

# **APPENDICES**

## **Acronyms**

**AMP** – Asset Management Plan (AMP4 – 2010-2015, AMP5 – 2015-2020, AMP6 – 2020-2025)  
**cSAC** – candidate Special Area of Conservation  
**CCWater** – Consumer Council for Water  
**CSO** – Combined Storm Overflow  
**DEFRA** – Department for Food and Rural Affairs  
**DWF** – Dry Weather Flow  
**DWPP** – Diffuse Water Pollution Plans  
**EA** – Environment Agency  
**GQA** – General Quality Assessment (an assessment of the state of rivers and canals to identify changes in quality over time). This has now been replaced by the Water Framework Directive  
**LEP** – Local Enterprise Partnerships  
**NE** – Natural England  
**NEP** – Natural Environment Programme  
**OFWAT** – Office for Water ??  
**RoC** – Review of Consents  
**SAC** – Special Area of Conservation  
**SAP** – Site Action Plan  
**SSSI** – Site of Special Scientific Interest  
**STW** – Sewage Treatment Works  
**SvT** – Severn Trent Water Limited  
**WFD** – Water Framework Directive  
**MWQ(P)MP** – Mease Water Quality (Phosphate) Management Plan

## **APPENDIX 2**

### **Summary of the Results of the Condition Assessment – Condition Status of River Mease SAC**

#### **Natural England Condition Survey (January 2010)**

The river is split into 4 units for monitoring purposes and each unit is assessed against a range of criteria which are directly related to the features of interest (e.g. Population size and structure) or measure parameters such as community structure (presence of non native species, undesirable species etc.) physical characteristics that may affect the features of interest (barriers in the river preventing fish movement, straightening and over deepening the channel etc.) and in the case of rivers issues around water quality (phosphate, chemical and biological GQA scores etc.). Each unit only has to fail one of these to be considered to be unfavourable.

Once all the reasons for unfavourable condition are identified, then their cause is assessed to identify remedies for the condition failure. These remedies include the action required and the responsible body, once these have been identified then the organisation that is responsible is approached by NE firstly to agree the remedy is theirs and then to discuss ways of delivering the remedy. Once the delivery of all the remedies that are needed on a SSSI unit are underway then the unit will become Unfavourable improving (this was the old SSSI PSA target- a new SSSI target is being agreed with DEFRA at the moment)

Currently all the units within the SSSI are considered to be unfavourable, some of the reasons are not linked to the water quality but they are included in the attached reports for completeness. In essence all the units fail the phosphorus concentration, unit 2 fails its biological GQA target of a/b, all units fail on the density of fish and the population composition and all fail on lack of crayfish.

Table 20 Summary of the results of the Condition Assessment

RIVER SSSI ASSESSMENT FORM (for assessment of field results)								
Record F (favourable), R (recovering), U (unfavourable) or D (declining)								
Attribute	Unit no	1	2	3	4			
	500m site	B	A	B	B			
<b>1</b>	<b>Habitat functioning: water flow</b>							
1.1	characteristic flow maintained	-	-	-	-			
1.2	ecological flow criteria met (if applicable)	N/A	N/A	N/A	N/A			
1.3	no problem with water availability	F	F	F	F			
1.4	springs in aquifer-fed rivers maintained	N/A	N/A	N/A	N/A			
<b>2</b>	<b>Habitat functioning: water quality</b>							
2.1	compliance with biological GQA Class target	F	U	F	F			
2.2	compliance with chemical GQA Class target	F	F	F	F			
2.3	compliance with Unionised ammonia target	F	F	F	F			
2.4	compliance with suspended solids target	F	F	F	F			
2.5	compliance with Soluble Reactive Phosphorus target	U	U	U	U			
<b>3</b>	<b>Habitat structure: substrate</b>							
3.1	observed surface siltation	F	F	F	F			
<b>4</b>	<b>Habitat structure: channel and banks</b>							
4.1	compliance with river planform target	-	-	-	-			
4.2	compliance with river profile target (RHS transect data)*	F	F	F	U			
4.3	compliance with river profile target (RHS sweep-up data)*	-	-	-	-			
4.4	compliance with river bank vegetation target	U	F	U	U			
4.5	compliance with riparian zone target	U	F	U	U			
4.6	compliance with HMS target	F	F	F	F			
<b>5</b>	<b>Plant community</b>							
5.1	compliance with species composition target	F	U	U	U			
5.2	compliance with loss of species target	-	-	-	-			
5.3	compliance with abundant species target	-	-	-	-			
5.4	compliance with reproduction target	F	F	F	F			
<b>6</b>	<b>Negative indicators (biological disturbance)</b>							
6.1	compliance with native macrophyte species target	F	F	F	F			
6.2	compliance with naturalness of macrophytes target	F	U	U	F			
6.3	compliance with 'other organisms'	N/A	N/A	N/A	N/A			
<b>7</b>	<b>Indicators of local distinctiveness</b>							
7.1	Maintain distinctive elements	-	-	-	-			

\* Either transect (4.2) or sweep-up data (4.3) can be used. Results of both analytical processes are provided for comparison purposes.

## APPENDIX 3

### Extracts from the Natural England Fish Survey Report:

#### **4.2 Overall fish community**

----- Previous Environment Agency (EA) fisheries surveys have reported a maximum of 12 different fish species from the River Mease. This corresponds closely with the 11 different species caught during this study. The species encountered were all indigenous to the UK and Trent catchment and are considered typical of a lowland river in this part of England. Eel, a UK BAP species and the subject of an EC directive, have been previously recorded from the River Mease but were not found during this survey. APEM Final Report 410902 25

#### **4.3 Bullhead**

A 1997 EA fisheries survey report provided by NE does not contain numerical values for bullhead but does report on their relative abundance throughout the River Mease. Where bullhead were caught in the EA survey they were typically observed as being present or abundant. There was clear site-to-site variation in density of bullheads within the River Mease SAC with this species being particularly abundant at 2 sites (2 and 14). The reasons for the high abundance at these two sites in particular is not clear from this study but is probably related to site specific feature e.g. habitat availability and/or prey abundance. The CSM target minimum density for bullheads is 0.5 individuals/m<sup>2</sup> for lowland rivers (JNCC, 2005) sampled using electric fishing techniques. Units 1 and 4 yielded density estimates above the CSM target for electric fishing. However, Units 2 and 3 yielded estimates below the target. The mean density for the SSSI as a whole was also below the CSM target for both sampling methods. The presence of bullheads fitting the 0+ cohort indicates that recruitment is occurring although it should be noted that 0+ fish were poorly represented in samples. This could again be related to poor capture efficiency of these small and difficult to see individuals as reported by Cowx & Harvey (2003). JNCC CSM targets state that young-of-year fish should occur at densities at least equal to adults (JNCC, 2005), which does not appear to be the case for the River Mease bullhead population. These smaller/younger fish seem to be relatively most abundant in the upper reaches of the water course which suggests that these upper reaches may be important habitat for spawning and juvenile fish. **Based on targets both for overall density and proportion of the population comprised by juveniles, bullhead are considered to be in unfavourable condition on the River Mease.**

#### **4.4 Spined Loach**

As mentioned previously, the spined loach is not an interest feature for the Mease SSSI Unit 1 and has therefore not been included in the density calculations. Previous EA electric fishing surveys in 1999 report the average density of spined loach to be 0.32 individuals/m<sup>2</sup>. This value is higher than those obtained in our study using both electric fishing techniques (0.05 individuals/m<sup>2</sup>) and using hand trawling, the recommended survey

methodology for spined loach (0.09 individuals/m<sup>2</sup>). The CSM target minimum density for spined loach is 0.1 individuals/m<sup>2</sup> (JNCC, 2005). Using the data from hand trawling, SSSI Units 2 and 4 should be considered unfavourable in terms of its spined loach population. However, Unit 3 can be considered to be in favourable condition with regards to the spined loach populations.

The presence of spined loach fitting the 0+ cohort indicates that the current population has successfully reproduced in the year of the survey although it should be noted that 0+ fish were poorly represented in samples. This could again be related to poor capture efficiency of these small and difficult to see individuals. CSM target states that at least 50% of the population should be comprised of 0+ fish. This is clearly not the case for all 3 SSSI Units (for which the species is an interest feature) comprising the River Mease SSSI and **based on the juvenile abundance target the SSSI is in unfavourable condition with regards to the spined loach population structure.**

#### **4.5 Crayfish**

Despite the presence of habitat deemed to be suitable for **crayfish no individuals were observed during this study.** The reasons for this are not clear but we advise a cautionary approach to interpreting this result as a lack of sightings does not necessarily infer a complete absence of species in this river system. These are discussed in turn below: Predation, Competition, Pesticides

## APPENDIX 4

### EXTRACTS TAKEN FROM THE ENVIRONMENT AGENCY WATER FRAMEWORK DIRECTIVE WATER BODY REPORTS (CURRENTLY IN PROCESS OF COMPLETION)

The following are extracts from the Environment Agency's WFD Water Body reports:

- The water body GB104028046570, **River Mease from Gilwiskaw Bk. to Hooborough Bk**

Classified at Moderate status, driven by the phosphorus physico-chemical element.

Phosphorus is at Bad status, however, other physico-chemical, chemical and invertebrate elements would indicate that the water body is at Good or High. The Moderate classification occurs because the invertebrate ecological element is at Good status and supporting elements such as phosphorus can only reduce the overall classification to Moderate (even if the individual supporting elements are at Poor or Bad).

The R. Mease, from the confluence with the R. Trent to Packington on the Gilwiskaw Bk, has Protected Area Status as it has been designated a Special Area of Conservation, therefore, the more stringent Habitats Directive rules apply.

The water body has been classified for invertebrates using two sites:

- Measham (Biosys code: 50447)
- Stretton Bridge (Biosys code: 48310)

When RICT and VISCOUS plots for the R. Mease are studied, they confirm that the river is at Good status. However, the slightly lower ASPT scores compared with NTAXA indicates low level organic pollution.

The interim 2010 classification has been reduced to poor, driven by the ecological element phytobenthos (diatoms). This is explained by the fact that diatoms were not included in the 2009 classification and the phosphorus levels are relatively high. However, it is unlikely that this represents a genuine deterioration in water quality.

The physico-chemical data shows a steady decline in phosphorus concentrations which is particularly marked from 2007/08 onwards. In March 2007 phosphorus stripping was added to Snarstone STW. This is likely to be responsible for the reduction in phosphorus concentrations within the river. The downward trend still appears to be continuing but has not yet consistently met Good status. Ammonia peaks occur on several occasions. The ammonia

peaks and high phosphorus levels would indicate that treated sewage effluent and occasional storm discharges are the major factors driving the ecological status of the water body. In the near future phosphorus source apportionment work, carried out regionally, may give a more accurate assessment of the contributions of phosphorus to the river by the STW and agriculture.

In Summary. The water body is failing to reach good status. It is highly likely that the classification is being driven by sewage effluent from Packington and Snarestone STW. If this water body is to be raised to Good status, STW must consistently produce a high quality effluent.

- The water body GB104028046590 : **Gilwiskaw Brook from source to R. Mease**

Classified as Poor with fish being the driving element.

The Gilwiskaw Brook, from Packington has Protected Area Status as it has been designated a Special Area of Conservation with the R. Mease to its confluence with the R. Trent.

This water body contains a major sewage works at Packington and a large culverted section below Ashby-de-la -Zouch

Two fish sites were used for classification:

- Snarestone
- Stonehouse Farm, Packington

The fish population present in the Gilwiskaw Bk has been **severely impacted by episodic poor water quality**. Polluting discharges from a variety of point sources have resulted in serious fish mortalities on a number of occasions. This is highly likely to have changed the fish community structure present in the brook.

Three invertebrate sites were used for classification.

- U/S Ashby (Biosys code: 47720)
- Ashby (Biosys code: 53812)
- Measham Fields Farm (Biosys code: 50427)

The invertebrate element has been classified as Moderate. When RICT and VISCOUS plots are studied for the three sites, it is confirmed that the water body is at less than good status. ASPT tends to be lower than NTAXA, indicating that organic pollution may be largely responsible for impacts on the invertebrate community. The most serious impact appeared to occur at the site located D/S of the culvert below Ashby. This site must be considered to be at high risk of water quality problems associated with wrong connections and diffuse urban drainage. The site at Measham Fields Farm was considered to be at Good status for invertebrates. This is a positive result as it would suggest that the discharge of treated sewage effluent from Packington STW is

of a consistently high quality for organic matter. Physico-chemical dots would also indicate that the treated effluent is low in organic matter. However, all of the sites are at less than Good status for phosphorus. Measham Fields Farm fails by the greatest margin. This is highly likely to be due to the effluent from Packington STW. A phosphorus source apportionment investigation is currently being undertaken regionally. This will help to determine the relative contributions of sewage effluent and agricultural sources of phosphorus to the waterbody. Together with this, a large number of chemical samples have been taken throughout the R. Mease catchment during 2010. The results of this study will be available in the near future. In March 2012, phosphorus stripping will be added to Packington STW with a consented discharge of 1mg/l P. This should result in a major reduction in phosphorus concentrations in the Gilwiskaw Bk. and River Mease.

In Summary: The fish population has been impacted by periodic pollution events from a variety of point sources within the catchment. **Pollution prevention actions are needed to stop these one off events.** Close attention should be paid to poor water quality resulting from diffuse urban drainage in the Ashby area. **Phosphorus stripping at Packington STW, commencing in March 2012, should result in a major reduction in phosphorus concentrations**

## APPENDIX 5

### River Mease Fish FCS2 Data Analysis

#### **FCS2:**

FCS2 works out the Ecological Quality Ration (EQR), this is the expected fish population compared to observed. (Determine species composition and abundance in undisturbed conditions (expected abundance)). The closer to a EQR of 1, the closer the fish species are to expected levels.

#### **Calculation of reference values ( Expected):**

Are defined in terms of the expected catch of each species of fish at the survey site, within a particular river type. Each species are not as a single value, but as a probability distribution of all possible values.

**Note:** 'Data on fish abundance classified on a log-abundance scale, or presence-absence data for species that have not been enumerated in historical surveys, may be used in place of counts.' (UK TAG Rivers Assessment Methods Fish Fauna, Fisheries Classification Scheme 2 (FCS2). This includes minor species (Bullhead, Minnow and Stone Loach), so scores are only based on presence-absence.

#### **Fish Boundary Values:**

High – 0.7

Good – 0.4

Moderate – 0.2

Poor – 0.125

#### **GB104028046590: Gilwiskaw Brook to River Mease:**

Two Sites used for classification, both surveys conducted in 2007. Overall classification is poor.

Snarestone: Classed as MODERATE (2007 survey).

Bullhead and stone loach at high status. In the 2010 survey both were again recorded, so will maintain high EQR score.

Stone House Farm, Packington: Classed as BAD (2007 survey).

Only Stone loach recorded in the 2007 survey. So Stone loach have a high EQR while Bullhead are absent to have an EQR of 0.1222. Bullhead and Stone loach recorded on both 2009 and 2010 surveys. This may contribute to improved overall classification of the site to poor for the 2010 classification. Surveys conducted without stop nets, this could effect the catch efficiency.

Stone House Farm bad classification, is probably due to a major fish kill that occurred in 2007 when the brook was heavily polluted with sewage effluent. Fish stocks have been slow to recover. The Snarestone site downstream, close to the confluence with the River Mease, is classed as Moderate. This maybe because the impact of the pollution was less severe and/or fish stocks have recovered more quickly here due to the proximity to the main River

Mease which has a good fish population. There has been a history of pollution events on the Gilwiskaw Bk that have resulted in serious fish mortalities on a number of occasions. This is highly likely to have changed the fish community structure present in the brook.

In 2010 an extra fish survey was conducted upstream of Stone House Farm at Packington village. Only 3-spined stickleback and stone loach were recorded and Chub observed. The fish stocks may be poor because of the loss of fish downstream of Packington in 2007 and/or the weir near Red Burrow farm is causing a barrier to fish migration.

**GB104028046570: River Mease from Gilwiskaw Brook to Hooborough Brook:**

Only one site used for classification, survey conducted in 2007. Overall fish classification is high.

U/S A42 Road Bridge: Classed as HIGH

All species that are predicted were recorded on survey. Bullhead and Stone loach present 2007, 2009 and 2010, no survey conducted in 2008. This gives both Bullhead and Stone loach high EQR scores.

**GB104028046560: River Mease from Hooborough Brook to River Trent:**

Four sites used for classification, surveys used were from 2006 and 2007. Overall classification for fish is high.

Edingale: HIGH Classification (2006),  
Bullhead and Stone loach present, so high EQR scores.

Stones Bridge: HIGH Classification (2007).  
More species recorded than predicted. Bullhead and Stone loach present in 2007, 2009 and 2010, no survey conducted in 2008.

Netherseal: HIGH classification (2007).  
Bullhead and Stone loach present in 2007, 2009 and 2010, no survey conducted in 2008. So high EQR scores for both Bullhead and Stone loach.

Croxall Bridge: HIGH Classification (2006)  
More species recorded than predicted. Bullhead and Stone loach present, no other surveys conducted here.

**River Mease (Bullhead and Stone loach) Summary:**

The River Mease seems unaffected by the pollution events occurring on the Gilwiskaw brook, as expected fish species are present in good abundances. Although Bullhead and Stone loach are mainly recorded as a presence-absence, some abundances are available although not reliable due to the method of catching. The Gilwiskaw Brook has poor fish stocks, although is showing some recovery occurring within Bullhead and Stone loach recorded in 2009 and 2010.

## APPENDIX 6

### Further Information on Development and Housing

#### Quantifying Available Wastewater Capacity for Growth

Since 2005, through working with the water industry the Agency has significantly improved the ability to assess available capacity for growth within existing STWs consents/permits.

The environmental impact of a discharge to the water environment depends on the load of pollutants discharged. The Load is the concentration multiplied by the flow rate. In regulating discharges to control their effect on the environment, then the flow rate is just as important as the concentration of the discharge. For a sewage treatment works discharge, the flow rate into and hence from the STW will vary due to; diurnal variations in water use, rainfall (most STWs have some rainfall inputs from the sewerage system), seasonally due to groundwater level changes effecting infiltration into the sewerage system.

Increases in DWF could also be the result of growth within the catchment (domestic or commercial) or increases in trade discharges to the serving sewered catchment.

We control the flow rate in the consents/permits we regulate through a measure, known as the Dry Weather Flow (DWF).

The traditional compliance definition of DWF until 2010 was:

*'the mean flow over seven dry days after seven days when rainfall did not exceed 0.25 mm on any one day'.*

Flow measurement treated sewage discharges above 50 m<sup>3</sup>/d was significantly improved during the water companies' asset management plan 2000-2005 (AMP3) investment programme. The flow measurement device now needs to meet a detailed specification and measurement is independently certified. This programme and ongoing regulation, has provided reliable DWF data since 2005.

However, when we used the traditional compliance definition for the first time with measured flow data, it proved to be an unsuitable regulatory parameter for both the operators and us.

In 2009 the Water Industry and Environment Agency secured a new way of defining DWF, based on a statistical analysis of the data. A Q80 exceedance (planning flow) and Q90 exceedance (compliance flow) approach.

We will normally report compliance against DWF limits each year. When we record that the 90%-exceeded measured flow exceeds the DWF limit, we will

require a technical report from the operator on the reasons and, where necessary, the proposed solution. We will then require the operator to take any appropriate action to restore compliance. We will only record a failure to comply with the consent if the operator fails to report or fails to take the appropriate action.

The Agency is working with STW Ltd to develop procedures to identify and drive a proactive approach to managing DWF compliance and growth schemes.

### **Dry Weather Flow Capacity**

The industry is now in a position to measure DWF compliance and hence volumetric headroom and hence capacity for growth within existing consented volumes.

It is not the Agency's role to quantify or specify what headroom STW Ltd may have at a particular STWs. This is part of the Water Companies role in managing its operations within the consent.

We do need to be aware of which STWs have headroom and which don't so that we can take account of this when advising Local Planning Authorities through planning consultations.

Given the scrutiny that the Mease catchment is under, and the reliance of available capacity at STWs, STW Ltd should be requested to provide a regular (quarterly?) update of the Headroom at each of the nine primary STWs in the catchment.

The calculations that we carry out to determine permit limits are based on a maximum effluent flow. In practice, many sewage treatment works operate significantly below this maximum flow and there can often be an unused capacity in the permit. This means that additional flow – for example that resulting from urban growth within a catchment – can be incorporated within the existing limits of the permit. Those limits were set to protect the receiving river, so utilisation of this capacity would still be within a “safe” range of impact. For this reason, we have not objected to growth which can be accommodated within existing permits on water quality grounds.

If growth would result in flows which cannot be accommodated within the existing permit, we would issue a revised permit. In this case, a more stringent limit for pollutants like phosphorus may be required so that the current level of impact is maintained and certainly not made worse.

NWLDC have received advice from consultants specialising in the Habitats Regulations (David Tyldesley and Associates). This advice focuses much attention on an outcome from the RoCs, which related to a water quality action plan to tackle diffuse P loads within the catchment. *“As yet the River Mease Water Quality Action Plan, as detailed in the SAP, is yet to be delivered. Until such time that this “further action” (which was relied upon by the EA under the provision of Regulation 64(3) to enable them to conclude*

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*their RoC) is delivered, the residual “adverse effect on integrity” associated with Packington WWTW remains.”* The advice goes on to direct NWLDC that any increase in flow arriving at the STWs within current consent limits even if there is DWF headroom, would result in an adverse effect.

Once this Plan is accepted by NE and NWLDC, this issue with headroom not being available for growth will be resolved.

### **Potential Options**

Development will result in increased wastewater flows to STWs, If these additional flows can not be accommodated within the consented DWF at the nearest STW, then the options available need to be carefully considered. These options can either considered as strategic or local/short term.

The Agency supports the adoption of a strategic solution, however recognises that the mechanisms to put this in place may not available instantaneously. Given the current view of NWLDC and NE, that existing DWF can not be utilised, then this may direct Developers to consider local/short term solutions to the wastewater their proposed developments would generate.

Any development should not create an increase in DWF at STWs within the catchment above the consented DWF, without ensuring measures are in place/secured prior to the generation of the additional flows, that will not cause a deterioration (adverse effect) from the position set out in the RoCs.

In developing solutions, if Developers can provide some environmental enhancement over and above the standstill position, then this is welcomed and will be encouraged. However in considering options, the following three should be considered:

- **The solution is viable** (inclusion of environmental enhancement elements within the scheme should not make the solution non viable).
- **The enhancement should be measurable**
- The solution should **not increase the risk to the environment**

This is a list of some of the solutions currently being considered:

- No Growth
- Growth, additional wastewater to sewer, no upgrade to STWs
- Growth, additional wastewater to sewer, no upgrade to STWs. Compensate additional load by offsetting ( wetland treatment etc)
- Growth, additional wastewater to sewer, upgrade following Maintenance of Load Principles
- Growth, additional wastewater to sewer, upgrade for just additional flows to meet 0.06mg/l
- Growth, additional wastewater treated privately to meet 0.06mg/l effluent quality

- Growth, wastewater to sewer, catchment transfer, but bring all flows back over time.
- Growth, wastewater to sewer, catchment transfer, but bring proportion of flows back over time.
- Growth, additional wastewater to sewer. Private enterprise initiative to treat the additional flows from the STWs to a 0.06 mg/l standard.
- Growth, additional wastewater to sewer. no upgrade to STWs, but mitigate fro additional loads by bypassing a proportion of the watercourse through a reedbed arrangement.

These options are being appraised through the Water Cycle Study (WCS). The WCS will give a clear way forward in dealing with the wastewater / growth issues in the catchment.

### **Private Treatment Plants**

The Agency is clear that a strategic long term plan is required to deal with wastewater within the Mease. Local solutions may have a significant role to play, but can present significantly higher environmental risk for no or little gain/benefit and remove the driver for a strategic solution, thus perpetuating non mains drainage solutions.

The Agency has received a permit application for a privately run package treatment plant (PTP), discharging at 0.1mg/l of Total P into a tributary of the R Mease SAC. The Agencys National Permitting Service (NPS) are in the process of determining this permit (Feb 2011).

A possible outcome is that we shall grant a discharge permit with a 0.06mg/l P. This will eventually lead to a big increase in applications and the number of small STW plants in the catchment of the River Mease (and elsewhere in the country). The risk of pollution occurring in the catchments, due to failure of the PTPs or accidental release of chemicals used in the process and impact on the SAC, will be significantly increased over a mains drainage solution.

SEPA Approach - SEPA have allowed a relaxation of their policy on connecting to mains drainage (where there is no capacity at the public sewage works) by supporting short term non mains drainage solution. However this is only when there is a sustainable/secured long term plan for mains drainage solution and the non-mains solutions are time limited to ensure connection to the public sewer system once it is able to accept the flows. In the Mease there is as yet no secured long term plan.

### **SvT Ltd Catchment Transfer Option**

The Agency has worked with STW Ltd in breaking into the current deadlock in developing a solution that does not impact on quality limits at STWs. The catchment transfer solution will take wastewater flows (equivalent to 2,500 homes) to be treated at a STWs where there is ample capacity/headroom discharging to the R Trent (outside the SAC). This would provide capacity for

2,500 new homes within the SAC, without deteriorating water quality and with no need to modify any discharge consents.

The scheme should be considered through the WCS, particularly the opportunities that could arise for environmental enhancement, any environmental risks and viability. The funding (~£2.5m, to be funded through requisition) will need detailed consideration, as will a temporary element of the scheme to ensure no adverse effect due to the temporary loss of flow from the SAC.

### **Flow scenarios – What are the benefits of possible actions**

It is helpful to consider how the options available to deal with wastewater issues resulting from growth might effect the phosphate concentrations in the SAC. To do this an example loosely centred around Packington STW and the Gilwiskaw brook illustrates for five scenarios:

<b>Scenario</b>	<b>Description</b>
<b>Scenario 1</b>	No Growth
<b>Scenario 2</b>	Development of 1000 houses, discharging to STWs , not changes to P limits
<b>Scenario 3</b>	Development of 1000 houses, discharging to STWs , P limit modified for all effluent using Maintenance of Load Principles
<b>Scenario 4</b>	Development of 1000 houses, discharging to STWs , P limit not changed for existing flows but set at 0.06mg/l for additional flows
<b>Scenario 5</b>	Development Current situation, but with loss of 500 houses worth of flow out of the final effluent.

All river concentrations have been compared with Scenario 1. The results have been presented to 2 decimal places. If the result is the same as Scenario 1 then the P concentrations are presented in **black**, if deteriorated then in **red** and if better then reported in **green**.

#### **Scenario 1 – No Growth**

Calculated P concentration in watercourse downstream of a STW discharge.

Flow upstream of STWs 237 l/s

Flow from STWs 55 l/s

Varying the quality of the Final Effluent and P concentration in the upstream watercourse.

STW	Final Effluent P mg/l	Upstream P = 0.14 mg/l	Upstream P = 0.12 mg/l	Upstream P = 0.06 mg/l
3.5		0.7729	0.7566	0.7079
1		<b>0.3020</b>	0.2858	0.2371
0.5		0.2078	0.1916	0.1429
0.12		0.1362	<b>0.1200</b>	0.0713
0.06		0.1249	0.1087	<b>0.0600</b>

There are much greater improvements to be had in river P levels by tackling point source discharges, rather than diffuse. The effects of tackling diffuse pollution becomes proportionally more significant as we move much closer to the standards/targets.

### Scenario 2 – Development of 1000 houses, discharging to STWs , no changes to P limits

Calculated P concentration in watercourse downstream of STW discharge, but with 1000 house additional development

Assuming additional flows equivalent to 1000 houses (2.4 hds occupancy at a consumption of 140l/hd/d) = 3.89 l/s

If this additional flow passes through the STW and discharges at the same quality as the existing effluent

STW	Final Effluent P mg/l	Upstream P = 0.14 mg/l	Upstream P = 0.12 mg/l	Upstream P = 0.06 mg/l
3.5		0.8087 (0.0359)	0.7927 (0.0361)	0.7447 (0.0367)
1		0.3112 (0.0092)	0.2951 (0.0094)	0.2471 (0.0100)
0.5		0.2116 (0.0038)	0.1956 (0.0041)	0.1476 (0.0047)
0.12		0.1360 (-0.0002)	<b>0.1200</b> (0.0000)	0.0719 (0.0006)
0.06		0.1241 (-0.0009)	0.1081 (-0.0006)	<b>0.0600</b> (0.0000)

The figures in brackets are the differences between this scenario and Scenario 1

Increasing the load of wastewater discharged through the existing STWs without modifying the P consent, has a resulting deterioration in the in river P concentrations for scenarios other than those with tight final effluent limits and poorer quality upstream quality. Albeit small the deterioration from 0.3 to 0.3112 mg/l does represent a 0.01mg/l deterioration which is ~19% of the conservation objective.

If FE quality was secured at 0.06 mg/l then the increased load would actually offer a slight improvement over the No Growth Scenario for the poorer quality upstream P concentrations.

**Scenario 3 – Development of 1000 houses, discharging to STWs , P limit modified for all effluent using Maintenance of Load Principles**

Calculated P concentration in watercourse downstream of a STW discharge, but with 1000 house additional development

Assuming additional flows equivalent to 1000 houses (2.4 hds occupancy at a consumption of 140l/hd/d) = 3.89 l/s

If this additional flow passes through the STW and discharges at the same quality as the final effluent, but with the final effluent consent limit modified using the maintenance of load approach. (revised limits in brackets)

STW Final Effluent P mg/l	Upstream P = 0.14 mg/l	Upstream P = 0.12 mg/l	Upstream P = 0.06 mg/l
<b>3.50 (3.2688)</b>	0.7627 (-0.0102)	0.7467 (-0.0099)	0.6986 (-0.0093)
<b>1.00 (0.9339)</b>	0.2980 (-0.0040)	0.2820 (-0.0038)	0.2339 (-0.0031)
<b>0.50 (0.4670)</b>	0.2051 (-0.0027)	0.1891 (-0.0025)	0.1410 (-0.0019)
<b>0.12 (0.1121)</b>	0.1344 (-0.0018)	0.1184 (-0.0016)	0.0704 (-0.0009)
<b>0.06 (0.0560)</b>	0.1233 (-0.0016)	0.1073 (-0.0014)	0.0592 (-0.0008)

The figures in brackets are the differences between this scenario and Scenario 1

The Maintenance of Load approach does actually offers a small improvement over the no growth scenario, particularly for the higher final effluent and upstream quality calculations.

**Scenario 4 – Development of 1000 houses, discharging to STWs , P limit not changed for existing flows but set at 0.06mg/l for additional flows**

Calculated P concentration in watercourse downstream of a STW discharge, but with 1000 house additional development

Assuming additional flows equivalent to 1000 houses (2.4 hds occupancy at a consumption of 140l/hd/d) = 3.89 l/s

If this additional flow is treated through the STW or a separate PTP at a quality of 0.06 mg/l.

STW	Final Effluent P mg/l	Upstream P = 0.14 mg/l	Upstream P = 0.12 mg/l	Upstream P = 0.06 mg/l
3.5		0.7635 (-0.0094)	0.7475 (-0.0092)	0.6994 (-0.0085)
1		0.2988 (-0.0032)	0.2828 (-0.0030)	0.2347 (-0.0023)
0.5		0.2059 (-0.0019)	0.1898 (-0.0017)	0.1418 (-0.0011)
0.12		0.1352 (-0.0010)	0.1192 (-0.0008)	0.0712 (-0.0001)
0.06		0.1241 (-0.0009)	0.1081 (-0.0006)	<b>0.0600</b> (0.0000)

The figures in brackets are the differences between this scenario and Scenario 1

The results are similar albeit slightly less beneficial than the Maintenance of Load scenario. The river responds better to a small improvement to all the treated flows as it does to this scenario where only the additional flows are treated to superior standard.

### Scenario 5 – Development Current situation, but with loss of 500 houses worth of flow out of the final effluent.

Calculated P concentration in watercourse downstream of a STW discharge.

Flow upstream of STWs 237 l/s

Flow from STWs 55 l/s

Assuming loss of flows equivalent to 500 houses (2.4 hds occupancy at a consumption of 140l/hd/d) = 1.94 l/s

Varying the quality of the Final Effluent and P concentration in the upstream watercourse.

STW	Final Effluent P mg/l	Upstream P = 0.14 mg/l	Upstream P = 0.12 mg/l	Upstream P = 0.06 mg/l
3.5		0.7546 (-0.0182)	0.7383 (-0.0183)	0.6893 (-0.0187)
1		0.2973 (-0.0047)	0.2810 (-0.0048)	0.2320 (-0.0051)
0.5		0.2059 (-0.0020)	0.1895 (-0.0021)	0.1405 (-0.0024)
0.12		0.1363 (0.0001)	0.1200 (0.0000)	0.0710 (-0.0003)
0.06		0.1254 (0.0004)	0.1090 (0.0003)	<b>0.0600</b> (0.0000)

The figures in brackets are the differences between this scenario and Scenario 1

Taking flows out of the catchment through a catchment transfer scheme and bringing the same volume back to support growth would present the same in river concentrations as the No Growth scenario. However if as presented in this scenario 500 houses of flow is not returned to the catchment, then this would provide some water quality benefit in terms of lower P concentrations in the river, for scenarios where there is cleaner upstream quality and poorer final effluent quality.

Although the effects may well be small, it is not desirable to lose flow out of the catchment. The flow regime in the River Mease SAC is under pressure and loss of flow would not help the designated features.

## **Discussion**

Flows generated by developers will be small compared to existing flows, so opportunities to realise an advantage (environmental enhancement) that could be realised will also be small.

There are policy reasons for encouraging developers to provide more than a standstill solution, but this is unlikely to deliver much in improvements for P concentrations in the river. Developers have their part to play in ensuring that no deterioration is caused, but their role is limited when it comes to providing significant environmental enhancement. The scenarios show that certain solutions to growth, may provide environmental benefits now, but as concentration in the final effluent and upstream quality improve, then the level of enhancement may well change and even become deteriorating in some circumstances. Any solution to growth should be assessed against future final effluent and background quality scenarios.

In promoting Developers to provide environmental enhancement on the back of growth schemes, we should carefully consider any environmental risk associated (e.g. pollutions due to proliferation of PTPs) and the viability of securing such schemes and the risk this places on the planning process of stagnating growth.

The WCS should consider appraisal of potential options in more detail.

## **The Water Cycle Study**

### **Approach**

A Water Cycle Study is one of a number of strategic studies used by Local Planning Authorities as part of the evidence base for Local Development Frameworks. The study will propose necessary infrastructure and policy requirements to achieve the planned growth without compromising, and where possible, enhancing the water environment. It also aims to identify the

phasing of the water infrastructure requirements so that these do not constrain the timing of the proposed development.

The key issues that should be addressed in a WCS include:-

- Assessing the capacity of the current water infrastructure to accommodate growth without adversely affecting the environment by considering:
  - The availability of water resources
  - The capacity of the drainage network
  - The potential to increase flood risk
  - The capacity of existing wastewater infrastructure
  - The environmental capacity of receiving watercourses to receive wastewater
  
- Determining the potential impact of the proposed development in the context of requirements of environmental legislation including the Water Framework Directive, Habitats Directive and any other relevant water cycle policy;
  
- Identifying the infrastructure necessary to achieve the proposed growth within the constraints of the environment and legislation; and
  
- Developing a strategy for a phased approach to development that allows key growth targets to be met whilst providing sufficient time for the identified infrastructure to be adopted.

Wastewater treatment works have a smaller defined catchment area than water supply and so the location of development relative to the capacity of the nearest treatment works and receiving water can be critical.

### **Three Phases for a WCS:**

**Scoping** – to collate and review existing information and work with key stakeholders to identify issues that require consideration in the following stages of work;

**Outline** – Identify potential environmental and water infrastructure constraints to development and provide an evidence base to support the Core Strategy;

**Detailed** – Aims to resolve areas of uncertainty through further more detailed studies. This may also involve an assessment of costs and benefits, along with what infrastructure is needed and where and when. It also provides guidance to the local authorities to facilitate implementation and funding of the Strategy.

North West Leicestershire District Council (NWLDC) commissioned Entec to carry out a Scoping and Outline Water Cycle Study (WCS) which was completed in March 2010.

### **Summary Of Findings From the scoping and outline stages.**

- **Water Quality and Wastewater Treatment**

Water Quality constraints were shown to exist at Ashby-de-la-Zouch

Chemical Status is Poor status with high pollutants

The Chemical status of groundwater units around Ashby are classified as poor

There are no Freshwater Fish Directive designations on the Gilwiskaw Brook

The River Mease SAC presents a major constraint to development in the area, that requires mitigation for development.

Water quality constraints were also shown to exist at Measham

Chemical Status is Moderate status with high pollutants

The Chemical status of groundwater units around Measham is classified as poor

The River Mease is designated under the Freshwater Fish Directive from the Gilwiskaw Brook to the confluence with the River Trent

The River Mease SAC presents a major constraint to development in the area, that requires mitigation for development.

Treatment capacity of the STW's within the catchment have not been assessed in the Scoping and Outline study, therefore the impact of growth on discharge quality cannot be determined. Investigating the impacts and potential mitigation measures would fall under the remit of a Detailed WCS.

The outcome of this WCS was to recommend that options with the minimum amount of growth in the Ashby and Measham areas are favoured as a result of the constraints of the R Mease SAC. Option 1 was the preferred option which concentrated growth in the Coalville area (with 500 houses in Ashby and 50 houses in Measham) and Option 4 the second preferred option which concentrated growth in Coalville, Castle Donington and Ibstock but allowed small developments in Ashby and Measham (500 and 400 houses respectively).

- **Water Resources and Supply**

It is recommended that all new homes are built to Code for Sustainable Homes Level 3/4 to reduce the demand from new households. Severn Trent Water has forecast that there will be a surplus in supply over the growth period, dependent on a combination of demand management and increasing abstraction where available. It is key that the Council brings forward recommendations for all new homes to be water efficient in the Core Strategy.

- **Flood Risk and Sustainable Drainage**

New development in North West Leicestershire should be guided toward the lowest flood risk zones. Surface water flooding should also be a material planning consideration. New development should apply drainage techniques to control flood risk, whilst also providing benefit in terms of water quality, amenity value and green infrastructure targets.

## **WCS – The Next Stage (Detailed Water Cycle Study)**

Given the particular issues regarding the River Mease Special Area of Conservation (SAC) and the capacity at some of the Waste Water Treatment Works, the study recommended that a detailed Water Cycle Study be undertaken. NWLDC are currently undertaking (with their Consultants) a detailed water cycle study which will:

- **General**
  - Review the findings of the Scoping and Outline Report. Take account of the final determination of OFWAT in respect of Severn Trent's submitted Water Resource Management Plan.
  - Develop a detailed Water Cycle Strategy (including a Demand Management Strategy). The WCS should include a detailed and costed programme for water infrastructure improvements required to accommodate the anticipated level of development across the district and in individual settlements, who would be responsible for providing the identified infrastructure and by when, whilst also minimising the use of water resources and achieving water quality objectives.
  - Consider how the Detailed WCS can help contribute towards the Water Quality (P) Management Plan being prepared by the Environment Agency.
  
- **Water Quality and Wastewater Treatment**
  - Identify and assess potential solutions for resolving water quality issues associated with new development in the River Mease catchment, particularly in relation to the WwTW at Packington, whilst balancing these with water resource and issues.  
Assess potential solutions that contribute towards the protection of the Mease. The assessment will include:
    - The technical and financial feasibility of each option.
    - the physical infrastructure required.
    - the cost of implementation and maintenance including how costs could be met/shared between individual developments and other interested parties;
    - possible timescales for implementation.
    - the sustainability of each option.
    - how the different proposals will impact upon the efficient use of the water resourceThe study will also consider how the cost of implementing the infrastructure requirements will impact upon the viability of potential new housing development in the River Mease catchment.

- Investigate sewage constraints identified in the Scoping and Outline Report, particularly in respect of the Snarrows WwTW, and identify options for remedying these constraints and the costs involved;
- Investigate in more detail sewer capacity issues identified in the Scoping and Outline report and identify any potential solutions, likely costs and timescales for implementation.
- Identify locations where capacity in the existing sewerage system is limited (i.e. major pinch points in the infrastructure)
- Provide an assessment on deterioration in predicted spill volumes from Combined Storm Overflows/pumping stations etc.

The phosphate issues in the Mease are not solely due to Severn Trent Water point sources. Our estimates show that ~1/3 of the load could be due to other sources. The Agency is committed to work with partners to reduce all sources of phosphates in the catchment. Urban diffuse sources of phosphates are likely to be linked to the sewerage system. We need to better understand the interaction of the sewerage system and phosphates in the catchment. Sources could be from misconnections, CSOs, sewer flooding or pollution incidents.

The Environment Agency and Severn Trent Water Ltd will be working together to quantify and work to reduce the phosphate loading in the catchment from these sources. Severn Trent Water Ltd are part of the working group looking at the WCS with the emphasis on the management of their assets, the sewerage infrastructure (both the sewerage network and sewage treatment works).

This work should be developed through a Urban Pollution Management type project, which could be linked into the WCS and which will need to consider the impact of development on sewerage. The WCS working group (and Plan partners) will look **to Severn Trent Water to support the inclusion of sewerage through the WCS** and to undertake a **review of current potential P sources from their sewerage assets**.

- **Water Resources and Supply**

- An assessment in general terms of the feasibility in terms of technology, cost and any local constraints to securing Code for Sustainable Homes level 3/4 as recommended in the Scoping and Outline report.

- **Sustainable Drainage Systems (SUDs)**

- Advise on the most suitable Sustainable Urban Design Systems for potential development sites and likely costs;

The detailed WCS is expected to be complete by July 2011 and the Water Quality Action Plan is expected to form part of the data and information used

to develop the detailed WCS. The WCS will identify how appropriate new development and associated investment in infrastructure can help bring forward actions that bring the Mease SAC towards its agreed target. The findings of the WCS will contribute to the evidence base NWLDC will use to prepare its Core Strategy. The Core Strategy will set out the future planning framework for the district up to 2026 determining levels, type and timescales for development over the plan period.

## **Strategic Influencing**

### **LEPs**

One of the main aims of the current government is to put decision making back into local communities and end the 'top down' approach to planning and investment policy. Therefore to replace the Regional Development Agencies which are being wound up by 2012 the government offered local areas to take control of their future economic development.

To realise this policy the Government is supporting the creation of Local Enterprise Partnerships (LEPs). These LEPs will be locally owned partnerships between local authorities and business tasked with driving economic growth across common economic areas.

LEPs will be able to review the most cost effective approach to regeneration and economic development across their area. Recognising the need for appropriate infrastructure to deliver economic growth they will be looking at approaches to enable this most effectively for their members. To support the delivery of the LEPs objectives for growth in their areas they are expecting to be able to bid for Regional Growth Funds and other strategic funding streams (including European funding).

The catchment of the River Mease covers a number of LEPs namely:

- Leicester/Leicestershire (Including North West Leicestershire District Council)
- Derby, Derbyshire, Nottingham and Nottinghamshire (including South Derbyshire District Council)
- Birmingham, Solihull and Lichfield, East Staffs and Tamworth (including Lichfield District Council)

In addition, the Mease catchment within North West Leicestershire District forms part of the 3 Cities 3 Counties New Growth Point (2006 – 2026). The Growth Point status aims to help deliver investment to realise the ambitions for sustainable housing growth and future communities.

As the LEPs have a clear role in strategic planning and sustainable development there will be a need for the Water Quality (P) Management

Plan partners to engage with the LEP process. The engagement will enable LEP input to the development of strategic actions and possible investment in infrastructure to support sustainable growth whilst putting action in place to move the Mease SAC towards its agreed target.

### **Developer Contributions**

Planning Policy Statement 1: Delivering Sustainable Development, advises that local planning authorities should ensure that development plans promote outcomes in which environmental, social and economic objectives are achieved over time. It is now a well established principle that sustainable development is that which seeks win-win-win solutions for the environment, society and the economy.

Planning Policy Statement 9: Biodiversity and Geological Conservation, advises that planning policies and planning decisions should aim to maintain and enhance, restore or add to biodiversity and geological conservation interests. In taking decisions, local planning authorities should ensure that appropriate weight is attached to designated sites of international, national and local importance.'

The use of planning obligations is set out within section 106 of the Town and country Planning Act 1990, hence the term 'Section 106 agreements.' This legislation was updated by the Planning and Compulsory Purchase Act 2004. Circular 05/2005 provides the Government's guidance with regard to planning obligations. It advises that obligations must be relevant to planning, necessary to make a proposed development acceptable, directly related to the development and fairly and reasonably related in scale and kind to the proposed development, and reasonable in all other respects. The Circular advises that planning obligations can be used to mitigate for the effect of a development proposal, and also to compensate for harm caused by a development proposal.

With regard to mitigating obligations, the Circular advises that obligations could be used where a development would create the need for a particular facility that is relevant to planning. With regard to compensatory obligations, the Circular advises that obligations may be used to offset damage to a feature or resource present, with the example of a landscape feature of biodiversity value being given.

The good practice guide accompanying PPS9 states that securing necessary measures to protect, enhance, mitigate and compensate for biodiversity and geological assets through planning conditions and obligations is a key example of best practice. New benefits for biodiversity and geological assets, as a result of planning obligations are also promoted within the guide.

The objective of the Water Quality (P) Management Plan is to mitigate for the effects of point source discharges to the River Mease that are contributing to the adverse effect upon the site's ecological integrity. Additional development within the River Mease catchment, that seeks to utilise mains sewer facilities, adds to that effect. The achievement of growth whilst also

mitigating or compensating for harm, and additionally restoring environmental quality is in accordance with the principles of sustainable development. The Plan sets out measures for short term, medium term and long term actions to restore the water quality of the river back to a point where it meets its conservation objectives. This will only be achieved with a combination of actions, targeting the whole range of pollution sources. Developer funding through planning obligations will make a very positive contribution to the task ahead, providing resources to contribute towards strategic solutions and also initiatives that bring positive environmental benefits in terms of reducing phosphate levels in the river.

Developer contributions can be directly linked back to the development itself through their requirement for mains connection, and can provide compensatory funding to offset their own phosphate contribution made, whilst also providing enhancement and new benefits for this internationally important wildlife site.

The action is therefore for the development of a planning obligations scheme, which will provide a funding source for a number of proposals within the nutrient management plan, along with new actions that will be added to the plan as it continually evolves. It is possible that new initiatives may themselves be developer led, and this should be encouraged where appropriate. Other wildlife bodies and charitable trusts may also become involved, which again where appropriate, would also meet the Government's Big Society/Localism agenda. As the Plan develops, specific actions to which planning obligations funding can be directed will be specifically focused upon.

The development of a planning obligations scheme will need to be a partnership approach with Natural England, the Environment Agency and North West Leicestershire District Council and will be a key element of the Plan. The developer community is keen to engage in win-win-win solutions in the catchment, and they should also be involved in the establishment of a contributions scheme.

### **Maintenance and Repair Works**

The impact of projects and plans on the SAC also includes those schemes carried out as part of maintenance and repair of existing assets. Such schemes may include road resurfacing or drainage works.

As with all plans and projects the impact of activities on the features of ecological importance will require assessment by the proposer. The assessment will need to identify measures that sufficiently determine, minimise, monitor and manage any uncertainty associated with impacts and these must be appropriately managed. The impacts may be direct, indirect or cumulative or a combination of all three.

In order to secure protection of the SAC determining authorities will need assurance that the activity will not adversely affect the features of the Mease

SAC. Although not limited to the following, activities that will require particular attention are:

- Pollution control measures.
- Activities that may impact on protected species such as lighting, noise, works to the bed or banks of waterway channels, timing of operations.
- On-site welfare arrangements the use of which may have the potential for release of effluent into the environment.
- Flood risk measures.
- Opportunities for actions that further benefit the long term protection of the SAC and/or address ongoing issues.

## APPENDIX 7

### GRAPHS TO SHOW ORTHOPHOSPHATE QUALITY IN THE RIVER MEASE PRE AND POST AMP IMPROVEMENTS.

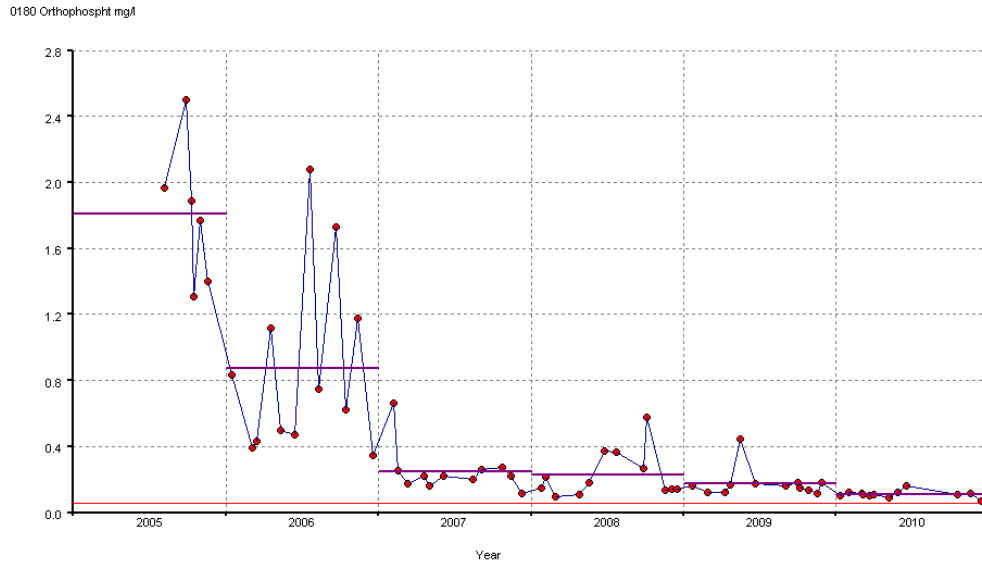
#### River Mease – d/s Snarestone STW and d/s Norton juxta Twycross STW – orthophosphate 2005 - Present

The red line shows the conservation objective of 0.06mg/l

Time Series Plot - (0180 Orthophosphat mg/l)

58473850; RIVER MEASE - DS SNARESTONE STW

05-08-2005 to 14-12-2010



#### River Mease – d/s Snarestone STW and d/s of Norton-juxta-Twycross STW – Orthophosphate (restricted to show improvements in WQ following phosphate removal at Snarestone STW and Norton juxta Twycross STW).

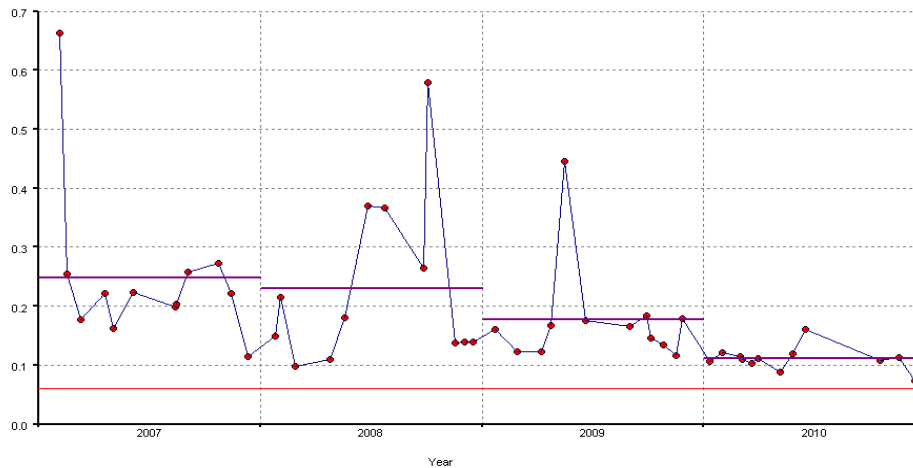
The red line indicates the conservation objective 0.06mg/l

Time Series Plot - Restricted (0180 Orthophosphat mg/l)

58473850; RIVER MEASE - DS SNARESTONE STW

05-02-2007 to 14-12-2010

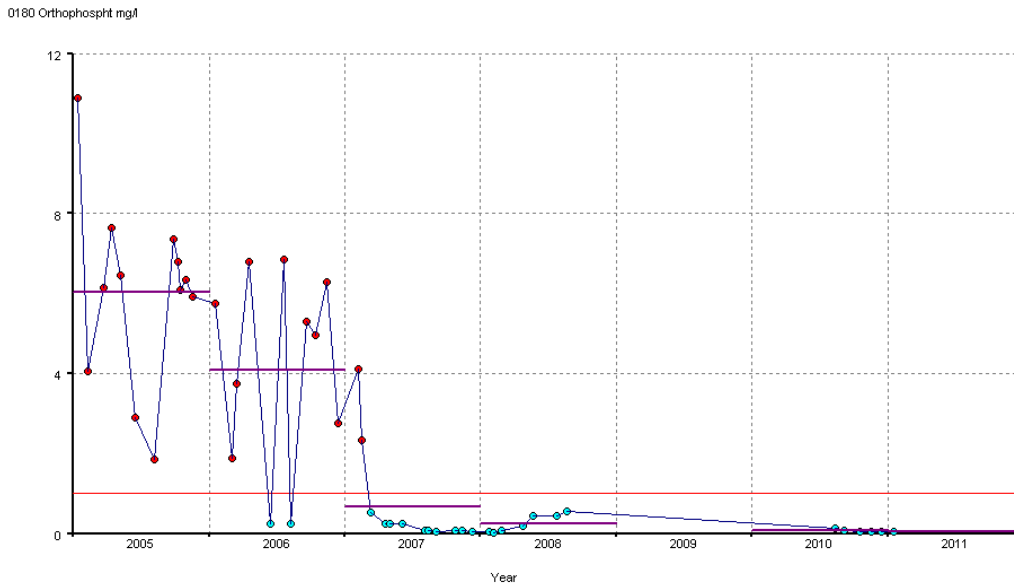
Restricted (0180 Orthophosphat mg/l)



## Snarestone STW – Final Effluent Quality – Orthophosphate, 2005 - Present

The red line indicates the consent limit of 1mg/l put in place in March 2007.

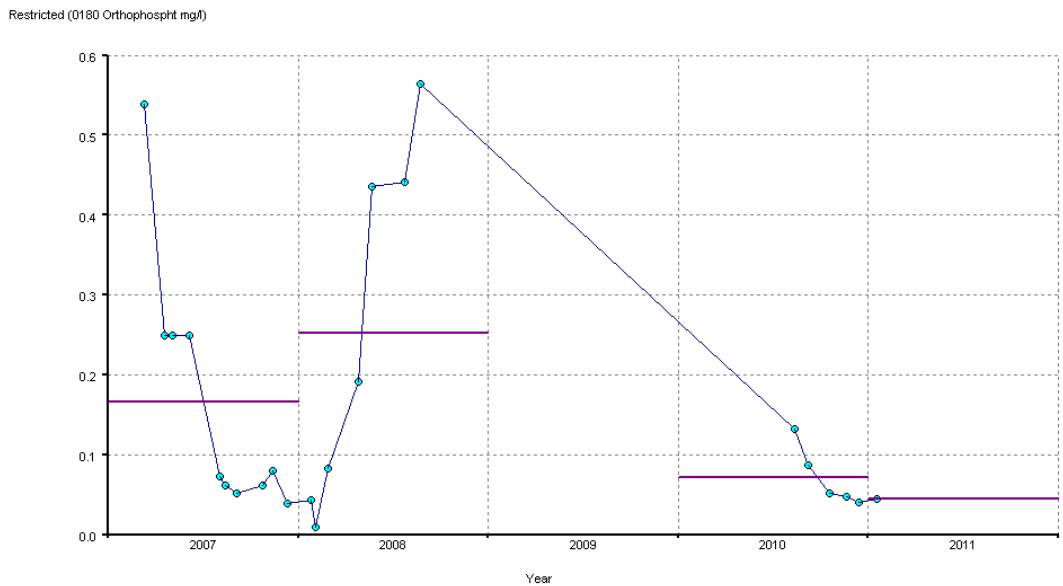
Time Series Plot - (0180 Orthophosphat mg/l) 12-01-2005 to 17-01-2011  
**58474050; SECONDARY TREATED SEWAGE EFFLUENT FROM SNARESTONE STW, APPLEBY ROAD, S**



## Snarestone STW – Orthophosphate (restricted to show improvements in effluent quality following phosphate removal)

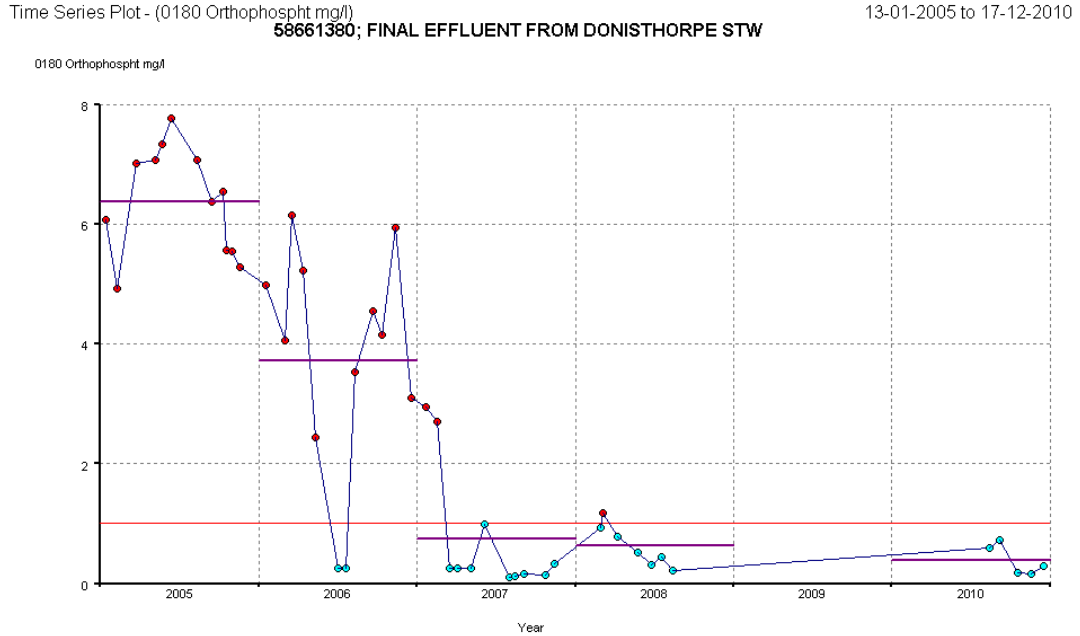
The consent limit for this STW is 1mg/l. All samples taken were less than 1mg/l

Time Series Plot - Restricted (0180 Orthophosphat mg/l) 09-03-2007 to 17-01-2011  
**58474050; SECONDARY TREATED SEWAGE EFFLUENT FROM SNARESTONE STW, APPLEBY ROAD, S**



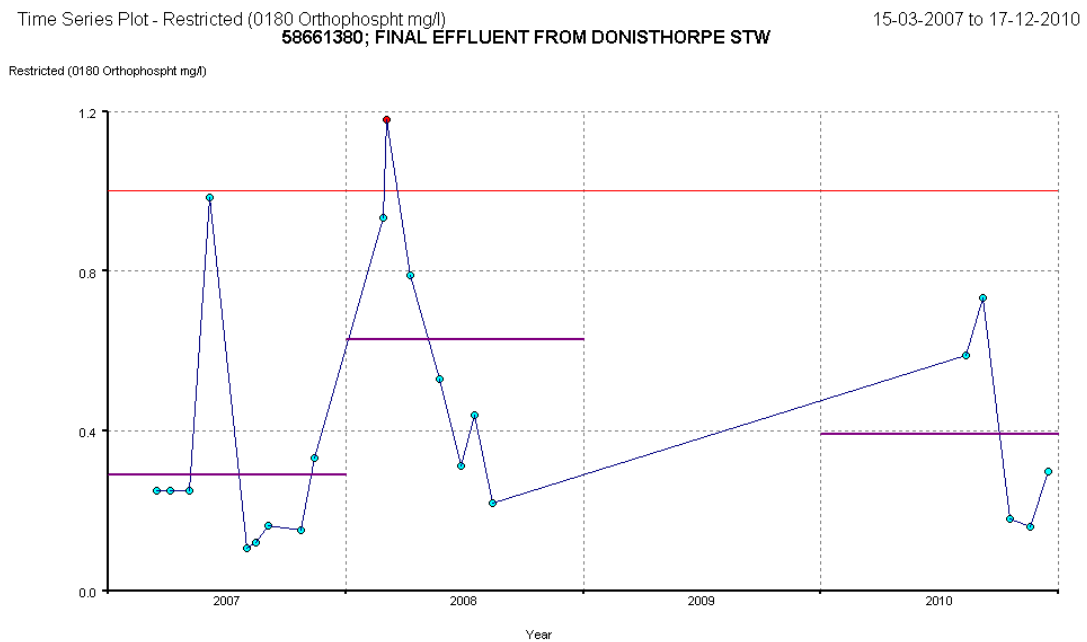
## Donisthorpe STW – Final Effluent Quality – Orthophosphate, 2005 - Present

The red line indicates the consent limit (1mg/l) put in place in March 2007



## Donisthorpe STW – Orthophosphate (restricted to show improvements in effluent quality following phosphate removal )

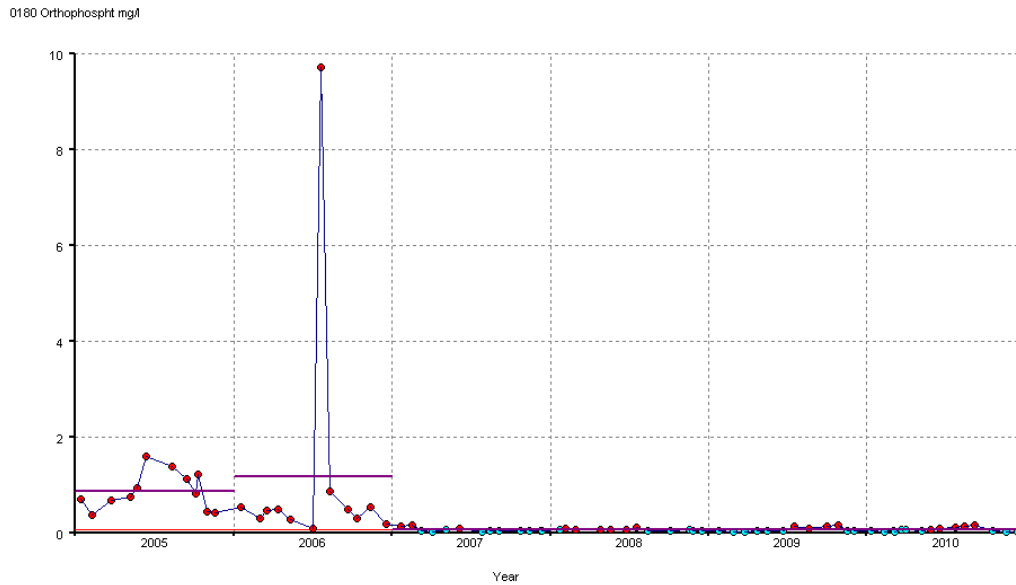
The red line indicates the Consent Limit (1mg/l) for Donisthorpe STW



## Hooborough – Acresford, d/s of Donisthorpe STW – orthophosphate, 2005 - Present

The red line indicates the conservation objective of 0.06mg/l (the Hooborough Brook is an indirect tributary to the SAC but is not part of the designated SAC)

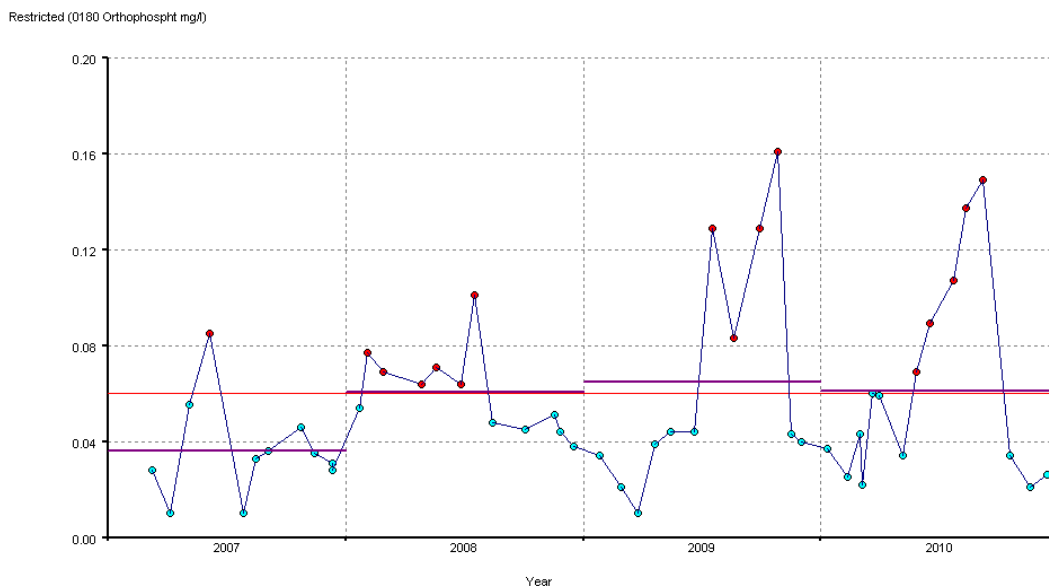
Time Series Plot - (0180 Orthophosphat mg/l) 13-01-2005 to 14-12-2010  
**58661180; HOOBOROUGH BROOK - ACRESFORD**



## Hooborough Brook – Acresford, d/s of Donisthorpe STW (restricted to show improvements in water quality following phosphate removal at Donisthorpe STW)

The red line indicates the conservation objective of 0.06mg/l (the Hooborough Brook is an indirect tributary to the SAC but is not part of the designated SAC)

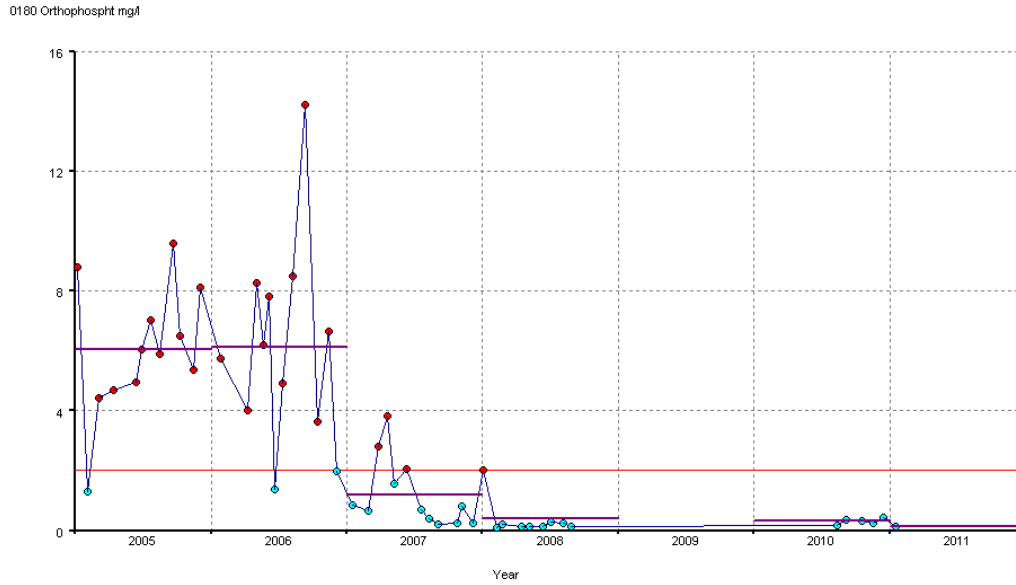
Time Series Plot - Restricted (0180 Orthophosphat mg/l) 08-03-2007 to 14-12-2010  
**58661180; HOOBOROUGH BROOK - ACRESFORD**



## Norton-juxta-Twycross STW – Final Effluent Quality – Orthophosphate, 2005 - Present

The red line indicates the consent limit (2mg/l) put in place in March 2007

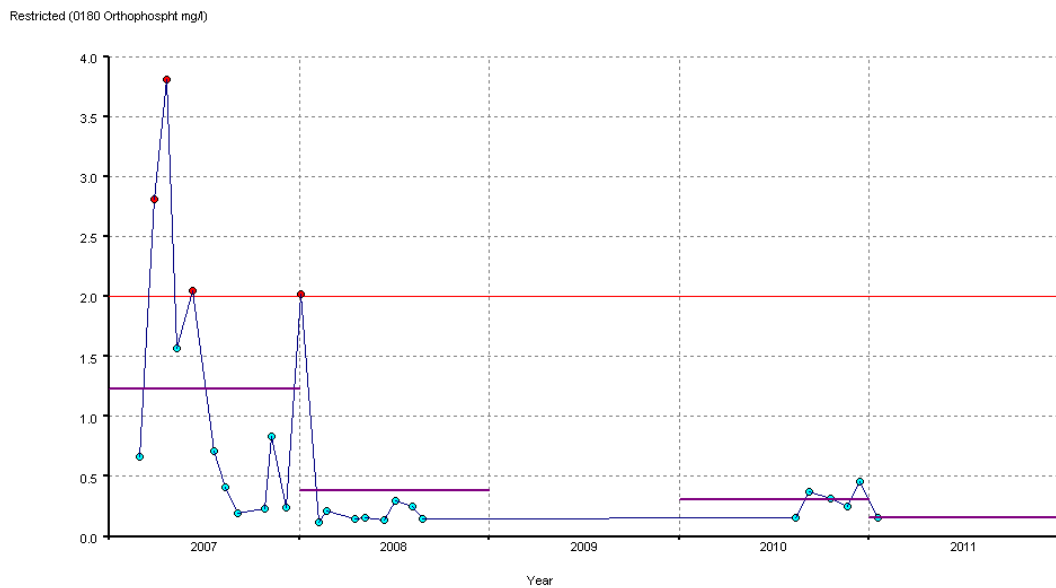
Time Series Plot - (0180 Orthophosphat mg/l) 06-01-2005 to 17-01-2011  
**58952160; TREATED SEWAGE EFFLUENT FROM NORTON-JUXTA-TWYXCROSS STW, COTTAGE LANE,**



## Norton-juxta-Twycross STW – Orthophosphate (restricted to show improvements in final effluent following phosphate removal)

The red line shows the consent limit (2mg/l) for this STW

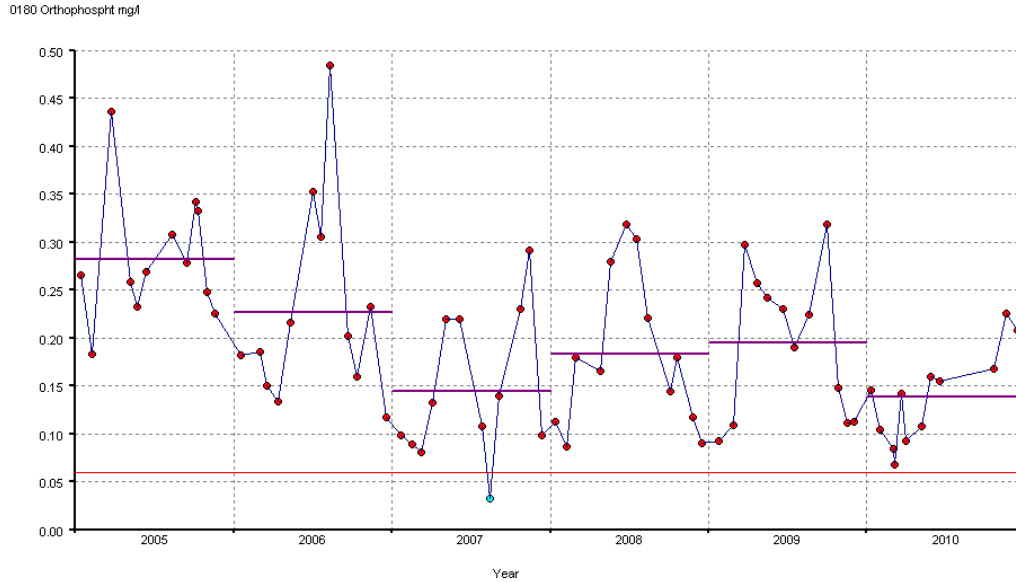
Time Series Plot - Restricted (0180 Orthophosphat mg/l) 27-02-2007 to 17-01-2011  
**58952160; TREATED SEWAGE EFFLUENT FROM NORTON-JUXTA-TWYXCROSS STW, COTTAGE LANE,**



## Gilwiskaw Brook – Ashby de la Zouch, u/s Packington STW – Orthophosphate, 2005 - Present

The red line shows the conservation objective for the SAC (this sample point is upstream of the SAC boundary)

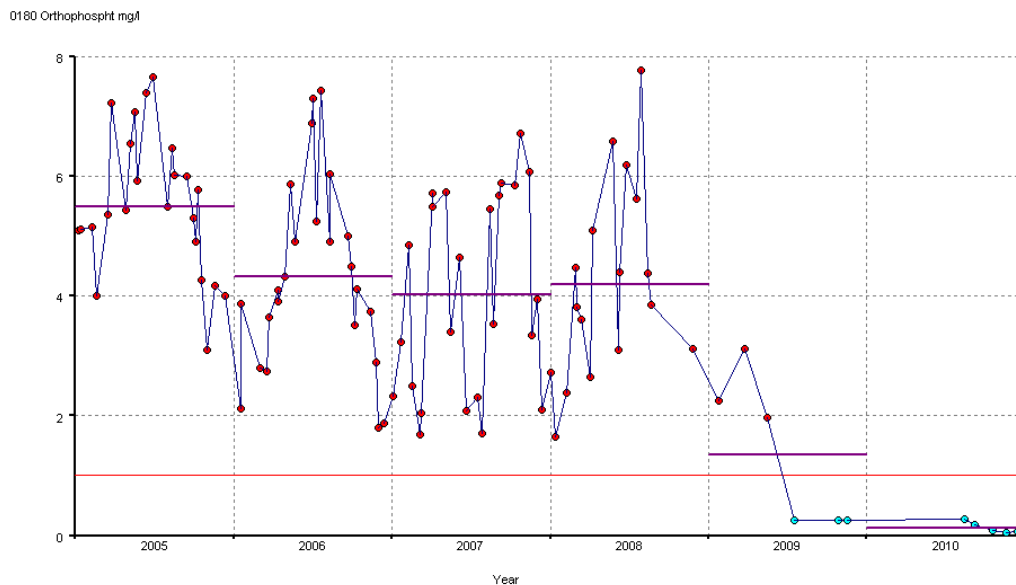
Time Series Plot - (0180 Orthophosphat mg/l) 13-01-2005 to 15-12-2010  
**58809180; GILWISKAW BROOK - ASHBY-DE-LA-ZOUCH**



## Packington STW – Orthophosphate, Showing recent final effluent quality and improvements in final effluent quality (2010)

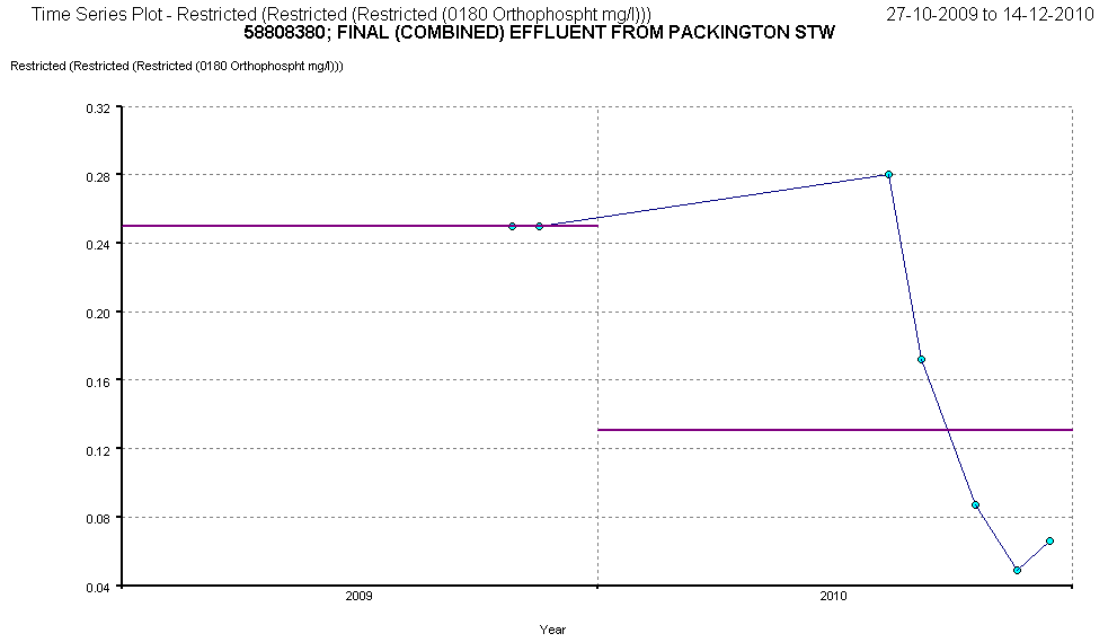
The red line shows the consent limit (1mg/l) which will be in place in 2012

Time Series Plot - (0180 Orthophosphat mg/l) 07-01-2005 to 14-12-2010  
**58808380; FINAL (COMBINED) EFFLUENT FROM PACKINGTON STW**



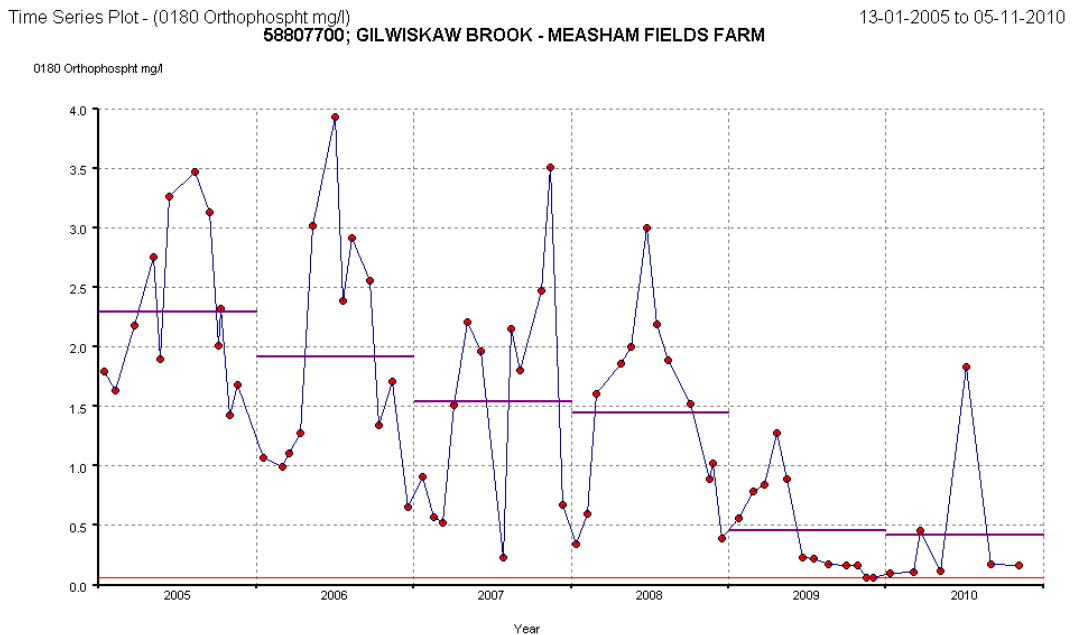
**Packington STW – Orthophosphate (restricted to show recent improvements in final effluent quality from 2009)**

This shows that the consent limit (1 mg/l) would be met with the final effluent quality as shown in the graph below



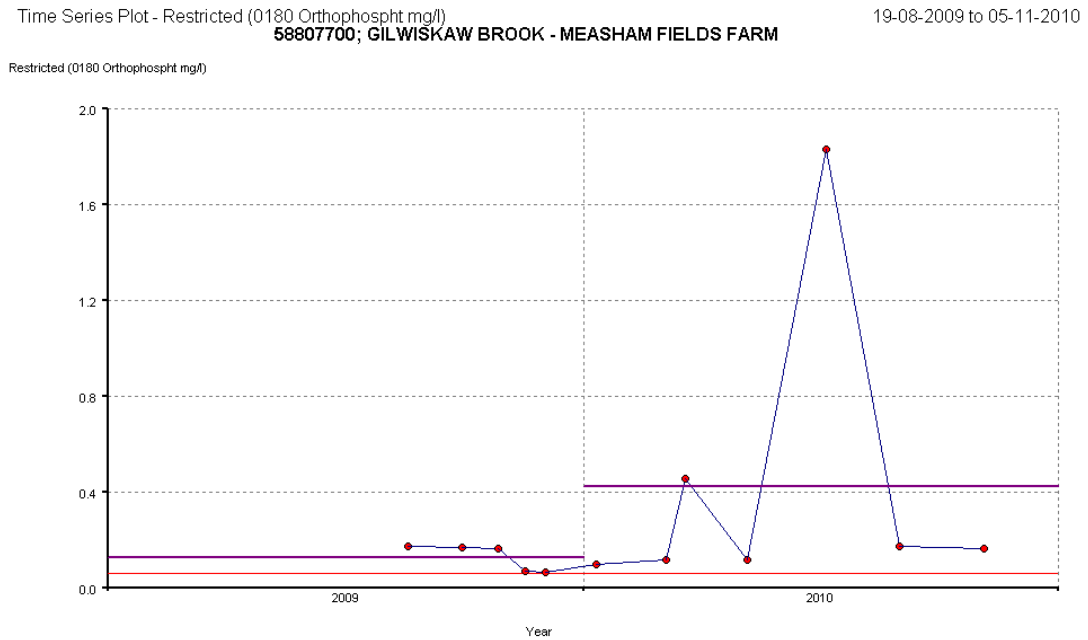
**Gilwiskaw Brook – Measham Fields Farm, d/s Packington STW – Orthophosphate, 2005 - Present**

The red line shows the conservation objective for the SAC (0.06mg/l)



**Gilwiskaw Brook – Measham Fields Farm, d/s Packington STW – Orthophosphate (restricted to show recent improvements in water quality from 2010)**

The red line shows the conservation objective for the SAC (0.06mg/l)



## APPENDIX 8

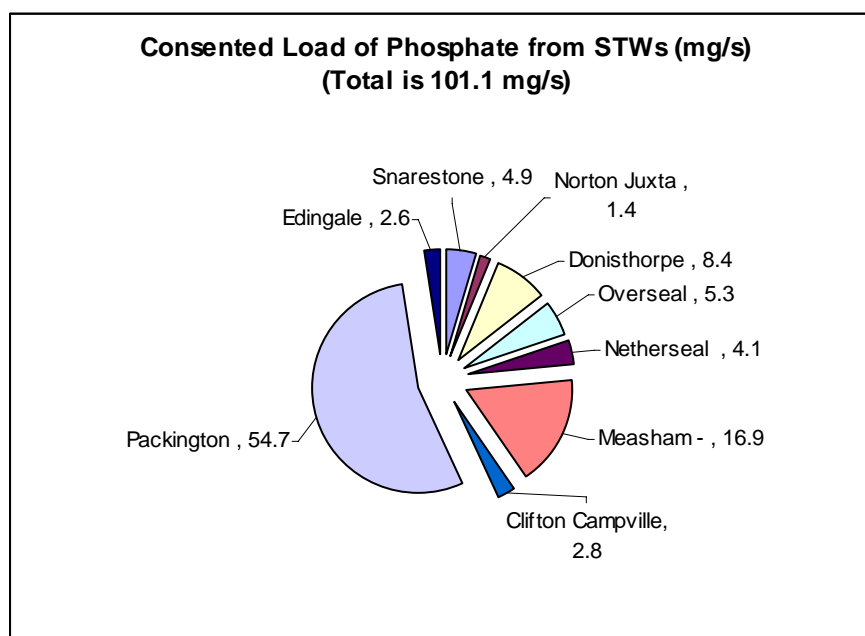
### Further Information on Point Sources in the R Mease Catchment

#### The Relative Contributions from the nine STWs

The following table lists the nine key STWs in the catchment, detailing the consented phosphate limit, the dry weather flow (DWF) consented volume and the calculated maximum consented load. The STWs have been ranked in load order.

STWs	P Limit (mg/l)	DWF Consent (m3/d)	DWF Consent (l/s)	Load (mg/s)
Packington	1	4729	54.7	54.7
Measham -	1	1464	16.9	16.9
Donisthorpe	1	725	8.4	8.4
Overseal	1	455	5.3	5.3
Snarestone	1	420	4.9	4.9
Netherseal	2	176	2.0	4.1
Clifton Campville	2	121	1.4	2.8
Edingale	2	113	1.3	2.6
Norton Juxta	2	60	0.7	1.4

The loads are illustrated graphically below.

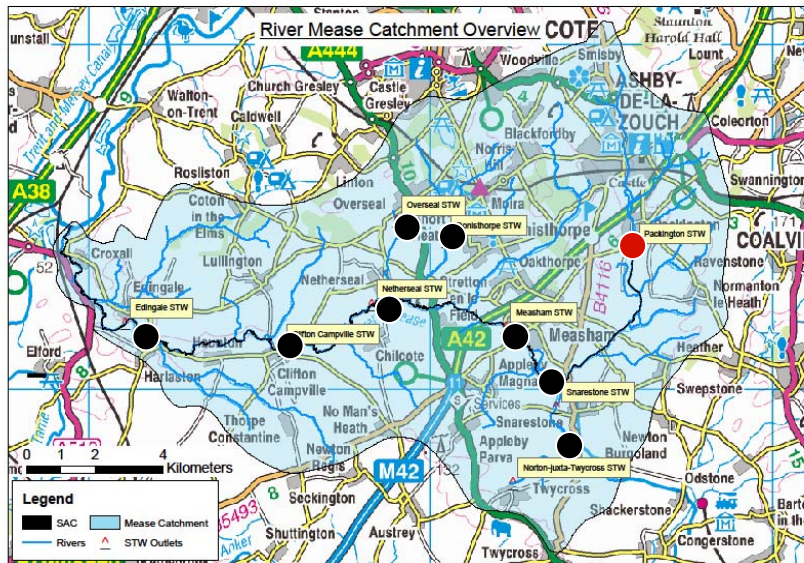


In reducing the phosphate loads in the River Mease by tackling STWs, then the priority must be to consider those works contributing the greatest load, therefore Packington STW is where we need to focus. This is even more so

when we consider that Packington STW is towards the head of the catchment, at the upper boundary of the SAC. Improvements here will have a more pronounced local impact due to the limited dilution and any benefits will be experienced along the full length of the SAC.

The STWs at Measham and Donisthorpe, together with Packington STW are significant contributors (80% of total load from treatment works).

The relative positions of the STW are shown in the map below.



### Contribution from Point Source (STWs) Vs the Contribution from Diffuse Source (agriculture, run-off etc) and the Removal – Impact on the Environment

The phosphate concentrations in the River Mease are contributed by one of two sources; point source (primarily Severn Trents STWs) and diffuse (urban and rural).

We know that current diffuse and point source contributions are both in excess of the WFD and conservation objectives. To secure a given standard in the river (assuming that total P is equivalent to ortho-P), and that P is conservative once it is released to the environment, then we should be aiming to get both diffuse and point source discharges down to the given standard. If this is WFD then we would be looking to secure final effluent consent limits in the long term at 0.12mg/l or in the case of the conservation objectives, this would currently be 0.06mg/l. Alternatively if we over achieve on one then a more relaxed limit could be achieved on the other.

The Scenario below demonstrates this principle in that the 0.06mg/l target will only be attained when both sources are discharging at this quality.

The example is loosely based around Packington STW and the Gilwiskaw brook.

**Scenario 1**

Calculated P concentration in watercourse downstream of a STW discharge.

Flow upstream of STWs 237 l/s  
 Flow from STWs 55 l/s

Varying the quality of the Final Effluent and P concentration in the upstream watercourse.

STW	Final Effluent P mg/l	Upstream P = 0.14 mg/l	Upstream P = 0.12 mg/l	Upstream P = 0.06 mg/l
3.50		0.77	0.75	0.70
1.00		0.30	0.28	0.24
0.50		0.21	0.19	0.14
0.12		0.14	<b>0.12</b>	0.07
0.06		0.13	0.11	<b>0.06</b>

Reductions in diffuse become more significant as tighter point source limits are secured.

In practice it is not this simple, actual river phosphate concentrations are likely to be significantly better than shown, because, over achievement of consent compliance and phosphate (also known as Ortho-phosphate) is the parameter measured in the environment and which the standard relate to is only a proportion of the total phosphorus, which we consent on and on which the calculations are based..

**Urban Wastewater Treatment Directive UWWTD Sensitive Area Eutrophic (UWWTD SA[e])candidate - River Mease submission**

Prior to the conclusion of the RoC, the River Mease was submitted for possible designation as a Sensitive Area [eutrophic] under the Urban Wastewater Treatment Directive by the Environment Agency. The candidate report was submitted in 2005 and the submission accepted in 2007. This meant that phosphate removal was required at major STWs in the catchment. For the purposes of this study, this only meant Packington STW was of a sufficient size to be considered. The phosphate limit imposed for this STW was also higher than the limit imposed under the Habitats Regulations. However the surveys carried out for the candidate submission show there is damage to the Mease SAC and are shown in summary below.

Macrophyte studies on the River Mease and the Gilwiskaw Brook at all points surveyed for the candidate submission report showed that the macrophyte communities were already eutrophic or at risk of becoming eutrophic. The Gilwiskaw Brook downstream of Packington STW (the only UWWTD qualifying discharge within the catchment) was regarded as being badly

damaged. The 2003 and 2004 surveys carried out up and downstream of Packington STW both demonstrated that the discharge from the qualifying discharge had an impact on the environment, causing a decline in Mean Trophic Rank (MTR) score.

Diatom surveys confirmed that the River Mease catchment can be regarded as being eutrophic although, they suggested that deterioration as a result of the final effluent from Packington STW may be related to factors other than nutrient enrichment. Indication that the biological quality of the watercourse (invertebrate data) was seen as being fair to good.

The UWWTD criteria for orthophosphate (0.1mg/l) was exceeded at all the sampling points within the candidate Sensitive Area, indicating that the river is nutrient enriched.

Under the performance regimes at the time this report was submitted (2005), it was apparent that conditions within the River Mease were improved by the flow from the Gilwiskaw Brook, into which the qualifying discharge from Packington STW is made.

The report recommended that the Gilwiskaw Brook/River Mease catchment be designated as a Sensitive Area (Eutrophic). The submission was successful and the catchment was designated as an UWWTD SA[e] in October 2007.

Although the designation of the Candidate was successful, phosphorus removal was not considered under the UWWTD because the only qualifying discharge (Packington STW), along with 8 other sewage treatment works in the catchment are due to or have already received phosphorus limits on their Consent under the Habitats Regulations.

This Candidate submission report used data from 1999 – 2004, for a submission in 2005. Therefore, with the introduction of 3 phosphorus removal schemes under AMP4 (Snarestone STW, Donisthorpe STW and Norton juxta Twycross STW) and other improvements throughout the catchment (including the recent improvements in the final effluent at Packington STW), the levels of orthophosphate within the catchment are likely to have improved since.

## **Research and Development**

### **The Effectiveness of Phosphate Removal, Phosphate Removal Methods and Treatment Methods in other Countries**

A paper was reviewed which related to types of treatment and effectiveness of treatment: This was a Natural England Review of Advances Wastewater Treatment Processes for phosphate removal (see references for full details)

This paper showed that typical wastewater contains 3-4mg/l phosphate as orthophosphate and 6-8mg/l as Total Phosphorus.

A number of treatment types were also discussed which included chemical dosing and biological nutrient removal along with possible concentrations which could be met with the differing treatment types.

Finally, a summary was written of methods for orthophosphate removal in other countries around the world. Most of the countries chose to utilise biological and chemical treatment in order to achieve very low phosphorus concentrations of between 0.3mg/l and 1mg/l in the final wastewater effluent.

A second paper was reviewed which looked at the effectiveness of phosphorus removal at sewage treatment works (**Environment Agency 'Effectiveness of Phosphorus removal by sewage treatment works, April 2009'**)

Although a fuller summary can be found in the appendix, the report used data taken for Urban Wastewater Treatment Directive Reporting and concluded that as studies carried out post phosphorus removal have seen improvements in water quality, they are not as marked/noticed in diatoms/chlorophyll. Although sewage treatment works may be a major contributor, other factors may also exist which would require further investigation.

Conclusions from Report showed that using Mean Trophic Rank scores for macrophytes, conditions became less eutrophic in 1 out of 27 cases studied. Individual macrophyte species showed an improvement in percentage cover but did not provide evidence of a clear and consistent directional response to phosphorus removal.

A number of reasons for this were suggested which included inadequate monitoring, the biological communities were not being affected by the levels of orthophosphate, not enough time had elapsed between phosphorus removal and reporting and the changes in orthophosphate concentrations were not enough to trigger a response in the biological communities.

### **Research and Development in Partnership with Severn Trent Water Ltd Total Phosphorus and Ortho-Phosphorus**

As part of the Balancing Carbon Programme, a study is being undertaken between the EA and Severn Trent regarding an ortho-phosphate investigation to include a literature review and an understanding of fractions of phosphorus, which of these contribute to eutrophication and whether seasonality should be taken into account when permitting. In order to do this it is proposed a trial (outside the Mease catchment) is designed to observe actual ecological effects at varying P levels, and identify how the balance of total-P, ortho-P and other P fractions contribute to the total P level at which eutrophication becomes an ecological issue.

### **Review the effectiveness of AMP4/5 P Schemes in the Mease - biology (Have the AMP schemes delivered biological improvements)**

It is clearly evident that P removal schemes in the catchment that are currently operational, have had a significant impact on P concentration within the River Mease. When the remaining six schemes become operational P concentrations will be further improved. However these alone will not bring the concentrations down to the required numeric targets.

The recent surveys from Natural England and the Environment Agency have demonstrated that the SAC is not meeting favourable condition (in relation to the designated features), although it may be seen as unfavourable (no change).

Assessment of the Physico-chemical biological and fishery status by the Environment Agency has indicated that the water bodies comprising the Mease fail to achieve Good status. High P concentrations from STWs may be one of the factors, but not the sole issue here. The designated features will not all be sensitive to P concentrations and those that are will take time (>2 years ?) to show signs of recovery once levels of P are reduced.

It is important to note that intermittent pollution incidents have been identified as a limiting factor to the status of the River Mease. P removal will help, but there is also a significant role for pollution prevention visits/self reporting and sewerage catchment management.

There is a need to keep monitoring to see if AMP schemes are providing benefit, especially once the AMP limits for the remaining 6 works come into force.

There are currently 3 schemes in place with phosphorus removal in the R Mease catchment (Snarestone STW, Donisthorpe STW and Norton-juxta-Twycross STW). These schemes were put in place during the AMP4 period (approximately 2008). Routine chemical sampling data will be available from this period and will form part of the review of existing and additional sampling to be completed by the end of August 2011. The biological data (historic and additional sampling currently being undertaken) will also be reviewed by the end of August 2011 where possible. Some additional biological invertebrate sampling has been programmed for 2011 and this will be reviewed in early 2012.

## **Asset Management Plans (AMP)**

- **National Environment Programme – NEP**

The Environment Agency produces the National Environment Programme (NEP) after consultation with the water industry, Natural England, Countryside Council for Wales and numerous other organisations. The NEP is a list of environmental improvement schemes that ensure that water companies meet European directives and national targets. The NEP forms part of the final Asset Management Plan (AMP) that determines the overall level of investment that water companies need to make over a five year period based on the new prices set by Ofwat.

In the last AMP period (AMP4) water companies were allowed £3.5 billion as part of the NEP to improve sewage treatment works and storm overflow discharges to the water environment.

In the latest AMP period (AMP5) £4.4 billion will be invested as part of the NEP and there are 1861 schemes to improve, monitor or investigate water company assets. 121 of these schemes are to specifically improve water quality relating to SSSIs, habitat sites and biodiversity.

When planning our programme of water industry improvement schemes to go into the NEP, we want to ensure that we get the best value for the environment and make the best use of resources. We will target our efforts on areas where we have strong supporting evidence that we need to improve water industry discharges to correct a failure of water quality. One of our top priorities for improvement schemes in the PR09 NEP were schemes that secured compliance with the Habitats Directive (HD).

The Environment Agency ensures that the five year National Environment Programme is implemented by water companies. We report annually to Ofwat on the environmental performance of the water industry and Ofwat uses our assessments to decide if they should impose financial penalties on the companies.

- **Influencing STW Ltd / CCW / OFWAT and Development of a robust business case**

The Agency will advise the Govt and Ofwat on the programme of schemes it requires Companies to deliver to meet agreed and required environmental targets. The Agency, as in PR09, did work on assessment of disproportionate costs for WFD schemes to inform and advise the Govt on this issue. The Govt then decides on the scope and scale of the final programme based on the environmental needs as identified by the Agency, the costs of the programme to deliver those needs as identified by Ofwat and what it considers is affordable for the country.

In the time leading upto a periodic review, then Agency will assess its priorities and gather evidence to support these priorities. Experience of previous periodic reviews has demonstrated that Habitats Directive schemes have gained strong support for inclusion in the AMP NEP. However in proposing future tightening of P limits on the nine STWs in the catchment, we have to have to consider the fact that these works have already received investment. We would therefore expect to provide evidence of the degree to which previous schemes have delivered the required outcome (show that P removal is effective in improving the SAC status) and to demonstrate the magnitude of any shortfall between the then current and target phosphate concentrations and based on evidence to promote further tightening of P limits through AMP.