
Chapter 14: Water environment

Introduction

14.1 This chapter considers the potential impacts of the proposed wind farm on the hydrology and water quality of the site and its surroundings. The study and assessment was undertaken by SKM and assesses potential impacts during the construction and operation of the wind farm, and outlines mitigation measures to reduce the predicted effects of the proposals. The assessment identifies:

- sensitive features in the water environment at and around the site
- potential impacts associated with construction and operational activities and their control through best management practices
- mitigation measures to control and reduce other potential impacts of the proposed development
- the significance of residual effects.

14.2 This assessment is primarily concerned with the wind farm site and the area within 2 kilometres of its boundary. Where significant impacts are considered possible beyond this range, the assessment has been extended to cover these.

14.3 The ecological interest of the water environment is addressed in chapter 12 of this environmental statement.

Desktop assessment methodology

14.4 Given the nature and location of the site, the water environment was scoped as being of secondary importance. Highly sensitive wetland nature conservation sites of national and European importance are located several kilometres away, but the proposal was not considered to have the potential to affect these significantly. These issues are addressed further in chapter 12 of this environmental statement.

14.5 The assessment has therefore been based on a review of desk based information and data collected from the Environment Agency and other sources, including an ‘Envirocheck’ report. No site surveys have been undertaken during the course of the study. The assessment of impacts has been based on latest guidance and legislation relating to the water environment and control of pollution. Maps and data sources were also interrogated to establish whether there are any existing or former land uses that may have led to contamination.

14.6 Given the absence of water abstractions and sewage requirements in the proposals, the focus of the assessment is on:

- site preparation and earth moving activities

- use of fuels, lubricants and other required chemicals on-site during construction and operation of the project
- the effect of site access roads, infrastructure and tower foundations that may occur on surface water bodies and groundwater hydrology.

Guidance and legislation

- 14.7 The assessment undertaken is primarily qualitative, based on professional judgement and statutory and general guidance. Such guidance includes the sources listed in table 14.1.

CIRIA Report C532 Control of water pollution from construction sites (2001)
CIRIA Report C502 Environmental good practice on site
Defra Guidelines for handling soils (MAFF 2001)
Development and Flood Risk PPG 25
EA Pollution Prevention Guidance Notes (PPG)
PPG 1 General guide to the prevention of water pollution
PPG 2 Above ground oil storage tanks
PPG 3 Use and design of oil separators in surface water drainage systems
PPG 5 Works in, near or liable to affect watercourses
PPG 6 Working at construction and demolition sites
EA Policy regarding culverts
Forestry Commission (2003) Forest and water guidelines
Table 14.1: statutory and general guidance

- 14.8 In addition to the general guidance, there is a range of environmental legislation that any development must adhere to throughout the life of the project. Key legislative drivers relating to the water environment that have been considered within this assessment are listed in table 14.2.

Groundwater Regulations 1998
UK Water Quality (Water Supply) Regulations 2000
EC Fisheries Directive (78/659/EEC)
Water Framework Directive (2000/60/EC)
Environment Act 1995
Land Drainage Act 1991.
Table 14.2: key legislation

Data collection and consultations

- 14.9 The assessment is also based on the collection of a wide range of data and information from published material, and on the results of consultation with statutory bodies (e.g. Environment Agency) relating to the local and wider hydrological environment.

- 14.10 Data sources referred to in the assessment are outlined in table 14.3.

Climate and rainfall
National River Flow Archive (www.ncl.co.uk/nrfa)
Topography, elevation, relief
Ordnance Survey Explorer 1:50,000 mapping
Surface water, flooding, water quality, fisheries
Environment Agency (www.environment-agency.gov.uk)
Groundwater, aquifer, groundwater vulnerability
Environment Agency, Hydrogeological Map of England and Wales (scale 1:625,000)
Groundwater Vulnerability Map No. 52 Isle of Wight
Geology, solid and drift, sites of scientific importance
British Geological Survey (BGS) map of the Isle of Wight, Special Sheet, 1:50,000 scale
English Nature (www.english-nature.org.uk)
Water resources, abstractions and discharges
Environment Agency
Table 14.3: references and sources of information

Assessment criteria and evaluation of effects

14.11 There are no published guidelines or criteria for assessing and evaluating effects on the water environment, however, a methodology was developed for this assessment, providing a tool for assessing and evaluating the significance of effects. This methodology is based on a set of criteria as follows:

- the type of effect (i.e. whether it is positive, negative, neutral or uncertain)
- the probability of the effect occurring (be it certain, likely, or unlikely)
- the policy importance or sensitivity of the resource under consideration in a geographical context (whether it is international, national, regional or local, as defined in table 14.4)
- the magnitude of the effect in relation to the resource that has been evaluated, quantified if possible, or rated qualitatively as high, medium or low as defined in table 14.5.

International	Important on a European or global level (e.g. cross boundary water resource)
National	Important in the UK (e.g. water resource of national importance)
Regional	Important in the context of the Isle of Wight and the South Coast; Regional Important Geological Sites (RIGS)
District	Important in the context of the west of the Isle of Wight (e.g. public water supplies)
Local	Important within watersheds to which the site may drain; within the site and up to 2km from the site (e.g. private water supplies)

Table 14.4: definitions of water environment importance / sensitivity

Magnitude of effect	Runoff regime	Surface water quality	Riverine flow regime	Riverine morphology	Groundwater levels	Groundwater quality	Geological changes
High	Change (>50%) in proportion of site rainfall immediately running off, changing flood risk or erosion potential	Change in water quality, changing river status with respect to EQS for more than one month	Change in flows of >5% resulting in a measurable change in dilution capacity or flood risk	Changes in erosion and deposition, with conservation interests put at risk	Change in groundwater levels leading to an identifiable change in groundwater flow regime and artesian flow, affecting water supplies	Change in groundwater quality, changing site quality with respect to DWS for more than 1% of samples	Disturbance or loss of the geological feature of interest
Medium	Change (10-50%) in proportion of site rainfall immediately running off, changing flood risk or erosion potential	Change in water quality, changing site status with respect to EQS for less than one month	Change in flows between 2-5% resulting in a measurable change in dilution capacity and flood risk	Some change in deposition and erosion regimes	Change in groundwater levels leading to an identifiable change in groundwater flow regime. Measurable change in flow to water supplies and baseflows	Change in groundwater quality, changing site quality with respect to DWS for less than 1% of samples	Some disturbance or loss to the geological feature
Low	Change (<10%) in proportion of site rainfall immediately running off, but no change flood risk or erosion potential	Measurable change in water quality but no change with respect to EQS	Measurable change in river flows of <2%, but no change in flood risk	Slight change in bed morphology and sedimentation pattern. Minor rates of erosion	Measurable change in groundwater levels, though no appreciable change in groundwater flow regime.	Measurable change in groundwater quality, but not changing status with regards to DWS	No disturbance or loss to the geological feature

Table 14.5: impact magnitude criteria – water environment

EQS: Environmental Quality Standard, as laid down in relevant EU Directives and national legislation

DWS: Drinking Water Standards

- 14.12 Professional judgement is used to assess the findings in relation to each of these criteria to give an assessment of significance for each effect. Effects are considered to be of major, minor, or negligible significance. As a guide a significance table has been developed whereby the combination of sensitivity and magnitude give the significance of the effect (table 14.6).

Sensitivity of impact	Magnitude of Impact		
	Low	Medium	High
International	Minor/Major	Major	Major
National	Minor/Major	Major	Major
Regional	Negligible to Major	Minor/Major	Major
District	Negligible/Minor	Minor/Major	Minor/Major
Local	Negligible	Minor	Minor/Major

Table 14.6: evaluation of effect significance

Baseline description

- 14.13 This section describes the existing water environment baseline conditions at the proposed site and within its immediate surroundings.

Consultee responses

Environment Agency

- 14.14 The Environment Agency information shows that there are a number of licensed groundwater abstractions from the chalk. The site is classified as minor aquifer with high leaching potential, and is located within 1 kilometre of a source protection zone for the Shalcombe public water supply. The Water Resources Act 1991 (sections 39 and 199) outlines the need for control of impacts on groundwater levels and resources.

- 14.15 The potential for flooding is highlighted in Calborne, though the site is not located within the indicative flood plain. The Environment Agency did not make a request for a flood risk assessment.

Environmental Health Officer, Isle of Wight Council

- 14.16 The Environmental Health Officer was not aware of any private water supplies within the site or its surroundings which could be impacted by the proposals, but noted that there could be unregistered sources.

English Nature

- 14.17 The nearest geological sites of special scientific interest are Prospect Quarry, Lacy's Farm Quarry, Shide Quarry, Compton Chine to Steephill Cove and Bouldner and Hamstead. All but Prospect Quarry are several kilometres from the proposed development site, and further details are set out in chapter 12 of this environmental statement.

Climate

- 14.18 The annual average rainfall for the Isle of Wight is approximately 840 to 860mm, based on catchment averages for the Lukely Brook, the River Medina and the River Yar (National River Flow Archive 2004).

Topography and surface drainage

- 14.19 The proposed wind farm lies to the north of Brook Down, which is a narrow, east to west trending ridge line, with a maximum elevation of 164 metres AOD. Elevations within the study area range from approximately 50 metres to 80 metres AOD. Surface water runoff within the existing site flows northwards to one of four tributaries, that feed the Thorley Brook catchment. These tributaries are formed from issues arising within the site and close to the proposed development, some of which have formed a narrow valley through which they flow (figure 14.1).
- 14.20 Two other tributaries to the east of the proposed site flow in a northerly direction, and are tributaries of the Newton River. The main tributary is the Caul Bourne. These are unaffected by the proposals.
- 14.21 The Environment Agency floodplain map shows that there is some flood risk on watercourses downstream of the site. In particular, there are flooding problems on the lower part of the Thorley Brook and along Newton River (figure 14.2). The assessment has considered the implications of the development on flooding downstream of the site. A flood risk assessment was not requested by the Environment Agency.
- 14.22 The only other surface water feature of note is a small, calcareous pond in Prospect Quarry. It is situated at an elevated point to the south of the site boundary, affording it protection from potential impacts.

Geology

Drift geology

- 14.23 There is no drift material overlying any part of the site. Soils directly overlie the solid geology, which is described below.

Solid geology

- 14.24 The solid geology beneath the site belongs to the Bembridge Limestone series and the Osborne Beds of the Oligocene Period. These beds are up to 207 metres thick on the Isle of Wight and dip gently to the north. To the south of the site, and steeply inclined, is the following sequence of older strata: Bagshot Beds; London Clay; Reading Beds; and, Upper Chalk. Further south still is the Upper and Lower Greensand.

14.25 There are a number of important geological sites on the Isle of Wight, with the Prospect Quarry Geological SSSI the closest (grid reference SZ 365867). This quarry is designated due to the presence of the exposures of Bembridge Limestone. Locally this layer is referred to as the 'insect' limestone, since it is an important source of tertiary fossil insects and fossil plants. The nearest turbine (turbine 4) is located 400 metres from the quarry.

Hydrogeology

14.26 Runoff rates will be reasonably low due to the presence of loamy soils. Where geology permits recharge of underlying groundwater will take place. The underlying strata at the site could restrict groundwater recharge, since the Bembridge and Osborne Series consist mainly of clays and marls with occasional sands and limestones. The Environment Agency has classified the underlying strata as a 'Minor Aquifer' (figure 14.3).

14.27 Small yields are possible from the limestones, but these tend to have quality problems with high iron levels. The Reading Beds and the London Clay consist mostly of clay, which is mottled where it overlies the Chalk, and would act to restrict groundwater flow. Being to the south and steeply inclined, the Reading Beds and London Clay provide a barrier between strata underlying the site and the more productive aquifers, which are found to the south. Groundwater flow underlying the site will generally tend to flow northwards by following the general fall in topography.

14.28 The Chalk is a highly productive aquifer where flow is predominantly through fractures and fissures. Higher yields are found in the Lower Greensand, which comprises sands and sandstone. The Lower Greensand can yield up to 50 l/s with flow largely as intergranular flow.

14.29 The Hydrogeology Map of England and Wales indicates groundwater levels in the region of +60 metres AOD, and therefore levels will typically be about 10 metres below ground level. The Lower Greensand supports public water abstractions and there are designated Source Protection Zones (SPZ) for these abstractions. The edge of the site boundary is located within 1 kilometre of a source protection zone (SPZ) for the Shalcombe public water supply. There are no SPZs within the proposed site boundary.

Water quality

14.30 Water quality measurements are taken by the Environment Agency on the Caul Bourne. Water quality classifications for this watercourse based on the General Quality Assessment (GQA) Classification are grade A for chemical and grade B for biological, on a grading system A to E, with A being very good quality water.

- 14.31 The Environment Agency has provided details of water quality River Ecosystem (RE) Objectives for the Thorley Brook, which has a current objective of 4, which indicates relatively poor water quality. RE objectives for Caul Bourne confirm reasonably good quality water at grade 2.

Abstractions, discharges and other consents

- 14.32 The Environmental Health Officer at the Isle of Wight Council did not identify any private surface water abstractions locally, though there are potentially a number of unlicensed groundwater abstractions. This is indicated by the presence of groundwater wells marked on the Ordnance Survey 1:50,000 scale map.
- 14.33 These abstractions are probably from the Bembridge Limestone or Osborne Series, and may suffer inherent water quality problems; they are therefore likely to be used only for agricultural purposes.
- 14.34 The Environment Agency has confirmed that there are public water supply abstractions close to the site, with the nearest located approximately 1.2 kilometres away. The Environment Agency has also confirmed that the site is not located within the hydrogeological boundary of any of these public water supplies.

Soils

- 14.35 Soils within the site and surroundings are generally calcareous soils derived from the underlying clays and limestone geology. These soils are cultivated for agricultural purposes, generally within relatively large open fields. The mapping suggests that the soils belong to the Aberford Soil Association, which more characteristically gives rise to shallow, well drained calcareous loams.

Contamination

- 14.36 An Envirocheck report with a series of historic maps of the site and surrounds was examined for potential features and activities that might have led to contamination. The site of the development is shown to have been in agricultural production throughout, and no evidence of any such activities was discovered. Contamination is therefore not considered further in this assessment.

Baseline summary and sensitivity

- 14.37 The site is located within an open arable agricultural setting where surface water runoff tends to predominate. This has resulted in the formation of a number of small watercourses issuing from the site. Water quality in these tributaries is generally of very good to good quality and they will therefore be sensitive to changes during the construction and operation of the development.

- 14.38 Particular sensitivity will occur at any watercourse crossing points and where access tracks run close to watercourses. Any changes to runoff characteristics have therefore been considered, particularly as there is a suggestion of potential flooding implications downstream of the development.
- 14.39 In terms of risk to groundwater, the strata immediately underlying the site are not classified as a productive aquifer, and the productive aquifers to the south are protected by steeply inclined impermeable strata, such as London Clay. The risks to sensitive groundwater resources are therefore not considered to be significant and are not considered further.
- 14.40 No evidence of existing contamination or earlier activities that might have caused contamination on or around the site has been identified in desk studies.

Potential impacts

- 14.41 This section provides a summary of the potential impacts of the wind farm, based on an assessment of activities that will occur during its construction and operation, prior to the inclusion of mitigation measures. Table 14.7 considers the potential impacts during the construction phase, while table 14.8 outlines the potential impacts during the operational phase of the wind farm.
- 14.42 An assessment of these impacts determines the need for mitigation measures, which are discussed in detail later. Therefore, this section does not necessarily reflect the likely effects of the development. The actual residual effects of the development are outlined at the end of this chapter.

Activity	Potential impact	Magnitude	Sensitivity	Significance	Need for mitigation	Comment
Access tracks	Changes in surface water runoff patterns could change flooding risk	Low	District	Minor	✓	Mitigation required to ensure that there is no increase in flood risk potential.
	Generation of turbid runoff which could enter nearby watercourses	Medium	Local	Minor	✓	Controls on access track construction needed so any earth works and roadstone placement do not generate turbid water and affect water quality status which is currently very good.
Watercourse crossings	Loss of streambed due to culvert watercourse crossing	Low	Local	Negligible	✓	Best practice guidance will need to be adopted on the design of the watercourse crossing.
	Erosion of channel banks and generation of turbid water	Medium	Local	Minor	✓	As above.
Wind turbine foundation and crane pads	Excavation of soils resulting in damage to soil structure and loss of resource	Low	Local	Negligible	✓	The volume of soils removed for 6 turbine bases is not considered significant and the soil will be re-used wherever possible within the development.
Electric cables	Could act as small drainage channels and lead to turbid water entering watercourses	Low	Local	Negligible	-	Gradients on the site are small so it is unlikely that cable trenches will act as drainage channels, and therefore no turbid water would develop.
	Damage to soil structure & soil erosion	Medium	Local	Minor	✓	Best practice soil handling needed.
Compound and switching station	Damage to soil resources	Low	Local	Negligible	-	A very small area will be damaged.
Site activities	Spillages and leakages of oils, fuels, and other potentially polluting substances	Medium	Local	Minor	✓	Best site management practices to be adopted to reduce potential for any spillage or leakage of potentially polluting substances.

Table 14.7: potential impacts during construction phase

Activity	Potential impact	Magnitude	Sensitivity	Significance	Need for Mitigation	Comment
Access Tracks	Changes in surface water runoff patterns which could change flooding risk	Low	District	Minor	✓	Mitigation is required to ensure that there is no increase in flood risk potential.
	Generation of turbid runoff which could enter nearby watercourses	Medium	Local	Minor	✓	Controls on access track construction needed to ensure any earth works and roadstone placement do not generate turbid water and affect water quality status which is currently very good.
Watercourse crossings	Loss of streambed due to culvert watercourse crossing	Low	Local	Negligible	✓	Best practice guidance will need to be adopted on the design of the watercourse crossing.
	Erosion of channel banks and generation of turbid water	Medium	Local	Minor	✓	As above.
Switching station	Leakage of polluting substances	Low	Local	Negligible	-	Modern designed switching stations are unlikely to result in pollution issues.
Site activities	Spillages and leakage of oils, fuels, and other potentially polluting substances	Low	Local	Negligible	✓	Best site management practices would be adopted to reduce the potential for any spillage or leakage of potentially polluting substances.

Table 14.8: potential impacts during the operational phase

Mitigation

14.43 This section outlines the mitigation measures proposed to address the identified potential impacts. The first approach to mitigation has been to avoid problems through the design of the wind farm layout. Measures adopted included avoiding watercourse crossings where possible and practicable, avoiding development on steep slopes, and providing development-free buffer zones around watercourses. The mitigation measures described below are divided into those relating to construction and operation activities.

Construction phase

14.44 The Environment Agency's PPG6 guidance will be followed throughout the construction process on the site.

Access tracks

14.45 The access track layout and design of the tracks are illustrated in the proposals chapter of this environmental statement. Access tracks avoid all watercourses with the exception of a single watercourse crossing between turbines 5 and 6. The track layout minimises the area of land take, and thus will minimise the amount of soil that will be stripped and stockpiled. Stockpiled soils will be stored upgradient to ensure that runoff does not unnecessary flow onto track surfaces. There is a minimum stand off of 20 metres from the stockpile areas to any watercourse to minimise the potential for contamination.

14.46 Where access tracks are built above the ground surface, they will be finished with a camber to ensure that drainage is quickly shed to avoid erosion of track surfaces and turbid water generation. Buffer strips adjacent to the tracks will be provided to ensure that any runoff is adequately filtered through vegetation. Where access tracks are below ground surface, drainage will be collected in track-side ditches and will be directed to discharge points along track routes.

14.47 These discharge points will enter small buffer zones, again designed to filter out sediments. There will be no need for a direct discharge into any watercourse from access track drainage as the runoff rates will be relatively small and the buffer zones will ensure that runoff filters into surrounding fields. These buffer zones will also reduce runoff rates and therefore no increase in runoff or downstream flooding risks are predicted.

14.48 The contractors will be required to comply with a sediment management plan for the site, incorporating these measures and others described in Environment Agency PPG notes, CIRIA guidance and Forest and Water Guidelines.

14.49 The drainage arrangement will also ensure that runoff rates are not unnecessarily increased. A PPG25 flood risk assessment is not required as there is no predicted increase in runoff rates from the site.

Watercourse crossing

- 14.50 A single watercourse crossing will be required, and this will be designed in accordance with Environment Agency and CIRIA (CIRIA 2001) best practice guidance. The type of crossing method chosen will be based on the sensitivity of the stream banks and bed at this location. It will be designed to minimise the impacts on the stream bed. The crossing is also likely to require Land Drainage Act consent from the Environment Agency, and this process will also act to place controls on the design of the crossing.
- 14.51 The watercourse crossing will be oversized to ensure that it can convey all likely flows experienced within the channel. This will ensure that there is no risk of flooding or increased velocities resulting in potential erosion problems.

Turbines and crane pads

- 14.52 Turbines have been located as far from all watercourses as feasible, the closest being turbine 1 which is approximately 15 metres from the head of a small drainage channel. Turbine foundation excavation depths will be between 2 metres and 3 metres. When excavating the turbine foundations, a soil water table may be encountered. Any water will be pumped out and passed to a temporary sump to allow suspended sediment to settle out. Treated water will then either be passed to a nearby watercourse with the prior agreement of the Environment Agency or passed through a buffer area of vegetation (the latter being the preferred option).
- 14.53 At these depths, turbine foundation are not expected to encounter groundwater of any significance and site investigations carried out for geotechnical purposes will confirm this prior to construction. No interception of groundwater flows or interruption of flow patterns are therefore predicted. Should groundwater be present, the method of construction will be such that impacts will be minimised. Sheet piling would be used to minimise the impact on groundwater level and reduce the need for extensive dewatering of the excavations.
- 14.54 Soils will be excavated in accordance with Defra guidelines for handling soils (MAFF 2001) to ensure that damage to soil structure is minimised. Such measures will include:

- use of backacters and dump trucks for soil excavations and movements
- soil excavations to be carried out during dry weather, where possible
- re-use of soils around turbine footings where possible
- topsoil and subsoil to be excavated and stored separately
- minimal (if any) soil resources to be transported off-site
- excavated soil resources to be seeded and re-vegetated as quickly as possible, if not re-used, to avoid erosion potential.

Electric cables

- 14.55 The installation of electric cables will be within small trenches that will be dug during dry weather conditions where possible. These trenches will run alongside or under access tracks. Topsoil and subsoil will be excavated

separately to ensure that the soil profile can be restored once the cables are in place. Soils will be replaced as quickly as possible to avoid these small trenches becoming drainage pathways.

Construction compound and switching station

- 14.56 Erosion control measures will be put in place when developing the construction compound which will be located 45 metres from a tributary of the Thorley Brook. A small cut off ditch or buffer system will be adopted to control any releases from the site.
- 14.57 All potentially polluting substances will also be stored within containment bunds to Environment Agency standards.
- 14.58 Since the development footprint is small the damage to soil resources and land use will be minimal and other than adopting best practice measures for handling soils, no further mitigation is required.
- 14.59 Toilet facilities for the work force will be of a well maintained portaloos type, with no local implications for foul drainage.

Site activities

- 14.60 The storage of oils, fuels and other substances will be within the site compound and in compliance with the Oil Storage Regulations. Storage will be within impervious storage bunds with 110% capacity, so that any spillage or leaks are contained. Throughout the construction best working practices will be adopted and measures to protect the water environment will be incorporated, adopting recommendations set out in the Environment Agency PPG notes.
- 14.61 Construction machinery will be checked regularly. Any maintenance required will occur over hardstanding or on a suitable impermeable ground cover. Refuelling will be limited to a designated area, on an impermeable surface, away from any drains or watercourses. Spill kits, absorbent pigs and absorbent sands will be available on site at all times. Any spills will be cleaned up as soon as possible, according to the spill response plan in the Working Practice Procedure, with any contaminated sands bagged up and disposed of correctly. Detailed descriptions of measures to be adopted will be set out in an Environmental Management Plan (found in the appendix at the end of this chapter).

Operational phase

- 14.62 This section describes the mitigation measures that will be employed in the operation of the wind farm to reduce effects on the water environment.

Access tracks

- 14.63 The proposed mitigation measures for the potential impacts of the access tracks on hydrology have been described under the construction phase above,

and will continue to function throughout the operational phase of the development.

- 14.64 Methods incorporated into the scheme are designed to be sustainable and drainage will be designed to cope with wet weather conditions. Therefore, only routine maintenance is envisaged for the track network during the operation of the site. The drainage provision incorporated into the design of the access tracks will ensure that there is no increase in surface water runoff entering any of the nearby watercourses. Therefore there is no predicted increase in flooding risk downstream of the site.

Watercourse crossing

- 14.65 The potential for sediment input from the crossing will be controlled by the placement of protective barriers, 0.25 metres in height, along the sides of the crossing. This will restrict the direct entry of runoff from the tracks into the watercourse and restrict the potential for turbid water input. Any runoff will be directed away from the crossing and will be allowed to flow into vegetated buffer areas.

Switching station

- 14.66 The switching station will be designed in accordance with best practice, which will ensure that there is no potential for leaks or pollution incidences from the site. The switching station will also be subject to routine checks and maintenance.

Site activities

- 14.67 There will be a need for routine maintenance of the wind farm. Maintenance personnel may bring oils, greases and other substances on site, with a minor potential for accidental spillage. However, such spillages (if they occur) are likely to be very small and will be dealt with immediately by the site crew using appropriate spill kits. Since site drainage will be limited, the risk to any downstream watercourse is negligible.
- 14.68 Additionally, soils on-site would tend to restrict the movement of pollutants and therefore there is little risk to groundwater resources.
- 14.69 The site will be operated in accordance with best working practices and measures to protect the water environment will be in operations as set out with Environment Agency PPG notes.
- 14.70 All vehicles visiting the site will be equipped with sand trays to place below any oil or fuel filling activities, and will also be equipped with emergency oil spillage kits.
- 14.71 An outline operational Environmental Management Plan is outlined in the appendix to this chapter.

Residual effects

Introduction

- 14.72 This section describes the effects that are predicted to occur as a result of the development after mitigation.

Construction phase

Effects on surface water

- 14.73 The changes to surface water runoff are predicted to be minimal and with the incorporation of buffer zones to filter and slow down runoff from access tracks there should be no noticeable changes to the quality or quantity of surface water flows within the nearby watercourses.
- 14.74 The only predicted effect on surface water during the construction of the wind farm will be the incorporation of a single watercourse crossing to gain access to turbine 6. There may be some disturbance to the stream banks and beds and this could result in small areas of erosion and temporary sediment input to the channel.
- 14.75 As with any construction project there will be the potential for accidental spillage of pollutants used on-site. Measures will be in place to reduce the risk of these occurrences and to respond to such occurrences. It is not expected that any pollutants would enter the surface water environment.

Effects on groundwater

- 14.76 Immediately beneath the site there is limited groundwater sensitivity due to the lack of water-bearing strata. Measures to contain potentially polluting substances on-site and measures outlined within the Working Practice Procedure will mitigate the likely of surface pollution entering groundwater. Any borrow pit excavations and piling are not expected to encounter groundwater and therefore no significant effects are predicted. The major aquifers of the Chalk and Lower Greensand are also not in hydraulic continuity to the site and therefore water supplies from these strata are not at risk from the development. Therefore there are no predicted effects on groundwater resources.

Effects on geology

- 14.77 There are no important exposed geological features within the vicinity of the development, though it is noted that the underlying Bembridge Limestone is of local interest due to the fossil artefacts. The development will require very little excavation and will not impact on the underlying strata.

Effects on soils

- 14.78 There is the need for some soil excavations for access tracks, turbine bases, switching station compound and electric cable trenches. These excavations

will be carried out in accordance with Defra guidelines to minimise the effects of the proposals, and overall the total area and volume of disturbance is very small (less than 5 hectares).

- 14.79 Soils will be re-used on site where possible, around turbine footings or stored in small stockpiles that are quickly re-vegetated. Removal of soil from site will be kept to a minimum.

Operation phase

Effects on surface water

- 14.80 There will be very few changes to surface water during wind farm operation. The drainage provision alongside access tracks will ensure that there are no water quality issues or runoff changes. Activities on-site will be minimal and therefore the risk of accidental spillage entering surface watercourses is remote.

Effects on groundwater

- 14.81 There are no predicted effects on groundwater resources during the wind farm operation.

Effects on soils

- 14.82 There are no predicted effects on soil resources during wind farm operation.

Evaluation of residual effects

- 14.83 Residual effects are rated on a scale range of negligible, minor and major significance and are presented within table 14.9. The criteria for determining effect significance are described earlier in the methodology section of this chapter.

Conclusion

- 14.84 This assessment describes the hydrology and water quality effects of the proposed development and the planned mitigation for protection of the water environment. Overall, there are predicted to be very few effects resulting from the proposals following the introduction of a successful mitigation strategy.
- 14.85 The potential impacts have been addressed through the design of the wind farm and its layout. All other mitigation measures, which are designed to reduce the effects of potential impacts, are based on best management practice, which is available from the Environment Agency, CIRIA and Defra.
- 14.86 The turbines and all other development will be away from any surface water feature as far as practicable. There is a single watercourse crossing that cannot practically be avoided; here the most up to date guidance from the Environment Agency and CIRIA will be followed. A sustainable drainage scheme is planned whereby any runoff from the access tracks will be routed to

buffer zones where vegetation will slow down runoff and filter out any sediment. Mitigation measures will be formalised within a site management plan, which the contractors will be required to comply with.

Effect	Type	Probability	Sensitivity	Magnitude	Significance	
					Ranking	Rationale
Construction						
Effects on surface water:						
Disturbance to stream bed and bank from a single crossing	-ve	Certain	Local	Low	Negligible	Crossing constructed in accordance with best practice but some effects unavoidable.
Accidental spillage of oils, fuels or polluting substances	-ve	Unlikely	Local	Low	Negligible	Spillages will be controlled and response measures will be in place for accidental events.
Effects on geology:						
Excavation of locally important Bembridge Limestone for turbine foundations and roadstone	-ve	Certain	District	Low	Negligible	No exposures of important geological strata affected. Small volume of limestone removed during construction.
Effects on soils:						
Soil excavations for turbine bases, tracks and other excavations	-ve	Certain	Local	Low	Negligible	A very small volume of soil removed for development: where possible re-used.
Operation						
Effects on surface water:						
Accidental spillage of pollutants from on-site activities	-ve	Unlikely	Local	Low	Negligible	Spillages controlled and response measures in place for accidental events
Table 14.9: predicted residual effects and evaluates the significance of these effects						
Symbols and criteria used in the above categories						
	-ve = Negative	Certain	International	Major	Major	
	+ve = Positive	Likely	National	Medium	Minor	
		Unlikely	Regional	Low	Negligible	
			District			
			Local			

14.87 The assessment has also highlighted that there are no predicted effects on groundwater.

14.88 The turbines and associated infrastructure represent a very small area of land take and the effects of this are considered to be negligible. The mitigation measures adopted to minimise affects on soil resources are based on the Defra guidelines for handling of soils. These measures will ensure that soils are stored and handled in a manner that will enable reuse and restoration.

Appendix to chapter 14

A framework for an environmental management plan

- 14A.1 This appendix provides an outline framework for the implementation of mitigation measures relating to the protection of the water environment for the proposed West Wight wind farm. It is relevant to all phases of the project and is based on the best practice guidance available from the Environment Agency and others. It provides a basis for developing method statements and management plans in association with the site contractor to control potential impacts. These will be agreed with the IoWC and the Environment Agency.
- 14A.2 This document broadly addresses the following issues:
- i) Avoidance and control of pollution via various sources (eg sediment enriched runoff, concrete, fuels, oils). This will be addressed through the development of a Pollution Prevention and Control Plan; and
 - ii) Spillages and leakages of oils, fuels and other substances either through accidental or abnormal occurrences. This will be addressed through the development of an Emergency Response Plan.
- 14A.3 In addition to these documents, a Wind Farm Construction Method Statement would be developed to provide the contractor and the regulatory bodies with a detailed method statement of site activities. A Decommissioning Method Statement would also be produced at the appropriate time.

Guidance and best practice

- 14A.4 This plan will be prepared in accordance with available best practice and guidance at the time. Reference to these will be made when developing method statements and management plans with the site contractor, who will be responsible for implementing the plan. Currently, this best practice and guidance includes the following:
- EA Pollution Prevention Guidance Notes (PPG)
 - PPG 1: General guide to the prevention of water pollution
 - PPG 2: Above ground oil storage tanks
 - PPG 3: Use and design of oil separators in surface water drainage systems
 - PPG 5: Works in, near or liable to affect watercourses
 - PPG 6: Working at construction and demolition sites
 - PPG 8 Safe Storage and Disposal of Used Oils
 - PPG 13 High Pressure Water and Steam Cleaners
 - PPG 26 Storage and Handling of Drums and Intermediate Bulk Containers

- CIRIA Report C532 Control of Water Pollution from Construction Sites (2001)
- CIRIA Report C502 Environmental Good Practice on Site (1999).

Pollution prevention and control plan

Introduction

- 14A.5 This section outlines the framework to be adopted in the preparation of a Pollution Prevention and Control Plan for the development. This framework plan has been prepared to address the specific issues highlighted in the assessment.
- 14A.6 The framework identifies best working procedures, standards and guidance for particular operations that will be implemented by all subcontractors and staff when working on site.
- 14A.7 The procedures have been developed to ensure that site activities comply with Environment Agency Pollution Prevention Guidelines. Further refinements to the plan can also be made in response to additional planning conditions or requirements set out by the local planning authority or other regulatory bodies.

Pollution prevention and control measures

Contaminated land

- 14A.8 No contaminated land is expected at the site, though its presence cannot be ruled out. Any remediation or disposal of contaminated land will only be carried out following consultation with the local environmental authority, if no work is required on the contaminated land it will be fenced off to prevent disturbance.
- 14A.9 Assessment of the hazards for underground services where present shall include an assessment of the environmental impact of damage during construction.
- 14A.10 Vandalism, theft and tipping are common causes of pollution and the compound area should be adequately protected by fencing and locked to discourage unauthorised access. Any occurrence of tipping on the site will be reported to site management who will inform the local environmental authority and the police if necessary

Site drainage

- 14A.11 No water, clean or otherwise, is to be directly discharged to any surface watercourse. Wet cement and raw concrete shall never be allowed to enter any watercourse. Vegetated areas should be present between construction activities and any watercourse.

Fuels, oils and chemicals

- 14A.12 Fuel and oil deliveries shall take place within the designated refuelling areas only, which will be located within each site compound. A responsible person will supervise site deliveries to ensure that the correct amount of material is delivered to the correct tank and that the level is checked prior to refilling to avoid spillage.
- 14A.13 All fuels and oils will be stored in a designated area only, including mobile bowsers when not in use, which shall be banded. The band shall be capable of containing 110% of the fuel stored or there shall be a double skinned fuel tank. These should be routinely inspected. The site subcontractor is required to adhere to the measures outlined within Environment Agency PPG2 Above Ground Oil Storage Tanks.
- 14A.14 Generators permanently stationed in the site compound (used for powering site cabins) will be kept in the designated refuelling area. Chemicals on site shall be stored in accordance with their COSHH assessment and appropriate spill kit kept by the subcontractor.
- 14A.15 All bowsers shall be stored so as to minimise the risk of collision, run-away and vandalism. They will not be stored adjacent to watercourses. When not in use, bowsers will be securely stored in the designated refuelling area.
- 14A.16 The contents of any tanks on site will be clearly marked. Warning notices including 'No smoking' and 'Close valves when not in use' shall also be displayed.
- 14A.17 No tanks or containers may be perforated or dismantled on site. A competent operator will empty all contents and residues for safe disposal elsewhere.

Waste management

- 14A.18 All waste will be stored in designated areas that are isolated from surface drains, prior to removal from site. Skips will be covered to prevent refuse blowing away and rainwater accumulating. They will be replaced when full and the contents disposed of in accordance with statutory requirements.
- 14A.19 Chemical containers, used oil and filters, solvents, paints, electrical items, contaminated materials and hazardous refuse are all classified as 'special waste' and, as such, will be stored in a banded area within the site compounds away from watercourses and disposed of by licensed contractors in a controlled manner.

Earthworks

- 14A.20 Sediment entrained water can arise from excavations, exposed ground, stockpiles, wheel-washing and site roads. Water containing sediment shall not be discharged directly to watercourses. Wherever possible, the likelihood of generating sediment entrained water should be avoided.

However, where it is unavoidable it should be prevented from entering watercourses using the following methods:

- Natural percolation into the ground where topography allows. This should be used where possible to deal with any water dewatered during turbine and crane hardstanding construction
- Use of sumps to filter out sediments, before discharging into watercourses where agreement has been obtained from the Environment Agency. The level of accumulated silt should be monitored and lowered through controlled removal when necessary. Series of sumps may be necessary to deal with larger discharges. Alternatively, each turbine may require small sumps.

14A.21 Where possible, water will be prevented from entering excavations. Use of earth bunds and sheet piling will be necessary. Water dewatered by any pumping arrangement will be allowed to percolate back into the ground from within a contained banded area adjacent to the excavation works.

14A.22 It is of paramount importance to minimise disturbance to soil structure. Topsoil and vegetation must be stored separately from subsoil if to be retained on-site. Where soils are to be retained and re-used on-site they should be restored and quickly re-seeded to prevent soil erosion.

14A.23 The total quantity of exposed ground and stockpiles, and storage duration will be minimised in order to minimise generation of sediment entrained runoff and dust. Long-term storage will be avoided. In dry weather dust suppression measures may be required.

Vehicles and plant

14A.24 Where possible, mobile plant and vehicles will be refuelled in the designated area. Where plant is to be refuelled outside this area a double skinned bowser must be used and re-fuelling will take place over a drip tray. Refuelling shall always take place away from watercourses or surface drains.

14A.25 Plant and site vehicles are to be well maintained and any vehicles leaking fluids must be repaired or removed from site immediately. Any servicing operations will take place over drip trays.

14A.26 After use the drip tray will be cleaned using an appropriate absorbent material which will be disposed of in accordance with COSHH regulations. Drip trays will be regularly checked and cleaned.

Road cleanliness

14A.27 Site roads will be brushed or scraped as required to minimise dust and mud deposits, especially at site entrances and any watercourse crossings. If necessary during dry weather, dust suppression may be achieved by spraying water onto the site tracks to dampen down the airborne dust particulates.

14A.28 Measures will be undertaken throughout all phases of development to ensure that dust and mud does not migrate onto the adjacent public highway. This may require the establishment of a wheel washing station comprising an apron onto which vehicles will drive in order to clear the wheels and undersides using a power washer. Any water used during the wheel washing process will be collected and passed through a silt trap before discharging into a soakaway. Run off water will be channelled via a silt trap into a purpose made soakaway and will not be discharged directly into watercourses.

Concrete

14A.29 Concrete is highly alkaline and corrosive and can have a detrimental impact on watercourses. Washing-out of concrete wagons on site will not be permitted, unless in a designated sealed wash-out pit. No tools, equipment or materials will be washed in watercourses. Mortar mixing and material storage areas must be away from watercourses.

14A.30 Sulphate resistant concrete shall be used where groundwater conditions dictate, to prevent long term corrosion of concrete (local release of alkaline compounds) due to sulphate attack.

Watercourse crossing

14A.31 Watercourse crossings will be micro-sited in consultation with the site Environment Manager. This is required to avoid potentially sensitive ecological habitats or protected species.

14A.32 No plant should enter any watercourse during the installation of the watercourse crossings.

14A.33 Where earthworks are required to finalise the installation of pre-cast culvert crossings these earthworks should be undertaken to avoid sediment input to watercourses. Cofferdams should be used where appropriate and practicable.

14A.34 The construction of watercourse crossings should not be undertaken during flood conditions, as this may lead to excessive erosion around the structure, notwithstanding the health and safety issues.

Emergency response plan

14A.35 This section outlines the framework to be adopted in the preparation of an Emergency Response Plan for the development. This framework plan has been prepared to address the specific issues highlighted in the assessment. This plan will effectively form part of the Pollution Prevention and Control Plan, which will be implemented to avoid the likelihood of emergency situations occurring.

14A.36 The Plan is to be developed to respond to accidental and abnormal occurrences and to provide a methodology for responding to such situations at the wind farm.

Emergency procedures

14A.37 Emergency procedures may be required to deal with the following unlikely, but possible occurrences:

- spillages or leakages of oils, fuels, lubricants from plant, vehicles or storage areas entering soils or watercourses
- spillages during refuelling entering soils or watercourses
- spillages of concrete entering watercourses
- uncontrolled releases of sediment input to watercourses following bank failure as a result of a nearby activity.

Emergency provisions

14A.38 Spill kits of appropriate form and size for the controlled substances being used would be supplied on site. They would be present on any mobile refuelling bowser and would be present at all major construction activity locations.

14A.39 Spill kits will likely include the following: absorbent pads and booms; dispersing chemicals; sand; artificial barriers; and small pumps. Used spill kits and any other contaminated material (eg rags) used during the incident are disposed of into a site waste disposal container. Spillages or leakages to ground will be removed by excavating the contaminated material to a mobile and dedicated waste skip for such occurrences.

14A.40 Oil booms will be stored within the site at all times. These will be used to control any oil spills or leaks to water. Contaminated water will be pumped and treated as appropriate.

14A.41 Measures for dealing with concrete spillages will be developed. This is likely to include the use of mobile bunds to ensure that if any spillages do occur bunds can quickly be deployed to control the flow of spillages.

14A.42 Any waste material collected as a result of spillages or leakages will be disposed of in accordance with waste management regulations, by a licensed disposal company and waste transfer certificates retained. The Environment Agency will be informed of the incident and further advice sought if required.

Responsibilities

14A.43 The need to adhere to the plan and the need to ensure that all measures are in place at all times will be the responsibility of each person working on the site. The site Environmental Manager will have overall responsibility for ensuring that there are enough spill kits in place, and for ensuring that the

measures outlined within the Pollution Prevention and Control Plan are maintained.

- 14A.44 In the event of an environmental emergency occurring at the site, the member of staff or subcontractor who noticed the emergency will follow the work instruction put in place to address the situation eg oil spills. This will ensure the incident will be addressed as soon as practicably possible.
- 14A.45 Following pollution incidents, the Environment Agency should be contacted.

Environmental training

- 14A.46 Staff and subcontractors will undertake an environmental awareness training session. Training will be provided in the use of spill kits to ensure that site workers are competent and familiar with the emergency procedures.

Site environmental management philosophy

- 14A.47 The environmental protection measures described within this report outline the frameworks around which a Pollution Prevention and Control Plan and an Emergency Response Plan will be developed. Staff will work closely with the site contractor and any other subcontractor to ensure that these plans are developed into workable measures.
- 14A.48 The plans would be agreed with the local authority and the Environment Agency. Ongoing monitoring and auditing of the plans would be undertaken by the Environmental Manager every 2 to 3 weeks to ensure compliance.