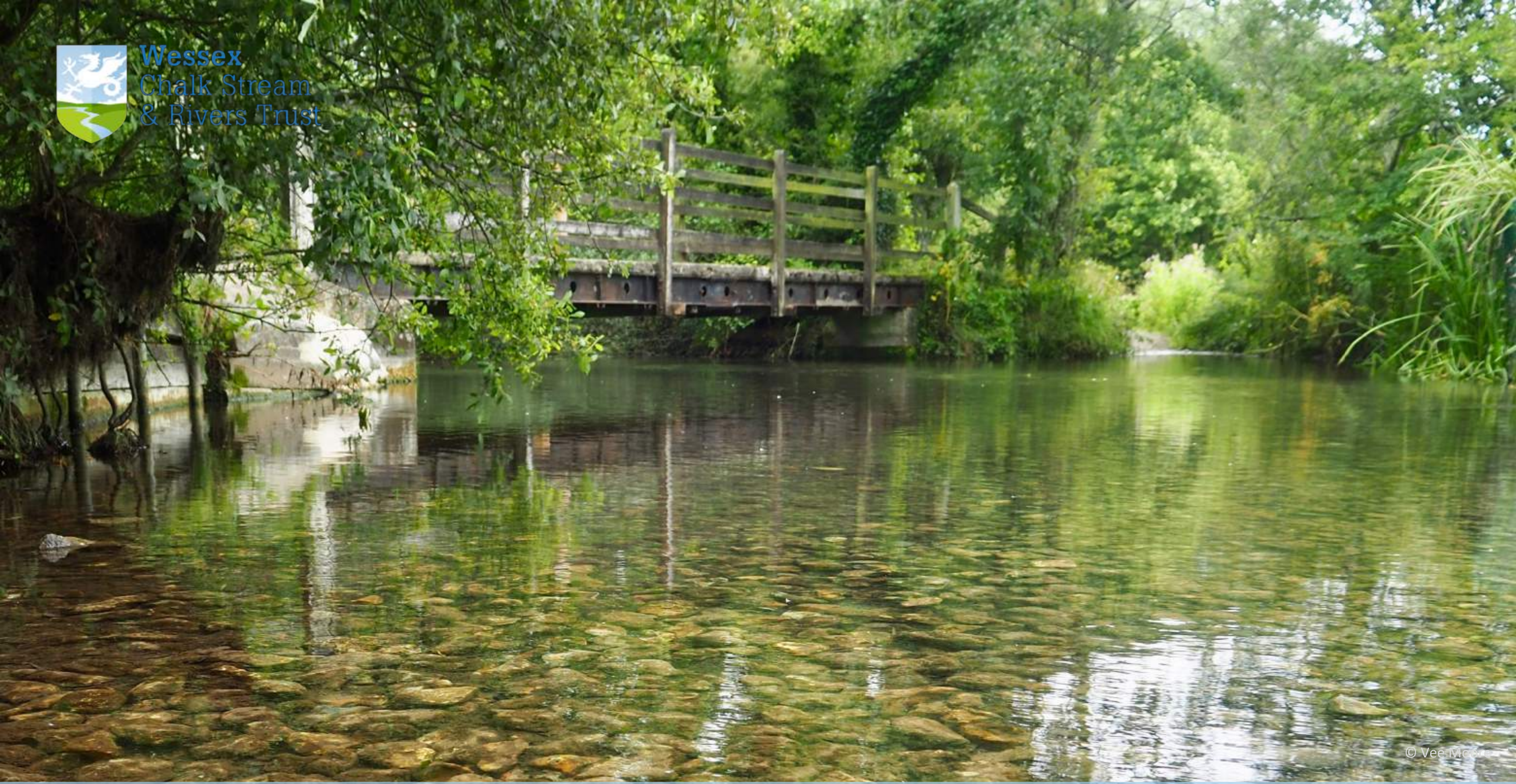

River Meon

Catchment Invertebrate Fingerprinting Study

The River Meon Catchment Invertebrate Fingerprinting study is a partnership project between the Wessex Chalk Stream & Rivers Trust, the Test & Itchen Association and the South Downs National Park Authority.

Wessex Chalk Stream & Rivers Trust

Test & Itchen Association

SOUTH DOWNS NATIONAL PARK

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Report produced by Andy Blincow and Rupert Kelton, WCSRT

Wessex Chalk Stream & Rivers Trust

Invertebrate Fingerprinting

The River Meon Catchment Invertebrate Fingerprinting study is a partnership project between the Wessex Chalk Stream & Rivers Trust (WCSRT), Test & Itchen Association (T&IA) and South Downs National Park Authority (SDNPA) with the objective of identifying the current and recent pressures facing the River Meon through collection and analysis of robust scientific data.

Aquatic 'macro' - invertebrates are a valuable monitoring tool for determining the biological water quality (condition) of our rivers. Invertebrates can provide a direct indication of biologically significant levels of pollution or environmental conditions due to their preference or tolerance to changes in these elements. Due to the extended aquatic life stages of many groups, aquatic invertebrates also provide a longer-term picture of water quality than is available from chemical water quality sampling.

The River Meon Catchment Invertebrate Fingerprinting (CIF) study is a continuation of previous studies undertaken within the Wessex region, including those on the Hampshire Avon and Test & Itchen. The CIF studies examine the responses of aquatic invertebrate communities to a range of environmental stressors, including; sedimentation, low flow conditions, phosphate pollution, organic pollution, and pesticide pollution.

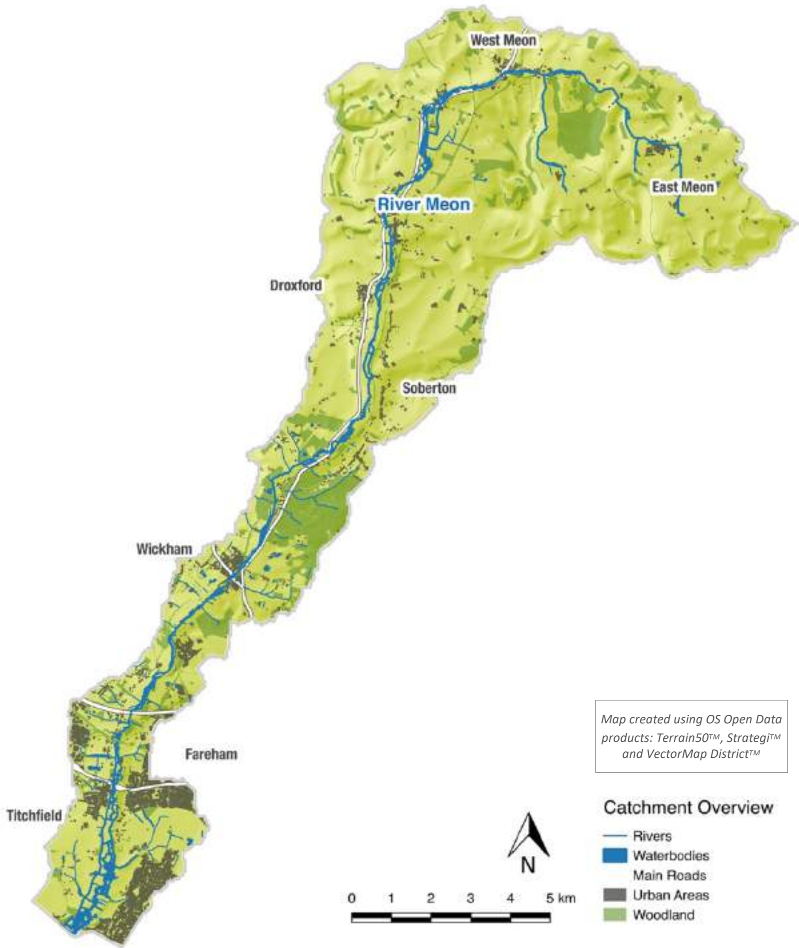
The first phase of the study comprised collection of samples by the WCSRT and SDNPA volunteers from 12 locations within the catchment. Samples were collected and preserved in the 2017 accepted spring and autumn seasons using the standardised 'kick sample' methodology with samples preserved and later identified to species level. Analysis of the community structure at each sample site was undertaken utilising the following five biometric indices: PSI (fine sediment), TRPI (total reactive phosphorous index), Saprobic (organic pollution), LIFE (low-flow impacts) and SPEAR (pesticide impacts).

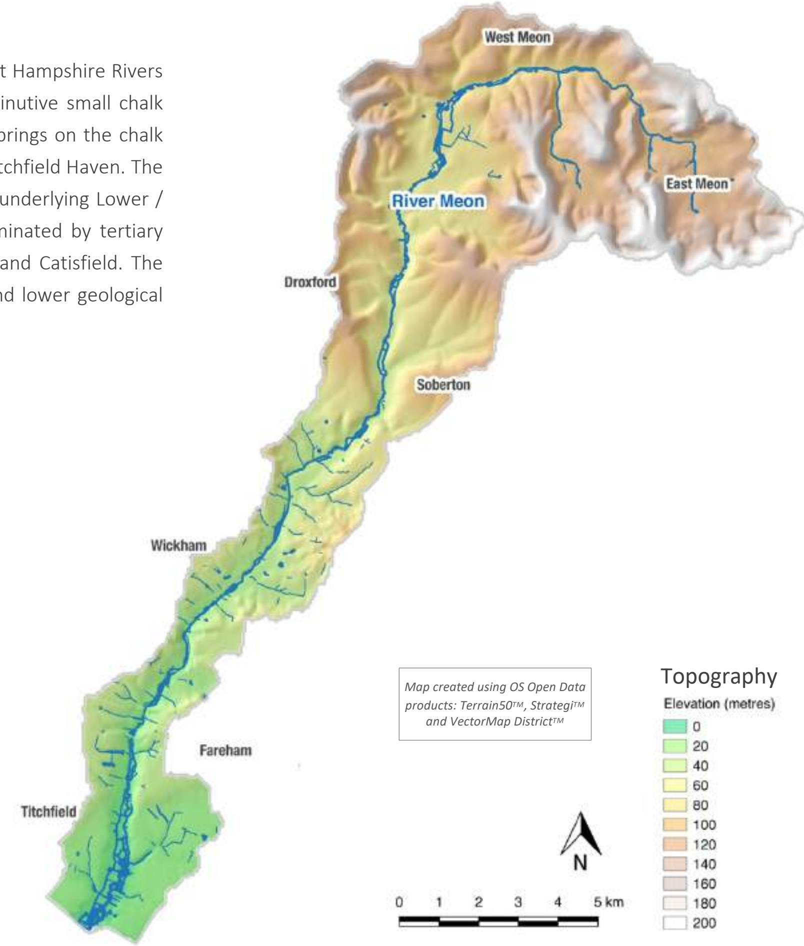
The second phase of the study examined historic invertebrate monitoring data supplied by the Environment Agency (EA). For three sample locations at which a consistent dataset was available analysis of the community structure was undertaken using the same five biometric indices. EA monitoring data was predominantly to family level, however data towards the latter part of the period contained some species level date allowing for mixed taxon biometric analysis.

Catchment Overview

River Meon Catchment

The River Meon drains a fairly small catchment, covering an area of 108 sq. km on the western extent of the East Hampshire Rivers Operational Catchment. Often referred to as a 'Cinderella river', the Meon is one of Hampshire's several diminutive small chalk streams – less famed but less obviously modified than the larger Test & Itchen or Avon. The river rises from springs on the chalk downs near East Meon, flowing south-westwards for approximately 34km before discharging into the Solent at Titchfield Haven. The upper and middle reaches of the catchment are predominantly rural and the landscape is characterised by the underlying Lower / Upper chalk deposits. Downstream of Wickham, the character of the catchment changes with a geology dominated by tertiary London Clay / Reading Sands and progressive urbanisation including the heavily populated areas of Titchfield and Catisfield. The Meon has a greater flow range than many typical chalk streams due to a combination of increased gradient and lower geological permeability.

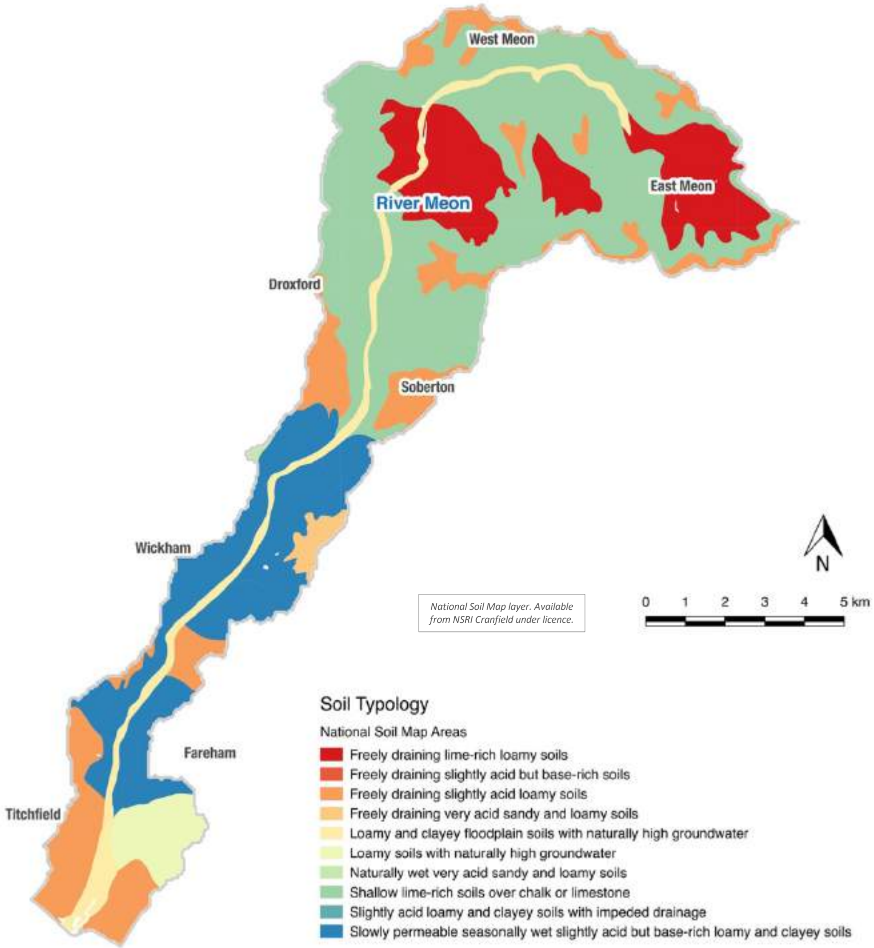


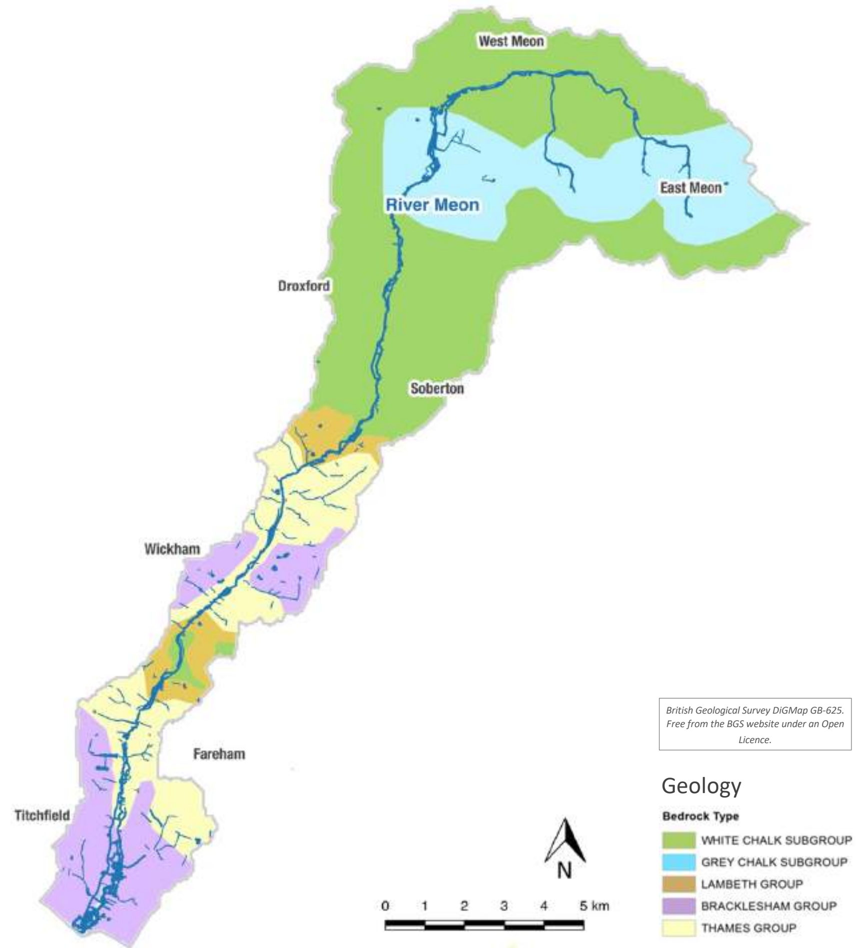


South East River Basin District

Soil Typology

Soils influence the character of our local landscapes and play a key role in the regulation of environmental services such as nutrient cycling, water quality, water flow regulation and carbon storage. The natural permeability of soils also has a significant influence on the drainage of water. The more permeable the soil the greater potential for surface water infiltration, potentially reducing the likelihood and severity of spate floods and overland transport of sediment, nutrients and pollutants. Poor land management practices can result in compaction and loss of soils with resulting impacts upon the water environment.





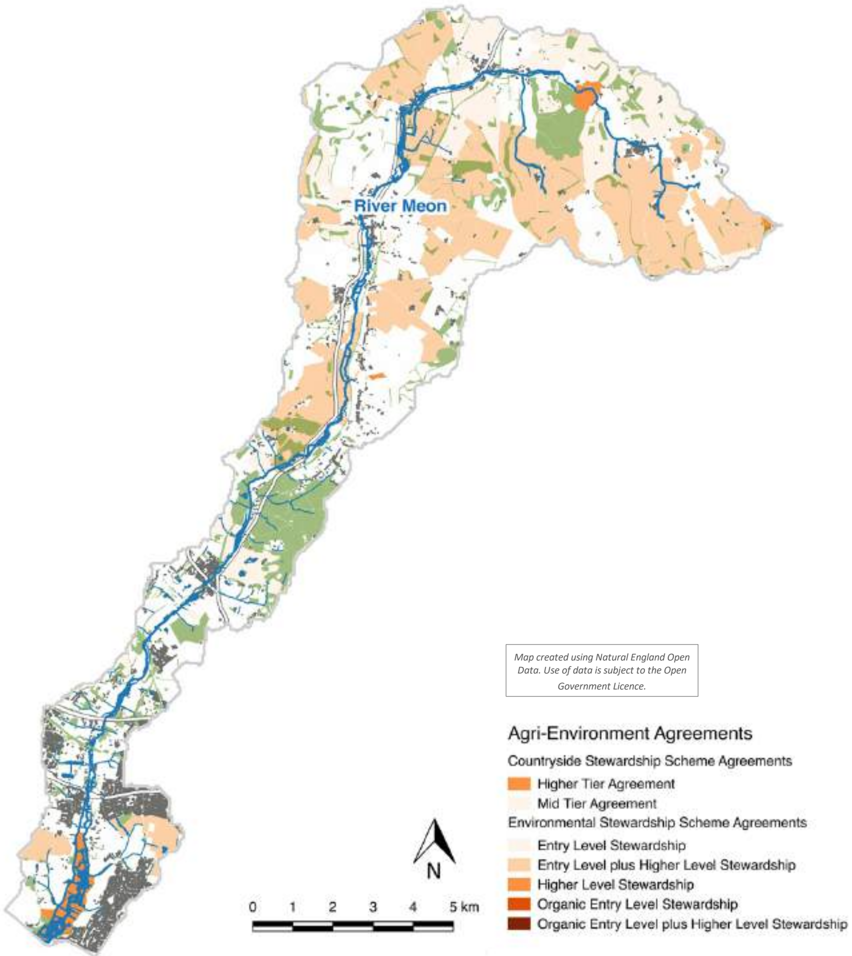
Bedrock Geology

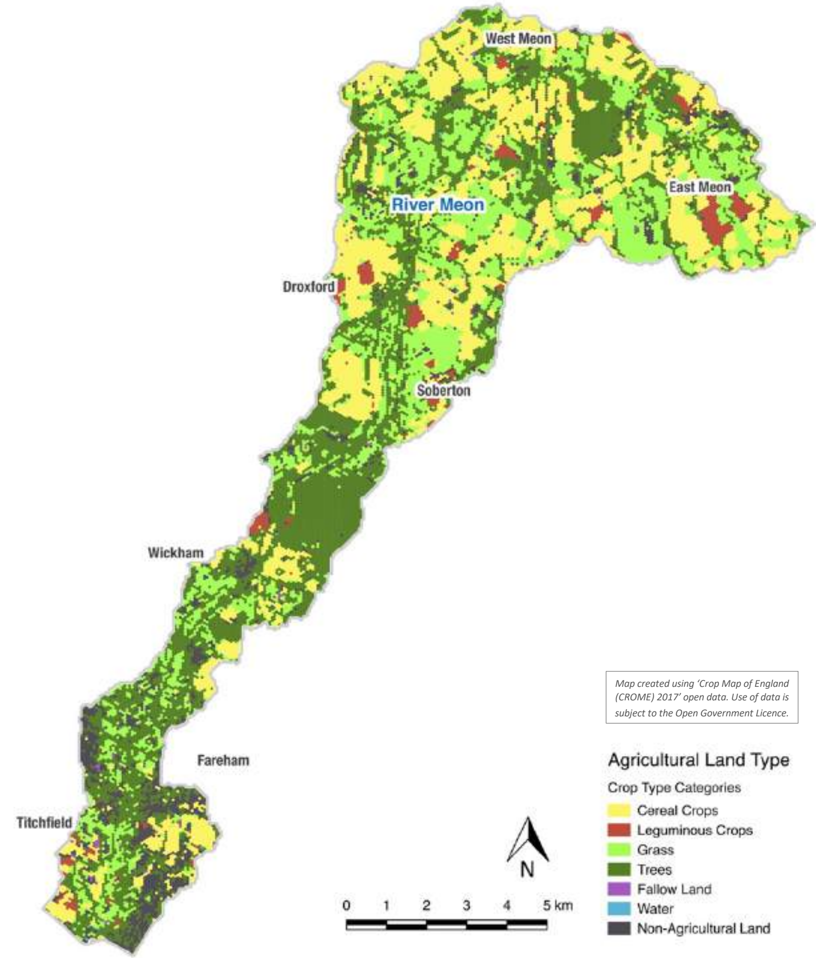
Local geology is highly influential upon streams and rivers. The source of the Meon is the aquifers and springs associated with the permeable Upper / Lower chalk deposits in the upper catchment. Typically, chalk streams display a relatively small difference between winter and summer flows, limited spate events, a water temperature range remaining closer to the annual mean than in rivers receiving more surface runoff. Chalk streams also typically have water chemistry with a high pH and high levels of calcium carbonate. Tertiary geology such as the London Clay / Reading Sands dominant in the mid-lower Meon catchment are generally less permeable to precipitation, typical resulting in increased overland flow.

Agri Environment Agreements

DEFRA provides funding for farmers, woodland owners, foresters and land managers to make environmental improvements. Under the current Countryside Stewardship (CS) Scheme and previous Environmental Stewardship (ES) Scheme there are multiple tiers available to farmers and landowners depending upon the environmental significance of their land. This includes Higher Tier (HT) and Mid Tier (MT) for CS and Entry Level, Higher Level, Organic Entry Level and Organic Higher Level for ES. The available land management options vary between scheme tiers.

The map below displays the take-up of agri environment schemes in the Meon catchment. An increased coverage of land and adoption of higher tiers is apparent within the upper catchment and headwaters.





Agricultural Practices

The agricultural activities practiced in a catchment define the character of the rural landscape and can have a significant influence on the aquatic environment, including: sources of diffuse water pollution (sediment, organic and inorganic pollutants), soil health, localised water abstraction and quality of riparian habitat.

The chalk downland in the upper Meon catchment is dominated by a combination of grazed grassland and cereal crops with occasional leguminous crops present. Prevalence of cereal crops reduce in the mid - lower catchment, with wooded areas becoming more common. Towards the lower catchment smaller pastoral fields dominate combined with increasing urbanisation.

Environmental Stressor

SEDIMENT

Sediment

'Sediment' is the mineral and organic material that is eroded, from all across a catchment (source), transported via rills, gullies, drains etc. (pathway) and eventually deposited into the river network (receptor). Naturally occurring sediment is an important part of a healthy river system and is an essential component of many aquatic ecosystems. However, problems arise when human activity increases the amount of sediment entering the watercourse, impacting on the river's natural processes.

What is the problem?

Increased levels of sediment can have a number of impacts on our river catchments. In particular, sediment is known to damage aquatic ecosystems by blocking light to aquatic plants, clogging the gills of fish and smothering benthic habitats, suffocating the organisms and eggs that reside in the substrate. Similarly, sediment is often a contributor to increased nutrients and chemical contaminants that can cause water pollution and impact on the provision of clean drinking water, increasing the associated costs of water treatment and price to the consumer. Sediment is also known to impact on flood risk, reducing the rivers carrying capacity of water and slowing down and in severe cases impeding conveyance through the river catchment. Finally, chalk river catchments are renowned for the amenity value they provide for recreational angling and the associated economic benefits that this delivers. Fisheries, salmon and trout stocks in particular, are vulnerable to the impacts of sediment on water quality and spawning habitats.

What are the solutions?

There are a range of well established measures for reducing sediment loads entering rivers and streams. These measures are primarily aimed at mitigating the availability of sediment sources, decreasing the likelihood of material being mobilised and disconnecting pathways via which sediment (mainly soil) is carried to watercourses. In the Meon catchment there are mechanisms to deliver these mitigation measures, including initiatives that assist landowners with improving land use and soil management to deliver benefits to farm businesses as well as the environment. Further information and advice for landowners is available from:

Wessex Chalk Stream & Rivers Trust

A clear solution for farmers — Catchment Sensitive Farming

Environment Agency

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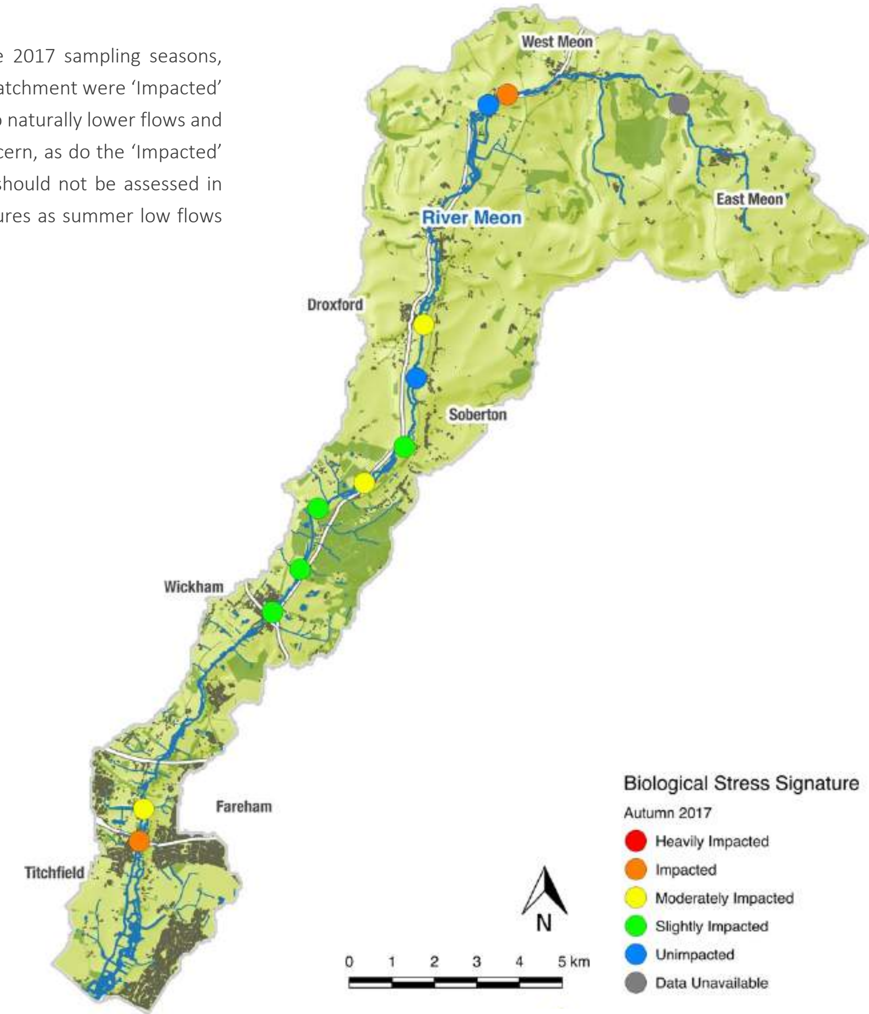
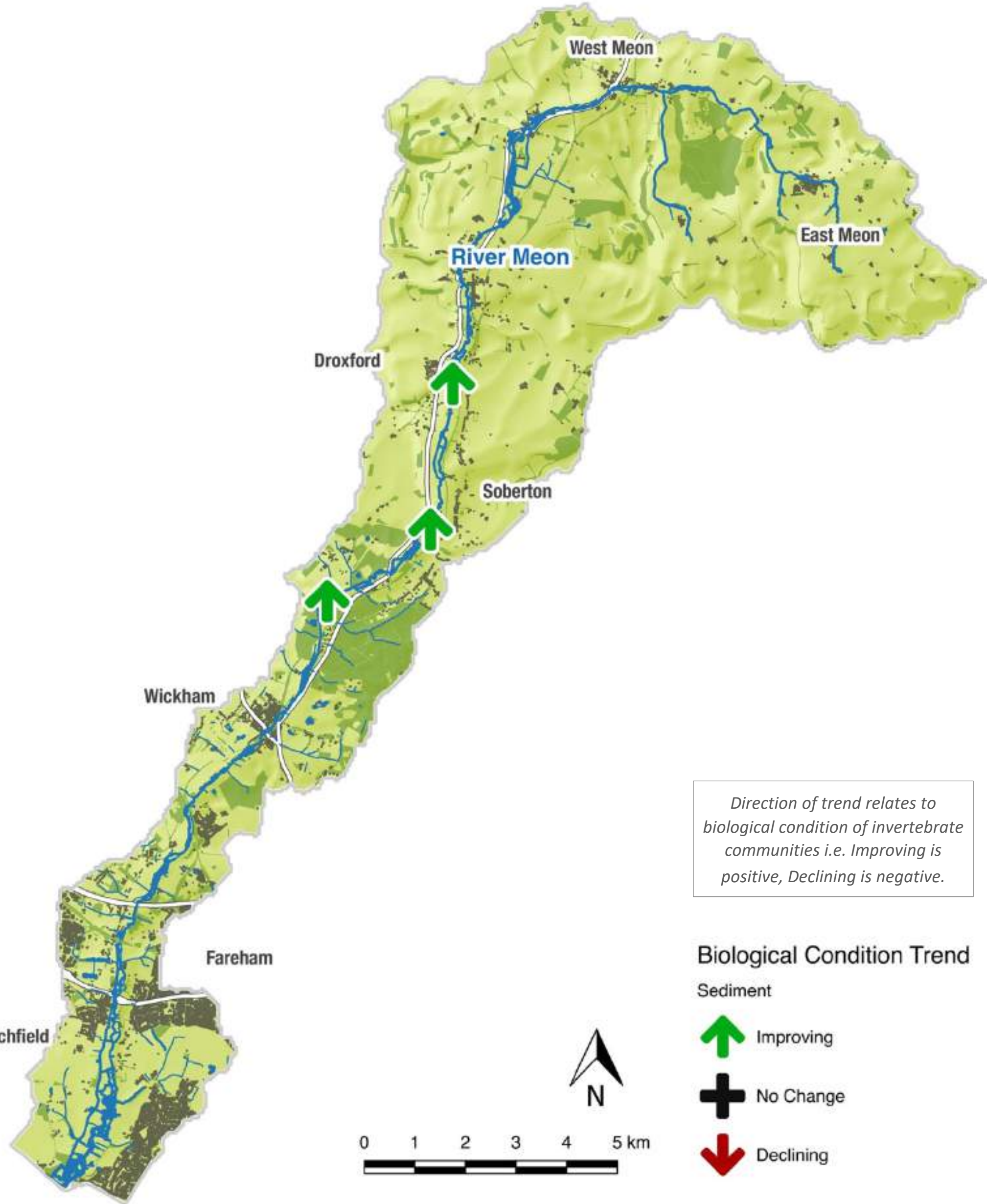
Sediment – Species Level Results

Sediment stress signatures for the Meon were predominantly 'Slightly Impacted' or 'Impacted' during the 2017 sampling seasons, however in spring Abbey Meadows at the bottom of the catchment and Drayton Vinns Farm at the top of the catchment were 'Impacted' and 'Moderately Impacted' respectively. Increases in stress signatures in autumn are generally expected due to naturally lower flows and the continued presence of raised stress signatures at Abbey Meadows ('Moderately Impacted') warrants concern, as do the 'Impacted' communities (Moorhen Fisheries and Titchfield Hill) in the lower and upper catchment. Specific pressures should not be assessed in isolation and low flows in particular must be considered where communities indicate sediment stress signatures as summer low flows conditions are associated with increased sediment deposition.



Proportion of Sediment-sensitive Invertebrates (PSI)

The PSI index is a biomonitoring tool that is designed to identify the degree of sedimentation in rivers and streams. The tool was developed using previous literature and expert knowledge of invertebrate morphological/physiological traits that are associated with either a sensitivity or tolerance to fine sediment. The PSI score describes the percentage of sediment-sensitive taxa present in a sample and the metric is calculated using scores for the particular invertebrate groups.



Sediment – Historic Trend Analysis

At all sites within the mid catchment of the River Meon, analysis of historic EA invertebrate data demonstrates a statistically significant increase in biological condition. This indicates that pressure from fine sediment deposition has decreased since 2002, resulting in improved conditions for the invertebrate community. Interestingly, no significant seasonality was recorded within the dataset at any of the sites.

EA sample points were selected for analysis based upon the relative continuity of datasets. Intermittent data is available from additional EA sample points within the catchment upon request.

Amongst the riverflies particularly sensitive to sediment are some of the iconic species found in southern chalk streams e.g. the southern iron blue *(Baetis niger)*

Adult

© Dr. Cyril Bennett

Nymph

© Dr. Cyril Bennett

Dry fly pattern

Environmental Stressor

LOW FLOWS

Cracked soil
Photo: Terry Freedman

Low Flows

Chalk streams can derive as much as 80% of their annual discharge from groundwater stored in chalk aquifers. Overland flow from rainfall is therefore only a relatively small component of natural stream flow, meaning that chalk streams benefit from a relatively stable hydrological regime. However, human activity through historic management practices and increasing abstraction have caused changes to the natural flow regime which do not always support a healthy ecology.

What is the problem?

Abstraction is the removal of water, permanently or temporarily, from a water body. It can alter the natural flow regime either directly on surface water flows or indirectly by groundwater pumping, depleting groundwater levels. Other human activity which regulates flow e.g. by physically modifying rivers with impounding structures such as weirs and sluices can similarly alter natural flow regimes. The changes brought about by these human activities can have a number of subsequent effects on the in-river ecology, including; increasing sedimentation rates, loss of habitats, loss of in-channel geo-morphological diversity and hindering the passage of migratory fish.

What are the solutions?

Abstraction of water is controlled through a licensing system operated by the Environment Agency. Recent changes to this system have seen a drive towards more sustainable abstraction and a regime that meets the environmental obligations set by the Water Framework Directive. Similarly, water companies have responsibility for planning how they can meet future customer demand, whilst maintaining an affordable price and not damaging the environment. Finally, as consumers we are all responsible for saving and using water more efficiently and can seek information and advice from local water companies on improving efficiencies in homes and businesses.

In addition to reducing demand and making the abstraction of water more sustainable, there are also a number of opportunities for using natural processes to mitigate the impacts of human activity:

River Restoration:

Improving river habitats and restoring natural process, e.g. through channel narrowing can increase the resilience of rivers to low flow conditions and support the recovery to a more naturally functioning ecosystem.

Wetland Restoration:

Wetland restoration can increase the attenuation of water, which can benefit groundwater recharge, support river summer base flows and improve water quality and sediment retention.

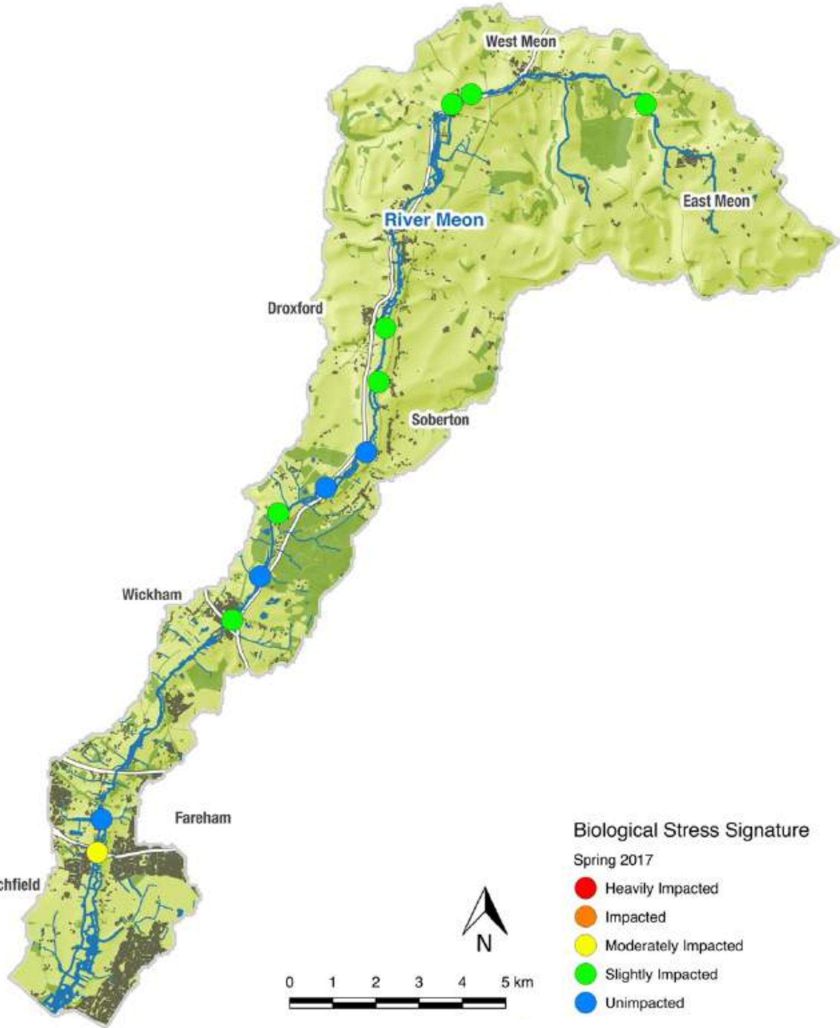
Catchment Management:

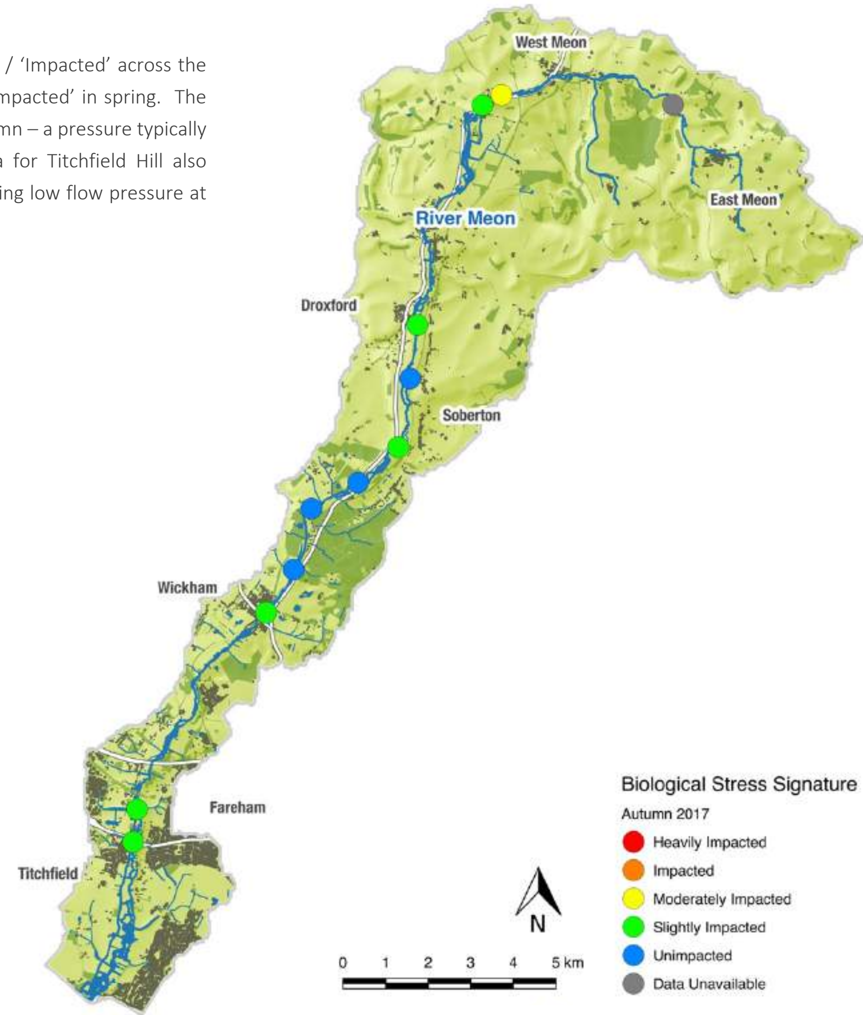
Changes in land management practices can alter the way water moves through or is retained in the catchment. Similarly, soil management practices can have a significant influence on water infiltration within the catchment.

© Jack Perks

Flow – Species Level Results

The data indicate that invertebrate communities across the catchment were predominantly 'Slightly Impacted' / 'Impacted' across the 2017 sample seasons. Only Titchfield Hill the farthest downstream sample point was notable as 'Moderately Impacted' in spring. The data demonstrated Moorhen Fisheries in the upper catchment to be 'Moderately Impacted' by low flows in autumn – a pressure typically experienced in the headwater locations as aquifers become depleted. In autumn the biometric index data for Titchfield Hill also demonstrated a community on the borderline of 'Moderately Impacted' / 'Impacted' ranks (LIFE : 7.00), indicating low flow pressure at this site across seasons – potentially a response to poor habitat parameters.





Lotic Invertebrate Flow Evaluation (LIFE)

The LIFE index is used to assess the impact of variable flows on benthic populations. Many freshwater invertebrates have precise requirements for particular current velocities or flow ranges, and certain taxa are ideal indicators of prevailing flow conditions. The method links qualitative and semi-quantitative change in riverine benthic macroinvertebrate communities to prevailing flow regimes. The higher the LIFE score in comparable flow-habitat sections of watercourse the higher the prevailing flow conditions

Low Flows – Historic Trend Analysis

At Droxford Church and St Clair's Farm on the River Meon, analysis of historic EA invertebrate data demonstrates a statistically significant increase in biological condition. This indicates that pressure from low flows has decreased at these sites since 2002, resulting in improved conditions for the invertebrate community. Analysis demonstrates no significant change in biological condition as a result of low flows at Mislingford Weir

EA sample points were selected for analysis based upon the relative continuity of datasets. Intermittent data is available from additional EA sample points within the catchment upon request.

Amongst the riverflies particularly sensitive to low flows are some of the iconic species found in southern chalk streams e.g. the yellow may dun *(Heptagenia sulpherea)*

Adult

© Dr. Cyril Bennett

Nymph

© Dr. Cyril Bennett

Dry fly pattern

Environmental Stressor

PHOSPHOROUS

Phosphorous

Phosphorous, initially in the form of dissolved phosphate is essential to human, animal and plant life. It is a fundamental component of a healthy water environment, supporting aquatic plants which produce oxygen and create habitats needed by other aquatic organisms, such as invertebrates and fish. Phosphates of various solubilities are commercially produced and used in many cleaning, industrial and agricultural production processes. Excess dissolved phosphate acts as a pollutant and is the main cause of eutrophication in rivers, especially when combined with other pressures such as low flow conditions.

There are many potential sources of phosphorous in river catchments; including diffuse sources such as fertiliser applied to agricultural land, sewage discharges, domestic waste water and agricultural point sources such as cress farms and slurry stores.




What is the problem?

Human activity within our river catchments can cause an increase in the accumulation of commercially produced phosphorous in the freshwater environment. This leads to unbalanced and uncontrolled growth of aquatic plants and algae in a process known as ‘eutrophication’. Algae are dying and decomposing over short timescales all the time, both under natural and eutrophic conditions. However, where particularly high biomasses of plants and algae are rapidly decomposed by oxygen-consuming bacteria a 'sag' in dissolved oxygen can occur, limiting survival of sensitive invertebrates and fish while compromising the ecological health of the watercourse. The problem can also have detrimental effects on the supply of water for drinking water, recreational use of rivers and the production of food such as fish.

What are the solutions?

Tighter regulation has led to activity from water companies, cress farmers and the farming industry to address some of the major sources of phosphorous. However, large numbers of small sources from domestic waste water and septic tanks are still a significant problem.

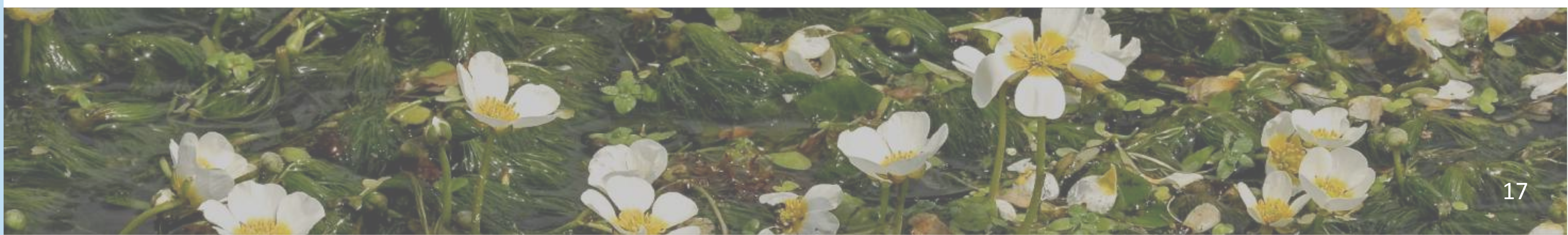
Householders can help reduce their impact on the water environment by using low phosphate or phosphate-free products and ensuring septic tanks are properly maintained.

Diffuse agricultural sources of phosphorous are still a significant issue but there are a number of well established soil, land and fertiliser management solutions available to help improve farm business efficiencies and reduce the impact of farming activities on the environment. For further information contact:

Wessex Chalk Stream & Rivers Trust

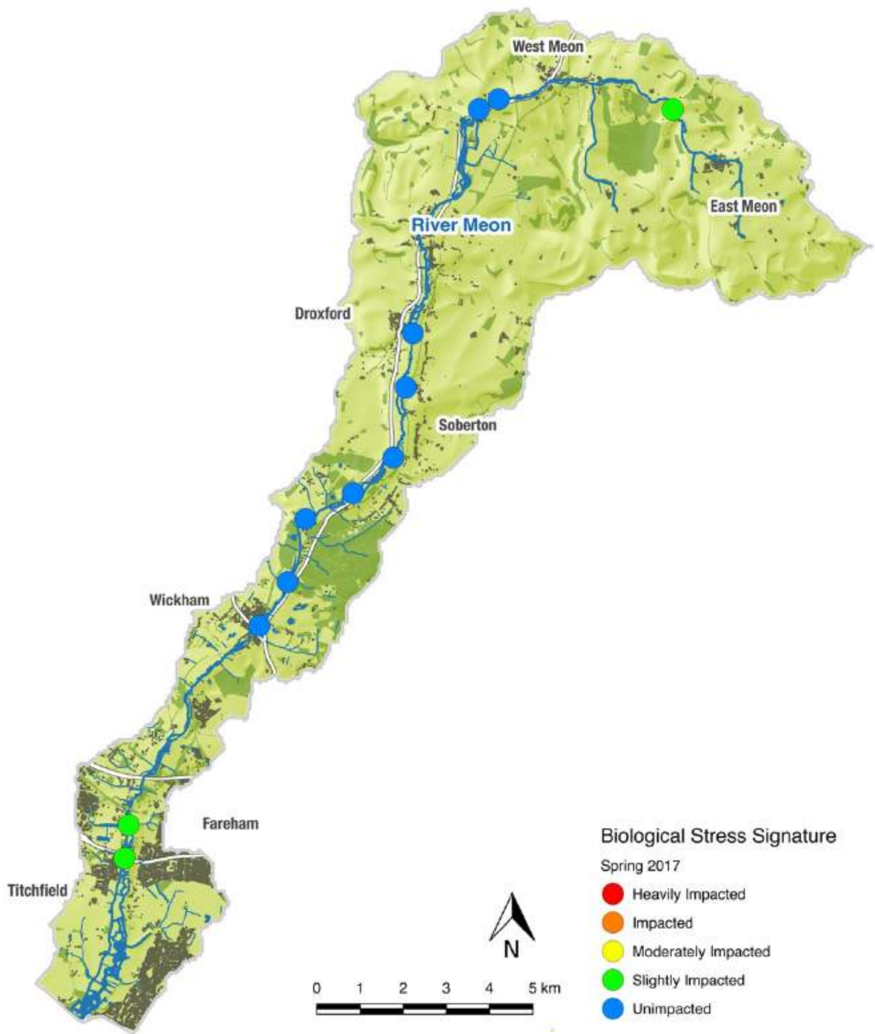
A clear solution for farmers
CATCHMENT SENSITIVE FARMING

Environment Agency



Phosphorous – Species Level Results

Overall, the invertebrate communities throughout the catchment were 'Unimpacted' or only 'Slightly Impacted' by phosphorous. There was a slight within-class increase in pressure recorded throughout the catchment in autumn, which may be explained by a combination of prolonged summer low flow stress and the influence of increased precipitation resulting in overland flows. Abbey Meadows in the lower catchment was 'Moderately Impacted' in Autumn, a cause for concern when considered in combination with the sedimentation and pesticide stress signatures also recorded at this sample site.



Total Reactive Phosphorous Index (TRPI)

TRPI uses the proportion of phosphorous tolerant and intolerant macroinvertebrates in a sample according to various river types, seasons and alkalinity. The more Total Reactive Phosphorous (TRP) sensitive families present the lower the TRPI% and the less chemical TRP present in the watercourse. The biometric has been developed by Dr. Nick Everall and Dr. Martin Paisley using macroinvertebrate datasets from a wide UK geographical range.

Phosphorous – Historic Trend Analysis

Analysis of historic EA invertebrate data demonstrates no statistically significant change in biological condition at the mid-catchment sample sites. This indicates no significant change in phosphorous pressure over the period of the dataset. Interesting no significant seasonality was recorded within the dataset at any of the sites.

EA sample points were selected for analysis based upon the relative continuity of datasets. Intermittent data is available from additional EA sample points within the catchment upon request.

Amongst the riverflies particularly sensitive to phosphorous are some of the iconic species found in chalk streams e.g. blue winged olive *(Serratella ignita)*

Adult

© Dr. Cyril Bennett

Nymph

© Dr. Cyril Bennett

Dry fly pattern

Environmental Stressor

ORGANIC POLLUTION

Organic Pollution

Organic pollution is caused by human activities which introduce easily degradable organic material into the watercourse. Typically, the most common sources of organic pollution are sewage works, sewage misconnections, farm waste and organic fertilisers such as farmyard manure.

What is the problem?

Organic pollutants are principally a problem because they increase the activity of aerobic bacteria which decompose organic waste and, in doing so, use up more oxygen from the water as they respire. This increase in Biochemical Oxygen Demand (BOD) puts pressure on other aquatic organisms such as invertebrates and fish which also depend on oxygen for respiration. Organic pollution can also lead to a number of other problems such as physically smothering the stream bed, exacerbating eutrophication where plant communities benefit from residual nutrients left behind after organic material has been decomposed and finally, increased levels of ammonia, which is toxic and harmful to aquatic life.

What are the solutions?

Over the past twenty years there has been a steady reduction in organic pollution, largely due to investment from water companies and improved farming practices from the agricultural sector. Farmers are required to meet regulations on storing silage and slurry (SSAFO Regulations) as well as standards linked to the Basic Payment Scheme, with additional compliance measures for farmers in Nitrate Vulnerable Zones (NVZs).

In addition, investment from water companies to improve treatment at sewage treatment works is on-going and includes efforts to address sewage misconnections in urban areas.

Advice and support to help farmers meet the various standards and regulations is available through NE Catchment Sensitive Farming, as well as advice and capital grants to contribute towards capital works including; watercourse fencing, yard infrastructure, cattle tracks and other items. In addition, the EA Farming Rules For Water introduced in 2018 provide guidance on getting full value from fertilisers and soil.

Further information is available from:

Wessex Chalk Stream & Rivers Trust

A clear solution for farmers CATCHMENT SENSITIVE FARMING

Environment Agency

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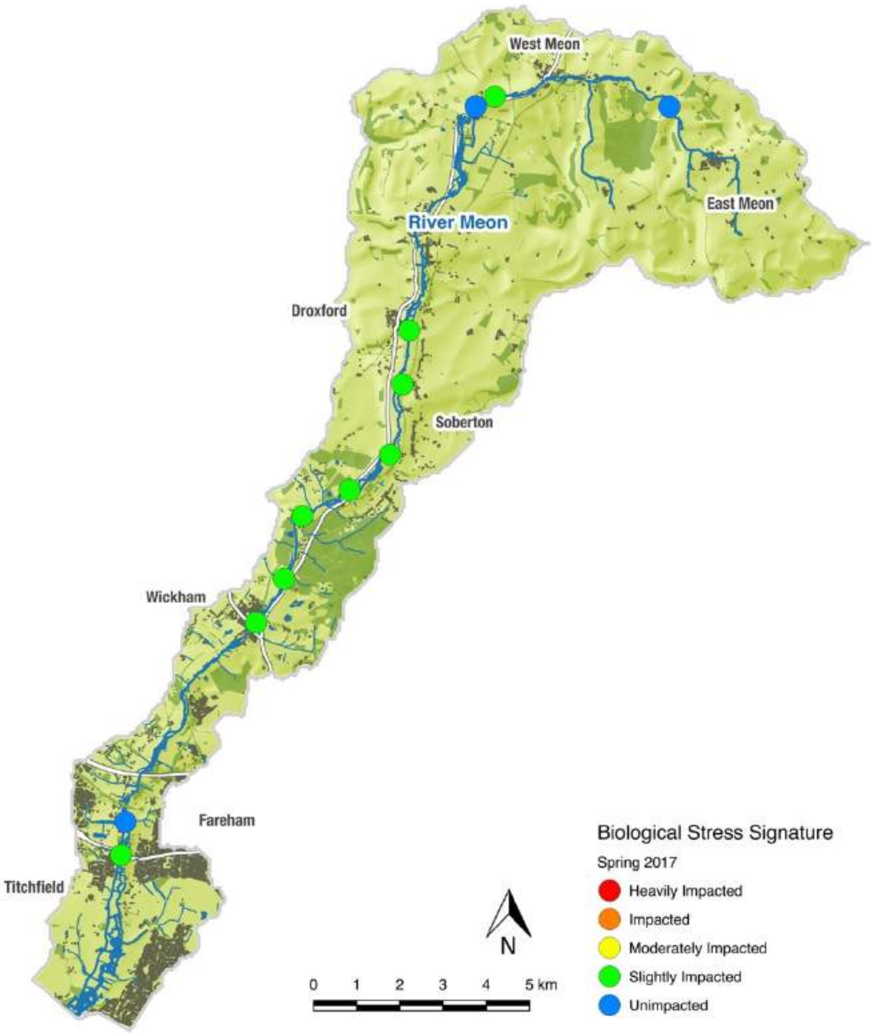
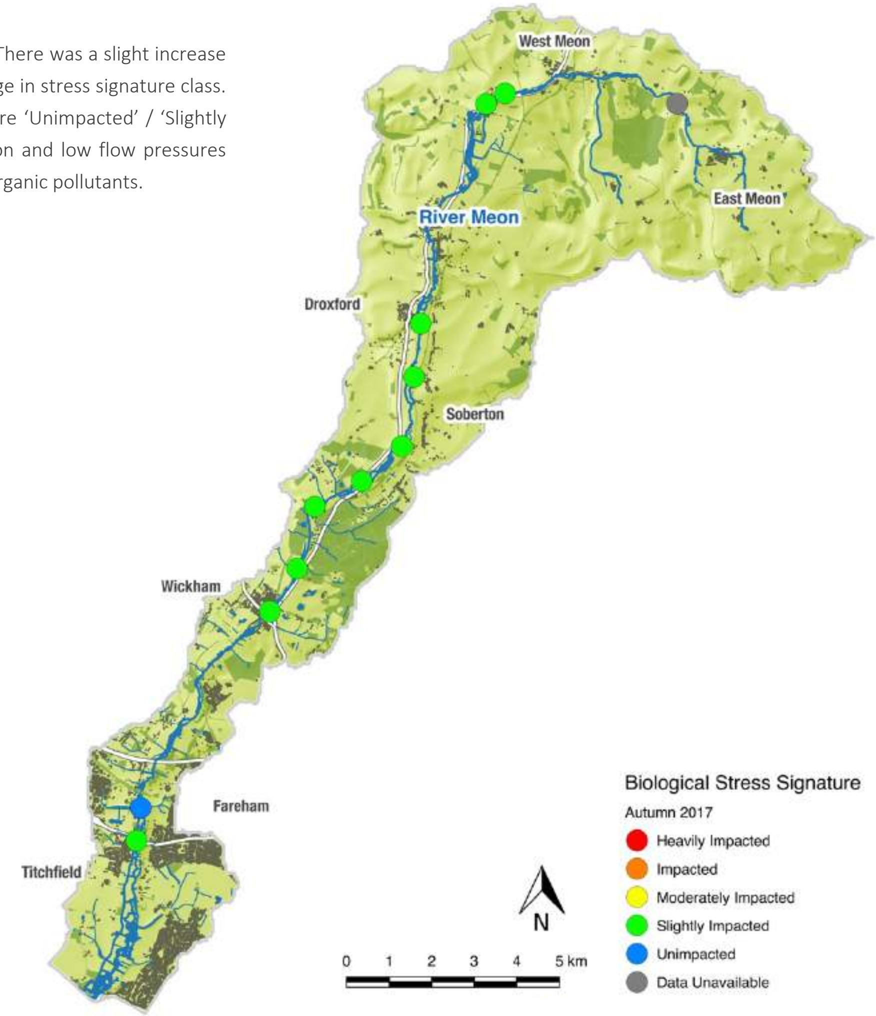
Organic Pollution – Species Level Results

Overall, invertebrate communities within the Meon catchment were 'Slightly Impacted' by organic pollution. There was a slight increase in stress signature in most communities across the catchment in autumn although not to the extent of a change in stress signature class. Interestingly, sites at the far downstream extent of the catchment (Abbey Meadows & Titchfield Haven) were 'Unimpacted' / 'Slightly Impacted' by organic pollution in spring and autumn sample seasons, indicating that elevated sedimentation and low flow pressures recorded at these sites are acting upon the invertebrate community largely independently of pressures from organic pollutants.





Saprobic Index

The Saprobic index is an alternative to the Average Score per Taxon (ASPT) biometric used to assess the impact of organic pollution on macroinvertebrate taxa. The Saprobic index has been shown to provide a more revealing insight into the nature and quantum of organic pollution in watercourses than other methods, as it accounts for species differences in tolerance to organic pollutants (e.g. elevated ammonia and lowering dissolved oxygen regimes).

Direction of trend relates to biological condition of invertebrate communities i.e. Improving is positive, Declining is negative.

Organic Pollution – Historic Trend Analysis

Analysis of historic EA invertebrate data demonstrates no statistically significant change in biological condition at the mid-catchment sites. This indicates no significant change in pressure from organic pollution over the period of the dataset. Interesting no significant seasonality was recorded within the dataset at any of the sites.

EA sample points were selected for analysis based upon the relative continuity of datasets. Intermittent data is available from additional EA sample points within the catchment upon request.

Amongst the riverflies particularly sensitive to organic pollution are some of the iconic species found in southern chalk streams e.g. the Yellow Sally *(Isoperla grammatica)*

Adult

© Dr. Cyril Bennett

Nymph

© Dr. Cyril Bennett

Dry fly pattern

Environmental Stressor

PESTICIDES

Pesticides

Pesticides are chemical or biological substances used to control pest species that may impact food production or human health. Pesticides may take many forms, commonly including those intended to target insect pests (insecticides), nuisance plants (herbicides) and fungal infections (fungicides) within the agricultural sector. Some are used as seed treatments prior to sowing, but most crop protection products are diluted in water and applied to crops using specialised spraying equipment. Pesticides are also used outside agriculture, for example, to improve the quality of gardens, golf courses and sports pitches and to maintain roads and railways.

In addition to pesticides, a wide range of complex chemical compounds (e.g. those of pharmaceutical origin) may enter the aquatic environment through routes other than agricultural application; agricultural sources of these compounds are likely to pose the most significant threat to aquatic invertebrate communities in the UK. Pesticides may enter watercourses in various ways, but the most common are diffuse pollution, dilution or when bound to sediment.

What is the problem?

The primary impact of pesticides to aquatic invertebrates is the direct toxicity of insecticides to specific taxa. For some pesticides, significant ecological effects have been detected at concentrations likely to arise from normal usage, giving cause for concern about other pesticides that have been given little or no attention in field situations. The toxicity of sediment-bound pesticides and of pesticide additives or carriers have rarely been addressed in either laboratory or field situations hence the impact is not known for many groups and species of invertebrates. In addition, due to the persistence of many pesticides many active compounds including those now banned are still present in the environment decades after application.

Not all pesticide poisonings result in lethal toxicity of invertebrates. Smaller "sublethal" doses of some pesticides can lead to changes in behaviour, impaired fecundity (reproduction) and lowered tolerance to other environmental pressures. In addition, pesticides can have wider ecosystem impacts, including changes in habitat availability i.e. macrophyte (aquatic plant) loss through herbicide pollution.

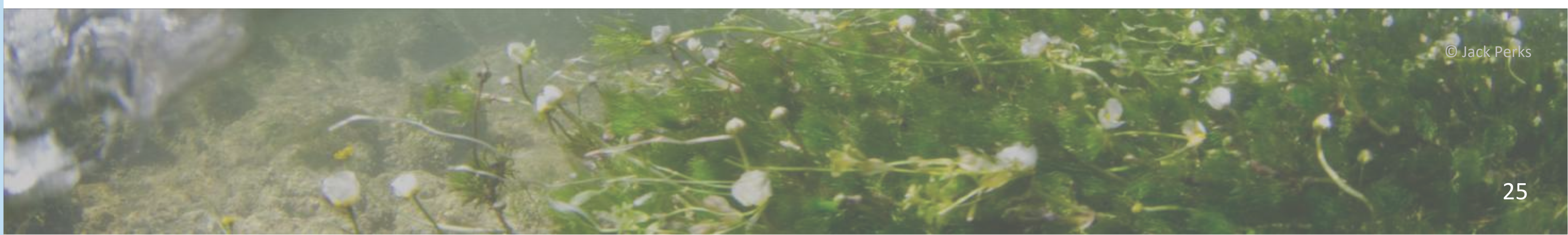
Pesticides within the aquatic environment may also have potential impacts upon human health, for example the regular exceedance of metaldehyde (a molluscicide applied in pellet form to arable land) in treated waters within the UK.

What are the solutions?

There are a number of well established soil, land and fertiliser management solutions available to help improve farm business efficiencies and reduce the impact of farming activities on the environment.

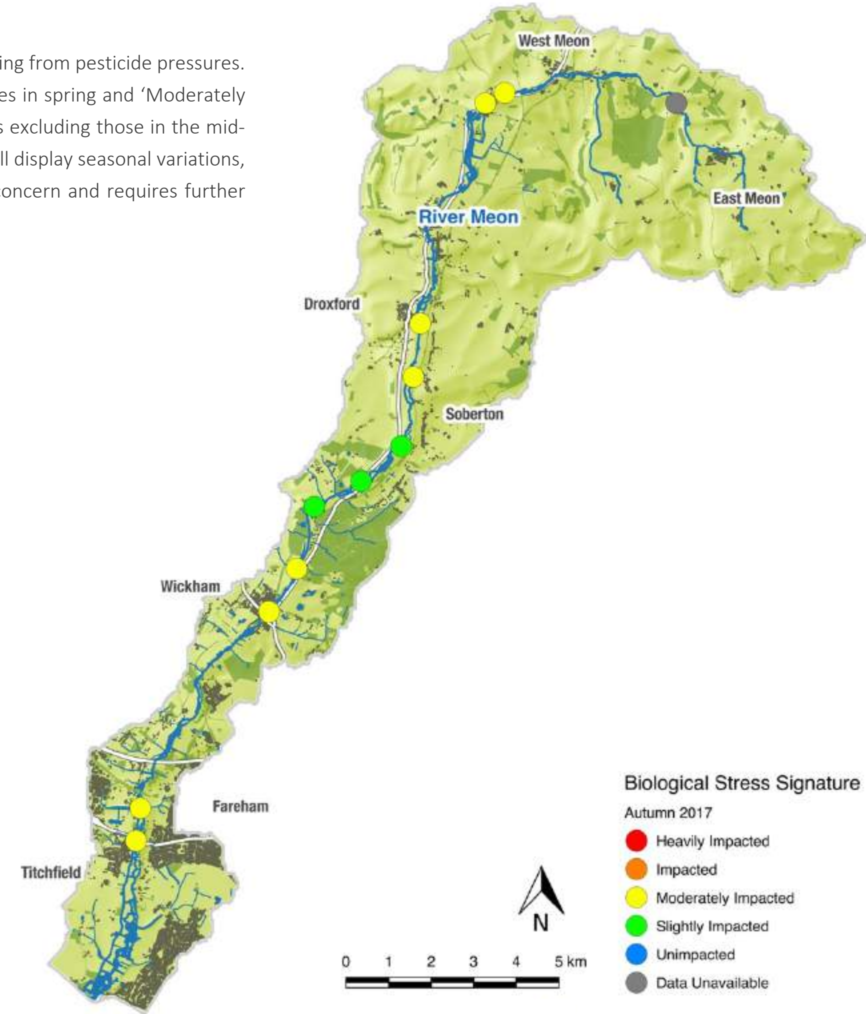
Reducing the overall amount of pesticide applied to land is the most beneficial way of significantly reducing the risk of pesticides impacting upon aquatic invertebrates. This may be achieved via the use of a combination of voluntary and more targeted regulatory mechanisms.

Householders can help reduce their impact on the water environment by reducing the use of pesticide containing products through adoption of natural pest control techniques or switching to organic based products.



Pesticides – Species Level Results

Invertebrate communities at multiple locations across the Meon catchment were demonstrated to be suffering from pesticide pressures. The sample site at Droxford Church is of particular concern, exhibiting a community 'Impacted' by pesticides in spring and 'Moderately Impacted' in autumn. Pesticide stress signatures were raised across the catchment in autumn, with all sites excluding those in the mid-catchment 'Moderately Impacted'. Whilst it is acknowledged that chalk stream invertebrate communities will display seasonal variations, particularly increasing stress signatures in autumn samples, the results from across the catchment raise concern and requires further investigation and potential action to address this pressure.



SPEcies At Risk (SPEAR)

The pesticide-specific bioindicator system SPEAR (SPEcies At Risk) was developed to link complex chemical exposure and effects to responses in macroinvertebrate communities. The index is based on biological traits responsive to the effects of pesticides (i.e. insecticide toxicity, physiological sensitivity, spatio-temporal co-occurrence of organisms and toxicants) and post-contamination recovery (generation time, migration ability). An advantage of the SPEAR indicator system is its simple expression of balance between pesticide-tolerant and intolerant stream invertebrates.

Direction of trend relates to biological condition of invertebrate communities i.e. Improving is positive, Declining is negative.

Pesticides – Historic Trend Analysis

Analysis of historic EA invertebrate data demonstrates a statistically significant increase in biological condition at Droxford Church. No significant change in biological condition is demonstrated at St Clair's Farm or Mislingford Weir. This indicates that pressure from pesticides has decreased or remained stable within the mid-catchment since 2002. Significant seasonality is demonstrated at all sites, with higher scores observed in spring that autumn.

EA sample points were selected for analysis based upon the relative continuity of datasets. Intermittent data is available from additional EA sample points within the catchment upon request.

Amongst the riverflies particularly sensitive to sediment are some of the iconic species found in southern chalk streams e.g. southern iron blue (*Baetis niger*)

Adult

© Dr. Cyril Bennett

Nymph

© Dr. Cyril Bennett

Dry fly pattern

Notable Taxa

Riverfly Diversity

Riverflies (mayflies, stoneflies and caddisflies) are acknowledged to have greater sensitivity to pollution than other taxa groups of freshwater aquatic invertebrates. Subsequently, the abundance of riverfly families or species within a sample can be used in combination with other biotic indices to determine the biological status of a waterbody.

Diversity of riverfly groups is referred to as Ephemeroptera-Plecoptera-Trichoptera (EPT) richness. EPT is the sum of all the riverfly families EPT(F) or species EPT(S) from these three invertebrate orders. It is based on the theory that cleaner streams have greater riverfly family or species richness. Spring EPT(S) is generally used as species richness declines seasonally. EPT(S) ranks for UK rivers based upon expert EA opinion are displayed in Table 1, whilst Salmon & Trous Conservation (S&TC) consider 20 to be a minimum spring EPT(s) target for main river reaches of chalkstreams.

Table 1. EPT(S) Ranks

Rank	EPT(S) richness
1 (Bad)	<1
2 (Poor)	2 - 9
3 (Moderate)	10 - 19
4 (Good)	20 - 29
5 (Very good)	>30

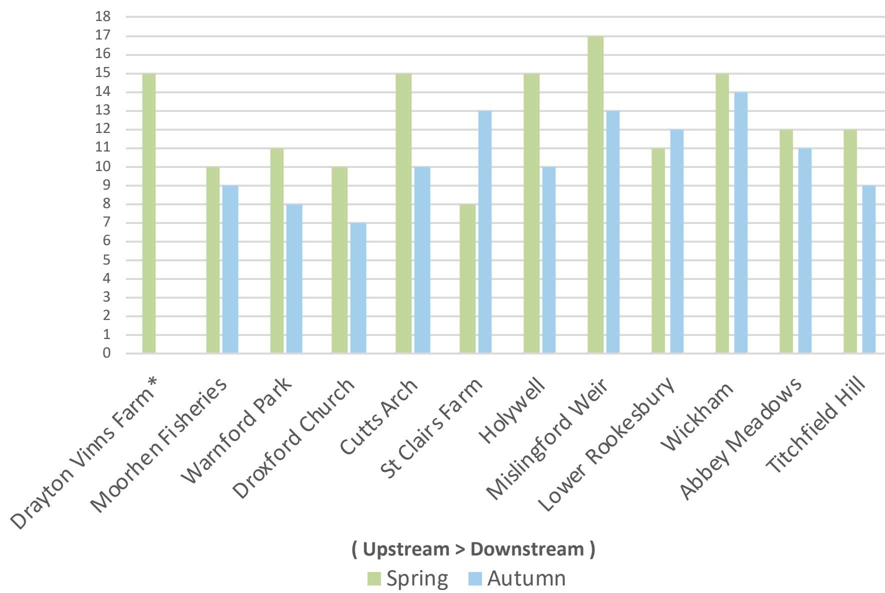


Figure 1. River Meon Autumn 2017 Riverfly Species Abundance

**Data unavailable*

Seven of the 12 Meon sites recorded 'Moderate' EPT(S) richness, although this was predominantly on the 'Poor' – 'Moderate' boundary (Figure 1). All scores fall below the target of 20 for healthy chalk streams. Lower values in the upper catchment (Drayton Vinns Farm to Warnford Park) may be explained by the headwater nature of the waterbody at these sites, however riverfly species diversity was shown to be suppressed across the whole catchment.

Freshwater Shrimp

The freshwater Shrimp (*Gammarus pulex*) is one of the most ubiquitous aquatic invertebrates within chalk stream systems. Instantly recognisable, few species have proven as contentious, with anecdotal evidence of severe long-term declines regularly reported by anglers and conservationists alike. This species plays an essential function within aquatic systems, recycling nutrients and providing a vital food source for wild fish communities.

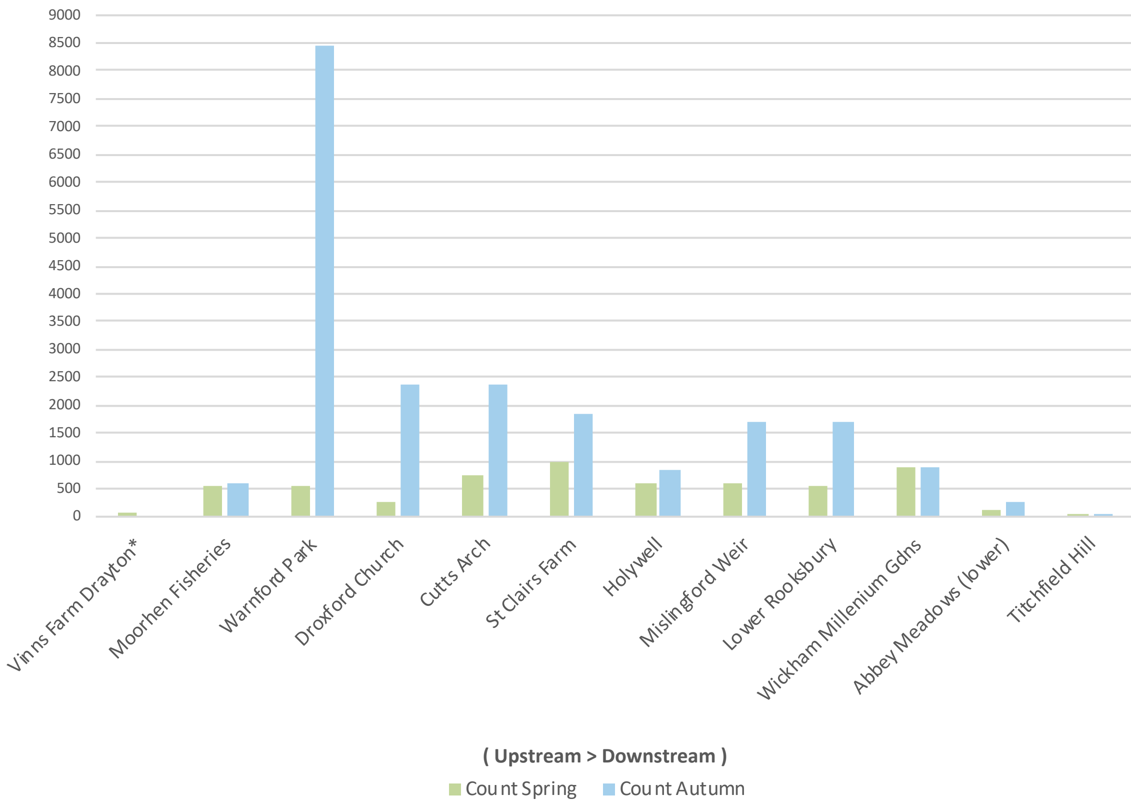


Figure 2. River Meon *Gammarus* Abundance Spring and Autumn 2017

**Data unavailable*

Targets and Status

The Environment Agency and S&TC have agreed a target of >500 Gammarus per sample (autumn season) for healthy chalk streams (S&TC, 2018). The 2017 data (Figure 2) shows numbers considerably over that threshold, with a count of 8472 at Warnford Park and counts typically >1000 in the mid catchment. Lowest autumn abundance was recorded in the furthest downstream sites, with Titchfield Hill autumn count in single figures and Abbey Meadows a count of 256. Interestingly, the non-native amphipod *Crangonyx pseudogracilis* was recorded exclusively at Titchfield Hill in Spring and Autumn samples, however both Titchfield Hill and Abbey Meadows have also shown evidence of biological stress from sedimentation, low flow, phosphate and pesticide pressures – also combined with poor habitat parameters.

Ref: Salmon & Trout Conservation (2018). Riverfly Census Conclusions, Test & Itchen.

Summary of Results

The study results indicate that the ecological status of the River Meon is subject to a range of pressures. However, evidence of these pressures is less pronounced than for comparable chalk streams i.e. the Test & Itchen or Hampshire Avon. Biological signatures indicate that invertebrate communities across the Meon catchment were predominantly Unimpacted / Slightly Impacted across the 2017 seasons, although there was clear evidence of specific pressures or impacted locations.

River reaches in the headwaters (Drayton Vinns Farm & Moorhen Fishery) and downstream extent of catchment (Abbey Meadows & Titchfield Hill) demonstrated communities 'Moderately Impacted' / 'Impacted' by pressure from fine sediment broadly across seasons. This pressure was reflected by the 2017 spring low flow stress signature at Titchfield Hill which is likely to exacerbate biological impacts of sedimentation, although further communities at Abbey Meadows and the headwater sites were not shown to be impacted by low flows. Invertebrate communities across the catchment were demonstrated to be broadly 'Unimpacted' / 'Slightly Impacted' by both organic pollution and phosphorous pressures, although a seasonal variation was noted as a slightly increased pressure was evident in autumn samples. Whilst only the invertebrate community at Droxford Church exhibited notable pesticide pressure in spring, pesticide stress signatures were raised across the catchment in autumn, with many sites in the upper and lower catchment 'Moderately Impacted'. It must be noted that these pressures seldom act in isolation and the combined and additive impacts of raised signatures are acknowledged to be greater than the individual stresses.

Analysis of historic Environment Agency invertebrate monitoring data demonstrates a broad trend of increasing or unchanging biological conditions at sites within the mid-catchment from the period 2002 – 2015. This indicates that environmental pressures have decreased or remained unchanged at the sites analysed, resulting in improved conditions for those invertebrate communities.

Looking forward...

The Wessex Chalk Stream & Rivers Trust works with partner organisations and regulators to deliver environmental improvement projects across the East Hampshire, Test & Itchen, Hampshire Avon and Dorset Stour Rivers. Through implementation of catchment management initiatives sources of pollution can be reduced by encouraging better land management and management of water resources. Delivery of floodplain and river restoration projects can improve resilience of freshwater systems by increasing habitat and flow diversity and restoring natural functions.

To support the Trust or find out how to get involved, please visit our website:

www.wcsrt.org.uk

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