How Hill NNR
Management Plan

This plan covers the period:
2011/12- 2015/16

Prepared by

Erica Murray
Conservation Officer
Broads Authority

CONTENTS

1.1 Location

		Notes
Location	How Hill Nature Reserve lies within the three parishes of Barton Turf, Ludham and Catfield, in the Broadland district of the County of Norfolk. The reserve is approximately 24km northeast of Norwich, and 6.9km northeast of Horning and lies on both sides of the River Ant, north of Ludham. As well as the NNR, this management plan refers to the entire How Hill Estate.	The reserve is accessible via How Hill Road, from School Road in Ludham and Sharp Street in Catfield, with a further right for Broads Authority staff traffic through the entrance to How Hill House Study Centre and along the hard track to the southern entrance of compartment 11. Public access to the site is also from How Hill Road, using the car park located to the south of the main house.
County	Norfolk	
District	North Norfolk	
Local Planning Authority	Broads Authority	
National Grid Reference	O.S. Sheet no. 134 (1:50,000), TG368194 (centre of reserve) (*Refer to Map 1)*	

1.2 Land Tenure

	Area (ha)	Notes
Total Area of NNR	129.95 ha	Total of 141 hectares (includes land leased to How Hill Trust). Acquired by the Broads Authority in 1983.
Freehold	129.95 ha	Owned by the Broads Authority
Leasehold	12 ha	Compartments 12, 59 and part of 60 are leased to the How Hill Trust. These estate compartments are not part of the NNR.
S 35 Agreement	×	
S16 Agreement	×	
Other Agreements	×	
Legal rights of access		A public footpath follows the access track between How Hill Road and the staithe; it passes How Hill House and car park and Toad Hole Cottage (see Map 9). A second footpath terminates some 300 metres south of the staithe on the riverbank opposite Turf Fen. These two footpaths are connected by a permissive path that runs alongside the moorings south of the staithe, and continues upstream, terminating at the second drainage mill. The Norfolk Windmills Trust have a right of access to the three windpumps on site in order to undertake maintenance works.
Navigation		The public have the right of navigation through the reserve via the River Ant. There is no public boat access to the dyke system on the reserve, although a boat trail using internal dykes is run by the Broads Authority.
Other rights, covenants, etc		Owing to the location of the reserve on both sides of the river, the Broads Authority also owns the riverbed within the boundaries of the reserve and the moorings south of the staithe. Ownership of the staithe is unknown but the Broads Authority undertakes its management.
Notes		How Hill Trust own the house and ornamental gardens. Compartments 12, 59 and part of 60 are leased to the How Hill Trust (c.12ha – see Maps 1 and 11).

1.3 Site Status

Legal designations affecting the site (Refer to Map 3)

Designation	Area (ha)	Date	Notes
SAC	5865.60 Ha	**Designation:** The Broads 8 January 1996, revised 16 March 2001 31 July 2002	Includes 27 Broads SSSIs. Registered 14 June 2005
SPA	5462.4 Ha	**Designation:** Broadland 21 September 1994	Includes 25 Broads SSSIs Registered 30 January 1996
Ramsar	5488.61 Ha	**Designation:** Broadland 21 September 1991	Includes 25 Broads SSSIs Registered 30 January 1996
NNR	129.95 ha	**Declaration(s):** How Hill NNR 15 May 2006	
SSSI	Ant Broads & Marshes 745.79 ha	**Notification:** Date Notified (1949 Act): Date Notified (1981 Act): Ant Broads and Marshes SSSI (part of) 1954 Barton Broad & Sutton Broad; 1971 Ant Marshes 1989	SSSI Units 5 121.82ha 36 (Crome's Broad) 4.26ha 37 (Reedham Water) 4.04ha
GCR	×		
Other designations (site):			
Wider designations:	×		

1.4 Physical Features

The physical aspects of the reserve which form part of the site's importance or which have a bearing on its management

Geomorphology, Geology & Soils

The substrate and principle aquifer underlying the site is Norwich Crag, an assorted strata of iron-rich sands, gravels and clays, laid down when east Norfolk was covered by a shallow sea. This is capped by layers of glacial sands, gravels and Norwich Brick-earth – glacial deposits of sandy clay and sandy-clay loam. Reedham Hill represents an example of a small drift of Norwich Brickearth, rising a few metres above the valley floor and thus contrasting with the surrounding marshes lying at sea level.

The Crag is underlain at some depth by the Upper and Middle Chalk, but much of the groundwater that irrigates the Ant fens is derived from the Norwich Crag and Brickearth deposits and is often extremely acidic and low in nutrients. In the lower part of the Ant valley, including How Hill, blue grey alluvial clays deposited during the Romano-British marine transgression overlie the Crag. This in turn is covered by a layer of peat *(see Map 10),* commonly between 6-8 metres in depth, which was deposited during freshwater conditions. North of How Hill the clay decreases in width and depth. Deeper deposits are more abundant towards Ludham Bridge, which lies to the south.

Wheeler (1983) has shown that the proximity of the estuarine clay beneath the peat surface varies considerably across Reedham Marshes. It was found to be nearest the surface along the Hundred Stream meander and lowest within compartments 35 and 36 (see Map 11 for compartments and Map 7 for hydrology). The clay contains high concentrations of calcium,magnesium, sodium and potassium, which influence the chemistry of the upper horizons. Brackish conditions predominate near the hundred stream where estuarine deposits seem to be especially abundant. In addition, salt tolerant species such as Grey Club-rush (*Schoenoplectus tabernaemontani)* and Parsley Water-dropwort (*Oenanthe lachenalii)*, also occur within the fen vegetation.

Jennings (1952) reported that east of the river the clay was generally nearer to the peat surface (taking into account surface wastage of the grazing marshes). Jennings also revealed that *Phragmites* peat was abundant in, on, and below the estuarine deposit. Lower strata were of brushwood peat (this is common in the Ant Valley).

A large proportion of the fen area at How Hill is thought to have been worked for peat, either during the medieval period, creating water bodies such as Crome's Broad, or during the subsequent phase of shallow excavations, which produced the extensive turf ponds that underlie much of Reedham Marshes. Numerous peat baulks have been found across Reedham Marshes, indicating the use of the area for peat extraction. Owing to this history of peat extraction, the western side of the Reserve should be treated as hazardous when walking or taking machinery over the peat surface.

Hydrology & Hydrochemistry

The two parts of the Reserve separated by the river have very different hydrological systems (see Map 7). The land to the east of the river operates as part of a pump drained level, whereas an open fluvial system exists to the west. East of the river, surface water enters the site through Summer House Wood to the east of Crome's Broad, water flows through the Broad itself and then passes into the dykes of Clayrack Marshes.

Three Water Control Structures (WCS) exist on this part of the site (see Map 7). WCS 1 maintains high water levels in the adjacent water gardens; WCS 3 maintains high water levels on the whole area during the summer as without this structure, dyke levels would be undesirably low.
In combination, all of these control structures aim to maintain the dykes at marsh level between January and April, and no more than 45cm below marsh level between June and October. WCS 4 was originally installed in 1988 to isolate Crome's Broad from the river. This sluice was later repaired, with true isolation being achieved in 1992. Following this closure and subsequent mud pumping of half the Broad in the same year, significant improvements in water quality and aquatic plant growth were observed (Kennison, 1987). Long-term aims may include reconnecting the Broad to the river, however, the sluice also forms an important flood defence role and any changes could have significant impacts on land downstream.
Broadland Environmental Services Ltd (BESL) replaced the sluice in 2009 as part of the flood defence works. Clayrack is at the top of a pumped system, so maintaining high water levels in this part of the site does not affect adjacent land, unless there is a break in the river wall. Dyke water evacuates the site near Toad Hole Cottage and is finally pumped into the river downstream at Ludham Bridge, thus fulfilling an important flood defence role for the wider area. River wall strengthening and the creation of a new soke dyke has been carried out on of the eastern side of the river as part of The Broadland Flood Alleviation Project.
In comparison, the western side of the Reserve is hydrologically connected to the river and undefended from flooding. River water flows freely through the dyke system and is thought to penetrate 0.5 kilometres into Reedham Marsh (Kennison, 1987). A number of dykes connect directly to the river and owing to a degraded riverbank, water floods onto compartment 49 when the river level is high. The river water then percolates through reedbeds and disused dykes to reach Reedham Water, by which time its quality has improved in comparison to that of the river. Considerable quantities of water are held in this compartment owing to numerous small ponds. It is not thought that the historic peat cuttings and terrestrialised turf ponds affect the hydrology on the western side of the reserve.

Map 7 shows the location of three WCS on this side of the river. WCS 5a & b were installed as part of a water quality experiment and have only caused semi-isolation of this dyke (Andrews, pers comm). WCS 6 was installed as part of the LIFE Bittern I project and was designed to maintain higher reedbed water levels in the winter, with capacity for temporary draw-down to facilitate management.

This was possible owing to the presence of bunds around the southern side of the site, originally installed when this area was drained by Turf Fen Mill (George, 1992). However, owing to the degraded state of the riverbank on this section of the site, the sluice cannot function effectively and is not in use.

Drainage and subsequent re-wetting of this area has resulted in shrinkage of the peat, and the emergence of numerous water-filled holes. Coupled with high winter water levels, this has rendered management of this area problematic. Three abstractions points exist near the site, two to the east and one to the west. None of these are known to have direct impacts on the site, although there is a possibility that they may result in a change in the proportion of groundwater to surface water feeding the site (Andrews, pers comm.) The western abstraction is surface water only and periodic.
The pump located outside the NNR boundary to the west, is controlled by the Internal Drainage Board for normal water drainage.
Two hydrological features with considerable historical importance are present on the Reserve. The old course of the River Ant runs through Reedham Marshes (Hundred Stream meander), and the linear dykes in compartment 28 were created as parish boundaries hundreds of years ago. (See Maps 7 & 11).

Water Quality

The southern section of Crome's Broad has seen significant improvements in nutrient status, clarity, aquatic macrophytes and the fish community since initial restoration took place in 1988. This positive response, particularly by macrophytes prompted further mud pumping of the northern section of the Broad; however signs of successful recovery were limited. The mud depth in the northern Broad was significantly deeper, and considerable mud still remains which is limiting macrophyte growth. The total phosphorus levels in the broad although decreasing, have remained significant as have filamentous algae communities. Alternative management techniques to overcome these problems are currently being explored.

Conductivity within the Broad remains low at 691uS/cm (Hoare pers comm, March 2010). The dykes on the eastern side of the reserve were surveyed as part of the Broadland Flood Alleviation Project (BFAP) in 2004, which revealed a mean conductivity measurement of 745uS/cm for the soke dyke and a slightly higher mean measurement of 1008uS/cm within the internal marsh dykes, possibly owing to reduced flushing within the internal system. Clear water and diverse plant communities feature throughout these dykes, a designation feature of the Broads SAC.
Reedham Marsh has been included within a conductivity monitoring programme undertaken by the BA since December 2003. Readings are taken on a monthly basis at 25 points around the dyke system to determine the penetration of saline water through the fen. The same measurements are being taken at other key Broadland sites with various levels of river connectivity. Readings at Reedham Marsh are similar at each of the stations, reflecting the high level of connectivity around the dyke system, although there is a trend for those sampling points furthest from the river to record slightly higher readings.
Reedham Water is eutrophic in nature, and hence very low in aquatic plants due to the high nutrient input from resident and wintering waterfowl.
Further improvements to water quality around the site now rely upon measures to control diffuse pollution within the surrounding catchment.

Climate

Norfolk is one of the driest counties in England with warm summers and low annual rainfall. This climate is typified at the reserve.

1.5 Biological Features

The plants and animals which form part of the reserve's importance and which contribute to national and local biodiversity

Flora (*See species lists, Appendix 1)*

OPEN WATER & EMERGENTS

Crome's Broad consists of two small interlinked broads (2.3ha and 2ha), separated by a shallow area dominated by Common Reed (*Phragmites australis)* and Reedmace (*Typha angustifolia)(see Map 4)*. Historically, the Broad was dominated by two main aquatic macrophyte species, Rigid Hornwort *Ceratophyllum demersum)* and White Water-lily (*Nymphaea alba)* with more species only noted back in 1939 (Water-violet (*Hottonia palustris),* Whorled Water-milfoil *(Myriophyllum verticillatum),* Water-soldier *(Stratiotes aloides)* and Bladderwort (*Utricularia* spp.)) (Jackson, 1981). Before mud pumping and isolation from river-borne nutrients in 1992, the northern section of the Broad contained little true aquatic flora, dominated instead by flocculent mud and thread algae (Clarke et al, 2005). Following restoration, macrophytes rapidly colonised, resulting in a large standing crop of Rigid Hornwort, which has since persisted with some stoneworts and lily beds. Fish surveys have noted the status of macrophytes and it appears that the Hornwort beds have achieved a high and stable density (Perrow et al, 2004). Water soldier has been regularly re-introduced, from clearance of local dykes; however it has not successfully survived the winter or water bird grazing.

Improvement in the north basin plant community has, however not yet reached the same level of that found in the south basin. Further management options to improve the north basin water quality and plant community are being considered (Broads Authority (2009) Annual Water Plant Monitoring Report). Restoration work to Reedham Water is not being considered at present. High nutrient input from waterfowl are thought to be responsible for the eutrophic nature of the water.

The dykes within Clayrack marshes and Reedham Marsh are a European cSAC feature, containing plant species such as Water-starwort (*Callitriche* spp.), Water-violet (*Hottonia palustris)*, Watercrowfoot (*Ranunculus* spp.), Water Mint (*Mentha aquatica)*, Bladderwort (*Utricularia* spp.*),* Arrowhead *(Sagittaria sagittifolia)*, Broad-leaved Pondweed (*Potamogeton natans)* and the nationally rare Water-soldier (*Stratiotes aloides)* and nationally scarce Whorled Water-milfoil (*Myriophyllum verticillatum)*.

Communities

FEN

Floodplain fen habitat *(see Map 5)* is extensive on the western side of the reserve, with a total of 30 NVC fen communities across whole site (including sub-communities & new proposed variants). Of these the nationally important S24-S25 intermediate community is most frequent, as is S24d in the central part of Reedham Marshes and S4b & S4a on the South Western section of the site.

Within the fen the dominant species are typically Common Reed (*Phragmites australis)*, Purple Small-reed (*Calamagrostis canescens)* and Great Fen-sedge (*Cladium mariscus)*.
Constant species include the following: Cuckooflower (*Cardamine pratensis), Tufted-sedge (Carex elata),* Hemp-agrimony *(Eupatorium cannabinum),* Meadowsweet *(Filipendula ulmaria),* Common Marshbedstraw *(Galium palustre),* Marsh Pennywort (*Hydrocotyle vulgaris),* Yellow Iris (*Iris pseudacorus),* Blunt-flowered Rush *(Juncus subnodulosus),* Yellow Loosestrife *(Lysimachia vulgaris),* Purple-loosestrife *(Lythrum salicaria),* Forget-me-not *(Myosotis* spp.*),* Marsh Cinquefoil*(Potentilla palustris),* Lesser Spearwort *(Ranunculus flammula),* Water dock *(Rumex hydrolapathum),* Bittersweet *(Solanum dulcamara),* Marsh Fern *(Thelypteris palustris),* Reedmace *(Typha angustifolia)* and Common Valerian (*Valeriana officinalis)*.

The fen communities can be divided by the location of the Hundred Stream meander with *Cladium* occurring largely inside this dyke, and reed dominated communities occurring largely outside. *Map 4* shows the current distribution of habitat types, while *Map 5* shows the location of NVC fen and woodland communities. The nationally rare plant Crested Buckler-fern (*Dryopteris cristata)* is present, as are 7 nationally scarce species: Marsh Sow-thistle (*Sonchus palustris),* Greater Water-parsnip (*Sium latifolium)*, Cowbane (*Cicuta virosa),* Marsh Fern (*Thelypteris palustris),* Marsh Pea (*Lathyrus palustris)*, Fibrous Tussock-sedge (*Carex appropinquata)* and frequent Milk-parsley (*Peucedanum palustre)*. A number of rarities have been recorded in the past and possibly still occur; they include Narrow leaved Marsh-orchid (*Dactylorhiza traunsteineri)* and Marsh Gentian (*Gentiana pneumonanthe)*.

Crested Buckler-fern *(Dryopteris cristata)* is associated with Downy Birch (*Betula pubescens)* scrub, *Sphagnum* moss and other bryophytes. Other ferns can be found but are not dominant; a hybrid between Crested Buckler-fern and Narrow Buckler-fern (*Dryopteris carthusiana)* (*D. xuliginosa*) can often be found (Kennison, 1987). The Crested Buckler-fern community is of international importance, with the Ant Marshes SSSI hosting the largest population within the Broads. It is likely that the population at How Hill forms the largest colony. A small area of mire exists on the western side of Reedham Marsh containing such locally uncommon species as Black Bog-rush (*Schoenus nigricans)*, Flea Sedge (*Carex pulicaris)*, Lesser Tussock-sedge (*Carex diandra)*, and Bog Pimpernel (*Anagallis tenella)*.

<u>RUSH PASTURE & FEN MEADOW</u>

The rush pasture to the east of the river *(see map 4)* has a long history of management. Much of this area was ploughed during the First World War, and from the 1960's onwards was mown for hay and aftermath grazed. This practice ceased in the mid 1990's as the grazing of marginal land became unproductive. The three most northerly marshes (Clayrack; compartments 6-8) are dominated by Soft-rush (*Juncus effusus)*, although there are numerous open patches containing a more diverse plant assemblage including species such as Yellow Loosestrife (*Lysimachia vulgaris),* Skullcap *(Scutellaria galericulata)* and Purple-loosestrife (*Lythrum salicaria)*; this is particularly the case on the northernmost marsh. It is thought that these areas of higher species-diversity have always been present but have been encouraged by pony grazing, which has opened up the sward.

The majority of the Clayrack area however has become dominated by Soft rush since the cessation of annual mowing management, however trial scraping of the area to remove this species has recently taken place. The Soft rush scraping is being monitored to determine the success of this trial.
Compartment 9 maintains a much higher water level than the other compartments, possibly owing to a lower surface. This compartment also contains a high proportion of sedges and the substrate appears to be peatier than those to the north.

An area of fen meadow exists in compartment 11, known as the wildflower meadow and is part of the SAC Molinia Meadows feature.
This area avoided the plough during the First World War and is thought to have a greater depth of peat than the other marshes in this block. NVC community M23a dominates this compartment, with a small patch of M25b in the centre (Parmenter, 1995).
The southern half of this compartment in particular contains frequent Meadow Thistle *(Cirsium dissectum)* and is a popular feeding ground for the Swallowtail butterfly *(Papilio machaon)* during early summer. Other frequent plant species include Blunt-flowered Rush *(Juncus subnodulosus),* Greater Bird's-foot-trefoil *(Lotus uliginosus),* Fen Bedstraw *(Galium uliginosum),* Heath Wood-rush *(Luzula multiflora),* Carnation Sedge *(Carex panacea) and* Devil's-bit Scabious *(Succisa pratensis)*.

Despite heavy invasion by brambles and scrub when the Broads Authority took over the management of the site in 1983, clearance and regular mowing management have restored compartment 11 to a diverse fen meadow. The north-western part of this compartment become more reed-dominated, possibly owing to a low-point on the western dyke, which allowed water to flood onto the marsh during the winter. However recent flood defence works as part of the BFAP programme have resolved winter flooding and consequent reed spread in the marsh. The BFAP works have resulted in some loss of terrestrial habitat through river wall widening, material sourcing for crest-raising and the creation of a new soke dyke.

DRY GRASSLAND

Three areas of dry grassland exist on the Reserve *(see Map 4),* two of which are leased to the How Hill Trust and are used as general recreational areas. The third area lies to the west of Crome's Broad, located on higher ground to the edge of the floodplain. These three fields consist of a mixture of meadow and ranker grasses, with a fair scattering of thistles. Mature Blackthorn *(Prunus spinosa)* and Hawthorn *(Crataegus monogyna)* hedges partially divide the fields, with mature Oak (*Quercus* spp.) trees lining the upland boundary. This area is grazed by Broads Authority Welsh ponies in the winter and is frequently used by barn owls as hunting ground.

WOODLAND & SCRUB

To the east of the river, mature wet woodland occurs around Crome's Broad *(see Map 4)* consisting of mixture of the internationally important W5 community and W6 which also occurs to the South of the Broad in areas such as Pigeon and Gale Wood. Alder (*Alnus glutinosa)* is almost always dominant but Grey Willow (*Salix cinerea),* Ash *(Fraxinus excelsior),* Downy Birch *(Betula pubescens)* and Pedunculate Oak *(Quercus robur)* also occur.

Characteristic ground flora species include Gipsywort (*Lycopus europaeus),* Tufted-sedge *(Carex elata),* Remote Sedge *(Carex remota),* Yellow Loosestrife *(Lysimachia vulgaris),* Marsh-marigold *(Caltha palustris),* Wild Angelica *(Angelica sylvestris)* and Common Nettle *(Urtica dioica)*.

Small areas of birch woodland also occur to the east of the river, e.g. Gale Marsh (comp 58). While not of particular importance, these woods provide valuable bird habitat and receive minimal management, for example, glade creation. Situated further south is an extensive area of mixed beech woodland known as Toad Hole Wood. While this is outside the SSSI boundary, it provides further diversity of habitat, supporting numerous bird and mammal species, and forms an important element of the fabric of the site.
Carr woodland and scrub also occur to the west of the river on Reedham Marshes, with moderate areas of W2a and smaller areas of the nationally rare W2b and W5.
An area of W10 also exists on a glacial knoll known as Reedham Hill (compartment 14).

This high point is host to some native broad-leaved trees, but was also planted with Scots Pine *(Pinus sylvestris)* by the Boardman family. While these trees are rather out of place in ecological terms, they are not an invasive species and have become something of a landscape feature. The trees are also used by a number of birds including long-eared owls.
Shrubs and small trees are an important component of many of the How Hill woods, e.g. Elder*(Sambucus* spp.), Black Currant (*Ribes nigrum)*, Red Currant (*Ribes rubrum)*, Bramble (*Rubus fruiticosus)*, Buckthorn (*Rhamnus catharticus)*, Guelder-rose *(Virburnum opulus)*, Dog-rose (*Rosa canina)* and Field Maple (*Acer campestre)*. The field layer can be tall and vigorous including such species as Yellow Iris (*Iris pseudacorus)*, Sedge *(Carex* spp.), Meadowsweet (*Filipendula ulmaria)*, Purple Small-reed (*Calamagrostis canescens)* and Common Reed (*Phragmites australis),* with bryophytes and ferns also well represented. Some introduced and invasive species also occur and continue to be targeted by eradication programmes, e.g. *Rhododendron ponticum* and Red-berried Elder *(Sambucus racemosa)*.

Scattered scrub occurs across the fen in clumps, larger clusters (namely where the birch-crestedbuckler fern communities are located) and as isolated trees. This scrub forms an integral part of the wetland mosaic, providing valuable habitat for birds and invertebrates. Management occurs in the form of long rotation scrub roguing as required.

Fauna

MAMMALS

27 species of rodent have been recorded on the reserve, although the status of the majority is unknown. Species such as mice, voles and shrews flourish, providing an important source of food for birds of prey. Otters *(Lutra lutra)* are regularly and increasingly seen across the whole of the Reserve and water voles *(Arvicola terrestris)* are widespread. Other mammals using the site include Chinese water deer *(Hydropotes inermis inermis)*, rabbit *(Oryctolagus cuniculus)*, fox *(Vulpes vulpes)*, grey squirrel *(Sciurus carolinensis)*, mole *(Talpa europaea)* and five species of bat, common pipistrelle *(Pipistrellus pipistrellus)*, soprano pipistrelle *(Pipistrellus pygmaeus),* Daubenton's *(Myotis daubentonii)*, Natterer's *(Myotis nattereri)* and noctule *(Nyctalus noctula)*. In addition, brown long-eared bats *(Plecotus auritus)* are resident within How Hill House.

European mink *(Mustela lutreola)* have not been seen on the Reserve, but based upon other sightings, are likely to be in the locality.

BIRDS

The fen *(see Map 4)* areas of the reserve provide valuable breeding, roosting and wintering habitat for a wide range of birds, including a number of species listed on Annex 1 of the EC Birds Directive. Large numbers of reed warbler *(Acrocephalus scirpaceus)*, sedge warbler *(Acrocephalus schoenobaenus)* and grasshopper warbler *(Locustella naevia)* can be seen in summer and good numbers of breeding Cetti's warbler *(Cettia cetti)* (10-12 pairs) have also been recorded.

Bearded tit *(Panurus biarmicus)* and reed bunting *(Emberiza schoeniclus)* are plentiful with a pair of breeding marsh harrier *(Circus aeruginosus)* and wintering hen harrier *(Circus cyaneus)* also using the site.
Montagu's harrier *(Circus pygargus)* have also been seen on the Reserve and bittern *(Botaurus stellaris)* use the Turf Fen area of Reedham Marshes for wintering, feeding and breeding.

The abundance of scrub and woodland is also responsible for the presence of many other breeding species such as woodcock (*Scolopax rusticola)*, tawny owl *(Strix aluco)*, treecreeper *(Certhia familiaris)*, chiffchaff (*Phylloscopus collybita)*, redpoll *(Acanthis flammea),* great spotted woodpecker *(Dendrocopus major)*, lesser spotted woodpecker *(Dendrocopus minor)*, green woodpecker *(Picus viridis)*, coal tit *(Parus ater)*, marsh tit *(Parus palustris)*, long-tailed tit *(Aegithalos caudatus)* and great tit *(Parus major)*.
On the grazing marshes and cut reed/sedgebeds a number of waders can be observed including redshank *(Tringa totanus)*, snipe *(Gallinago gallinago)* and oystercatcher *(Haematopus ostralegus).* Lapwing *(Vanellus vanellus)*, redshank and snipe no longer breed on site, although their decline appears to be national as opposed to site-specific.

Water-birds such as great crested grebe *(Podiceps cristatus)*, little grebe *(Tachybaptus ruficollis)*, tufted duck *(Anas fuligula),* pochard *(Aythya ferina)*, shoveler *(Anas clypeata)*, water rail *(Rallus aquaticus)*, coot *(Fulica atra),* moorhen *(Gallinula chloropus)* and other breeding ducks can be found on dykes, ponds, Reedham water and Crome's Broad. Common tern *(Sterna hirundo)* and black-headed gull *(Larus ridibundus)* also breed on the reserve with the latter being especially numerous around Reedham Water. Eroded river banks have provided a niche for nesting kingfisher *(Alcedo atthis)* in recent years.

Many wildfowl overwinter on Reedham Water, Crome's Broad and the bird scrape. Common winter visitors include wigeon *(Anas penelope)* and teal *(Anas crecca)* with passage birds also often observed, especially common sandpiper *(Actitis hypoleucos)*, dunlin *(Calidris alpina)* and occasionally osprey *(Pandion haliaetus)* and buzzard *(Buteo buteo)*. In addition, a large starling *(Sturnus vulgaris)* roost is a regular feature within the reedbeds of Reedham Marshes. Summer management of the scrape attracts a variety of waders, including redshank, little ringed plover*(Charadrius dubius)*, which have bred in the recent past and avocet *(Recurvirostra avosetta)*, which bred for the first time in 2005. In winter, the flooded scrape is good for ducks, including nationally important numbers of shoveler.

The bird scrape was created during the Boardman's ownership of the site. Originally created for duck shooting, the purpose of the scrape was changed to that of a bird refuge when the ownership changed to the Broads Authority in 1983. The water levels on the scrape are artificially controlled to provide a range of conditions suitable for birds throughout the year. In the Spring, water is pumped off to create muddy conditions; during the summer, water levels are controlled in order to maintain these muddy conditions, along with shallow pools; and in winter, natural levels are allowed providing a larger area of water for wintering birds.

The pumping of water during the spring and summer is achieved through daily checking by the Information Assistant at Toad Hole Cottage and use of a small diesel pump. Without such water control, the natural lower water levels of the scrape would encourage the gradual growth of reedbed and result in succession from open water. If pumping is taking place, care is taken not to significantly lower water levels in the surrounding dykes.

HERPTILES & FISH

Smooth newt *(Triturus vulgaris)*, common toad *(Bufo bufo)* and common frog *(Rana temporaria)* have been recorded and grass snake*(Natrix natrix)* are known to occur on the site. The usually recorded range of Broadland fish is present within the dykes and open water bodies of the Reserve (bream, eel, pike, perch, roach), although introduced carp are also thought to be resident in Reedham Water. Crome's Broad has been subject to annual monitoring of the fish population since 1997 (Perrow et al, 1998, 2000-2004). Roach, perch, tench, rudd, pike, ruffe and eel have all been recorded, with the numbers of tench and perch increasing as aquatic plant populations have stabilised.

INVERTEBRATES

The rich invertebrate assemblage of the Broads is recognised within its Ramsar designation, and specifically within the Ant Broads and Marshes SSSI citation. How Hill provides an excellent example of the diversity of wetland invertebrate life with many aquatic, marsh and woodland species observed. Rare priority species recorded on site include the small dotted footman moth *(Pelosia obtusa)*, reed leopard moth *(Phragmataecia castaneae)*, flame wainscot moth *(Senta flammea)*, dotted Fan-foot moth *(Macrochilo cribrumalis)* and the spider *Clubonia juvenis.* Both the nationally important Norfolk hawker dragonfly *(Aeshna isosceles)* and the beetle *Hydrochus brevis* are also present.

Insects are found in prolific numbers during the summer months, especially various mosquitoes, beetles, midges, horse and hover-flies. Various dragonfly and damselfly species thrive around the open water of dykes and ponds with 15 species recorded to date. There is an extremely high diversity of moths present in the area, including hawks and wainscots, with a total of 332 species recorded. Large populations of the RDB2 swallowtail butterfly *(Papilio machaon)* are regularly observed, particularly in the wildflower meadow area where they feed on Ragged-Robin *(Lychnis flos-cuculi)* and Meadow Thistle *(Cirsium dissectum)*, and on Reedham Marshes where there is abundant Milk-parsley *(Peucedanum palustre)* for egg-laying. 18 other species of butterfly are also regularly seen on the Reserve.

Aquatic invertebrates are abundant where there is a good growth of water weeds. Species include swan mussels, water fleas, pond-skaters, whirligig beetles and caddis flies.

Crome's Broad has a very healthy population of the swan mussel (*Anodonta cygnea*). Indicating good water quality, and larger mussels congregating along the margins. Fifty individuals were collected and replanted into the southern section of the Broad (Clarke et al, 2005). The dykes within the Clayrack Marshes area are particularly notable as breeding sites for dragonflies and damselflies. The list of other invertebrates is extensive with many species of Diptera, Coleoptera and others (see species list, *Appendix 1*).

1.6 Cultural Features

Landscape importance, historical and archaeological features of the NNR and its use for purposes other than nature conservation

Joint Character Area:	80. The Broads

Landscape Character

The Broads are located on the eastern edge of East Anglia with a boundary delineated by the floodplain edges of the rivers Bure, Yare, Waveney and their tributaries.

The low lying landscape making up the Broads has a mix of characters, predominately consisting of large, open, grazing marshes with ditches rich in aquatic life and low-lying wetland. These wetland areas are made up of wide open 'Broads' (flooded former peat diggings) of varying size interconnected by river channels, reed swamp, fen and carr woodland with some arable cultivation.

In the upper reaches of the river valleys, deciduous woodland, copses and hedgerows characterize the landscape (Natural England, 2006).

Ant Valley

How Hill NNR is located in the Ant valley *(see Map 1)* which is characterised by large areas of freshwater fen. The river valley is narrow and winding with tributaries running both East to West. Valley sides are generally very low with areas of carr woodland preventing both access and views across the valley. How Hill however provides a rare vantage point from which to view the surrounding valley floor.

The Ant valley fens are known for being the least saline influenced of the Broadland fens, resulting in a greater diversity of species.

Historically these areas were subject to various forms of management in the nineteenth and twentieth century including shallow turf cutting for fuel. Drainage of the surrounding landscape was also practiced, shown by the many drainage mills that still scatter the landscape. Drainage appears to have been abandoned in the 1930s and 40s with the surrounding landscape reverting to fen.

The loss of traditional fen management practices since the late nineteenth century has seen an increase in carr woodland with the loss of open fen and its associated plant and animal species (Broads Authority Landscape Character assessment).

How Hill National Nature Reserve

How Hill NNR – Summary Description

How Hill Nature Reserve consists of two areas of land either side of the River Ant *(see Map 1).* To the west of the River lies Reedham Marshes, a large tract of internationally important unreclaimed fen with areas of carr woodland, scrub, and open water *(see Map 4).* The fen is dominated by Common Reed (*Phragmites australis)*, Great Fen-sedge (*Cladium mariscus)*, or a mixture of these species, with many tall herb fen associates including Milk-parsley (*Peucedanum palustre)*. Following a continuous programme of scrub clearance, large blocks of open fen have been restored, leaving scattered sallow bushes as an integral part of the fen mosaic. Patches of Downy Birch (*Betula pubescens)* also occur with associated bog moss (*Sphagnum* spp.) and Crested Buckler-fern (*Dryopteris cristata)* ground flora; an important wet woodland community. To the east of the river lies Clayrack Marshes, a small area of unimproved marsh. The southern most marsh is of particular interest supporting a number of fen meadow species, including those characteristic of acidic conditions. Just northeast of Clayrack lies Crome's Broad, an area of open water, created through historical peat excavation. This Broad is surrounded by internationally important alder woodland and alongside other areas of open water on the reserve, provides valuable habitat for many wildfowl.

Archaeological and Historical Features

Three windmills/pumps are located on the Reserve *(see Map 10),* all of which are the property of the Norfolk Windmill Trust. The internal machinery within Turf Fen Mill on the western riverbank (TG369188) has been fully restored and the mill is of special interest on account of its double scoop wheels and varying gears. Boardman's Mill (TG369192) and Clayrack Mill (TG369194) are both located on the eastern river bank.

The former is a trestle or skeleton mill, fitted with a turbine pump and commonly used in the nineteenth century to drain smaller marshes. Owing to their wooden construction, few of these mills survived, with this one restored by the Windmill Trust in 1980. Lastly, Clayrack Mill has a hollow post construction with a scoop wheel and was moved to the site from Ranworth in c.1987.
Two hydrological features with considerable historical importance are present on the Reserve. The old course of the River Ant runs through Reedham Marshes (Hundred Stream meander), and the linear dykes in compartment 28 were created as parish boundaries hundreds of years ago. (See Maps 7 & 11).
Toad Hole Cottage, now the site of the Broads Authority's information centre at How Hill, is a restored marshman's cottage and museum. Along with the windpumps, the cottage provides a cultural link to the past, as does the wealth of wetland habitats present on the reserve, originally created as a by-product of a thriving local economy. Today, this cultural legacy and abundance of wildlife attracts many visitors to the reserve.

Land-Use History

A large proportion of the fen area at How Hill is thought to have been worked for peat, either during the medieval period, creating water bodies such as Crome's Broad, or during the subsequent phase of shallow excavations, which produced the extensive turf ponds that underlie much of Reedham Marshes. Numerous peat baulks have been found across Reedham Marshes, indicating the use of the area for peat extraction. Owing to this history of peat extraction, the western side of the Reserve should be treated as hazardous when walking or taking machinery over the peat surface.

Socio-economic Use

As well as conservation reedbeds the reserve also has commercial reed and sedge beds on Reedham Marshes. Reed is cut in the winter and sedge in the summer, supplying sought after material for the thatching industry.
Reserve visitors make a small contribution to the local economy, making use of local accommodation and refreshment facilities.

Education

The Reserve has a wide-reaching educational remit owing to the use of the site by the How Hill Trust. The Trust owns the house and gardens and lease a further c.12ha *(see map 11, compartments 12, 59 and part of 60*) from the Broads Authority. In addition, an agreement exists whereby the Trust can make use of other parts of the Reserve in order to further their environmental education remit. The Trust runs courses for schools and adults and utilises both the conservation management work undertaken by the Authority and their own initiatives to educate their students. Around 3,500 children visit the reserve annually (How Hill Trust, 2010). General education and interpretation regarding conservation management and wildlife is achieved through guided boat trips, walks and staff at Toad Hole Cottage during the summer.

Research Use

The extensive area of fen and the variety of habitats present on the reserve provide ideal opportunities for study and research. Past studies into the impacts of management on invertebrates, the success of scrub removal and the ecology of the swallowtail butterfly are just a few examples of how the Reserve has been utilised in the past. Further relevant research should be encouraged, providing there is not a negative impact upon the conservation interest of the Reserve.

The Reserve is also studied as part of Broads Authority funded initiatives such as hydrological monitoring and annual macrophyte monitoring, as well as the more recent Fen Ecological Survey which was part funded by Natural England.

In addition, the regular and recorded management history and presence of long-term monitoring quadrats advocates a revitalisation of Kennison's monitoring programme to determine some of the effects of fen management, as well as recording the status of rare species such as Crested Buckler-fern, bittern, otter and water vole.

Demonstration

As a site with varied management, opportunities exist for demonstration of fen harvesting; grazing, commercial reed and sedge harvesting and lake restoration (e.g. mud pumping of Crome's Broad).

1.7 Access Features

Accessibility and visitor appeal, public transport routes, access routes and visitor facilities

Access Plan Category	Open	Managed	Restricted	Excluded
		✓	✓	

Visitor Appeal, Suitability for Access & Visitor Facilities

The reserve is very popular with visitors, with c.30,302 recorded during 2009 (this figure represents the number of visitors entering Toad Hole Cottage; total numbers visiting the reserve are likely to be much higher; see Appendix 6). Public access is available via a footpath that runs from How Hill Road, past the main house to the staithe. This then joins another footpath downstream, by way of a permissive path adjacent to the moorings. The moorings footpath has recently been improved as part of the Broadland Flood Alleviation Scheme. This permissive path also runs upstream, alongside the river, ending at Clayrack Drainage Mill (see Map 9). To improve access for less-abled visitors a footpath has been created which runs through the wildflower meadow to Clayrack marshes.

Public access is also available to the grass area in front of the house, adjacent to the public car park. This is the vehicular point of access for visitors wishing to visit Toad Hole Cottage – a restored marshman's cottage, museum and information centre. Tickets can be purchased at the Cottage for the adjacent Nature Trail and Electric Eel boat trip. The Nature Trail is a part-surfaced trail, with viewing points overlooking the bird scrape and Crome's Broad. It follows a circular route around the eastern side of the Reserve.

During the review of information centre sales it became apparent that How Hill offered particular potential for, and enhancement of, its visitor facilities through the establishment of a new visitor centre in the cottage grounds. The current display information/sales area of Toad Hole Cottage is extremely small and offers limited space both for sales and information display. The only potential for expansion within the existing building would be to sacrifice part of the museum, which would be extremely damaging to the interpretive function of the cottage as a museum (Broads Information Centre Review, 2007).

Visitors choosing a boat trip on the Electric Eel, experience quiet boat travel through the undisturbed fen on the western side of the reserve *(see Map 4),* including a stop at a bird hide overlooking Reedham Water. The western side of the Reserve also contains an unsurfaced walk known as Ann's Trail. This path was created following a bequeathment and was designed to provide a natural walking experience through the fen, hence its unsurfaced nature. As this side of the Reserve is only accessible via the river, access is restricted to guided walks and events. To avoid disturbance to the sensitive fen habitat, this trail is only used for a moderate number of such events each year.

Toad Hole Cottage, the Nature Trail and Electric Eel all open seasonally from April to the end of October, with slightly longer opening hours in the high season (June to September). To ensure child safety for residential groups at the main house, the car park remains locked outside opening times and dates. No dogs are permitted on the nature trail.

The How Hill Trust, while providing residential courses as opposed to general public access, contribute to the visitor usage of the reserve, and undertake a valuable educational remit. Within term time, school visits incorporate walks, activities and boat trips, with adult courses also using the Reserve in holiday periods. As with all other users of the Reserve, access to the western side of the river is restricted and always guided. How Hill Trust have constructed a thatched building within compartment 60, replacing the existing marquee. This project, known as the Living Marshman Project, will enhance the educational facilities provided by the Trust, and in particular, will display traditional products and explain their use in the present day.

Owing to the nature of the site, access for wheelchairs users is currently limited to the grass area immediately adjacent to the house. However, improvements to the staithe as part of the Broadland Flood Alleviation Project (BFAP) have enabled a series of enhancements to be made whereby access to Toad Hole Cottage and the riverside path will be possible for wheelchairs. In addition, a small area of reedbed, under the management of the How Hill Trust may be opened up to public access to provide greater visitor interpretation and demonstration of some of the management methods used on the reserve. Should this take place, there are opportunities to link the riverside path and provide a circular surfaced path, which would be accessible to all.

The permissive riverside path leading downstream from the Reserve links to existing footpaths on Buttle Marsh, an area of former arable land purchased by the Broads Authority and restored to fen. This restoration work has created new wetland habitat for the public to experience and new interpretation material could be used to highlight these increased visitor access opportunities, so close to the How Hill Reserve.

See Appendix 2 for Access Management Plan
See Map 9 for visitor facilities

Access Provision

See Map 9

The site is accessible via How Hill Road, from School Road in Ludham and Sharp Street in Catfield. There is a further right of access for Broads Authority traffic through the entrance to How Hill House Study Centre and along the hard track to the south entrance of compartment 11; this track is jointly owned by the Broads Authority and the How Hill Trust. The track ends in a small car park adjacent to Toad Hole Cottage where there is room for six vehicles to park. Additional vehicular access is also possible following the edge of the camping field, and onto an unsurfaced track to the southern end of Clayrack Marshes. However, this route is only suitable for off-road vehicles in dry weather.

Public access to the site is also from How Hill Road, using the car park located to the south of How Hill House. Pedestrian access cuts across the lawn from the car park to Toad Hole Cottage,

or follows the route of the access track mentioned above, which leads to the staithe. The main house and gardens are owned and managed by the How Hill Trust and are reserved for use by residents on educational courses and school groups. The Freshwater Ecology Centre, adjacent to the main house is also owned by the Trust and used primarily as a laboratory/classroom for school visits. It is also used by specialist groups and can be booked for meetings and conferences by outside bodies. The Trust also leases a further c.12ha from the Authority.

The site is also accessible from the River Ant, which flows through the middle of the Reserve. An area of public mooring exists on the eastern bank, downstream of Toad Hole Cottage, and a private boathouse and mooring are also in place for Broads Authority vessels. The western side of the reserve is accessible via the river, although this is private access for Broads Authority staff and guided visits only.

1.8 Summary of Site Features

Tables summarising the site's features of importance

Table 1.8.1 Geological and Biological Features

Feature No.	BAP Broad Habitat Type or Geological Site Type	Specific Feature	Explanation of Feature/Ranking	Legal Site Designations						Other Classifications						
				SAC	SPA	Ramsar	Other	SSSI	GCR	European	National BAP	Nationally rare	Nationally	Protected	Character Area	Other
1	Standing Open Water and Canals	**SSSI** – Lowland ditch systems **SAC** – Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp	Freshwater ditch systems and turf ponds	✓		✓		✓								
		SSSI – Standing water **SAC** – Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation	Freshwater ditch systems and turf ponds	✓		✓		✓								
		Lutra lutra	Otter	✓		✓				✓	✓			✓		✓
		Arvicola amphibius	Water vole								✓			✓		
		Bufo bufo	Common Toad								✓			✓		
		Vascular Plant Assemblage: *Potamogeton coloratus* *Stratiotes aloides*	Plant assemblage: Fen pondweed Water soldier			✓		✓								
		Anas strepera	Gadwall		✓	✓				✓						
		Anas clypeata	Shoveler		✓	✓				✓						
		Lowland open water and their margins	Assemblage of					✓								

Feature No.	BAP Broad Habitat Type or Geological Site Type	Specific Feature	Explanation of Feature/Ranking	Legal Site Designations						Other Classifications						
				SAC	SPA	Ramsar	Other	SSSI	GCR	European	National BAP	Nationally rare	Nationally	Protected	Character Area	Other
		assemblage	breeding birds													
		Aggregation of non-breeding birds	Wintering waterfowl assemblage		✓	✓										
		Invertebrate assemblage (see Criteria Sheet for list of species) Broad Assemblage Type: W21 mineral marsh & open water, W31 permanent wet mire Specific Assemblage Types: W211 open water on disturbed sediments	Invertebrate assemblage Grazing marsh			✓		✓								
2	Fen, Marsh and Swamp	**SSSI** – S2 *Cladium mariscus* swamp	Swamp and sedge-beds			✓		✓								
		SSSI – S24 *Phragmites australis Peucedanum palustris* tall-herb fen **SAC** – Calcareous fens with *Cladium mariscus* and species of the *Carex davallianae*	Tall-herb fen	✓		✓		✓								
		SSSI – M5 *Carex rostrata-Sphagnum squarrosum* mire (as a transition with S27)	Mire	✓		✓		✓								

Feature No.	BAP Broad Habitat Type or Geological Site Type	Specific Feature	Explanation of Feature/Ranking	Legal Site Designations						Other Classifications						
				SAC	SPA	Ramsar	Other	SSSI	GCR	European	National BAP	Nationally rare	Nationally	Protected	Character Area	Other
		SAC – Transition mires and quaking bogs														
		SSSI – S27 *Carex rostrata–Potentilla palustris* tall–herb fen **SAC** – Transition mires and quaking bogs	Tall–herb fen	✓		✓		✓								
		SSSI – M24 *Molinia caerula–Cirsium dissectum* fen meadow **SAC** – *Molinia* meadows on calcareous, peaty or clayey–silt–laden soils (*Molinion caeruleae*)	Marshy grassland	✓		✓		✓								
		Lutra lutra	Otter	✓		✓										
		Vertigo moulinsiana	Desmoulin's whorl snail	✓		✓					✓					
		Botaurus stellaris	Bittern		✓						✓					
		Circus aeruginosus	Marsh Harrier		✓											
		Anas strepera	Gadwall		✓	✓										
		Anas clypeata	Shoveler		✓	✓										
		Vascular Plant assemblage: *Carex appropinquata*	Plant assemblage: Fibrous tussock–			✓		✓								

Feature No.	BAP Broad Habitat Type or Geological Site Type	Specific Feature	Explanation of Feature/Ranking	Legal Site Designations						Other Classifications						
				SAC	SPA	Ramsar	Other	SSSI	GCR	European	National BAP	Nationally rare	Nationally	Protected	Character Area	Other
			sedge													
		Cicuta virosa	Cowbane													
		Dactyloriza traunsteineri	Narrow-leaved marsh orchid													
		Dryopteris cristata	Crested buckler fern													
		Peucedanum palustre	Milk parsley													
		Pyrola rotundifolia	Round-leaved wintergreen													
		Sonchus palustris	Marsh sow-thistle								✓					
		Sium latifolium	Great water parsnip													
		Thelypteris palustris	Marsh fern													
		Invertebrate assemblage (see Criteria Sheet for list of species)	Invertebrate assemblage													
		Broad Assemblage Type: W31 permanent wet mire				✓		✓								
		Specific Assemblage Type: W313 mesotrophic fen and W314 rich fen	Fenland													
3	Broadleaved, Mixed and Yew Woodland	**SSSI** – W2a *Salix cinerea-Betula pubescens-Phragmites australis* woodland	Wet woodland/fen carr					✓								
		SSSI – W5 *Alnus glutinosa-Carex*	Alder woodland	✓		✓		✓								

Feature No.	BAP Broad Habitat Type or Geological Site Type	Specific Feature	Explanation of Feature/Ranking	Legal Site Designations						Other Classifications						
				SAC	SPA	Ramsar	Other	SSSI	GCR	European	National BAP	Nationally rare	Nationally	Protected	Character Area	Other
		paniculata woodland **SAC** – Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*														
		SSSI W6 *Alnus glutinosa-Urtica dioica* woodland **SAC** – Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	Alder woodland	✓		✓										
		W7 *Alnus glutinosa-Urtica dioica* woodland **SAC** – Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	Alder woodland	✓		✓										
		Invertebrate assemblage (see Criteria Sheet for list of species) Broad Assemblage Type: W31 permanent wet mire Specific Assemblage Type: W314 rich fen or W126 sheltered seepage	Wet woodland			✓		✓								

Feature No.	BAP Broad Habitat Type or Geological Site Type	Specific Feature	Explanation of Feature/Ranking	Legal Site Designations						Other Classifications						
				SAC	SPA	Ramsar	Other	SSSI	GCR	European	National BAP	Nationally rare	Nationally	Protected	Character Area	Other
		Pipistrellus pipistrellus	Common pipistrelle	✓						✓				✓		
		Pipistrellus pygmaeus	Soprano pipistrelle	✓						✓	✓			✓		
		Nyctalus noctula	Noctule	✓						✓	✓			✓		
		Plecotus auritus	Brown long-eared bat	✓						✓	✓			✓		
		Myotis nattereri	Natterer's bat	✓						✓				✓		
		Myotis daubentonii	Daubenton's bat	✓						✓				✓		

Table 1.8.2 Landscape Features

Feature No.	Specific Feature	Explanation of Feature/Ranking	Legal Designations				Other Classifications	
			World Heritage Site	National Park	AONB	Heritage Coast	Joint Character Area	Other
4	Continuous & cut peat over alluvial and estuarine deposits	Historic peat diggings Broads JCA feature		✓			✓	
	Original course of the River Ant (Hundred Stream meander)	Historic river course Broads JCA feature		✓			✓	
	Linear dykes delineating parish boundaries	Historic dyke boundaries Broads JCA feature		✓			✓	

Table 1.8.3 Archaeological & Historical Features

Feature No.	Specific Feature (see Map 10)	Explanation of Feature/Ranking	Legal Designations				Other
			World Heritage Site	Scheduled Monument	Listed Building	Historic Parks/Garden	Other
5	Turf Fen Mill (TG369188)	Uncommon double scoop wheels and varying gears mill					✓
	Boardman's Mill (TG369192)	Restored trestle or skeleton mill, fitted with a turbine pump and commonly used in the nineteenth century to drain smaller marshes					✓
	Clayrack Mill (TG369194)	A hollow post construction mill with a scoop wheel. The mill was moved to the site from Ranworth in c.1987.					✓
	Toad Hole Cottage (TG370191)	Restored marshman's cottage and museum					✓
	Wetland Habitats	Historic peat diggings					✓

Table 1.8.4 Socio-economic Use

Feature No.		Very Important	Important	Insignificant
6	Economic Use		✓	
	Community Involvement		✓	

Table 1.8.5 Education, Research & Demonstration

Feature No.		Very Important	Important	Insignificant
7	Education	✓		
	Research	✓		
	Demonstration		✓	

Table 1.8.6 Public Access

Feature No.		Very Important	Important	Insignificant
8	Public Access	✓		

Table 1.8.7 Other Estate Assets

Site assets, not listed in preceding summary tables, which the management plan needs to address

Feature No.	Asset Description	Notes
9	**Dry Grassland** Reserve dry grassland areas	Three areas of dry grassland are present on the reserve; two of these are leased to the How Hill Trust.
	Water Control Structures	WCS East of river 1, 3,4, WCS West of river 5 a & b, 6
	Machinery	Fen Harvester Digger Electric Boat

		Hand Mower Ancillary Equipment
	Buildings	**Location**
a	Staithe Boatshed	TG369191
b	Scrape Bird Hide	TG370193
c	Crome's Broad Bird Hide (north)	TG374199
d	Crome's Broad Bird Hide (south)	TG373196
e	Reedham Marshes Boatshed	TG367190
f	Reedham Marshes Shed	TG368190
g	Reedham Marshes Bird Hide	TG366189

2.1 Site Analysis

The issues which have positive and negative effects on the management of the site

Site Strengths	Site Weaknesses	External Opportunities	External Challenges
European Importance The majority of How Hill Nature Reserve forms part of the Ant Broads and Marshes SSSI (the reserve occupies 17.5%), one of the 27 SSSIs on the Register of European Sites which comprise the Broads SAC and the 25 SSSIs which comprise the Broadland SPA/Ramsar Site, since they contain habitat types and species which are rare or threatened within a European context (see *Map 3 & 6).* **Habitat Diversity** The reserve covers a large area of open fen, scrub and woodland covering 141 hectares. At least two thirds of the site is open fen, making it the highest proportion of any site in Broadland with the exception of fen areas in the Thurne system (Parmenter, 1995). The reserve adjoins a recreated wetland area, also under the management of the Broads Authority (the Bittern II project area – Buttle Marsh).	**Scrub Invasion** Scrub invasion is a problem in almost all of the Broadland fens and this site is no exception. The most common invasive species here are sallow, birch and alder. Much of the site is managed at present, either commercially for reed and sedge, or to maintain the open mixed litter fens. Periodic scrub removal is also undertaken across the site. Without management to maintain the open fen areas, the fen communities at this site would quickly succeed to carr woodland, with the conse-quent loss of many important species. **Catchment Issues** This site like many others is vulnerable to changes in water quantity and quality. Water abstraction from the numerous agricultural boreholes that surround the site is a cause for concern, although a substantial proportion of the water irrigating this site,	**Valley-side Restoration** The potential restoration of the valley sides to semi-natural vegetation would provide buffering for existing habitats particularly from agricultural practices. Ecological networks would also be created aiding movement and spread of species between habitats. Several projects for the Ant Valley are currently underway including Valentine's Meadow, located downstream of How Hill. Here heathland and grassland habitats are to be created by the Broads Authority. Future projects could be realised through agri-environment schemes. **Reduce Diffuse Pollution** Potential reductions in diffuse water pollution in the catchment would result in higher water quality and associated increases in biodiversity interest. These reductions could be implemented through Diffuse Water Pollution plans, incorporating	**Climate change** Impacts resulting from climate change will be difficult to predict and manage across the Broads. We may expect to see wetter winters and drier summers, and corresponding floral and faunal changes. Higher water levels during the winter months and increased flood events leading to saline water penetration higher up the system will also have considerable implications for freshwater fen communities and their management. **Invasive Species** The reserve is at risk from invasive plant and animal species, including Australian Swamp Stonecrop (*Crassula helmsii)* and American Mink. Crassula which was present in the water gardens and has since been eradicated. This plant can reproduce rapidly, forming dense mats and outcompeting native biodiversity.

Site Strengths	Site Weaknesses	External Opportunities	External Challenges
Species Diversity The diversity of fen communities at this site is high with a total of 24 NVC and 19 transitional terrestrial NVC communities recorded. The area of internationally important fen community S24d is significant. Owing to the diversity of communities and habitat types, the site is also host to an extremely rich assemblage of birds including Bitterns and Marsh Harriers, with 170 species recorded on the reserve. Invertebrate records for the site are also extensive. (See species lists in Appendix 1). **Species Rarity** This area supports the nationally rare plant species Crested Buckler-fern *(Dryopteris cristata)* and 7 nationally scarce plant species including; Greater Water-parsnip *(Sium latifolium),* Marsh Sow-thistle *(Sonchus palustris),* Marsh Pea *(Lathyrus palustris),* Cowbane *(Cicuta virosa),* Milk-parsley *(Peucedanum palustre),* Marsh Fern *(Thelypteris palustris)* and Fibrous Tussock-sedge *(Carex appropinquata)*. Of the fauna	particularly in the main Reedham Marsh area comes from the river. The western margin of the site receives some of its irrigation from groundwater sources and a constant supply is important for the maintenance of the fen communities. Levels of phosphate and nitrate entering the system from diffuse sources continue to present a threat. **Management constraints** The time of the Broads Authority's permanent field staff and the financial resources that are available have to be divided between this reserve and other commitments throughout the Broads. The one full-time member of staff, employed as marshman to manage the commercial beds and other parts of the estate has retired and no replacement has been sought. The minimum resources required to maintain the interest features in their present state are those to manage the open fen and rush pasture/fen meadow areas, maintain the dykes, remove scrub as necessary and maintain visitor	catchment sensitive farming initiatives and measures to deal with septic tank/soakaway sewage emissions. **Broadland Flood Alleviation Project** The Broads Authority has worked with the BFAP scheme to incorporate material from the restoration of Clayrack Marshes into flood bank enhancements. **Valley Approach and HLF Landscape Partnership bid** Site restoration could be enhanced by increasing the conservation volunteer resource, as well as improving the communication about the importance of the NNR. **Visitor Centre** The potential for a new visitor centre at the reserve has been identified (Broads Information Centre Review 2007). The display information/sales area of Toad Hole Cottage is extremely small and offers limited space both for sales and information display. **Reserve Interpretation** Providing interpretation for the	American Mink *(Mustela lutreola)* are not known to use the reserve, but should they start to do so, could become a serious threat to water vole populations and other native fauna. **Nutrient & Sediment Inputs** Nutrients and sediments enter the reserve via run-off from the surrounding land, and via irrigating river water. Measures to address river water quality issues through phosphate stripping at sewage treatment works have resulted in a much improved situation in the River Ant, although diffuse pollution from non-point sources such as farmland run-off are much harder to control. **Recreational Pressure** Visitor disturbance levels may become a problem with the potential new visitor facilities at Ludham Bridge. The ROWIP is currently being investigated for potential impacts to nature conservation interests of adjacent wetland sites. The current Rights of Way of the reserve need to be

Site Strengths	Site Weaknesses	External Opportunities	External Challenges
recorded on the site, there are 16 RDB invertebrate species, and the Reserve is regularly used by the rare Bittern *(Botaurus stellaris)* and otter *(Lutra lutra) (see species list)*. **Position in an ecological unit** The reserve is adjacent to other protected areas and the majority of the site is hydrologically connected to the rest of the Ant system. This connectivity actively supports the dispersal and transfer of species and enhances conservation and natural interest of the Reserve. The purchase of c.40 hectares downstream of How Hill and reversion from arable to reedbed and fen (Buttle Marsh) has also expanded the immediate ecological unit within which the reserve itself is located. As part of the Ant Broads and Marshes SSSI and the Broads SAC and Broadland SPA/Ramsar, the Reserve also provides an important link within the wider European wetland network.	infrastructure such as gates, fences, paths and sluices. Additional resources will be required for monitoring of plant and animal communities.	Bittern ll project, as well as improving current reserve interpretation would inform visitors as to why the reserve is special and the reasons for managing and protected the site. **Access Limitations** There is currently limited access for less-abled visitors. Further enhancements to access could be made for example boardwalks where they did not impact on the important characteristics of the site (see Map 9).	carefully managed to minimise impact on the site and its wildlife.

Site Strengths	Site Weaknesses	External Opportunities	External Challenges
Reserve Management Management of the reserve incorporates many techniques from traditional reed and sedge cutting to new and novel cutting machines, grazing animals and lake restoration through mud pumping. **Education & Research** Environmental education features highly on this reserve, in large part owing to the role of the How Hill Trust's use of the estate to educate school children and to host adult education courses. Numerous research and student projects have used How Hill in recent years and the Broads Authority still encourages this.			

2.2 Site Management Policy

The broad management policies for the site and the reasons why these options have been chosen

See Map 6 SAC Habitats, Map 4 for Habitat Types & Map 8 for Planned Management

Water Regime

The current water regime on the eastern side of the reserve fulfils most of the requirements of the site. Owing to its position at the top of a pump-drained unit, the necessary water levels can be held during the summer without compromising grazing marsh owners further down the system.

The installation of foot drains has improved the water flow on and off Compartment 9, Map *11*; however the hydrological functioning of compartment 11 should be investigated to determine the remedial measures that may need to be taken to prevent further reed encroachment. The installation of structures around Clayrack marshes has enabled lower levels to be maintained adjacent to the wildflower meadow, while higher levels are maintained further up the system.

Open Water (including fen, woodland & rush pasture dykes)

All of the dykes within the fen and rush pasture areas *(see Map 4 & 8)* are regularly maintained (rush pasture on a 5-7 year rotation; fen on a 8-10 year rotation), with only one side of the dyke cleaned at any one time. This regime prevents succession and eventual terrestrialisation of the aquatic habitat, and has resulted in healthy dyke systems with numerous aquatic plants and associated invertebrate life. Many of the dykes are classified within the Broads SAC feature. This management regime should be maintained to ensure continued hydrological functioning and the healthy survival of SAC features.

The water trail dykes are maintained on a 5-7 year rotation to maintain a clear passage for the Electric Eel. This should be carried out at the end of October to ensure turions have set, and the array of water plants and dragonflies are still present for viewing by water trail passengers.

Crome's Broad is divided into north and south basins by a reed strip on top of a historic peat baulk. The north basin has historically had shallow water depth and very few aquatic macrophytes, whereas the south broad has a greater depth of water as a result of dredging (in 1988), and has had a higher plant abundance and richness in comparison. During the winter of 2004/05 the north basin was mud pumped and a greater water depth achieved. By 2006, the north basin had been colonised by rigid hornwort *(Ceratophyllum demersum)* and large beds of filamentous algae. Improvement in the north basin plant community has, however not yet reached the same level of that found in the south basin. Further management options to improve the north basin water quality and plant community are being considered, such as the use of Phoslock to reduce phosphate levels within the Broad. Only small areas of emergent reed exist along the margins and this should be monitored to ensure current reed levels are retained. Periodic clearance of broad-side scrub should be carried out to prevent shading and build-up of leaf litter within the Broad which increases nutrient levels. (Broads Authority (2009) Annual Water Plant Monitoring Report).

Pony grazing on Clayrack Marshes and the wildflower meadow should be maintained as the dyke

edges are grazed and in some areas trampled beneficially, providing a range of profiles and herbage structure. Emergents are often controlled in this way although some mowing of dyke edges may be necessary where grazing does not occur; this should be carried out biennially if warranted. Mowing of dyke edges should also be carried out on the western side of the Reserve, particularly to encourage bittern feeding points.

There are a number of dry or stagnant dykes surrounding Crome's Broad. These have been in this condition for some time and care should be taken that any changes to these dykes are not undertaken without an assessment of the possible impact on the hydrological functioning of this area. However there is currently no management planned for these dykes within the life of this plan.

There are currently no plans to carry out any form of management on Reedham Water (for example mud pumping), however this expanse of open water is maintained, undisturbed for wintering birds.
The other significant area of temporary open water is that of the bird scrape in compartment 57 *(see Map 11).* This area is of considerable interest on account of its use by birds, particularly in winter, by shoveler, teal and passage waders. The scrape is currently managed to provide appropriate seasonal habitat, with mud and pools during spring and summer and open water during the winter. This is achieved through the use of a small pump, which is operated by Toad Hole Cottage staff. An additional bird scrape has been created on the western side of the reserve in 2009/10. The reed and surface substrate has been scraped to allow a shallow pool to form which will benefit wading birds and other reserve wildlife. Water levels are mainly gravity fed, with the option of maintaining higher water levels during the bird breeding season. These management regimes should be maintained.

Further open water could be created on the reserve through the excavation of shallow scrapes up to 40cm in depth. Four small turf ponds were created in 1985/86 in compartment 37 *(see Map 11);* these have since completely terrestrialised to produce a rejuvenated wet reed bed. Similar options are also desirable in compartment 27 or 38, where a dried reed monoculture or areas of scrub exist. Introducing open water and earlier successional phases reduces the requirement for mowing management.

Two species in particular rely upon the presence and sensitive management of healthy water bodies. Specific requirements for the otter include healthy fish populations and a proportion of undisturbed vegetated banks with water-side trees as potential holt sites. The current dyke maintenance programme utilises standard water vole mitigation measures and ensures that a proportion of dykes with emergent vegetation are present at any one time.

Open Fen Communities

The open fen communities *(see Map 4 & 8)* consist of reed, sedge and litter fens, all of which require regular management to maintain an open herbaceous condition. As a minimum, the current programme of periodic scrub roguing across the fen should be maintained, allowing a scattered dispersal of individual bushes and clumps of trees within the fen, providing important habitat in their own right. Current levels of scrub are seen as desirable (circa 5%), but particular note should be taken of the birch - crested buckler fern communities to ensure the optimal

amount of birch scrub is maintained. The amount and distribution of scrub should be monitored every five years using aerial photographs. All scrub removal should be followed by stump treatment.

The reed dominated fen is particularly important for milk-parsley *(Peucedanum palustre)* and the swallowtail butterfly *(Papilio machaon)*, marsh harrier *(Circus aeruginosus)* and bittern *(Botaurus stellaris)*.

These reed areas are currently managed through a mixture of winter commercial double-wale rotations, 5-10 year rotations by the fen harvester and patchy hand mowing and scrub roguing on Turf Fen Marshes where treacherous working conditions make larger-scale management difficult. Those reedbeds harvested for commercial reed have a long history of management using this method and make up a small proportion of the total amount of reed-dominated habitat. This range of techniques and rotations ensures a spatial and temporal mosaic of management, with the aim of ensuring optimal habitat conditions for the wide range of flora and fauna dependent on these tall herb fen communities.

The sedge *(Cladium)* dominated areas are also under regular management, with the majority cut on a summer rotation of 3-4 years. Significant amounts are cut commercially and the remaining areas are cut on a similar rotation to ensure optimal conditions, with cut material removed or burned. Beds are cut between April and September to avoid frost and flooding damage, maintaining diverse species-rich areas. This hand-mowing management does require significant resources and should be maintained.

All mowing activity should ensure no disturbance to birds to observe breeding bird legislation, and large-scale mowing by the fen harvester should continue to ensure uncut areas are retained on a long rotation for invertebrate refuge. Footdrains should be maintained to ensure adequate flow of water on and off each compartment. Where material is hand mown and not used commercially, all arisings should be burned on designated bonfire sites, away from areas of interest, with a proportion left unburned as habitat piles. If possible, measures should be taken to remove ash following the use of bonfires, to avoid local nutrient enrichment.

There are some areas of the reserve where difficult physical conditions prevent regular management from taking place, resulting in increasing levels of scrub. This situation applies to the Turf Fen area to the south of Reedham Water, where past drainage and re-wetting has led to peat shrinkage, followed by the development of numerous holes. However conservation management objectives have been achieved at Turf Fen in 2009, with the reopening of dykes to improve reedbed condition for wildlife, particularly the bittern. This has been achieved by using the 'Trux' or amphibious weed cutter which has opened up unmanaged dykes, where other machines would simply have sunk into the peat.

Transitional Mire Communities

Two small areas on the western side of the reserve have been identified as containing the transition mires SAC feature *(see Map 6).* While patchy mowing management does occur here, resources should be targeted to ensure a regular mowing regime is put in place on this compartment to encourage the maintenance and possible expansion of this community into the

adjacent reed-dominated community.

Wet Woodland

The areas of established alder carr woodland should be managed through minimal intervention with only essential tasks being undertaken to allow existing access, remove introduced species, and ensure public safety.

The few remaining areas of *Rhododendron* in particular should be removed. This non native species has an amazing ability to spread and shade out native plants which eventually die.

Rhododendron removal by mechanical means is best suited to the autumn and winter months to lessen further seed dispersal. Follow up management will be required to prevent this species from re-establishing.

The current extent of wet woodland should be maintained and not allowed to expand at the expense of open fen habitat. Coppicing of the wood/scrub/fen boundary is also desirable to maintain a transition between the different communities without allowing the woodland to expand naturally.

Other Woodland

There are a few areas of mixed wet and dry woodland on the eastern side of the Reserve. These areas, while not of specific interest, provide valuable bird and invertebrate habitat and contain considerable standing and fallen dead wood. Clearing these areas would not yield significant gain over and above the current general biodiversity value, and it is suggested that these should be managed with little intervention beyond occasional glade creation.

The pine trees at Reedham Hill should be left insitu and allowed to decay naturally. As this occurs, the surrounding oaks should regenerate within any clearings, eventually resulting in a native woodland area.

Rush Pasture/Fen Meadow

The rush pasture at Clayrack Marshes (compartments 6, 7, & 8, *see Map 11*), should continue to be grazed during the summer and early autumn. The current water regime, which maintains dykes just below marsh level during the summer, should continue. Although water can move on and off the site at the moment, the marshes may further benefit from the installation of footdrains to facilitate evacuation of rain water.

The spread of Soft-rush *(Juncus effusus)* on this area is considerable and efforts elsewhere in the Broads to control it would suggest that this may not be the best use of resources. The practice of weed wiping with glyphosate has been considered, but owing to the use of chemicals, alternative methods have been sought. The reserve has carried out its own trial *Juncus* treatment, which includes scraping off the tussocks of Soft-rush, flail cutting in winter, as well as leaving an area untreated as a control. The results of these trials are currently being monitored. The current pony grazing while possibly exacerbating the situation through poaching is nonetheless enhancing the floral interest of these marshes through the maintenance and expansion of open glades and the creation of structural diversity. The current regime of 4-6 Welsh ponies grazing between May and November should be maintained.

The increase in *Juncus* is thought to have resulted from the cessation of hay cutting and aftermath grazing during the 1990's and the maintenance of higher water levels, made possible by the installation of the existing water control structures. Hay cutting and aftermath grazing is probably the optimal management for this area, but the difficulties in removing cut material from the site, coupled with the unproductive nature of the grazing make this an unlikely commercial venture. Lack of staff time and other higher priorities also make this an unsuitable in-house management solution.

Compartment 9 is routinely grazed as part of the Clayrack system, although retention of considerable surface water often discourages the ponies from utilising this area. Dyke management and the installation of footdrains have improved water circulation, and this marsh can either be included or excluded from the grazing unit. Cranes have been seen on this marsh, so closing it off from grazing during the breeding season is desirable.

The wildflower meadow (compartment 11) contains the *Molinia* meadow SAC feature and has been managed in recent years through a mixture of summer mowing and grazing by 2-3 Welsh ponies. The ponies graze the site during late July/August (to the end of October depending on site wetness) and have tended to concentrate on the drier fen meadow areas, creating a varied vegetation structure, whilst not eating the flowering plants for which the area is well known. The lower, wetter areas have been previously hand mown towards the end of the summer and have become increasingly reed dominated, to the expense of lower growing rush, meadow thistle and cotton grass. It is thought this may have occurred owing to retention of surface water. To reduce reed dominance in these wetter areas, footdrains, have been installed, and mowing is now carried out earlier in the summer. In addition grazing the site earlier in the season when the reed is more palatable may also help to control its spread and encourage a greater diversity in this section of the compartment.

River Corridor

The River Ant runs through the centre of the Reserve, providing valuable riverside habitat and forming part of the navigable waterway. Flood defence measures have resulted in the removal of riverside scrub and trees upstream and downstream of Toad Hole Cottage on the eastern bank. The western side of the river forms part of the undefended area of the Broads in terms of flood defence and as such will not be subject to improvements. There are a number of mature trees on this side of the river, interspersed with significant stretches of open fen, some of which is managed commercially and so periodically allows deeper views into the fen. Scrub along this side of the river should be managed as part of the general fen management regime with bushes only removed if they start to spread into the fen, or if they present a navigation hazard. Mature trees should be retained for bird, bat and otter interest. Any scrub or tree removal should comply with the Tree and Scrub Management Strategy (Kelly, 2005).

Landscape Features

Like many Broadland fens, the peat at How Hill was excavated for fuel up to and during medieval and later centuries. Crome's Broad provides an example of the deeper medieval peat digging, whereas Reedham Marshes show evidence of shallower peat cutting (Wheeler, 1983). Part of Reedham Marshes (compartments 33, 39-43, 47-51) may not have been cut for peat as these

areas were drained and grazed. Subsequent re-wetting has rendered these compartments quite treacherous owing to peat shrinkage followed by expansion and hole creation.
The old course of the River Ant runs through Reedham Marshes known as the Hundred Stream Meander. Dyke edges are maintained by rotational mowing, as well as coppicing of any invasive scrub species.
The linear dykes in compartment 28 were created as parish boundaries hundreds of years ago. The dykes are maintained in open condition through a regular programme of clearance, namely every five years. All dykes are cleaned from one side at a time and the spoil placed at least 2 metres from the dykes and levelled. Intermittent gaps should be left in the lines of spoil to allow surface water to flow freely.

Historical Features

Three windmills/pumps are located on the reserve *(see Map 10),* namely Turf Fen Mill (TG369188); Boardman's Mill (TG369192) and Clayrack Mill (TG369194). All of the mills/pumps are the property of the Norfolk Windmill Trust who are responsible for their maintenance. Toadhole cottage is a restored marshman's cottage, which now serves as a museum and information centre. The cottage is maintained in good serviceable condition by Broads Authority staff so that it complies with health and safety requirements.

Education

Conservation education and interpretation is achieved through guided boat trips, walks and staff at Toad Hole Cottage during the summer. Further opportunities exist via demonstration of conservation management techniques including fen harvesting, grazing, commercial reed and sedge harvesting and lake restoration (e.g. mud pumping of Crome's Broad).

Additional educational activities are achieved through the use of the site by the How Hill Trust. The Trust runs courses for schools and adults and utilises both the conservation management work undertaken by the Authority and their own initiatives to educate their students.

Public Access

The site already has high amenity value and use. Open access is available onto the grass area downstream of the house and controlled access is permitted via ticket purchase to the nature trail that runs around the eastern side of the reserve. The dry grassland and reserve trails are maintained by site staff. Access to the west of the reserve is also controlled and takes the form of an electric boat trip and periodic accompanied walks. As this side of the reserve is only accessible from the river, accompanied access provides the most sensible means of exploring this area. Owing to this, the western side of the Reserve retains an undisturbed character, which is not only important for the wildlife, but which also provides visitors with a unique experience. Recent access improvements, particularly for disabled visitors have taken place to the staithe area as a result of the Broadland Flood Alleviation Project. The enhanced permissive footpath runs alongside the moorings, staithe, and upstream to the drainage mills.

Other Estate Assets

How Hill Estate has several other structures that need to be maintained in good working. These include the boatsheds at the Staithe and Reedham Marshes, Bird hides at Cromes Broad (North & South), Reedham Marshes and the bird scrape. Structure checks should be carried out on a 6

monthly basis by site staff, preferably before the winter months and before the start of the tourist season.

2.3 The Vision

A 50 Year Vision for How Hill National Nature Reserve

How Hill National Nature Reserve paints an idyllic Broadland scene with wildlife-rich lowland wetland habitats connected by the River Ant. The reserve is of local as well as national importance for nature conservation, as it forms a network with other protected sites in the Broads. The reserve is popular with summer visitors and local residents arriving by electric boats, cycles and marked walks, all wishing to enjoy the traditional Broads landscape its habitats and wildlife.

The high conservation value of the site is evident with managed species-rich open wet fen supporting breeding bittern, marsh harrier, cranes and swallowtail. Areas of unmanaged wet woodland are rich in invertebrates and birds and provide breeding and lying up areas for otter. Crome's Broad and the numerous reserve dykes are rich in aquatic plant and animal life supporting food for bittern, otter, water vole and the wealth of other wildlife present.
The peat resource is maintained and protected, supporting wildlife rich habitats, as well as providing flood water and carbon storage capacity.
The reserve is free from non native plant and animal species such as American Mink that threaten local native wildlife.

As well as being managed for conservation, high quality reed and sedge beds are cut for commercial purposes. These areas provide materials for thatching and support a traditional local industry. Demonstrations to visitors using traditional and modern reed cutting techniques provide an insight into how and why the reserve is managed.
The historic mills present on the reserve are protected and restored, and provide a glimpse into the past landscape practices of this special area.

Neighbouring land outside of the reserve is positively managed so as to deliver conservation and environmental benefits such as 'buffers zones' to the reserve habitats. These zones in turn act as ecological networks allowing wildlife to move between valley habitats in response to the changing climate. Diffuse water pollution problems in the valley are minimal due to these farming advice initiatives.

Visitors can experience the Broads landscape, its history and the wealth of wildlife by using the reserve nature trails, guided electric boat trip or browse the visitor centre. The thatched visitor centre provides interactive reserve interpretation, as well as live camera images of nesting bitterns. Visitors can understand how and why the reserve is managed, and how important it is to protect this special area.
The How Hill field centre continues excellent environmental education studies for children. Children are able to learn firsthand about the history of the Broads, its wildlife and why it needs to be managed and protected for the future.

2.4 Objectives

What we want to do during the period of the plan to take us towards realising the Vision

2.4.1 Geological and Biological Objectives

Objective 1: Achieve and Maintain Favourable Condition for the Nationally and Internationally Important Standing Open Water Communities
Natural eutrophic lakes typically contain aquatic macrophyte communities dominated by pondweeds *Potamogeton* spp., spiked water-milfoil *Myriophyllum spicatum*, yellow water-lily *Nuphar lutea*, and occasionally by associations of stoneworts *Chara* spp.
Features addressed by this objective:
1
Attributes/targets for key features:
Feature 1: Fen and rush pasture dyke maintenance & clearance of emergent and bankside vegetation **Attribute:** Extent **Target:** Maintain the current dyke length 12,277 metres **Feature 1:** High summer water levels within rush pasture dykes **Attribute:** Extent **Target:** Maintain three existing water control structures. **Feature 1:** Maintain an open margin along the western side of Crome's Broad **Attribute:** Extent **Target:** Maintain western margin of Cromes Broad approx 0.4 hectares **Feature 1:** Ensure seasonal variation in water levels on the bird scrape **Attribute:** Water levels **Target:** Shallow spring/summer water levels/ deep winter water levels **Feature 1:** Turf pond creation **Attribute:** Two new turf ponds **Target:** Create two new turf ponds in compartments 27 & 38
Objective Methods:
fen and rush pasture dyke maintenance and clearance of emergent and bank-side vegetation Dykes to be maintained in open condition through a regular programme of clearance. All dykes should be cleaned from one side at a time and the spoil should be placed at least 2 metres from dykes and levelled. Intermittent gaps should be left in the lines of spoil to allow surface water to flow freely. Rush pasture dykes should be cleaned every five to seven years, although where compartments are grazed, less frequent dyke maintenance may be needed if emergent vegetation has already been removed. Existing dyke profiles should be maintained, i.e. to include a gently sloping

Objective 1: Achieve and Maintain Favourable Condition for the Nationally and Internationally Important Standing Open Water Communities

batter. Fen dykes should be cleaned every 7-10 years.
Water vole mitigation - dykes should not be cleared during March-September to protect breeding water voles. Dyke sections and sides should be rotationally managed to ensure lengths of undisturbed bank remain and steep-sided dykes should be maintained to provide burrowing sites.
In ungrazed areas, emergent and bankside vegetation should be cleared, with alternate sides mown at different times. This should be undertaken between August and March. Some dykes may require annual attention, particularly in the Turf Fen area, where Bitterns feed. Other dykes may only need cutting every two years, depending on plant growth. Some dykes in grazed areas may require periodic cutting if the vegetation is not being managed. All cut material should be placed in small habitat piles or burned at designated fire sites. Individual or small groups of trees can be retained if not a hazard to dyke clearance machinery. Persistent scrub should be removed.
Water vole mitigation - edges can be cut during September to encourage them to move.

High summer water levels within rush pasture dykes
Maintain high water levels within rush pasture dykes during the summer months through the use of existing water control structures. The current system of sluices allows water levels to be held up throughout this area, otherwise water would gravity drain to the lower level of the surrounding grazing marshes.

Maintain an open margin along the western side of Crome's Broad
Young scrub surrounding Crome's Broad should be removed to prevent leaf litter build-up within the open water. This should be repeated on a 5-year rotation to prevent the scrub becoming too established in-between clearance programmes. Where areas of older woodland meet the Broad edge, these should be retained. Part of the scrub edge provides winter shelter for important numbers of Teal; trees from this area should be cleared sensitively to avoid removing this shelter belt.

Ensure seasonal variation in water levels on the bird scrape
In order to maintain ideal water levels for waders and other waterfowl, water should be pumped from the bird scrape during spring and summer. The level of water on the scrape should be monitored on a daily basis and the pump operated as required. Water from the scrape can be pumped into any of the surrounding dykes. Pumping is not needed during the winter months as the natural higher water levels encourage wintering wildfowl to use the scrape.

Creation of new turf ponds
Compartment 37 contains a series of four turf ponds, created in the 1980's, and site management discussions have considered the creation of more ponds within the drier mixed fen areas of Reedham Marshes in compartments 27 or 38. The shallow ponds provide open water and early succesional fen conditions for colonisation by a range of both common and rare species. The turf ponds are created by shallow scraping of the peat substrate to a maximum depth of 40cm. Any spoil is disposed of else-where to prevent the fen surface height

Objective 1: Achieve and Maintain Favourable Condition for the Nationally and Internationally Important Standing Open Water Communities

from being raised with associated drying. The turf ponds will remain unmanaged to allow natural plant succession to take place.

References

WHEELER B D (1983) Turf ponds in Broadland. BARS 5, Broads Authority, Norwich.
JENNINGS J N (1952) The origin of the Broads. Roy. Geog. Soc. Res. Mem. No 2, John Murry, London.
Kennison G C B (1987) How Hill Management Plan – Draft. Unpublished report held by the Broads Authority, Norwich.
George M (1992) The Land Use, Ecology and Conservation of Broadland. Packard Publishing Limited.
Clarke K et al (2005) Survey of Swan mussels in Crome's Broad. Unpublished report held by the Broads Authority, Norwich.
Jackson M J (1981) A Chronological Record of Aquatic Macrophytes found in each of the Norfolk Broads. Unpublished report held by the Broads Authority, Norwich.
Perrow M et al (1998, 2000-2004) Multiple reports - annual fish surveys of Crome's Broad. Held by the Broads Authority, Norwich.
Broads Authority (2009) Annual Water Plant Monitoring Report

Likely Significant Effect:

These proposals are likely to have a significant effect on the internationally important nature conservation features of the site, but are directly connected with or necessary for their nature conservation management.

Monitoring Methods:

- Survey and monitor aquatic macrophytes (BA Annual Macrophyte Survey) & fish populations
- Survey and monitor populations of migratory species & over-wintering waterfowl (Monthly Webs Count)
- Survey and monitor populations of otter (Lutra lutra)
- Survey and monitor populations of water vole (*(Arvicola terrestris)*
- Survey and monitor new turf ponds

Objective 2: Maintain in Favourable Condition the Nationally and Internationally Important Fen, Marsh Swamp Communities

Maintain existing areas of Great Fen-sedge fen *(Cladium mariscus)* , species of the Small-Sedge fen *(Caricion davallianae)* with open low-growing sedge vegetation and Common Reed (*Phragmites australis – Peucedanum palustris* tall-herb fen), Common Reed (*Eupatorium cannabinum)* tall-herb fen (S2, S24, S25)

Features addressed by this objective:

2, 6

Attributes/targets for key features:

Feature 2: Great Fen-sedge fen *(Cladium mariscus),* Small-Sedge fen *(Caricion davallianae)* Common Reed (*Phragmites australis)*
Attribute: Extent
Target: Maintain existing open fen habitat (82.55ha), Reed bed (*Phragmites australis)* (26 ha)

Feature 2: Maintain areas of *Molinia* meadow
Attribute: Extent
Target: Maintain current extent of molinia meadow (1.29 ha)

Feature 2: Maintain areas of reed dominated and mixed fen
Attribute: Extent
Target: Maintain existing open fen habitat (82.55ha), Reed bed (*Phragmites australis)* (26 ha)

Feature 2: Maintain and enhance rush pasture/fen meadow
Attribute: Extent
Target: Maintain the current extent of rush pasture (4.73ha)

Feature 2: Fen scrub communities
Attribute: Extent
Target: Maintain current levels and scattered distribution of fen scrub (scattered scrub equivalent to 5-10% cover)- 5.03ha, scrub – 7.61ha)

Feature 2: Maintain footdrains in fen and rush pasture/fen meadow
Attribute: Extent
Target: Maintain the current extent of footdrains which exist in all fen, rush pasture/fen meadow compartments

Feature 6: Commercial Reed & Sedge Cutting
Attribute: Extent
Target: Maintain current levels, 2009 sedge 3.03 ha, reed 1.75 ha

Objective 2: Maintain in Favourable Condition the Nationally and Internationally Important Fen, Marsh Swamp Communities

Objective Methods:

Maintain existing areas of *Cladium* dominated fen

Mow Cladium dominated fen on a four to five year rotation with cut material removed from the site, or piled and burned. Uncut areas within these communities should be retained as invertebrate refuge. Commercial *Cladium* beds should continue to be mown commercially. Periodic control of scrub is undertaken when required. Stumps are treated with Glyphosate and any arisings are burnt on site.

Maintain species-rich mire communities

Target areas containing transitional mire communities (S27) for regular mowing management (2-3 years). Cut material should be removed or piled and burned. Periodic control of scrub to be under taken as required. Uncut areas within these communities should be retained as invertebrate refuge.

Maintain areas of *Molinia* meadow

Annual management of Molinia meadow during the summer using a combination of mowing (cut material should be removed or piled and burned) and grazing as required. Timing of grazing should be varied with early grazing used to target reed growth. A maximum of 3 ponies should be used with the aim of grazing for a 4 week period. However, the impacts of this grazing should be carefully monitored and the length of grazing season shortened if the site becomes too wet, or if an appropriate amount of vegetation has been consumed, or lengthened, if conditions are dry and vegetation is plentiful. The nature trail should be diverted away from this compartment for the duration of any grazing.
Periodic control of scrub to be under taken as required.

Maintain areas of reed dominated and mixed fen

Mow diverse fen areas on a 4-5 year rotation to maintain floral interest, particularly milk parsley. Mow remaining mixed fen areas on an 8-10 year rotation, ensuring lower disturbance for species such as marsh harrier.
Mow selected areas of reed dominated fen on a 2 year (double-wale) commercial rotation. These areas should be scattered throughout the fen area to maintain a mixture of mowing rotations.
All mowing activity should result in uncut areas or strips being retained within managed areas for invertebrate refuge. Ongoing recording of management activities should enable refuges to be located and maintained for a variety of timescales.
Periodic scrub removal as required but ensuring scattered bushes and clumps of scrub are retained for bird and invertebrate interest.

Maintain and enhance rush pasture/fen meadow through extensive grazing

Graze with low stocking densities (c.5 ponies) between May and November to maintain open diverse areas within the rush dominated sward. Pony numbers may increase for short periods to encourage grazing of dyke edges.

Objective 2: Maintain in Favourable Condition the Nationally and Internationally Important Fen, Marsh Swamp Communities

Undertake trial scraping of soft rush as a control method

Manage fen scrub communities

Current levels of scrub within open fen are deemed acceptable and should be maintained through an alternating programme of non-intervention followed by scrub control where clumps begin to expand.

Maintain footdrains within fen and rush pasture/fen meadow areas

Existing footdrains within fen areas should be maintained where needed to facilitate water flow on and off compartments. Footdrain maintenance should be undertaken on rotation when the vegetation of each compartment is managed.

Commercial reed & sedge

Mow selected areas of reed dominated fen on a 2 year (double-wale) commercial rotation. These areas should be scattered throughout the fen area to maintain a mixture of mowing rotations. Commercial reed and sedge cutting should be maintained on the reserve

References

JENNINGS (1952) The origin of the Broads. Roy. Geog. Soc. Res. Mem. No 2, John Murry, London.

Kennison G C B (1987) How Hill Management Plan – Draft. Unpublished report held by the Broads Authority, Norwich.

George M (1992) The Land Use, Ecology and Conservation of Broadland. Packard Publishing Limited.

Parmenter (1995) The Broadland Fen Resource Survey. Volumes I to V. Broads Authority/English Nature

Likely Significant Effect:

These proposals are likely to have a significant effect on the internationally important nature conservation features of the site, but are directly connected with or necessary for their nature conservation management.

Monitoring Methods:

- Undertake an NVC survey of fen communities on Reedham Marshes
- Reinstate fen monitoring quadrats to determine long term impacts of fen management
- Continue the programme of hydrological monitoring of fen dykes
- Monitor the population status of Dryopteris cristata
- Encourage the use of the reserve for external research and record results of project

Objective 3: Maintain in Favourable Condition the Nationally and Internationally Important Wet Woodland Communties

Maintain the existing areas of alder woodland within the reserve by minimal intervention other than that required to allow existing access, remove dangerous trees or invasive species. The woodland boundary should be managed to encourage a gradual transition from wooded to open habitat.

Features addressed by this objective:

3

Attributes/targets for key features:

Feature 3: Alder (*Alnus glutinosa*) and Ash (*Fraxinus excelsior)* (W5, W6)
Attribute: Extent 22 ha
Target: Maintain the current extent of carr woodland without allowing it to expand at the expense of open fen habitat.

Objective Methods:

Maintain existing areas of alder woodland within the reserve. Manage alder woodland with minimal intervention other than that required to remove dangerous trees or invasive species such as Rhododendron present on the East side of the reserve . Mechanical Rhododendron removal is best suited to the autumn and winter months to lessen further seed dispersal. Follow up management will be required to prevent this species from re-establishing.
Manage the woodland boundary to encourage a gradual transition from wooded to open habitat

References

Kennison G C B (1987) How Hill Management Plan – Draft. Unpublished report held by the Broads Authority, Norwich.
George M (1992) The Land Use, Ecology and Conservation of Broadland. Packard Publishing Limited.
Kelly (2005) River Corridor Tree and Scrub Management Guidance: A Guide for Managers in the Broads. Broads Authority.

Likely Significant Effect:
These proposals are likely to have a significant effect on the internationally important nature conservation features of the site, but are directly connected with or necessary for their nature conservation management.

Monitoring Methods:

- Monitor extent using aerial photographs

2.4.2 Landscape and Cultural Objectives

Objective 4: Maintain Landscape, Archaeological & Historical features
As well as supporting important wetland habitats and wildlife, the peat resource plays an important role in flood water and carbon storage as well as proving a historical link to the past. The reserve also contains manmade historical features in the form of three drainage mills and a restored marshmans cottage.
Features addressed by this objective:
4, 5
Attributes/targets for key features:
Feature 4: To preserve the solid peat resource **Attribute:** Extent **Target:** To preserve and maintain the peat resource 140 ha **Feature 4:** Original course of the River Ant (Hundred Stream meander) **Attribute:** Extent **Target:** Maintain valuable riverside habitat 2,143 metres **Feature 4:** Linear dykes **Attribute:** Extent **Target:** Maintain the current linear dykes which delineate the parish boundaries. **Feature 5:** Toad Hole Cottage **Attribute:** Fabric condition **Target:** Maintain in good serviceable condition **Feature 5:** Estate Mills **Attribute:** Fabric condition **Target:** Maintain in good serviceable condition **Feature 9:** Dry Grassland areas (two areas leased to the How Hill Trust) **Attribute:** Extent 6.02 **Target:** Maintain grassland areas as required
Objective Methods:
Peat Resource Maintain current levels of open fen management to prevent scrub invasion and subsequent fen succession and drying of the peat soils. **Original course of the River Ant** Rotational mowing of the dyke edges should be undertaken, as well as coppicing of invasive scrub species where present.

Objective 4: Maintain Landscape, Archaeological & Historical features

Parish linear dykes

Maintain dyke edges in an open condition through a regular programme of clearance (every 5 years). All dykes to be cleaned from one side at a time and the spoil should be placed at least 2 metres from the dykes and levelled.

Historical Buildings

Toad Hole cottage should be maintained in safe working order for staff and visitors. Building checks should be made 6 monthly to ensure this is the case.
The three mills present on the estate are owned and maintained by the Windmill Trust.

Dry Grassland

The two areas of dry grassland, leased to the How Hill Trust should be maintained by cutting regularly in the spring and summer.

Likely Significant Effect:
These proposals are likely to have a significant effect on the internationally important nature conservation features of the site, but are directly connected with or necessary for their nature conservation management.

Monitoring Methods:

- Annual monitoring of dyke edge vegetation and scrub communities
- Undertake peat coring to establish baseline levels
- Dykes to be monitored as ongoing reserve management
- Checks of buildings and structures should be carried out on a 6 monthly basis by site staff, preferably before the winter months and before the start of the tourist season

Objective 5: Maintain Education & Public Access Provision

The reserve provides a high level of education provision mainly through the work of the How Hill Trust. The reserve is very popular with visitors using the reserve footpath trails and the electric boat tour.

Features addressed by this objective:

6, 7, 8

Attributes/targets for key features:

Feature 7: Maintain education provision
Attribute: Extent
Target: Maintain 3,500 children visiting the reserve annually via the How Hill Trust and general reserve talks and boat trips
Feature 8: Maintain public access provision
Attribute: Extent
Target: Maintain footpaths (including disabled paths) 709 metres (700 metres river path),

Objective 5: Maintain Education & Public Access Provision

electric boats in good condition for public access.

Feature 6: Community Involvement
Attribute: Extent
Target: Maintain current volunteer work force numbering approximately 35, that assist with scrub removal on the reserve.

Objective Methods:

Education Provision

The Nature Trail, boat trail, Ann's Trail and the Cottage are all used as part of the How Hill Trust's education programme. Groups of school children are escorted to various parts of the reserve to learn about the wildlife, history and management of the Broads.
Adult education courses are also run by the How Hill Trust and make use of the Nature Trail and surrounding area. Additional education provision is provided by Broads Authority Staff through demonstration of traditional and modern management techniques.

Public Access

Footpaths and the electric boat are maintained by site staff to provide safe access around the reserve. The information centre and staff are available on site between April–October, managing the Nature Trail, boat trips and general enquiries.
Information staff at Toad Hole Cottage should continue to count total visitors and the facilities being used. These should be undertaken at monthly intervals throughout the open season.

Community Involvement

Volunteers play an important part in scrub removal to maintain the open fen landscape. Volunteer numbers should be maintained (circa 35) to retain this important function.

References

How Hill Trust 2009
How Hill Access Plan (Appendix 2)

Likely Significant Effect:
These proposals will have no significant effect on the internationally important nature conservation features of the site.

Monitoring Methods:

- How Hill Trust children count figures
- Visitor centre count figures

2.4.3 Estate Asset Objectives

Objective 6: To maintain reserve buildings and estate structures not addressed by other objectives in an appropriate condition

Several structures are found on the reserve including a restored marshmans cottage, boatsheds, and bird hides. These should be maintained in good working order and be compliant with heath and safety standards.

Features addressed by this objective:

5, 9

Attributes/targets:

Feature 9: Staithe Boatshed
Attribute: Fabric condition
Target: Maintain in good serviceable condition

Feature 9: Scrape Bird Hide
Attribute: Fabric condition
Target: Maintain in good serviceable condition

Feature 9: Crome's Broad Bird Hide (north & south)
Attribute: Fabric condition
Target: Maintain in good serviceable condition

Feature 9: Reedham Marshes Boatshed
Attribute: Fabric condition
Target: Maintain in good serviceable condition

Feature 9: Reedham Marshes Shed
Attribute: Fabric condition
Target: Maintain in good serviceable condition

Feature 9: Reedham Marshes Bird Hide
Attribute: Fabric condition
Target: Maintain in good serviceable condition

Objective Methods:

Buildings and structures should be checked regularly and maintained in an appropriate condition as and when needed.

Likely Significant Effect:
These proposals will have no significant effect on the internationally important nature conservation features of the site.

Monitoring Methods:

Objective 6: To maintain reserve buildings and estate structures not addressed by other objectives in an appropriate condition
• Checks of buildings and structures should be carried out on a 6 monthly basis by site staff, preferably before the winter months and before the start of the tourist season

3.1 Identification of Projects

The management required to achieve the plan objectives

Objective	Project Code	Project Title
1. ACHIEVE AND MAINTAIN FAVOURABLE CONDITION FOR THE NATIONALLY AND INTERNATIONALLY IMPORTANT STANDING OPEN WATER COMMUNITIES		
	MH64/01	Manage habitat, open water, clearing/dredging/re-profiling DYKE CLEARANCE
	MH65/01	Manage habitat, open water, clearing surrounding vegetation DYKE-EDGE CLEARANCE
	MH60/01	Manage habitat, open water, water level control CONTROL STRUCTURES, SLUICES
	ME20/01	Equip site by providing other structures DIPWELLS
	RP13/01	Collect data, hydrological, monitor WATER LEVELS
	MH07/01	Manage habitat, woodland/scrub, scrub control BROAD EDGE SCRUB CLEARANCE
	RF23/01	Collect data, other vascular plants, monitor REED FRINGE
	MH60/03	Manage habitat, open water, water level control CONTROL STRUCTURES, PUMPS
	MH69/01	Manage habitat, open water, other activities TURF POND CREATION
	RP15/01	Collect data, hydrological, research project DIFFUSE POLLUTION PROJECT

2. MAINTAIN IN FAVOURABLE CONDITION THE NATIONALLY AND INTERNATIONALLY IMPORTANT FEN, MARSH AND SWAMP COMMUNITIES		
Protect and enhance fen, marsh & swamp	MH52/01	Manage habitat, swamp, fen, inundation, scrub clearance SCRUB IN FEN, MIRE & MOLINIA COMMUNITIES
	RF13/01	Collect data, trees/shrubs, monitor MONITOR SPREAD OF SCRUB USING AERIAL PHOTO'S
	MH53/04	Manage habitat, swamp, fen, inundation, mowing FEN MOWING MEDIUM ROTATION
	MH53/05	Manage habitat, swamp, fen, inundation, mowing FEN MOWING LONG ROTATION
	MH53/06	Manage habitat, swamp, fen, inundation, mowing FEN MOWING SHORT ROTATION
	MH53/01	Manage habitat, swamp, fen, inundation, mowing CLADIUM FEN MOWING
Protect and enhance areas of rush pasture and fen meadow	RF13/01	Collect data, trees/shrubs, monitor MONITOR SPREAD OF SCRUB USING AERIAL PHOTO'S
	MH54/01	Manage habitat, swamp, fen, inundation, controlled grazing MOLINIA MEADOW GRAZING
	MH52/01	Manage habitat, swamp, fen, inundation, scrub clearance SCRUB IN FEN, MIRE & MOLINIA COMMUNITIES
	RF13/01	Collect data, trees/shrubs, monitor MONITOR SPREAD OF SCRUB USING AERIAL PHOTO'S
Protect and enhance areas of transitional mire	MH53/02	Manage habitat, swamp, fen, inundation, mowing TRANSITIONAL MIRE MOWING
	MH52/01	Manage habitat, swamp, fen, inundation, scrub clearance SCRUB IN FEN, MIRE & MOLINIA COMMUNITIES
	MH59/01	Manage habitat, swamp, fen, inundation, other activities FOOTDRAIN CREATION & MAINTENANCE

	RF13/01	Collect data, trees/shrubs, monitor MONITOR SPREAD OF SCRUB USING AERIAL PHOTO'S
3. MAINTAIN IN FAVOURABLE CONDITION THE NATIONALLY AND INTERNATIONALLY IMPORTANT WET WOODLAND COMMUNITIES		
Protect and enhance areas wet woodland	MH05/01	Manage habitat, woodland/scrub, non-intervention ALDER WOODLAND
	MH04/01	Manage habitat, woodland/scrub, ride/path/glade maintenance WOODLAND PATH MAINTENANCE
	MS01/01	Manage species, other vascular plant WOODLAND INVASIVE SPECIES CONTROL
	MH00/01	Manage habitat, woodland/scrub, coppicing WOODLAND EDGE COPPICING
	RF13/01	Collect data, trees/shrubs, monitor MONITOR SPREAD OF SCRUB USING AERIAL PHOTO'S
4. MAINTAIN LANDSCAPE, ARCHAEOLOGICAL & HISTORICAL FEATURES		
Continuous & cut peat over alluvial and estuarine deposits	MH40	Manage habitat, bog/mire/flush/WATER LEVEL CONTROL
	MH41	Manage habitat, bog/mire/flush/ CONTROLLED GRAZING
	MH42	Manage habitat, bog/mire/flush/SCRUB CONTROL
Original course of the River Ant (Hundred Stream meander)	MH65/01	Manage habitat, open water, clearing surrounding vegetation DYKE-EDGE MOWING
	MH65/01	Manage habitat, open water, clearing surrounding vegetation DYKE-EDGE CLEARANCE
Linear dykes delineating parish boundaries	MH64/01	Manage habitat, open water, clearing/dredging/re-profiling DYKE CLEARANCE
	MH65/01	Manage habitat, open water, clearing surrounding vegetation DYKE-EDGE CLEARANCE
Maintain Toad Hole Cottage in serviceable condition Maintain reserve mills in good working order	MC0*	Manage cultural interest/archaeology/history/ STONEWORK/OTHER ACTIVITIES

		/ TIMBER STRUCTURE BY OTHER ACTIVITIES
Maintain Dry Grassland Areas	MH10/01 MH15/01	Manage habitat, grassland, controlled grazing DRY GRASSLAND WINTER PONY GRAZING Manage habitat, grassland, non-intervention DRY GRASSLAND
5. MAINTAIN EDUCATION & PUBLIC ACCESS PROVISION		
	ML00/01	Liaise, owners/occupiers HOW HILL TRUST
	ME30/01	Equip site, by maintaining other structures FOOTPATH, PERMISSIVE PATH & TRAIL FURNITURE
	ME70/01	Equip site, by providing/maintaining rides/paths FOOTPATH, PERMISSIVE PATHS & TRAILS
	MH59/05	Manage habitat, swamp, fen, inundation, other activities VISITOR CONTROL
	ME70/02	Equip site, by providing/maintaining rides/paths IMPROVEMENTS TO LESS-ABLED ACCESS TO RIVERSIDE PATHS
	MI10/01	Inform visitors, general ACCESSIBILITY OF SIGNS & FORMAT OF LEAFLETS
	RH51/01	Count visitors VISITOR NUMBERS USING INFORMATION CENTRE
	ML50	Liaise, local community/groups
6. MAINTAIN RESERVE BUILDINGS AND ESTATE STRUCTURES NOT ADDRESSED BY OTHER OBJECTIVES IN AN APPROPRIATE CONDITION		
	MC0*	Manage cultural interest/archaeology/history/ TIMBER STRUCTURE BY OTHER ACTIVITIES

3.2 Project Register

A complete list of projects for this management plan

Project Code	Project Title	Project Description
RP13	Collect data, hydrological, monitor	MONITOR WATER QUALITY
RF02/01	Collect data, vegetation, survey	MONITOR FEN COMMUNITIES
RF03/01	Collect data, vegetation, monitor	MONITOR RIVERSIDE TREES
RF03	Collect data, vegetation, monitor	MONITOR NOTABLE PLANTS
RF06/01	Collect data, vegetation, list species	MAINTAIN SPECIES LISTS
RF13/01	Collect data, trees/shrubs, monitor	MONITOR SCRUB USING AERIAL PHOTO'S
RA00/01	Collect data, mammals	MONITOR RARE/NOTABLE SPECIES
RA03/01	Collect data, mammals, monitor	MONITOR MINK
RA10/01	Collect data, birds	MONITOR RARE/NOTABLE SPECIES
RA33/01	Collect data, fish, monitor	MONITOR FISH WITHIN CROME'S BROAD
RA44/01	Collect data, Lepidoptera,	BUTTERFLY/MOTH ESTIMATES
RA54/01	Collect data, Odonata,	DRAGONFLY ESTIMATES
RH51/01	Count visitors	MONITOR VISITOR NUMBERS
MI10/01	Inform visitors, general	ACCESSIBILITY OF SIGNS & LEAFLETS
ML00	Liaise, owners/occupiers	HOW HILL TRUST
MH04/01	Manage habitat, woodland/scrub, ride/path/glade maintenance	WOODLAND PATH MAINTENANCE
MH05	Manage habitat, woodland/scrub, non-intervention	MANAGE ALDER WOODLAND
MH07	Manage habitat, woodland/scrub, scrub control	MANAGE FEN SCRUB
MH10/01	Manage habitat, grassland, controlled grazing	PONY GRAZING
MH19/01	Manage habitat, grassland, other activities	TOP LATE SUMMER AND/OR SELECTIVE SPRAY MID SUMMER
MH53	Manage habitat, swamp, fen, inundation, mowing	FEN MOWING
MH54	Manage habitat, swamp, fen, inundation, controlled grazing	PONY GRAZING
MH59/01	Manage habitat, swamp, fen, inundation, other activities	FOOTDRAIN CREATION & MAINTENANCE
MH59/02	Manage habitat, swamp, fen, inundation, other activities	LEAVE UNCUT INVERTEBRATE STRIPS WITHIN OPEN FEN
MH59/04	Manage habitat, swamp, fen, inundation, other activities	MANAGE VISITOR CONTROL
MH60/01	Manage habitat, open water, water level control	CONTROL STRUCTURES

MH64/01	Manage habitat, open water, clearing/dredging/re-profiling	DYKE CLEARANCE
MH65/01	Manage habitat, open water, clearing surrounding vegetation	DYKE-EDGE CLEARANCE
MH69/01	Manage habitat, open water, other activities	CREATION OF SCRAPES
ME20/01	Equip site by providing other structures	INSTALL DIPWELLS
ME30/01	Equip site by maintaining other structures	FOOTPATH, PERMISSIVE PATH & TRAIL FURNITURE
ME70/01	Equip site by providing/maintaining rides/paths	FOOTPATH, PERMISSIVE PATHS & TRAILS
MS01/01	Manage species, other vascular plant	WOODLAND INVASIVE SPECIES CONTROL
MS03/01	Manage habitat, swamp, fen, inundation, manage species, mammal	MINK CONTROL IF RECORDED ON SITE
AP20/01	Prepare/revise plan, management, reserve	REVISE MANAGEMENT PLAN
AP70/01	Convene meeing, Annual Programme Review	HOW HILL TRUST & BROADS AUTHORITY
AR00/01	Prepare report, project recording	FEN MANAGEMENT EVENTS, WORK DIARY
AI01/01	Inspections and audits	HEALTH & SAFETY

3.3 Five Year Plan

Project Code	Project Title	Project Description	Year				
			10/11	11/12	12/13	13/14	14/15
RP13/01	Collect data, hydrological, monitor	MONITOR DIPWELLS	✓	✓	✓	✓	✓
RP13/03	Collect data, hydrological, monitor	MONITOR WATER QUALITY	✓	✓	✓	✓	✓
RF02/01	Collect data, vegetation, survey	MONITOR FEN COMMUNITIES	✓				
RF03/01	Collect data, vegetation, monitor	MONITOR RIVERSIDE TREES	✓				
RF03/02	Collect data, vegetation, monitor	MONITOR FEN COMMUNITIES				✓	
RF03/03	Collect data, vegetation, monitor	AQUATIC MACROPHYTES IN CROME'S BROAD	✓	✓	✓	✓	✓
RF03/04	Collect data, vegetation, monitor	MONITOR DRYOPTERIS CRISTATA IN FEN COMMUNITIES					
RF06/01	Collect data, vegetation, list species	MAINTAIN SPECIES LISTS	✓	✓	✓	✓	✓
RF13/01	Collect data, trees/shrubs, monitor	MONITOR SPREAD OF SCRUB USING AERIAL PHOTO'S			✓		
RF23/01	Collect data, other vascular plants, monitor	MONITOR REED FRINGE				✓	
RA00/01	Collect data, mammals	MONITOR RARE/NOTABLE SPECIES	✓	✓	✓	✓	✓
RA03/01	Collect data, mammals, monitor	MONITOR MINK	✓	✓	✓	✓	✓

Project Code	Project Title	Project Description	Year				
			10/11	11/12	12/13	13/14	14/15
RA10/01	Collect data, birds	MONITOR RARE/NOTABLE SPECIES	✓	✓	✓	✓	✓
RA33/01	Collect data, fish, monitor	MONITOR FISH WITHIN CROME'S BROAD	✓	✓	✓	✓	✓
RA44/01	Collect data, Lepidoptera, count/estimate/measure/census	BUTTERFLY ESTIMATES	✓	✓	✓	✓	✓
RA42/01	Collect data, Lepidoptera, survey	MOTH TRAPPING			✓		
RA54/01	Collect data, Odonata, count/estimate/measure/census	DRAGONFLY ESTIMATES	✓	✓	✓	✓	✓
RA82/01	Collect data, other/general invertebrates, survey	GENERAL SURVEYS	✓	✓	✓	✓	✓
RH51/01	Count visitors	MONITOR VISITOR NUMBERS USING INFORMATION CENTRE	✓	✓	✓	✓	✓
MI10/01	Inform visitors, general	ACCESSIBILITY OF SIGNS & FORMAT OF LEAFLETS	✓	✓	✓	✓	✓
MI50/01	Provide interpretative material	INFORMATION BOARDS & LEAFLETS	✓	✓	✓	✓	✓
ML00/01	Liaise, owners/occupiers	HOW HILL TRUST	✓	✓	✓	✓	✓
ML00/02	Liaise, owners/occupiers	MEMORANDUM OF UNDERSTANDING	✓	✓	✓	✓	✓
MH04/01	Manage habitat, woodland/scrub, ride/path/glade maintenance	WOODLAND PATH MAINTENANCE	✓	✓	✓	✓	✓
MH05/01	Manage habitat, woodland/scrub, non-intervention	MANAGE ALDER WOODLAND	✓	✓	✓	✓	✓

Project Code	Project Title	Project Description	Year				
			10/11	11/12	12/13	13/14	14/15
MH05/02	Manage habitat, woodland/scrub, non-intervention	RETAIN ALDER WOODLAND AND RIVERSIDE TREES FOR OTTER HABITAT				✓	
MH05/03	Manage habitat, woodland/scrub, non-intervention	MANAGE FEN SCRUB	✓	✓	✓	✓	✓
MH05/04	Manage habitat, woodland/scrub, non-intervention	MANAGE RIVERSIDE SCRUB			✓		
MH07/01	Manage habitat, woodland/scrub, scrub control	BROAD EDGE SCRUB CLEARANCE					✓
MH07/02	Manage habitat, woodland/scrub, scrub control	CONTROL OF W2 WOODLAND EXPANSION				✓	
MH07/03	Manage habitat, woodland/scrub, scrub control	MANAGE FEN SCRUB	✓	✓	✓	✓	✓
MH10/01	Manage habitat, grassland, controlled grazing	DRY GRASSLAND PONY GRAZING	✓	✓	✓	✓	✓
MH15/01	Manage habitat, grassland, non-intervention	DRY GRASSLAND PONY GRAZING	✓	✓	✓	✓	✓
MH19/01	Manage habitat, grassland, other activities	TOP LATE SUMMER AND/OR SELECTIVE SPRAY MID SUMMER	✓	✓	✓	✓	✓
MH53/01	Manage habitat, swamp, fen, inundation, mowing	CLADIUM FEN MOWING	✓	✓	✓	✓	✓
MH53/02	Manage habitat, swamp, fen, inundation, mowing	TRANSITIONAL MIRE MOWING				✓	
MH53/03	Manage habitat, swamp, fen, inundation, mowing	MOLINIA MEADOW MOWING		✓			

Project Code	Project Title	Project Description	Year				
			10/11	11/12	12/13	13/14	14/15
MH53/04	Manage habitat, swamp, fen, inundation, mowing	FEN MOWING MEDIUM ROTATION	✓	✓	✓	✓	✓
MH53/05	Manage habitat, swamp, fen, inundation, mowing	FEN MOWING LONG ROTATION	✓	✓	✓	✓	✓
MH53/06	Manage habitat, swamp, fen, inundation, mowing	FEN MOWING SHORT ROTATION	✓	✓	✓	✓	✓
MH54/01	Manage habitat, swamp, fen, inundation, controlled grazing	MOLINIA MEADOW GRAZING	✓	✓	✓	✓	✓
MH54/02	Manage habitat, swamp, fen, inundation, controlled grazing	RUSH PASTURE PONY GRAZING	✓	✓	✓	✓	✓
MH59/01	Manage habitat, swamp, fen, inundation, other activities	FOOTDRAIN CREATION & MAINTENANCE	✓				
MH59/02	Manage habitat, swamp, fen, inundation, other activities	LEAVE UNCUT INVERTEBRATE STRIPS WITHIN OPEN FEN	✓	✓	✓	✓	✓
MH59/04	Manage habitat, swamp, fen, inundation, other activities	VISITOR CONTROL	✓	✓	✓	✓	✓
MH60/01	Manage habitat, open water, water level control	CONTROL STRUCTURES, SLUICES	✓	✓	✓	✓	✓
MH60/03	Manage habitat, open water, water level control	CONTROL STRUCTURES, PUMPS	✓	✓	✓	✓	✓
MH64/01	Manage habitat, open water, clearing/dredging/re-profiling	DYKE CLEARANCE		✓			✓
MH65/01	Manage habitat, open water, clearing surrounding vegetation	DYKE-EDGE CLEARANCE	✓	✓	✓	✓	✓
MH69/01	Manage habitat, open water, other activities	CREATION OF SCRAPES	✓	✓			
ME20/01	Equip site by providing other structures	INSTALL DIPWELLS	✓	✓	✓	✓	✓

Project Code	Project Title	Project Description	Year				
			10/11	11/12	12/13	13/14	14/15
ME30/01	Equip site by maintaining other structures	FOOTPATH, PERMISSIVE PATH & TRAIL FURNITURE	✓	✓	✓	✓	✓
ME70/01	Equip site by providing/maintaining rides/paths	FOOTPATH, PERMISSIVE PATHS & TRAILS	✓	✓	✓	✓	✓
ME70/02	Equip site by providing /maintaining rides/paths	IMPROVEMENTS TO LESS-ABLED ACCESS TO PERMISSIVE RIVERSIDE PATHS	✓	✓	✓	✓	✓
ME70/03	Equip site by providing /maintaining rides/paths	TOAD HOLE COTTAGE BRIDGE AND PATH	✓	✓	✓	✓	✓
MS03/01	Manage habitat, swamp, fen, inundation, manage species, mammal	MINK CONTROL IF RECORDED ON SITE	✓	✓	✓	✓	✓
AP20/01	Prepare/revise plan, management, reserve	REVISE MANAGEMENT PLAN					✓
AP70/01	Convene meeing, Annual Programme Review	HOW HILL TRUST & BROADS AUTHORITY	✓	✓	✓	✓	✓
AR00/01	Prepare report, project recording	FEN MANAGEMENT EVENTS, WORK DIARY	✓	✓	✓	✓	✓
AI01/01	Inspections and audits	HEALTH & SAFETY	✓	✓	✓	✓	✓