East Anglia TWO Offshore Windfarm

Appendix 20.4

Water Resources and Flood Risk Cumulative Impact Assessment with the Proposed East Anglia ONE North Project

Preliminary Environmental Information
Volume 3
Document Reference – EA2-DEVWF-ENV-REP-IBR-000815_004

Revision Summary					
Rev	**Date**	**Document Status**	**Prepared by**	**Checked by**	**Approved by**
01	11/01/2019	For issue	Paolo Pizzolla	Julia Bolton	Helen Walker

Description of Revisions			
Rev	**Page**	**Section**	**Description**
01	N/A	N/A	Final draft

Table of Contents

Glossary of Acronyms

CCS	Construction Consolidation Sites
CIA	Cumulative Impact Assessment
DCO	Development Consent Order
HDD	Horizontal Directional Drilling
MW	Megawatts

Glossary of Terminology

Applicant	East Anglia TWO Limited.
Construction consolidation sites	Compounds which will contain laydown, storage and work areas for onshore construction works. The HDD construction compound will also be referred to as a construction consolidation site.
Development Area	The area comprising the Proposed Onshore Development Area and the Offshore Development Area
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one offshore construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
European site	Sites designated for nature conservation under the Habitats Directive and Birds Directive, as defined in regulation 8 of the Conservation of Habitats and Species Regulations 2017 and regulation 18 of the Conservation of Offshore Marine Habitats and Species Regulations 2017. These include candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach to the EIA and the information required to support HRA.
Horizontal directional drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
Jointing Bay	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land, and connect to the onshore cables.
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing electrical earthing links.
Mitigation areas	Areas captured within the Development Area specifically for mitigating expected or anticipated impacts.
National Grid infrastructure	A National Grid substation, connection to the existing electricity pylons and National Grid overhead line realignment works which will be consented as part of the proposed East Anglia TWO project Development Consent Order but will be National Grid owned assets.
National Grid overhead line realignment works	Works required to upgrade the existing electricity pylons and overhead lines to transport electricity from the National Grid substation to the national electricity grid
National Grid overhead line realignment works area	The proposed area for National Grid overhead line realignment works.

National Grid substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia TWO project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia TWO project Development Consent Order.
National Grid substation location	The proposed location of the National Grid substation.
Natura 2000 site	A site forming part of the network of sites made up of Special Areas of Conservation and Special Protection Areas designated respectively under the Habitats Directive and Birds Directive.
Onshore cable corridor	The corridor within which the onshore cable route will be located
Onshore cable route	This is the construction swathe within the onshore cable corridor which would contain onshore cables as well as temporary ground required for construction which includes cable trenches, haul road and spoil storage areas.
Onshore cables	The cables which would bring electricity from landfall to the onshore substation. The onshore cable is comprised of up to six power cables and two fibre optic cables.
Onshore infrastructure	The combined name for all of the onshore infrastructure associated with the proposed East Anglia TWO project from landfall to the connection to the national electricity grid.
Onshore substation	The East Anglia TWO substation and all of the electrical equipment, both within and connecting to the National Grid infrastructure.
Onshore substation location	The proposed location of the onshore substation for the proposed East Anglia TWO project.
Proposed Onshore Development Area	The area in which the landfall, onshore cable corridor, onshore substation, mitigation areas, temporary construction facilities (such as access roads and construction consolidation sites), and the National Grid Infrastructure will be located.
Transition Bay	Underground structures at the landfall that house the joints between the offshore export cables and the onshore cables.

20.4 Cumulative Impact Assessment

20.1 Introduction

1. This appendix covers the cumulative impact assessment of the proposed East Anglia TWO project with the proposed East Anglia ONE North project in relation to water resources and flood risk.

2. The East Anglia ONE North offshore windfarm project (the proposed East Anglia ONE North project) is also in the pre-application stage. The proposed East Anglia ONE North project will have a separate Development Consent Order (DCO) application but is working to the same programme of submission as the proposed East Anglia TWO project. The two projects will share the same landfall location and cable route and the two onshore substations will be co-located.

3. The proposed East Anglia TWO project Cumulative Impact Assessment (CIA) for water resources and flood risk will therefore initially consider the cumulative impact with only the East Anglia ONE North project against two different construction scenarios (i.e. construction of the two projects simultaneously and sequentially). The realistic worst case scenario of each impact is then carried through to the main body of the CIA assessment which considers other developments which are in close proximity to the proposed East Anglia TWO project.

4. For a more detailed description of the CIA please refer to ***Chapter 5 EIA Methodology***.

20.2 Construction Scenarios Realistic Worst Case Parameters

5. This appendix considers the proposed East Anglia TWO project and the proposed East Anglia ONE North project under two construction scenarios:

    - Scenario 1 - the proposed East Anglia TWO project and proposed East Anglia ONE North project are built simultaneously; and
    - Scenario 2 - the proposed East Anglia TWO project and the proposed East Anglia ONE North project are built sequentially.

6. As discussed in ***section 20.1***, the realistic worst case (based on the assessment of these two construction scenarios) for each impact is then carried through to the wider CIA which considers other developments, projects or plans which have been screened into the CIA assessment for the proposed East Anglia TWO project.

7. It should be noted that the operational phase impacts on water resources will be the same irrespective of the construction scenario. Therefore, operational impacts identified in Scenario 1 will be the same as those for Scenario 2.

8. Mitigation measures for the proposed East Anglia TWO project and proposed East Anglia ONE North project will be the same. These are detailed in ***Chapter 20 Water Resources***.

20.2.1 Scenario 1

9. ***Table A20.1*** presents the realistic worst case parameters of Scenario 1. In this instance, the proposed East Anglia TWO project and proposed East Anglia ONE North project are built simultaneously.

Table A20.1 Scenario 1 Realistic Worst Case

Impact	Parameter	Notes
Construction		
Impacts related to the landfall	HDD temporary works area: 13,300m^2 (70m x 190m) Transition bay excavation footprint (for 4 transition bays): 3,108m^2 (37m x 42m) Landfall CCS: 40,950m^2 (210m x 195m) Landfall transition bays approximate quantity of spoil material (for 4 transition bays): 908m^3	Landfall to be achieved via HDD. No beach access required.
Impacts related to the onshore cable corridor	Onshore cable route: 574,720m^2 (8,980m x 64m) Jointing bay construction excavation footprint: 570m^2 (30.6m x 18.6m). Total for 72 jointing bays: 41,040m^2 (570m^2 x 72) HDD (retained as an option to cross SPA / SSSI): • Entrance pit CCS (x1): 13,650m^2 (195m x 70m) • Exit pit CCS (x1): 5,850m^2 (195m x 30m) Onshore cable route CCS: 40,950m^2 (210m x 195m). Total for 5 CCS: 204,750m^2 (40,950m^2 x 5) Temporary roads: • Onshore cable route haul road between landfall and Snape Road (4.5m wide with additional 4m for passing places at approximately 87m intervals): 41,376m^2 • Onshore cable route and substation access haul road (9m width): 18,675m^2	Onshore cable corridor construction footprint may be located anywhere within the proposed onshore development area. The location strategy for access routes, CCS and jointing bays will be to site them near to field boundaries or roads as far as practical. Two link boxes sit underground beside each jointing bay at a depth of approximately 1.2m. The construction footprint of these is included in the jointing bay construction excavation footprint.

Impact	Parameter	Notes
	• Temporary access road: 23,495m^2 Onshore cable trench approximate quantity of spoil material: 26,642m^3	
Impacts related to the onshore substation(s)	Onshore substation CCS: 17,100m^2 (190m x 90m). Total for 3 CCS: 51,300m^2 Permanent footprint (used as CCS during construction): 36,100m^2 (190m x 190m). Total for 2: 72,200m^2 Substation operational access road: 12,800m^2 (1,600m x 8m)	Construction access is included above as the onshore cable route and substation access haul road.
Impacts related to the National Grid Infrastructure	National Grid substation CCS: 78,750m^2 (250m x 315m) Permanent footprint (used as CCS during construction): 45,500m^2 (325m x 140m)	Design for the required overhead line (OHL) realignment work (including cable sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***. Construction access is included above as the onshore cable route and substation access haul road. Operational access is included above as the substation operational access road.
Operation		
Impacts related to the landfall	4 transition bays will be installed underground, each with an operational volume of 227m^3	Transition bays will be buried approximately 1.2m underground – there will no above ground infrastructure.
Impacts related to the onshore cable corridor	72 jointing bays will be installed underground, each with an operational volume of 77m^{3}144 link boxes will be installed underground (2 per jointing bay), each with an operational volume of 3m^3	Jointing bays will be buried approximately 1.2m underground – there will no above ground infrastructure. Link boxes will be located underground immediately adjacent to jointing bays – there will be no above ground

Impact	Parameter	Notes
		infrastructure.
Impacts related to the onshore substation(s)	Operational footprint: 36,100m^2 (190m x 190m). Total for 2: 72,200m^2 Substation operational access road: 12,800m^2 (1,600m x 8m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR).
Impacts related to the National Grid Infrastructure	National Grid operational substation: 45,500m^2 (325m x 140m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR). Design for the required overhead line (OHL) realignment work (including cable sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***.
Decommissioning		
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. However, the onshore substation will likely be removed and be reused or recycled. It is expected that the onshore cables will be removed and recycled, with the transition bays and cable ducts (where used) left *in situ*. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.		

20.2.2 Scenario 2

10. Scenario 2, represents the realistic worst case scenario in the eventuality that the proposed East Anglia TWO project and proposed East Anglia ONE North project are built with a construction gap.

11. Scenario 2 assumes that when permission is granted, the proposed East Anglia TWO project will be constructed as soon as permission is granted. The proposed East Anglia ONE North project will leave the largest possible gap (between the reinstatement of the proposed East Anglia TWO project and start of construction for the proposed East Anglia ONE North project) to begin

construction within the consent period. Further detail regarding the likely construction gap is provided in ***Chapter 5 EIA Methodology***.

Table A20.2 Scenario 2 Realistic Worst Case

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
Construction			
Impacts related to the landfall	HDD temporary works area: 7,000m^2 (70m x 100m) Transition bay excavation footprint (for 2 transition bays): 1,554m^2 (37m x 42m) Landfall CCS: 18,400m^2 (160m x 115m) Landfall transition bays approximate quantity of spoil material (for 2 transition bays): 454m^3	HDD temporary works area: 7,000m^2 (70m x 100m) Transition bay excavation footprint (for 2 transition bays): 1,554m^2 (37m x 42m) Landfall CCS: 18,400m^2 (160m x 115m) Landfall transition bays approximate quantity of spoil material (for 2 transition bays): 454m^3	Landfall to be achieved via HDD. No beach access required.
Impacts related to the onshore cable corridor	Onshore cable route: 287,360m^2 (8,980m x 32m) Jointing bay construction excavation footprint: 570m^2 (30.6m x 18.6m). Total for 36 jointing bays: 20,520m^2 (570m^2 x 36) HDD (retained as an option to cross SPA / SSSI): • Entrance pit CCS (x1): 7,000m^2 (100m x 70m) • Exit pit CCS (x1): 3,000m^2 (100m x 30m) Onshore cable route CCS: 18,400m^2 (160m x 115m). Total for 5 CCS: 92,000m^2 (18,400m^2 x 5) Temporary roads: • Onshore cable route haul road between landfall and Snape Road (4.5m wide with additional 4m for passing places at approximately 87m intervals): 41,376m^2	Onshore cable route: 287,360m^2 (8,980m x 32m) Jointing bay construction excavation footprint: 570m^2 (30.6m x 18.6m). Total for 36 jointing bays: 20,520m^2 (570m^2 x 36) HDD (retained as an option to cross SPA / SSSI): • Entrance pit CCS (x1): 7,000m^2 (100m x 70m) • Exit pit CCS (x1): 3,000m^2 (100m x 30m) Onshore cable route CCS: 18,400m^2 (160m x 115m). Total for 5 CCS: 92,000m^2 (18,400m^2 x 5) Temporary roads: • Onshore cable route haul road between landfall and Snape Road (4.5m wide with additional 4m for passing places at approximately 87m intervals): 41,376m^2	Onshore cable corridor construction footprint may be located anywhere within the proposed onshore development area. The location strategy for access routes, CCS and jointing bays will be to site them near to field boundaries or roads as far as practical. Two link boxes sit underground beside each jointing bay at a depth of approximately 1.2m. The construction footprint of these is included in the jointing bay construction excavation footprint.

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
	• Onshore cable route and substation access haul road (9m width): 18,675m^2 • Temporary access road: 23,495m^2 Onshore cable trench approximate quantity of spoil material: 13,321m^3	• Onshore cable route and substation access haul road (9m width): 18,675m^2 • Temporary access road: 23,495m^2 Onshore cable trench approximate quantity of spoil material: 13,321m^3	
Impacts related to the onshore substation	Onshore substation CCS: 17,100m^2 (190m x 90m) Permanent footprint (used as CCS during construction): 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	Onshore substation CCS: 17,100m^2 (190m x 90m) Permanent footprint (used as CCS during construction): 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	Construction access is included above as the onshore cable route and substation access haul road.
Impacts related to the National Grid Infrastructure	National Grid substation CCS: 78,750m^2 (250m x 315m) Permanent footprint (used as CCS during construction): 45,500m^2 (325m x 140m)	National Grid substation CCS: 78,750m^2 (250m x 315m) Permanent footprint (used as CCS during construction): 45,500m^2 (325m x 140m)	Design for the required overhead line (OHL) realignment work (including cable sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***. Construction access is included above as the onshore cable

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
			route and substation access haul road. Operational access is included above as the substation operational access road,
Operation			
Impacts related to the landfall	2 transition bays will be installed underground, each with an operational volume of 227m^3	2 transition bays will be installed underground, each with an operational volume of 227m^3	Transition bays will be buried approximately 1.2m underground – there will no above ground infrastructure.
Impacts related to the onshore cable corridor	36 jointing bays will be installed underground, each with an operational volume of 77m^3 72 link boxes will be installed underground (2 per jointing bay), each with an operational volume of 3m^3	36 jointing bays will be installed underground, each with an operational volume of 77m^3 72 link boxes will be installed underground (2 per jointing bay), each with an operational volume of 3m^3	Jointing bays will be buried approximately 1.2m underground – there will no above ground infrastructure. Link boxes will be located underground immediately adjacent to jointing bays – there will be no above ground infrastructure.
Impacts related to the onshore substation	Operational footprint: 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	Operational footprint: 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR).
Impacts related to the National Grid Infrastructure	National Grid operational substation: 45,500m^2 (325m x 140m)	National Grid operational substation: 45,500m^2 (325m x 140m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR). Design for the required overhead line (OHL) realignment work (including cable

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
			sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***.
Decommissioning			
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. However, the onshore substation will likely be removed and be reused or recycled. It is expected that the onshore cables will be removed and recycled, with the transition bays and cable ducts (where used) left *in situ*. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.			

20.3 Cumulative Impact Assessment During Construction

12. The following sections discuss which of the two construction scenarios detailed in ***section 1*** will be the realistic worst case in terms of impacts to water resources and flood risk.

20.3.1 Cumulative Impact 1: Direct Disturbance of Surface Water Bodies

13. Under scenario 1, the temporary dams and culvert on the Hundred River will remain in place for the same amount of time as they would for the construction of the proposed East Anglia TWO project alone whilst both projects are constructed concurrently (***Table A20.1***). This means that the impacts resulting from this activity will be identical to those described for the East Anglia TWO project alone in ***section 20.6.1.1*** of ***Chapter 20 Water Resources and Flood Risk***.

14. Under Scenario 2, the temporary dams and culvert will be removed following construction of East Anglia TWO, assuming East Anglia TWO is constructed first, and the channel will be reinstated. A new set of temporary dams and a temporary culvert will then be installed in a similar location as part of the East Anglia ONE North project. This is likely to occur several years after the initial period of disturbance, and the river and its associated habitats could either be still recovering or may have only recently recovered. As a result, the magnitude of the effect resulting from East Anglia TWO and East Anglia ONE North being constructed sequentially has the potential to increase. This means that Scenario 2 is considered to be the worst case for this impact. However, the lack of geomorphological diversity observed in the system suggests that any impacts are likely to be highly localised and of low magnitude. The residual impact is therefore considered to remain as **minor adverse** following completion of both projects.

20.3.2 Cumulative Impact 2: Increased Sediment Supply

15. Under scenario 1, a larger proportion of each surface water catchment will be disturbed when compared to the construction of the East Anglia TWO project alone (***Table A20.3***).

Table A20.3 Estimated Maximum Area of Disturbed Ground in Each Water Receptor

Receptor	East Anglia TWO		Scenario 1	
	m^2	%	m^2	%
Coastal fringe	68,918	16.81	142.756	34.82
Hundred River	303,549	1.17	569,187	2.19
Leiston Beck	94,885	0.59	184,857	1.16
Friston Watercourse	229,290	3.80	316,904	0.19
Groundwater	696,642	0.05	1,213,704	0.08

16. This could potentially increase the pre-mitigation magnitude of the impact on each catchment:

- Coastal fringe: This will remain as no impact due to the lack of permanent surface water receptors in the catchment.
- Hundred River: The effect will increase from low to medium magnitude.
- Leiston Beck: The effect will increase from negligible to low magnitude.
- Friston Watercourse: The effect will increase from low to medium magnitude.

- Groundwater: This will remain as no impact due to the lack of a mechanism for increased sediment supply to impact upon groundwater.

17. However, the mitigation measures, described in detail in ***sections 20.3.3*** and ***20.6.1.2*** of ***Chapter 20 Water Resources and Flood Risk***, are considered to be effective regardless of the scale of disturbance and will result in negligible impacts on each catchment. The residual impacts are therefore considered to be **minor adverse** for the Hundred River, Leiston Beck and Friston Watercourse under scenario 1.

18. Under Scenario 2, the worst case area of disturbance will be no greater than under scenario 1 but the worst case duration of the impact will be increased to a maximum of 6 years. The longer duration of construction activities means that there is potential for sediment to be supplied to the surface drainage network for a longer period of time (with areas along the cable corridor being disturbed twice), which could therefore result in a greater magnitude of impact. This could potentially increase the pre-mitigation magnitude of the impact on each catchment:

- Coastal fringe: This will remain as no impact due to the lack of permanent surface water receptors in the catchment.
- Hundred River: The effect will increase from low to medium magnitude.
- Leiston Beck: The effect will increase from negligible to low magnitude.
- Friston Watercourse: The effect will increase from low to medium magnitude.
- Groundwater: This will remain as no impact due to the lack of a mechanism for increased sediment supply to impact upon groundwater.

19. However, the mitigation measures described in detail in ***sections 20.3.3*** and ***20.6.1.2*** of ***Chapter 20 Water Resources and Flood Risk***, are considered to be effective in preventing an increase in sediment supply regardless of the overall duration of disturbance, and will result in negligible impacts on each catchment. The residual impacts are therefore considered to be **minor adverse** for the Hundred River, Leiston Beck and Friston Watercourse under Scenario 2.

20.3.3 Cumulative Impact 3: Accidental Release of Contaminants

20. As stated in ***section 20.6.1.3*** of ***Chapter 20 Water Resources and Flood Risk,*** the risk of the accidental release of contaminants is likely to be proportionate to the scale of construction activities (and hence disturbed ground) in each receptor. The increased proportion of construction activities

described in ***Table A20.3*** for scenario 1 will therefore result in the following magnitude of impact:

- Coastal fringe: This will remain as no impact due to the lack of permanent surface water receptors in the catchment.
- Hundred River: The effect will increase from low to medium magnitude.
- Leiston Beck: The effect will increase from negligible to low magnitude.
- Friston Watercourse: The effect will increase from low to medium magnitude.
- Groundwater: The impact will remain negligible.

21. The mitigation measures outlined in ***sections 20.3.3*** and ***20.6.1.3*** of ***Chapter 20 Water Resources and Flood Risk***, will result in negligible impacts on the Hundred River, Leiston Beck and Friston Watercourse, because they will also be scaled proportionately alongside the development. The residual impacts under Scenario 1 are therefore considered to be **minor adverse** for the Hundred River, Leiston Beck, Friston Watercourse and underlying groundwater.

22. Under scenario 2, the worst case area of disturbance will be broadly the same as it would be for the East Anglia TWO project alone but the duration of activities will be increased. The increased duration of construction activities means that there is a greater risk that contaminants could be accidentally released at some point during the construction period, and could therefore increase the pre-mitigation magnitude of the impact on each catchment, as set out for scenario 1 above.

23. However, the mitigation measures described in detail in ***sections 20.3.3*** and ***20.6.1.2*** of ***Chapter 20 Water Resources and Flood Risk,*** are considered to be effective in preventing the accidental release of contaminants regardless of the overall duration of construction activities, and will result in negligible impacts on each catchment. The residual impacts are therefore considered to be **minor adverse** for the Hundred River, Leiston Beck and Friston Watercourse under scenario 2.

20.3.4 Cumulative Impact 4: Changes to Surface Water Runoff and Flood Risk

24. The scale of changes to surface water runoff and flood risk is also likely to be proportionate to the scale of construction activities in each receptor. The increased proportion of construction activities described in ***Table A20.3*** for scenario 1 will therefore result in the following magnitude of impact:

    - Coastal fringe: This will remain as no impact due to the lack of permanent surface water receptors in the catchment.

- Hundred River: The effect will increase from low to medium magnitude.

  Leiston Beck: The effect will increase from negligible to low magnitude.
- Friston Watercourse: The effect will increase from low to medium magnitude.
- Groundwater: The impact will remain negligible.

25. However, the mitigation measures described in detail in ***section 20.3.3*** of ***Chapter 20 Water Resources and Flood Risk*** are considered to be effective regardless of the scale of disturbance and will result in an impact of negligible magnitude. The residual impacts are therefore considered to be **minor adverse** for the Hundred River, Leiston Beck, Friston Watercourse and the underlying groundwater.

26. The duration of impact will be increased under Scenario 2, and the worst case area of disturbance will be approximately double as it would be for the East Anglia TWO project alone. This means that the impacts resulting from this activity will be identical to those described in ***Chapter 20, section 20.6.1.4,*** for the East Anglia TWO project. Scenario 1 is therefore considered to represent the worst case for this impact.

20.4 Cumulative Impacts Assessment during Operation

27. Operational impacts on water resources and flood risk will be the same irrespective of construction scenario.

20.4.1 Cumulative Impact 5: Changes to Surface Water Runoff, Groundwater Flows and Flood Risk

28. The magnitude of the impact associated with changes to surface water runoff, groundwater flows and flood risk has been assumed to be proportional to the area of the permanent development in each catchment (***Chapter 20, section 20.6.2.1***). In terms of cumulative impact with the proposed East Anglia TWO and East Anglia ONE North projects, a larger proportion of each surface water catchment will contain permanent development in comparison to the East Anglia TWO project alone (***Table A20.4).***

Table A20.4 Maximum Area of Permanent Development in Each Water Receptor

Receptor	East Anglia TWO		East Anglia TWO and East Anglia ONE North	
	m^2	%	m^2	%
Coastal fringe	2,230	0.54	4,644	1.13
Hundred River	9,990	0.04	21,060	0.08
Leiston Beck	3,960	0.02	8,100	0.05

Receptor	East Anglia TWO		East Anglia TWO and East Anglia ONE North	
	m^2	%	m^2	%
Friston Watercourse	96,380	1.60	137,660	2.28
Groundwater	112,560	0.01	171,464	0.01

29. This could potentially increase the pre-mitigation magnitude of the impact on each catchment:

- Coastal fringe: This will remain as no impact due to the lack of permanent surface water receptors in the catchment.
- Hundred River: The effect will increase from negligible to low magnitude.
- Leiston Beck: The effect will increase from negligible to low magnitude.
- Friston Watercourse: The effect will increase from low to medium magnitude.
- Groundwater: The impact will remain negligible.

30. However, the embedded mitigation measures, described in detail in ***section 20.3.3*** of ***Chapter 20 Water Resources and Flood Risk***, are considered to be effective regardless of the scale of permanent development and will ensure that the magnitude of the impact is negligible. The residual impacts are therefore considered to be **minor adverse** for the Hundred River, Leiston Beck, Friston Watercourse and the underlying groundwater.

20.4.2 Cumulative Impact 6: Supply of Fine Sediment and Other Contaminants

31. The scale of changes to the supply of fine sediment and other contaminants is also likely to be proportional to the scale of the permanent development in each receptor (***section 20.6.2.2*** of ***Chapter 20 Water Resources and Flood Risk***). The increased proportion of permanent infrastructure described in ***Table A20.4*** will therefore result in the following magnitude of impact:

- Coastal fringe: This will remain as no impact due to the lack of permanent surface water receptors in the catchment.
- Hundred River: The effect will increase from negligible to low magnitude.
- Leiston Beck: The effect will increase from negligible to low magnitude.
- Friston Watercourse: The effect will increase from negligible to low magnitude.
- Groundwater: The impact will remain negligible.

32. The mitigation measures described in ***section 20.6.2.2*** of ***Chapter 20 Water Resources and Flood Risk,*** will reduce the magnitude of the impact to negligible. The residual impacts are therefore considered to be **minor adverse** for the Hundred River, Leiston Beck, Friston Watercourse and the underlying groundwater.

20.5 Summary

33. ***Table A20.5*** gives an overarching summary of which of the two construction scenarios, detailed above, will be the realistic worst case in terms of impacts relating to water resources.

Table A20.5 Summary of Scenario 1 and Scenario 2 Realistic Worst Case Assumptions

Impact	Worst Case	Notes
Impacts related to direct disturbance of surface water bodies	Scenario 2	Impacts for Scenario 1 are identical to the East Anglia TWO project alone. Scenario 2 will result in greater magnitude due to projects being constructed in succession.
Impacts related to increased sediment supply	N/A	The potential impacts are considered to be minor adverse for both Scenarios.
Impacts related to release of contaminants	N/A	The potential impacts are considered to be minor adverse for both Scenarios.
Impacts related to changes to surface water runoff and flood risk	N/A	The disturbed area of ground will be identical for both scenarios.
Impacts related to supply of fine sediment and other contaminants	N/A	The potential impacts will be the same for both scenarios.

34. Overall, construction scenario 2 creates a realistic worst case in terms of impacts to water resources and flood risk. Therefore, scenario 2 will be carried through into the wider CIA with other developments, see ***section 20.7*** in ***Chapter 20 Water Resources.***