

Managing muddy floods: Balancing engineered and alternative approaches

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Abstract

Muddy runoff from agricultural fields is widespread across Europe causing damage to properties, transport, and freshwater systems. Clean-up costs are high and include making water fit for drinking. Mitigation against muddy flooding (MF) includes standard soil conservation and flood protection measures. MF occurs during intense localised storms, for example, in Flanders, northern Belgium, but can also result from longer duration rainfall events, for example, in southern England. MF occurs in catchments with large areas of arable land, adjacent to property or freshwater systems. Early experience with mitigation measures favoured engineered approaches. On their own, these have frequently failed to achieve adequate protection or been ruled out on economic or safety grounds: a combination of engineered and land-use approaches is necessary. We illustrate this with reference to the Molenbeek catchment in Flanders where monitoring shows a significant decline in erosion and damage to adjacent properties. Cost–benefit analysis of mitigation measures shows them to pay for themselves over short periods of time. Protecting freshwater systems from MF damage should focus on interrupting flow from field to streams, ditches and roads which act to convey muddy runoff to the main river channels.

KEYWORDS

detention structures, mitigation measures, muddy flooding, off-site impact, runoff, soil erosion

1 | INTRODUCTION

The term “muddy flooding”(MF) was introduced to define an off-site impact of soil erosion: floods caused directly by runoff from agricultural land, carrying large quantities of soil as suspended sediment or bedload and causing damage to property and infrastructure (Boardman, Verstraeten, & Biolders, 2006). The impact of MF on freshwater systems has also emphasised the damage to ecology and the need for water companies to provide clean potable water supplies (Evans, 1996). The first systematic review of MF in western Europe was in 1994

(Boardman, Ligneau, De Roo, & Vandaele, 1994) but previously other terms had been used to describe impacts on property, for example, “mud deluges”: Morgan (1980); “inondations boueuses”: Auzet (1987); “modderoverlast”: Schouten, Rang, and Huigen (1985). Reports of MF come also from France (Le Bissonnais, Montier, Jamange, Darousson, & King, 2001), Germany (Arevalo, Reichel, & Schmid, 2012), Switzerland (Prasuhn, 2011), Slovakia (Stankoviansky & Fulajtar, 2006), and UK (Boardman, 2013). The phenomena are likely to be under-reported and to be a contributor to classic cases of fluvial flooding, for example, severe flooding of low-lying parts of

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Somerset, UK, in early 2014, was exacerbated by runoff from maize and winter cereal fields (cf. Palmer & Smith, 2013). Costs of MF are difficult to obtain and include road clearance costs, damage to properties and water cleaning (Evans, 1996, p. 46). MF affects urban areas and therefore costs are high (Morris, Beedell, & Hess, 2016), but damage to freshwater systems should also be factored in. MF costs in the Belgian loess belt are estimated at $14\text{--}138 \times 10^6$ €/year (Evrard, Biielders, Vandaele, & van Wesemael, 2007). In Saxony, Arevalo et al. (2012) estimate costs at $>1.3\text{--}3 \times 10^6$ €/year.

Areas of intensive arable farming give rise typically to well-connected systems where movement of runoff and sediments is enhanced by anthropogenic landscape elements such as tracks, roads, sunken lanes, ditches, drains, and culverts (Boardman, Vandaele, Evans, & Foster, 2019). Field boundaries often allow the passage of runoff and sediment from field to field. The complexity of off-site connectivity thus means that the appropriate scale for meaningful mitigation intervention is the small catchment rather than the single field. Several case studies illustrate successful interventions: Evans and Boardman (2003), Boardman, Evans, and Ford (2003), Fiener, Auerswald, and Weigand (2005), Evrard, Vandaele, van Wesemael, and Biielders (2008), Wilkinson, Quinn, Barber, and Jonczyk (2014), Frankl, Pretre, Nyssen, and Salvador (2018), Peukert, Uglow, Langdon, Thorne, and Webb (2018). The Demonstration Test Catchment project in the UK is also based on this principle (Biddulph, Collins, Foster, & Holmes, 2017; Defra, 2016). In the UK, remarkably few of the dozens of published case studies deal with the issue of mitigation measures against MF. Instead they focus on the river channel-flood plain relation and with grazed catchments (Environment Agency, 2017).

The challenge of dealing with MF has much in common with designing measures to control fluvial flooding and soil erosion, in that the damaging events are intermittent and unpredictable. In an arable landscape there is the added problem of regular changes to land cover on specific fields. Difficult-to-predict factors such as the drilling date of crops, in relation to rainfall events, can significantly affect the magnitude of MF (Boardman & Favis-Mortlock, 2014).

Measures of an emergency nature must be undertaken after flooding to limit further damage. Longer-term effective protective measures will be of a different character and it is those that we are primarily concerned with here. Unfortunately, land managers often have short-term memories and assume that 5 years without flooding means that the problem is solved: an efficient “institutional memory” for past events and events in adjacent areas, is an important aspect of effective planning

(Boardman & Vandaele, 2010). Similarly, Waylen, Holstead, Colley, and Hopkins (2018) and Wingfield, Macdonald, Peters, Spees, and Potter (2019), discuss the barriers to implementation of Natural Flood Management and note the slow progress of implementation.

Many different and often overlapping terms have been used for approaches to flood control that are in contrast to “engineered structural solutions, such as dams and embankments” (Kenyon, Hill, & Shannon, 2008). For example, “Catchment-Based Flood Management” and its subset, “Natural Flood Management” (Dadson et al., 2017); “natural water retention measures” as a type of “green infrastructure” (Collentine & Futter, 2018 and “sustainable flood management” (Kenyon et al., 2008); see also Environment Agency (2017) for further discussion of terminology. Small earth dams used as water retention features as advocated in many studies (e.g., the Belford catchment) are referred to as “soft-engineered catchment modifications” (Barber & Quinn, 2012), suggesting that there is a continuum of measures between hard-engineered and land use approaches to the flood problem. We advocate a mixture of such measures at the catchment scale.

In this paper, we aim to discuss the problems of relying solely on engineered approaches in managing MF and the advantages of using mitigation methods that include detaining and re-routing runoff and sediments in upstream locations. A similar plea for the use of a variety of mitigation measures in addressing rural/urban relationships with respect to fluvial flooding is made by Morris et al. (2016) and Waylen et al. (2018). A case study from Flanders illustrates the potential for this approach. In that study, the success of mitigation methods has been evaluated that is lacking in many such cases (Dadson et al., 2017). We also discuss the challenge of protecting freshwater systems where excessive fine sedimentation resulting from MF is an ecological and water quality problem. The specific areas that we reference in this study, the South Downs National Park, southern England and Flanders, Belgium, are suitable exemplars because of large MF databases, and because of contrasting managerial approaches to the problem.

2 | WHAT ARE THE TYPICAL ENGINEERING APPROACHES?

The need to detain runoff and prevent it reaching vulnerable sites (usually houses and/or freshwater systems), means that a variety of bunds, banks, retention structures and dams have been built or proposed. These have the advantage that when not actively detaining water they take up little land and do not interfere with field

operations. If permanent ponds are created, then land is lost to agriculture. Detention structures may or may not have systems of ditches and culverts to lead water away from sensitive sites; many are simply allowed to overflow into adjacent fields. Questions of adequate size and continued management of drainage systems are important and will be illustrated in the next section. Some recent successful interventions in small catchments rely heavily on engineered structures such as the “Runoff Attenuation Features” in the Belford catchment (Nicholson, Wilkinson, O'Donnell, & Quinn, 2012; Wilkinson et al., 2014; Wilkinson, Quinn, & Welton, 2010). This reliance appears to be largely due to the unwillingness of farmers to change land use or practices and also the lack of suitable remuneration for impacts on farm businesses of alternative mitigation approaches.

3 | COPING WITH MF: EARLY LEARNING EXPERIENCES

The first study of MF's impact on property and possible solutions to the threat was based on the flooding of houses on the Highdown estate, Lewes, on the South Downs, UK (Stammers & Boardman, 1984). Runoff occurred from a recently drilled 21 ha field of winter cereals in the winter of 1982–83. The local authority, Lewes District Council (LDC), was obliged to take the lead in emergency measures and then in planning for the future. With an uncooperative farmer, changes in land use or farming practices were ruled out, and LDC was forced to explore engineered solutions. Emergency measures were a trench and pipe to feed runoff between houses and into a soakaway system. A dam designed to store runoff from a one in 20-year storm was proposed with a pumping station and sewer to the River Ouse. Costs of >£100,000 for the dam and > £100,000 for the sewer were estimated. The need for continuous monitoring and maintenance was noted as were safety fears in having ponded water up to 5 m depth next to a large housing estate. The engineered solution appeared unacceptable to a small local council and the stalemate was resolved by the purchase of the 21-ha field by LDC with conversion to sheep-grazed grassland. The discussion around the possible options was valuable especially as other MF incidents and threats to housing developed through the 1980s on the South Downs.

A similar case arose at Shepherds Mead, Worthing, on the South Downs, in November 1987 at a site where flooding had occurred several times previously and affected houses. The problem fields were owned by Worthing Borough Council (WBC) and rented to a farmer for arable use. Again, a dam was seriously considered as a

solution in the absence of farmer cooperation. A report to WBC pointed out that it would, for example, be quite infeasible to detain runoff from a 100 mm rainfall event (Boardman, 1988a). For a 30 mm event (which occurs every year), with crusted soils and therefore the possibility of 100% runoff, the 18.6 ha field would generate c. 5,580 m³ of water requiring temporary storage. A dam with an average depth of water of 1 m would require a land area of 100 × 55.8 m. Problems of siltation, overflow, continuous management and safety were emphasised. Again, the eventual solution was a change of land use to grass and a reduction in rent to the tenant farmer.

One of the lessons from the Shepherds Mead incident was that heavy or exceptional rainfall was not necessary to cause MF. The estimated rainfall amount on 13 November was 21.1 mm. Planning for protection for urban areas on the South Downs had to consider the low threshold at which runoff occurred on bare silty soils as well as recognise that severe damage was likely with heavier falls, for example, 66 mm over the eastern South Downs on October 7, 1987 (Boardman, 1988b).

MF on the South Downs is reviewed in Boardman (1995). Thirty-three sites are listed, some of which have been flooded several times. At many sites ditches and dams were built sometimes as emergency measures but also as permanent features. At several sites dams built years before to protect houses failed or were overtopped. In at least one case, overtopping was due to poor maintenance of installed drainage systems. In four cases land use change is noted as a response to flooding or the failure of dams.

In considering MF at several sites around Brighton in 1987, Robinson and Blackman (1990), point out that local councils, who owned much of the farmed land around the edge of the urban area, chose the engineered solution of building dams and improving drainage rather than demanding land use change. Thus, the costs were borne by local urban tax payers rather than the farmers. This occurred because of the difficulties of enforcing change on unwilling farmers.

The most detailed consideration of responses to MF describes measures taken at Sompting on the South Downs, a site with a history of repeated flooding of houses (Boardman et al., 2003; Evans & Boardman, 2003). In brief, refusal of farmers to accept responsibility led to the construction of a series of small dams which failed or were overtopped. Finally, the introduction of grass onto valley bottoms and steep slopes, in a catchment dominated by winter cereals, led to the elimination of flood risk: there has been no subsequent flooding (Dr R. Evans, personal communication). The local council was unable to fund what would have been very substantial dams. The land use change was enabled by Set Aside funding and that from the Environmentally Sensitive Area scheme.

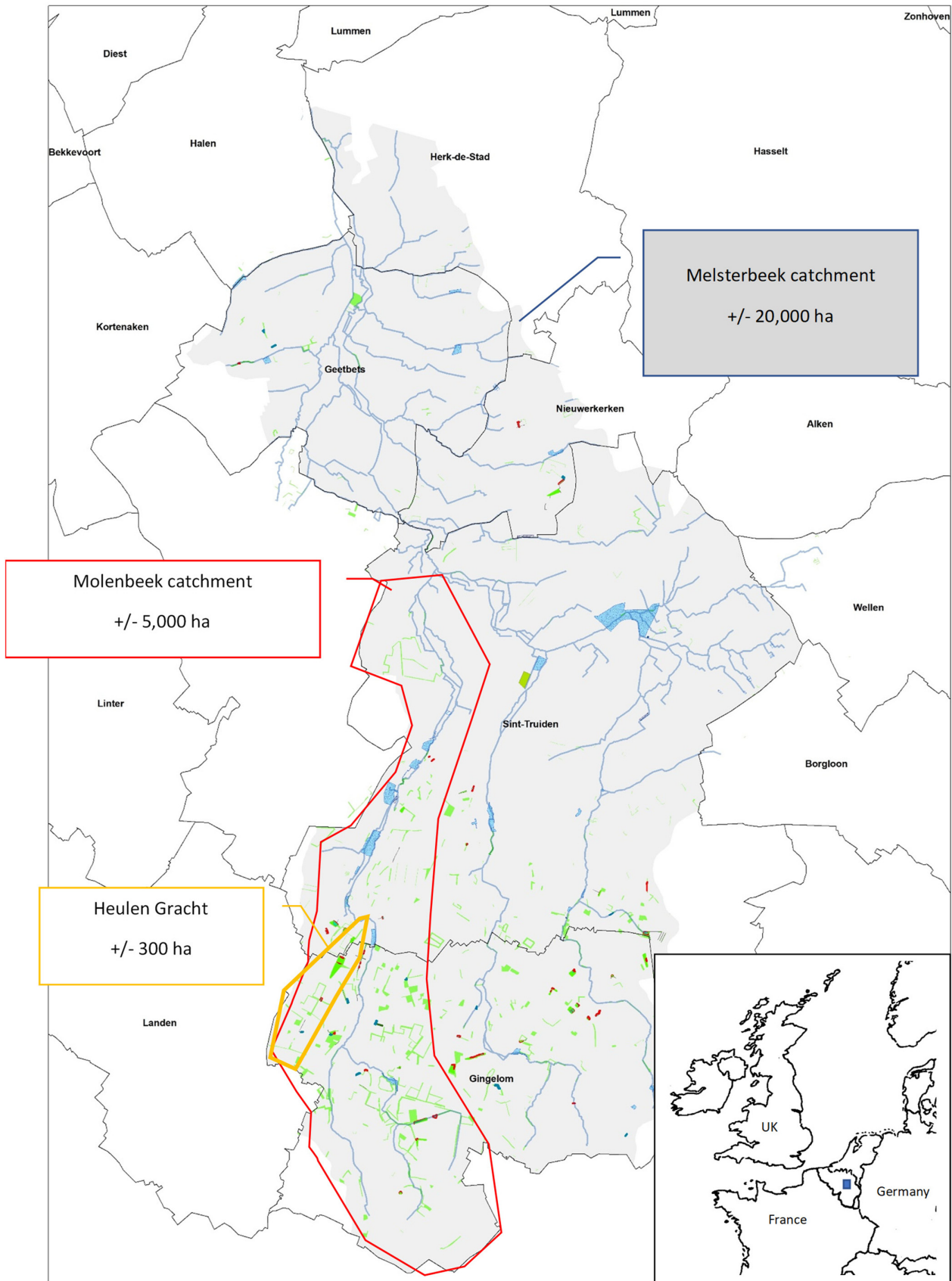


FIGURE 1 The Melsterbeek catchment and sub-catchments with inset showing location in Belgium

4 | HOW CAN WE COMBINE ON-FIELD MEASURES AND ENGINEERED SOLUTIONS?

The Sompting example shows that an approach using non-engineered solutions can be effective. The approach was, however, adopted after several years of flooding and failure to reach agreement on how to protect the houses. This was both an argument about methods, responsibility and how to pay for the necessary changes. These difficulties have affected British attempts to protect people from MF with a very limited number of effective protective schemes being set up. For this reason, we turn to an ongoing project in Flanders to explore the elements that make for success and the challenges that remain.

5 | THE MOLENBEEK CATCHMENT

The Molenbeek catchment is situated in the eastern part of the Belgian Loess plateau (Figure 1). It has a gently rolling landscape, dissected by streams draining to the north. Annual mean precipitation ranges from 700 to 900 mm (Hufty, 2001). Loess is very susceptible to soil erosion, but due to its high soil fertility, there is a long agricultural tradition in this region. Arable land covers 58% of the total surface (Statistics Belgium, 2018). During the last three decades, the area covered by summer crops (sugar beet, maize, potatoes, and chicory) increased at the expense of winter cereals (Evrard, Persoons, Vandaele, & van Wesemael, 2007). These summer crops provide little cover to the soil during the thunderstorms that occur during late spring or early summer (Evrard et al., 2008,b). During intense rain storms, soil crusts with very low infiltration capacity are formed, resulting in high quantities of runoff and MF of downhill areas (Evrard, Vandaele, van Wesemael, & Bielders, 2008). During the period 1992–2002, some parts of the Molenbeek catchment have been affected by MF at least 10 times (Evrard, Bielders, et al., 2007).

As a result, the local authorities in the Molenbeek catchment set up a common structure to specifically address the problems of soil erosion and MF. Several types of measures have been implemented to mitigate MF (Boardman & Vandaele, 2015). A first type of action aims at preventing runoff generation. Cover crops during the dormant period and alternative agricultural practices, such as conservation tillage, aim to prevent the generation of runoff and subsequent soil erosion. Grass buffer strips at the bottom of fields were installed to enhance infiltration and to decrease net soil loss. Along the topographically controlled concentrated runoff pathways, grassed

waterways (GWWs) were installed. Finally, earth dams and retention ponds were built to trap sediment. The sub-catchment Heulen Gracht (300 ha) has the highest density of soil erosion control measures (Figure 2). In this sub-catchment there are 23 farmers in total of which nine are involved in control measures (i.e., conservation tillage, buffer strips, GWWs, earth dams). About 5% of the total farmland is used for soil erosion control measures. The costs for implementation of the MF control measures were financed with grants of up to 90% by different government agencies.

The catchment has been intensively monitored from 2005–2018 and 64 runoff events were recorded in that period (Evrard, Vandaele, Bielders, & van Wesemael, 2008 and personal observations). Peak discharge (per ha) was reduced by 69% between the upstream and the downstream extremities of the GWW. Before the installation of the control measures, specific sediment yield (SSY) of the catchment reached $3.5 \text{ t ha}^{-1} \text{ year}^{-1}$ and an ephemeral gully was observed nearly every year in the catchment (Evrard, Vandaele, Bielders, & van Wesemael, 2008). Since the control measures have been installed, no (ephemeral) gully has developed and the SSY of the catchment dropped to a mean of $0.5 \text{ t ha}^{-1} \text{ year}^{-1}$. Hence, sediment transfer from the cultivated dry valley to the Molenbeek dramatically decreased (Table 1). Subsequently, since flood protection measures have been instituted, the number of MF has decreased significantly: from a high point of 39 floods (1997–2001) to much lower figures of 15 in 2007–2011 (Figure 8, Boardman & Vandaele, 2015) and 16 in 2012–2016. Therefore, this approach seems to be effective.

Evrard, Bielders, et al. (2007) detail the huge costs of MF to municipalities in Belgium. However, when these costs are set against the costs of MF prevention measures it is clear that it is worthwhile to invest in protection (Table 3, Boardman & Vandaele, 2015). So the approach in the Molenbeek catchment is not only effective but also efficient. It also chimes with what policy makers demand: percentage reductions in soil erosion, MF and reduction in damage due to the measures.

6 | PROTECTING FRESHWATER SYSTEMS

Protecting freshwater systems from excessive sediment loads first requires an assessment of the origin of the sediment and the pathways by which this sediment enters the system (connectivity). Collins, Anthony, Hawley, and Turner (2009) estimate that the agricultural sector in England and Wales contributes 76% of sediment input to rivers. In exceptional cases, stream banks are important

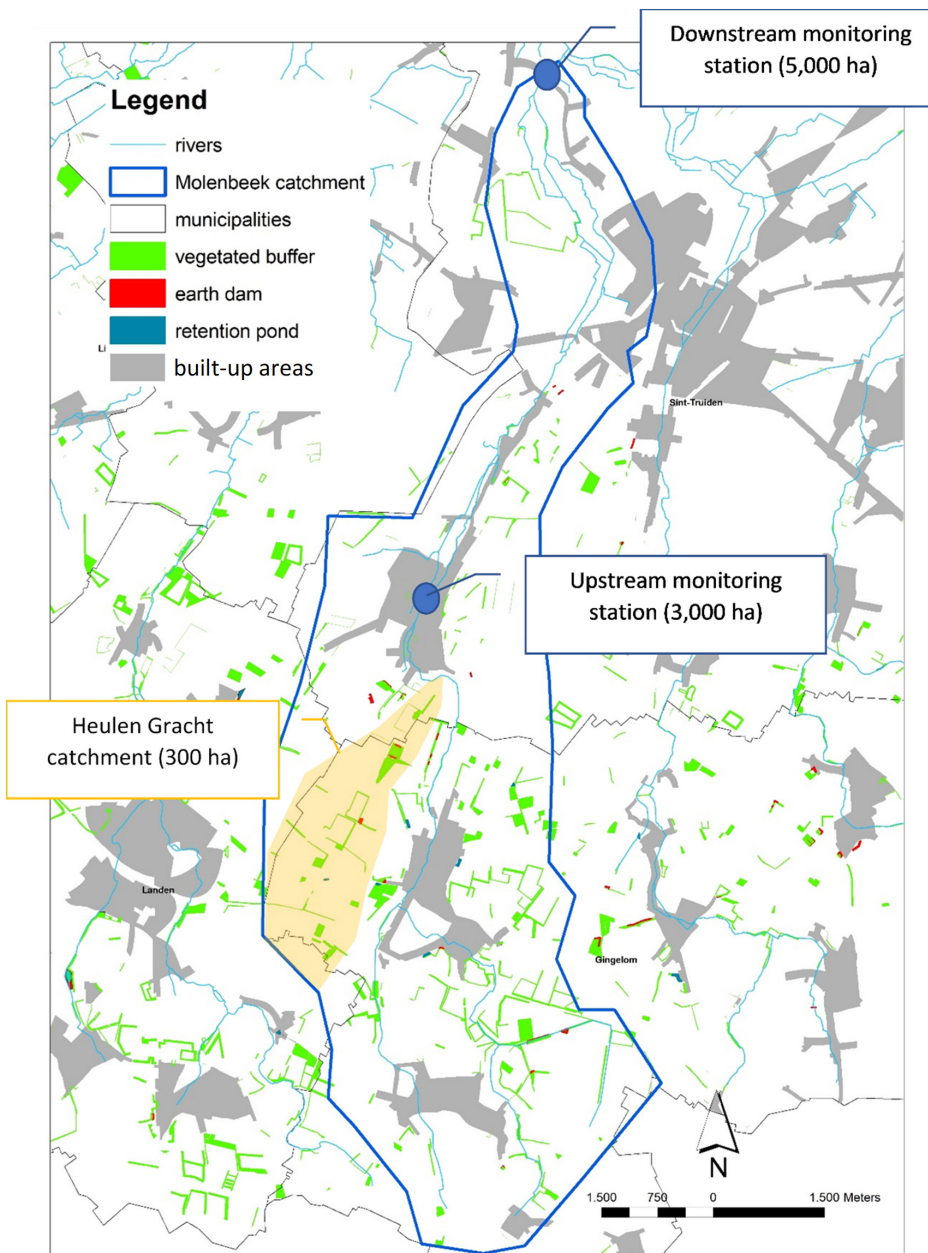


FIGURE 2 The Molenbeek and Heulen Gracht catchments, monitoring locations and muddy flood protective measures

sources (Pulley & Foster, 2015). In the Rother valley, West Sussex, erosion on cultivated fields is a major source (Boardman, Shephard, Walker, & Foster, 2009), but erosion of stream banks is a factor in the Lod, a tributary of the Rother (Evans, 2018). In the Rother catchment, connectivity between arable fields and the river is common. Of 165 fields with a history of recent erosion, 101 are potentially connected to the river (Boardman et al., 2019). Protecting the river will be achieved by two approaches: encouraging increased infiltration on the fields and interrupting connectivity between the fields and the river with detention structures. Detention of runoff between the field and the river encourages sedimentation.

Dadson et al. (2017) Table 1) list the catchment-based measures that could contribute to flood management. Many of these are standard, well-known approaches appropriate to the management of MF though we would need to add GWs to the list. The management of ditches raises an interesting point in that efficient conveyance of runoff from agricultural areas to rivers is “a good thing”. However, recently cleaned ditches are problematic in that they may act as a source of sediment. The ecological health of some rivers requires a decrease in sediment loads (and associated pollutants) and therefore systems of detention and sedimentation between the field and the river are necessary. Land use change at sites of high risk of runoff and erosion, may seem attractive but

TABLE 1 Sediment concentration in the Molenbeek catchment (see Figure 2 for sampling locations)

	Upstream site		Downstream site	
	1998–2005	2006–2013	1996–2005	2006–2014
Lower quartile	19.75	3.5	14	9.5
Minimum	10.2	0.8	2.15	1
Mean	58.8	17.5	43.1	28.4
Median	32.5	12.8	26	22
Maximum	337	109	283	110
Upper quartile	57.08	17.8	56.7	42.05

Note: At the upstream sampling site, the Molenbeek was sampled monthly (= one sample every month) from 1998 until 2013. The mean sediment concentration (mg/l) was calculated for the period 1998–2005 (period with no or very few erosion control measures in place) and for the period 2006–2013 (period with high number of erosion control measures in place). The number of samples for the period 1998–2005 $n = 60$ and for the period 2006–2013 $n = 83$. At the downstream sampling site, the Molenbeek was sampled monthly from 1996 until 2014. The mean sediment concentration was calculated for the period 1996–2005 ($n = 113$) and 2006–2014 ($n = 107$). The means for both periods at the upstream site were significantly different ($p < .001$) using the t -test. Data from Flemish Environment Agency. Sample size ± 5 L.

to the farmer is likely to be an uneconomic alternative, and to a local authority, an expensive option: the solution to MF at Highdown and Sompting being the exception rather than the rule.

Many mitigation structures are necessary in a large catchment and long-term monitoring is needed to demonstrate their effect. The Flemish Environment Agency sampled at two locations in the Molenbeek catchment from 1998 to 2014. Sampling was monthly at an upstream and downstream location (Figure 2). For the period 1998–2005 there were no or few erosion control measures (a mix of engineered and alternative approaches), and for 2006–2014 many control measures had been introduced. Mean sediment concentration had declined most where the number of control measures was highest, that is in the upstream area (Table 1).

7 | DISCUSSION AND CONCLUSIONS

The distinction has been made between slow onset, large catchment, river flooding often associated with widespread and long-lasting rainfall events affecting wet ground, and “pluvial flooding” caused by excess surface water due to intense, local rainfall (e.g., Dadson et al., 2017). This may also reflect the distinction between saturation-excess overland flow and infiltration-excess (Hortonian) overland flow, though the distinction is not absolute with complex interaction in time and space between the two processes. In dealing with fluvial flooding, several authors have stressed the need for mitigation measures to go beyond reliance on hard engineering structures (Environment Agency, 2017; Pitt, 2008).

TABLE 2 Muddy floods: damaging incidents 1982–2001 on the South Downs

Site (date)	Catchment area (ha)	Runoff contributing area: Bare/arable (ha)	Number of farmers in catchment	References
Highdown (1982)	21	21	1	Stammers and Boardman (1984)
Breaky Bottom (1982)	49	45	1 with major area of arable land	Boardman and Robinson (1985)
Breaky Bottom (1987)	189	51	1 with major area of arable land	Boardman (1988b)
Breaky Bottom (2000–01)	189	73	1 with major area of arable land	Boardman (2001)
Bevendean (1982, 85, 87, 2000–01)	139	91	1	Boardman and Robinson (1985); Boardman (1995); Boardman (2001)
Sompting (1990–91)	1,010	612	5 (2 with arable land)	Evans & Boardman et al. (2003)
Rottingdean (1987)	119	68	2 (1 with all arable land in catchment)	Boardman (1988b); Robinson and Blackman (1990)

Terms such as “natural water retention measures” have been used (Collentine & Futter, 2018).

MF differs from conventional fluvial events in that it is generated on areas with large proportions of arable land in small catchments, in Flanders these are generally first-order catchments, and is often the result of local intense rainfall events. However, it is difficult to generalise: in Flanders, most MF is associated with intense summer thunderstorms falling on spring planted crops. In southern England, it has often occurred on winter cereals as a result of relatively modest rainfall events (there are exceptions: see, for example, Boardman, Burt, Evans, Slattery, & Shuttleworth, 1996). In all cases, arable land close to property, transport links or freshwater systems, is a *sine qua non* for MF.

It is worth noting that the influence of land use in generating flooding in small catchments is not in dispute. This contrasts with the on-going debate about its role in larger catchments (Dadson et al., 2017; Environment Agency, 2017; O’Connell, Ewen, O’Donnell, & Quinn, 2007).

Experience with serious MF events in the South Downs National Park suggests that catchments are small but are dominated by arable land uses. However, the number of farmers managing the land is low and therefore instigation of mitigation measures should in theory be straightforward (Table 2). In practice, resistance to land use change, acceptance of responsibility, and costs of mitigation measures, have often meant long-drawn out negotiations before some degree of success. It is instructive to note that farmers on the South Downs affected by serious soil erosion often undertook mitigation measures, not because of loss of soil or damage to neighbour’s property, but because of the availability of agri-environmental funding schemes that encouraged land-use change (Boardman, Seymour, & Bateman, 2017; Evans & Boardman, 2003). In Flanders, the provision of substantial grants for mitigation measures is a vital component of protection from MF. This emphasises the point that one of the big challenges in many areas is how to pay for up-valley protection that benefits down-valley properties (Collentine & Futter, 2018; Posthumus, Hewett, Morris, & Quinn, 2008). The situation in Britain in terms of uptake of financial incentives for mitigation measures is still far inferior to that in Flanders. For example, in the Rother valley (cf. Boardman et al., 2019), in relation to Countryside Stewardship Agreements, numbers of mitigation measures (buffer strips of various types) were a very modest total of 35 for the years 2016–2019. The option for winter cover crops was not taken up (Natural England, 2019). Retention banks are not an option in this scheme.

On-field measures (no-till, conservation tillage etc) on their own will not solve the problem. Nor will engineered

solutions (dams, retention ponds etc). We need a combination of both. On-field measures can provide protection from small and medium events; the combination of on-field and off-field are needed to protect us from big events. Fiener et al. (2005) and Evrard, Persoons, et al. (2007); Evrard, Vandaele, Biielders, and van Wesemael (2008); Evrard et al. (2010) recognise that retention ponds on their own are not sufficient and advocate additional measures such as GWWs.

The use of a “soft engineering approach” with fascines (woven willow screens) to detain sediment usually placed at field boundaries is investigated by Frankl et al. (2018) in the Ar catchment, northern France. They show that fascines vary in their efficiency in detaining sediment and reducing erosion by ephemeral gullying. However, they are very dependent on regular management, repair, and replacement.

The number of farmers that need to be involved in the protective measures will vary from place to place. Interrupting the flow of runoff will likely require retention ponds and water storage areas in valley bottoms which incidentally are not usually classified as sites with a high risk of erosion because of their low gradient (Boardman et al., 2019). Catchment-wide measures will of course reduce the overall risk (Figure 2).

Finally, it is not always the case that the farmer is responsible for MF. The building of houses in vulnerable locations may be a factor. This is the case in several towns in Flanders. In southern England, much house building, in what turned out to be high-risk sites, was done in the 1920s and 1930s. The change from a grass-dominated landscape to one of winter cereals in the 1970s increased the risk of MF—this was the case at Highdown, Shepherds Mead and Sompting, quoted earlier.

Engineering solutions to muddy flood hazards have proved problematic when deployed on their own. This is because of cost and safety issues and the size of detention structures necessary to store large amounts of runoff. We advocate the use of a variety of mitigation measures to detain and interrupt flow throughout the catchment. Cost-benefit analysis in Flanders shows that protective measures make good economic sense. The challenge, as in all soil conservation and flood protective schemes, is not technical but socio-economic. Land managers must be persuaded to put in place protective measures for the benefit of down-valley properties and freshwater systems. Some form of agri-environmental funding for mitigation measures is essential. But it is clearly the case that they are very quickly cost-effective. Policy makers can be shown that damage costs heavily outweigh the cost of mitigation measures. This message has been taken on board in Flanders but less so in the UK.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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