

encourage the use of the newly-created site by a range of species (see Section 16.10, below).

16.8.5 Finally, those areas marked in green on the constraints plan were considered to represent no constraint to development.

16.8.6 This constraints map was then used in the masterplanning process to ensure that areas of greatest nature conservation importance would be retained, and that the focus of the re-development of the site would be on those areas marked in green and yellow. This was done not only to maintain the nature conservation value and long-term ecological sustainability of the site, but also to help contribute to the natural landscape character of the proposed scheme.

16.8.7 Nevertheless, because of the sheer scale of the scheme and the relatively high ecological value of the site as a whole (in spite of the fact that it is, essentially, a brownfield site), there will clearly be some ecological impacts associated with the proposals. The most likely impacts from the demolition, remediation and re-development of the site would be associated with habitat loss and fragmentation, effects on the hydrology of the site, the potential for incidental mortality of protected and/or UKBAP priority species, and indirect effects on sensitive species (such as disturbance of breeding birds or dust contamination of lichens). These impacts are described in the following paragraphs, with each of the ecological receptors identified in Section 16.4 considered in turn.

Crymlyn Bog SAC

Southern Access

16.8.8 A potential direct impact on Crymlyn Bog during the construction phase would be at the far southern end of the scheme, where it is proposed that a viaduct will be constructed to carry the Southern Access road over the canal and the wet woodland of the SAC. The design of the crossing has been developed to minimise all impacts on the SAC (see Section 4), but without additional mitigation, there would be a possibility of effecting a small amount of habitat along the edge of the construction corridor (which is necessarily narrow at this point) as well as localised disturbance, pollution and sedimentation of the sensitive wet woodland and swamp habitats. Bird nesting, in particular, could potentially be disrupted in the vicinity of the works, and the potential also exists for amphibians and reptiles to be killed during the process of pier construction. There is also the potential for localised impacts associated with dust deposition along the edge of the retained habitat as a result of construction operations.

16.8.9 Mitigation measures are proposed in Section 16.10 which would address these issues and thus remove any significant potential for adverse impacts to occur.

Drainage Issues West of Refinery

16.8.10 Potential effects on the bog associated with the drainage system for the proposed Coed Darcy Urban Village are discussed in Section 15 Water Resources and Water Quality of the ES and hence are not dealt with in this section.

Zone 1 - Wet Woodland and Scrub

16.8.11 The valuable areas of wet woodland and scrub along the western margins of the site would not be affected by direct habitat loss, as they are outside the land-take for the development and will not require intrusive remediation. There will, however, be the

potential for nesting birds to be disturbed in the vicinity of the works, and for localised impacts associated with dust deposition along the edge of the retained habitat as a result of earthwork operations.

Zone 2 – Heathland Hillside and Species-rich Grassland

- 16.8.12 The majority of this hillside is to be retained within the scheme design, with only approximately 5-10% of the habitat (mainly comprising species-rich grassland known to support a diverse invertebrate assemblage) due to be lost under the footprint of the development. In addition, only limited remediation work will be required in this area, largely comprising removal of remaining pipe-work and other small remnants of refinery infrastructure.
- 16.8.13 There will, however, be the potential for incidental mortality of reptiles during the site clearance and earthworks activities in the area due to be lost, as this is one of the more valuable parts of the site for reptiles.
- 16.8.14 In addition, the potential also exists for nesting birds to be disturbed in the vicinity of the works, and for localised impacts associated with dust deposition along the edge of the retained habitat as a result of earthwork operations. It is likely that the use of this part of the site by foraging bats will not be affected to a significant degree.

Zone 3 – Mosaic of Oak Woodland, Heathland, Scrub and Species-rich Grassland

- 16.8.15 Approximately 60% of this zone (largely comprising areas of scrub and species-rich grassland, but also an area of heathland) would unfortunately be lost under the footprint of the development. This would also have a knock-on effect on the valuable invertebrate, reptile and bird assemblages present, including a loss of habitat for several species identified as priorities on the UK and local BAPs. These impacts would be permanent.
- 16.8.16 The potential also exists for nesting birds to be disturbed in retained habitats in the vicinity of the works, and for localised impacts associated with dust deposition along the edge of the retained habitat as a result of earthwork operations.

Zone 4 - Mosaic of Oak/wet Woodland, Heathland, Scrub and Species-rich Grassland

- 16.8.17 Approximately 40% of this zone (largely comprising areas of wet woodland, species-rich grassland, but also an area of heathland) would be lost under the footprint of the development in this location, although approximately 10-20% of the area to be lost (in the vicinity of the former LPG plant) currently comprises hard standing. The habitat loss would be permanent, and would have a knock-on effect on the valuable lower plant, invertebrate, reptile and bird assemblages present, once again including some loss of habitat currently used by species identified as priorities on the UK and local BAPs. In addition, the proposed development works would also affect some of the features identified as most heavily used by foraging bats. It is unlikely that works in this zone would have a significant effect on badgers (nor would any significant impacts be anticipated elsewhere across the site).
- 16.8.18 Construction works in the wet areas at the bottom of the slope (that is, the western strip of this area) will be complicated by the presence of peat to a depth of approximately 10m, and could also have a hydrological impact on neighbouring retained areas of similar habitat.

- 16.8.19 The potential also exists for nesting birds to be disturbed in retained habitats in the vicinity of the works, and for localised impacts associated with dust deposition along the edge of the retained habitat as a result of earthwork operations.

Zone 5 – Great Crested Newt Pond and Foraging Habitat

- 16.8.20 Although a small proportion of the existing habitat within this zone could be retained within the landscape planting for this area of the site, it is likely that at least 90% of the zone would permanently be lost. This will include not only the existing pond, used as a breeding site by great crested newts, but also areas of heathland, scattered scrub and species-rich grassland in the vicinity of the pond that represent an important foraging area for the newts. The loss of the pond would also represent an adverse impact on the local populations of the RDB3 caddis fly and the Notable B dragonfly recorded during the aquatic invertebrate surveys.

- 16.8.21 Removal of the newt pond will be required for two reasons. Firstly, surrounding development will need to be preceded by an extensive remediation programme, which will generally involve the excavation of soils down to depth of several metres. These works are necessary for public health protection and will deal with the legacy of oil contamination in the southern tank farm area. The efficacy of works would be compromised if areas of the former tank farm (where the newt pond is located) were left unremediated. Secondly, alterations will be made throughout the area to facilitate drainage for the new development. Currently water levels in the pond are maintained through runoff from surrounding areas, but as the development advances the final ground profile would be flatter and surface water drainage measures would be in place around buildings and in roadways. The long-term viability of the pond would therefore be uncertain at best.

- 16.8.22 In addition, several of the features within this zone were used by breeding birds (including several species identified as priorities on national and local BAPs), and supported populations of reptiles. Development in this zone would therefore also represent a loss of habitat for these groups.

Other Areas of Scrubby Grassland and Other Regenerating Habitats Throughout the Refinery

- 16.8.23 The majority of the areas of regenerating scrub, grassland and ephemeral vegetation across the site would be lost under the footprint of the development. Furthermore, because of the post-industrial, contaminated nature of these areas, even those parts not due for development are likely to require extensive remediation that would require habitat clearance and soil stripping. Although these areas largely represent recently-disturbed, anthropogenic habitats, they have been identified during the surveys as being of some importance for their bird, reptile and invertebrate populations. Therefore, although the habitats themselves are of relatively limited intrinsic nature conservation value, the loss of such a large area of this habitat would clearly, without mitigation, lead to a reduction in the resources available to these species locally.

- 16.8.24 As well as the permanent impacts related to habitat loss, construction activities in these areas also have the potential to result in the incidental mortality of individual reptiles, not only directly, but also through indirect effects associated with elevated population levels in neighbouring habitats caused by reptiles escaping the construction site.

- 16.8.25 The potential also exists for nesting birds to be disturbed in any retained areas in the vicinity of the works. Development and remediation works in some of these other areas would affect parts of the site used by foraging and commuting bats; however,

most of the more heavily-used areas and habitat features would remain available to them.

Remaining Areas of Bare Ground, Hard Standing, Buildings and Contaminated Water Bodies within the Refinery Site

- 16.8.26 The effect of the proposals on wetland habitat will be highly beneficial. Large areas of new reedbed, ponds and other wetland habitat are to be created, both within the former containment area and the South Site Reservoir, and these will be of value to a wide variety of wetland species, including great crested newts, grass snakes and reed buntings.
- 16.8.27 While the Masterplan has been developed specifically to utilise these areas of lowest nature conservation value, a potential does exist for adverse impacts on reptiles and lapwings in these areas. Construction activities again have the potential to result in the incidental mortality of individual reptiles (as above), and mitigation measures will need to be applied through the development and implementation of an Environmental Management Plan (EMP) to minimise the likelihood of these impacts. See also proposed Mitigation Measures in Section 16.10 below.
- 16.8.28 The loss of these areas will also have an adverse effect on lapwings, which are known to nest on these habitats in certain parts of the site. Given that the D'Arcy site (where lapwings are also known to nest) is also to be lost, the effect of the development would represent a cumulative impact on lapwings in the local area. The potential also exists for other nesting birds to be disturbed in any retained areas in the vicinity of the works.
- 16.8.29 Development and remediation works in some of these areas would also affect parts of the site used by foraging and commuting bats; however, most of the more heavily-used areas and habitat features would remain available to them. Several structures occasionally used by bats as night feeding perches (such as electricity sub-stations) would also be lost, although this would not represent a significant impact.

Areas of Wet Woodland and Marshy Grassland within the Corridor of the Proposed Southern Access Route (outside of Crymlyn Bog SAC)

- 16.8.30 Any impacts on these habitats are likely to be indirect, as they are some distance from the line of the proposed Southern Access. The most important of these is likely to be potential effects on the hydrology of these habitats, as their value is linked to the drainage characteristics of the local area, which could be disrupted by construction of the road. Drying out of these features could lead to a reduction in their value for several species of conservation importance, including rare moths (such as the double line), grass snakes and wetland birds such as reed buntings.
- 16.8.31 The potential also exists for nesting birds to be disturbed in retained habitats in the vicinity of the works, and for localised impacts associated with dust deposition along the edge of the retained habitat as a result of earthwork operations.

Remaining Features within the Corridor of the Proposed Southern Access Route (mainly Improved, or Species-poor Semi-improved, Grassland)

- 16.8.32 Although these features are of relatively low intrinsic nature conservation value, their loss would represent a reduction in available foraging habitat for reptiles and badgers. As well as the permanent impacts related to habitat loss, construction activities in these areas also have the potential to result in the incidental mortality of individual reptiles, not only directly, but also through indirect effects associated with elevated

population levels in neighbouring habitats caused by reptiles escaping the construction site.

- 16.8.33 The road would also have an impact on the badger sett located within the small area of grazed Oak woodland, either directly as a result of land take, or indirectly through disturbance. Whichever is the case, the sett is certainly within 30 metres of the proposed centre line of the road, so any construction activities would have to take place under licence to CCW. Depending upon the scope of the works, the sett may have to be removed and an alternative artificial sett built nearby, within the territory of the resident social group.

Importation of soil

- 16.8.34 Although the levels of soil importation extrapolated in the Remediation Strategy (see Section 4) would result in a substantial increase in lorry journeys, it is not anticipated that this would have a significant impact on species of conservation importance, given that vehicle speeds will be carefully controlled (thus minimising the risk of vehicle strike for birds, etc.). It is not possible at this stage to assess the impacts on the donor sites, as it will be the responsibility of the individual Developers to resource this and to identify suitable locations. It will, however, be an important feature of the development code to ensure that soil is not sourced from habitats of nature conservation importance, and this will need to be undertaken in consultation with the statutory consultees. It is therefore anticipated that the extraction of soil from donor areas will not have a significant adverse ecological impact.

16.9 Predicted Impacts during Operation

Generic Issues

- 16.9.1 Predicted impacts during the operational phase of the development are likely to be relatively generic across the entire application area, and are not therefore considered here on an area-by-area or zone-by-zone basis.
- 16.9.2 As with the construction phase, the potential impacts associated with the operational phase of the scheme have been avoided and reduced as much as practicable through the master-planning process. In particular, the decision to identify many of the more ecologically important habitats as areas of restricted access (as part of the overall landscape strategy) will greatly minimise the extent to which the habitats are trampled and the resident species disturbed. In addition, the footpath network has also been designed to discourage access to the more valuable areas. This is set out in detail in Section 11 (Landscape and Visual), and is also summarised in Section 16.9.3, below.
- 16.9.3 The provision of such a large new residential development could lead to ecological impacts associated with an increase in recreational use of the area. These impacts are likely to include an increase in litter and trampling of some sensitive habitats, including the retained areas of Zones 1 to 4. The potential for impacting areas of the Bog will be minimised through enforcing restricted access along the Western Margin of the site and the area alongside the southern access viaduct.
- 16.9.4 There will also be an increase in the incidental mortality of birds, newts and reptiles as a result of road kill, predation by cats, and by drains acting as traps. Again, it is difficult to quantify the magnitude of these impacts, but it would be appropriate to adopt the precautionary principle and to minimise their effect through specific mitigation measures.

- 16.9.5 In terms of species, the group most likely to be affected during the operational phase of the development is the birds, for which the site currently represents a relatively large and undisturbed area of diverse habitat. However, given that the former use of the site was as an active oil refinery, and that the site has been subject to sporadic demolition activities during the decommissioning process, it is considered that disturbance of birds in this area has historically been high, and that there would not be a significant increase.

Crymlyn Bog SAC

- 16.9.6 The proposals for the Southern Access have taken potential ecological impacts into consideration, with the aim of minimising their likelihood and magnitude. Specific mitigation measures have been incorporated into the proposals, which would mitigate issues such as the release of pollutants (from vehicle accidents), litter, light-spill, drainage and car emissions. These are discussed in Sections 16.10.12 – 16.10.16 below.
- 16.9.7 Whilst the potential exists for there to be shading effects on the habitats beneath the viaduct, the height of the viaduct (between 7 and 8 metres) is such that this is unlikely to be an issue. Impacts on bats and birds are also unlikely to be significant, as they will continue to be able to forage and commute underneath the structure, and will be unlikely to be at risk from vehicle strike.
- 16.9.8 Potential effects on the bog associated with the drainage system for the proposed Coed Darcy Urban Village are discussed in Section 15 Water Resources and Water Quality of the ES and hence are not dealt with in this section.

16.10 Proposed Mitigation Measures

- 16.10.1 The mitigation principles underpinning the redevelopment of the site are as follows:
- ❖ avoid impacts wherever possible;
 - ❖ where impacts are unavoidable then to seek to minimize them;
 - ❖ to attempt to ameliorate any remaining effects by *in-situ* enhancements of retained habitats and features; and
 - ❖ only when absolutely necessary, compensate for unavoidable losses by off-site habitat creation or enhancement.
- 16.10.2 As described in Section 16.7.1, above, impacts have been avoided to a great extent through the acknowledgement and incorporation of ecological constraints into the master-planning process. This has included providing ecological input to the development of the RAP, the remediation strategy ⁽⁸⁾, the landscape strategy, the Crymlyn Bog crossing, the overall site drainage scheme, and the long-term protection and enhancement of retained areas within the application boundary. All of these are considered in more detail below, along with species-specific mitigation measures designed to further minimise impacts.

Ecological Input to the RAP and the Remediation Strategy

- 16.10.3 The Remedial Action Plan (RAP) (see Appendix 4.C) has been developed with the objective of setting out a strategy for the protection of off-site receptors (particularly Crymlyn Bog) from potential risks resulting from on-site contamination. It thus relates largely to the periphery of the application area, focussing on the Western

Margin/Crymlyn Bog, the Containment Area, the North and South Site Reservoirs, the Southern Margin, Llandarcy Bog and the Neath Valley to the east (see Section 4 for details). This process is a statutory action, and would need to take place with or without the re-development of the refinery site.

- 16.10.4 In contrast, the Remediation Strategy ⁽⁸⁾ has been developed to deal with on-site contamination issues, specifically because this area is now proposed for mixed-use development, including a significant component of residential end-use.

- 16.10.5 In summary, the RAP aims to minimise impacts on non-human receptors off-site, whilst the site-wide Remediation Strategy addresses the future use of the application area as an Urban Village. The Remediation Strategy and the RAP are thus complementary, and both have the potential to have adverse and beneficial effects on ecology (although the adverse effects are generally short-term, while the benefits are long-term). Both will be further developed and implemented in consultation with the EA, CCW and Neath Port Talbot County Borough Council, with a view to minimising the adverse impacts and maximising the opportunities for ecological enhancement.

Ecological Benefits Associated with the RAP

- 16.10.6 Protection and enhancement of the Crymlyn Bog SAC, and related habitats, is one of the over-riding principles of mitigation associated with the re-development scheme. This has required, and will continue to require, close and continuing collaboration between the ecological advisors and statutory and non-statutory consultees, and those responsible for re-development master-planning, hydrological investigations, remediation proposals and drainage solutions.

- 16.10.7 The RAP for the site has primarily been developed in order to ensure that the SAC and other sensitive environmental receptors near to the site (including the Neath Valley/River and Llandarcy Bog to the south and east of the site) are protected from potential contamination. However, the RAP also provides the potential for a more proactive, positive approach, involving active habitat creation and enhancement for the benefit of biodiversity. As with the development of the Masterplan, therefore, ecological objectives have also been an important feature in the development of the RAP, and it has effectively been used as an opportunity to provide off-site mitigation for the scheme in areas otherwise outside the application boundary.

- 16.10.8 For example, the South Site Reservoir (in the north-western corner of the site) is to be converted into a valuable wetland habitat that will also serve as an attenuation lagoon as part of the new Sustainable Drainage System (SDS) for Coed Darcy Urban Village. Similarly, the long interception trench at the base of the western margin of the site, extending from the South Site Reservoir to the western tip of the Containment Area, will also be designed specifically to maximise its wetland biodiversity. Water from the trench will discharge to a linear reedbed, from which there will be a diffuse discharge to the Bog. For both ecological and Health & Safety reasons, access to this area will be severely restricted through landscape planting (see below), thus protecting it from disturbance during the operational phase of the development.

Remediation Strategy

- 16.10.9 The potential for ecological impacts as a result of remediation works has been carefully considered. Proposals aim to reduce any unnecessary loss of valuable habitats and species. Most significantly, a strategy of restricted access (see Section 11: Landscape) has been adopted in many areas where there is a combination of relatively low contamination and relatively high value habitat, thus allowing such

features to be retained without there being a risk to public health. This will mean that significantly less habitat will be lost as a result of the re-development of the site.

- 16.10.10 The installation of new trenches and wells across the site as part of the remediation process also has the potential to lead to the incidental mortality of great crested newts, along with other amphibians and reptiles. These structures will therefore be designed in such a way that they do not act as traps for these species.
- 16.10.11 Finally, in places, remediation will simply be achieved through the creation of ponds with associated reedbeds, into which contamination from the surrounding area will be drawn and then bio-remediated. These features will be designed specifically with a view to enhancing their value for wetland biodiversity.

Crymlyn Bog Crossing

- 16.10.12 The form of the viaduct for the Crymlyn Bog crossing, and the proposed construction methodology, have been designed specifically to minimise all significant ecological impacts. In particular, a method has been developed that will avoid alterations to the hydrology of the surrounding parts of Crymlyn Bog, through the use of piles that will inhibit the formation of new flow-paths. In addition, careful measures will be implemented to ensure that potential impacts on the neighbouring habitat during the construction process (for example, through sedimentation, pollution and disturbance) will be avoided. These measures (including sediment traps, oil interceptors, etc.) are explained in detail in Section 4, and are not therefore repeated here. However, it will also be necessary to employ measures to protect reptiles and amphibians during the construction operations, and to minimise disturbance effects on nesting birds (see species-specific mitigation in Section 16.10.42 to 16.10.45, below, for details). These measures will all be implemented through the Environmental Management Plan (EMP) for the scheme (see Section 16.10.54, below).
- 16.10.13 With regard to the operational phase of the development, the drainage system for the viaduct has been designed specifically to ensure that water quality is not affected, with run-off designed to drain away from the Bog and to be treated *ex-situ* (see Sections 4 and 15 for details). Furthermore, the sides of the viaduct will include a footpath/cycleway sloping towards the kerbline, an edge parapet approximately 75mm higher than the footway, and a mesh incorporated in the safety barrier. Detailed design of the crossing will also consider options to minimise the risk to of vehicles accidentally falling into the above.
- 16.10.14 These measures will minimise the risk of pollutants being released into the Bog and will also serve to minimise the likelihood of litter dropping into the Bog from the viaduct. The removal of litter from the viaduct and its surroundings will be an important element of the long-term management of the operation of the crossing.
- 16.10.15 Given that car emission levels will be below the accepted limits for human health and the protection of ecosystems (see Section 9: Air Quality), and that the viaduct will be raised high above the Bog (with the resultant dilution and dispersal effect), it is anticipated that there will be no significant adverse effects on the Bog from air pollution. Furthermore, the planting of hedgerows alongside the Southern Access will further minimise any potential effects of air pollution on neighbouring habitats. As noted in Section 9, predicted NO_x levels with the Southern Access in operation at the Crymlyn Bog are below the current UK annual of objective of 30µg/m³.
- 16.10.16 The height of the viaduct is such that impacts on bats and birds are unlikely to be significant, as they will continue to be able to forage and commute underneath the structure, and will be unlikely to be at risk from vehicle strike. Furthermore, the

crossing will deliberately not be lit, so that potential impacts on foraging bats, particularly those species that tend to avoid light (such as horseshoe and long-eared bats) will be avoided.

Ecological Input to the Landscape Strategy

- 16.10.17 In addition to the use of detailed ecological information in the masterplanning and RAP/remediation processes, ecological and biodiversity objectives have also played an important part in the development of the Landscape Strategy (see Section 11 for details).

Habitat Retention/creation

- 16.10.18 In particular, existing woodland and scrub will be retained wherever possible (i.e. where remediation will not require their clearance), and these woodland blocks will be linked by new planting on remediated areas. Where possible, new planting will comprise native species of local provenance, although planting schemes nearer to the centre of the development (i.e. in more urban areas) may involve ornamental species.
- 16.10.19 As part of this process, a 'green corridor' will be created across the central part of the site (see Figure 11.10), linking the woodland hillside to the east with Crymlyn Bog to the west, thus contributing to the ecological sustainability of the development. Features of particular value to invertebrates, newts, reptiles, nesting and foraging birds, and foraging bats will be incorporated into the detailed design of this corridor, which will be developed in consultation with CCW.
- 16.10.20 In addition, the wetland attenuation features required to service the drainage of the site will be designed to enhance their value for wildlife. On the site of the former tip, in particular, South Bay will be enlarged at an early stage of the development to take water from the new residential areas associated with Phase 2. In conjunction with this, new newt breeding ponds (and neighbouring foraging habitat) will be created, probably in association with the Lagoon at the western end of this area (see Section 16.10.34 to 16.10.38 for more details). Consideration will also be given to planting appropriate woody species with a view to creating wet woodland in the longer term.
- 16.10.21 All design of these features will be undertaken in consultation with CCW and the Local Authority Ecologist, to ensure that features of particular value for nature conservation are included, thus contributing to local biodiversity initiatives and targets. In order to screen this new wetland area from the rest of the site, and provide habitat enhancement for bats and birds, the belt of trees along the eastern edge of the tip will be retained and strengthened.
- 16.10.22 Any other areas of habitat across the site that do not require remediation will be retained, wherever possible, to ensure that relatively mature habitats are present throughout the development area. Where areas containing such habitats will need to be treated through the remediation process, but will nevertheless remain part of the landscaping for the site (for example, the green corridor and the area of grassland directly east of the railhead), the replacement habitats will be created specifically to optimise their value for invertebrates, reptiles, newts, birds and bats.

Restriction of Access

- 16.10.23 In order to minimise the potential impacts of human disturbance during the operational phase of the development, particularly on the Bog but also in other valuable retained habitats (especially those within Zones 1 to 5), landscape planting