

Appendix F.12 Nature Conservation and Landscape Management and Restoration Strategy

Anglian Water Services Ltd.
Great Billing Sand and Gravel Extraction and Restoration
Nature Conservation and Landscape Management and Restoration Strategy

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Drawings

772478-DWG-ENV-032 rev A: Site Areas

30755-3005-01 rev F: Restoration Strategy Plan

30755-3005-02 rev A: Combined Plan

0047/PO/1 v5: Progressive Operations Plans – Initial Development & Phases 1-2

0047/PO/2 v5: Progressive Operations Plans – Phases 3-4 & 5-6

0047/PO/3 v6: Progressive Operations Plans – Phases 7-8 & 9-10

0047/PO/4 v5: Progressive Operations Plans – Final Works and Completed Restoration

Non-technical Summary

This Nature Conservation and Landscape Management and Restoration Strategy has been prepared by MLM Consulting Engineers Limited (MLM) in collaboration with Peter Brett Associates for Anglian Water Services Ltd. and relates to restoration of the Great Billing sand and gravel extraction site. The purpose of this report is to provide information on the restoration strategy for the scheme including the creation of habitats and their management in order to enhance the site for biodiversity.

The aim of this strategy is to discuss the objectives of the restoration strategy for the scheme, including the creation and management of habitats and how the strategy will provide benefits for biodiversity. This strategy is considered a live 'working document' which will have further detailed information added to it prior to the restoration of habitats at the site and will be reviewed annually by the habitat management group.

The overall vision of this restoration strategy is to ensure habitats are created and managed to provide benefits for birds and wider biodiversity in the area and to enhance the River Nene green corridor. Habitats have been designed to provide habitat connectivity and continuity with the adjacent proposed quarry schemes.

Habitats to be created at the site include hedgerows, wetlands, reedbeds and grasslands. These will be created in the southern section of the site and will be created ensuring that the site is restored to levels appropriate to support the particular habitats and using plant species suitable for the conditions on site and the local area and which reflect the landscape character of the area.

Management at the site will be conducted to ensure the newly created habitats flourish and to enhance the existing areas of reedbed, woodland and hedgerows. The management activities at the site will include mowing/grazing of grassland areas, cutting back hedges, selective thinning/coppicing of woodland and clearing water bodies.

Annual monitoring surveys will include vegetation and bird surveys as well as the monitoring of water levels and quality. These surveys will be written up in an annual report which will be issued to the habitat management group.

Limitations and Exceptions

This report and its findings should be considered in relation to the terms and conditions proposed and scope of works agreed between MLM and the client.

Interpretations and recommendations contained in the report represent our professional opinions, which were arrived at in accordance with currently accepted industry practices at the time of reporting and based on current legislation in force at that time.

The copyright in this report and other plans and documents prepared by MLM Environmental is owned by MLM and no such report, plan or document may be reproduced, published or adapted without their written consent. Complete copies of this report may, however, be made and distributed by the client as an expedient in dealing with matters related to its commission.

This report is prepared and written in the context of the proposals stated in the introduction to this report and should not be used in a differing context. Furthermore, alterations to the initial proposals or changes in conditions on site over time may necessitate an alteration to the report in whole or in part after its submission. Therefore, in the event of any change in proposals or lapse of one year or more from the date of the report, the content of the report should not be relied upon unless referred to MLM for validation and, if necessary, re-appraisal.

Scientific survey data will be shared with local biological records centre in accordance with the CIEEM professional code of conduct.

This report was prepared only for our client and is not intended to be relied on by any other party. Third parties should not rely on the facts, matters or opinions set out in this report without the express written permission of MLM.

Please note that MLM does not purport to provide specialist legal advice.

Assumptions

The report focuses on habitat creation, monitoring and management practices only, and not the detailed methods for construction of landscape features, ponds or ditches.

Study Specific Limitations

Any limitations associated with the report will be stated, with an explanation of their significance. The consequences of any limitations on the survey, report findings and/or recommendations in the report are made clear in the report.

Unless stated specifically, drawings and plans are indicative only. As such, the position of features marked on the plans or drawings should not be taken as 100% accurate.

1 Introduction

1.1 Purpose

This report has been prepared by MLM in collaboration with Peter Brett Associates landscape team for Anglian Water Services Ltd. and relates to the proposed Great Billing minerals extraction site in Northamptonshire.

The purpose of this report is to provide information on the restoration strategy for the scheme including landscape restoration and enhancement, the creation of habitats and their management in order to enhance the site for biodiversity.

The aim of this strategy is to discuss the objectives of the restoration strategy for the scheme, including the creation and management of habitats and how the strategy will provide benefits for biodiversity and landscape character. The strategy is based on the habitat types to be included within the restoration scheme as shown on drawing no. 30755-3005-01 rev F.

The scheme is general at this stage with broad habitat types and landscape features only confirmed. The finer details of the scheme will be developed at a later date. The management objectives are discussed with general management actions described. A final detailed management plan will be produced at a later date, prior to the creation of the habitats.

1.2 Site Description

The site is situated east of Northampton along the northern side of the river Nene, between the villages of Ecton to the north and Cogenhoe to the south. The site covers an area of 126.3 ha and predominantly comprises open arable fields with no subdivision by hedges. There are pockets of broad leaved woodland, and areas of inundation vegetation within settlement lagoons that are periodically inundated.

The site is bordered to the north by Lower Ecton Road and the main A45, to the east by broad leaved woodland and arable fields, to the south by flooded gravel pits that are now used as private fishing lakes and to the west by the Water Recycling Centre.

The minerals extraction site is located 1.68 km to the north and 1.4 km to the west of the Upper Nene Valley Gravel Pits (UNVGP) Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI).

The Nene Valley is identified as a sub-regional corridor in the green infrastructure network across Northamptonshire. Policy 19: The Delivery of Green Infrastructure, sets out measures for the maintenance and enhancement of green infrastructure.

Policy 20: The Nene and Ise Valleys, states:

"The Nene and Ise Valleys will be priorities for investment in green infrastructure to strengthen biodiversity and landscape character... This will be achieved by managing development and investment to:

- a) Improve visual and physical linkages between the rivers and waterways and adjacent settlements by creating and maximising vistas to the valley/water...*
- g) Identify opportunities and proposals for floodplain and river re-naturalisation... and river habitat improvements."*

1.3 Details of Works

The red line boundary and the minerals extraction works area are shown on drawing no. 772478-DWG-ENV-032 rev A, the red line boundary includes areas which will not be affected by the mineral extraction works but which fall within the land ownership and application boundary. The restoration strategy includes habitats within this red line boundary as well as the management of the existing reedbeds to the south of the red line within the land owned by Anglian Water Services Ltd.

The works will involve the extraction of sand and gravel and associated works and will be phased alongside restoration such that restoration will be undertaken in some areas whilst extraction is undertaken in others.

Restoration of the site would start in year 5 and continue until year 20; drawings 0047/PO/1 v5, 0047/PO/2 v5, 0047/PO/3 v6 and 0047/PO/4 v5 show the proposed phasing and the location of the plant and operations and water management areas.

The restoration of the site will include a combination of natural habitats in the southern part of the site including reedbeds, wet and neutral grasslands, hedgerows and waterbodies. Areas of arable land with additional boundary features will be included in the northern part of the site. The restoration strategy is shown on drawing no. 30755-3005-01 rev F and is detailed within this report.

1.4 Consultation

This restoration strategy was developed with consultation with the following consultees:

- Northamptonshire County Council - Tina Cuss
- RSPB - Colin Wilkinson
- Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire - Alan Smith, Matt Johnson and Oliver Burke
- Steve Brayshaw – Independent Consultant
- Environment Agency - John O'Neil
- Natural England - Kayleigh Cheese and Ross Holdgate

Meetings have been held with these individuals and feedback has been received from these consultees throughout the development of the restoration scheme.

1.5 Responsibilities and Timeframes

Anglian Water Services Ltd. will be responsible for the creation and restoration of habitats at the site.

The management of the habitats following their creation will also be the responsibility of Anglian Water Services Ltd. Anglian Water Services Ltd. will seek to form an agreement with another party such as the Wildlife Trust to carry out the management at the site. The habitats will be managed by Anglian Water Services Ltd. throughout the restoration and extraction process and for 10 years following the completion of the restoration of the land. After these ten years any future management operations will be reviewed.

A habitat management group will be formed prior to the commencement of the restoration of habitats on site. Representatives from interested parties including the RSPB, the Planning Authority, Natural England, the Environment Agency and the Wildlife Trust will be invited to join the landowner and the operator to form this group. The group will then meet annually to discuss the progression of the restoration scheme and advise on any changes to management regimes required.

2 Objectives for the Management and Restoration of Habitats at the Site

The main aims of the restoration scheme are to:

- Improve habitat connectivity within the local area, through the enhancement of the River Nene green corridor
- Create and manage habitat for use by overwintering and breeding birds including those bird species designated as features of the UNVGP
- Improve biodiversity on site through the creation and enhancement of habitats for a range of species
- Strengthen landscape character
- Manage existing landscape features to be retained
- Improve public access

The scheme will also encourage public access to nature through the inclusion of mown grass footpaths and timber boardwalks leading to wetland viewing platforms.

Indicative restoration plans showing habitat creation locations and areas are provided on drawing No.30755-3005-01 rev F.

2.1 Improvement of the River Nene Green Corridor

The location of the restored habitats is along the south of the site to ensure connectivity to the existing reedbeds and waterbodies adjacent to the southern boundary of the site and the River Nene. The location and types of habitat were designed considering not only the habitats on site but how they would fit in with existing and proposed habitats within the local area along the River Nene corridor and so adopting a landscape wide approach.

The creation of wetland and grassland habitats within the south of the site will strengthen the River Nene green corridor in line with the aims of the Nene Valley Nature Improvement Area (NIA) (ref. 1). The NIA currently contains fragmented ecological network of statutory and non-statutory sites. The site is targeted as new habitat within the NIA habitat opportunity mapping.

The management and restoration of habitats and landscape features on site will contribute to the establishment of a coherent ecological network at the landscape scale, as part of the Nene Valley NIA.

As well ensuring connectivity with the existing habitats in the area the scheme was designed to provide habitat connectivity and continuity with the adjacent proposed quarry schemes; Earls Barton Spinney quarry to the east, and Earls Barton to the south. With the implementation of all three schemes a large area of connective habitat including a variety of habitats will be present along this section of the River Nene, improving the connectivity between the two sections of the UNVGP site to the north and west of the site. The locations of the habitats were particularly designed to ensure there is a continuation of reedbed and wetland habitats from the site to the Earls Barton Quarry scheme which adjoins the site in the south eastern corner.

The total area of wetland and reedbed across the three sites will provide areas of reedbed large enough to support species found within the UNVGP such as bittern (*Botaurus stellaris*).

The plans for these adjacent sites and how all three schemes connect and complement one another is shown on drawing no. 30755-3005-02 rev A.

The Great Billing site will be managed sympathetically with the surrounding landscapes, and in keeping with the wider management initiatives along the Nene valley. In particular the restoration and management of the habitats on site will be in keeping with the Wildlife Trusts work in the wider landscape, which includes the preservation and restoration of rare habitat communities in the Nene valley, the encouragement of careful grazing and hay cutting at the right time of year.

2.2 Creation and Management of Habitat for Birds

The primary focus when deciding which habitats would be created and managed at the site was breeding and wintering birds. This was due to the presence of the UNVGP site, the existing habitats in the area and that species such as bittern, greylag goose (*Anser anser*), skylark (*Alaunda arvensis*), mute swan (*Cygnus olor*) and barn owl (*Tyto alba*) have been recorded using the site (ref. 2).

The creation of large areas of wetland and reedbed will provide habitat for a range of wintering birds as well as providing further breeding habitat for wetland birds recorded on site such as mallard (*Anas platyrhynchos*) and gadwall (*Anas strepera*).

The areas of wet and neutral grasslands will provide enhanced and larger areas of foraging habitat for waders including those recorded using the site such as mute swan as well other bird species such as barn owl, fieldfare (*Turdus pilaris*), song thrush (*Turdus pilaris*) and starling (*Sturnus vulgaris*). The grassland will also provide further areas of higher suitability for ground nesting birds such as skylark.

The additional hedgerows and woodland planting will provide nesting habitats for a range of species.

2.3 Improving Biodiversity on Site

Although the main focus of the restoration scheme was to provide habitat for birds the variety of habitats on site will also provide benefits for a range of species and increase the biodiversity value of the site.

The floristically enhanced margins around the arable fields and the new areas of grassland will provide important pollen and nectar source for pollinating insects, as well as habitats for over-wintering insects. This will in turn provide further food sources for bats and birds. These habitats along with the new waterbodies will also provide further habitat for grass snake (*Natrix natrix*).

The new areas of woodland planting and hedgerows will provide additional habitat for badgers as well as further foraging and commuting habitat for bats.

The waterbodies will provide further habitat for amphibians.

Overall, the combination of hedgerow, trees, wetlands and woodland belt will improve habitat connectivity and habitat suitability for a range of species.

2.4 Strengthen Landscape Character

Given that the site has very few landscape features, limited to the substantial hedgerows down the byway and Ecton Brook, the brook itself, Wind Spinney and trees down Barton Brook on the eastern boundary, the restoration plan aims to strengthen landscape character by planting new mixed hedgerows across the site, supplementing the existing woodland at Wind Spinney and the hedgerow down the byway, as well as planting new broadleaved woodland across the north-west part of the site. Combined with the creation of new waterbodies in the south and their associated reed beds, the creation of areas of neutral and wet grassland and the provision of new wet ditches, the character of the site would be strengthened compared with the existing.

The remainder of the site will continue to function as agricultural land.

2.5 Manage Existing Landscape Features to be Retained

The existing woodland at Wind Spinney, the hedgerows on the byway and vegetation along Barton Brook are not currently managed. The management plan will include processes that will retain them and ensure their long-term future through selective felling, tree surgery, coppicing or other techniques, new planting to provide diversity, and so on.

2.6 Improve Public Access

Public access is currently limited to the byway. The management plan will provide public access through the eastern part of the site on defined paths to enable pedestrians to experience the new waterbodies, reedbeds and other areas, linking with the north-south byway and the one just outside the north-eastern boundary.

Access will be managed to minimise impacts on the habitats and landscape features created as part of the restoration and management of the site, by way marking and fencing.

3 Habitat Creation and Restoration

The habitats to be created during the restoration of the site will include:

- Neutral grassland: 183896 m²
- Wet grassland: 94240 m²
- Reedbed: 191335 m²
- Grassland buffer to edges of agricultural fields: 5268 m
- Woodland belt: 30374 m²
- Mixed native species hedgerows with intermittent tree planting (measured as linear metres): 2706 m
- New wet ditches (measured as linear metres): 2353 m
- Waterbodies within the reedbeds - streams/linear waterbodies: 1836m; - pools of waterbodies: 9681 m²

General technical guidance on habitat creation has been taken from the following documents whilst drafting this report:

- Nature after Minerals Website (ref. 3);
- Wildflower Meadow Creation and Management in land regeneration (ref. 4).

A timeline outlining suitable months of the year for the creation of habitats on site is provided in table 3.1 below.

Table 3.1 Timeline for Creation and Restoration of Habitats

Task	Month											
	O	N	D	J	F	M	A	M	J	J	A	S
Neutral grassland												
Wet grassland												
Grassland buffer to edges of agricultural fields												
Scrape with wet grassland												
Waterbodies and reedbed												
Woodland belt												
Mixed native species hedgerow with intermittent tree planting												
Wet ditches												

Legend

Actions to create habitats (e.g. sowing / planting)		
Actions to establish habitats (e.g. mowing / weeding)		

3.1 Neutral Grassland

Due to the spreading of sewage on the site in the past and current use of the site for agriculture, the top soil on site contains contaminants and high nitrate levels (ref. 5).

Due to levels of contamination in the topsoil, the top 500 mm of soil will not be used in the restoration of the grassland areas. The subsoil will be used. The soil preparation should take place in dry conditions to avoid overcompaction of soil. Sowing should take place in dry, still conditions and rates of sowing should be in accordance with the supplier's recommendations.

A wildflower seed mix will be chosen to suit the climate and soil conditions of the site, and ideally be sourced as locally as possible. This mix should be in the approximate ratio of 4:1 grass seed:wildflower seed and contain a small percentage of semi-parasitic species such as yellow rattle (*Rhianthus minor*) or red bartsia (*Odontites vernus*). The soils on site are considered well drained, light soils and the seeds will be sown in autumn, and it is expected with careful management in the first year after sowing, the neutral grassland would be established by the following spring.

3.2 Wet Grassland

The wet grassland is to be created adjacent to the wetland areas. These areas of wet grassland will provide a transition between the areas of reedbed and neutral grassland at the site. The restored level will be lower than within the areas of neutral grassland to reflect the water levels on site and ensure that water levels will be high enough to retain this type of habitat.

This should also be created on subsoil to ensure the substrate has the lowest nutrient content possible. The soil preparation should take place in dry conditions to avoid overcompaction of soil. Sowing should take place in dry, still conditions and rates of sowing should be in accordance with the supplier's recommendations.

The areas of wet grassland will provide a transition between the areas of reedbed and neutral grassland at the site. A wildflower seed mix will be chosen to suit the climate and soil conditions of the site, and ideally be sourced as locally as possible. This mix should be in the approximate ratio of 4:1 grass seed:wildflower seed and contain a non-competitive grass seed mixture suitable to seasonally flooded lowlands. The restored level will be lower than within the areas of neutral grassland to reflect the water levels on site and ensure that water levels will be high enough to retain this type of habitat. It is important that the grass seed is sown in August/September when the water table is at its lowest, to allow any seed sown chance to germinate before waterlogging occurs.

The wet grassland will include dips and mounds to vary the level of vegetation cover and wetness of habitat in order to provide different micro-habitats for birds.

3.3 Grassland Buffer to Edges of Agricultural Fields

The margins of the agricultural fields will be created without the use of the top 500 mm of soil, will be kept pesticide-free and will be sown with a native seed mix similar to that used to establish the neutral grassland (section 3.1). Variety in margin widths to maximise variety of shading levels will be included to encourage a mix of species to take hold; including wildflower species which require plenty of sunlight and protection from winds. The grassland buffers to the edges of the agricultural fields will be established in the same way as the neutral grassland in section 3.1, but less mowing in the first year may be tolerated as long as there is one cut in spring and one cut in early autumn.

3.4 Waterbodies and Reedbeds

Waterbodies and reedbeds will be created following relevant guidance produced by the RSPB (ref. 6) and will include variability in gradients and water depth across the habitats.

A large reedbed area will be created on site to comprise of 19.1 ha, in the south east corner of the site situated on slightly lower ground to the rest of the site, thus naturally intercepting drainage from the areas of the site to the north. The reedbed area will include interlinked water bodies and channels and will be adjacent to reedbed habitats in the neighbouring scheme to the east as shown on drawing no. 30755-3005-02 rev A.

The reedbeds will be created by one of two methods, planting up small areas either:

- with seeds and/or seedlings then allowing the plants to naturally colonise adjacent areas, or
- with locally sourced reed rhizome taken from areas of the site where reedbed currently exists.

Planting of reeds should take place during the dormant period between October and February, and an expansion rate of 1-10m per year from each small area of planting should be allowed for. Care should be taken to ensure deeper areas of open water are maintained within the reedbeds to provide a habitat mosaic.

As shallow a slope as possible will be created within the waterbodies in order to maximise edge habitat and connections with surrounding vegetation. However, care will need to be taken to ensure enough water is kept within the pond(s) and not spread to outlying areas. Gently sloping to flat beaches of bare sediment will be created which are important for predatory invertebrates. The waterbodies will be planted with a range of aquatic plant species beneficial for invertebrates. Further detailed recommendations can be found in Nature after Minerals (ref. 3).

3.5 Woodland Belt

Woodland areas will be retained and enhanced by the addition of woodland belt to improve connectivity between the existing woodland blocks. A suitable native species mix for the area will be planted.

Species will be chosen based on the species that would regenerate naturally on a site, and on local conditions such as soil pH, nutrient levels, hydrology and climate. Suitable species include pedunculate oak (*Quercus robur*), alders (*Alnus* sp.) and willows (*Salix* sp.). Ash (*Fraxinus excelsior*), although locally prevalent should be avoided due to anticipated reduced success rates associated with ash die-back disease. Plants should not be planted into frozen ground.

3.6 Mixed Native Species Hedgerow with Intermittent Tree Planting

The new hedgerows and tree planting areas will include a mix of minimum five native woody species, known to be beneficial for wildlife, such as hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*), blackthorn (*Prunus spinosa*), field maple (*Acer campestre*) and holly (*Ilex aquifolium*) and oak. The hedgerows will include intermittent trees, without any gaps in the overall structure. Additionally, the planted hedgerows will link with connecting habitats in the wider landscape and creation of habitats will follow the hedgeline website (ref. 7). Plants should not be planted into frozen ground.

3.7 Wet Ditch

A new wet ditch will be created to aid the movement of water from the north to the south of the site. The ditches are not expected to be wet at all times and so will include areas with sides of a shallower gradient in order to provide suitable crossing points for wildlife. The ditches themselves will not be planted but the boundaries of the ditch will either be hedgerows or grassland buffer edges as described above.

3.8 Arable Fields

Part of the site will also be restored to agricultural fields. The areas of top soil which cannot be used within the habitat areas will be used in the fields. These areas will be used to grow crops for animal feed as they are used currently.

4 Management Activities

The sections below include general management tasks which will be required at the site. A full management plan with further detail will be produced prior to the commencement of restoration at the site. This plan will be renewed annually taking into account the results of the monitoring surveys and the outcome of the meeting of the Habitat Management Group.

Management at the site will include the newly created habitats as well as the reedbeds within Anglian Water Services Ltd. ownership to the west of the newly created habitats, the existing woodland area and hedgerows.

Management will be required to ensure the habitats created establish and flourish. Implementing a mowing or grazing regime will help maintain open habitats.

In general, the management tasks required on site are likely to include a combination of one or more of the following activities:

- Mowing/ grazing of grassland
- Selective thinning/coppicing and planting for diversity of species and age within the woodland
- Cutting back hedgerows
- Vegetation clearance and/ or dredging of channels/ waterbodies
- Removal/ management of any invasive species
- Management including pruning and replacement of new tree and shrub planting
- Repair or reinstatement of new grass areas

These management activities will need to be undertaken at the appropriate time of year. A timeline indicating suitable months of the year for undertaking management activities is provided in table 4.1 below.

Table 4.1 Timeline for Management of Created Habitats

Task	Month												
	O	N	D	J	F	M	A	M	J	J	A	S	
Mowing grassland (if mowing regime is the management strategy)													
Extensive grazing of grassland (if grazing regime is the management strategy)													
Selective thinning, coppicing and clearance of scrub in woodland (every eight years)													
Cutting back hedgerows (every two years)													
Pruning and replacement of new tree and shrub planting													
Vegetation removal and dredging in reedbed if required to maintain habitat mosaic													

4.1 Mowing/ Grazing of Grassland

Grassland areas will be maintained and managed by an appropriate mowing and grazing regime. The exact maintenance requirements will be tailored to site conditions and will be reviewed annually. This will involve grazing or mowing annually at appropriate time of year in order to maintain a diverse sward.

Immediately following grassland creation in the first year after autumn sowing, specific management measures will be required to ensure successful establishment of the swards, for both neutral and wet grassland habitats. This will include a cut in March to approximately 100mm if there is sufficient material, followed by another cut in early May to 100mm, and a third final cut in September to 100mm after flowering. At each cut care should be taken to remove pernicious weeds such as thistles and nettles.

After this first year, the exact maintenance requirements will be tailored to site conditions and will be reviewed annually. This will involve grazing or mowing annually at appropriate time of year in order to maintain a diverse sward.

If mowing is chosen as the management strategy, the annual cut will be in August or September to allow flowers to set seed and all cuttings will be removed off-site.

If grazing is chosen as the management strategy, this will require erection of stock-proof fencing and will be exclusively extensive grazing with suitably low stock densities. Grazing should be restricted to April through September to avoid both compaction of waterlogged soils and also potential impacts on overwintering birds. Grazing management and stocking densities should aim to remove the years grass growth before grazing ceases in autumn.

4.2 Repair or Reinstatement of New Grass Areas

If any areas of new grassland fail, then additional seeding will be undertaken as required. Seeding and management to establish the grassland will be carried out in accordance with programme in table 3.1.

4.3 Woodland Management

Selective thinning, coppicing and clearance of some scrub areas to open up the clearings within the woodland will be undertaken in order to improve the diversity of habitat under the tree canopy.

Coppicing and vegetation clearance is best carried out in winter during dormant growth stage and when the tree is easier to work with and the bark less likely to tear, this will also avoid any disturbance to nesting birds. Tree coppicing should be on a rotational cycle, meaning the stumps are left to grow for a certain number of years before they are cut back again. Rotations depend on tree species but typically would be on seven to eight yearly cycles (ref. 8).

Brash and cuttings will be retained within piles in the woodland and will be placed on top of stumps to minimise any potential damage to the stump caused by animals. Log piles will also provide additional habitat for invertebrates.

Management for public safety will be undertaken including annual inspection and remedial action for trees in or adjacent to areas of public access.

4.4 Cutting Back Hedgerows

Hedgerows will be cut back on a rotation so that each hedgerow is cut every two to three years. This will ensure that thick vegetation cover is present for use by nesting birds at all times. The cuts will be made in January to February to avoid the nesting bird season and to allow any berry crop to be used by wintering birds.

4.5 Pruning and Replacement of New Tree and Shrub Planting

New trees and shrubs will be monitored and any failed plants replaced. Pruning will be undertaken as required, ensuring this is done outside the nesting bird season to avoid any disturbance to nesting birds.

4.6 Management of Waterbodies and Reedbeds

Management of waterbodies and reedbeds may involve dredging and/ or vegetation clearance and/or additional planting and will be undertaken in a manner to ensure no impact upon protected species which may be using this habitat. Reedbeds will be managed in accordance with guidance produced by the RSPB (ref. 6).

4.7 Management of Invasive Species

Should invasive species be identified on site during annual surveys, these will require management and removal. The methods will depend on the species present and the areas of coverage. Prescriptions for management added to the management plan as required.

4.8 Repair of Boardwalks and Viewing Platforms

As and when required, boardwalks and viewing platforms will be repaired and maintained, whilst taking in to consideration time of year, in order to minimise impact upon nesting birds and overwintering birds using the site.

4.9 Other

Annual surveys may highlight other management requirements from time to time, such as measures to deal with unforeseen events such as vandalism, or extreme weather events that have led to damage on site requiring remediation.

5 Monitoring Strategy

Annual monitoring surveys will be undertaken in order to monitor the development of the habitats on site in order to recommend any necessary management activities to encourage these areas to improve.

Monitoring methods are described in the following sections. These methods will be reviewed and refined as necessary at the annual habitat management group meetings. The timing of the issuing of the reporting is not prescribed since this should be selected to coincide with the annual management group meeting once this is scheduled.

A timeline for undertaking monitoring surveys is provided in table 5.1 below.

Table 5.1 Timeline for Monitoring Actions

Task	Month											
	O	N	D	J	F	M	A	M	J	J	A	S
Vegetation surveys												
Water levels and quality sampling and analysis												
Wintering bird surveys												
Breeding bird surveys												

5.1 Vegetation Surveys

A walkover survey by a suitably qualified botanist will be conducted annually in order to assess the species present within each of the habitats and to assess the success of the establishment of new habitats which have been created. This will include all the habitats included within the restoration strategy.

5.2 Water Quality

Water levels and water quality will be monitored in the water bodies in order to check hydrology and contaminant levels on site in order to make suitable management recommendations for sustaining these areas.

5.3 Bird Surveys

It is hoped that the restoration of the habitats will result in an increased number, frequency and variety of bird species in general, including important species associated with the adjacent SPA and Ramsar site. Annual bird surveys will be undertaken to gauge the success of habitat restoration on birds. Surveys will include both wintering and breeding bird surveys. A minimum of two survey visits, each spaced at least one month apart, will be carried out for the monitoring purposes: two in winter and two in spring.

5.4 Annual Reporting of Environmental Surveys

Annually a report will be produced which will include the results from all of the surveys undertaken that year. This will include the following:

- **Vegetation surveys:** A species list for each habitat type created will be compiled. The botanist will identify on a plan any invasive species or areas requiring active management (for example, removal of a large patches of thistles in the grassland areas, or reeds taking over open water areas, etc).
- **Water Quality:** readings of water levels and chemical composition will be provided, along with any recommendations to improve water quality or maintain water levels.
- **Breeding and wintering bird surveys:** A map for each survey using BTO codes will be produced and numbers of species found will be tabulated. Trends from previous years' surveys will be reported.

The report will include recommendations for future monitoring and/ or management requirements. This will be provided to the habitat management group for their annual meeting. Any management recommendations will have to be subject to risk assessments.

5.5 Safety Inspections

The site will be subject to regular safety inspections to ensure that the site is safe for the public and for those working on the site, including inspection of fencing, overhanging trees and shrubs, flooding and water logging, access to waterbodies, damage or wear to surfaces and structures (including board walks), and so on. These should be carried out at suitably regular intervals, for example every two to three months.

Any management operations will have to be subject to risk assessments.

6 References

- 1 Nene Valley Nature Improvement Area (accessed May 2017) <http://www.nenevalleynia.org/>
- 2 MLM (2017) Ecology: Chapter 7 of EIA for Great Billing Sand and Gravel Extraction and Restoration
- 3 Nature after Minerals (2017). Partnership programme led by RSPB and supported by Natural England, Mineral Products Association and Mineral Aggregates Association. Website accessed March 2017 (<http://www.afterminerals.com/about-us/>)
- 4 Forest Research (2014) Best Practice Guidance for Land Regeneration Note 15: Wildflower Meadow Creation and management in land regeneration ([https://www.forestry.gov.uk/pdf/BPG_15.pdf/\\$file/BPG_15.pdf](https://www.forestry.gov.uk/pdf/BPG_15.pdf/$file/BPG_15.pdf))
- 5 MLM (2017) Ground Conditions: Chapter 13 of EIA for Great Billing Sand and Gravel Extraction and Restoration.
- 6 RSPB (accessed May 2017) Bringing Reedbeds to Life: creating and managing reedbeds for wildlife (https://www.rspb.org.uk/Images/bringing_reedbeds_to_life_tcm9-385799.pdf)
- 7 Hedgelink (access May 2017) <http://hedgelink.org.uk/index.php>
- 8 Forestry Commission (2003) The management of semi-natural woodlands [https://www.forestry.gov.uk/PDF/fcpg003.pdf/\\$FILE/fcpg003.pdf](https://www.forestry.gov.uk/PDF/fcpg003.pdf/$FILE/fcpg003.pdf)

Drawings

772478-DWG-ENV-032 rev A: Site Areas

30755-3005-01 rev F: Restoration Strategy Plan

30755-3005-02 rev A: Combined Plan

0047/PO/1 v5: Progressive Operations Plans – Initial Development & Phases
1-2

0047/PO/2 v5: Progressive Operations Plans – Phases 3-4 & 5-6

0047/PO/3 v6: Progressive Operations Plans – Phases 7-8 & 9-10

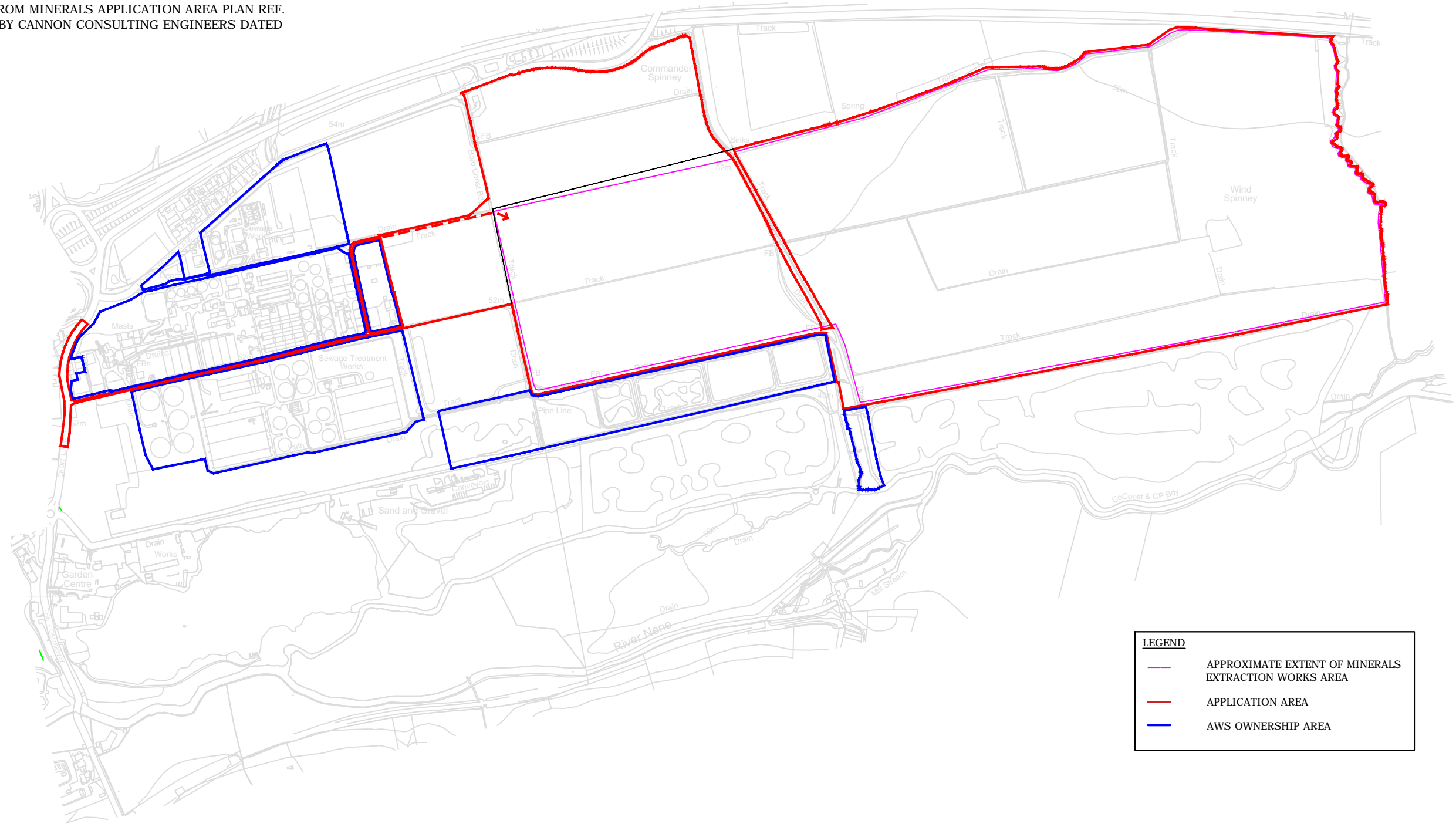
0047/PO/4 v5: Progressive Operations Plans – Final Works and Completed
Restoration




NOTES


1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEER'S, ARCHITECT'S AND SPECIALIST'S DRAWINGS AND THE SPECIFICATION.

2. **DO NOT SCALE** FROM THIS DRAWING MANUALLY OR ELECTRONICALLY. WRITTEN PERMISSION MUST BE OBTAINED FROM MLM PRIOR TO SCALING ELECTRONICALLY OR USING THIS ELECTRONIC FILE.

3. BASE PLAN TAKEN FROM MINERALS APPLICATION AREA PLAN REF. F191-033-REVISION B BY CANNON CONSULTING ENGINEERS DATED 13.07.2017.



LEGEND	
	APPROXIMATE EXTENT OF MINERALS EXTRACTION WORKS AREA
	APPLICATION AREA
	AWS OWNERSHIP AREA

 MLM Multidisciplinary Consulting Building 7200, Cambridge Research Park, Cambridge, CB25 9TL Tel: 01223 632800 Fax: 01223 815630 Website: www.mlm.uk.com					Drawing Status		FINAL ISSUE			Drawing Title			SITE AREAS		
					Client		ANGLIAN WATER SERVICES LIMITED			Drawn/Design	AT	Date	MAR 2017	Scales	1:1000 @ A3
Project		GREAT BILLING MINERAL EXTRACTION SITE			Checked	EG	Approved	EG	MLM Ref	772478					
Rev		Date	Description	Made	Ckd	Drawing No.			772478-DWG-ENV-032			Rev	A		