



# Manhood Wildlife and Heritage Group



**Fixing and Linking Our Wetlands (FLOW) Project**  
**North and South Mundham Parish**  
**Ditch condition assessment results and drainage and**  
**habitat improvement plan 1.0**

**Jane Reeve and Christopher Drake**  
**Manhood Wildlife and Heritage Group**

**June 2021**



Camic Pond, South Mundham, April 2020 © Jane Reeve

## Acknowledgements

The FLOW Project would like to thank the landowners of the parish for giving permission for surveys to be carried out on their land, Chichester District Council for providing Ordnance Survey (OS) maps and licensing and the NLHF for financially supporting the FLOW Project.

Thanks, should also go to the volunteers who attended ditch assessment training and then spent many hot and humid, as well as cold, wet, and windy days walking the fields of North and South Mundham Parish looking at the ditches.

Thanks to CDC, WSCC and the EA for all their help and support and all the information that they provided.

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## Acronyms and abbreviations

Name	Acronym
Area of Outstanding Natural Beauty	AONB
Cabinet Office Briefing Room	COBR
Chichester District Council	CDC
Chichester Harbour Conservancy	CHC
Department for Environment, Food & Rural Affairs	DEFRA
Environment Agency	EA
Fixing and Linking our Wetlands	FLOW
Geographical Information System	GIS
Local Wildlife Site	LWS
Manhood Peninsula	MP
Manhood Peninsula Partnership	MPP
Manhood Peninsula Surface Water Management Plan	MPSWMP
Manhood Wildlife and Heritage Group	MWHG
National Lottery Heritage Fund	NLHF
Natural England	NE
Operation Watershed	OW
Sussex Biodiversity Records Centre	SxBRC
Southern Water	SW
Trust for Conservation Volunteers	TCV
West Sussex County Council	WSCC

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## Executive Summary

The Heritage Lottery Fund (HLF) Fixing and Linking Our Wetlands (FLOW) study of the Mundham Parish ditch system took 18 months to complete and used a scoring system to analyse the main attributes of the ditches. This included drainage, environmental and biodiversity aspects. In this time 180 ditches and waterways were surveyed which totalled approximately 51 kilometres and this is illustrated in Figures 5a and 5b.

The majority of the ditches were found to be in good or moderate condition, and it was clear that the main landowners do manage the ditches on their land. Most have a system of rotational management and these ditches tended to have the better vegetation structure and diversity.

Opportunities were found for improvements in the water storage capacity of ditch systems during high rainfall events that would also provide better wetland habitat. Other locations were found for pond enhancements that could provide better water storage. Putting small interventions like this into the system could make a difference during high rainfall events by just holding back a low percentage of the water.

9 opportunities for drainage and environmental improvements can be seen in Figure 14, which range from improving vegetation diversity to opening up old ponds and the stretch of relic Arundel to Portsmouth canal that runs through the parish.

Feedback has been provided to all the landowners about the survey findings on their land with advice and ideas for improvements if needed.

The Mundham Parish has a ditch system that is extensive and generally has been well looked after by its landowners.

The Parish Council have been active in identifying and addressing areas of flooding, but the FLOW team did find some small opportunities to make drainage and environmental improvements. In the long term these could become attractive assets to the parish and be monitored and maintained by landowners and the community.

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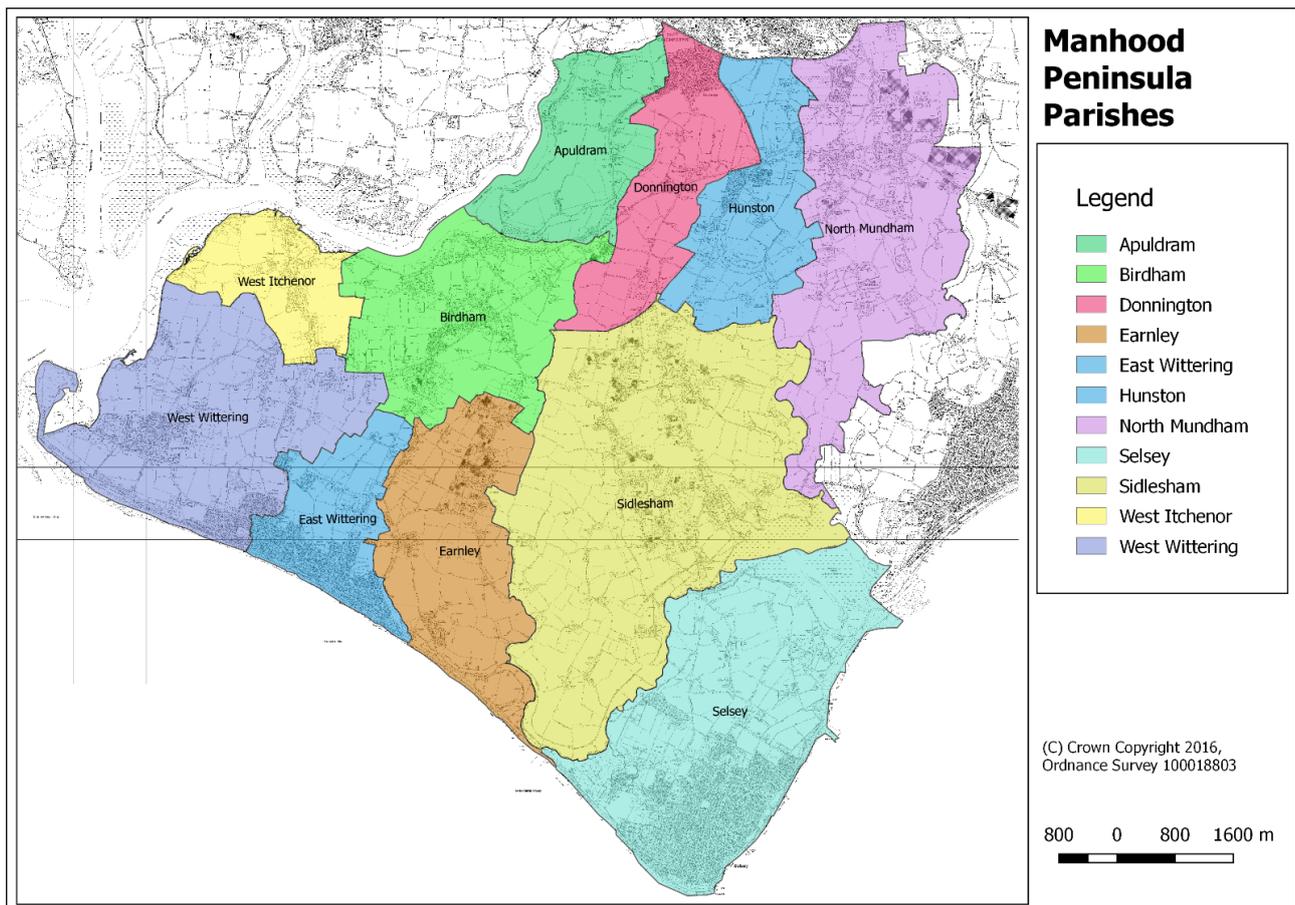
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## 1. Introduction to the FLOW Project

Fixing and Linking Our Wetlands, FLOW, is an HLF Project to carry out a complete condition assessment of all the wetlands on the Manhood Peninsula (MP), conduct hedgerow surveys of all the Parishes, and develop costed management plans to help identify and prioritise improvement.

Figure 1: FLOW Project area



Ditches and waterways form a large, linked habitat on the MP, that connect the internationally important sites of Pagham Harbour, Medmerry and Chichester Harbour, and their care and upkeep is not just of benefit to wildlife but increasingly to local communities, as more frequent flooding events take place. Well maintained ditches, ponds and rifes allow water to be stored or flow away to the sea, reducing the risk of flooding and providing a stable and important home to many species, including the fast-declining water vole (Strachan 2011).

Repeated flooding events in 2012, 2013 and 2014 highlighted the need to address the condition of the wetland system. Responsibility now rests with riparian owners who may require encouragement, information and support to identify and tackle what needs doing. The dissolution of the local Internal Drainage Boards (IDBs) and Districts (IDDs) by DEFRA means that they are stepping back from much of the management of ditches and waterways that they have traditionally carried out and, again, riparian owners will have to take over.

WSCC published the Manhood Peninsula Surface Water Management Plan (MPSWMP) in July 2015, written by CHM2Hill consultants. They have stated that *'Given the scale and length of the drainage network in the Manhood Peninsula, it is not possible or practicable for a single body to ensure that every part of the drainage system is fully functioning. There is simply insufficient resource and funding available for this to happen'*. The role of the FLOW team is to have an overview of the parishes and to work with and advise different riparian owners, small and large about wetland management while also working with the diverse range of agencies that also have an interest in this area.

The MPSWMP recommendations support the work that FLOW intend to carry out by engaging the local community, advising riparian owners, identifying areas for improvement and managing that work. The recommendations were as follows:

*'In the longer-term ongoing management and maintenance will be critical to manage flooding. The MPSWMP identified five principles which are considered the fundamental elements to ensuring continued long-term maintenance and management of the drainage system across the Manhood Peninsula:*

-  *ditch clearance remains the responsibility of riparian owners and landowners;*
-  *local communities have a key role to play;*
-  *runoff into the ditch network needs to be controlled;*
-  *the continuity of the ditch network is critical, and;*
-  *a consequence-based approach should be adopted (i.e. focusses on the critical parts of the drainage network).*

*The ongoing management and investment should be based around four key themes:*

-  *the importance of land drainage consents to prevent culverting or infilling of watercourses where it will increase flood risk;*
-  *the need to control runoff from new developments;*
-  *the requirement to continue maintaining watercourses, culverts and highway drainage on a cyclical basis, and;*
-  *the need to control runoff from glass houses on the Manhood Peninsula.*

*The objective is to ensure that the drainage system is managed and maintained on a proactive, cyclical basis to ensure it is functioning as intended. This can be achieved through an annual walkover survey of the critical drainage routes to identify their condition, maintenance requirements and any land drainage consent issues. This should take place in late autumn to allow vegetation die back following the summer, but also to identify any remedial measures before the wet winter months when the Manhood Peninsula is primarily affected by flooding'*

Hedges are another important habitat as they are abundant but undermanaged and overlooked on the MP, often originally relic pieces of woodland, they act as important green infrastructure. The hedges in this area are often associated with a drainage ditch and these form the boundaries to fields. The two combined offer good wildlife corridors and connect the designated areas of Pagham and Chichester Harbours, and Medmerry. Hedgerows, whether related to ditches or not, can be targeted

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for improvement to combat soil erosion and reduce surface water movement across agricultural land which is an important factor in overall water management.

MWHG have received funding from the NLHF to carry out the FLOW Project. The project aims to gain a working understanding of the ditch network across the peninsula by assessing the condition of the ditches which form it. An action plan of suggested improvement work will be produced, focusing on reducing the impact of flooding and enhancing biodiversity. A couple of the opportunities identified have been started as part of the FLOW project. In addition to the main focus on the wetland network, the project will look at other important habitats across the peninsula including hedgerows and rough grassland. These will inform Chichester District Council (CDC) Green Infrastructure maps which investigate habitat provision and connectivity specifically for water voles, bats, and barn owls.

Much of the natural area has been neglected and this will continue unless the issues arising in the wider environment between the managed sites are addressed. The area offers a discrete opportunity for demonstrating the importance of the Lawton Report (2010) suggestions and thus would contribute to enhancing not only the habitats and their associated species but would increase resilience in the face of climate change and provide an example for others to follow.

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## 2. The Heritage Lottery Fund Grant

The Heritage Lottery Grant for the Fixing and Linking Our Wetlands Project (FLOW) (HG-14-06996) was awarded in June 2015 to the Manhood Wildlife and Heritage Group to carry out the Development Phase from September 2015. This lasted until 31st May 2016 and the time was spent on a Pilot study area, West Wittering, developing, and refining the projects aims, objectives and activities, reviewing the budget and understanding which outputs would be useful.

In January 2019 the Heritage Lottery Fund (HLF) became the National Lottery Heritage Fund (NLHF).

In October 2016, the MWHG were awarded a grant from the HLF to continue the project until March 2021 and therefore the ditches and hedges in the remaining parishes be surveyed and mapped with a view to improvement. This will cover the parishes of Apuldram, Donnington, Earnley, Hunston, North Mundham, Selsey and Sidlesham \*, and allow a comprehensive picture of the condition of the waterways, and potential improvements, to be seen.

While the parishes of West Itchenor and Birdham are not being surveyed, they are being included in wetland improvement works and projects being supported by volunteers and consultancy input by FLOW staff.

\* Birdham and West Itchenor parishes were previously surveyed in 2013 and 2014 as part of an independently funded wetlands project.

### 3. Mundham Parish

Mundham and Runcton is the ninth parish to be surveyed as part of the FLOW survey schedule and the last on the MP to be surveyed since 2014 when grants from CHC, CDC and MPP funded ditch assessment projects in the parishes of Birdham and West Itchenor, following significant flooding in previous years.

#### **i General information about the parish**

The Parish of North Mundham contains the villages of North Mundham, South Mundham and Runcton as well as the hamlets of Bowley and Fisher and stretches from the A27 Chichester bypass, which since its completion in 1959 has formed the northern boundary, about 8 kilometres southwards to Pagham Harbour which forms its southern boundary. It is never wider than 3 kilometres from East to West.

The Parish consists of mostly high-grade agricultural land, flat and all less than 10 metres above sea level. In common with the rest of the Sussex coastal plain the Parish enjoys a very high winter light factor and is thus highly suitable to the glasshouse industry. Traditionally most of the land was used for dairy farming and sheep and there were quite a number of glasshouses enterprises, but towards the end of the 20th Century changes in the nature of farming and the decline in the glasshouse industry has resulted in significant changes. The land is now mostly arable, much down to lettuce grown in the open air. Only the larger glasshouse businesses survive grouped on or around the Runcton Horticultural Area (H.D.A) which was designated in 1996 on the old Merston Airfield to the North of the Walnut Tree Pub. Much of the southern part of the Parish comprises of water meadows and is prone to flooding but the northern part is drained by the Pagham and Bremere Rifes and their associated ditches. The Chichester Flood Relief scheme uses the rifes and is intended to divert the occasional flood waters of the River Lavant down the eastern boundary of the Parish through sluice gates in the Pagham Harbour wall to the sea.

In the north-western corner of the Parish there was extensive gravel extraction between 1920 and 1965 resulting in a number of lakes which are now a significant geographical feature and used for angling and water sports.

About 1.3 kilometres south from its northern boundary, the Parish is traversed in an east/west direction by the now defunct Chichester to Arundel Canal.

In Runcton, Mill Lane leads south to the Runcton Conservation Area which contains a number of houses of architectural interest situated around Runcton Mill and then as Runcton Lane onwards to Bowley. South Mundham and Honer can be reached by either of these lanes but further south both peter out into farm tracks and there is no vehicular access either to Pagham or the Sea. A network of ancient footpaths and bridleways criss-cross the Parish and the area between South Mundham and Pagham. A significant part of the RSPB's Pagham Harbour Nature Reserve lies within the Parish and is made up of habitat with internationally recognised protective designations.

Figure 2: North Mundham Parish

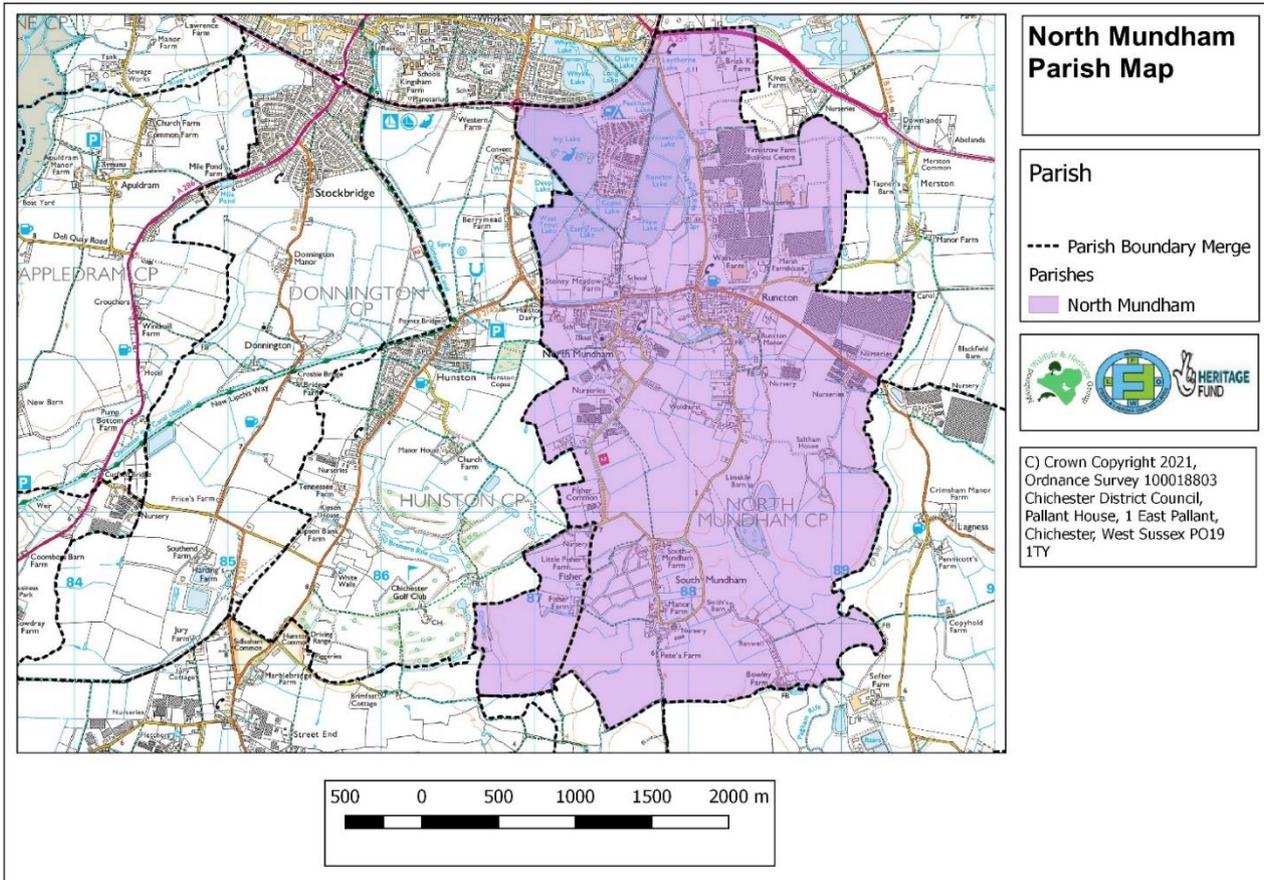
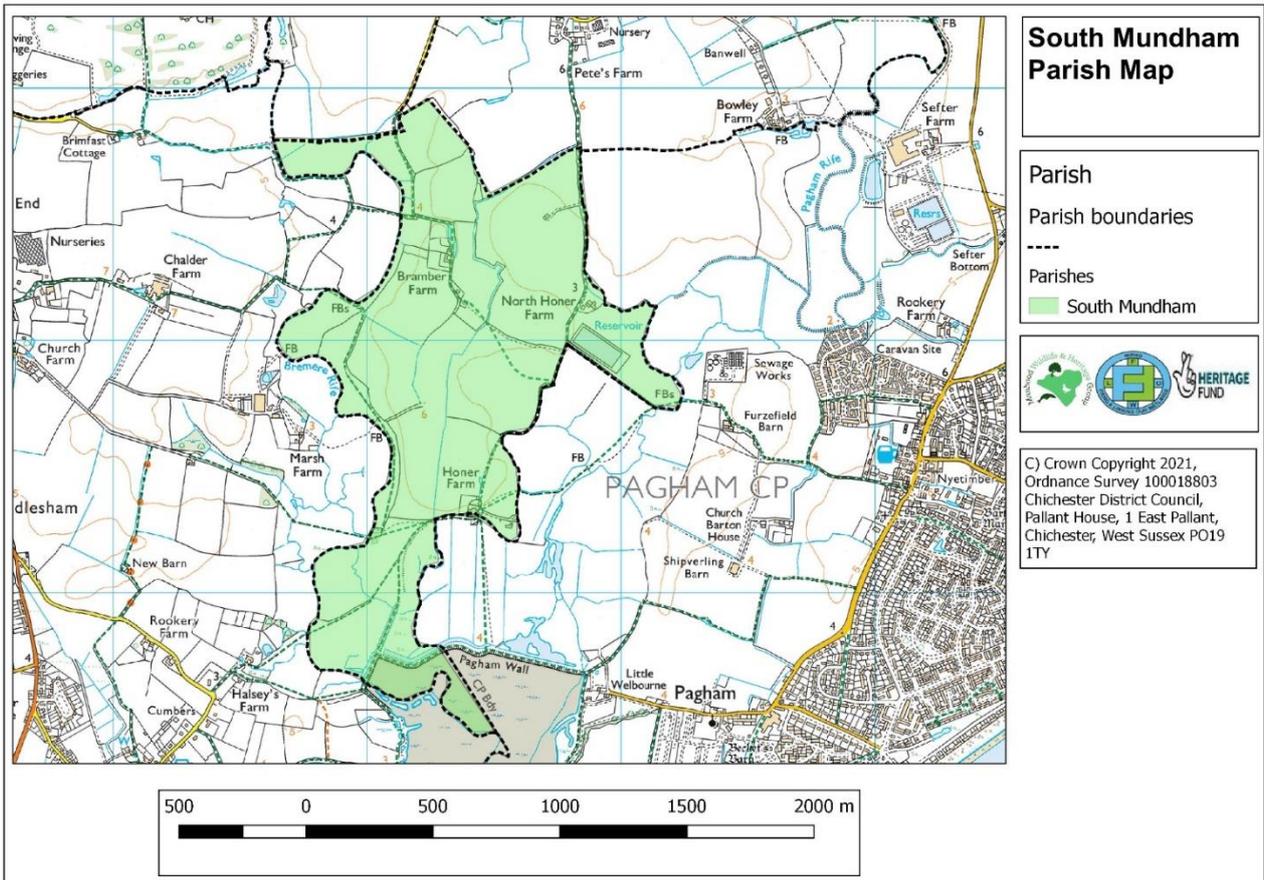


Figure 3: South Mundham Parish



## ii Recent flooding events and parish action

In 2012, 2013, 2018 and 2019 the MP suffered from severe flooding events and many local parish flood groups have been extremely active in investigating and remedying the causes of this flooding. Through the Parish Councils and WSCC (through Operation Watershed and Highways) funding was made available for drainage improvement projects.

A summary of flood issues on Mundham Parish and their status identified in the MPSWMP (2015) commissioned by WSCC and updated in December 2017 is seen below.

<p><b>Summary of flooding issues:</b> The drainage in South Mundham is predominantly open ditches which some short, culverted sections. There are two primary drainage routes, one flowing east along Punches Lane before flowing north into Camic Pond, and the other flowing north before flowing east into Camic Pond. Camic Pond then discharges east via a ditch into the Pagham Rife. Along both drainage routes into Camic Pond there was evidence of constrictions to flows during the site visit in December 2014, although it is recognised that the works undertaken by WSCC post 2012 have already helped to alleviate flooding in South Mundham. The flooding issues in South Mundham are primarily located at the junction of Punches Lane and Manor Lane where property and road flooding occurred most notably in June 2012.</p>				
<p><b>Existing investment:</b> Following the June 2012 flooding WSCC cleared the ditch and associated culverts which flowed along Punches Lane to Camic Pond. According to feedback from local residents this has made a significant improvement to the flooding situation in the village. North-west of the village landowners have undertaken ditch clearance to alleviate flooding on Manor Lane.</p>				
<p><b>Investment strategy:</b> Repair and maintain</p>				
Ref (in priority)	Type of measure	Description	Status	Action owner
SMUN_001	Maintenance	North of Punches Corner the culverted drain becomes open ditch again. During the site visit it was observed that this section of open ditch was very narrow and constricted, which could cause backing up within the culverted section and affect properties and infrastructure on Punches Lane	Proposed	Landowner
SMUN_002	Maintenance	Further north on Punches Lane there is a culvert which takes flows from the ditch into Camic Pond. The culvert appeared to have collapsed and needs repairing	Proposed	Landowner
SMUN_003	Capital	Along Manor Lane there are various access culverts which have a significantly smaller cross-sectional area than the incoming ditch (e.g. 75mm culvert north of Manor Farm, and 150mm culvert 100m further to the north). These will cause backing up of the ditch network and could cause localised flooding. To maintain consistent flow through the network these should be upsized to a 225-300mm pipe	Proposed	Landowner
SMUN_004	Capital	At the junction of Punches Lane and Manor Lane some properties are	Proposed	WSCC

		lower lying than the road. To drain additional surface water and reduce flood risk new gullies could be installed at the low points (e.g. outside Cornwood)		
<p><b>Commentary on impacts to downstream flood risk:</b> None of the proposed measures will have any significant impact on flows in the localised ditch network or the Pagham Rife and are therefore not considered to have any detrimental impact on downstream flood risk.</p>				
<p><b>Summary of Environmental Risks</b> The increased flow and storage capacity of the drainage system will reduce flood risk to people, properties, agricultural land, heritage, and the highway network in South Mundham. However, care will be required during action implementation to ensure that the works avoid construction impacts on designated sites (e.g., two listed buildings) and sensitive habitats. Pre-construction checks will be required to assess the value of habitat in the footprint of the culvert repairs, upsized ditch and new gullies, and its potential to support protected, notable, and invasive species, while care will be required to avoid pollution of surface water and groundwater, particularly within the surface water NVZ.</p>				

ID	Type	Funding of action	If other, specify	Action status (where relevant)	Description or details (Free text box)
NMUN _1	Action	Other	Southern Water	Proposed	700 mobile homes, foul drainage runs south down school lane. Apparent agreement to discharge at controlled rate not being honoured, overloading top end of foul drainage system
NMUN _2	Action	Other	Southern Water	Proposed	Sewage backs up in heavy rain, Fletchers place and Fletchers Close. SW pump station at this location. Lots of sewer infiltration, may be shallow emergent ground water. SW may be addressing?
NMUN _3	Flood Location	Other	Southern Water/ WSCC	Not Identified	Sewage issues in house, road flooding may get into sewers via unsealed manholes. WSCC to evaluate road drainage issues?
NMUN _4	Action	WSCC		Proposed	Post office lane. Some flooding over road from blocked culvert PC have asked WSCC to clear culverts. Flooded but driveable
NMUN _5	Action	Riparian Owner		Not Identified	Runton Manor "Severalls" installed weir and water features, created their own problems
NMUN _6	Flood Location	EA		Not Identified	Flooding from rife, tree fell into Rife Assume cleared?
NMUN _7	Flood Location	Other	Unclear	Not Identified	Significant flooding from fields onto the road, which is lower, lots of ditch clearance carried out (not clear by whom, by landowner?)
NMUN _8	Flood Location	WSCC		Completed	Flooding from fields to the east, blocked culvert, property "Cornwood" flooded. A lot of road flooding in this area, houses OK as mostly at higher elevation
NMUN _9	Action	WSCC		Completed	Drainage runs east then north, then east again. When culvert blocked, flowed north to flood Cornwood instead (see above). WSCC highways have done a lot of work

ID	Type	Funding of action	If other, specify	Action status (where relevant)	Description or details (Free text box)
					on culverts which a pears to have eased issue. Ongoing maintenance on outward channel needed
NMUN_10	Flood Location	Other	none needed	Not Required	Rife flooding....fields
NMUN_11	Action	WSCC		Completed	Clear 100m of ditch and make sure gully is running. between Smith's Barn and croft cottage, between eastings:488308 northings:100337 and eastings:488396 northing:100290 (see map in sharepoint)
NMUN_12	Action	WSCC		Completed	Clear 10m of ditch to alleviate gully outlet. junction of Brookside / Lagness Road between eastings: 488428 and northings: 102373 eastings: 488417 and northings: 102366
NMUN_13	Action	WSCC		Completed	Clean approx. 5 gullies (record missing gullies marked with a star on the plan for inclusion on the WSCC inventory) clean assoc. catch pits and jet pipes to out outfall.

<b>Runcton</b>	
<ul style="list-style-type: none"> <li>○ Increasing risk of flooding to properties and infrastructure, particularly the B2145.</li> <li>○ Increasing risk of flooding on local road network affecting transport in and out of the area, tourism to Chichester and the South Downs and businesses.</li> <li>○ Quality of life affected by flooding.</li> <li>○ Lack of understanding of the drainage network and the connectivity and flow issues.</li> <li>○ Increasing risk of collapse of outfalls structures and overtopping of brooks and ponds.</li> </ul>	<ul style="list-style-type: none"> <li>○ The increased flow and storage capacity of the drainage system will reduce the flood risk to people, properties, agricultural land, heritage, and the highway network in Runcton. This will reduce property damage, may improve quality of life for residents and reduce the effects of flooding on local businesses and access.</li> <li>○ Construction works associated with measures 001, 003 and 004 could temporarily affect properties adjacent to the works through noise and visual disturbance.</li> <li>○ Potential for an increase in flow conveyance to affect local flora and fauna in some areas.</li> <li>○ Pre-construction checks will be required to assess the value of affected habitat (e.g. footprint of pond bank, and replacement pipe at Saltham Lane) and their potential to support protected (e.g. great crested newts), notable and invasive species.</li> <li>○ The proposed measures will have minimal effects on the visual amenity of the local area once the works are complete.</li> </ul>
<b>South Mundham</b>	
<ul style="list-style-type: none"> <li>○ Increasing risk of flooding to properties and infrastructure.</li> <li>○ Increasing risk of flooding on local road network affecting transport in and out of the area, tourism to Chichester and the South Downs</li> <li>○ Quality of life affected by flooding.</li> </ul>	<ul style="list-style-type: none"> <li>○ The increased flow and storage capacity of the drainage system will reduce the flood risk to people, properties, agricultural land, heritage and the highway network in South Mundham. This will reduce property damage, may improve quality of life for residents and reduce the effects of flooding on local businesses and access.</li> </ul>

<ul style="list-style-type: none"><li>○ Increasing constrictions to flow and no maintenance of ditches.</li></ul>	<ul style="list-style-type: none"><li>○ The construction works associated with all measures could temporarily affect properties through noise and visual disturbance.</li><li>○ Potential for an increase in flow conveyance to affect local flora and fauna in some areas.</li><li>○ Pre-construction checks will be required to assess the value of affected habitat (e.g. in footprint of culvert repairs, upsized ditch and new gullies) and their potential to support protected, notable and invasive species.</li><li>○ Measures 001 and 004 are within a surface water NVZ and therefore care will be required to avoid pollution of surface waters.</li><li>○ Potential for measures 003 and 004 to impact on the setting of two listed buildings that lie in close proximity; the impacts on these buildings and their setting will require further consideration.</li><li>○ The proposed measures will have minimal effects on the visual amenity of the local area once the works are complete.</li></ul>
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## 4. Methodology

### i. Access and initial information

Following contact with the Chair and Clerk of the Parish Council, a parish neighbourhood plan event in September 2019 was used to advertise the data gathering work of the FLOW project, recruit local volunteers, and gather information about landowners. In addition, information was sought about the parish drainage, historic waterways, and any flooding issues.

### ii. Ditch and pond surveys

A Ditch Condition Assessment sheet (Appendix I, section 14) was developed to capture a wide range of information on the ditches and ponds surveyed. These surveys have been designed to give a rapid assessment of a wide range of information including the physical attributes of each ditch (bank profile, water availability, storage capacity, conveyance potential etc), the emergent and bankside vegetation structure, historical and current management observations and surrounding land use. In addition, information on flow regimes and direction were recorded along with any additional information relevant to each survey site and a detailed sketch was completed. No survey was undertaken without landowner permission, which was granted by all those approached as part of this parish evaluation. All surveys were undertaken between May 2019 and November 2020.

The information gathered was 'scored' to enable comparisons between ditches. In order to produce maps of the results a traffic light system was developed with red as "poor", amber as "moderate" and green as "good". However, it should be noted that this scoring system is relative and as such does not imply an overall status but rather the specific ditch's condition relative to others surveyed.

Whilst the long-term intention of the FLOW project is to train volunteers from each Parish to undertake much of the survey work, and long-term management of improved areas, no local residents were successfully engaged to get involved at this stage of the project. Experienced and trained volunteers from MWHG undertook all survey work.

All data was compiled into Microsoft Excel Spreadsheets before being used to create maps of the parish using Geographical Information System (GIS), specifically, QGIS (Wein QGIS 2:18.3 2020).

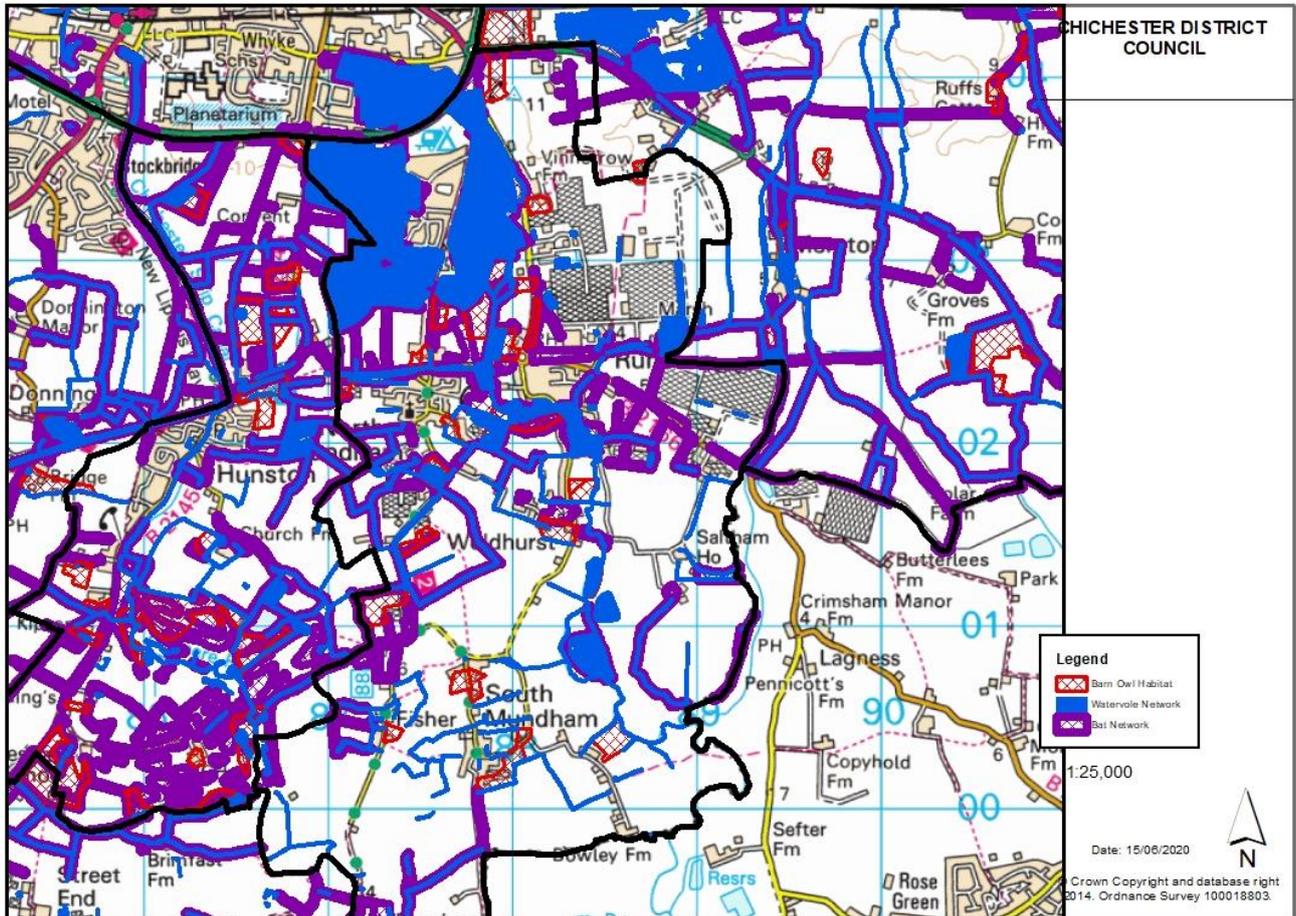
### iii CDC Green Infrastructure maps

In 2013 CDC carried out a desk-based study mapping three key habitats on the MP. Data was used from the SxBRC, ecological surveys submitted through Planning applications and enquiries, local Biodiversity Action Plans and any other information that could be used. The data focussed on the waterways network with water voles (*Arvicola amphibius*) in mind, the hedges network for bats and rough grassland habitat for barn owls (*Tyto alba*).

As part of these Parish surveys, the maps are ground-truthed to give an indication of their accuracy for habitat associated with the target species.

Figure 4. shows the three different habitats marked up as green networks and these were examined during the fieldwork.

Figure 4: CDC Green Networks map provided by CDC



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## 5. Sources of information

Information on drainage, the environment and flooding within the parish of Mundham has been gained locally from the Parish Council and landowners as well as Chichester District and West Sussex County Councils and the Environment Agency.

Chichester District Council provided an Ordnance Survey License to enable mapping of results along with a number of local, relevant GIS layers. West Sussex Highways Authority granted access to GIS information regarding the local area (utility locations, agricultural land grading information, hedgerow information and other historical information) and allowed these to be printed. Further GIS based information has been obtained from the Open Access, Environment Agency website. NE data sets were also used to look at designated area boundaries, key species locations, habitat mapping and which farms are in stewardship.

Parish Tithe Maps were purchased from WSCC Records Office to inform on the historical location of features which could be reinstated or improved and the WSCC Manhood Peninsula Surface Water Management Plan (MPSWMP 2015), provided information about the flooding and drainage problems of Mundham. This has informed us of specific issues within the parish and enabled us to look more closely at and in those areas.

The individual landowners that we approached about access to their land were asked about detailed information on their ditches, the flow direction, historic and recent management, capacity, etc. Where possible we asked them to give us field maps with ditches marked on and to have a tour with them of their land.

## 6. Results

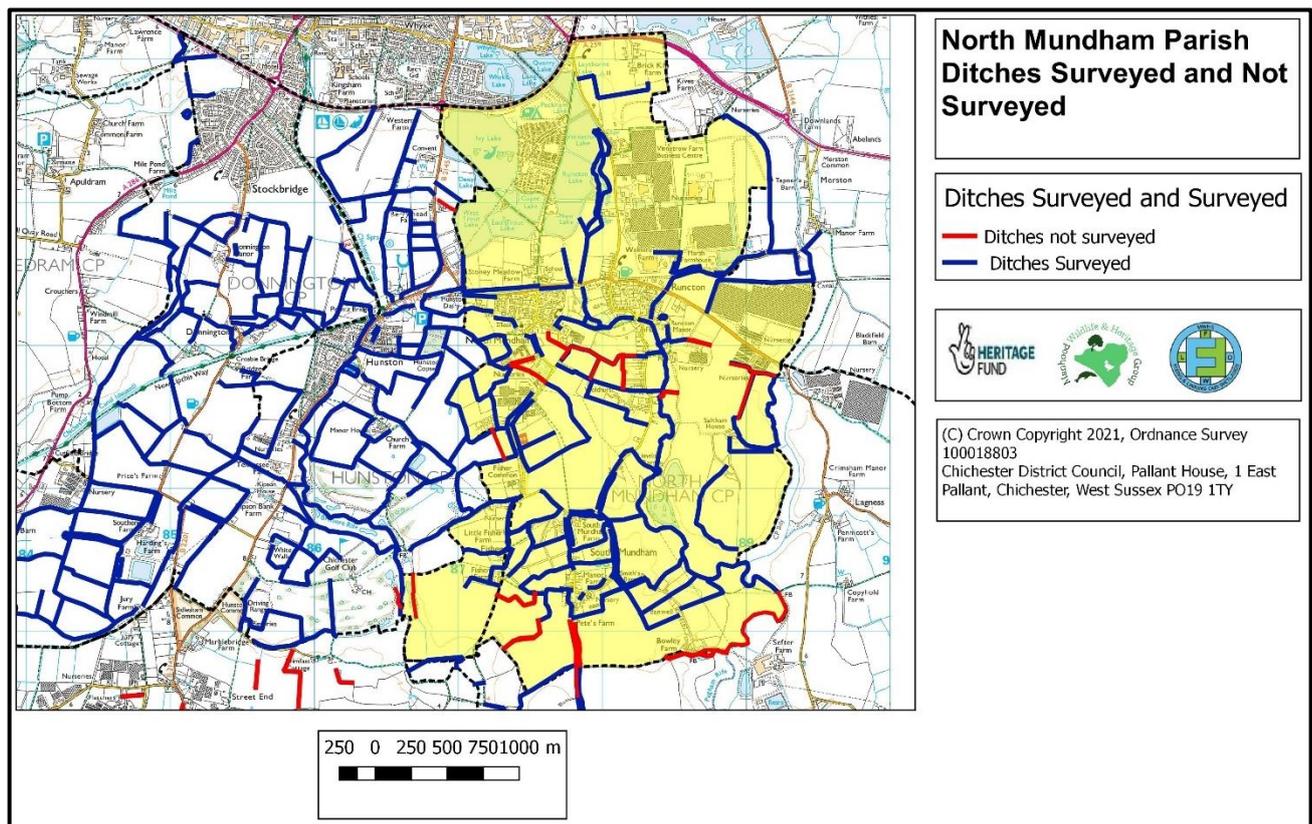
With the help of the Chair of the Parish Council we managed to survey most of the sites that we sought permission for, getting good coverage of the Mundham Parish.

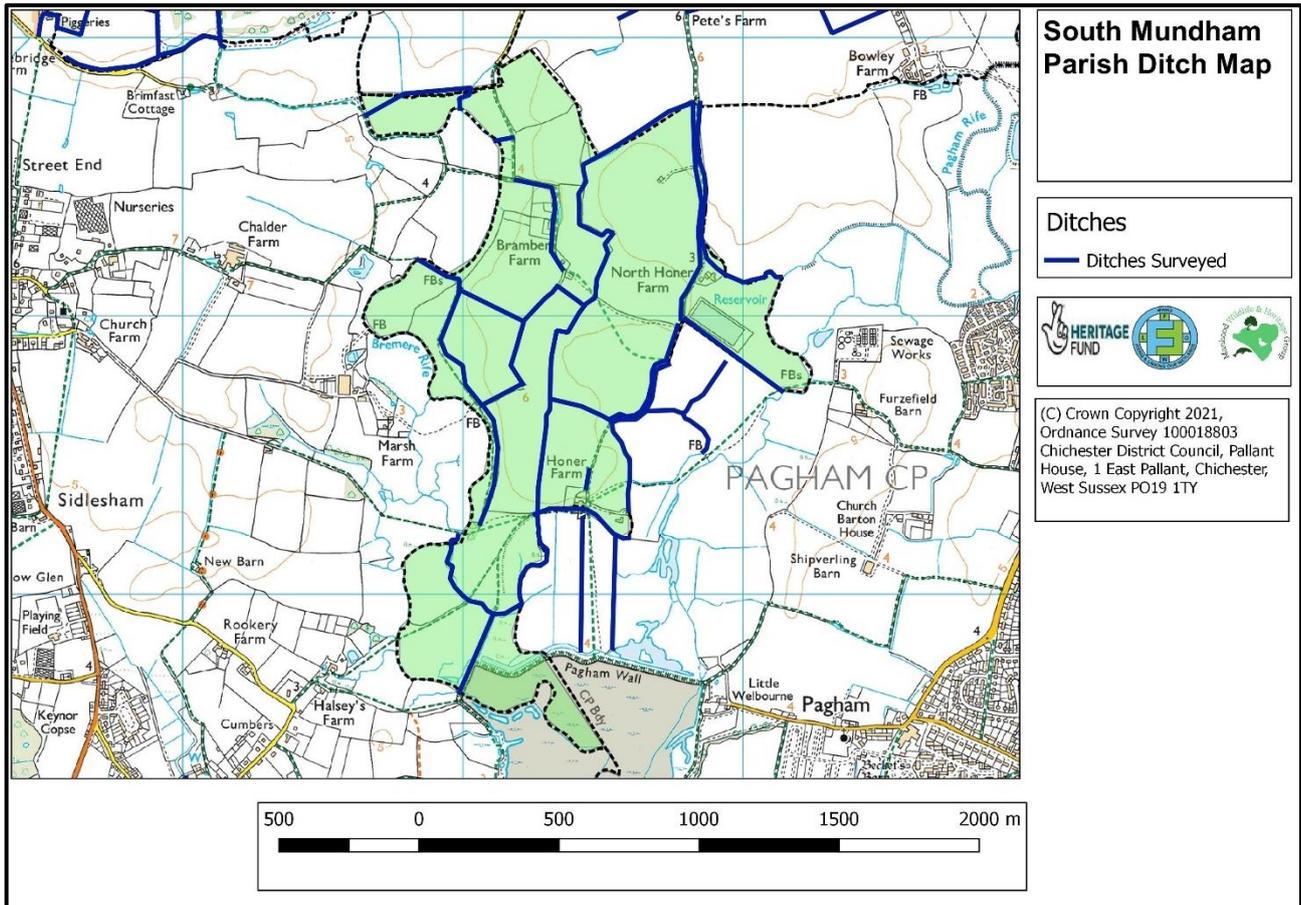
Where a landowner gave us permission to access their land and to carry out surveys, we tried to get complete coverage of that area, without concern for the parish boundary. We did this so that the full picture of the ditch system could be gained where possible and to ensure that we only had to ask permission for access once.

**The total length of ditches surveyed in North Mundham was approximately 41km, and un-surveyed was 15km.**

**The total length of ditches surveyed in South Mundham was approximately 10km, and un-surveyed was 8km.**

Figure 5a: Surveyed and un-surveyed ditches in North Mundham





A few ditches were not surveyed in detail for various reasons - access and visibility difficulties (e.g. overgrown vegetation and behind high fences).

### i Overall results of ditches surveyed

The table below summarises the survey statistics from the ditch condition assessments (see Appendix 1 for ditch condition assessment form used).

Attributes surveyed			%	Notes
Average Ditch Score		35		180 ditches surveyed
Total good ditches (score >40)		37	21	
Total moderate ditches (score >21-40)		130	72	
Total poor ditches (score <21)		13	7	
Ditches which remain wet throughout the year		67	38	52 ditches unknown
Ditches which are seasonally dry		57	32	
Relative ditch capacity	very high	14	8	
	high	12	7	
	moderate	65	37	
	low	11	6	
	very low	73	42	
Ditches with concrete or boarded sides		1	0.5	
Buffer width	Very wide (>4m)	24	14	
	Wide (2.1-4m)	48	27	
	Moderate (1.1-2m)	73	42	

Narrow (0.1-1m)	29	17	
Not present	0	0	
Average buffer size 1.7m = moderate (1.1-2m)			
Ditches observed with moderate to high bank erosion on one or both sides	25	15	
Litter	none recorded	66	37
	litter present	78	44
	litter abundant	33	19
Vegetation	high (>5 types)	47	27
diversity	moderate (3-4 types)	84	50
	Low (<3 types)	38	23
Average number of types per ditch 3.6			
Riparian	Present	166	88
vegetation	2 or more types	86	47
	3 or more types	67	37
Channel	present	145	80
vegetation	absent	35	20
Ditches not managed on rotation	38	23	
Heavily shaded ditches (>80% shaded)	57	33	
Moderately shaded ditches (40—80% shaded)	56	33	
Ditches with little/no shading (<40%)	59	34	
Thick layer of sediment	36	21	
Ditches with hedge on one or both sides	103	57	

These survey results have been used to create maps in the rest of this section and in **7. Discussion** and **8. Opportunities for improvement works**.

## ii Landowners

Mundham Parish is made up of 18 or 19 significant landowners who own and farm the arable land in the parish. There are many smaller landowners with small holdings and domestic sized gardens. It was the larger land areas that we targeted as we wanted to study the network of waterways for drainage attributes and biodiversity value. Figure 6a and b shows the landowner plots surveyed.

The landowners have not been identified as this information is confidential and, in some cases, landowners only agreed to allow access to their land for surveying if their identity was made anonymous

There are field areas on the map that have not been covered (in white) because the fields did not have ditches, and therefore we did not seek access to the land, or the fields were small and individual owners could not be identified but this totalled a limited amount of land.

Figure 6a: Landowners involved in the FLOW project in North Mundham Parish

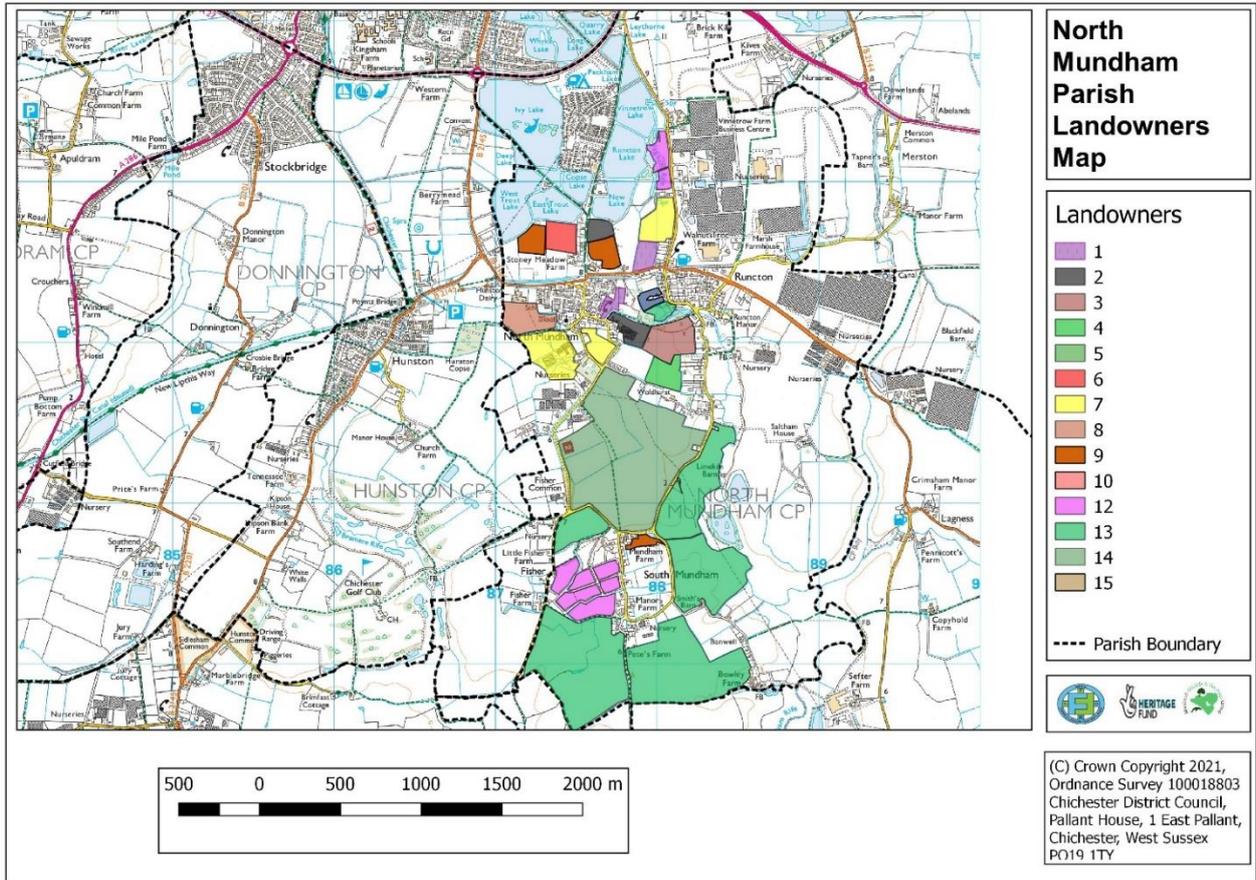
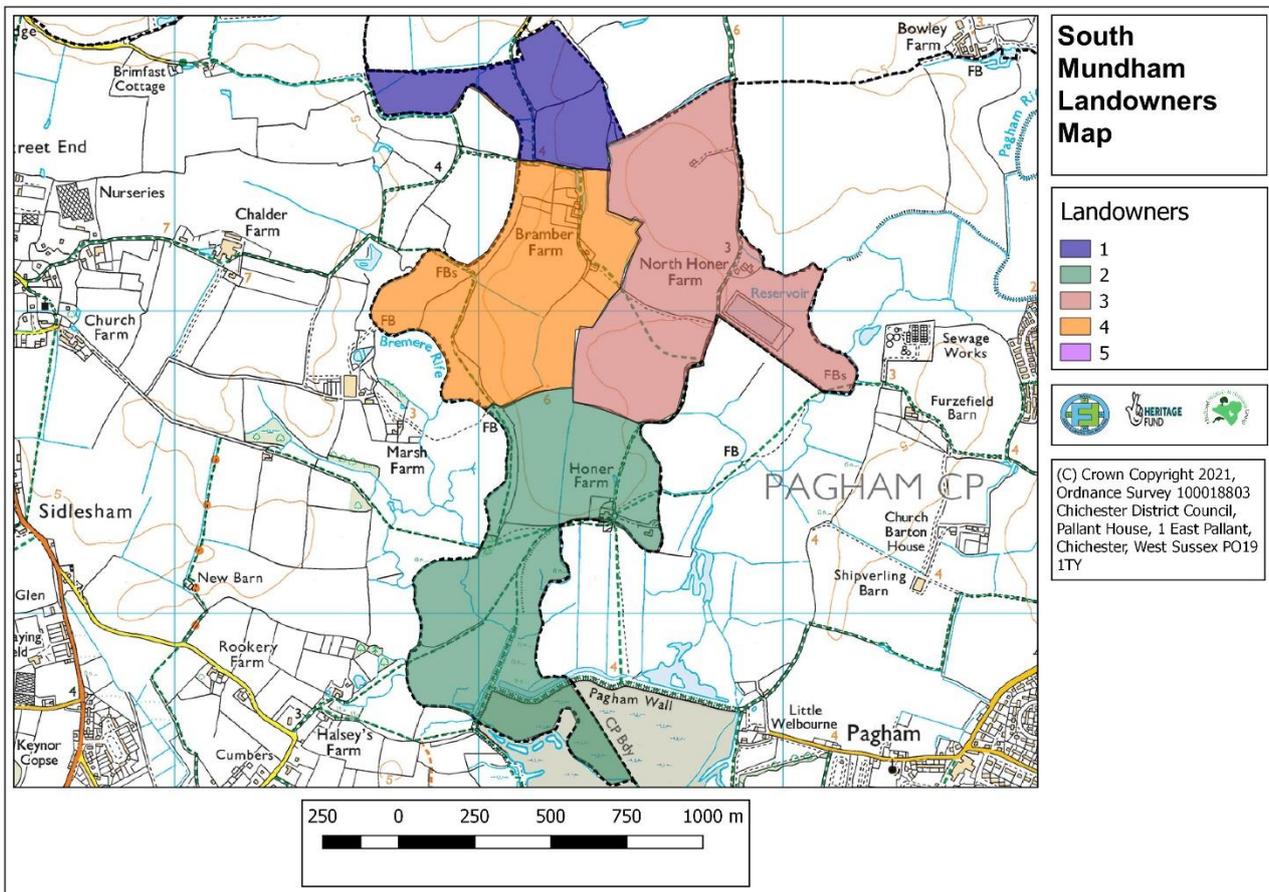


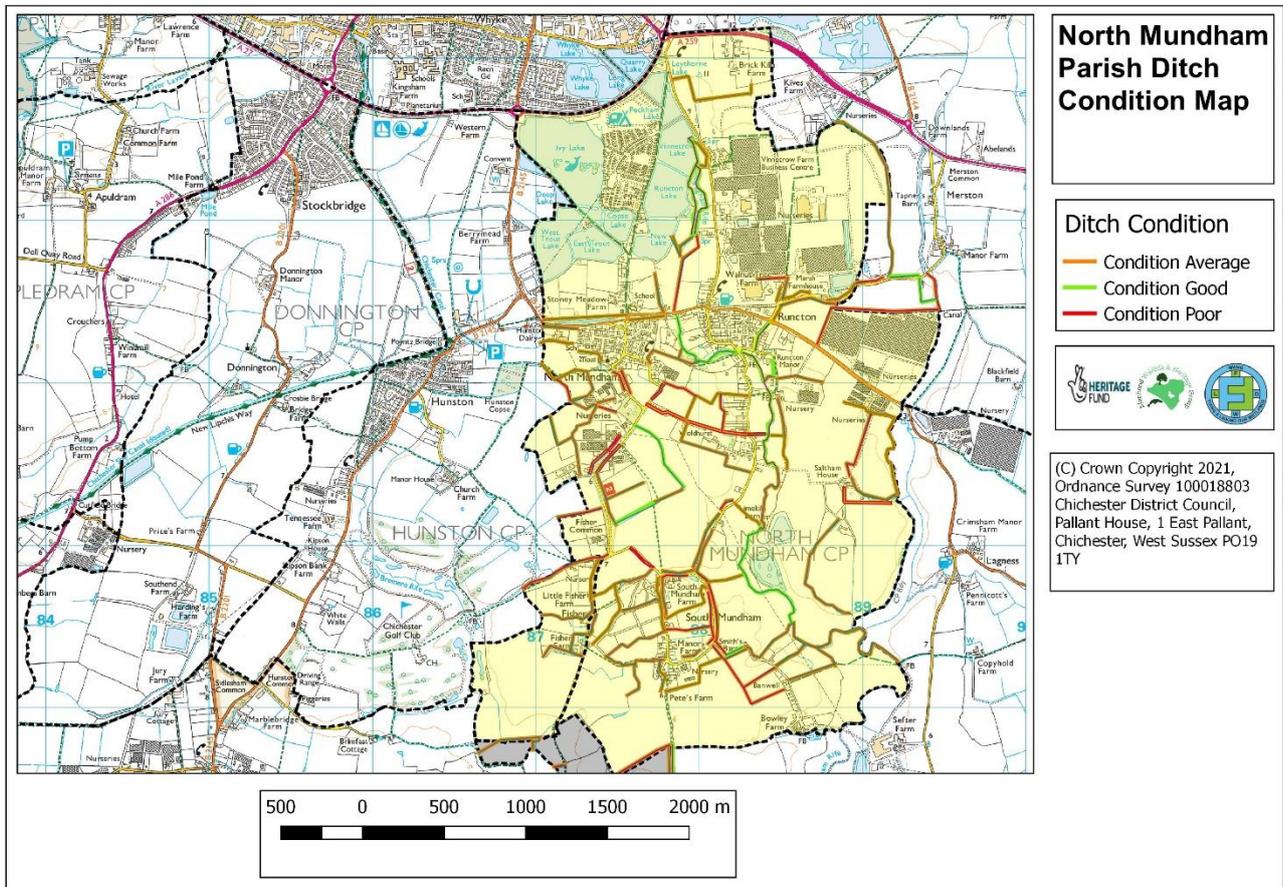
Figure 6b: Landowners involved in the FLOW project in South Mundham Parish



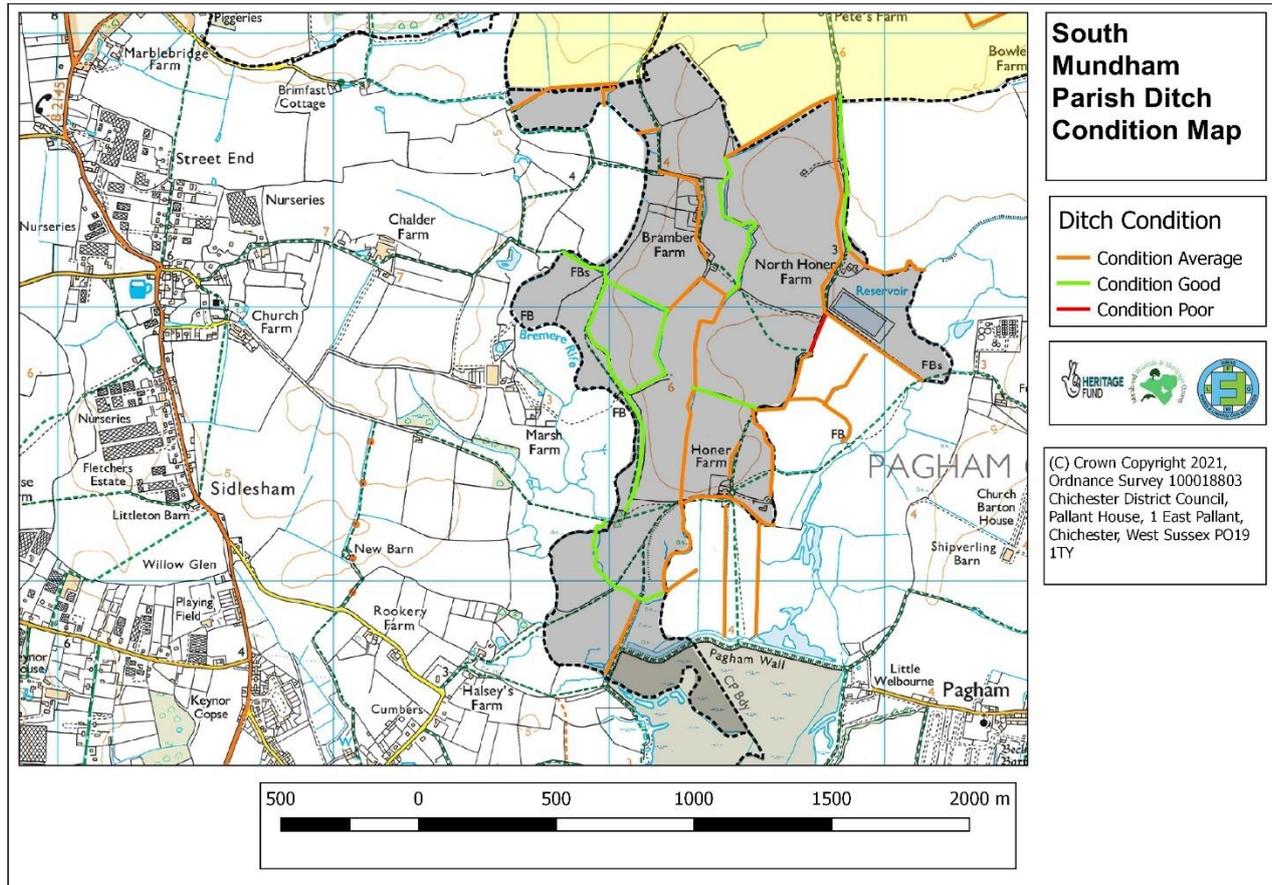
### iii Condition of the ditches across the Parish

Using the scoring system, we were able to see which areas had ditches with high scores and were considered in good condition, and those with low scores and possible problems. Most of the ditches fell into the 'moderate' category - some of which had potential for improvement but some, which due to their location, original role, physical attributes, or neighbouring land management could not be improved.

**Figure 7a: Condition Assessment of ditches in North Mundham**



**Figure 7b: Condition Assessment of ditches in South Mundham**



A high scoring ditch would be one that was large, had water all year round, good vegetation cover on the banks, had a range of vegetation in the water and on the banks, and which also had a hedge associated with it.

Poor ditches varied from being completely overgrown with bramble so that they couldn't be seen, to being very shallow, bare earthed and dry most of the year. Most ditches were seen with vegetation of either one or both sides and none had been over managed with complete vegetation removal.

## 7. Discussion

The Manhood Peninsula Surface Water Management Plan (MPSWMP) 2015, commissioned by WSCC, focusses on flooding events that took place in 2012/2013 on a parish-by-parish basis. It looks at actions that need to take place to reduce future flood risk and identifies individual issues and problems. In the Mundham parish there was an opportunity for the Parish Council to meet with the authors of the report to talk through issues in the parish and many problems were reported and detailed actions taken for solutions. There were 4 actions detailed for South Mundham and 13 for North Mundham with many having been carried out using EA, WSCC OW, and private funds, with the remaining due to be completed.

This project focussed its work on identifying opportunities to improve drainage and biodiversity opportunities on the farmland where ditch and ponds could be examined, and not land built up with culverts.

### i Mundham parish key waterways

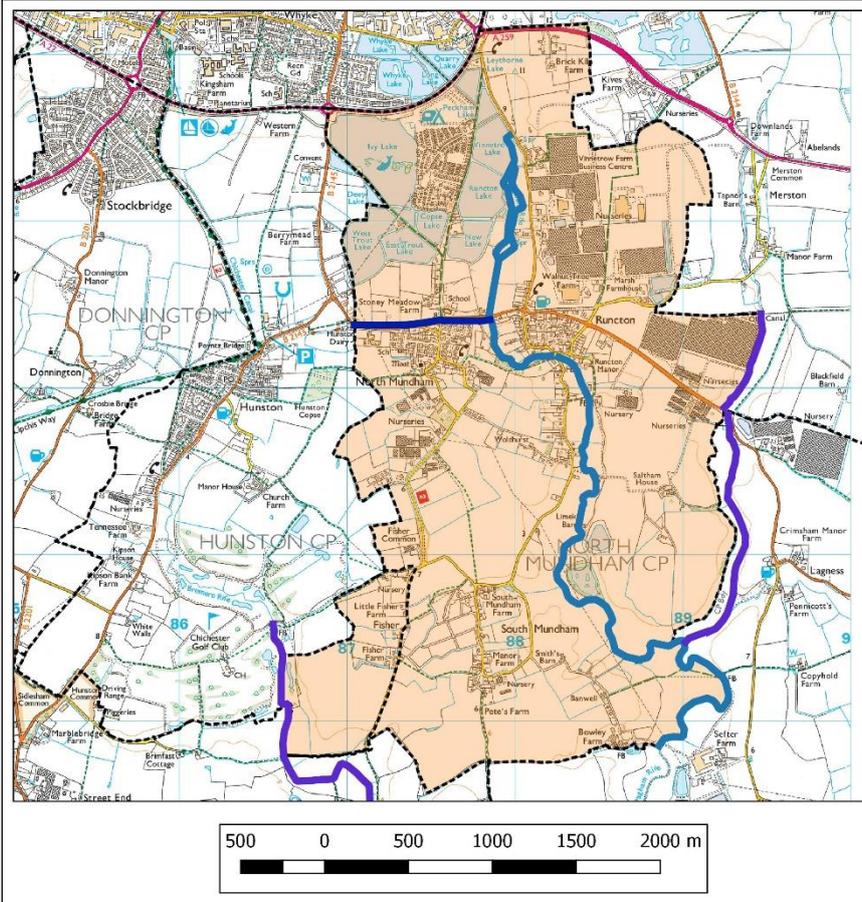
As noted in the MPSWMP, primary conveyancing routes have been identified in the parish and their condition was focused on. These are *'the critical routes of the drainage network which will cause the most significant flooding to property and infrastructure if they are blocked or poorly maintained (NB: these routes include all of the Rifes, and builds upon the 'key transport routes' initially proposed by Royal Haskoning in 2006)'*

There are two main routes for water to travel through to get out to sea and a couple of these rifes have different names along their length:

- Pagham / Runcton Rife
- Bremere Rife

These rifes are larger channels that pick-up water from farm drainage and roadside highways ditches and are key to the water storage and movement capacity of the drainage system of the parish. They are also key for environmental connectivity as they hold water for longer and have the potential to be hotspots for wetland biodiversity with good management. These rifes do not just drain water from this parish but also take water from Hunston, Sidlesham, and Pagham.

Figure 8a: Main rife and waterways map of North Mundham



**North Mundham Main Rife & Main Waterway Map**

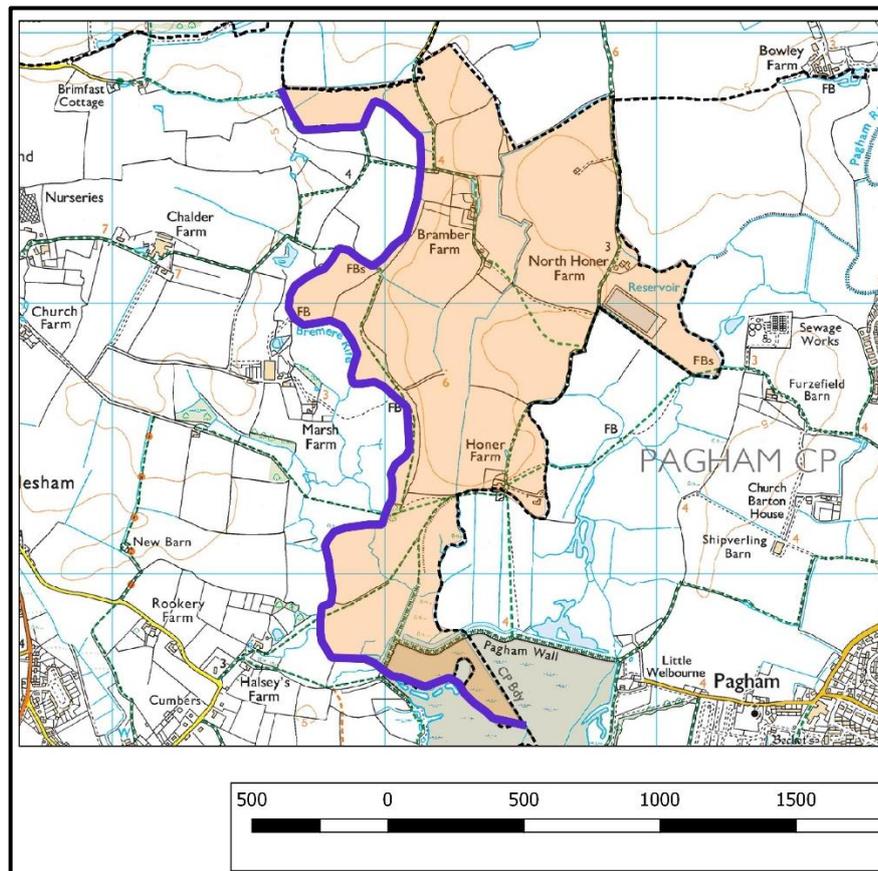
**Main Rife and Main Waterway**

- Bremere Rife
- Old Canal Chichester to Arundel
- Chichester Flood Relief Channel
- Pagham Rife



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Figure 8b: Main rife and waterways map of South Mundham



**South Mundham Main Rife & Main Waterway Map**

**Main Rife and Main Waterway**

- Bremere Rife



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Chichester District Council, Pallant House, 1 East Pallant, Chichester, West Sussex PO19 1TY

These waterways need to be prioritised for any clearance and maintenance work as they are key to the conveyance of water. If they become blocked or are overwhelmed, they will have the largest impact on people, properties, and roads. Investigation of sites adjacent or connected to these that could be used as temporary water storage areas was explored.

## ii Overall condition of the ditches

Figures 8a and b, map the condition assessment results in Mundham parish, clearly shows that the majority (72%) of the ditches in the parish are in 'moderate' condition and that only 7 % were 'poor'. However, as previously stated this scoring is relative and boundaries between categories must be made. As such some moderate ditches will be marginally inside the required scoring band and should be considered, where appropriate, as a priority for improvement or further monitoring. The fact that 21% of the ditches are shown to be in good condition may be skewed by the high number of rifes with larger margins and all year-round water availability.

The physical and biological condition of the ditches is primarily influenced by their management regime and therefore different landowners tended to have ditches that were characteristic to them with similar adjacent land uses, managed hedges and banks looking homogenous. This was also influenced by their position within the parish, their proximity to the sea, and the influence of the wind.

It can be seen that 62% of the ditches in the Parish are managed on a rotational basis with only one bank being cut at a time. This may be because many of the ditches have hedges associated with them and therefore it is only practical to do one bank or because vegetation was only cut on one bank per year as is best practice.

It was seen that 38% of ditches had both sides managed every year and while this appears to open up the channel for water movement, it can actually contribute to bank erosion, depending on the height and type of vegetation cut. It also tends to lessen the biodiversity value of the ditch.

Figure 9a: Rotational Management of ditch banks in North Mundham

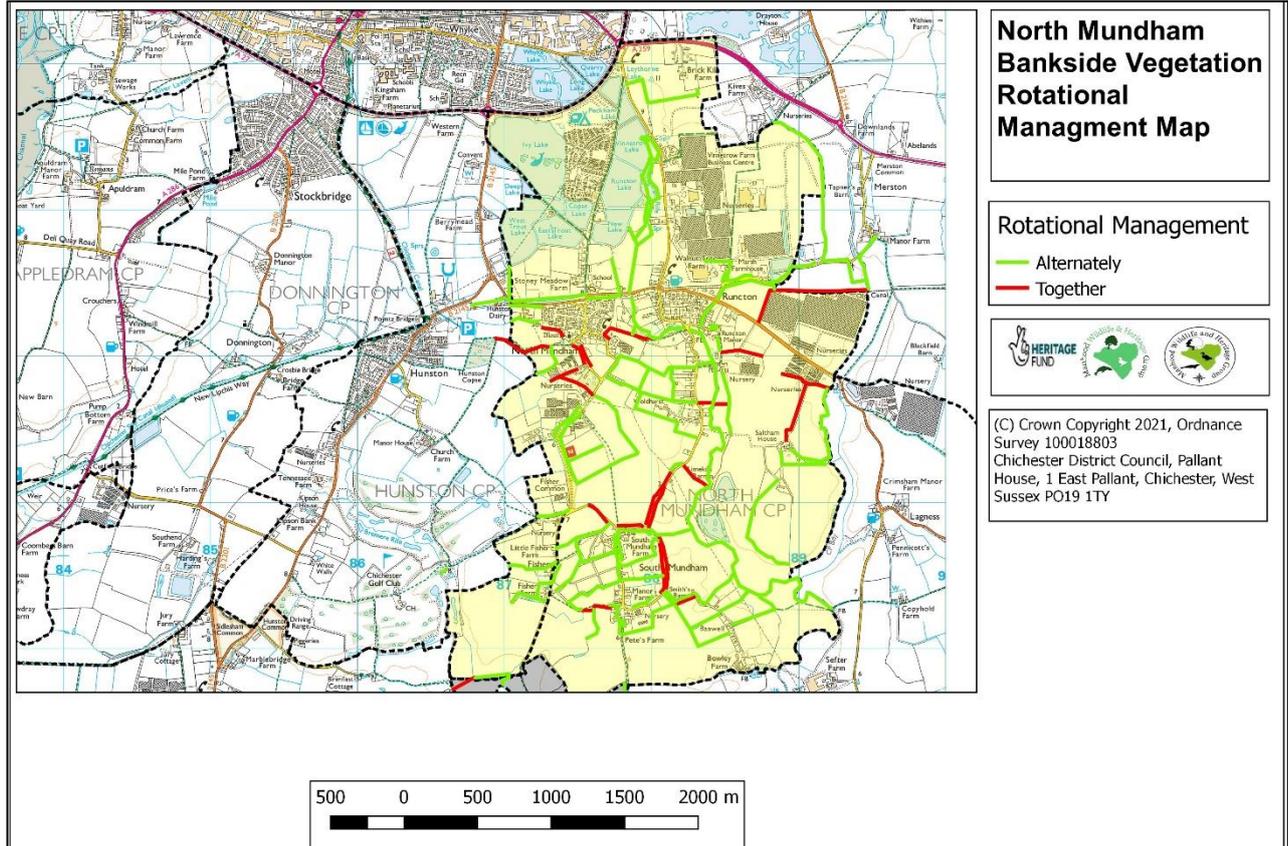
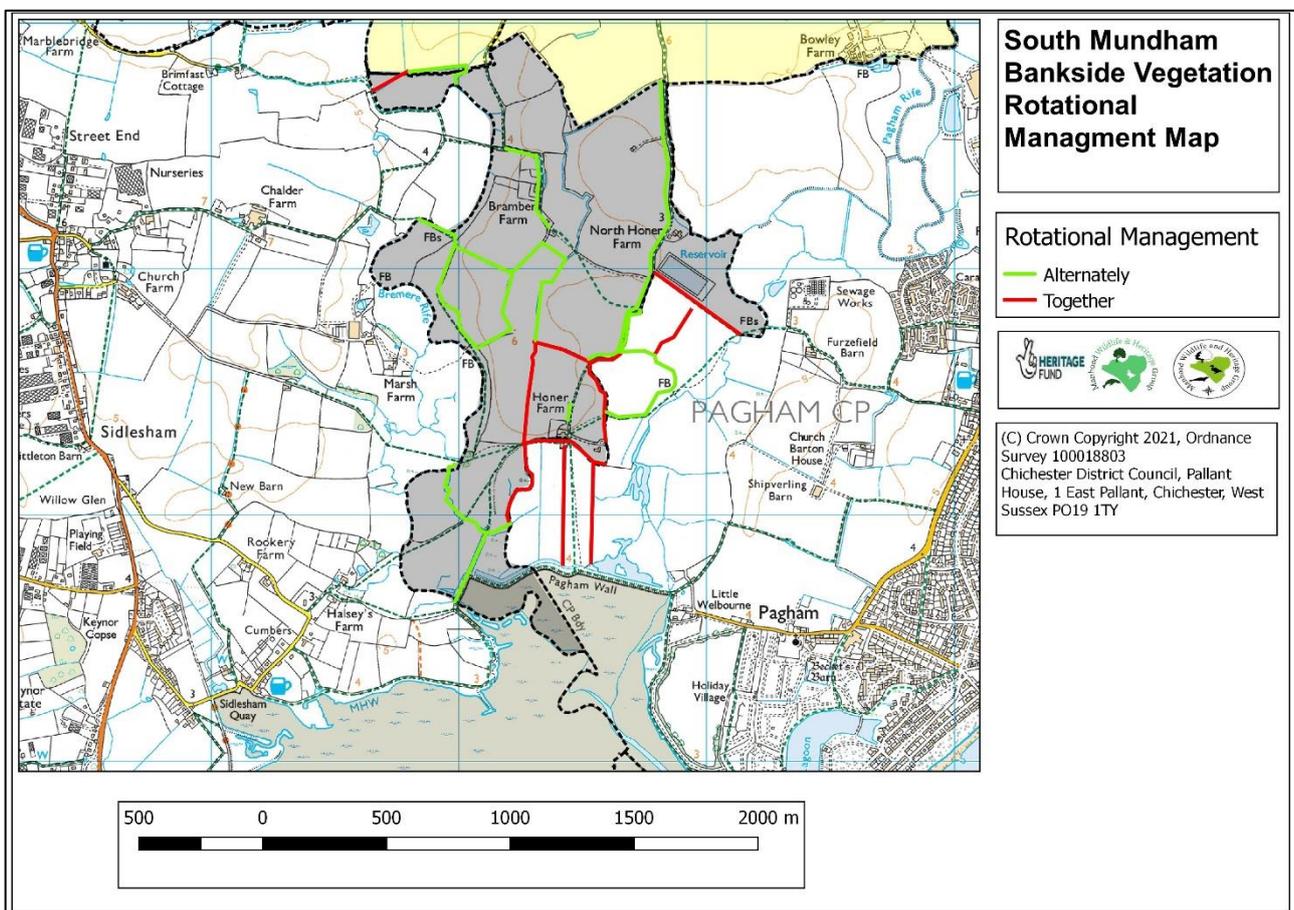


Figure 9b: Rotational Management of ditch banks in South Mundham



During the examination of the ditches, culverts were also inspected, where it was possible to do so, and it was noted where some culverts were silted up or looked in poor condition as these can often be a source of flooding if they get blocked.

Figure 10a: Culverts in North Mundham ditches

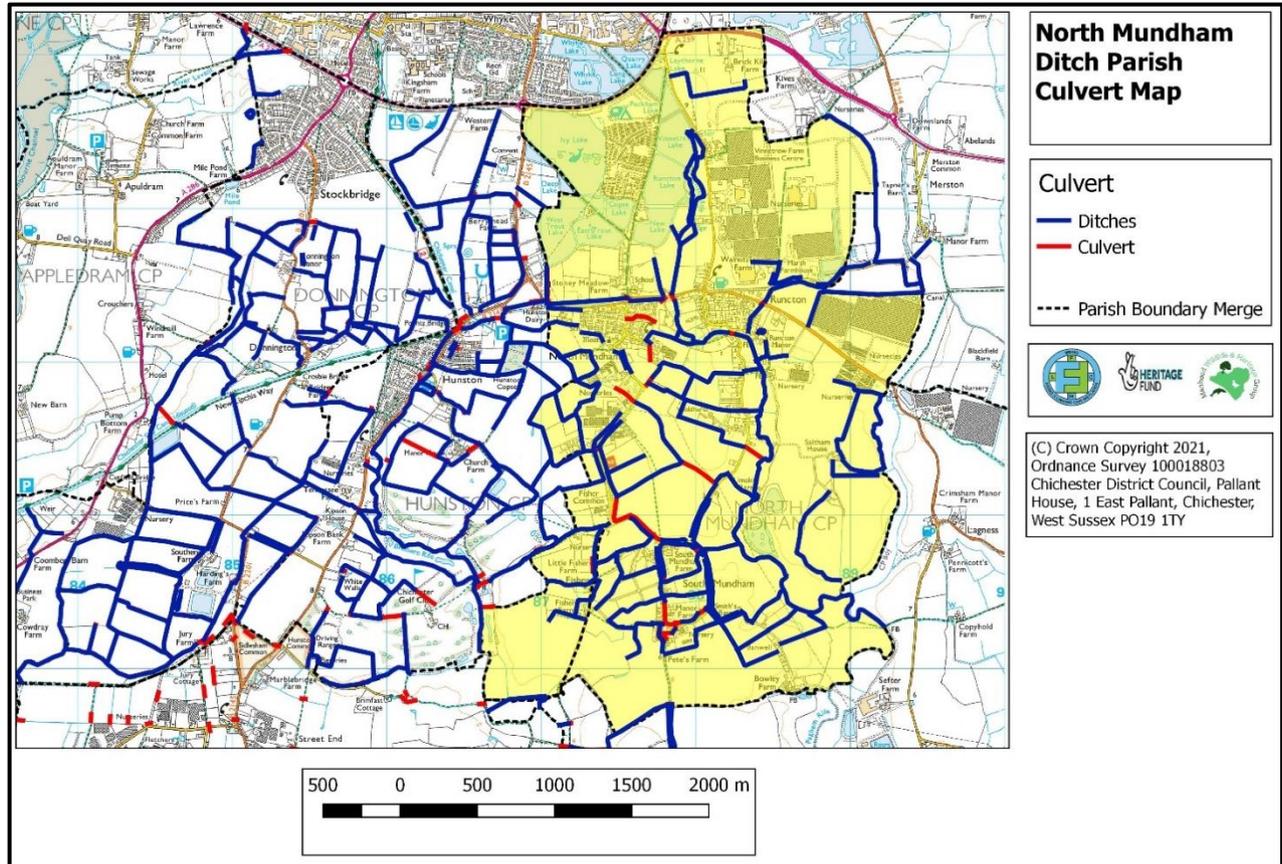
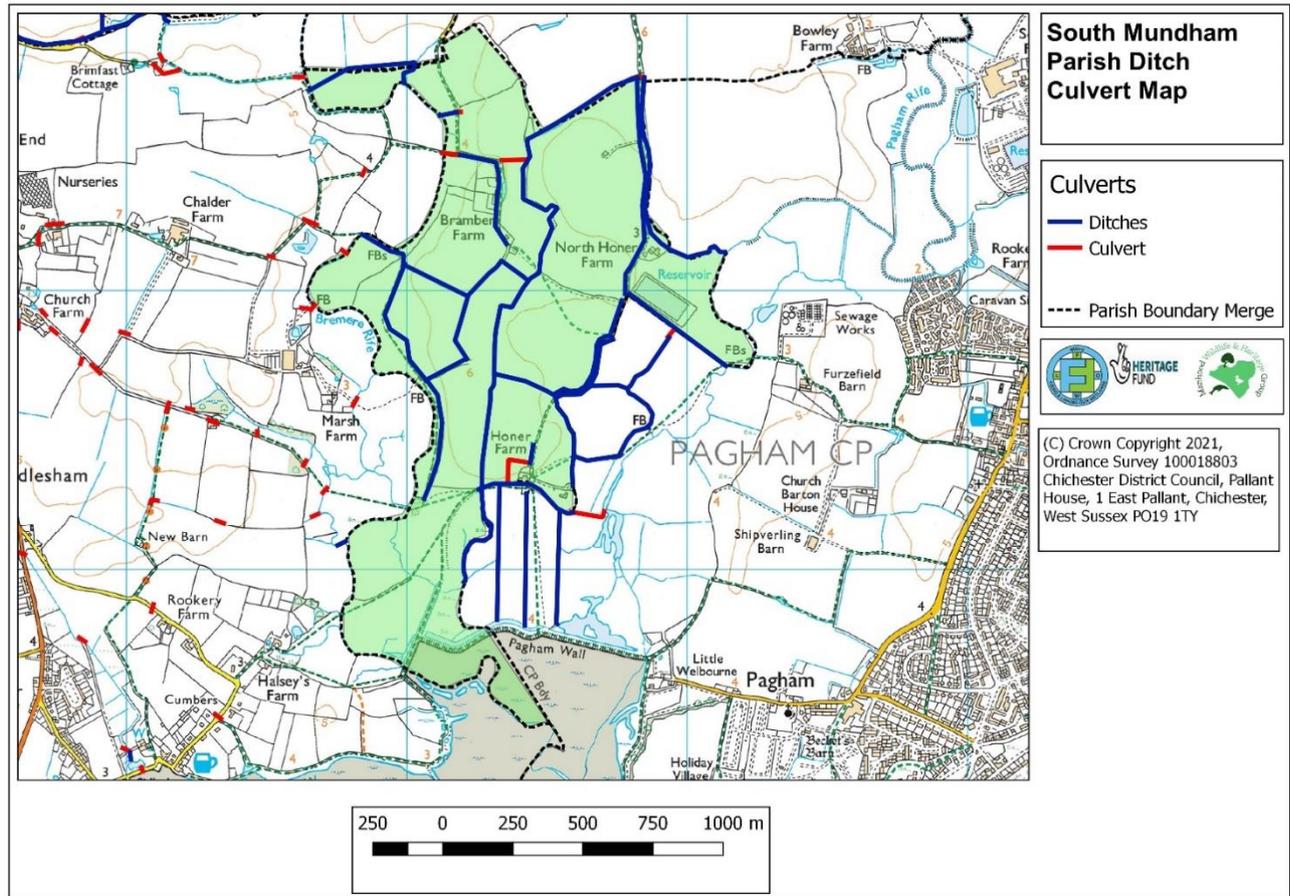


Figure 10b: Culverts in South Mundham ditches



The management regimes that the ditches experience is reflected in their appearance and their biodiversity. There will also be factors relating to their wider environment such as water quality,

The general pattern is that where ditch bankside vegetation is cut on both sides every year, then these have less plant species present.

One of these is water availability as it is common for the ditches on the MP to dry up during the summer, as there are often long periods without significant rain. Some of larger ditches and rifes, and some ponds, will hold water for longer and these are particularly important for wildlife such as water voles, amphibians, dragonflies, aquatic invertebrates, and birds. Mundham parish has a relatively large number of ditches that stay wet all year round (38 %) and this is influenced by the rifes running through the parish.

Figure 11a: Water availability in ditches surveyed in North Mundham

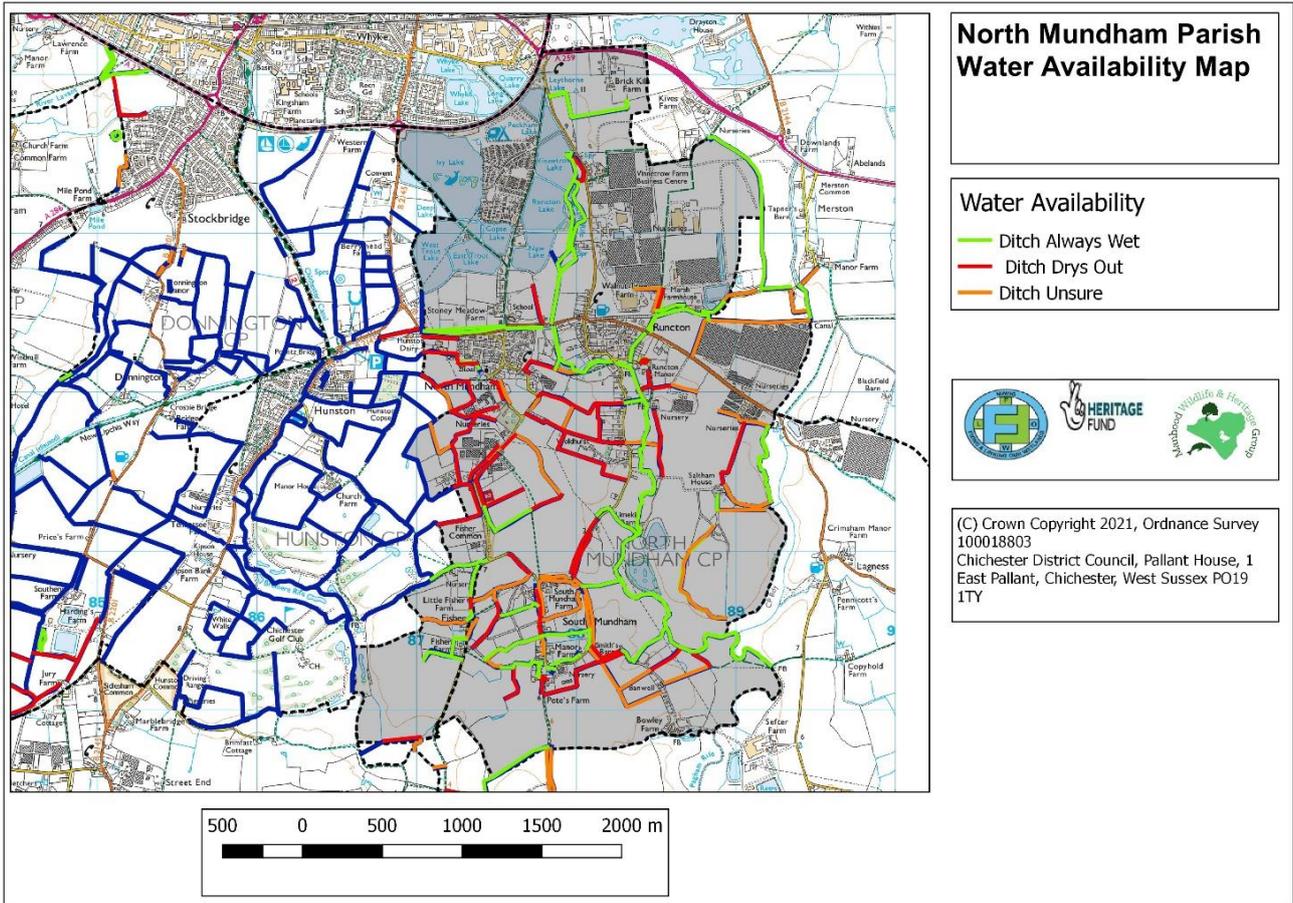
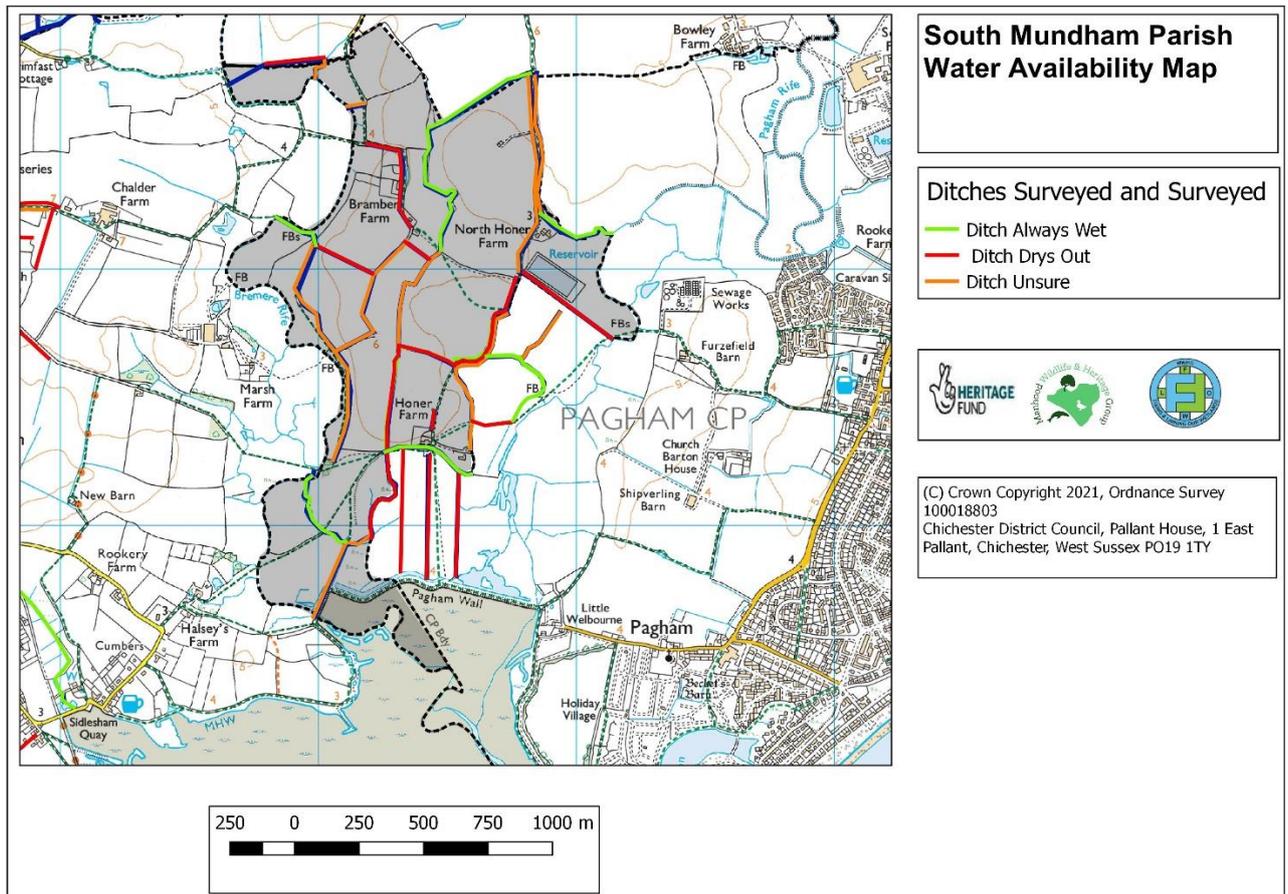


Figure 11b: Water availability in ditches surveyed in South Mundham



### **iii Management for water voles**

One of the key species in the area is the water vole (*Arvicola amphibius*), the fastest declining mammal in England, (Strachan et al. 2011), and it lives in the linked-up waterways of the MP and is considered a regionally important population. Water voles have specific habitat requirements that include the all year-round availability of water and good vegetation coverage on soft earthy banks with a wide range of plant species. These needs do not sound onerous, but water voles do not hibernate, spending much of the winter in their burrows with cached food, but they prefer undisturbed vegetation on the banks all year round for cover and quite steady levels of water. On the MP, it has been noted that water voles do use ditches that dry out as part of their habitat and seem to use the linked network of ditches to move to wetter areas and ponds as condition change.

Looking at Figures 11a and b, water voles are most likely be found in areas where there is most water year-round and therefore a wide range of plant species. It can quickly be seen that this reduces the number of suitable water vole ditches in the parish.

A management regime that cuts just one side of the bank every year, puts the debris away from the channel, and even leaves some areas untouched on a 4-year rotational basis will benefit water voles the most. Placing small bunds in the ditch, at a low level, to hold water back in the spring will keep the ditches wetter for longer and encourage water voles to stay.

The EA document '*delivering consistent standards for sustainable asset management*' Version 3 March 2012 lays out various cutting regimes available, with timings and frequencies, the range of bankside cuts, in-channel vegetation removal, silt removal etc, with wildlife and other factors in mind. Management can take place of ditches, but it needs to be sympathetic. Where water voles have been identified as being present then advice should be sought from the EA about the habitat management as under the Wildlife and Countryside Act 1981, updates 2006, it is an offense to interfere with water vole habitat and a license from NE would be required for work.

Water voles leave very clear indications of their presence and can be easily and quickly surveyed for. The SxBRC will have historic records of their locations, but it is presumed by WSCC that they are present in all ditches on the MP and therefore this must be checked before work goes ahead.

### **iv Limitations of the study**

The ditch condition assessment form was created using an Assessment Form that had originally been developed to assess water vole habitat, was then adapted for use during the Birdham and West Itchenor ditch studies and was further evolved to take in more environmental and physical characteristics. The form has a scoring system so that ditches could be rated as 'Good', 'Moderate, and 'Poor' and a traffic light - Green, Amber and Red system used so that on maps it could be instantly seen which ditches would form the focus of management recommendations.

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Although this form was used, and a score given to all the ditches, it soon became evident that most of the ditches were amber, meaning in 'moderate' condition. We realized that the scoring system had severe limitations as the ditches have so many characteristics that it is impossible to accurately represent this with a number. It might be best to break this down into a physical attribute score, a biological score, an environmental score (for the surrounding habitat), and a management score. A well but sympathetically managed ditch can be good for water flow and storage and for wildlife but capturing that as a single number is not realistic. Therefore, maps have been created that look at the specific attributes.

The water quality was not analysed during this project, but it would be useful in future to get a picture of specific issues in particular locations. We have been able to infer some runoff and pollution incidents from the vegetation and the state of the water itself but there would be value in gaining information on the specifics and subtleties across the area. This information can then be used to find the sources of the problems and address them.

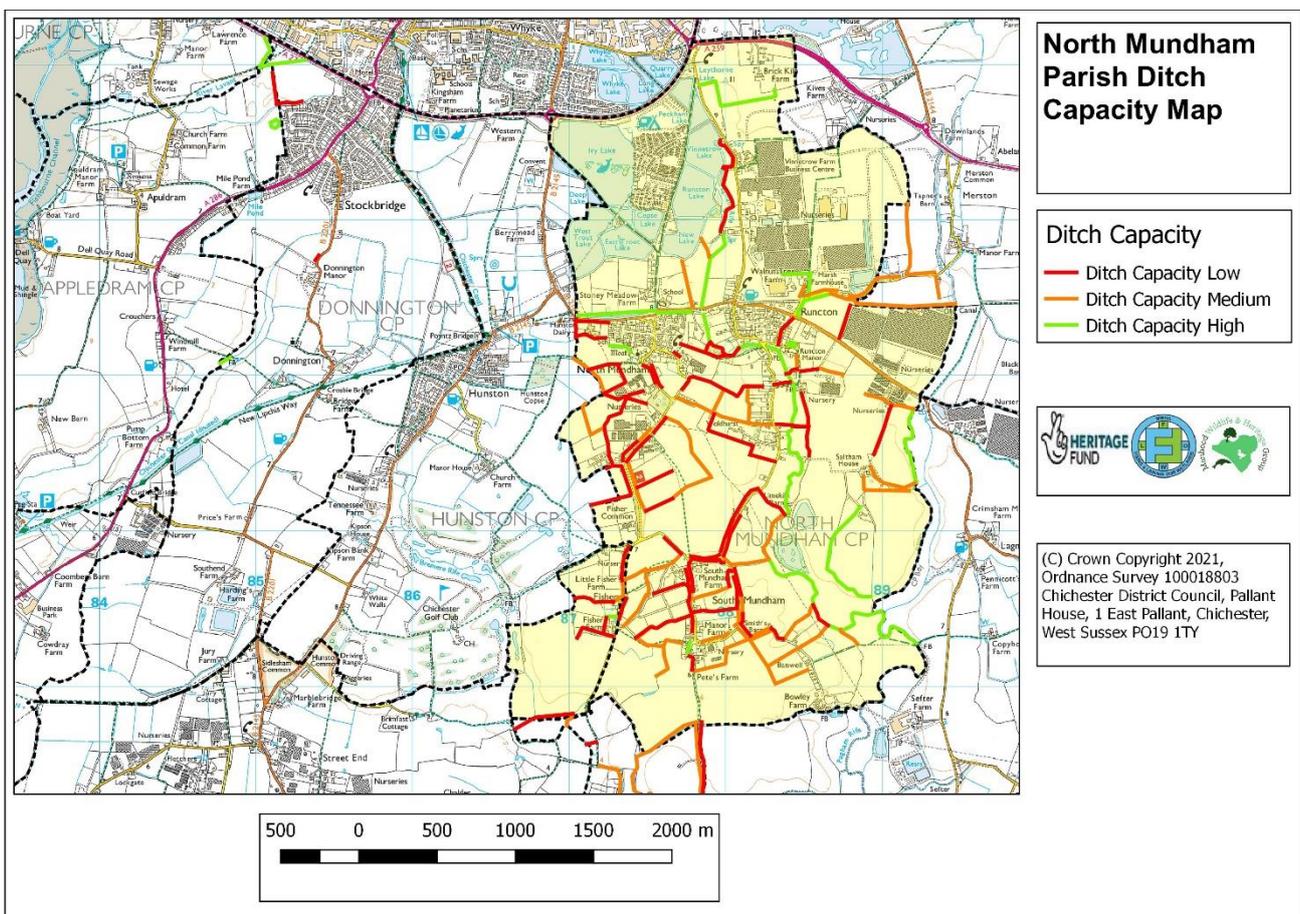
## 8. Opportunities for improvement works

Through the detailed fieldwork and data gathering that we have carried out, combined with the desk-based study of the information provided by WSCC, CDC, EA and other organisations, we have looked for opportunities to improve the water carrying capacity of the ditches and ponds, and to also find benefits for wildlife.

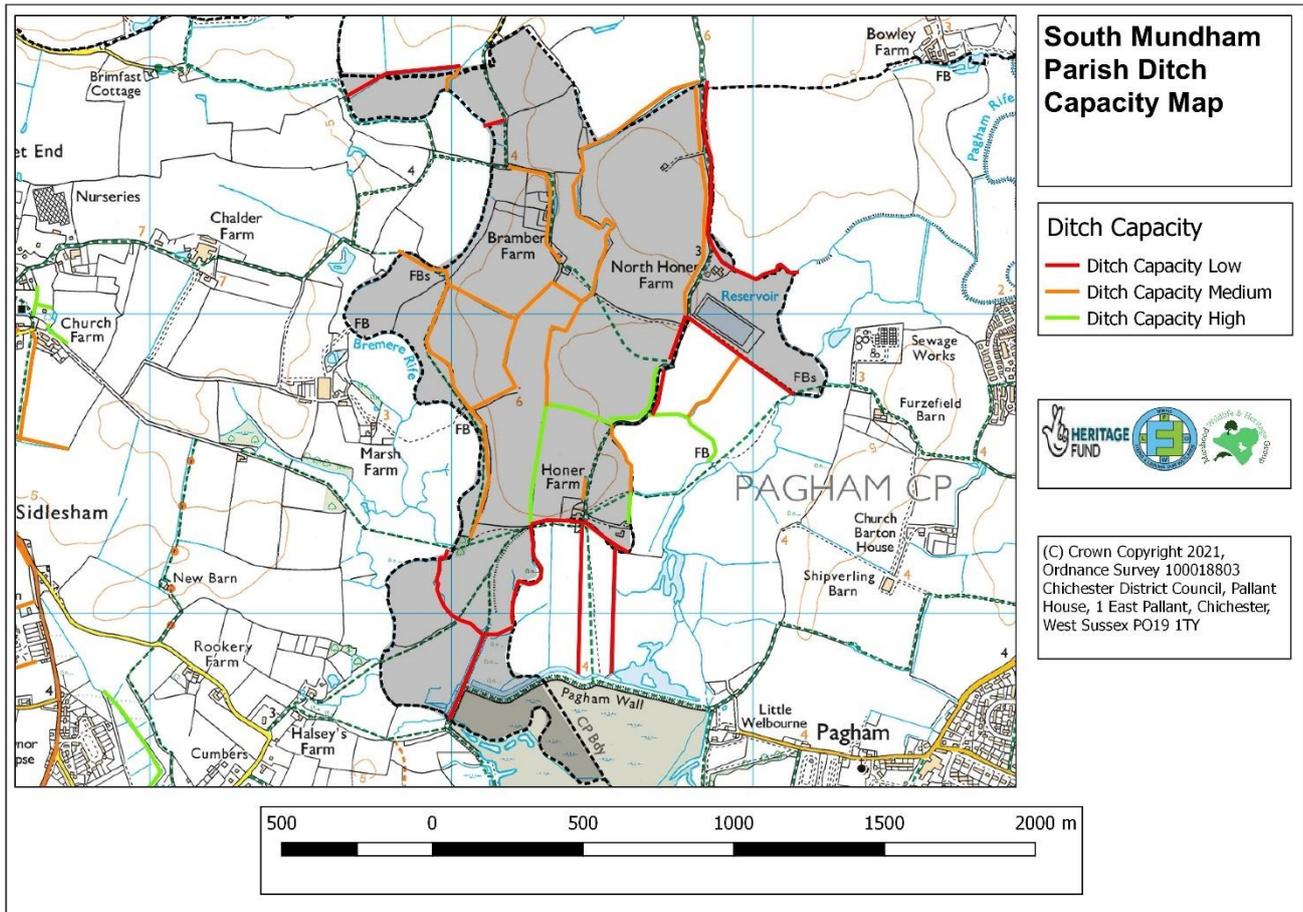
The findings have been divided into areas of opportunities and areas with issues that need action or some form of resolution.

In order to look at opportunities for improvement the approximate capacity of the ditches and waterways was calculated from the ditch widths, depth and lengths that we had gathered and the mapped, see Figure 15. This illustrates which ditches have the potential to hold more water and confirms the positions of the primary conveyancing routes.

**Figure 12a: Approximate measure of the capacity of ditches surveyed in North Mundham**



**Figure 12b: Approximate measure of the capacity of ditches surveyed in South Mundham**



Related to this was the sediment amount recorded in ditches and this information was gathered and mapped. The primary conveyancing routes and most of the ditches on farmland do not appear to have much silt, and it was approximately 36 ditches that had silt deeper than 250mm.

Figure 13a: Sediment depth in ditches surveyed in North Mundham

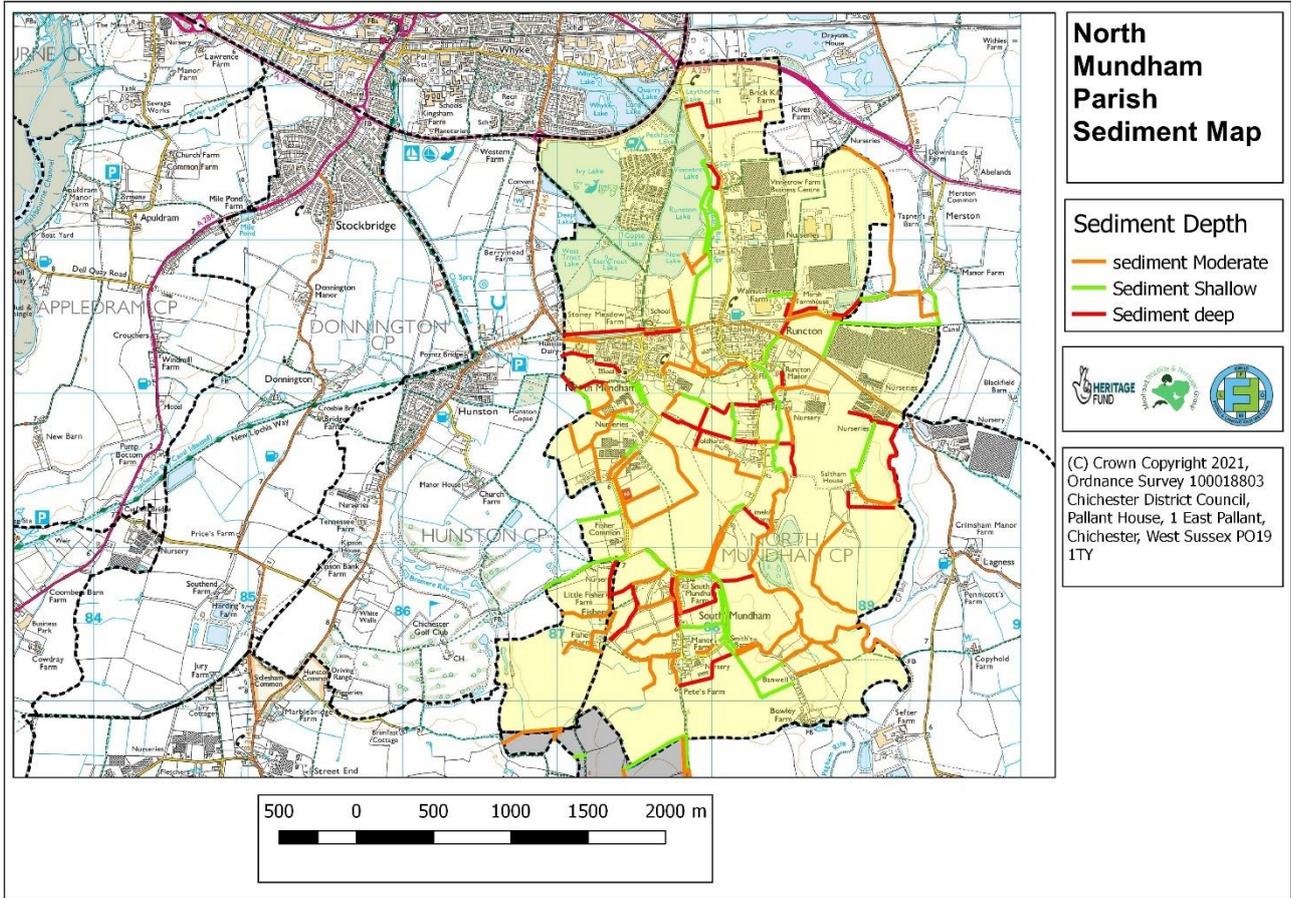
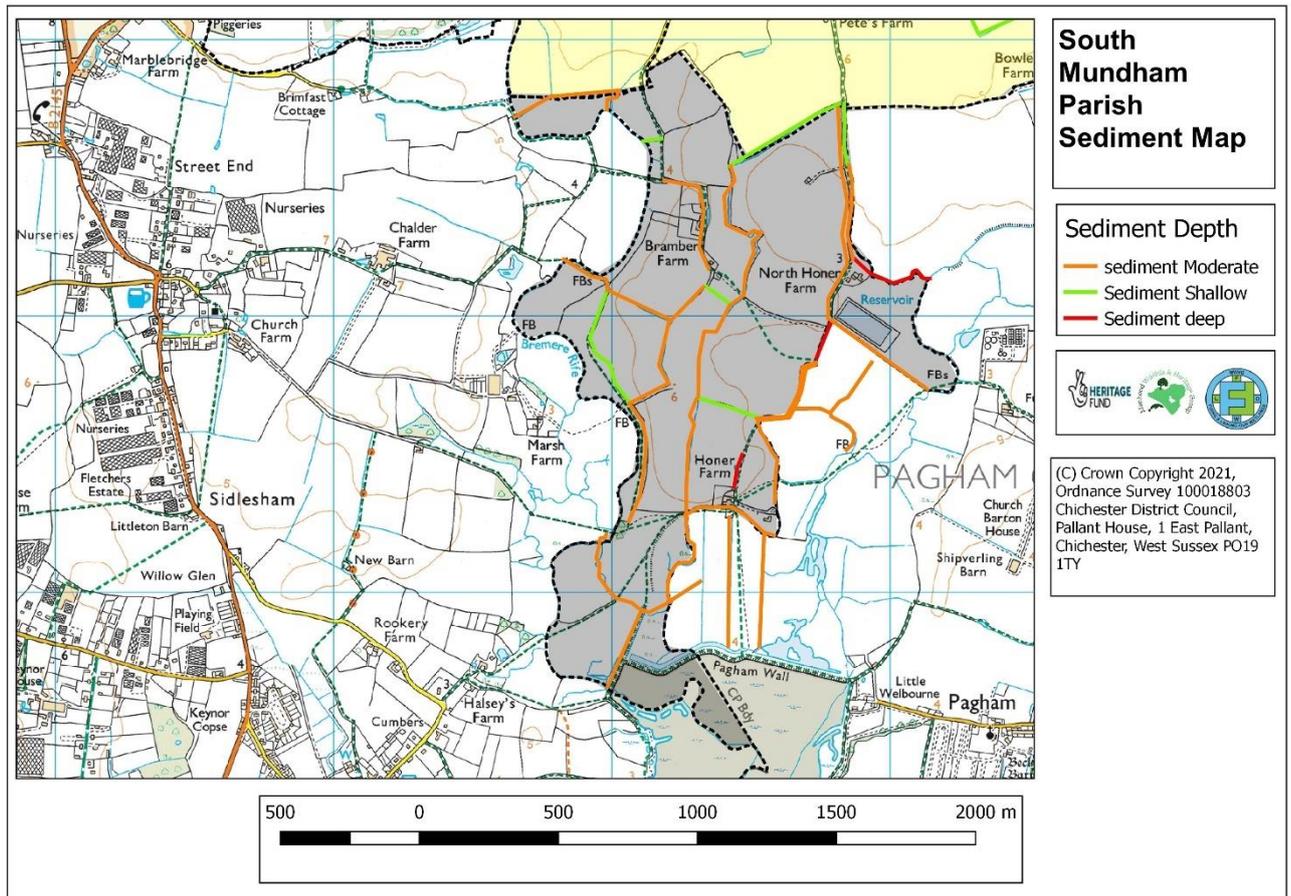


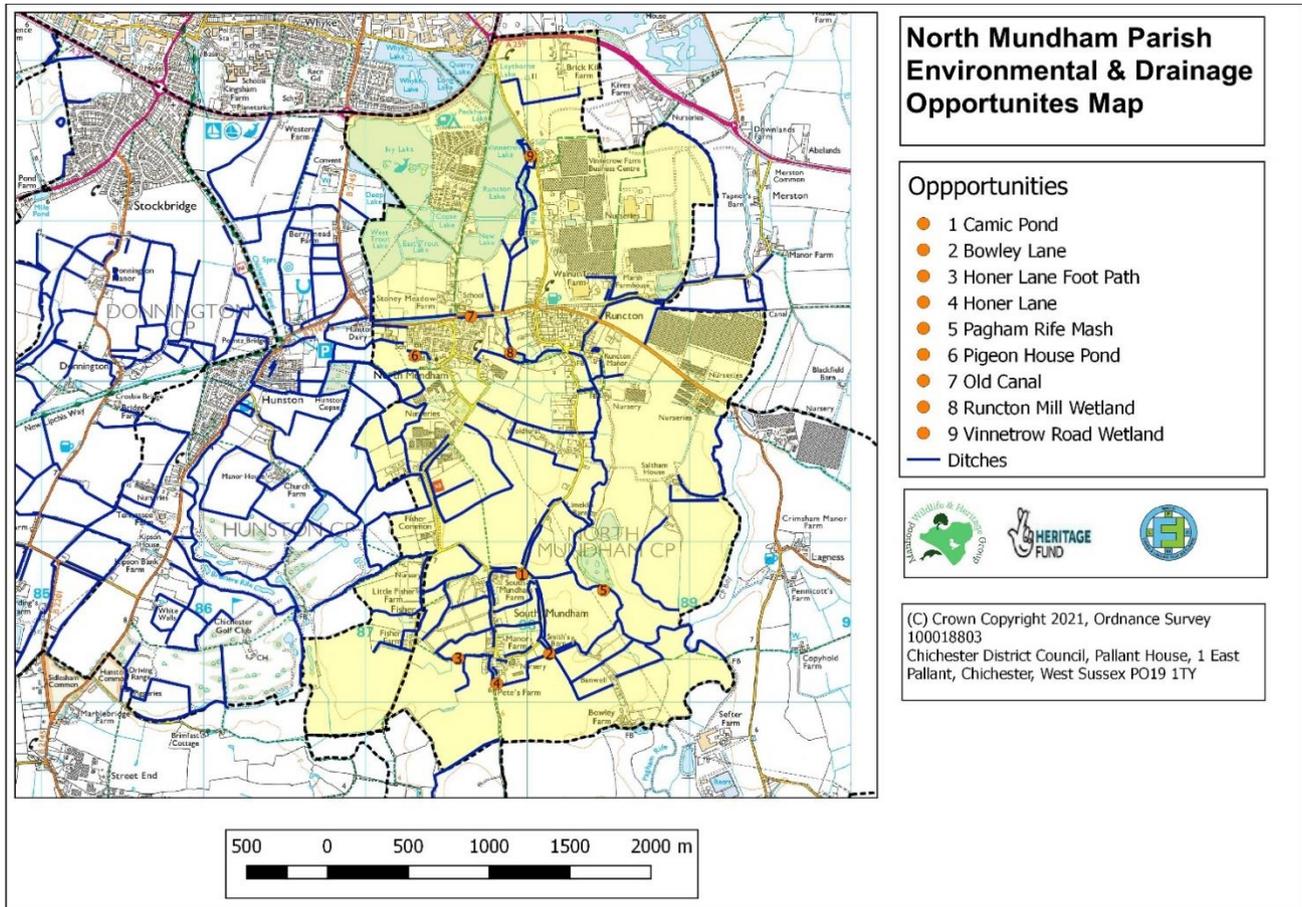
Figure 13b: Sediment depth in ditches surveyed in South Mundham



## i The opportunities

The opportunities found reflect drainage and environmental benefits as any improvements made are positive for both aspects.

Figure 14: Environmental and Drainage Opportunities in Mundham Parish



The table below lists the sites identified as potential improvement sites with a description of the site and the proposed actions and resultant benefits.

id	Location	Proposed Improvement
1.	<b>Camic pond</b> SU 87972 00806	This relic farm pond dries out as it is full of silt and has not been managed in many years. It is a key part of the drainage system of South Mundham and increasing its capacity will benefit water management in the area during high rainfall events. Recent work has improved the tanking capacity, opened up the surface to the light and volunteers have planted trees.
2.	<b>Bowley Lane</b> SU 88162 00304	There is a deep pond on this 's' bend of Bowley Lane which has not been managed and is full of silt. Overhead power lines run across the pond so improvement work will have to bear these in mind. Willow trees grow over the pond shading it out and reducing biodiversity. Due to the local flooding issues in the area, increasing the tanking capacity of this pond would be of benefit.

id	Location	Proposed Improvement
3.	<b>Honer Lane footpath</b> SU 87602 00276	This corner of Honer Lane has serious flooding issues and the ditch running parallel to the Honer lane is blocked. Honer Lane has a relic pond which dries out and digging it out will alleviate some of the flooding problems further down.
4.	<b>Honer Lane</b> SU 87813 00091	This lane is very prone to flooding due to discontinuous ditches and low-lying land. Three ditches join one ditch and there is a wildlife buffer strip containing hedges and wildflowers. Digging a tanking pond at this site will hold water, improve biodiversity, and support the existing habitat for bats.
5.	<b>Pagham Rife Marsh</b> SU 88486 00715	Situated on the Pagham Rife close to Camic Pond, this low-lying wet meadow contains water during the winter and supports bird species like Lapwing. Digging deep areas, creating spoil mounds and permanently wet meadows will improve biodiversity for more species. Moreover, planting new hedgerows and mini woodlands will reduce flooding in the local area.
6.	<b>Pigeon House Moat</b> SU 87320 02187	This old pieces of relic moat dries out and is full of silt and rubbish. It still currently supports bats, moths, butterflies, and frogs but digging this area out and managing the surrounding trees to get light in on the water surface will improve species diversity.
7.	<b>Relic stretch of the Arundel to Portsmouth canal</b> SU 87641 02409	Undermanaged for many years this stretch of the relic canal has a large accumulation of silt and rubbish. Opening up the waterway, digging it out and putting in a dead hedge will improve the habitat opportunities for many species.
8.	<b>Runcton Mill wetland</b> SU 88156 02217	This site has a large wet woodland bordering Pagham rife. A dried-out ditch runs through the middle but digging this out will improve a corridor for water voles and other species. It will also hold more water during high rainfall events.
9.	<b>Vinnetrow Road wetland</b> SU 88036 03385	This is an overgrown Willow copse, adjacent to SWT trust owned Leythorne meadow, with the only chalk stream on the MP. This site has a deep silt layer and it would be beneficial to dig out some pond areas. Reinstating this wetland's natural features - ponds, scrub, wet meadow, and high banks will greatly improve the biodiversity opportunities.

**Appendix iii** contains photos and sections of the 1847 tithe map of the potential improvement sites

When considering improvement work on a large scale, there are issues that must be taken into consideration and these have been identified in the MPSWMP:

- Landscape issues
- Historic environment
- Water
- Geology, soil and geomorphology
- Biodiversity, flora and fauna

## ii High level physical works

This will be used on sites where ditch and pond banks require reprofiling, junction ponds are created, and silt is removed. Contractors maybe needed for this work, but the preference would be for the landowners to carry this out as they know their land intimately and can fit the work in with cropping regimes or other work on the land.

A significant issue when carrying out ditch or pond work and spoil or silt is removed, is what to do with it. Taking it to landfill can be a significant cost to a project so where possible, spreading it on adjacent land or using it to create higher banks would be preferable. It may be that a D1 exemption certificate maybe needed from the EA to do this (to prevent the spreading of contaminated spoil on land for food production): [www.gov.uk/guidance/waste-exemptions-disposing-of-waste](http://www.gov.uk/guidance/waste-exemptions-disposing-of-waste)

See Appendix iii for a costed plan of the suggested work.

### **iii Low level physical and maintenance work**

As part of the landowner reports and follow up dialogue opportunities are identified for wetland, hedge and habitat improvement and this could take the form of physical works that involve landowner machinery or contractors. Lower-level work could be carried out by volunteers.

Volunteers can carry out a range of tasks:

- Hedgerow improvement – planting new hedges, filling in gaps in hedges, and laying hedges
- Sympathetic ditch and pond maintenance removing vegetation – bramble and bankside vegetation
- Biological survey work– water voles, amphibians, botanical, invertebrate, bat and bird.

## 9. Other environmental Issues found

During the course of our work we have come across a range of land management issues (discussed above) and these have been discussed with the individual landowners via reports and face to face meetings. However, it is worth noting them here as they can have an overall cumulative effect on the environment of the parish.

### i Water Quality

The EU Water Framework Directive was adopted by the UK in Dec 2000 and it covers water quality in river catchments, in groundwater and aquifers, the abstraction of water, and runoff from all sources and pollution types.

While we did not analyse the water quality in Sidlesham we were aware of the symptoms of runoff, particularly of nitrates and phosphates, and where possible we noted their source. Most arable farms use nitrates-based fertilisers intensely and there is no organic farming in the Parish. The ditches, where they have a good margin and a range of riparian vegetation on the banks, even small relic reedbeds can utilise this nitrate runoff and 'mop it up' before it gets passed on through the water course. If the nitrates stay in the water this can lead to eutrophication and significant algal growth which uses up all the oxygen in the water. This effectively kills all other species so that no invertebrates or other aquatic plants can survive and so the water way loses its biodiversity. Even ditches with vegetated margins can become covered in algae and blanket weed as field drains bypass this vegetated fringe and deliver water directly into the ditch.

Blanket weed, and algae were seen in many ditches and, as this was not a specific item to note on our original ditch condition assessment form, we did not map it.

#### Nitrate and Phosphate analysis

Over the course of the FLOW project University students carry out individual pieces of research and a Masters' student, Claire Lipop, from the University of Oxford spent the 2017 summer assessing water vole habitat across the MP, (C. Lipop 2017). She looked at ponds and waterways, their vegetation structure, water levels and some water quality issues. During her analysis she checked the phosphate and nitrate levels of these areas and but there were no specific sites in Mundham and Runcton parish.

**Nitrate levels:** at sites across other neighbouring parishes, nitrate levels were significant, and the factor seemed to be the size of the waterway/pond and the larger the channel/wetland, the higher the nitrate levels. This may be due to the fact that the larger waterways receive water from other sites and, so they gain runoff from many farmers' fields, and it has had a cumulative effect.

**Phosphate levels:** many sites in other parishes had significant levels of phosphates and this will be related to adjacent farmland activity although no specific sites in Mundham and Runcton were tested.

## ii Litter

We came across litter in many of the ditches that we surveyed and this partly because it is such an open and flat parish that litter blows across fields and gets caught in the hedges and then falls into the adjacent ditches. Some of the ditches were worse than others, but this litter is a threat to wildlife, water quality and may end up in the sea where it also becomes a hazard.

Figure 15a: Ditches containing litter in North Mundham

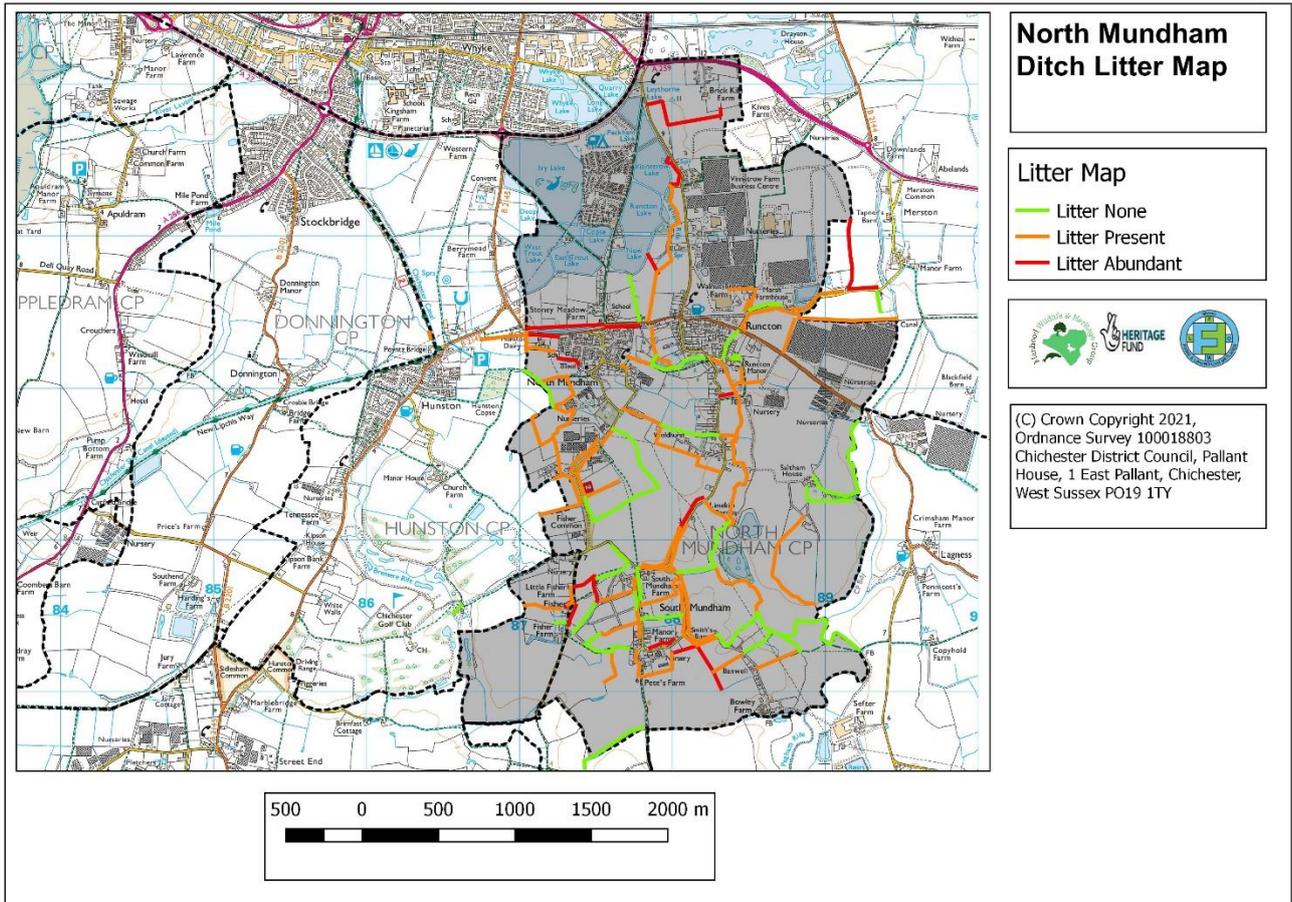
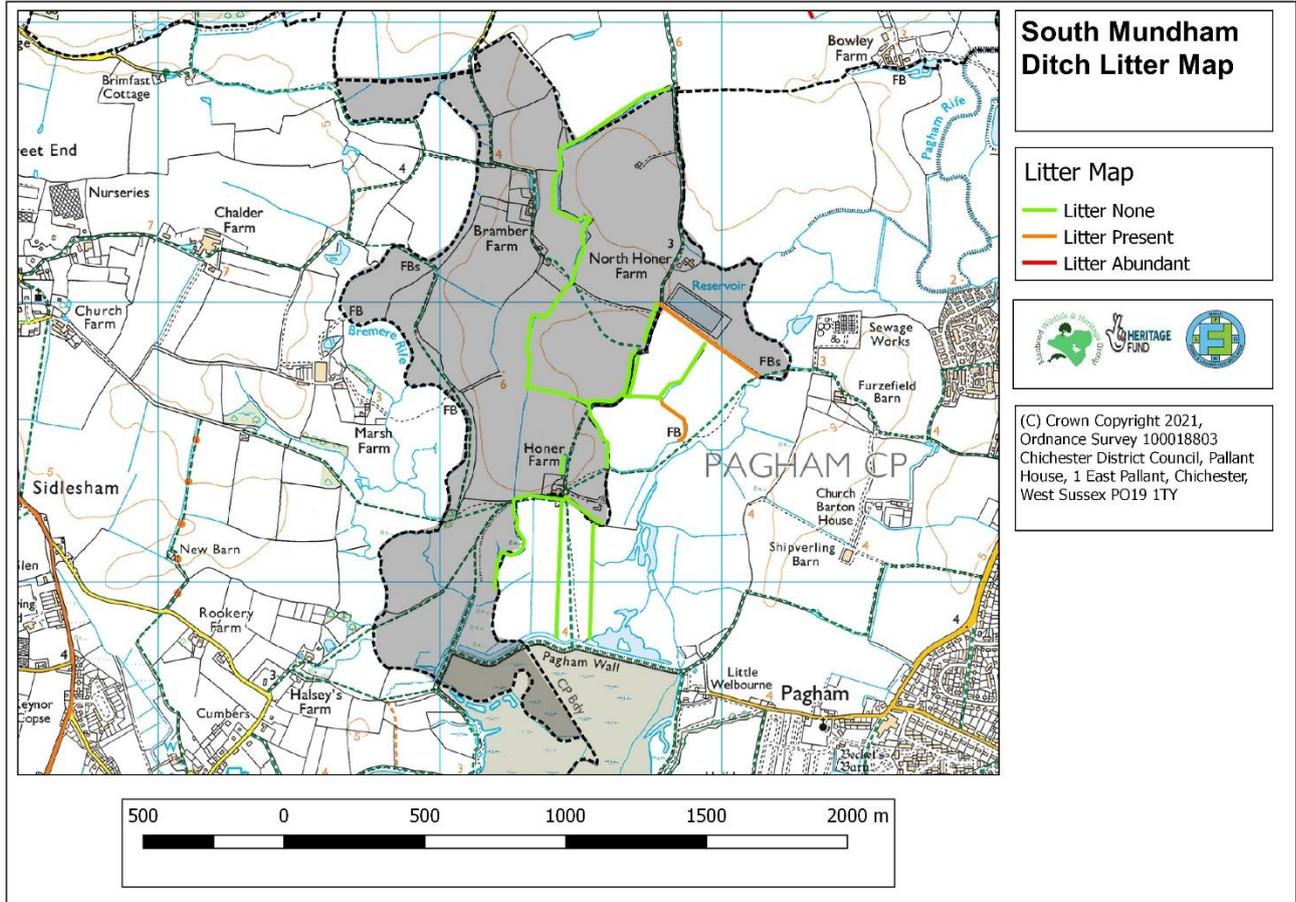


Figure 15b: Ditches containing litter in South Mundham



### iii CDC Green network maps

The CDC Green network maps were created to look at three habitat types; wetland, hedgerow and rough grassland for barn owls. These were desk-based studies and had not been reviewed or previously checked.

As the FLOW team walked around the parish and examined most fields, they were able to ground truth these maps and to check their accuracy at the time of surveying.

Figure 18a: CDC Green network survey results for North Mundham

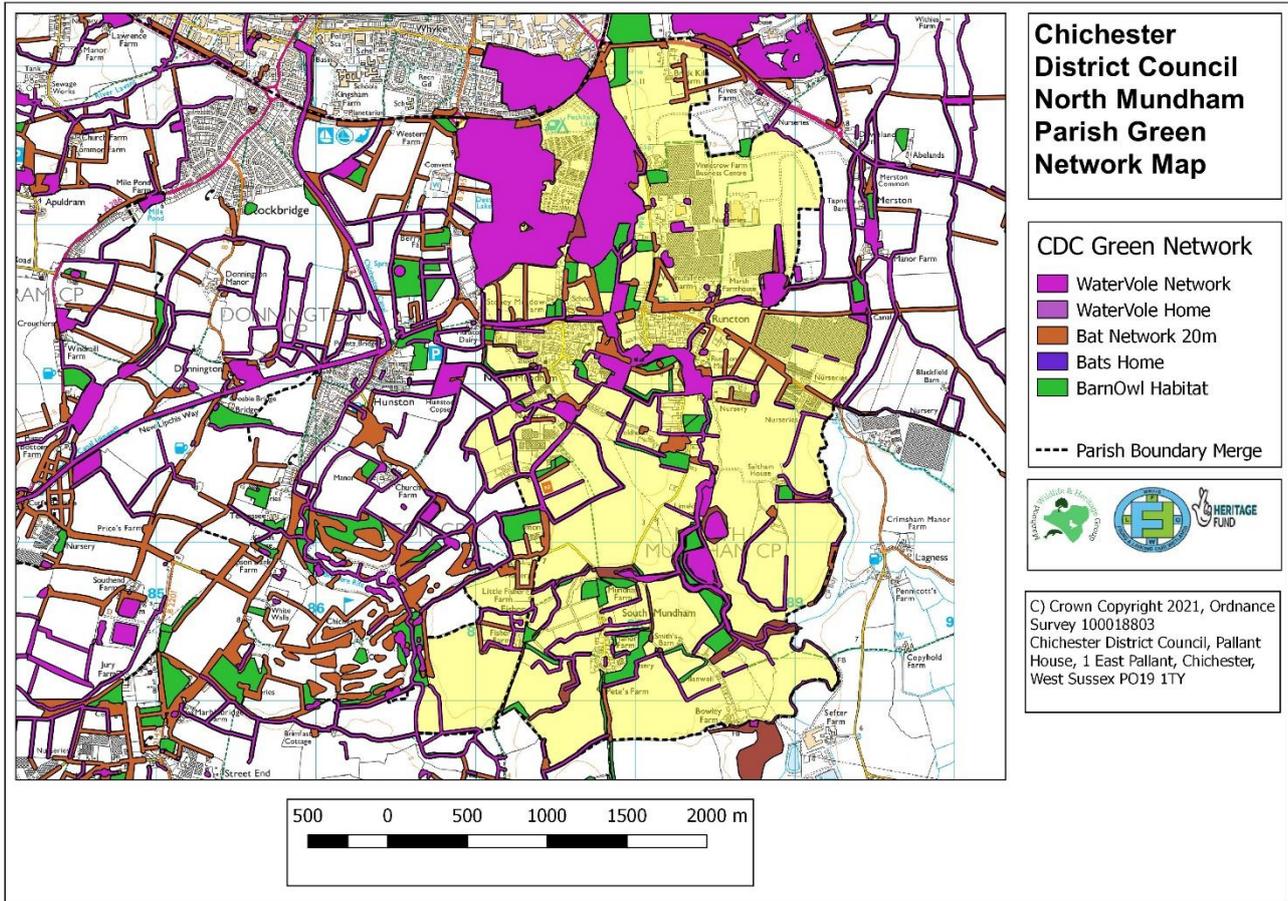
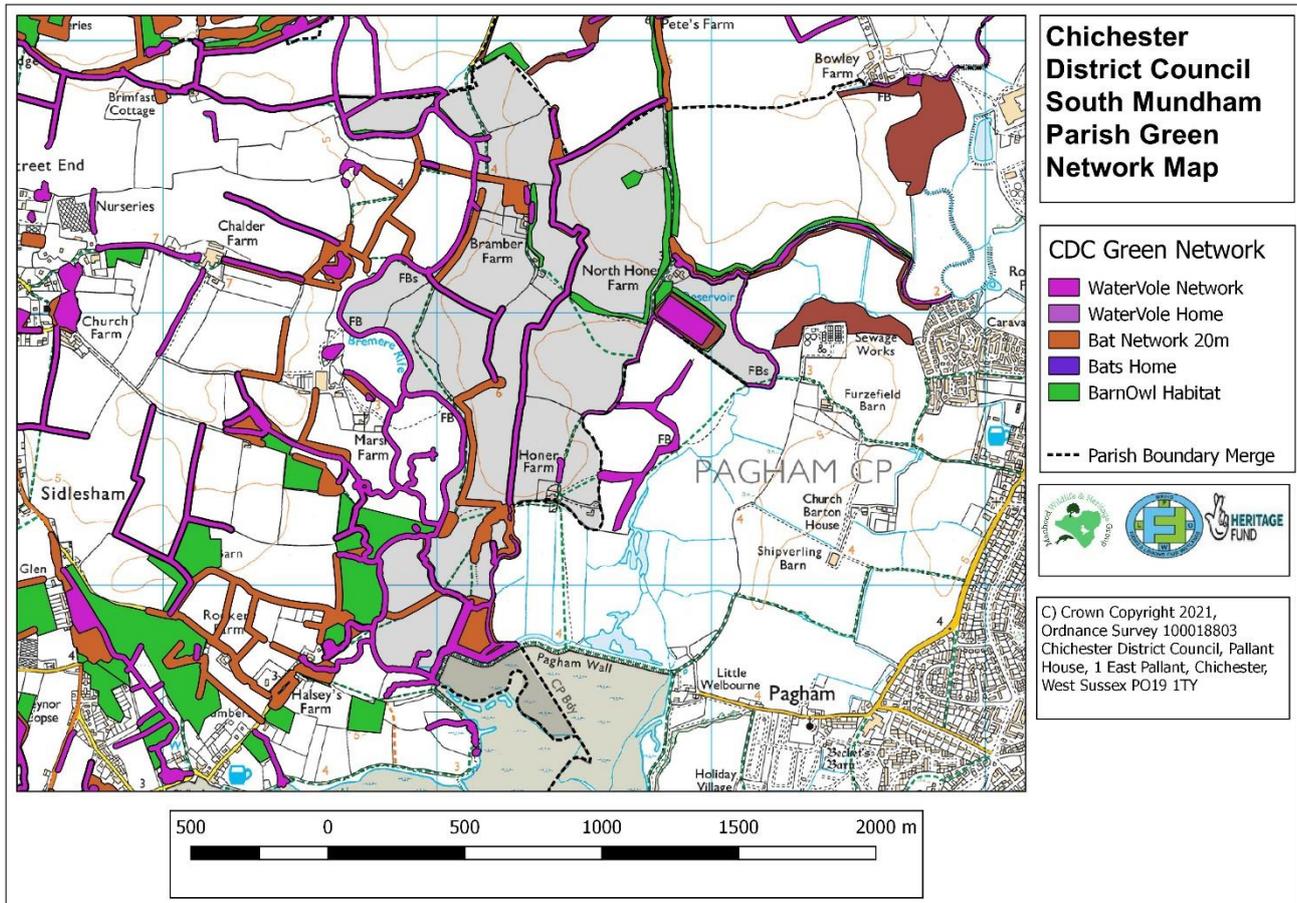


Figure 18b: CDC Green network survey results for South Mundham



The suitable waterways for water voles were noted and the meadows and margins for barn owls. The hedgerow network, good habitat for bat use, was noticeably thin in South Mundham compared to other parishes on the peninsula.

Mundham parish has main rifes that contain water for much of the year and they are host to water vole populations at many locations. These rifes link the wider area to Pagham Harbour, a stronghold for this species and allow the water voles to disperse out across the area, boosting the genetic diversity of other water vole colonies.

## 10. Work Timescales

Work must be planned to fit in with the boundaries set by the wildlife and Countryside Act 1981, amended 2006, so that the birds breeding, and nesting season is avoided and also the water vole breeding season. This begins at the end of February and runs to the end of July, and during that time no removal of tree or hedgerow vegetation can take place, or ditches that may contain water voles (unless they are checked, and voles absent or removed with a NE license).

Work may be best carried out between the end of July and the end of October, before the ground is too wet for heavy vehicles, and when the ditches are dry and do not have water voles in them – subject to checking. Where ditches have no records of water vole activity (can be checked via the Sussex Biodiversity records Centre <http://sxbrc.org.uk/>). Advice should be sought from the EA's Biodiversity Department (lead agency for water vole conservation) before carrying out any work on or around water vole habitat and Natural England ([www.gov.uk/guidance/water-voles-protection-surveys-and-licences](http://www.gov.uk/guidance/water-voles-protection-surveys-and-licences)). Water voles can breed as late as October, dependant on the weather and therefore surveys must take place before any work is proposed. It may be that mitigation will be necessary.

The presence of ground nesting and wading birds would need to be considered during the winter months, but the work recommended in this report does not affect their habitat directly but may take place adjacent to farmland and indirectly disturb them.

## 11. Management priorities

Appendix ii is a plan of the proposed work with a detailed description of the actions required and an estimate of the funds required.

### Ditch Management

Many long-term drainage and habitat issues can be solved with sympathetic monitoring and maintenance actions. Capital works can be paid for with grants or carried out by local councils but unless the work is followed up with regular management this money will have to be spent again 5 years or so down the line for the work to be repeated.

Ditches need to be managed carefully for drainage purposes and so that they function as good wetland for wildlife. This does not have to be mutually exclusive and by sympathetically cutting vegetation on the banks of ditches, not totally removing it, this provides better erosion resistance, which in the long term can affect the carrying capacity of ditches.

Where hedges are associated with a ditch it is common for the field side only to be managed and this allows the ditch to recover quickly and continue to offer wildlife habitat. Hedges next to ditches should still be gently cut back to prevent shading of the water but all debris should be removed, or it will block up the ditch, prevent water flow and potentially cause problems.

Refer to EA document '*delivering consistent standards for sustainable asset management*' Version 3 March 2012 for different cutting regimes that takes wildlife and water heights and conditions into consideration.

The debris from vegetation cuts around ditches, and hedge management, should be removed from site and not left in the ditch. This will only cause problems. Any silt removed from the ditch channel, where possible, should be left on the bank for 48 hours, to allow invertebrates to re-colonise the water, but should then be removed. Putting nitrogen rich sediment on the edge of the bank will cause some of the loose material to fall back into the water if it rains, negating the work done, and it will produce a flush of nettles and reduce biodiversity along this edge. Where possible, time the work with ploughing of the field, and with an EA D1 exemption certificate, this nitrogen rich material can be spread across the field.

Ensure that no manure or silage is stored on ditch margins but kept away from waterways so that the nutrient rich runoff cannot pollute the water.

The wider the margin between the ditch and / or hedge, and the farmed land, the more wildlife potential the network will have, especially if it is not mowed more than twice a year and the debris removed. This could provide pollen rich and wildflower areas for invertebrates and birds to use.

## 12. Sources of future help

### i Funding - grants

For the larger physical works to be carried out, landowners who have the equipment will be encouraged to do this work where possible. However, it may be that contractors or vehicles can be hired in to do the work but the issue of spoil removal will also need to be considered.

**West Sussex County Council Operation Watershed fund** - this has been supplied by central government for the use by local flood groups and organisations in the County for flood relief work and applications and information about the grants are available at <https://www.westsussex.gov.uk/leisure-recreation-and-community/supporting-local-communities/operation-watershed/>

**Countryside Stewardship**, managed by Natural England, can be considered in some cases with Mid-Tier and Capital Grants for wetland creation and improvement work:

Other grants that could be applied for.

**Chichester District Council Communities Fund** – looking at parishes south of Chichester and one of their priorities is to improve the wildlife value of the area – any wetland or hedgerow improvement could fall into this category. <http://www.chichester.gov.uk/article/24324/Funding-opportunities>

There may be **biodiversity grants** available from private companies Biffa, Viridor and Veolia, and plastic bag and other smaller grants that can be applied for from a range of supermarkets and retailers.

### ii Labour – volunteer led work

MWHG use local volunteers across the MP to manage wetland and other habitat sites. Their knowledge and experience can be utilised to get working parties going and to lead improvement work.

Vegetation clearance work will need to be carried out on a rotational basis. The initial work, on overgrown ditches will be time and labour intensive but in future years this should be easier as only one years' worth of growth is tackled. A regular programme of works in each Parish, focussing on those particularly important ditches is the key, and making it a fun team building community experience that involved everyone will encourage continual participation.

The MWHG can organise and provide training in a range of areas and this can include learning more about the local fauna and flora, and also the practical aspects of habitat management. The training offered can include:

Educational: Plant identification  
Water vole surveying  
Ditch condition assessment surveying  
Hedgerow surveying  
Reptile surveying

Bat surveying  
Bird surveying  
Mink monitoring

Management: Health & Safety  
First Aid  
Hedge laying  
Ditch management

A group of local volunteers carrying out management work in local ponds could be set up so that any improvement work is monitored and continued. Tools, training and resources could be provided by the MWHG.

The Trust for Conservation Volunteer (TCV) have a local group in Chichester who carry out physical improvement and conservation tasks <http://www.chichesterconservationvolunteers.org.uk/>

All these volunteer resources should be realised and encouraged to carry out important clearance work to expose ditches in winter months and remove smaller low tree branches shading out ditches. Making these working parties a regular event and having a social aspect to them will make them more sustainable. Not everyone is required to carry out physical work and volunteers can add value by providing refreshments, helping to do surveys, draw maps etc.

### 13. References

- 'Making Space for Nature: A review of England's wildlife sites' (Sir John Lawton, 2010)
- 'The Manhood Peninsula Surface Water Management Plan' (CH2M HILL, 2015)  
[https://www.westsussex.gov.uk/media/5607/manhood\\_peninsula\\_swmp\\_final\\_report.pdf](https://www.westsussex.gov.uk/media/5607/manhood_peninsula_swmp_final_report.pdf)
- Chichester Harbour AONB Management Plan 2014 -2019 (Chichester Harbour Conservancy 2014)
- 'Options for the future of South West Internal Drainage District – business case' (TAW for West Sussex IDD Steering Group Dec 2013)
- 'Delivering benefits through evidence – quantifying the benefits of flood risk management actions and advice' (EA Report –SC090039/R Stage 3, March 2015)
- 'The Water Vole Conservation Handbook – 3rd edition', Rob Strachan, Tom Moorhouse, and Merryl Gelling, (WILDCRU, 2011)
- 'The Water Vole Mitigation Handbook' (the Mammal Society Mitigation Guidance Series), Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016) Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.
- Personal Comment - Tom Monnington, Mapsons Farm, Sidlesham, January 2016
- QGIS Wein 2.8.4 (2015) <http://qgis.org/en/site/>
- 'Water Vole (*Arvicola amphibious*) distribution and abundance in water courses and ponds within the Manhood Peninsula, West Sussex and the effect of habitat quality'. Lipop, C. (2017) University of Oxford.
- Downs & Harbours Clean Water Partnership. <http://www.cleanwaterpartnership.co.uk/>
- '*delivering consistent standards for sustainable asset management*' Environment Agency, Version 3, March 2012
- Notes of visit to Stroud Rural SuDS project – April 16 - Alastair Driver, National Biodiversity Manager Environment Agency

## 14. Appendices

### i. Ditch Condition Assessment Form (MWHG)

Ditch Assessment – Score Sheet					
<b>Survey Information</b>					
Location		Survey Ref.		Grid reference	
Recorder		Date		Recent rainfall	
Water present	Y/N	Depth (m)		Flow direction	
<b>Attribute</b>					
<b>Scoring criteria</b>					<b>Score</b>
Water availability	Dries out = 0; unsure = 1; always wet = 2				/2
<b>Ditch profile</b>					
Ditch width	<0.5m = 0; 0.6m-1m = 1; 1.1m-2m = 2; 2.1m-4m = 3; >4m = 4				/4
Ditch depth	<0.5m = 0; 0.6m-1m = 1; 1.1m-2m = 2; >2m = 3				/3
Banks slope	neither bank slope between 30° and 60° = 0; one side only = 1; both sides = 2				/2
Bank structure	Concrete = 0; gravel/sand/earth etc. = 1				/1
<b>Total</b>					<b>/10</b>
<b>Environment</b>					
B1* buffer width	0m = 0; 0.1m – 1m = 1; 1.1m – 2m = 2; 2.1m – 4m = 3; > 4m = 4				/4
B2 buffer width					/4
B1 buffer quality	Bare/managed lawn/nettle dock or thistle dominated = 0				/1
B2 buffer quality	Diverse plant and shrub communities/scrub = 1 (if no buffer enter NA)				/1
Bank erosion	Medium/high = 0; none/low = 1				/1
Litter	Abundant = 0; present (1-2 items) = 1; absent = 2				/2
<b>Total</b>					<b>/13</b>
<b>Water quality</b>					
Turbidity	High (water appears opaque) = 0; moderate = 1; low (almost clear water) = 2				/2
Algal bloom	Present throughout ditch = 0; present in part of ditch = 1; absent = 2				/2
Pollution <i>e.g. oil</i>	Present = 0; absent = 1 (comment on nature and possible source overleaf)				/1
<b>Total</b>					<b>/5</b>
<b>Bankside vegetation</b>					
B1 trees	/2	B2 trees	/2	Absent = 0 Present (1-50%) = 1 Abundant/dominant (>50%) = 2	
B1 bushes	/2	B2 bushes	/2		
B1 riparian forbs	/2	B2 riparian forbs	/2		
B1 sedges	/2	B2 sedges	/2		
B1 rushes	/2	B2 rushes	/2		
B1 reeds	/2	B2 reeds	/2		
B1 long grass	/2	B2 long grass	/2		
<b>Total</b>		/14	<b>Total</b>		
<b>Total</b>					<b>/28</b>
<b>In-channel vegetation</b>					
Open water	<40% = 0; 41%-60% = 1; >60% = 2 (if dry enter NA)				/2
Aquatic plants	>60% = 0; 41%-60% = 1; 1-40% = 2 (if none enter NA)				/2
Non-aquatic	>60% = 0; 41%-60% = 1; 1-40% = 2 (if none enter NA)				/2
<b>Total</b>					<b>/6</b>
<b>Management</b>					
Rotation	Both sides managed together = 0; different timings/types = 1				/1
Shading	Watercourse >80% shaded by vegetation = 0; 40%-80% = 1; <40% = 2				/2
Sediment depth	>25cm = 0; 5-25cm = 1; <5cm = 2				/2
Invasive species	Any non-native invasive sp. = 0 (record info in sketch); none present = 1				/1
<b>Total</b>					<b>/6</b>
<b>Overall score:</b>					<b>/70</b>

\*B1 = north or east bank of ditch, B2 = south or west bank of ditch

**Ditch Assessment – Additional Information**

Additional ditch information				
Drainage issues	Previous flood events in vicinity			Yes / No
Connectivity	Number of adjoining ditches (if culverted more than 10m = no connection) Include ditches at either end of surveyed section			
Adjacent land use	B1	Arable Pasture Residential Garden Road Commercial Other .....	B2	Arable Pasture Residential Garden Road Commercial Other .....
Hedgerow present	B1	Yes / In-part / No	B2	Yes / In-part / No
Hedgerow survey	B1	Yes / No	B2	Yes / No

Pipes/culverts in ditch section		
Please record the location and condition of any pipes the ditch flows through, including at the start and end of the surveyed section.		
Ref. number (please label on map)	Condition description e.g. clear / blocked / collapsed / unknown	Approximate size
1		
2		
3		
4		
5		

Additional comments	
<p><i>e.g. any recent disturbances, blockages, information received from local people, concerns about invasive species, nature of any pollution, etc.</i></p> <p>Include a diagram if necessary</p>	

Annotate the survey map with the following information:

- Direction of flow where evident
- The location of any pipes/culverts with the reference number used on this form
- The location of any points of note e.g. sewage locations, blockages, invasive species, water vole signs etc.
- Mark any areas of flooding or very wet ground
- The location of any ash trees

Photo taken?