

## **Appendix 6.2 Phase 1 Ecological Mitigation Strategy**

BARRY WATERFRONT CONSORTIUM

**THE QUAYS – DEVELOPMENT PHASE 1**

**ECOLOGICAL MITIGATION STRATEGY**

13 JULY 2012



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BARRY WATERFRONT CONSORTIUM

THE QUAYS – DEVELOPMENT PHASE 1

ECOLOGICAL MITIGATION STRATEGY

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Issue	Revision	Stage	Date	Prepared by	Approved by	Signed
A		Planning	21 December 2011	Annabelle Phillips	Dr Matthew Watts (Director)	
B	Revision to boundary of Phase 1	Planning	28 February 2012	Annabelle Phillips	Dr Matthew Watts (Director)	
C	Revision to Figure 1	Planning	12 April 2012	Annabelle Phillips	Dr Matthew Watts (Director)	
D	Minor amendments following feedback from Vale of Glamorgan Council Ecologist	Planning	13 July 2012	Annabelle Phillips	Dr Matthew Watts (Director)	

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## 1.0 INTRODUCTION

- 1.1 Soltys Brewster Ecology were commissioned to devise an ecological mitigation strategy for Phase 1 of the development of The Quays in Barry. The Quays development is spread over approximately 41ha of land located around the former docks area of Barry Waterfront. Construction at the site is to be undertaken through a series of phases, with Phase 1 due to begin in summer 2012 in the area known as West Pond (see location and phasing plans in Appendix I).
- 1.2 The area associated with Phase 1 currently comprises of a mosaic of habitats dominated by neutral grassland, early successional and ruderal vegetation, scrub and bare ground which support a variety of bird, bat and invertebrate species.
- 1.3 The extensive scale of the works within the application boundary and the requirement to surcharge all areas of the site constrains the possibility of retaining existing habitats and features at ground level. Mitigation has therefore focussed on the protection of adjoining habitats/features and maximising the biodiversity value of new planting/open space, with provision of specific on-site mitigation measures for existing species/ features of value.
- 1.4 A number of planning conditions are of relevance to the ecological mitigation to be implemented as part of the development. The full list of planning conditions relating to site ecology is included in Appendix II, with those of particular relevance to the Mitigation Strategy detailed below:

### Full conditions

- 7 *No development shall commence until such time as a detailed scheme for the provision of the proposed habitat mitigation / creation shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme.*
- 8 *Before the commencement of development a detailed mitigation statement and translocation methodology (including assessment of any proposed receptor site and measures to increase carrying capacity) shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme, unless any variations are agreed in writing with the Local Planning Authority.*
- 9 *No development shall commence until a survey of the site for badgers has been undertaken and prepared by competent persons with suitable qualifications, licenses and experience, and a report submitted to and approved in writing with the Local Planning Authority. The timing of the survey shall be appropriate to*

*confirm the absence of badgers from the site immediately prior to work commencing and to ensure that it is undertaken using nationally recognised survey guidelines / methods where available and working to best practice standards.*

- 10 *Any vegetation clearance across the site shall be undertaken outside the nesting season, which is generally recognised to be from March to August inclusive, unless it can be demonstrated through submission to the Local Planning Authority of an appropriate survey immediately prior to works commencing that nesting birds are absent or a method statement for works is agreed in writing with the local planning authority and fully implemented prior to works commencing.*

Outline conditions

- 25 *Before the commencement of any construction works on the first of any building approved in each phase of the development site a detailed scheme for the provision of the proposed habitat mitigation / creation relating to that phase, shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme.*

- 31 *Any vegetation clearance across the site shall be undertaken outside the nesting season, which is generally recognised to be from March to August inclusive, unless it can be demonstrated through submission to the Local Planning Authority of an appropriate survey immediately prior to works commencing that nesting birds are absent or a method statement for works is agreed in writing with the Local Planning Authority and fully implemented prior to works commencing.*

- 1.5 The purpose of this document is to set out a strategy for the provision of the proposed habitat mitigation/creation relating to Phase 1 of the development which is programmed to start with site clearance/surcharging from summer 2012.

## 2.0 SUMMARY OF BASELINE CONDITIONS – ENTIRE SITE

2.1. The ecological baseline conditions at the site were established by a combination of desk study and field surveys undertaken in 2008 and 2009. The existing ecological resource across the entire site is dominated by unmanaged neutral grassland, early successional and ruderal vegetation and scrub. Further description of the existing site conditions can be found in the following sections and in The Extended Phase 1 Habitat Survey Report (SBE, 2008), Phase 2 Survey Summary Report (SBE, 2009) and the Ecology Chapter of the Barry Waterfront Environmental Statement (NLP, 2009).

### Habitats and Vegetation communities

#### *Grassland*

2.2. The extent of grassland habitat at the site established during the Extended Phase 1 Habitat Survey is shown by means of maps and Target Notes in Appendix III. Subsequent mapping of grassland communities using the National Vegetation Classification (NVC) identified most of the semi-improved grassland as one of two communities of neutral grassland (OV23c and OV23d), with calcareous grassland (CG3 community) restricted to the face of the limestone cliff overlooking South Quay.

2.3. A number of plant species of national or local rarity were recorded during the site surveys. These included Childing Pink *Petrorhagia nanteuilim* (a nationally rare plant, protected under the Wildlife and Countryside Act 1981 (as amended)), Corky Fruited Water- Dropwort *Oenanthe pimpinelloides* and Corn Parsley *Petroselinum segetum* (both locally rare). The Corky Fruited Water- Dropwort was found in grassland to the south of West Pond, with the Corn Parsley and Childing Pink at East Quay. The Childing Pink is located outside, but adjacent to the planning application boundary – no colonies of this species were noted within the application site.

2.4. The grassland communities, whilst of limited intrinsic diversity, do represent a notable ecological resource in terms of area coverage and there are no other comparable grassland habitats at a local geographical scale.

#### *Early successional vegetation*

2.5. The site includes extensive areas of early successional vegetation (classified as Ephemeral/short perennial in the Phase 1 Habitat Survey, Appendix III) across the site, especially in the South Quay area. Underlying substrates were variable, but were all freely draining, and on the whole comprised an irregular mixture of crushed hard materials (brick, concrete, pebbles etc.). This vegetation appeared to be the most diverse within the surveyed area, with a wide range of herbs, grasses and mosses present. East Quay also supported

an extensive area of Brownfield vegetation colonised over calcareous stone chippings, which appeared to be at least moderately diverse and supported notable plant species (see Section 2.3 above).

#### Scrub

2.6. Scrub was present across much of the site, mostly as scattered bushes in grassland and ephemeral vegetation (including Gorse *Ulex europaeus*, Buddleja *Buddleja davidii*, Bramble *Rubus fruticosus* and Hawthorn *Crataegus monogyna*). Dense stands of similar species were also present on banks and cliffs (e.g. in West Pond and South Quay) and along many of the existing and decommissioned railway lines. The scrub was generally considered to be of low botanical value, although it was considered to have potential to support nesting birds.

#### Scattered Trees

2.7. Few trees were present on the site and those that were present were either as a result of historical landscape planting or associated with the dense scrub areas. Tree species included Willow *Salix sp*, Maples *Acer sp* and Leyland Cypress *Cupressocyparis leylandii*. None of these trees were particularly large nor mature and were considered to be of negligible ecological value.

### Fauna

#### Amphibians

2.8. The presence of ephemeral standing water at West Pond was considered potentially suitable to support common amphibians such as Palmate Newt *Lissotriton helveticus* or Common Frog *Rana temporaria*. This water feature was not considered of particular potential for Great Crested Newts *Triturus cristatus* based on the known habitat preferences of the species and the presence of limiting factors such as little/no aquatic vegetation. Amphibian surveys found no evidence to suggest any amphibian species were present at the site.

#### Reptiles

2.9. Much of the site area was considered potentially capable of supporting reptile populations, particularly in the grassland and vegetated areas across South Quay, West Pond and East Quay. However, reptile surveys undertaken across the site in 2008 confirmed the presence of Slow Worms *Anguis fragilis* only within the area to the east of South Quay, along the base of the cliff and within the grounds of the former NERC building.

#### Bats

2.10. Bat surveys undertaken at the site identified no evidence that any building on site supported roosting bats and all buildings have since been demolished. Bat activity surveys revealed low levels of bat activity at the site, restricted to foraging along the linear scrub at West Pond, the foot of the cliff at South Quay and the lit footpath along the eastern boundary of West Pond. Bat activity was dominated by Common Pipistrelle



*Pipistrellus pipistrellus*, with occasional passes by Noctule *Nyctalus noctula* and Myotis *Myotis sp.* These linear features are likely to provide clear navigational features used by commuting bats moving to and from other local feeding sites.

#### Birds

2.11. The assemblage of birds noted during surveys undertaken at the site were generally typical of the habitats and included up to 44 species, although some species were only seen flying over the site or associated with the dock basin. It was considered likely that 20 of the species seen were breeding on the site and of these seven were of conservation significance (Dunnock *Prunella modularis*, Herring Gull *Larus argentatus*, Lesser Black Back Gull *Larus fuscus*, Song Thrush *Turdus philomelos*, Skylark *Alauda arvensis*, Meadow Pipit *Anthus pratensis* and Linnet *Carduelis cannabina*), namely listed on UKBAP/Section 42/ Birds of Conservation Concern in the UK (Eaton et al., 2009).

#### Invertebrates

2.12. A broad range of invertebrates were recorded on the site, most of which are common and ubiquitous although 11 were of some conservation status and 13 were considered locally or regionally uncommon. The areas and habitats considered to have the highest value to invertebrates on the site include the base of the cliff in South Quay, the pond area in West Pond, the herb-rich grasslands in the northern part of East Quay and the grassland margins across the site as a whole.

#### Badgers

2.13. The Extended Phase 1 Habitat survey identified some evidence of the possible presence of Badgers *Meles meles* in parts of East Quay. However subsequent inspection found that the excavations present on site were unlikely to be suitable for use by Badgers, although it is possible that badgers may have foraged in the area in the past leaving some evidence of their presence. No field signs associated with badgers were recorded in any of the other areas surveyed and a site walkover survey of West Pond undertaken in December 2011 identified no evidence of use of the site by Badgers<sup>1</sup>.

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<sup>1</sup> In line with Full Planning Condition 9 and Outline Condition 31 a Badger survey at West Pond would be undertaken from May 2012, prior to the commencement of surcharging works.

### 3.0 MITIGATION OVERVIEW – ENTIRE SITE

3.1 This section provides an overview of the mitigation measures which will be implemented across the whole site. The ecological mitigation strategy developed for the whole site is illustrated in Figure 1 and was devised as part of the submitted impact assessment (Environmental Statement) in 2009. Prior to each phase of development an Ecological Mitigation Strategy will be produced with specification for the mitigation measures to be provided as part of the relevant phase. More detailed description of the mitigation measures to be provided during Phase 1 of the development can be found below in Sections 5 and 6. Indicative specifications for South Quay and East Quay are included in *The Quays – Whole Site Ecological Mitigation Strategy (SBE, 2012)*, with more detailed specification dependent upon final site layout and timing of works.

3.2 In identifying the type and extent of mitigation through the site clearance, construction and operation stages, consideration has been given to the extensive scale of the works within the application boundary and the requirement to surcharge all areas of the site – this latter activity in particular constraining the possibility of retaining existing habitats/features at ground level. Mitigation has therefore focussed on the protection of adjoining habitats/features, maximising the biodiversity value of new planting/open space and provision of specific on-site mitigation measures for existing species/ features of value.

3.3 The mitigation strategy developed for the entire site incorporates the following key features<sup>2</sup>:

- Retention of approximately 2500m<sup>2</sup> grassland areas for Skylark to the south of East Quay<sup>3</sup>;
- Design of Public Open Space in East Quay to provide grassland (incorporating Rough and Meadow Grassland) of potential value to Skylark (approximately 9500m<sup>2</sup>)<sup>4</sup>;
- Retention of approximately 6800m<sup>2</sup> of ABP land on East Quay to retain grassland habitat in-situ and provide potential resource to Skylark<sup>5</sup>;
- Provision of approximately 3500m<sup>2</sup> wildflower meadow as part of public open space at East Quay<sup>6</sup>;
- Creation of linear park swale and meadow strip habitat through West Pond;
- Public space including grass, bulb, herbaceous, trees and shrub species selected to be beneficial to biodiversity;
- Street tree network to contribute to foraging corridors for birds and bats;

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<sup>2</sup> Further design details over and above the masterplan submitted with the ES have resulted in the revision of areas of some features associated with the ecological mitigation. Figures submitted in ES are detailed below.

<sup>3</sup> 5300m<sup>2</sup> specified in ES

<sup>4</sup> 2200m<sup>2</sup> specified in ES

<sup>5</sup> 7100m<sup>2</sup> specified in ES

<sup>6</sup> 1000m<sup>2</sup> specified in ES

- Retention and protection of a strip at least 2m wide at the cliff base and face along the South Quay;
- Retention and protection of rare plant (Childing Pink) areas off site (East Quay) and translocation of species (Corky Fruited Water Dropwort and Corn Parsley if required);
- Provision of brown roofs on the District Centre in West Pond (approximately 2500 m<sup>2</sup> of habitat).
- Brownfield habitat to be provided (up to 3500m<sup>2</sup>) as part of green corridor around south-western periphery of site<sup>7</sup>. This provision would be at ground level with a scrub corridor/hedge border adjacent to the development.
- Translocation of reptiles from within the application boundary to a suitable offsite area
- Creation of 'green corridor' link between off-site railway scrub and the cliff corridor.
- Retention of the cliff top green space managed as wildlife gardens, allotments and open space.
- Up to 1:5<sup>8</sup> of the approximate 600 houses in South Quay to have bird boxes.
- Up to 300m<sup>2</sup> of thicket scrub in East Quay Park<sup>9</sup>.

3.4 Appropriate management of these features has been identified in a separate management plan (SBE, 2012a) to assist with the discharge of Outline Planning Condition 24 (for the full list of planning conditions relating to ecology see Appendix II).

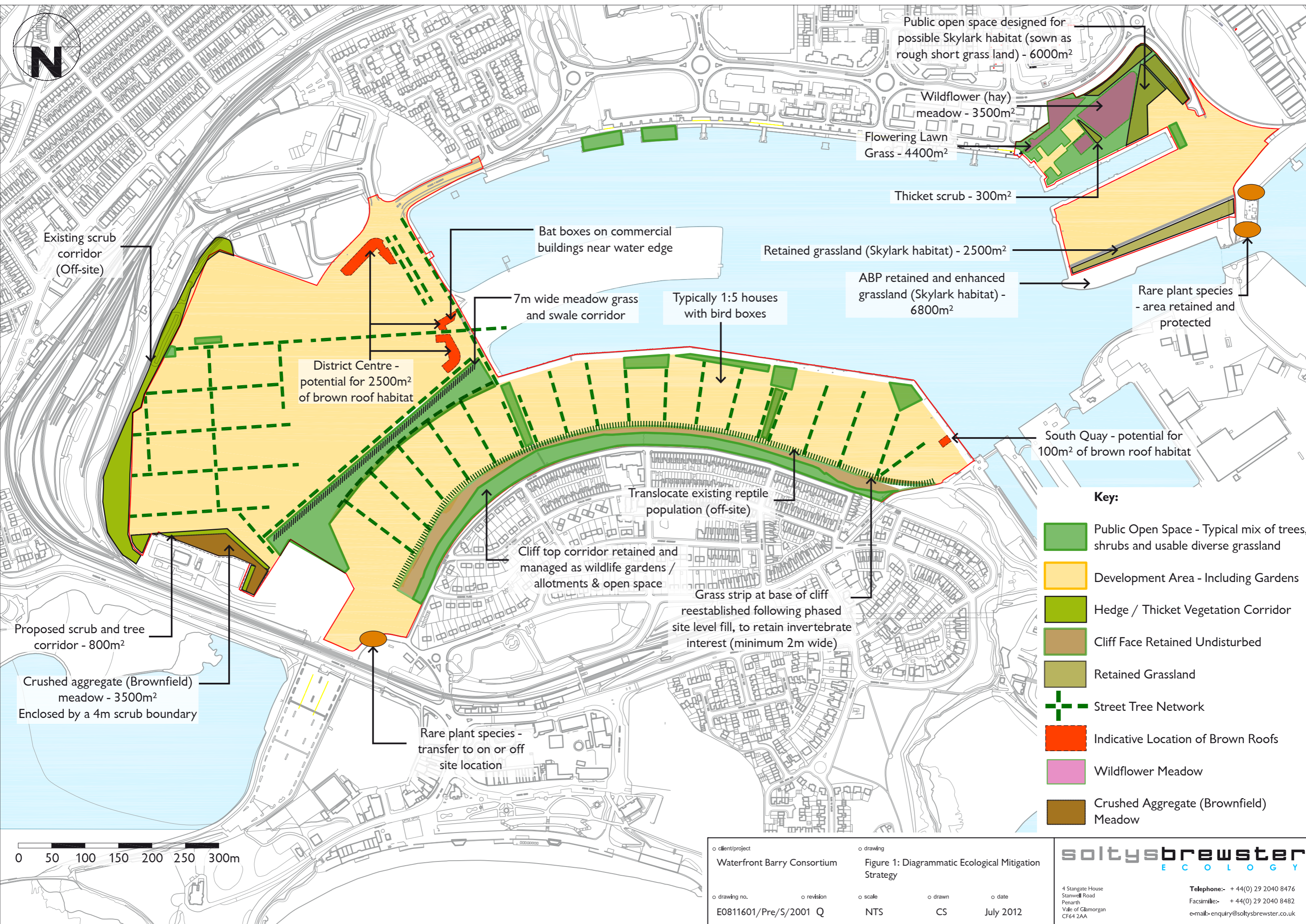
3.5 Separate mitigation strategies are being prepared for a number of species including reptiles, rare plants and invertebrates (see *Barry Waterfront - Invertebrate Management Plan* (SBE, 2012b)). These species have not been considered in detail within this document, although recommendations relating to these species have been made where appropriate. Additional surveys for the rare plants (Corky Fruited Water Dropwort, Childing Pink and Corn Parsley) are to be undertaken in summer 2012 to inform the preparation of an appropriate mitigation strategy which will be prepared prior to the commencement of the relevant phases of development.

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<sup>7</sup> 2000m<sup>2</sup> specified in ES

<sup>8</sup> Consultation with the Vale of Glamorgan post submission of the ES resulted in an increased provision of bird boxes – 1:10 provision was included in the submitted ES.

<sup>9</sup> 500m<sup>2</sup> specified in ES. Approximate total area of shrub planting in East Quay Park is 3200m<sup>2</sup>.



Public open space designed for possible Skylark habitat (sown as rough short grass land) - 6000m<sup>2</sup>

Wildflower (hay) meadow - 3500m<sup>2</sup>

Flowering Lawn Grass - 4400m<sup>2</sup>

Thicket scrub - 300m<sup>2</sup>

Retained grassland (Skylark habitat) - 2500m<sup>2</sup>

ABP retained and enhanced grassland (Skylark habitat) - 6800m<sup>2</sup>

Rare plant species - area retained and protected

South Quay - potential for 100m<sup>2</sup> of brown roof habitat

District Centre - potential for 2500m<sup>2</sup> of brown roof habitat

7m wide meadow grass and swale corridor

Typically 1:5 houses with bird boxes

Bat boxes on commercial buildings near water edge

Existing scrub corridor (Off-site)

Translocate existing reptile population (off-site)

Cliff top corridor retained and managed as wildlife gardens / allotments & open space










Grass strip at base of cliff reestablished following phased site level fill, to retain invertebrate interest (minimum 2m wide)

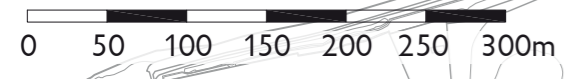
Rare plant species - transfer to on or off site location

Proposed scrub and tree corridor - 800m<sup>2</sup>

Crushed aggregate (Brownfield) meadow - 3500m<sup>2</sup> Enclosed by a 4m scrub boundary

**Key:**

-  Public Open Space - Typical mix of trees, shrubs and usable diverse grassland
-  Development Area - Including Gardens
-  Hedge / Thicket Vegetation Corridor
-  Cliff Face Retained Undisturbed
-  Retained Grassland
-  Street Tree Network
-  Indicative Location of Brown Roofs
-  Wildflower Meadow
-  Crushed Aggregate (Brownfield) Meadow



o client/project	Waterfront Barry Consortium	o drawing	Figure 1: Diagrammatic Ecological Mitigation Strategy		
o drawing no.	E0811601/Pre/S/2001 Q	o scale	NTS	o drawn	CS
o revision		o date	July 2012		

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## 4.0 SUMMARY OF BASELINE CONDITIONS - DEVELOPMENT PHASE 1

4.1 The area associated with Phase 1 of the development is dominated by semi-improved neutral grassland with early successional and tall ruderal vegetation, scrub and areas of bare ground.

### Habitats and vegetation communities

#### Grassland

4.2 The West Pond area was typically dominated by unmanaged neutral grassland, with grass species dominating the sward (80%+ cover). Prominent grasses included Creeping Bent *Agrostis stolonifera* and Red Fescue *Festuca rubra*, with less frequent associates including Yorkshire-fog *Holcus lanatus*, Common Bent *A. capillaris* and Cock's-foot *Dactylis glomerata*.

4.3 The extensive areas of grassland in West Pond were considered to have low intrinsic botanical interest, although were considered of interest due to their extensive nature.

#### Early successional vegetation

4.4 There were large areas of early successional vegetation in the West Pond area, with a wide range of herbs, grasses and mosses present at generally between 30% and 70% cover. Species present included herbs such as Hoary Mustard *Hirschfeldia incana*, Canadian Fleabane *Conyza canadensis*, Black Medic *Medicago lupulina*, Tall Melilot *Melilotus altissimus* and Great Lettuce *Lactuca vireola*.

#### Scrub

4.5 Scattered scrub was noted across the West Pond area and was generally dominated by Bramble, Gorse and Buddleja. Dense scrub was limited to the off-site areas along the western and northern boundaries, with a narrow corridor extending into the site from the western boundary.

#### Pond

4.6 An area of shallow standing water was found at the foot of spoil heaps in the West Pond area. The pond was considered likely to be ephemeral in nature, although the vegetation present suggested that the ground remains damp year round. Species present included small stands of Sea Club-rush *Bolboschoenus maritimus*, Reedmace *Thypha latifolia* and Hard Rush *Juncus inflexus*.

## Fauna

### Amphibians

- 4.7 Surveys of the shallow pond/ scrape within West Pond found no evidence that the site supports any amphibian species.

### Reptiles

- 4.8 Reptile surveys undertaken in 2008 found no evidence to suggest any species of common reptile are currently using the West Pond area of the site, with the population of Slow Worm restricted to the eastern end of South Quay.

### Bats

- 4.9 Bat activity surveys undertaken at the site identified a small number of Common Pipistrelle, Noctule and Myotis species commuting and foraging in the West Pond area. Activity was generally dominated by Common Pipistrelle and limited to linear features such as the site boundaries and scrub corridors.
- 4.10 Surveys of all buildings which previously occupied the site found no evidence to suggest the site supported roosting bats. These buildings have since been demolished and no other features on site were identified as having potential to support roosting bats.

### Birds

- 4.11 A variety of bird species were recorded across the area associated with Phase 1 of the development. Those of conservation significance include Dunnock, Herring Gull, Lesser Black Back Gull, Song Thrush, Skylark, Meadow Pipit and Linnet.
- 4.12 Other species of note seen during the bird surveys in this area included Short-eared Owl *Asio flammeus*, Eurasian Hobby *Falco subbuteo*, Black Redstart *Phoenicurus ochruros*, and Curlew *Numenius arquata*, none of which were considered to be resident on the site.

### Invertebrates

- 4.13 The main invertebrate interest in the West Pond area is associated with the shallow pond. Several species of Odonata (dragonflies and damselflies) occurred around the pond. Dragonfly species included Emperor *Anax imperator*, Common Darter *Sympetrum striolatum*, Broad-bodied Chaser *Libellula depressa*, Black-tailed Skimmer *Orthetrum cancellatum* and Golden-ringed Dragonfly *Cordulegaster boltonii*. Damselfly species included Azure *Coenagrion puella*, Blue-tailed *Ischnura elegans* and Large Red *Pyrrhosoma nymphula*.

- 4.14 A single Dingy Skipper *Erynnis tages* (a BAP priority species) was recorded in the grassland in the area, with several other species of butterfly recorded along the scrub at the site boundaries.
- 4.15 The grasslands supported the Nationally Notable 'B' species (recorded in 36-100 10km squares in the UK) *Oxystoma cerdo* (a weevil). They also support three species of Orthoptera (Long-winged Conehead *Conocephalus discolor*, Speckled Bush-cricket *Leptophytes punctatissima* and Mottled Grasshopper *Myrmeleotettix maculates*) that feature in the South Wales SINC guidelines (SWWSP, 2004 and Clements and Pryce, 2000) and several species from other groups that are considered local or regionally uncommon.

#### *Badger*

- 4.16 No evidence of Badger or use of the site by Badger has been identified during any of the surveys undertaken in the West Pond area of the site.

## 5.0 MITIGATION AND HABITAT CREATION - DEVELOPMENT PHASE 1

5.1 The habitat mitigation and creation associated with Phase 1 of the development is detailed below, with further detail on the specification of habitat creation provided in the following drawings and documents:

Ecological Mitigation: Street Tree Network	0833103/PI/GA/065
Ecological Mitigation: Brownfield Meadow and Pond	0833103/PI/GA/066
Ecological Mitigation: Linear Park and Swale	0833103/PI/GA/067
Invertebrate Management Plan	E0811601/ R08

### *Protection of offsite habitats/ existing scrub corridor*

5.2 Prior to the commencement of works at the site, the boundary of the site is to be clearly demarcated using appropriate fencing (Heras or similar) to prevent encroachment onto adjacent areas and ensure protection of the off-site scrub along the western and northern boundaries.

5.3 The boundary of any other areas of the site to be used for any purpose associated with Phase 1 of the development (e.g. for the stockpiling of material, storage, vehicular access etc) should also be clearly demarcated and activities should not be undertaken outside these areas. No work should be undertaken in any area of South Quay due to the existing reptile population in this location (South Quay Parkside may be used for storage of material etc – reptiles are not associated with this location (see location plan in Appendix I)). The area which supports a population of Corky Fruited Water Dropwort (south of West Pond) should be fenced out during all works to prevent encroachment/ damage in this area. A strip at least 3m wide along the base of the cliff should also be protected from all works and should be demarcated via red and white tape (or similar).

### *Badgers*

5.4 Site surveys including a site walk-over undertaken in December 2011 found no evidence to suggest Badgers are currently using the area of the site associated with Phase 1 of the development. However as a precautionary measure a dedicated badger survey will be undertaken within 4 weeks of the commencement of any works at the site (survey to be undertaken from May 2012). The results of the survey will be submitted for approval to the local planning authority to assist with discharge of Full Condition 9 and Outline Condition 31.

### *Nesting birds*

5.5 To reduce the suitability of the habitat for ground and scrub nesting bird species all existing vegetation within the boundary of Phase 1 (and any other area to be affected by works within Phase 1) should be cut to



ground level in January/ February 2012 (prior to the bird nesting season which typically runs from March to August inclusive). All arisings should be removed. Following the initial cut subsequent maintenance cutting of the vegetation should be undertaken every 2 – 3 weeks between September and February to maintain vegetation height at 50 – 100mm, or until the area has been surcharged.

- 5.6 No cutting should be undertaken in the area associated with the population of Corky Fruited Water Dropwort (south of West Pond), or along the base of the cliff (a strip at least 3m wide should be retained, protected and demarcated via red and white tape or similar).
- 5.7 Provision for nesting birds (bird boxes and retained areas for ground nesting species) are to be included in subsequent phases of the development (South and East Quay) and will be detailed in the mitigation plan produced prior to the commencement of the appropriate phase (for indicative specifications see *The Quays Whole Site Mitigation Strategy* (SBE, 2012)). The retained scrub along the eastern and northern boundaries is likely to provide continued resource for scrub nesting species, along with additional scrub and tree planting in the proposed soft landscaping.

#### *Pond*

- 5.8 Prior to the commencement of surcharging works at the site a shallow pond is to be created within the area identified for the brownfield meadow (see drawing number 0833103/PL/GA/066 - Ecological Mitigation: Brownfield Meadow and Pond). The pond is to be approximately 80m<sup>2</sup>, gently sloping to a maximum water depth of 500mm. The pond should be excavated using a toothed bucket to a depth of 700mm and lined with compacted clay (approx. depth of 200mm) to ensure it retains water. Following completion of the clay lining a toothed excavator bucket should be gently raked over any remaining smooth surfaces to roughen the substrate surface and provide habitat for plant colonisation. Care should be taken not to pierce the depth of the clay 'liner' during this process. In order to permit surcharging/in-filling of the existing pond from late autumn 2012, creation of the new pond in the brownfield meadow area would need to be programmed at the start of site works - i.e. from April/May 2012.
- 5.9 The pond should be allowed to fill naturally with rain water, or if filled artificially should be allowed to stand for a minimum of 14 days before introducing material from the existing pond. Material from the existing pond is to be dredged using an excavator with a straight edged (blade) bucket and immediately transferred to the newly created pond to transfer some of the existing interest and to help speed its establishment. Preferential timing for this operation would be in late summer/autumn 2012 so as to transfer eggs/larvae to the new pond, although transfer of material would need to be undertaken prior to any surcharging works in the area associated with the existing pond.

### Brownfield meadow

- 5.10 A brownfield meadow is to be created across an area of approximately 3500m<sup>2</sup> to the south of Phase 1 (see drawing number 0833103/PI/GA/066 - Ecological Mitigation: Brownfield Meadow and Pond). The substrate for the meadow should include a mixture of crushed aggregate (from the site where possible) and 'clean', free draining subsoil (free of contaminants – i.e. sourced from off-site) and is intended to replicate existing habitat conditions found across much of the site. The pH of any imported aggregate should be neutral to slightly basic (ie pH 7-8) and the grain range of between 25mm to dust. The meadow area is to include a number of gently sloping substrate mounds (approximately 1m high) with stone and log piles to increase habitat diversity. The substrate will be sown in Autumn 2012 or Spring 2013 (timing dependent upon completion of sewer which is to run beneath the brownfield meadow) with Emorsgate EM1Basic General Purpose Meadow Mixture (a native grass and wildflower seed mix). Sowing should not be undertaken during freezing conditions, or when the ground is waterlogged. A variety of plant species are also likely to naturally colonise the meadow via wind blown seed from other grassland habitats in the surrounding area. The brownfield meadow should be surveyed by a suitably qualified ecologist between July and September in the year following sowing. If a strong sward has failed to establish, further seed may need to be introduced. If required further seed will be collected from the species-rich grasslands at East Quay using a brush harvester (or similar method) and scattered across the brownfield meadow.
- 5.11 Log piles should be approximately 1.5m x 1m x 1m and should be constructed using timber and brush of varying sizes. Stone piles should include stones and boulders of varying sizes. The overall dimension of the stone piles should be approximately 1.5m x 1m x 1m. Timber and stones/ boulders could be sourced from the site itself if appropriate resources exist (any scrub/ trees should not be cut down in the breeding bird season which typically runs from March- August inclusive).
- 5.12 The brownfield meadow and adjacent scrub corridor (see Section 5.13) should be fenced out during all site clearance/ construction works to prevent any damage occurring during construction across the rest of the site. Vehicles should not be tracked over the area and the area should not be used for storage or for any other purpose to prevent damage to the substrate/ compaction.

### Scrub corridor

- 5.13 A 4m wide scrub and tree corridor is to be planted around the northern boundary of the brownfield meadow area to buffer the meadow from the residential development and provide additional scrub habitat on site (see drawing number 0833103/PI/GA/066 - Ecological Mitigation: Brownfield Meadow and Pond). Species planted will include those found elsewhere on the site such as Hawthorn, supplemented with other native species to increase diversity such as Blackthorn *Prunus spinosa*, Dogwood *Cornus sanguinea*, Holly *Ilex aquifolium* and Hazel *Corylus avellana* with trees such as Field Maple *Acer campestre*, Alder *Alnus glutinosa*, Wild

Cherry *Prunus avium* and Crab Apple *Malus sylvestris*. The tree and scrub planting will link into other tree corridors to be planted across the site.

#### *Tree corridors*

5.14 The tree corridors are to be detailed as part of a future reserved matters application. Tree species will include native and ornamental species, (both flowering and fruiting varieties) appropriate to differing public realm locations. The trees corridors will be designed to contribute to overall biodiversity and provide a network of foraging and commuting habitats across the site for species such as birds and bats (see drawing number 0833103/PI/GA/065 - Ecological Mitigation: Street Tree Network).

#### *Linear park*

5.15 The linear park (see drawing number 0833103/PI/GA/067 - Ecological Mitigation: Linear Park and Swale), which includes a tree corridor, swale and meadow grass meadow planting, is likely to provide shelter and foraging habitat for a variety of species such as birds, bats and invertebrates and is designed to link in to other linear habitats across the site such as the tree corridors.

5.16 The meadow grassland will form a 3m wide strip running the length of the park and will be seeded with Emorsgate EM2 Standard General Purpose Meadow Mixture, with Emorsgate EC1 Standard Cornfield Mixture as a nurse Mix. Additional bulbs and seeding will be included for landscape display purposes, including: Bluebell *Hyacinthoides non-scripta*, increased Cowslip *Primula veris*, Snakeshead Fritillary *Fritillaria meleagris* and spring and autumn crocus. The swale strip is to be 4m wide and located directly adjacent to the meadow grassland strip. The swale is to be seeded with Emorsgate EM8 Meadow Mixture for Wetlands to create a diverse, flower rich sward, with additional planting in key areas. The swale and meadow strip should be surveyed by a suitably qualified in ecologist between July and September in the year following sowing. If a strong sward has failed to establish, further seed may need to be introduced. If required further seed will be collected from the species-rich grasslands at East Quay using a brush harvester (or similar method) and scattered across the area.

5.17 Emorsgate EL1 Flowering Lawn Mix will be used in amenity grassland areas within the linear park. This mix includes a variety of grasses and wildflowers that respond well to short mowing and will provide greater diversity than a standard amenity grass seed mix.

#### *Invertebrates*

5.18 The full mitigation strategy for terrestrial invertebrates is detailed in *Barry Waterfront – Invertebrate Management Plan* (SBE, 2012b).

- 5.19 Much of the invertebrate interest in the area to be developed during Phase 1 is associated with the existing shallow pond. A similar shallow pond is to be created in the brownfield meadow area to the south of the site (see 5.8 – 5.9). This pond is to be dug prior to the destruction of the existing pond and material from the existing pond is to be transferred to the newly created pond to help speed its establishment. It is likely this transfer of material will also include some of the invertebrate interest. Many of the species associated with the existing pond are known to be quick to colonise new water bodies and rapid colonisation of the new pond from other existing ponds in the surrounding area is considered likely.
- 5.20 Off-site scrub along the western and northern boundary supported a variety of butterfly species. This existing resource is to be retained and protected during all site clearance and construction work. Additional habitat will also be provided within the brownfield meadow and scrub corridor, and the meadow and swale planting associated with the linear park.

#### *Bat boxes*

- 5.21 Bat boxes are to be incorporated into the commercial buildings along the water's edge, the full details of which are to be dealt with as part of a future reserved matters application. It is recommended that boxes should be positioned at a height of at least 5m above the ground on both the eastern and southern elevation of the commercial buildings (see Figure 1), close to the water's edge and the linear park. Appropriate boxes would include those that can be incorporated into a building itself (e.g. bat bricks <http://www.ibstock.com/sustainability-ecozone.asp>) or bat boxes which can be affixed to the external walls (e.g. Schwegler 1FF Bat Box [http://www.alanaecology.com/wildlife/1FF\\_Bat\\_Box.html](http://www.alanaecology.com/wildlife/1FF_Bat_Box.html)). These boxes are long lasting and require no maintenance and would be considered appropriate for species such as Pipistrelle which have been recorded on the site.
- 5.22 Off-site scrub along the western and northern boundary of West Pond will provide continued foraging and commuting habitat, with the linear park, street tree network and scrub corridor proposals within the site all providing additional potential commuting and foraging habitat.
- 5.23 To prevent disturbance to light sensitive species site lighting is to be restricted to maintain 'dark corridors' wherever possible along features such as the retained scrub boundaries. A lighting design plan for the development has not yet been prepared, but where standard height street lighting is required adjacent to the retained habitats, directional or cowled lanterns should be adopted that limit light spill. Lantern design should be of high-pressure sodium type. Further advice on street lighting and bats can be found in Appendix IV.

### *Brown roofs*

5.24 Brown roofs are to be incorporated onto the district centre, the full details of which are to be dealt with as part of a future reserved matters application – these buildings are not within the control of the Development Consortium. It is recommended that a substrate of crushed aggregate and subsoil similar to that used to create the brownfield meadow is used. The substrate depth should vary across the roof to promote the development of habitat diversity. The substrate should be sown in spring or autumn with a native grass and wildflower seed mix such as Emorsgate EM1 Basic General Purpose Meadow Mixture.

### *Rare plants*

5.25 Corky Fruited Water Dropwort was identified to the south of West Pond and no works should be undertaken in this area until a survey to confirm likely presence/absence of the plant has been undertaken (survey to be undertaken in July 2012). The area should be clearly demarcated/fenced out to prevent accidental damage (tracking of vehicles, storage of materials etc.).

### *Reptiles*

5.26 Reptile surveys undertaken in 2008 confirmed the likely absence of reptiles from all land which falls into Phase 1 of the development, although a medium sized population of Slow Worm was identified at the eastern end of South Quay. It is considered unlikely that the reptile population would have spread into the West Pond area due the largely unsuitable nature of the habitat in between the existing population at South Quay (predominantly bare ground and ephemeral/ short perennial vegetation). Prior to the commencement of any works at South Quay (where a Slow Worm population has been confirmed) a detailed reptile translocation strategy will be prepared and agreed with the Local Authority. The translocation strategy will include an assessment of any proposed receptor site and appropriate measures to enhance the habitat for reptiles at the site.

5.27 To prevent the spread of reptiles to other areas of the site where they could be at risk of killing or injury a suitable fence is to be erected along the western boundary of South Quay in 2012, prior to the commencement of development at West Pond. A concrete fence (dug into the ground) currently exists along much of the western boundary of South Quay but does not extend the full length of the boundary, with open metal fencing at both ends. A reptile-proof fence should be constructed from the concrete fence to meet the cliff face along the southern boundary and the existing tarmac along the northern boundary. The fence should be constructed using timber board securely fixed to upright posts or to the existing metal fence. The board should extend at least 600mm above the ground and should be dug a minimum of 300mm into the ground. After being dug into the ground material should be backfilled into the hole and compacted as far as possible to ensure that no fissures or gaps are left in the backfill or against the board. No gaps should be

present along or underneath the fence, or where the board abuts the existing concrete fence. The fence should be regularly checked to ensure it remains intact, with any damaged sections immediately replaced or repaired (within 24- 48hrs).

## 6.0 PROGRAMME OF WORKS

6.1 The anticipated timing for the completion of features associated with the ecological mitigation within Phase 1 are detailed in Table 1. All timings are approximate only and may be subject to change, dependent upon progress of works on site.

**Table 1. Anticipated programme of work**

<b>Works</b>	<b>Anticipated timing</b>
Construction of temporary fence around Corky Fruited Water Dropwort and demarcation of retained strip along cliff base (minimum 3m wide) via red and white tape or similar. Erection of reptile proof fence along western boundary of South Quay.	June/ early July 2012
Construction of shallow pond and transfer of material from existing pond to newly created pond.	July/ August 2012
Creation of brownfield meadow substrate.	Summer/ Autumn 2012*
Sowing of brownfield meadow (Emorsgate EM1 Meadow Mixture).	Autumn 2012 or Spring 2013
Planting of scrub corridor around brownfield meadow.	October 2012 – March 2013*
Sowing of meadow strip and swale within the linear park.	September 2015 – January 2016

\* = timing dependent upon completion of sewer which is to run beneath the brownfield meadow area.

6.2 Following completion of the above works a site visit is to be undertaken a suitably qualified ecologist and (if required) the local authority ecologist to check the features have been completed to the required specification.

## REFERENCES

Clements, D K & Pryce, R D (2000) *Criteria for the Selection of Wildlife Sites in Gwent, Glamorgan and Carmarthenshire*. Gwent Wildlife Trust.

Eaton, M. A. Brown, A. F. Noble, D.G. Musgrove, A. J. Hearn, R. Aebischer, N. J. Gibbons, D.W. Evans, A. & Gregory, R.D. (2009) *Birds of Conservation Concern 3: The Population Status of Birds in the United Kingdom, Channel Islands and Isle of Man* British Birds 102: 296-341

Nathaniel Lichfield and Partners (NLP) (2009) *Barry Waterfront – Environmental Statement Chapter F – Ecology*.

Soltys Brewster Ecology (SBE) (2008) *Barry Waterfront – Ecological Appraisal*.

Soltys Brewster Ecology (SBE) (2009) *Barry Waterfront - Phase 2 Survey Summary Report*.

Soltys Brewster Ecology (SBE) (2012) *The Quays – Whole Site Ecological Mitigation Strategy*.

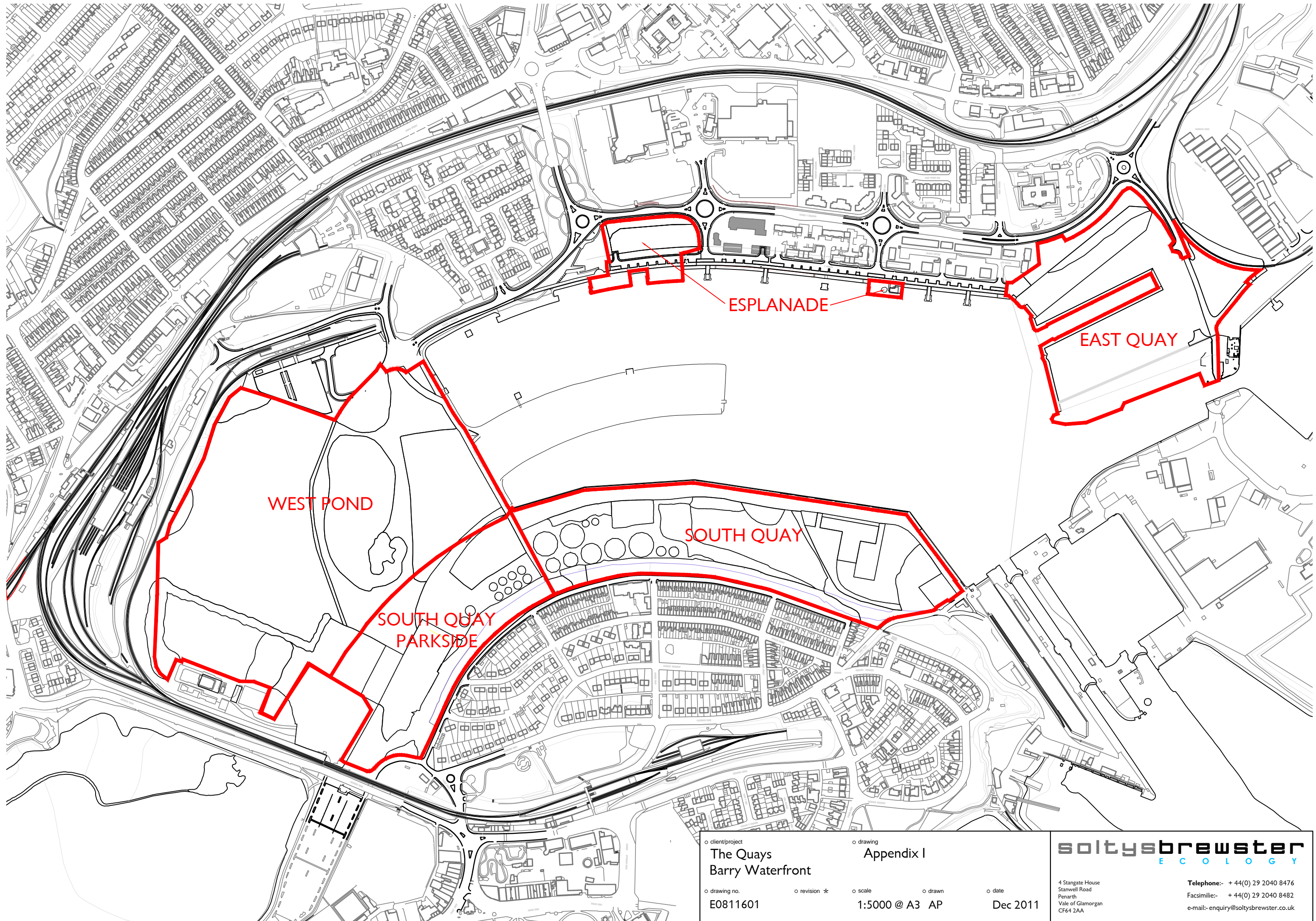
Soltys Brewster Ecology (SBE) (2012a) *The Quays – Ecological Management Plan*.

Soltys Brewster Ecology (SBE) (2012b) *The Quays - Invertebrate Management Plan*.

South Wales Wildlife Sites Partnership (SWWSP) (2004) *Guidelines for the Selection of Wildlife Sites in South Wales*. Gwent Wildlife Trust.



## APPENDIX I SITE LOCATION AND EXTENT OF PHASE 1 DEVELOPMENT



o client/project  
**The Quays  
Barry Waterfront**

o drawing no.  
**E0811601**

o drawing  
**Appendix I**

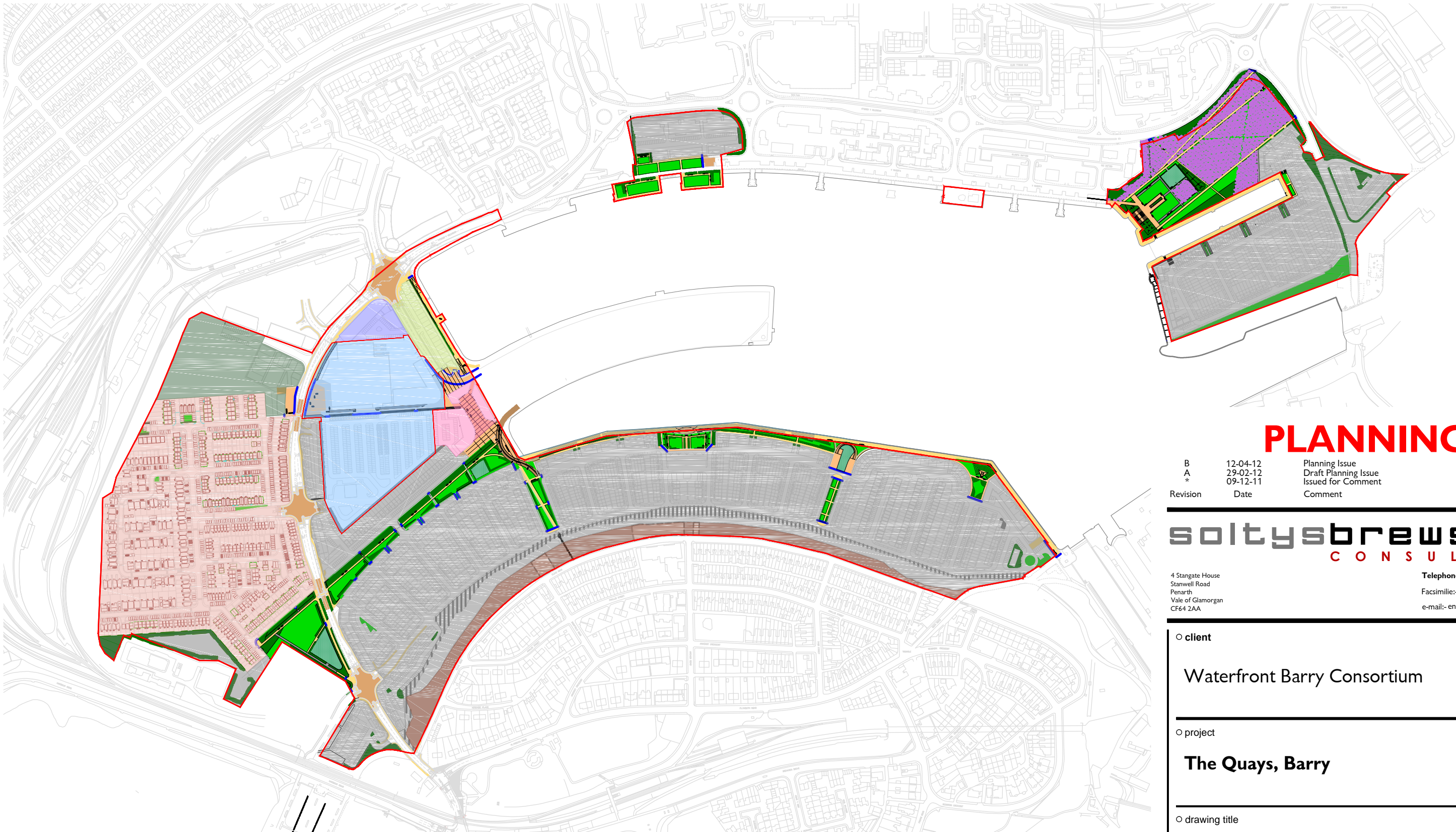
o revision \*  
o scale  
**1:5000 @ A3 AP**

o drawn  
o date  
**Dec 2011**

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# PLANNING

Revision	Date	Comment
B	12-04-12	Planning Issue
A	29-02-12	Draft Planning Issue
*	09-12-11	Issued for Comment

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○ client			
Waterfront Barry Consortium			
○ project			
The Quays, Barry			
○ drawing title			
Public Realm Extent			
○ scale	○ drawn	○ approved	○ date
1:5000 @ A3	CS	SB	April 2012
○ drawing no.			○ revision
0833103/PI/GA/064			B

### General Key:

	Public Realm (Including Link Road)		School Site
	Phase 1 Residential (West Pond)		Apartment Site (West Pond)
	Retail Site		Cliff Top Strip
	Waterside Retail and Commercial		Future, Principally Residential Development Phases (Arno Quay, South Quay, Park Side, East Quay)
	Hotel Site		

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## APPENDIX II PLANNING CONDITIONS RELATING TO SITE ECOLOGY

### Full Conditions

- 7 *No development shall commence until such time as a detailed scheme for the provision of the proposed habitat mitigation / creation shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme.*
- 8 *Before the commencement of development a detailed mitigation statement and translocation methodology (including assessment of any proposed receptor site and measures to increase carrying capacity) shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme, unless any variations are agreed in writing with the Local Planning Authority.*
- 9 *No development shall commence until a survey of the site for badgers has been undertaken and prepared by competent persons with suitable qualifications, licenses and experience, and a report submitted to and approved in writing with the Local Planning Authority. The timing of the survey shall be appropriate to confirm the absence of badgers from the site immediately prior to work commencing and to ensure that it is undertaken using nationally recognised survey guidelines / methods where available and working to best practice standards.*
- 10 *Any vegetation clearance across the site shall be undertaken outside the nesting season, which is generally recognised to be from March to August inclusive, unless it can be demonstrated through submission to the Local Planning Authority of an appropriate survey immediately prior to works commencing that nesting birds are absent or a method statement for works is agreed in writing with the local planning authority and fully implemented prior to works commencing.*

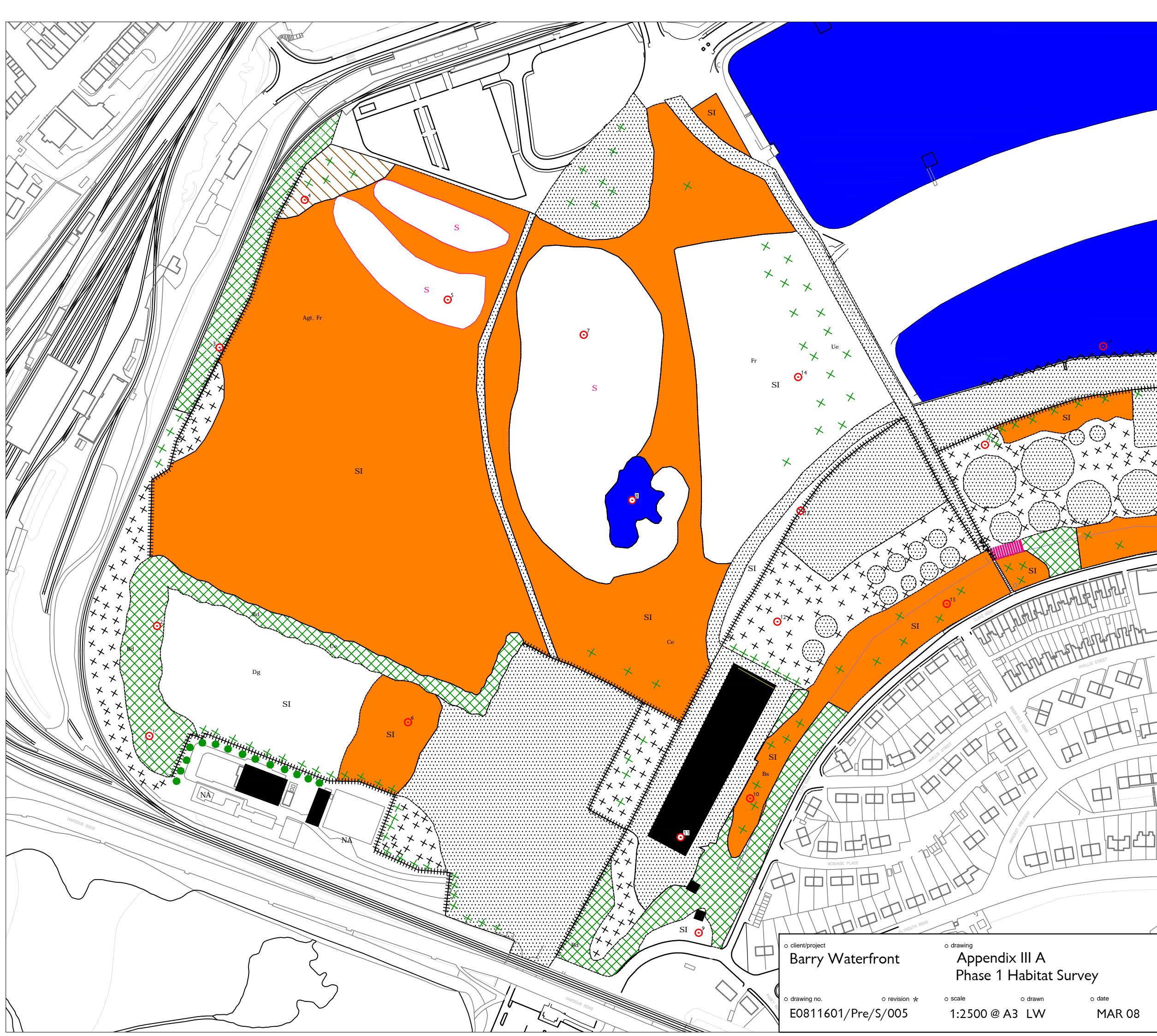
### Outline conditions

- 24 *Before the commencement of development a detailed and costed wholistic management plan and monitoring scheme for the biodiversity interests across the site, shall be submitted to and agreed in writing with the Local Planning Authority and this strategy shall be followed by a detailed and costed management plan for each phase of the development, prior to the commencement of any work on that phase. These phased plans shall provide for management responsibilities for a 20 year period and a monitoring scheme to include submission of a monitoring report and management review to the Local Planning Authority in years 2, 5, 10 and 20, and the agreed plan shall be implemented thereafter unless any variations are agreed in writing with the Local Planning Authority.*

- 25 *Before the commencement of any construction works on the first of any building approved in each phase of the development site a detailed scheme for the provision of the proposed habitat mitigation / creation relating to that phase, shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme.*
- 26 *Before the commencement of works on site full details of a scheme for the provision of artificial bird nesting sites, which shall equate to a minimum of one fifth of the total number of residential units to be developed across South Quay, shall be submitted to and approved in writing with the Local Planning Authority, and the development shall be implemented thereafter in accordance with the approved scheme, unless any variations are agreed in writing with the Local Planning Authority.*
- 27 *No development shall commence until full details of a clearance methodology and mitigation strategy for terrestrial invertebrates shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme, unless any variations are agreed in writing with the Local Planning Authority.*
- 28 *No development shall commence, on the relevant phases of development, until full details of a translocation method and management and monitoring scheme for *Oenanthe pimpinelloides* and *Petroselinum segetum* and protection of *Petrorhagia nanteuilim* shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme, unless any variations are agreed in writing with the Local Planning Authority.*
- 29 *No development shall commence until a detailed mitigation statement and translocation methodology for protected species of reptiles (including assessment of any proposed receptor site and measures to increase carrying capacity) shall be submitted to and approved in writing with the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme, unless any variations are agreed in writing with the Local Planning Authority.*
- 30 *Prior to the construction of any buildings on site, full details of a scheme to provide bat roosting locations across the site shall be submitted to and approved in writing with the by the Local Planning Authority and the development shall be implemented thereafter in accordance with the approved scheme, unless any variations are agreed in writing with the Local Planning Authority.*

- 31 *Before the commencement of each phase of the development as agreed in regard of Condition No. 8 above, a survey of the site for badgers shall be undertaken and prepared by competent persons with suitable qualifications, licenses and experience, and a report submitted to and approved in writing with the Local Planning Authority. The timing of the survey shall be appropriate to confirm the absence of badgers from the site immediately prior to work commencing and to ensure that it is undertaken using nationally recognised survey guidelines / methods where available and working to best practice standards.*
- 32 *Any vegetation clearance across the site shall be undertaken outside the nesting season, which is generally recognised to be from March to August inclusive, unless it can be demonstrated through submission to the Local Planning Authority of an appropriate survey immediately prior to works commencing that nesting birds are absent or a method statement for works is agreed in writing with the Local Planning Authority and fully implemented prior to works commencing.*

## APPENDIX III PHASE 1 HABITAT SURVEY PLANS AND TARGET NOTES



- Habitats**
- A Amenity grassland
  - SI Grassland  
Poor semi-improved
  - SI Grassland: semi-improved neutral
  - Bare ground
  - Ephemeral/short perennial
  - Tall ruderal
  - Dense / continuous scrub
  - Scattered scrub
  - Scattered broad-leaved trees
  - Coniferous trees
  - Introduced shrub
  - Buildings
  - Spoil
  - Maritime cliff-hard rock
  - Sea wall
  - Standing fresh water
  - S Sea water
  - Fence
  - NA Not accessible
  - Target note
  - Habitat boundary

- Dominant Species Codes**
- Ae - False Oat-grass
  - Agt - Creeping Bent
  - Bd - Butterfly-bush
  - Bs - False Brome
  - Ce - Wood Small-reed
  - Cm - Hawthorn
  - Dg - Cock's-foot
  - Fr - Red Fescue
  - Je - Soft-rush
  - Rf - Bramble

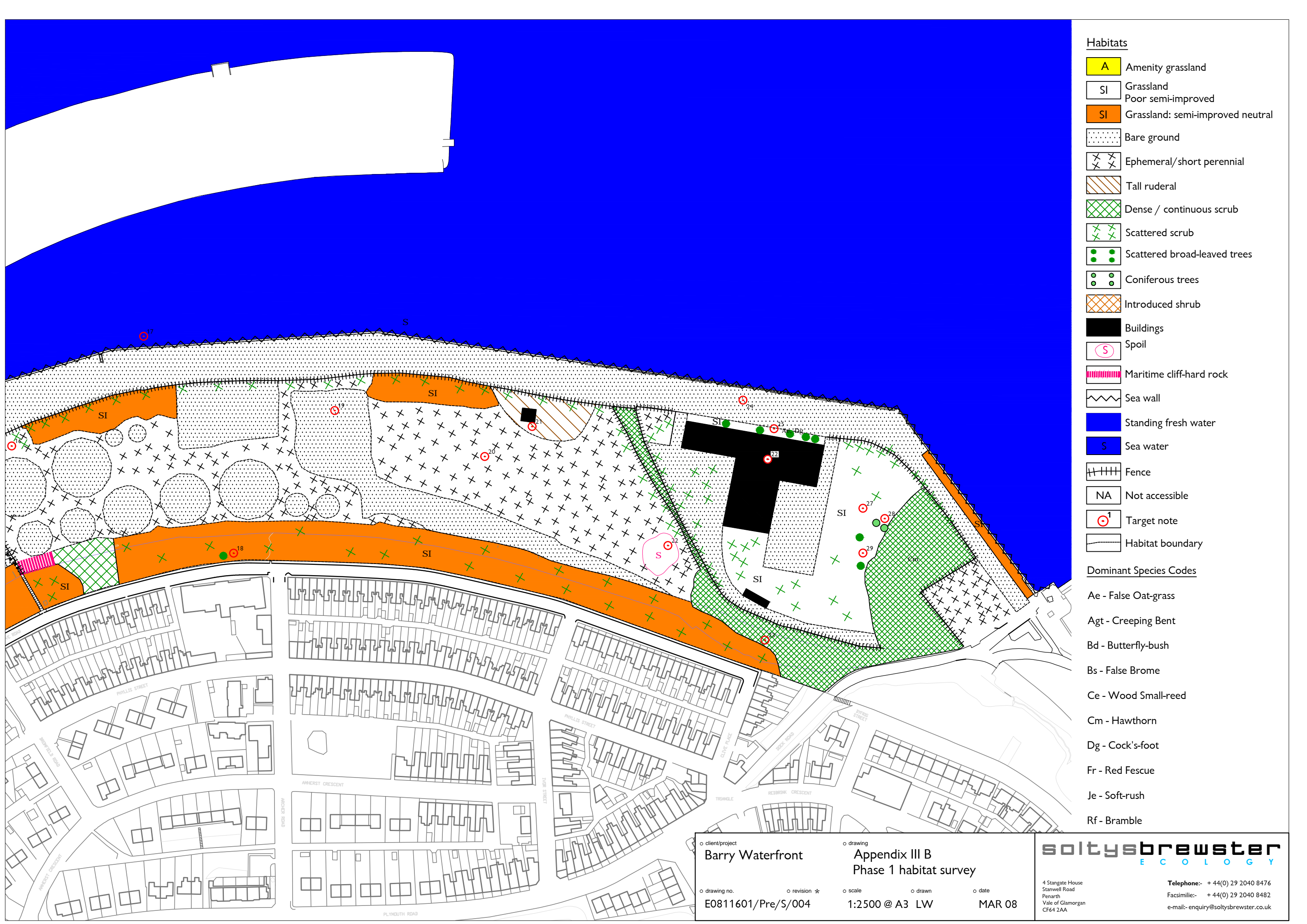
<p>o client/project <b>Barry Waterfront</b></p> <p>o drawing no.      o revision * E0811601/Pre/S/005</p>	<p>o drawing <b>Appendix III A Phase 1 Habitat Survey</b></p> <p>o scale      o drawn      o date 1:2500 @ A3 LW      MAR 08</p>
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**Habitats**

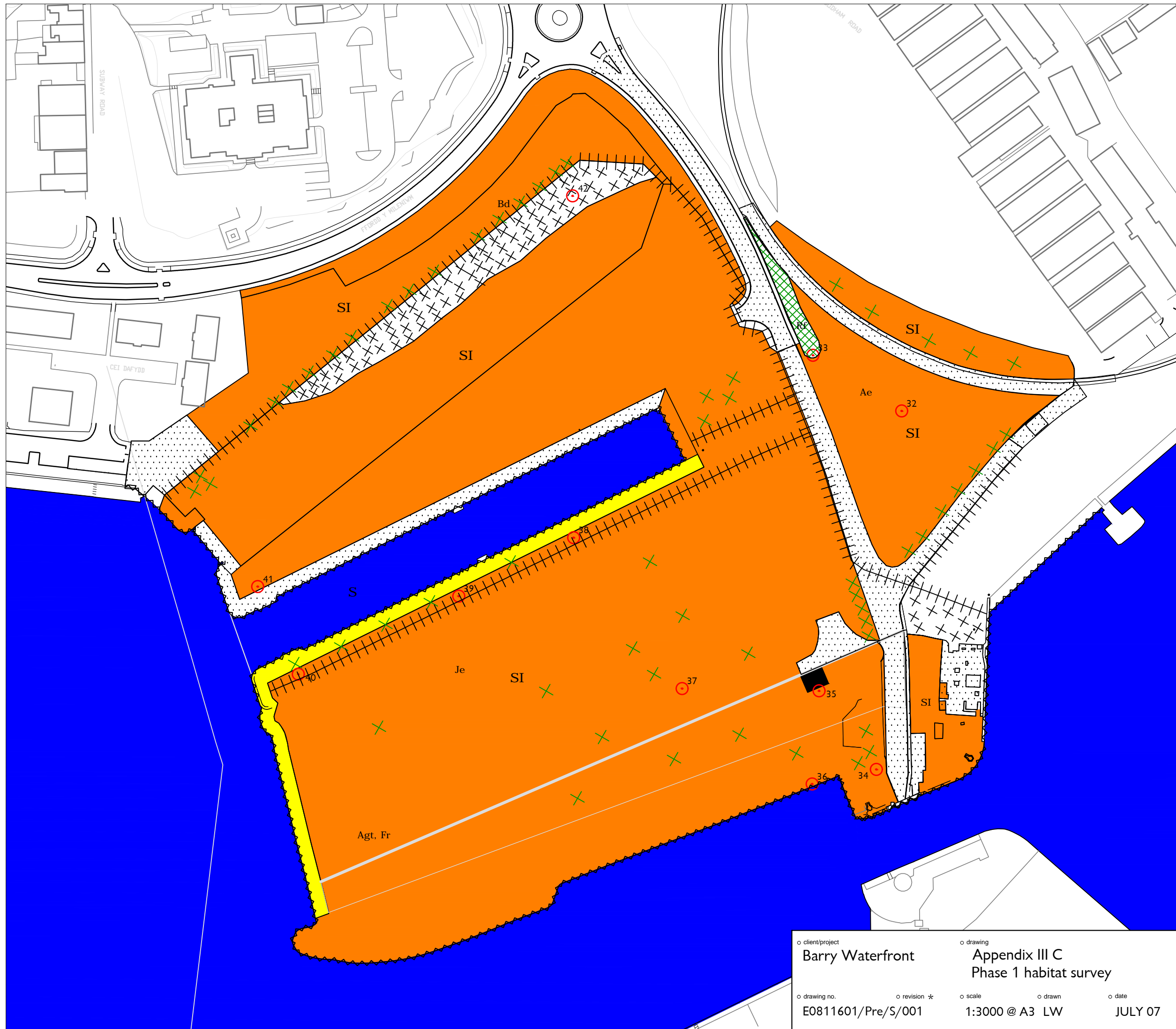
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- Maritime cliff-hard rock
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- Fence
- NA Not accessible
- 1 Target note
- Habitat boundary

**Dominant Species Codes**

- Ae - False Oat-grass
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- Dg - Cock's-foot
- Fr - Red Fescue
- Je - Soft-rush
- Rf - Bramble

client/project: Barry Waterfront  
 drawing: Appendix III B  
 Phase 1 habitat survey  
 drawing no.: E0811601/Pre/S/004  
 revision: \*  
 scale: 1:2500 @ A3 LW  
 drawn: [blank]  
 date: MAR 08

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  - S Sea water
  - ||||| Fence
  - NA Not accessible
  - ① Target note
  - — — — Habitat boundary

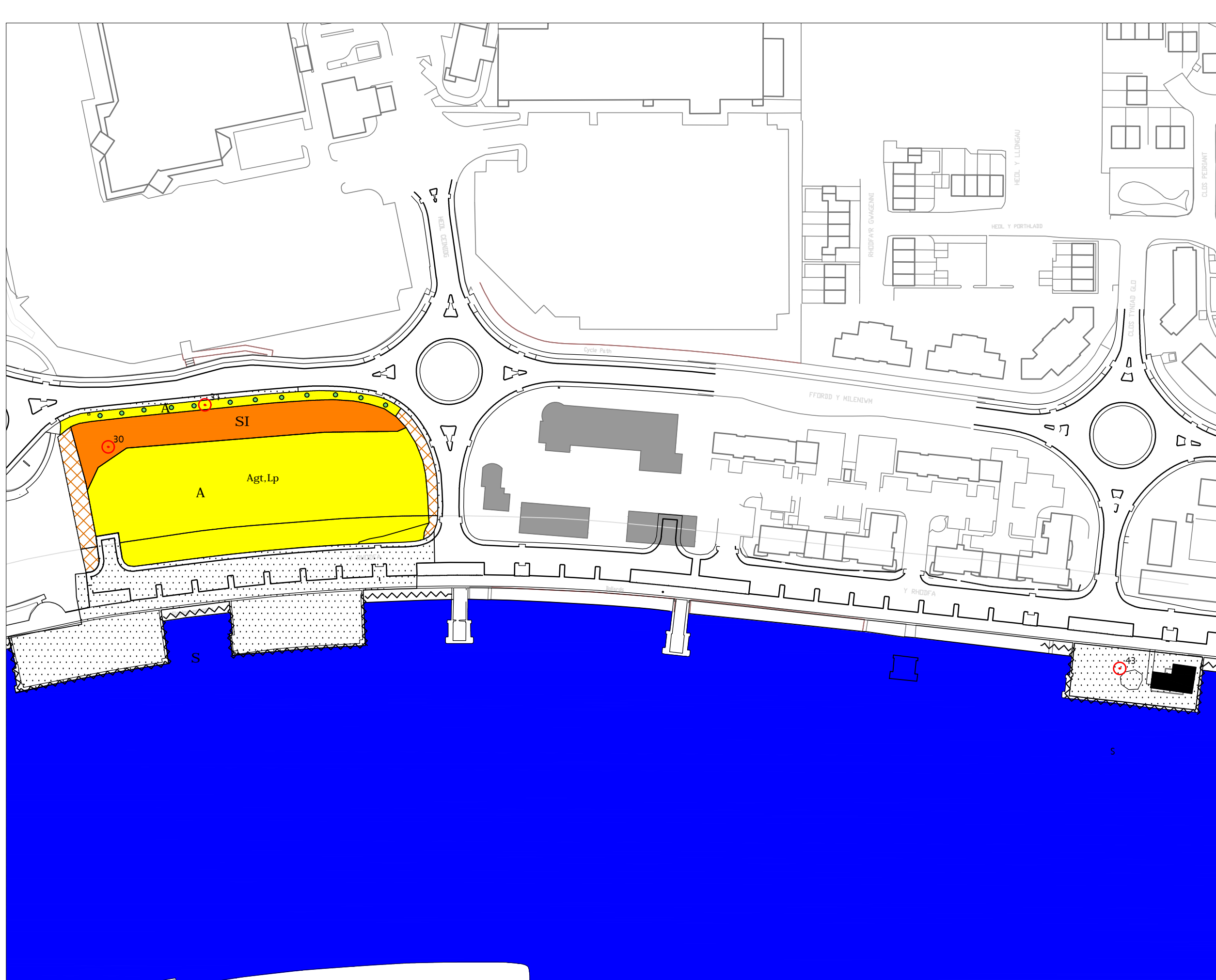
- ### Dominant Species Codes
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<p>o client/project <b>Barry Waterfront</b></p> <p>o drawing no.      o revision * E0811601/Pre/S/001</p>	<p>o drawing <b>Appendix III C</b> Phase 1 habitat survey</p> <p>o scale      o drawn      o date 1:3000 @ A3 LW      JULY 07</p>
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- Ce - Wood Small-reed
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- Je - Soft-rush
- Rf - Bramble

<p>o client/project <b>Barry Waterfront</b></p> <p>o drawing no.      o revision *</p> <p>E0811601/Pre/S/003</p>	<p>o drawing <b>Appendix III D</b> Phase 1 habitat survey</p> <p>o scale      o drawn      o date</p> <p>1:1500 @ A3 LW      MAR 08</p>	
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Target Note	Description/Comment
Birds Seen/Heard:	Skylark, Meadow Pipit, Stonechat, Goldfinch, Robin, Dunnock, Bullfinch, Pied Wagtail, Blackbird, Great Tit, Blue Tit, Wren, Song Thrush, Kestrel, Carrion Crow, Herring Gull, Black Headed Gull, Lesser Black-backed Gull, Wood Pigeon, Magpie, Great Crested Grebe, Cormorant
1	One well-established and probably untreated colony of Japanese Knotweed straddling the site boundary fence in Butterfly-bush scrub. Dimensions of colony estimated to be 8m x 10m.
2	Very dense Butterfly bush and Gorse scrub along bank associated with railway - bushes have retained leaves throughout the winter and so may conceal small stands of Japanese Knotweed. The scrub is several metres high. Many mammal paths leading into scrub indicative of rabbit/fox (Fox hair found). High bird nesting potential.
3	Small clumps of Japanese Knotweed on railway embankment (outside survey area but within a few metres of the boundary). Railway track inclines on an earth bank towards the west providing opportunities for Badgers along the length of the bank. Boundary fence backs onto an unmanaged railway track fully colonised by broadleaved shrubs and scrubs over gravel and early successional vegetation. Railway track is likely to function as a suitable wildlife corridor for mammals, reptiles and birds. Fence line has a sizable gap underneath along its entire length, which provides ample opportunities for mammals to enter the site. Evidence of rabbits along identified mammal paths. Dense Gorse scrub and Butterfly Bush encroaches onto the site along the fence line.
4	Several small colonies of Japanese Knotweed close to the fence (within survey area). Scrub along fence line has high potential for nesting birds. Long grassland, tall herbs and dense scrub adjacent to a railway corridor provide a suitable foraging and nesting habitat for birds. Large banks of colonised rubble to the south also provide good shelter from wind/weather. Large flock of goldfinches foraging around Teasel stands.
5	Spoil pile comprising large irregular blocks of concrete rubble, with the top parts colonised by Butterfly bush but little other vegetation.
6	Very closely rabbit-grazed grassland community which appears to be moderately diverse with small annual mouse-ears, Buck's-horn Plantain and the mosses <i>Homalothecium lutescens</i> , <i>Brachythecium albicans</i> and <i>Barbula unguiculata</i> . Less suitable for reptiles or nesting skylark.
7	These spoil heaps are typically 3-4 metres high with an underlying substrate of gravel-stone-soil or rubble and soil, deposited in a series of steps/terraces with steep sides. They are mostly fully vegetated with neutral grassland likely to be of low diversity. In many places Creeping Bent and Hairy Sedge are abundant, with Gorse and Butterfly bush on the slopes. Vigorous herbs are also present, especially Bristly Ox-tongue, docks, Wild Parsnip and Creeping Thistle. Some areas support significant stands of Great Horsetail. The heaps have been used for informal recreation e.g. biking and there are some areas of erosion.
8	Area of standing water (ca. 30m across) at foot of spoil heaps. Up to 30cm of water but may be seasonal. Vegetation suggests that the ground stays damp all year at least. Species present include small stands of Sea Club-rush, Bulrush, Hard Rush and an unidentified sweet-grass. There are also extensive carpets of the moss <i>Warnstorffii aduncus</i> . Potentially suitable for common amphibians and will require amphibian survey. Water frequently used by crows and gulls.
9	Rank neutral grassland dominated by False Oat-grass considered to have low intrinsic botanical

	interest but supporting a small population of Corky-fruited Water-dropwort, a species of considerable local rarity value.
10	Very steep cliff/bank supporting inaccessible neutral to slightly calcareous grassland with scattered saplings and scrub (mostly Hawthorn). False Brome is the dominant grass on the bank - the vegetation community appears to be relatively species-poor. Bramble and Traveller's-joy are encroaching. Steep cliff largely colonised by grass and scrub with few areas of exposed rock- Not likely to be suitable for nesting birds-of-prey although scrub has some potential for passerines despite heavy shading.
11	Large industrial Warehouse. Building is corrugated steel throughout with corrugated sheeting on the roof. The inside of the building consists of a large void extending up to metal rafters, which backs onto single corrugated roof sheets which is intact throughout. The western elevation is largely exposed – allowing wind and rain in. The building appears wholly unsuitable for bats although it was not closely inspected due to H & S issues. Nearby small brick-built flat-roofed hut to southwest with front access exposed. Whole building is covered in dense ivy covering. No value to roosting bats
12	Brownfield vegetation developed across an area of demolished structures. Substrate appears to be crushed brick and concrete. Appears to be at least moderately botanically diverse and could support notable species. Species that could be identified in the community at the time of survey included Tall Melilot, Hoary Mustard, Bristly Ox-tongue and Colt's-foot. Bare ground in between foundations colonised by rank grassland and ephemeral vegetation potentially suitable to support common reptiles particularly lizards. Some poorly drained areas holding water may need checking later in the season.
13	Brick built sub station with flat concrete roof and few opportunities for access. Of little if any value to roosting bats. Fascia boards lifting and split in places although the building is isolated and exposed to weather.
14	Very species-poor neutral grassland dominated by Red Fescue, along with frequent Creeping Thistle and Cock's-foot. Of very low intrinsic botanical interest. Grassland seems to be frequently used by dog walkers. Likely to support common reptiles, small mammals and grassland nesting bird species such as Skylark, Meadow Pipit and Wheatear. Area is relatively undisturbed and likely to be rich in invertebrates- providing foraging habitat for bats. Kestrel noted hunting over all grassland areas. Crow assemblage noted in numbers exceeding 50. The grassland contains areas of scrub and tall herbs such as teasel, which are valuable to foraging birds. Some areas with sporadic stands of pampas grass, which may provide suitable shelter for reptiles. Reptile mats were noted across the site. Further surveys recommended for birds, bats, reptiles and invertebrates. Many areas are poorly drained and large pools of standing water have formed in many areas proving potential breeding habitat for common amphibians. Further survey required. Area of gorse lining the trackway over grassland of high value to nesting birds. Likely to support a diversity of finches and warblers.
15	Horizontally inter-bedded cliff exposure. Appears to be limestone interbedded with mudstone or shale. Supports patchy False Brome grassland and scrub species, which suggest that soils are likely to be near neutral to slightly calcareous in reaction.
16	Species-rich early successional vegetation supporting a variety of different herbs, grasses and mosses. Herbaceous species include Lesser Trefoil, Common Vetch, Field Madder, Perforate St. John's-wort and frequent Canadian Fleabane. Vegetation and substrate likely to support common Lizard. Prominent mosses include <i>Barbula unguiculata</i> , <i>Bryum capillare</i> , <i>Bryum bicolor</i> and <i>Funaria hygrometrica</i> .

17	Sea-water dock. Deep water retained by vertical stone walls with negligible maritime vegetation.
18	Exposed cliff face with well defined stratified layers of limestone and scree. Fallen/eroded rocks at base of cliffs have ammonite fossils. Potential geological importance. Mature Willow on cliff with few splits and cracks and fallen limbs. Generally considered of low potential for bats. Well used mammal path up cliff face to around base of tree- no setts or burrows. A Goat Willow or Goat Willow-Grey Willow hybrid at the top of a low cliff. Has two main trunks, each c. 30cm diameter. The tree is c. 6-7 metres high and is apparently in good health. Cliff is steep and heavily vegetated with dense bramble and grass with occasional tree and shrub. There are no suitable ledges for nesting birds of prey such as kestrel or Peregrine although the trees may serve as perches. Dense bramble may have value for breeding passerines.
19	Area where there is a complex mosaic of bare ground (concrete footings) surrounded by early successional vegetation, scattered Butterfly-bush scrub and small patches of neutral grassland dominated by Creeping Bent.
20	This is an area where there were previously many silos/storage tanks, now removed and leaving patches of bare and broken ground. An irregular mosaic of Brownfield vegetation and small patches of species-poor neutral grassland has subsequently developed across the area.
21	Sub station similar to others. Brick built with flat roof of low potential to bats. Fascia boards are cracked and lifted but building is fairly isolated and exposed to the weather.
22	Excavated area with spoil and dumped material including masonry and household waste. Appears to have impeded drainage, as there are a few small puddles of standing water. Dipped area of ground with some pools of standing water some with algae. Very little if any opportunities for breeding amphibians and likely to be seasonally dry. Pigeon kill suggestive of fox.
23	Two trees on cliff face with ivy covering and visible splits. Generally low potential to bats. Dense scrub below colonised over a disused railway track- good connectivity/corridor into nearby habitats. Scrub is very dense and may require a through search for badger sett if affected by development
24	Interesting short-herb vegetation growing over stone chippings and in tarmac cracks. Species recorded here included the mosses <i>Didymodon fallax</i> , <i>Barbula unguiculata</i> and <i>Ceratodon purpureus</i> , Biting Stonecrop, Common Whitlowgrass, Oxford Ragwort, Weld, Hoary Mustard, Rue-leaved Saxifrage, Field Mouse-ear and Wild Carrot. There is also a small population of the locally rare Lesser Chickweed.
25	Planted standard maples (not possible to identify to species without leaves) in front of derelict building, growing in what is now rank MG1 grassland. The trees are young, not more than 6 metres high, with a trunk diameter of 20-30cm. They are not in good condition, as some are leaning, with dead branches and cracked bark.
26	NERC Vessel Research Services. Flat roofed, brick built office block with most windows boarded up. Spaces under boards and smashed windows provide adequate means of entrance. Buildings are of medium potential for bats and require further investigation. The west side of the warehouse provides a well-used pigeon roost.
27	Species-poor rank False Oat-grass (MG1) neutral grassland, probably former amenity grassland, long unmanaged suitable for reptiles. Many Hawthorn bushes are encroaching into the grassland. Large bank to the east colonised by a dense stand of hawthorn blackthorn scrub with some gorse. Likely to be a hot spot for nesting birds. Fox seen. No signs of badger seen.
28	Two sub-mature planted willows, likely to be either White Willow or Crack Willow cultivars.

	Both trees appear to be healthy, with a canopy height of about 10m and Ivy growth on the trunks.
29	Two 10m tall Leyland Cypress at the edge of an encroaching scrub belt. Bare at the base, but upper parts are dense and apparently healthy.
30	Bank appears to be relatively nutrient-poor and supports a patchy but moderately diverse vegetation cover, which includes Common Centaury.
31	Young ornamental pine saplings (no cones present). 2-3 metres high, planted at intervals beside pavement.
32	Rank sward suitable for reptiles. Nearby railway track provides connectivity to nearby habitats for reptiles and mammals. Sward is rabbit grazed and is used by gulls as a roost site- mussel shells and feathers around- wings feathers also found (suggestive of fox kill).
33	Earth Bank along access road with areas of dense scrub. Numerous rabbit burrows-with rabbit fur on nibbled bramble around entrance holes. No signs of badger. Dense scrub along railway track of high value to breeding birds. The whole area is fairly undisturbed other than a low speed train passing nearby once or twice a day
34	Rabbit burrows in earth bank. Larger holes near to harbour edge although the hole tapers off into small hole- not badger.
35	Substation. Brick built with flat roof and limited access into the internal void. Largely unsuitable for bats. Wooden fascias are loose and there are gaps in the soffit but unlikely to be suitable on account of exposed and isolated nature of building.
36	Dock wall 6-8 metres above water level is lined with stone setts with a gradient estimated to be c. 45°.
37	Dense cluster of gorse likely to be of value to nesting birds and used for shelter by rabbits. Evidence of rabbit 'forms' and grazing around base. Grassland of value to reptiles, gulls and grassland nesting species such as skylark and meadow pipit. Few areas of standing water but likely to be seasonally dry- unsuitable for breeding amphibians. No evidence of badger foraging or dung pits.
38	Bank along fence has numerous rabbit holes and burrows. The bank also contains a hole characteristic of badger with guard hair on the ceiling of the entrance
39	Another series of badger holes with guard hair at entrance. Clear current use by rabbits
40	Underground compartment associated with swing bridge. Low potential for bats.
41	Culvert over earth partially covered by a large steel plate. Large hole in earth with hole characteristic of badger. Entrance to culvert has a lot of fry grass bedding and badger guard hairs. Likely to be an outlier sett.
42	An extensive area of Brownfield vegetation over calcareous stone chippings. Appears to be at least moderately diverse and may support notable plant species. Identifiable species include Common Bird's-foot-trefoil, Ribwort Plantain and the moss <i>Cratoneuron filicinum</i> .
43	Landscaped gravel garden based on minimalistic planting of e.g. phormium and cordyline species over a substrate of marine gravel and slate chippings. Unoccupied modern building with boarded window on southern elevation where window has been smashed. Of no value to bats.

## APPENDIX IV ADVICE NOTE ON BATS AND LIGHTING

The following advice in relation to residential lighting where bats may be an on-site or influencing factor is based up on information contained within an article by Emery (2008) and available via Urbis lighting (<http://www.urbislighting.co.uk/>).

Firstly in terms of light source, the use of **Low Pressure Sodium (SOX) is recommended**, as these lamps emit light at a single wavelength with a very low amount of UV meaning that very few insects are attracted to this light source. This light also has a minimal effect on the bats. However, the use of these light sources is currently being phased out.

Next best would be High Pressure Sodium (SON) as these lamps emit light over a slightly broader wavelength spectrum attracting more insects but as these are a more intense light source they have a greater effect on bats. There are ranges of metal halide lamps available and they are classed as white light sources, these emit light at wavelengths across the colour spectrum but can also emit high levels of UV. These can attract large numbers of insects and are also a closer match daylight meaning these have an even greater impact on bats (avoid these types).

The lighting types recommended would be **8m Column heights** (rather than 10m - however, see notes below) using (in order of preference) **external rear louvres**, or internal rear louvres, or 120mm rear shields. **Either flat or curved glass protectors** may be used with the former being preferred, as light spillage is marginally less than curved. However, there may be conflicts with using some louvres (plus, spacing will be reduced and so more lighting columns may be required, therefore increasing costs).

Units may be obtained from numerous suppliers, as the above-mentioned items are standard items. However, talking to Matt Emery from Urbis Lighting with regards to bats is recommended. He is a lighting engineer firstly with an interest in bats and how light influences their behaviour and this information is also recommended by the Institute of Lighting Engineers (ILE) <http://www.ile.org.uk/>.

### FURTHER NOTES

#### Lower Mounting Height

This option is easily implemented and would generally result in a reduced column cost.

In comparison studies between 10m and 8m column heights, the overall spread of light has been reduced by lowering the column height, however due to the lower mounting height the intensity of the light on the road has been increased with the higher illuminance values spreading further. This option reduces the column spacing by 20% resulting in more columns being required thereby neutralising the benefit of the lower unit costs.

#### Louvres - External

External louvres are used with a flat protector so there is no spacing constraint from the optic. As with the shields mentioned below, these are externally mounted so there are increased stresses on the supporting columns and brackets from additional wind loading. As with the internal louvres (see below) an additional unit cost will incur.

In comparative studies, the external louvre almost completely blocks all the light emitted behind the units. However, this does have a greater effect on the column spacing achievable as large amounts of light are being blocked. Excellent for light sensitive species of bats (i.e. *Myotis sp.*). Urbis therefore recommends the use of its ZX2 and ZX3 product designs that have been proven to reduce light on a road scheme in the Sirhowey Valley, Caerphilly.

#### Louvres - Internal

Internal louvres are not available with a flat protector due to the limited space available inside the optic. Louvres are a specially designed accessory with each one requiring testing resulting in higher additional costs per unit than any of the other options described here.

In comparative studies, the internal rear louvre greatly reduces the spread of light behind the units. However it does reduce the column spacing achievable, this is because the louvre is blocking the light emitted from the optic making the luminaire less efficient.



### **Rear Shield**

Shields are becoming more widely available on a range of luminaires but as they are an accessory they incur an extra cost per luminaire. The longer the length of the shield the more effective it is, however the increased surface area causes greater stresses on the supporting column and bracket due to wind loading.

In comparative studies, the shield has helped reduce the spread of light behind the lighting column by almost 40%. However, the column spacing is reduced by 20% resulting in the possibility of more columns being required and also there is an increased unit cost for the accessory.

### **Using Flat Glass Protectors**

The majority of Traffic Route luminaires are available with a flat glass protector option, so this method of limiting light emitted at high angles is easily available at little or no extra cost on unit prices. However the range of protectors typically used on traffic route lighting include curved bowls due to their less restrictive light distribution.

In comparison studies results show that there is little effect on the spread of light when a flat protector is used to light roads. This is due to the decreased column spacing required to still achieve the required lighting specification on the road increasing the intensity of the light in the area. The decrease in column spacing will also mean that extra columns could be required on longer stretches of road increasing costs.

## **REFERENCES**

Bat Conservation Trust. (2008). *Bats and Lighting in the UK; Version 2, January 2008*. <http://www.bats.org.uk/>

Emery, M. (2008). *Effect of Street Lighting on Bats*. Urbis Lighting Ltd., 2 January 2008. <http://www.urbislighting.com/>