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Document Number:	752214-UAX-ZZ-ZZ-EV-EN-00001

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Section 1: Introduction

This Landscape Management Plan has been created to provide information on the proposed landscaping for the Staplefield Integrated Constructed Wetland (ICW). Details include, quantities, sizing, species, along with planting procedures and maintenance, as part of Planning and Design stages. This will be reviewed and revised (if required) prior to construction and operational phases of the Integrated Constructed Wetland (ICW) Site at Staplefield WTW.

Managers and operators should be aware of onsite aspects of the ICW system, including the general function and ecological aspects. Further details are provided in the ICW Operations and Maintenance Plan.

All planting and maintenance shall be carried out as per 'Good Horticultural Practice' and 'British Standard' with particular reference to:

- BS 3998: Recommendations for tree work.
- BS 8545: Trees from Nursery to independence in landscape.
- BS 4428: Code of practice for general landscape operations
- BS 7370: Grounds maintenance.

The time that trees and plants are held in temporary storage should be kept to a minimum. The storage area should be specific for that purpose.

1.1: General overview of the Proposed ICW Landscaping Plan.

The design of an ICW ensures that the ICW structure will 'fit' well into the landscape, e.g., by making the enclosing embankments curvilinear and conforming them to the site's topography. The wetland vegetation plays a functional role for water treatment within the wetland cells while the vegetation development within the wetland cells and surrounding area further enhances the visual natural appearance of the system, providing a biodiverse habitat.

The landscaping plan has been divided into key areas, wetland cell and marginal planting, tree and hedgerow and grasses and wildflower areas. There may be some variation in plant species, numbers and sizes, subject to availability at the time of planting.



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Section 2: Planting

2.1: General ground preparation.

A specific Planting Method Statement will be carried out prior to the commencement of any planting works. All plants will be of UK provenance and inspected upon delivery.

- Planting areas should be identified and marked out clearly, as per the Landscaping Plan drawing, 752214-UAX-ZZ-ZZ-DR-EN-00007;
- Planting areas will be demarked for species and ‘toolbox talk’ carried out to ensure all planting is carried out as per design;
- Ground preparation shall ensure sufficient topsoil is in place, soils decompaction and may include deep ripping where necessary. Topsoil shall be sourced on site and be weed free in accordance with relevant British Standards (BS4428);
- Planting works shall be carried out during appropriate ground and weather conditions for works being undertaken’ (ideally, Wetland planting: March-September, Trees and Hedge planting: November -February);
- Planting areas will be inspected prior to planting to ensure ground conditions are suitable;
- Following planting, ensure watering and weed control is maintained. Chemical weed control is not permitted within the wetland treatment cells.



Figure 1: Topsoil over wetland cell base, ready for planting.

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Figure 2: Team carrying out manual wetland planting.

2.2: Wetland Cell and Flood Mitigation Area Planting.

The planting of the wetland cell areas with marginal and emergent plants provides the following functions:

- Treatment of influent waters;
- Mitigate potential odours from initial wastewater;
- Slow hydraulic flows;
- Reinforcement of wetland soils;
- Oxygenation of the soil substrate to help the breakdown of organic pollutant;
- Enhance the amenity and aesthetic value of the area;
- Create and enhance the biodiversity of the area;
- Reduce maintenance;
- Deter access by humans to the water.

The wetland cells will be densely planted using a selection of plant species. The Staplefield ICW treatment cell area is 12,889 m². The flood mitigation (FM) area will also be planted in the same manner with a base area of 930 m². A list of the main species for the wetland cell and flood mitigation area planting is provided below in Table 1. The emergent plant species will dominate the majority of these areas while the marginal plant species will dominate the periphery of the wetland cell and flood mitigation area.

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Table 1: Wetland and flood Mitigation Area planting - species and numbers								
Wetland Planting [12889m ²]								
Common name	Botanical name	% cover	Cell 1	Cell 2	Cell 3	Cell 4	F.M. Area	Total plant number
			487m ²	5399 m ²	4418 m ²	2585 m ²	930 m ²	
			Plant number					
Emergent wetland plant species								
Lesser pond sedge	Carex acutiformis	25	731	8099	6627	3878	1395	20730
Reed Sweet Grass	Glyceria maxima	30	877	9718	7952	4653	1674	24874
Lesser reedmace	Typha angustifolia	20	584	6479	5302	3102	1116	16583
Greater reedmace	Typha latifolia	15	438	4859	3976	2327	837	12437
Marginal wetland plant species								
Yellow flag	Iris pseudacorus	2	58	648	530	310	112	1658
Water mint	Mentha aquatica	1	29	324	265	155	56	829
Purple loosestrife	Lythrum salicaria	1	29	324	265	155	56	829
Brooklime	Veronica beccabunga	1	29	324	265	155	56	829
Gipsywort	Lycopus europaeus	1	29	324	265	155	56	829
Marsh cinquefoil	Potentilla palustris	1	29	324	265	155	56	829
Marsh marigold	Caltha palustris	1	29	324	265	155	56	829
Meadowsweet	Filipendula ulmaria	1	29	324	265	155	56	829
Water forget-me-not	Myosotis scorpioides	1	29	324	265	155	56	829
Total plant number / cell			2920	32395	26507	15510	5582	82914

- 200 - 300mm layer of on-site topsoil is loosely laid over the cell soil liner to provide planting medium;
- Planting areas will be inspected to ensure ground conditions are suitable for planting;
- Appropriate source of water for preparing cells for planting will be confirmed in advance;
- Soils to be saturated prior to planting with no greater than 50-100mm depth of water;
- Wetland plants will be planted in a density of 6 plants/m² using nursery grown plug plants;

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- Plant size will be between 125cc and 230cc root trainers, depending on the species;
- Plant species will be planted in similar species groups/clusters;
- Planting will be carried out manually;
- Following planting water depths to be maintained at 50-100mm for plant establishment.
- Subject to time of year, water level management shall be reviewed weekly/monthly.



2.3: Trees, Shrubs and Hedgerows.

Additional landscaping will be provided around the ICW site using native trees and shrubs. Trees or shrubs will not be grown on the ICW embankments where access could be restricted or where there would be a possible risk of infiltration via roots, as well as shading over the treatment cell areas. The tree and shrub species for the hedgerow and surrounding areas selected are in keeping with the existing vegetation of the site. Tree, shrub and hedgerow planting locations are shown in Drawing 752214-UAX-ZZ-ZZ-DR-EN-00007. The proposed species are shown in Table 2, 3 and 4.

Table 2: Hedgerow planting (180m)				
Common Name	Botanical name	% Cover	Quantity	Size
Hawthorn	<i>Crataegus monogyna</i>	60	432	Height: 60-80cm
Blackthorn	<i>Prunus spinosa</i>	25	180	
Field Maple	<i>Acer campestre</i>	5	36	Winter planting: bare root stock
Dogwood	<i>Cornus sanguinea</i>	5	36	
Dogrose	<i>Rosa canina</i>	5	36	
Total		100	720	April-September planting: Root trainer stock.

Table 3: Shrubs planting – species and numbers			
Common Name	Botanical name	Plant number	Size
Hawthorn	<i>Crataegus monogyna</i>	5	Height: 60-80cm
Blackthorn	<i>Prunus spinosa</i>	5	
Field Maple	<i>Acer campestre</i>	5	Winter planting: bare root stock
Dogwood	<i>Cornus sanguinea</i>	5	
Dogrose	<i>Rosa canina</i>	5	
Total		25	April-September planting: Root trainer stock.

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- Hedging to be planted along the southern boundary of the ICW site between the Flood Mitigation Area and the WTW access road, (see Drawing 752214-UAX-ZZ-ZZ-DR-EN-00007 for location);
- Hedging will be bare root stock if planted in winter (November-February) and root trainer stock if planted in the period from March to October;
- Hedge planting is to be in 2 rows, 450mm apart with plants spaced at staggered 450mm spacing;
- Topsoil in planting areas must be decompacted, weed free and deep ripped if necessary; On site soils will be stripped back and stockpiled during construction and redistributed as final construction works. On site soils are underlain by superficial deposits comprising alluvium and Weald Clay, this is considered suitable soil material as planting medium for the proposed landscape plan.
- Mulching to the whole surface of planting beds with bark mulch in accordance with the specification and suppliers' instruction; Mulch should be bark mulch and be FSC certified, and conform to BS EN 4790:1997. Mulch shall be spread as a layer 50 to 100mm (2 to 4in) deep – around the stem in a circle of about 1m (3ft) diameter.
- Tree planting shall follow the UK's Tree Council guidelines on planting and maintenance for newly planted trees. Consideration shall be made to the best tree planting method e.g. turf and mound planting/pit planting or as specified by the supplier.
https://treecouncil.org.uk/wp/content/uploads/2019/12/TCHandbook_5_Care.pdf
- Tree guards using biodegradable material (where possible) to be included for protection, including tree stakes, tree guards and ties. Position the stake first, on the side of the tree facing towards the prevailing wind, to reduce chafing in storms. Position the tree 25 to 50mm (1 to 2in) from the stake. Attach the tree ties with pads 25mm (1in) from the top of the stake. Thread belt through and either fasten the buckle or tack to allow adjustment as the tree grows.
- Specific materials/items should consider landscape supplier/contractor recommendations.

Table 4: Tree planting - species and numbers

Common Name	Botanical name	Tree number	Size [trunk girth]
Birch	<i>Betula pubescens</i>	8	8-10cm
Common alder	<i>Alnus glutinosa</i>	6	8-10cm
Alder buckthorn	<i>Rhamnus Frangula</i>	8	8-10cm
Black Poplar	<i>Populus nigra subsp. Betulifolia</i>	2	8-10cm
Total tree number		24	

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2.4: Grasses and wildflower.

Areas not vegetated with wetland plant species or shrubs will be seeded with grasses and wildflower appropriate for the soil type and local environment. Please refer to Drawing 752214-UAX-ZZ-ZZ-DR-EN-00007 for layout. The inner and outer embankments will be grassed and of this, 20% will be sown with Wildflower and grass mix (1550m²) (See Table 6 for species mix). The remaining total grassed areas is 11,558m² (see Table 5 for species mix and cover).

The proposed grass and wildflower seed mix may be refined prior to seeding depending on final topsoil composition.

Table 5: Grass species mix and % cover (11,558m²)

<u>Grasses</u>	<u>% cover</u>
Crested Dogs Tail	15%
Strong Creeping Red Fescue	20%
Slender Creeping Red Fescue	15%
Sheep's fescue	20%
Smooth Stalked Meadow Grass	10%



Table 6: Grass and wildflower species mix and cover (1550m²)

<u>Grasses</u>	<u>% cover</u>
Crested Dogs Tail	15%
Strong Creeping Red Fescue	20%
Slender Creeping Red Fescue	15%
Sheep's fescue	20%
Smooth Stalked Meadow Grass	10%
<u>Wildflowers</u>	
Yarrow	0.90%
Greater Knapweed	1.60%
Common Mouse-ear	0.50%
Rough Hawkbit	0.80%
Oxeye Daisy	1.60%
Birds Foot Trefoil	1.40%
Cowslip	0.80%
Yellow Rattle	2.20%
Salad Burnet	1.80%

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Table 6: Grass and wildflower species mix and cover (1550m ²)	
Black Knapweed	1.70%
Wild Carrot	0.90%
Kidney Vetch (prefers chalk soils)	1.30%
Horseshoe Vetch (prefers chalk soils)	0.80%
Field Scabious	1.70%
Vipers Bugloss	1.20%
Devils Bit Scabious	0.80%

- Seed is best sown in the autumn or spring but can be sown at other times of the year if there is sufficient warmth and moisture;
- Areas to be seeded will be raked in preparation for seeding as per good horticultural practice (BS 4428);
- The seed must be surface sown and can be applied by machine or broadcast by hand. To get an even distribution and avoid running out, divide the seed into two or more packs and sow in overlapping sections. Do not incorporate or cover the seed, but firm in with a roller, or by treading, to give good soil/seed contact;
- Rate of sowing will be 5 g/m².



2.5: Mitigation measures during landscaping.

Mitigation measures should be employed during the landscaping stage of the ICW site to limit the impacts on surrounding environments through proper management and supervision.

Mitigation measures include, but not limited to:

- Construction of the wetland cells will be undertaken in sequence starting from the upper end of the site down to the lower end, or as an individual cell is ready following construction and testing;
- Planting shall be carried out in appropriate seasons as required (bare root/potted) (wetland planting; March -October, tree and shrub planting: November -February);
- No works to be undertaken during very wet weather;
- No planting if the ground is frozen;

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- A detailed landscape method statement will be prepared and will be followed by the contractor;
- All landscaping will be supervised;
- All planting will also be supervised, and only native species will be used;
- All plants brought to the site for use in the wetland will be checked for the possible presence of invasive species.



Section 3: Maintenance Requirements

A number of different operation and maintenance requirements will be undertaken on the ICW and Flood Mitigation Area. A draft Operations and Maintenance Plan (O&M) is prepared as part of the planning and design stages and will be updated prior to commissioning and operational phase.

Initial maintenance requirements (weekly) will include evaluation of plant health and support systems (stakes and ties) and watering (if required) to promote plant establishment.

Ideally wetland plants will be managed by sweetening flows from the WTW, terrestrial plant watering can be managed by Intermediate Bulk Container (IBC) and hose, if required during the first growing season.

Maintenance intervals will initially be carried out weekly and frequency will be moved to monthly, quarterly following evaluation of plant establishment.

3.1: Timeline to functioning wetland.

Subject to construction time (season) the ICW will be fully established within 2 growing seasons. The ICW will be operational following construction and planting, however, water level management will be required for plant establishment. Water level management shall be reviewed weekly for the initial phase following planting and reviewed as the site establishes.

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3.2: Wetland areas.

- Water level management within the wetland cells for plant establishment;
- Water levels shall be kept optimal to allow for species establishment and efficiency of the ICW system (operational water levels(150-200mm);
- Pulling back of vegetation from inlet and outlet pipe areas and dispose on embankments away from pipes;
- Monitoring and access points to be kept clear of vegetation;
- Overtime (15-20yrs) desludging and replanting;
- As required remove unwanted species, e.g., willow, under best practice;
- Ensure unwanted or invasive plant species do not establish in cells;
- There is no requirement to harvest/cut and removal of wetland vegetation.



Figure 3: Examples of cleared vegetation from around outlet pipes.

3.3: Trees, Shrubs and hedgerows.

3.3.1: Trees and Shrubs.

Maintenance and management of the trees, shall follow best horticultural practice and guidance documents (https://treecouncil.org.uk/wp-content/uploads/2019/12/TCHandbook_5_Care.pdf) the following points should be of considerable note but not limited to maintenance requirements.

- Watering of trees and shrubs shall be carried out (if necessary) weekly, immediately following planting. Watering frequency shall be assessed subject to season and requirements;
- Pruning shall be carried out as necessary to establish a well-balanced head relative to the natural form and shape of the species and purpose;
- Remove any dead, dying, and damaged branches or growth obstructing pedestrian or vehicular routes;

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- Tree support systems, ties and protective guards shall be checked regularly during establishment and adjusted where necessary. Any broken or missing items shall be replaced, and ties adjusted to allow growth and prevent rubbing of bark. Remove as soon as practical;
- Maintain a weed free area (~500mm radius) at the base of all trees and shrubs (e.g. this may be achieved using mulch mats, hoeing or installation of weed mats. Guidance from landscape contractor should be sought for site specific recommended methods);
- During maintenance works, strimmer's will be fitted with tree protection guards to avoid any damage to trees or shrubs.

3.3.2: Hedging.

- Watering of hedging shall be carried out (if necessary) weekly, immediately following planting. Watering frequency shall be assessed subject to season and requirements;
- Planting to be maintained to encourage vigorous growth according to species habitat;
- Species planting in blocks to be maintained to encourage substantial coverage and interlocking with adjacent species to avoid bare patches and discourage weed growth;
- Maintenance requirements including pruning shall be required to be tailored to the individual species. Remove any dead, dying and damaged growth obstructing pedestrian or vehicular routes outside of bird breeding season (March to August inclusive);
- Check condition of guards and shelters and replace broken or missing items until such a time as they become redundant. Adjust if necessary to allow for growth and prevent damage to bark. Remove as soon as practical. Re-firm any plants that have been disturbed by adverse weather or interference;
- Maintain a weed free area (~500mm radius) at the base of all hedging, (i.e. this may be achieved using mulch mats, hoeing or installation of weed mats. Guidance from landscape contractor should be sought for site specific recommended methods);
- Hedge trimming/cutting is recommended once annually, on only one side of the hedge. This can be alternated from year to year.

3.3.3: Grassed and wildflower areas.

- Mow long grass areas on an annual basis in September-October and to a minimum height of 100mm, arising to be left in situ for a couple of days to facilitate seed dispersal. Following this, removal of all arisings which would be stacked in scrub areas with no ground flora as habitat piles;
- Remove litter, rubbish and other debris from areas prior to cutting;
- Check for wildlife within areas of long grass before cutting/mowing to ensure no damage/harm;
- Exercise extreme care when working in close proximity to existing/new trees and prevent damage to stems/trunks. Strimmer's to be fitted with tree protection in these areas.

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Figure 4: Mowed tops of embankments.

3.3.4: General Plant behaviour.

The main growing season is March to September. New growth begins in March, with species such as *Iris pseudacorus* being one of the first to emerge. The exact emergence of new growth in a given season will depend on the temperature. Milder springs are associated with earlier growth and cooler springs associated with later growth (April-May).

All plants begin to brown between September-October, with deciduous plants losing all foliage and foliage from some of the plant species falling below the water (such as *Iris*). The foliage of some deciduous species will remain above water, such as *Typha spp.*, until the spring.

Some species are semi-evergreen (such as *Glyceria maxima*) whereby the level of die back will depend on the winter conditions. Colder winters cause more dieback than milder winters, while evergreen plants such as *Carex acutiformis* will brown slightly and will reduce in height during the winter.



Figure 5: Summer and winter growth plant comparisons.

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3.3.5: Replacement of damaged/dead plants.

Routine inspection and management of the site as part of the operation and management of the shall identify where 'any planting removed, dying or becoming seriously damaged or diseased within 5 years of planting shall be replaced within the first planting season thereafter with planting of similar size and species unless the local planning authority gives written consent for any variation.

3.3.6: Existing hedgerows.

Existing mixed hedgerows border the site along the northern and eastern boundaries. Following construction phase there is opportunity to enhance the existing hedgerows with the following:

- Identify existing tree species within the hedgerow and allowing them to develop to mature shape and size.
- Additional planting of trees and hedge species within the hedgerows where existing gaps occur.
- Reduce mowing areas along the hedgerows to allow development of existing species.

Such works should be considered and discussed with the landscape contractor following construction phase.

