle washing and cleaning. April 2017. NRW. http://www.netregs.org.uk/media/1414/gpp-13-v2-plussepa-plusniea-plusnrw.pdf
[RD41]	https://www.sepa.org.uk/media/100544/ppg-18-managing-fire-water-and-major-spillages.pdf
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[RD44]	https://www.sepa.org.uk/media/60190/ppg-26-safe-storage-drums-and-intermediate-bulk-containers.pdf
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[RD46]	Environmental Handbook for Building and Civil Engineering Projects. Part 2: Construction (C518). May 2000. Venables, R. et al., CIRIA.
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[RD50]	http://www.legislation.gov.uk/wsi/2016/359/contents/made
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[RD52]	Sewers for Adoption – A Design and Construction Guide for Developers. Seventh edition. August 2012. WRc plc.
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[RD56]	M-series Monitoring Technical Guidance Notes. M18 - Monitoring of discharges to water and sewer. Natural Resources Wales.
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