36 DRAINAGE AND FLOOD RISK

36.1 INTRODUCTION

36.1.1 This chapter provides an assessment of the impacts of the Compensation Site on drainage and flood risk. The aim of the assessment is to determine whether, and if so how, the Compensation Site will affect the hydrology, surface water drainage and flooding of the site and its surrounds. The impacts of the AMEP on drainage and flood risk are covered in *Chapter 13*.

36.2 LEGISLATION, POLICY AND GUIDANCE

36.2.1 Legislation, policy and guidance on drainage and flood risk which are common to both the AMEP and the Compensation Site and are covered in *Chapter 13*. Any relevant plans and policies contained within the ERYC Local Plan which are specific to the Compensation Site are summarised below. A Flood Risk Assessment (FRA) has been undertaken for the Compensation Site which considers the compliance of the development with other studies and Local Development Documents (*Annex 36.1*).

Local Plan Policy

Joint Structure Plan for Kingston upon Hull and the East Riding Of Yorkshire

36.2.2 Policy NAT6 from the Joint Structure Plan for Kingston Upon Hull and the East Riding Of Yorkshire (Hull City Council & East Riding of Yorkshire Council, 2005) states that:
'Development in coastal areas should in general, be focused on existing settlements in accordance with the development strategy. Any new development proposed at an undeveloped coastal location, or roll back of existing development, should avoid:

(i) the risk from flooding, erosion and landslip, within the lifetime of a building;

(ii) areas subject to managed realignment or monitor/review of coastal defence management measures;

(iii) a requirement to construct new or to extend or enhance existing coastal protection or flood defences;

(iv) significant interference with natural coastal or estuarine processes; and

(v) increasing the risk of flooding and coastal erosion, or affecting accretion and deposition of eroded materials on sites elsewhere.'

ERYC Holderness District Wide Local Plan

36.2.3 Policy Env5 of the Holderness District Wide Local Plan (ERYC, 1999) states that:
'The Council will only approve development proposals in the Holderness coastal zone which are not likely during the life expectancy of the development to:
(i) lead to a requirement to construct new or to extend or enhance existing coastal protection or flood defences;
(ii) interfere significantly with natural coastal or estuarine processes;
(iii) increase the risk of flooding and coastal erosion on site or elsewhere;
(iv) be affected by the risk of coastal erosion within the developments estimated lifespan;
(v) conflict with nature conservation policies of this plan.
(vi) preclude reasonably practical options to conserve or enhance important coastal habitats by managed retreat or soft engineering techniques.'

36.2.4 Policy Env7 states that:
'the Council will allow development in accordance with policy Env5 and the relevant policies applying to the specific location. Development will be required to maintain or improve the attractiveness of the local environment and complement the character of the area. Development will not be allowed to extend laterally along the cliff top outside existing coast defences.'

36.2.5 Policy U13 states that:
'Works required to protect Holderness from flooding will be supported in principle providing that:
1. there is no adverse visual effect;
2. there is no significant adverse effect upon areas of nature conservation importance;
3. they do not prohibit future opportunities for managed retreat;
4. the choice of materials is considered to be appropriate;
5. provided satisfactory routes for vehicles carrying materials required for flood protection can be agreed'.

Humber Flood Risk Management Strategy

36.2.6 The current Environment Agency strategy for managing the flood defences of the Humber including the Compensation Site is set out in *Humber Flood Risk Management Strategy* (Environment Agency, 2008). The overall strategy is to
'manage flood risk round the estuary.... by continuing to maintain existing defences where this is sustainable'.

36.2.7 The strategy has identified that defences between Stone Creek and Paull Holme Strays are '*generally in good condition. Major works are likely to be needed in 40 years or so'*. However, the Environment Agency's proposed management approach for this section of defence concludes that: *'...in the long term those responsible may decide it is not worthwhile carrying on.... We cannot say when this might happen, although we think it is unlikely to be within the next 20 years. We will reassess the situation when we review the strategy...'*

36.2.8 Within the Flood Risk Management Strategy, the Cherry Cobb Sands site is identified as a '*Planned habitat creation site*' where realignment of estuary defences is proposed after 2030 to meet obligations under the Habitats Directive to replace losses caused by the Strategy as detailed in the *Humber Coastal Habitat Management Plan* (CHaMP) (Environment Agency, 2005).

36.3 ASSESSMENT METHODOLOGY AND CRITERIA

Overview

36.3.1 The FRA which has been undertaken for the Compensation Site takes account of the Defra guidance, *Flood Risk Assessment Guidance for New Development* (DEFRA, 2005) and the specific requirements of Planning Policy Statement (PPS) 25 (Communities and Local Government, 2010). The FRA assesses how the Compensation Site will affect the immediate area and its surroundings as well as the integrity of the Humber Estuary's flood defences.

36.3.2 The assessment of the impacts of the Compensation Site on drainage and flood risk utilises the same methodology as for the AMEP (*Chapter 13*).

36.3.3 The impact of the Compensation Site on the hydrological environment at the site has been evaluated to determine the likelihood of the Compensation Site causing impacts to the surface water environment as follows:

- impacts on land drainage and flooding; and
- impacts associated with the pollution of surface watercourses during construction and operation.

36.3.4 Information sources used to complete the assessment include:

- Ordnance Survey maps;
- topographical surveys;

- Environment Agency flood maps;
- data provided by the Environment Agency;
- ERYC Strategic Flood Risk Assessment.

Construction Phase

36.3.5 The main impacts to be addressed during the construction phase are:

- ensuring that continuity of tidal defences is maintained;
- ensuring that the operation of the drains and of Stone Creek are maintained;
- release of sediment into the sea and inland watercourses;
- release of polluting substances into the sea and inland watercourses; and,
- disturbance to wildlife.

36.3.6 Whilst some impacts on sediment and wildlife matters are included in this chapter, they are addressed in more detail in *Chapter 34* and *Chapter 35*.

Operational Phase

36.3.7 The main impacts to be addressed during the operational phase are:

- ensuring that continuity of tidal defences is maintained;
- ensuring that the operation of the drains and of Stone Creek are maintained; and
- release of polluting substances into the sea and inland watercourses.

Sensitive Receptors

36.3.8 Sensitive receptors are:

- the ground, the sea, and inland watercourses;
- the local residents and landowners who depend on the flood defences and land drains for protection from flooding; and
- nearby installations and operations.

Significance Criteria

36.3.9 The assessment of the impacts of the Compensation Site on drainage and flood risk uses the same significance criteria as for the AMEP as detailed in *Chapter 13*.

36.4 CONSULTATION

36.4.1 Consultation comments received that relate to drainage and flood risk at the Cherry Cobb Sands part of the Compensation Site are detailed in *Annex 2.2* together with a description of how the comments have been addressed within the Environmental Statement.

36.5 BASELINE

Overview

36.5.1 The Compensation Site on the north bank of the Humber is on a low-lying tidal floodplain within a sparsely populated area of Holderness in the East Riding of Yorkshire used for arable farming. The edge of the tidal floodplain passes through the villages of Keyingham and Ottringham around 6 km inland from the line of the flood defences at Cherry Cobb Sands to the north east. However, to the north-west, low-lying land extends past the villages of Thorngumbald and Hedon and into the eastern outskirts of Hull including the large refinery at Saltend.

36.5.2 The Cherry Cobb Sands site does not lie within the district of any Internal Drainage Board. The Crown Estate who owns the land has devolved management of land drainage to the tenants occupying the land. The Old Little Humber Farm site lies within the area drained by the Thorngumbald Internal Drainage Board.

Holderness Drainage to Stone Creek

36.5.3 The area draining towards Cherry Cobb Sands can be characterised as being flat, low-lying floodplain of the River Humber. Ditches (or cloughs) generally drain the land south and south-west into the Humber through a series of outfalls *(Figure 36.1*). Four gravity outfalls discharge into Stone Creek, which lies approximately 400 m south-east from the site. These outfalls, which together drain approximately 84 km^2, are:

- Cherry Cobb Sands Drain (drains all land to the west of Keyingham Drain, including the Cherry Cobb Sands site);

- Keyingham Drain (draining land to the east and north of Keyingham Drain almost to the North Sea at Tunstall);

- Ottringham Drain (draining land between Ottringham and Stone Creek; and,

- Sunk Island Drain (draining land to the north and east of the cottages).

36.5.4 Cherry Cobb Sands Drain runs from Little Humber, approximately 2 km northwest of the site, along the south side of Cherry Cobb Sands Road. This watercourse drains all land to the west of Keyingham Drain. Land to the north of Little Humber is reported by the occupiers of the land to drain east north east possibly entering the Thorngumbald Internal Drainage Board (IDB) catchment.

Existing Drainage of Cherry Cobb Sands

36.5.5 Drainage of the site is currently via a network of lateral land drains that run in a generally northwest / southeast orientation across the fields (*Figure 36.1*). These connect to 'header' land drains that flow northeast to Cherry Cobb Sands Drain. The field drainage on the northeast side of the road follows a similar pattern, and discharges through culverts under the road into Cherry Cobb Sands Drain, which discharges into the Humber Estuary at Stone Creek through a sluice structure. Discharge becomes tide-locked during high tides and the configuration of the sluice prevents sea water flowing into the Drain.

36.5.6 Immediately landward of the existing flood defence, there is a soke dyke. It is understood that a small percentage of some of the header land drains may connect to this dyke. The dyke runs southeast, out of the site and past the radar mast, before turning northwards and connecting in to Cherry Cobb Sands Drain, just prior to it discharging into Stone Creek.

Existing Drainage of Old Little Humber Farm

36.5.7 Drainage of the Old Little Humber Farm Site is currently via a network of subsurface land drains that flow into the drainage ditches surrounding each field. Most of these drainage ditches also receive drainage flows from fields outside the side. The drainage ditches flow into the South Ends and Thorney Crofts Drain of the Thorngumbald Internal Drainage Board that runs along the eastern boundary of the site. The pattern of drainage ditches is shown on *Figure 36.2*.

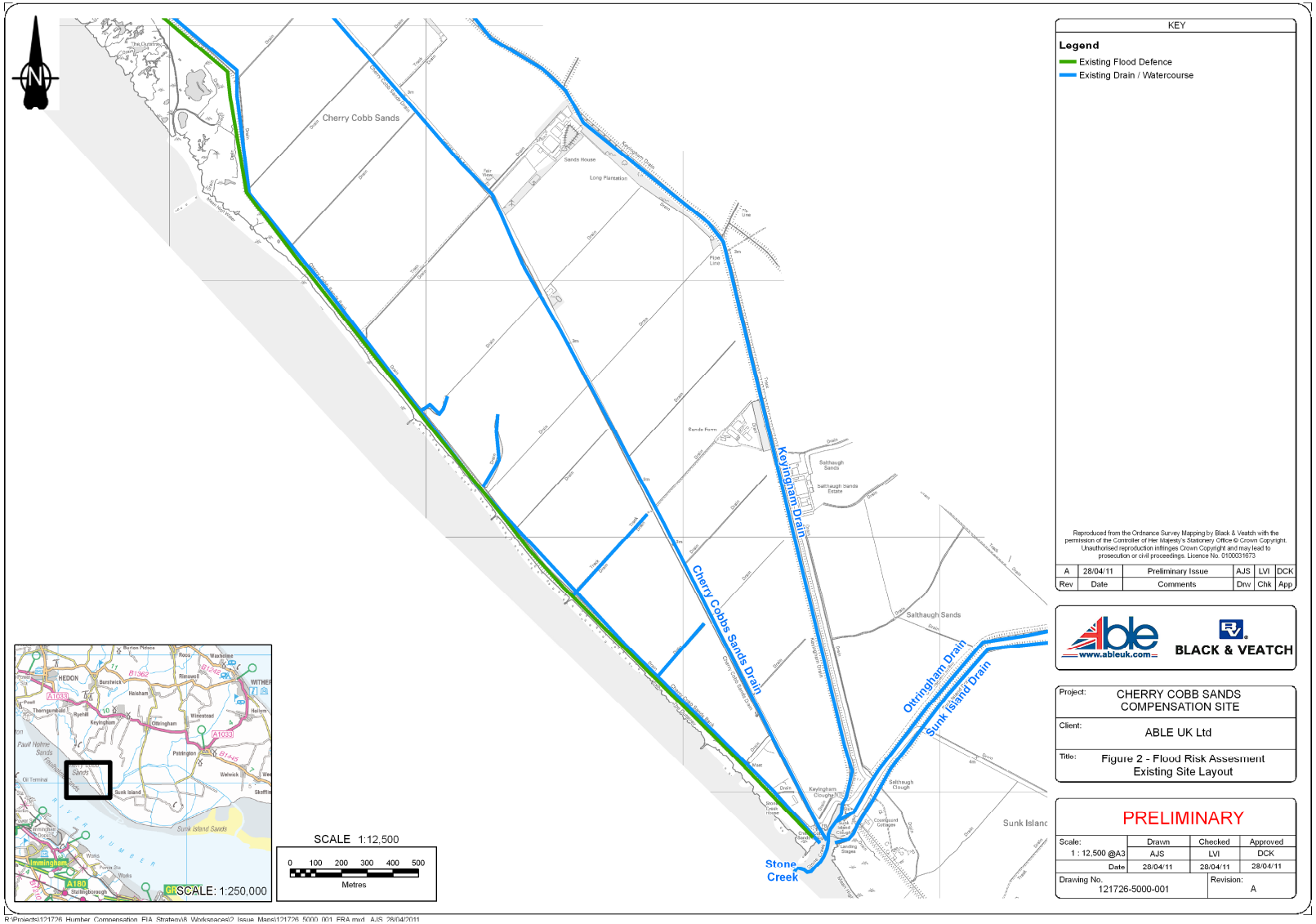

Figure 36.1 Existing drainage pattern at Cherry Cobb Sands

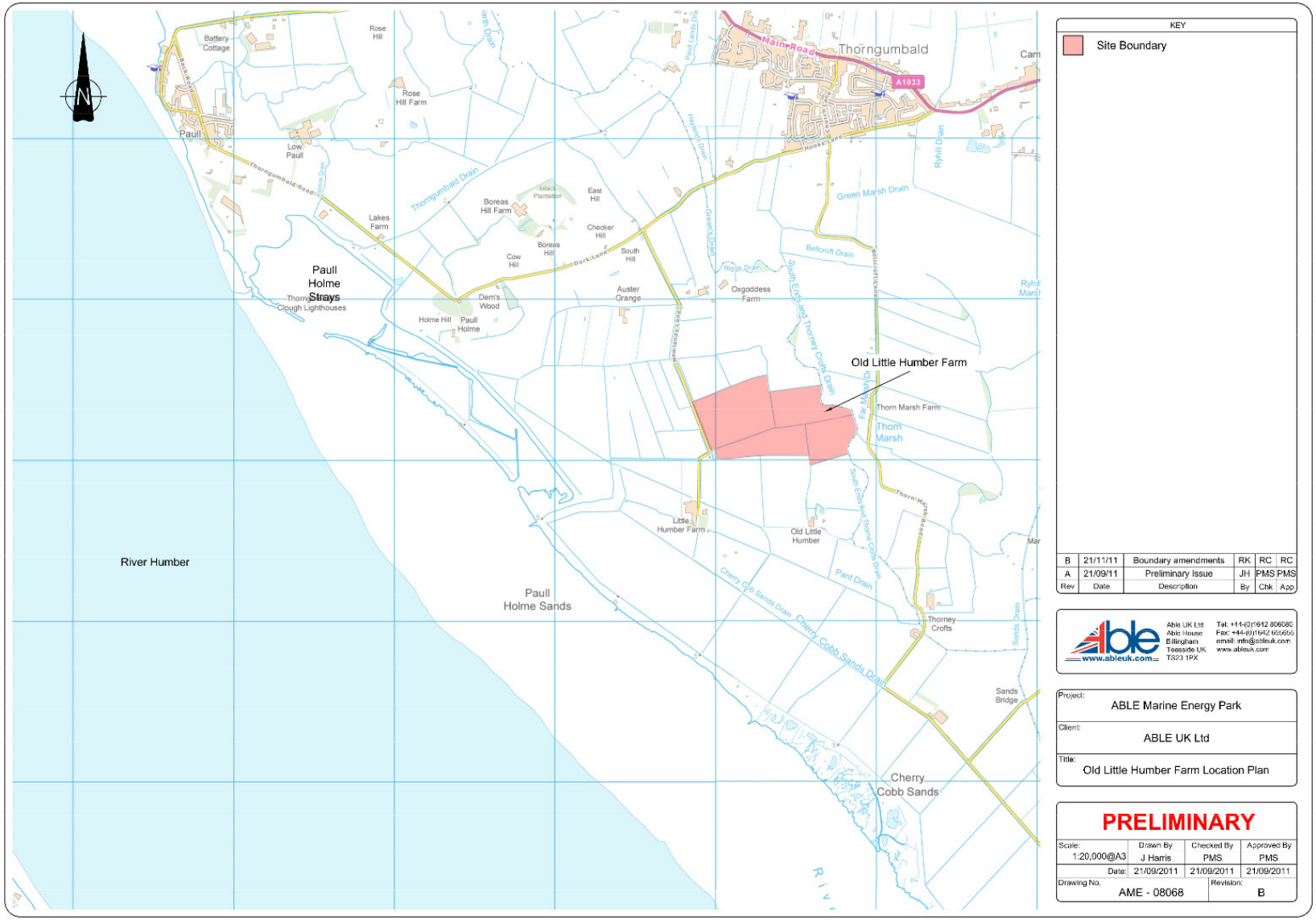

Figure 36.2 Existing drainage pattern at Old Little Humber Farm

Flood Risk at the Compensation Site

36.5.8 The Compensation Site lies within the flood plain of the Humber Estuary. The Environment Agency has advised that the whole site lies within Flood Zone 3a which is a zone of high probability of flood risk (Environment Agency response to PEIR, dated 18 March 2011) as the land has a 1 in 200 or greater annual probability of flooding from the sea (>0.5 percent) in any year.

36.5.9 The proposed development fits the Vulnerability Classification of "Water-compatible Development" in accordance with Table D.2 of PPS 25.

36.5.10 The Crown Estate is responsible for maintaining and managing the flood defences along the length of the Humber Estuary in proximity to Cherry Cobb Sands . Flood defences in the area generally consist of earth embankments. The Humber Flood Risk Management Strategy (EA 2008) considers these defences currently provide a '*1 in 80 year or better*' standard of protection (SoP) which is equivalent to a 1.25 percent annual exceedance probability (AEP).

Siltation

36.5.11 The Strategic Flood Risk Assessment (ERYC, 2010) identifies Keyingham Drain as having a 'Localised Drainage Issue'. Consultation responses from the Environment Agency, Internal Drainage Boards and local land owners and tenants have highlighted that there is concern about siltation in Stone Creek which if realised may adversely affect the discharge capacity of the four drains that discharge into this creek.

36.5.12 Siltation within Stone Creek has been an issue in recent years and following the major floods in the summer of 2007, the Environment Agency dredged Stone Creek in January 2008. Since the dredging occurred, the Internal Drainage Boards found that silt levels returned to their pre-dredge levels within one year. The Internal Drainage Boards are pressing the Environment Agency to dredge Stone Creek again, but have indicated that the Environment Agency is resisting this demand on the grounds that the benefit is not sufficient to justify the cost.

36.6 IMPACTS

Construction Phase

36.6.1 Construction activities will be managed to ensure drainage of surrounding land is not compromised at any time. The only drain which may be affected by works at Cherry Cobb Sands is the drain

known as Little Humber Area in the Water Framework Directive (*Chapter 33*). This is shown as the upstream section of a longer soke dyke which receives any seepage through the existing defences and some field drainage. The function of this drain will be maintained at all times outside the Cherry Cobb Sands site. This effect is therefore assessed as being of negligible significance.

36.6.2 The Old Little Humber Farm site consists of fields surrounded by drainage ditches. There will be no re-profiling of the land surface within 10 m of these ditches to avoid adverse effect on their drainage function.

36.6.3 During works at the Compensation Site, there is a general risk of polluted runoff entering the sea and the inland watercourses (eg soil and sediment being washed away from areas where topsoil stripping and excavation is in progress; and fuel or lubricants being washed away). These impacts are detailed in *Chapter 33*.

36.6.4 The new defence embankment at Cherry Cobb Sands will be completed and approved by the Environment Agency before the site is breached. Therefore no increased flood risks are anticipated during construction.

36.6.5 There is no need for a Flood Defence Consent for the works at Old Little Humber Farm as they will be more than 10 m from all watercourses. Specific consents for the temporary and permanent works at Cherry Cobb Sands are likely to include:

- Flood Defence Consent from the Environment Agency for works adjacent to existing flood defences and within watercourses;
- The landowner consent from the Crown Estate; and
- A Marine Licence from the Marine Management Organisation (previously Coast Protection Act consent) in relation to works in the Humber Estuary.

Operational Phase

Tidal Flood Risk

36.6.6 Following the construction of the scheme, the managed realignment area will be intentionally subjected to tidal flooding. As the purpose of the Cherry Cobb Sands site is to allow inundation of the site this is not assessed as being a significant impact.

36.6.7 The new tidal defences which will be constructed at the Cherry Cobb Sands site have been designed to ensure that they will provide better protection against flooding than the tidal embankment that they will replace. This follows consultation with the Environment Agency, which has requested a SoP of 1 in 200 years (0.5 percent AEP) after taking account of 100 years of sea level rise at the rate recommended by PPS 25. The new defences will be built to a standard of construction agreed with the Environment Agency for this location.

36.6.8 The increased SoP of defences is a permanent positive effect. The sensitivity of local residents is considered to be high as flooding will have a large impact on lives and properties. The magnitude of effect is low, as although the flood defences at Cherry Cobb Sands will be improved above what currently exists, this improvement alone will only lead to a minor overall reduction in flood risk to local residents as a larger reduction would require works on adjacent flood defences. It would, however, make future additional work to local flood defences more economically feasible and therefore the overall impact is assessed as being of minor positive significance.

36.6.9 Residential properties to the north side of Cherry Cobb Sands Road will be noticeably closer to the realigned flood defence than at present. Although closer to the new flood defence and thus at greater flooding hazard if there is a failure of the defence, the probability of a failure of this new defence will be much reduced as the standard of protection provided will be much higher. The *Flood Risk Assessment (Annex 36.1)* concludes that overall there will be a reduction in the number of people at high or medium flood risk due to failure of the defence following construction of the new embankment. This reduction will decrease over time so that after 100 years there will be no change to the existing risk. The magnitude of the effect is assessed as being low and therefore the resulting effect is assessed as being a minor positive significant effect.

36.6.10 There will be no change in tidal flood risk arising from the works at Old Little Humber Farm.

Fluvial and Surface Water Flood Risk

36.6.11 At Cherry Cobb Sands, a new soke dyke will be constructed between Cherry Cobb Sands Drain and the new tidal flood embankment. This will capture any seepage through the new flood defence embankment and any surface water runoff from the landward face of the embankment. The new dyke will connect with the existing flood defence soke dyke at the southwest corner of the site. As the new soke

dyke will act in the same manner as the existing soke dyke, its effect on drainage and flood risk is assessed as being negligible.

36.6.12 Fluvial or surface water flooding of the defended area at Cherry Cobb Sands could occur due to excessive rainfall overwhelming the Cherry Cobb Sands Drain or Keyingham Drain. The proposed scheme has no effects on the catchment of the Keyingham Drain and will reduce the catchment area draining to Cherry Cobb Sands Drain.

36.6.13 At Old Little Humber Farm, the development of wet grassland which would include a ridge and furrow land profile and the stopping up of the field drains will reduce runoff into the surrounding ditches. This will slightly reduce the risk of fluvial and surface water flooding in the South Ends and Thorney Crofts Drain.

36.6.14 The effects of both components of the Compensation Site on fluvial or surface water flooding are assessed as being negligible.

Siltation

36.6.15 There is potential that the Cherry Cobb Sands site may affect drainage through Stone Creek. There are three mechanisms through which this effect could be realised; i) through a small reduction in the duration of low tide, ii) a small raising in low tide level, and iii) a risk of increased siltation of Stone Creek. These effects are described in *Chapter 32*.

36.6.16 The reduced duration of low tide at Stone Creek and the raised level of low water are unlikely to impact the drainage of Stone Creek during normal flows, but could potentially limit the flows through Stone Creek during high flows. These effects are considered in *Chapter 32* to persist for a limited period of up to five years. In the longer term the increased size of Cherry Cobb Sands Creek is likely to restore the duration and level of low water in Stone Creek to its baseline value. The sensitivity of the drainage at Stone Creek is assessed as being moderate, as it drains a relatively large area of Holderness. The magnitude of effect is low as the change in low tide duration will only reduce by less than 1% and its duration is assessed as short term. The overall impact is assessed as being of minor negative significance.

36.6.17 The long term effect of the Cherry Cobb Sands managed realignment on siltation at Stone Creek is likely to be neutral or possibly beneficial, however in the short term there may be greater accretion within Stone Creek while Cherry Cobb Sands Creek adjusts to the increased flows arising from the managed realignment. The effect is difficult to quantify but could have a minor magnitude, which would result in an

overall minor negative significant impact on drainage at Stone Creek. Mitigation measures are described below in *paragraph 36.8.5*.

Maintenance

36.6.18 During normal operation there will be no operating equipment and there is therefore no risk of releasing polluting substances into the sea or inland watercourses (eg spillages of fuel and oil). However, these risks are present on the occasions when maintenance of the tidal flood defences is undertaken. These effects will be mitigated for as described in *paragraph 36.8.4.*

36.7 CUMULATIVE IMPACTS

36.7.1 There are no other projects known at this time, which will impact drainage and flood risk at Cherry Cobb Sands. There will be no cumulative impacts affecting drainage and flood risk at Old Little Humber Farm arising from the Humber wind farm proposal as the works will leave a 10 m wide strip at original ground level along the cable route.

36.8 MITIGATION MEASURES

Construction Phase

36.8.1 During the construction phase, the following Pollution Prevention Guidelines (as published by the Environment Agency) will be adhered to:

- PPG1 – General Guide to the Prevention of Pollution Mitigation Measures;
- PPG5 – Works or Maintenance in or Near Water;
- PPG6 – Working at Construction and Demolition Sites; and
- PPG21 – Pollution Incident Response Planning.

36.8.2 Among the recommendations which may be implemented are:

- minimising pollution risk - eg drip trays on mechanical equipment such as pumps and generators, fail-safe bunded storage of fuel and cement and other materials to prevent spillage to groundwater, watercourses or the sea.

- any over-pumping around works in watercourse channels will be carried out with a suitably-sized pump, in order that excessive flows are not generated and disturbance of the bed material is minimized.

- where possible, watercourse bank reinstatement works will be carried out by vehicles operating from the bank rather than the watercourse channel.

- for work on, over or adjacent to the watercourses, a maximum of one third of the watercourse will be bunded at any time, and the bunds will have a minimal height above normal water level, and should either wash out or create minimal obstruction during flood conditions.

- construction materials will be prevented from entering watercourses or the sea and blocking either the channels or culverts and bridges.

- care will be taken with all works involving concrete and cement. Suitable provision will be made for the washing-out of concrete mixing plant or ready-mix concrete lorries, and such washings will not be allowed to flow into watercourses or the sea.

- Temporary lagoons may be required to allow any sediment carried by surface water runoff to settle out and be trapped on site, prior to the runoff discharging to inland watercourses or the sea.

Operational Phase

36.8.3 Maintenance of the flood embankment and of the associated drainage ditches at Cherry Cobb Sands will be agreed with the Environment Agency *(*see *paragraph 28.2.33)* to ensure the required standard of protection is maintained throughout the life of the Compensation Site.

36.8.4 During the operational phase, the only activity anticipated on the Compensation Site will occur during maintenance of the flood embankments and drainage ditches at Cherry Cobb Sands. The Pollution Prevention Guidelines (as published by the Environment Agency) will be adhered to:

- PPG1 – General Guide to the Prevention of Pollution Mitigation Measures;

- PPG5 – Works or Maintenance in or Near Water;

- PPG21 – Pollution Incident Response Planning.

Siltation

36.8.5 An agreed monitoring and maintenance plan (*paragraph 28.2.34*) will be implemented to determine any impacts of the Cherry Cobb Sands site on land drainage through Stone Creek. This plan will identify the circumstances in which mitigation works will be undertaken. The resulting impact is therefore determined to be of negligible significance.

36.9 RESIDUAL IMPACTS

Operational Phase

36.9.1 No residual impacts have been identified.