

Property Flood Resilience Market Study



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Executive Summary

The Property Flood Resilience (PFR) Sector is a relatively new and relatively small segment within the building sector, producing, designing and installing measures to make buildings more resilient, such as flood barriers, pumps, airbricks and non-return valves. The annual turnover of PFR manufacturers and installers in recent years is estimated at £20-25M, with roughly £13-16M from the residential market and £7-9M from commercial and institutional work. Just over 40 manufacturers and 10-20 specialist installers account for the numbers in this report. Just over 2/3 of those are small companies with fewer than 20 employees. About £7-8M in exports comes primarily from residential products, with only a handful of companies exporting. Other professionals, such as surveyors, provide important functions within the PFR delivery chain but have not been included in calculations.

In the 2000s and 2010s, PFR installation was often in response to flood events and subsequent grant programmes, which fuelled an up-and-down industry, without established mechanisms for quality assurance. Recent years have seen fewer flooding events, but mechanisms such as the PFR Code of Practice, product certification, and EA schemes have led to more steady

delivery of resilience measures in UK homes and greater understanding of what works, alongside more robust quality-assurance processes. More than 500 homes per year have had PFR installed in recent years, the vast majority via public schemes. Commercial and institutional projects have also been growing, and are a desirable market due to the larger scale of projects.

The PFR sector still faces barriers to steady growth. Schemes provide a steady amount of business for many firms, but large-scale residential demand remains primarily a post-event phenomenon, which complicates planning and scaling up. Most installers report the ability to scale up by 20-40% within 2-4 months, and manufacturers report additional capacity of around 20% (but generally a hard cap on production beyond that). There are minimal plans to scale up without guaranteed contracts or demand. Product certification is a more intensive process than many small businesses are prepared to invest in, resulting in a limited supply of certified products. But practices such as diversification have helped some companies to sustain their business in the absence of major events, and initiatives underway to test, rate, and raise homeowner awareness of PFR measures could help to establish the market further.

Abstract

This study describes the current market for Property-Level Flood Resilience measures in the UK, with a focus on supply, demand, and the key market segments and characteristics. It was conducted with live interviews as the primary methodology. Secondary desk research was also utilised as a complement. 74 market experts and professionals were contacted, of whom 44 were interviewed. Interviews were typically 30 to 60 minutes long. All opinions were given with the understanding that the aggregated results will be publicly available, but that no individual company information would be identified.

The key points investigated were:

1. Size and characteristics of the market
2. Processes and practices
3. Barriers and drivers to entry and expansion
4. Scale-up capabilities
5. Implications for Build Back Better (BBB) implementation and best practices (this will not be substantively included in this report, but findings used in wider Flood Resilience work).

The data collected is not exhaustive and is used as a simplified representation of the market.



What is PFR

Property Flood Resilience (PFR)¹ refers to all measures and products that can be put in place in a property of any kind, to mitigate the damages and effects of flooding. This includes resistance measures, recoverability measures, and preparedness – all three make up resilience – and is not specific to flooding type (coastal, fluvial, pluvial).

Resistance measures are designed to limit the entry of water to the property (doors, barriers, airbricks, pumps and non-return valves are the most commonly-used products). Recoverability measures aim at reducing damages and clean-up time and costs, when the water does in fact enter the property – some examples include swapping wood and

carpet floors for concrete and tiles, raising cabinets and sockets, or using waterproofing materials in construction. Preparedness refers to the mindset knowing what actions to take in a flood situation to minimise risks and damages – “what to do and when to do it”; it includes product maintenance, awareness, and knowledge, and personal and community emergency flood response plans and exercises, as well as flood alerts. Preparedness does not always include PFR measures, but where it does, knowing where it fits into that plan is critical.

This report does not aim to provide an exhaustive list of PFR measures, a few resources are footnoted below.²

Market Features and Shape

This section primarily focuses on manufacturers and installers as the professionals directly involved in the delivery of PFR measures, although professionals like surveyors also play a key role in the PFR delivery chain. Where companies have a small proportion of their business in PFR, we have included these small segments without providing extensive detail on wider, non-PFR, functions of larger companies.

Evolution

The residential PFR market in the UK is relatively new, initially established in its current form as a response to heavy floods of the early 2000s. Growth and interest in this space was initially led by government initiatives. Between the early 2000s and mid-2010s, this newly established market was mostly sustained by public schemes (especially Defra grants 2009-2012, and early initiatives by the Welsh government 2004-2007), whereby homeowners in recently flooded areas or others in specific high-risk areas could benefit from government funding or incentives.³ These initiatives did create a market for PFR products and resilient homes. However, the ease of applying for grants and lack of specific standards⁴ also attracted “cowboys”, typically new and under-specialised entrants to the industry that started publicising grants door-to-door and convincing rebuilding homeowners following major events (a time when many are feeling stressed and vulnerable) to install PFR measures without the required flood risk knowledge or established standards.⁵

1. <https://thefloodhub.co.uk/wp-content/uploads/2018/09/Property-Flood-Resilience-PFR-booklet.pdf>

2. <https://www.floodguidance.co.uk/flood-guidance/flood-resistance-measures/>
<https://nationalfloodforum.org.uk/about-flooding/reducing-your-risk/protecting-your-property/>
<https://marydthonau.com/protect-my-home-from-flooding/> and Property Flood Resilience 2020 Publication

3. Early work was also undertaken to establish a knowledge base about PFR: effectiveness of different measures, best practices, etc.
https://assets.publishing.service.gov.uk/media/6038e0cad3bf7f03985e129d/Establishing_the_Cost_Effectiveness_of_Property_Flood_Protection_Technical_Report.pdf

4. As well as lack of capacity of many local authorities, who are often tasked with delivery of the grants, to oversee and ensure quality and understand the different standards for what is a new and specific area.

5. To note, this phenomenon was not limited to PFR installation, but post-flood reconstruction in general in hard-hit areas -- where massive shortages of labour and products existed locally, building back quickly and with relatively little oversight was seen as all-too-common.

Because of the lack of standards, many measures failed or did not perform to the expected levels, creating mistrust from affected householders towards PFR companies, and sometimes even among professionals and companies within the sector. There was also minimal tracking of the measures, so homeowners were not always aware of or engaged with what was installed in their homes and how to take care of it, and without the necessary maintenance these measures degraded and failed. Further post-event schemes by Defra in 2014/15, 2016/17, and to a lesser degree 2020/21 – those that made funds available with few strings attached immediately following events – were seen as earnest attempts to ‘build back better’ while giving homeowners full control over what measures to spend money on⁶, but still fit into the mold of earlier schemes that required additional tracking and accountability to ensure the performance and awareness of installed measures, and did not include funding for recoverability measures or preparedness. Defra has reported that over 20,000 properties received PFR measures via these grants. Many homeowners who participated in the scheme credit it for making their homes livable and resilient.⁷

While initiatives were underway to improve the industry’s quality since its inception, the experiences of the mid-2010s and severe flooding led to the establishment of the PFR Roundtable in 2015 by then Defra Minister, Rory Stewart, to tackle the low uptake of PFR measures. The Roundtable, which brings together industry, government, and academia, has been instrumental in developing standards that allowed the industry to move towards a focus on quality, including the British Standard for Flood Resistance Products (BS851188 – 2019), as well as the PFR Code of Practice⁸, released in 2019 and updated in 2021, both of which are outlined in greater detail below. The Roundtable has also been a platform for wider initiatives, such as Flood Re’s exploration of the Flood Performance Certificate (FPC)⁹ concept, and its potential role in promoting the uptake of PFR measures.

The PFR market and PFR schemes have been further hampered by 2 major issues:

- People are often unaware, or don’t believe, they’re at flood risk.¹⁰
- Even when people are made clearly aware that they are at high risk of flooding, and their homes are damaged by those floods, many people still choose not to have PFR measures installed. For example, take up rates for Defra’s 2019 and 2020 PFR repair grant schemes was 40% and 29% of affected properties in eligible areas, although the more comprehensive EA scheme take-up rates were considerably higher (50-100%).

These psychological challenges have been more widely explored elsewhere¹¹, but remain important context to understand a market which has been slow to develop in spite of a clear need.

The last decade has also seen, at the highest level, a shift from thinking purely about climate mitigation, towards including adaptation and resilience. Alongside that larger-scale shift in thinking, PFR has become embedded in longer-term planning by the EA and Lead Local Flood Authorities (LLFAs) to address community and homeowners flood risk, in addition to the Defra schemes noted above. Between 2015 and 2021, the government invested £2.6 billion (delivered by the Environment Agency and partners) to better protect 314,000 homes, nearly 600,000 acres of agricultural land, thousands of businesses and major pieces of infrastructure, principally through large-scale/engineered flood defences. This also included an expanded toolbox of measures to address resilience, including schemes administered by the EA and LLFAs to protect individual homes with PFR, supported by the establishment of an initial PFR framework to evaluate suppliers and address the quality-assurance issues noted above.

6. Though the £5K limit occasionally meant that the required PFR system would be incomplete, and private top-of funding was rare.

7. Sunday Times, “After the Flood” 12 February 2023 <https://www.thetimes.co.uk/article/how-to-make-your-house-flood-proof-6qqb7sdt>

8. https://www.ciria.org/CIRIA/Resources/Free_publications/CoP_for_PFR_resource.aspx

9. <https://www.floodre.co.uk/wp-content/uploads/Flood-Performance-Certificates.pdf>

10. https://www.researchgate.net/publication/5471521_‘It’ll_never_happen_to_me’_Understanding_public_awareness_of_local_flood_risk British Red Cross, “Every Time it Rains”, December 5, 2022. <https://www.redcross.org.uk/about-us/what-we-do/we-speak-up-for-change/every-time-it-rains-british-red-cross-report-on-flooding> pp 25, 36-37 provides figures for flood risk awareness

11. https://assets.publishing.service.gov.uk/media/6038fbfce90e070558e429c2/Applying_behavioural_insights_to_property_flood_resilience_-_report.pdf

These schemes have also seen an increase in absolute numbers, from about 780 properties protected via PFR schemes between 2011/2015, to 2,044 protected between via October 2018 and February 2023 via 109 schemes, predominantly led by local authorities. These measures, until very recently (see below), have typically focused only on resistance measures.

Results from this recent generation of EA framework schemes show that a quality-assured scheme has been an important step forward, and the recent 2022 East Peckham pilot has added recoverability and preparedness measures. The 160 homeowners who benefited from the EA resistance scheme have indicated that they appreciated the scheme giving them choice over the measures they install, but also validated guidance in terms of the most effective measures. Having measures subject to testing and evaluation and the resurveying of 30 properties for recoverability measures, allowed the data collection to create an evidence base of PFR effectiveness for Middlesex University's Flood Hazard Research Centre to develop a scoring methodology predicting loss and expected annual damages (EAD). The government has doubled its investment in flood and coastal erosion risk management to £5.2 billion to be delivered between 2021 and 2027.¹² This includes an extension of the EA's PFR schemes, for which an updated framework is due to be launched in summer 2023, and aims to better protect over 4,500 homes via 150 schemes.

Market Segments

A few distinctive segments and functions can be defined in the PFR market:

- There currently are more than 40 manufacturers and resellers based in the UK. Many manufacturers also provide installation and maintenance services with B2B and B2C structures. Only a few were “true manufacturers” focused on production only and primarily selling to other businesses.
- A small number of specialised installers (between 10 and 20), carry out PFR home improvements. Most of them also provide solution design services, as well as surveying the property to evaluate its PFR needs.

The numbers in this report will largely focus on the above 2 categories, although there are further categories of professionals that do generate additional value and activity related to the design and implementation of PFR:

- Several civil engineers (more than 30) are operating in the PFR market, focusing on larger-scale and community projects, rather than single-property renovations, mostly liaising with public authorities and the EA.
- Consultancies are currently involved in numerous projects and schemes, as surveyors and advisors to private companies (i.e., insurers) and the public sector (i.e., local authorities). They provide independent flood risk assessments and property surveys, reports and audits.¹³
- Organisations like CIWEM, CIRIA, and BSI are involved in the setting and assurance of standards for the services and products in the market.

12. <https://www.gov.uk/government/publications/flood-and-coastal-erosion-risk-management-an-investment-plan-for-2021-to-2027>

13. The Environment Agency framework is split into Lot 1 (Flood Risk Assessment and survey), and Lot 2 (design and installation)

The lines between companies in the PFR space are often blurred, particularly in the first 2-3 categories. Many manufacturers also install, and many installers also design. Almost all companies try to provide more than one kind of service to retain more business, in both the residential or commercial market. Over the course of this research, no two businesses were found to be exactly alike – therefore, the statements or percentages provided in this report should not be taken to apply to specific or individual companies in what is a diverse and specialised sector weighted towards small niche companies.¹⁴

There currently is a concentration (e.g. more than half) of manufacturers and installers in Yorkshire and the Midlands, with smaller numbers in the South, West, and the rest of the country.

Size of the Market



In 2021-22 the annual turnover generated by the manufacturers and installers participating in the study amounted to around £20-25M from PFR products and services.

Note: For the figures below, interviews typically yielded details allowing for breakdowns for roughly 60-80% of the total figure, but some were unable to share details beyond their total turnover due to confidentiality. Where a figure was incomplete, we applied the proportion for that incomplete/majority portion of the sector to the total. The variability in some figures also results from the amount of reselling in the market, discussed below.

- About £13-16M was generated in the residential market (both domestic and foreign), representing the largest segment of the market.
- The commercial and institutional sector made up the remainder (about £7-9M), with most companies noting that it made up a significant proportion of their business which they are attempting to grow.

Larger commercial/public sector projects are currently preferred by most providers as they do not suffer the same valleys and peaks as the residential PFR market.

- About half of this was accounted for by a manufacturing and installation combination, a quarter pure manufacturing, and a quarter pure installation.
- About £7-8M was generated from product exports and services provided to foreign markets.



£7-8M exports

- This is likely weighted towards product exports, as a small number of manufacturers are part of global distribution channels whereby they import certain products¹⁵, while using their distributor or parent's network to gain access to foreign markets for their own products.



Over 2/3 of the sector is small companies

(20 or fewer employees)

Just over 2/3 of the sector (about £14M) is made up of specialist companies, whose turnover is almost entirely from PFR work. Most specialised companies are small operators with fewer than 20 employees, with few exceptions.

The remainder is from more diversified/non-specialist companies, who offer a much broader range of services than PFR, typically in construction and engineering/designing – of these, there is a spread between those who provide a significant PFR offering (e.g. 30%+ of their business) and those for whom it was a very small part of their business (e.g. 5%). Non-specialists normally have PFR teams of around 5-10 employees, while their company FTEs might be in the 100s.¹⁶ It is estimated that about 150-250 people work directly on PFR (installation/manufacturing) most or all of the time, with another 100 in related professions such as surveying.

14. This study also has not considered separately PFR for historic buildings, which uses some different techniques and materials, and is even more specialised. Only portions undertaken using mainstream PFR companies or materials will be counted. Given the small size of this segment, it is not expected to significantly influence the figures and is within the margins/estimates provided.

15. These imports have not been factored into figures

16. Including the total size of these companies would add about £100M more to the PFR sector total, but we have only included these companies' PFR turnover in the totals.

Most companies noted that the sector overall was smaller than it was 3 or 4 years ago, and that there has been considerable churn in the market, particularly due to changes in UK residential demand (there have been fewer large flooding events lately), which was higher in the mid-2010s, as well as lack of clarity and continuity among schemes and frameworks – although they also noted this earlier higher-volume period also suffered from quality issues and “cowboy” companies. On the more positive side, the commercial/institutional and export part of the sector had grown and provided more steady and dependable work.

It should be noted that there are elements to the PFR sector that have only partially been included in these estimates. Measures that improve a property’s recoverability should it be flooded, such as (raised) sockets, sump pumps, or many non-permeable surfaces, employ effectively the same products as those used in normal construction or non-flood non-PFR applications. Similarly, the installation of products such as PFR air bricks is not substantively different from a normal airbrick. Transferable products were not deemed sufficiently different to be counted as PFR, except where it might be included in the figure of a wider PFR installation/delivery.¹⁷

Similarly, the variability in figures is largely due to the difficulty of separating out product manufacture from reselling and distribution. Many companies offer one another’s products, because of the bespoke nature of different homes requiring a wide range of products in order to offer property owners sufficient choice. Conservative estimates were used, but a degree of double-counting may be present in an exact figure, so a range has been provided.

Demand

Residential

The £13-16M annual UK domestic residential market, if removing exports and product sales according to observed proportions¹⁸, would be about £7.5-9M. Of this, the Environment Agency (EA) framework accounts for roughly half (just over £4M). This remainder is made up from sales to homeowners, of which it is thought that a large proportion of current demand is the sale of goods (e.g. air bricks, non-return valves).



This amounted to roughly 500-550 properties in a year undergoing significant works, with roughly half of those (and the most extensive works on average) via the EA’s schemes, and the majority having some form of government support.

The Environment Agency’s projects and schemes spent more than £4M, including local levies, in PFR measures, covering 240 properties, in 2020-21, with further programmes led by LLFAs meaning about 450 properties in total received support in some form through these schemes per year.¹⁹ This expenditure does not include any upgrades (i.e., a preferred colour for a flood door) that property owners have decided to pay out of pocket. The current EA framework started in 2018 and will conclude this year. Many companies surveyed felt that the EA’s current framework was geared towards larger companies, and not flexible enough to accommodate a sector made of many small companies. The EA published its tender for a new framework in January 2023, with changes in the requirements for companies that wish to be considered for the new framework seeking to embed the PFR code of practice, and a goal of more flexible requirements to allow for a wider range of eligible products and service providers.

17. Several firms market themselves as flood specialists, while offering a suite of largely market-standard products, which is entirely legitimate as those products fulfil their function while not being differentiated as PFR. These firms were similarly not counted, which required a degree of discretion.

18. Which would be about £3-4M for each category, with the products sales category reduced by the corresponding amount of exports to avoid double-counting.

19. Figures provided by the Environment Agency are that roughly 1,700 properties benefited from the scheme over 5 years, with greater numbers towards the end of the scheme.

Residential demand is still shaped by when and where floods happen, and the interest from homeowners for PFR measures naturally spikes around events, especially in the areas neighbouring those actually affected, the so-called “near miss”. This can create a boom-and-bust cycle, depending on the size and severity of events. Pre-event demand is typically fairly small, although just before an event, many companies receive an influx of calls asking for measures to be installed tomorrow. Post-event demand for affected properties (partly but not entirely through the insurance process) typically sees a large spike, and has also seen the “cowboy” phenomenon when an affected area has a huge amount of demand that cannot be fulfilled through normal or qualified channels (which has increased considerably when schemes have offered homeowner grants). Since awareness of resilience measures is in part driven by major flooding events, the lack of recent events has also seen lower uptake by homeowners for comprehensive measures. Overall, the level of residential work is thought to be at a lower level than it was 5-10 years ago, and companies in the sector identified the lack of steady work as a key barrier to growth (and in some cases, survival). The rush to install measures ahead of an oncoming storm, or to rebuild immediately following a flood, is not conducive to comprehensive works using the best possible measures – flaws in past work are sometimes attributed to this rushed, emotionally-charged environment.

It is notable that it appears as if 100 or fewer homes in the most recent year had PFR measures installed by the homeowner, with the majority of installations were publicly-supported despite the homeowner being the ultimate beneficiary.

Many recoverability measures can already be put in place, at no extra cost, at construction or reinstatement level. For example, there is no need to tear down and rebuild to have higher sockets in most post-event cases, they can just be built/rebuilt with recoverability in mind, and a TV can be directly mounted on the wall, instead of being placed standing on a low cabinet. Installing resistance measures at construction (e.g. new build) can favourably impact costs, as there is a degree of scaling when fitting multiple properties at the same time, and no tear-down costs.

The cost of installing resistance and recoverability measures per home varies significantly, depending on the existing structure, measures already implemented, and the extent of flood risk and possible depth. **A rule of thumb is that a terrace house may take about £5K in measures to protect, while larger single-family homes are more in the range of £17K-20K, and full recoverability for some properties can be up to £30K+.** Costs are heavily influenced by the numbers of doors, windows, and possible entry points for water, as well as anticipated/actual flood depths and the level of protection required. It was noted that providing cash grants of £5,000²⁰ to homeowners had resulted in some inflation of costs and proposed measures to obtain the full amount for homes, while homes that required more than £5,000 often did not complete the suite of measures necessary to fully protect those homes.

²⁰ Which includes the VAT portion, as well as the survey cost of £400-800, which meant the portion for spending on actual measures was often closer to £3500-3800

New Build

Homes built with PFR at the outset is far less expensive than adding the measures subsequently. Despite this, very few companies reported that their products were being extensively used in new build homes. The small number of companies that reported products going into new build homes indicated it was a significant (e.g. 30-50%) portion of their total turnover, and a beneficial line of business as it allowed some standardisation and scale. That said, the numbers of sales and installations reported pointed to only 250-400 new build homes including PFR products in the last year.

Several insurers, consultancies, and organisations mentioned that, ideally, many recoverability measures should be inserted into building regulations, making them compulsory for all new builds in high flood risk areas. *British Standard 85500:2015 - Flood Resilient Construction* gives flood resilience guidance for designers of properties, by advising on suitable materials and details for construction. This document is designed to help provide resilient solutions to all sources of flooding. It is not understood the extent to which this standard is referred to by planners and developers. Any sort of mandatory requirement would likely reshape the market for measures overnight, given the rough figure of 6,000 new homes per year being built in areas at risk of flooding in recent years.²¹ New build installations could also be an important conduit for upskilling the industry, as larger-scale projects typically see a greater amount of training and apprenticeships, so including PFR measures provides an opportunity to familiarise portions of the industry with PFR and how to install it.

Commercial

Commercial demand normally comes from a smaller number of larger projects, larger solutions, and overall more comprehensive interventions. These bigger projects are deemed to be more appealing, as they are more stable and lucrative, allow for slightly more scaling (though typically still requiring bespoke work), and is also less subject to seasonality. Businesses, especially when considering larger structures like factories containing costly equipment, do not normally wait for an event to happen, but act in advance, with preventative measures, meaning projects can be better planned and implemented. Although some commercial work remains event-driven reinstatement. PFR companies working on these kinds of projects usually have design capabilities, as well as installation, providing a “one-stop-shop” solution (though often incorporating a range of products). Products in this space tend to not be kitemarked (more on this below) due to the bespoke nature of the interventions, but each project is signed off by an engineering team, shifting the liability away from the product manufacturers. Commercial demand accounts for about £3-4M.²²

Public Sector/Institutional

Companies in this space often deal with local authorities for community projects and more, with a growing amount of projects around PFR for schools. The Department for Education (DfE) has started modelling flood risk in the country, with a view to proactively upgrading more schools deemed at highest risk from fluvial and surface water flooding, following some very high-cost reinstatements.²³ The DfE is currently focusing on schools that are covered by the Risk Protection Arrangement, a programme where schools have formed their own risk-pooling and insurance scheme, but will extend this project to all schools later down their roadmap. Their current framework for suppliers is informed by the EA's existing one, however, they are planning to create their own. It is thought that institutional/public sector demand currently accounts for about £2-3M – as the schools upgrade programme is only at its outset, and this could double or more in the coming years.

²¹ DLUHC land use change statistics <https://www.gov.uk/government/statistics/land-use-change-statistics-2021-to-2022> show 3% of new addresses being built in areas at medium/high risk of flooding in 2021, with 206,000 new addresses for 2021.

²² Not including exports and products

²³ Program does not exclude coastal risk, but has found that typically schools at highest coastal risk are being considered by EA coastal schemes

Exports

As noted above, the £7-8M in PFR exports appears largely weighted towards products/goods. Only a small number of firms export, and for most of these, exports make up a significant part of their business (between 30-70%). These companies are typically part of a global supply chain, or distribution network. There is a small amount of service export work as well, weighted primarily towards design and specification work.

Cyclical (or counter-cyclical) was noted in exports as well, because much of the residential demand in other markets is driven by flooding events as well. Normally, this will result in a bit of spreading out, as events don't typically occur all at the same time. However, one major event or series of events having significant impacts in a number of different countries could place pressure on the supply of products, beyond the scale of a domestic event alone.

Key markets were the US and the EU, with market size, flood and weather patterns, and location of distribution chains (mainly in the EU) all playing a role. Transport costs were cited as an issue.

Scale Up Capabilities and Costs

Currently, the sector recognises that it is an extremely small, niche grouping within a much bigger building sector. Manufacturing companies within the PFR market appear to be able to scale up production by 20% immediately (principally for manufacturers, who noted they were currently manufacturing slightly under capacity) or within 2-4 months. For installers this was slightly higher (3-6 months) as they would need to undertake a combination of project management, hire and train new staff, and occasionally partner. About 1 in 10 provided an estimate of about 6 months, due to the need for infrastructure expansion, and recruiting and training staff.

A 20% scale-up is seen as purely theoretical, and no companies are currently forecasting or planning for it (let alone any higher increase). Certain smaller companies, which are close to their capacity limits, are not keen to scale up, as there is not sufficient confidence in the market to make the investments necessary to expand

their capacity. Overall, in the sector there is a reluctance to over-expand or over-invest, given past experiences where the sector expanded rapidly during a post-event boom, or schemes had gaps or lack of continuity, followed by contraction and companies going out of business. While there was optimism that Build Back Better could increase the amount of residential work in the future, companies were only willing to invest based on actual contracted business rather than potential demand.

About 1 in 10 manufacturers are currently working on expanding their facilities, for diversification purposes and not because they were forecasting any direct increase of their PFR production; their idea is to expand their production lines, adding or incorporating manufacturing processes that are currently outsourced. This kind of investment is seen as an opportunity to streamline production and possibly increase their B2B routes, rather than a direct reaction to increased PFR implementation in the UK.

Supply chains were not cited as being a major barrier in 2021-2022 as they were in 2020-2021, because timelines seem to be back to manageable rates, and most of the companies have mentioned strong relationships with their providers, as well as good internal management of supply.

Some companies noted that they had access to additional types of products and solutions from abroad, that were not widely deployed in the UK owing to relatively high cost and lack of familiarity.

Cost is seen as being a continued barrier, with PFR-specific products typically costing 20-80% more than standard products. This is largely due to the bespoke nature of the products, which often require customization, as well as bespoke installation processes such as wet testing (which has made a major contribution to the industry shifting towards quality). As long as the sector remains small, economies of scale will be lacking – this is one of the fundamental chicken-and-egg issues the sector faces. Inflation has had a variety of effects, in some cases increasing the prices of normal products such that the price variation is less, but also increasing the costs of many materials and inputs for small firms with tight margins.

Labour and Skills

As a relatively new and specialised area, PFR skills are not widely available in the market. In some cases, the process for installing PFR measures looks broadly like the installation of other measures (e.g. most non-permeable flooring), and requires attention to detail and high quality, but not a completely new skill set. However, there are fundamental differences between some critical PFR and non-PFR processes, which can include the testing of measures. For instance, the installation of a flood door requires much more time and bespoke installation measures compared to a normal door, as there are different kinds of seals to be put in place, different flood doors have different features (like handles that require special attention), and a flood door should not just “close well” when installed, but should also be “wet-tested” on location.

A lack of skilled labour in the market was frequently cited as a challenge, due to the general lack of skilled/experienced professionals in the construction industry, as well as the overall lack of workers in the UK. When combined with the extremely specialised skill set for some PFR work, this amounts to an extremely tight labour market and shortage of workers. In the past, this gave rise to firms without the necessary skills undertaking work in a way that did not guarantee the effectiveness of measures. The PFR Roundtable and its partners have taken steps to ensure that companies and workers understand the specialised needs of PFR, through the Code of Practice (CoP), and make training in the CoP and techniques more widely available.

Code of Practice

Definition from the Code of Practice for Property

Flood Resilience: *This code of practice (CoP) is concerned with the physical measures that can be introduced to buildings at risk from flooding. The CoP includes six standards that specify what should be achieved. These standards will be supported by comprehensive guidance on how the standards should be met by following stages within a process.*

The CoP covers six areas:



Hazard assessment



Property survey



Options development



Construction



Commissioning and handover



Operation and maintenance.

During the development of the CoP, the Roundtable, and delivery partners Building Research Establishment (BRE)²⁴ and the Construction Industry Research and Information Association (CIRIA) and the Chartered Institute of Water and Environmental Management (CIWEM) involved government, regulators, and PFR survey, design and installation experts. Many of the companies that participated in this effort, also provided their input to this study. The CoP manual is fully available, free of charge, on their website.²⁵

24. <https://bregroup.com/buzz/flood-resilience-standards-certification-and-skills-have-your-say/>

25. <https://www.ciria.org/ItemDetail?ProductCode=C790F&Category=FREEPUBS>

CIWEM is now responsible for delivering foundation courses, which allow professionals from any company in the PFR market to obtain the fundamentals of PFR, in the context of flood-risk management. They cover the principles of flooding, what is PFR, what measures can be put in place, and more.

Thus far, more than 250 people have attended the PFR foundation training.²⁶ The online course is currently fully accessible and there is regular availability. It comprises 24 modules that should take about 10 hours to complete, plus a final live teaching session called “surgery session”, with a trainer, online. The foundation training is considered as an introduction for professionals, and a prerequisite to participate in the upcoming technical modules training, which will be based on each of the 6 standards of the CoP. The foundation course is currently only online, with a cohort capping of 25 people per session.

The Code of Practice and the course topics cover primarily areas of design and theory, rather than the hands-on installation practice. As such, course attendance so far has been heavily weighted towards surveyors, loss adjusters, and insurance professionals. Upcoming technical modules will focus more on direct hands-on practice of installing and maintaining PFR, which is expected to be a useful resource for installers, designers and those undertaking the physical works, and has been piloted with at least one firm in the market.

The market is now broadly aware of the importance of working with the right standards. Companies state that their internal training processes are based on the Code of Practice, and most companies are aware of CIWEM’s foundation training availability.²⁷

Company Approaches and Best Practices

Most companies in the PFR space, to counteract the seasonality of the residential market, diversify their offerings and markets. They diversify principally based on customers, geography, and on their offerings of goods and services.

Diversification of customers is mainly between residential and commercial, following the reasoning expressed earlier. Public entities are an additional diversification route, typically for medium to large companies due to some of the complexities of tendering. Some larger commercial or public projects, or participation in planned and phase public schemes, balance the seasonality of residential work. The EA scheme was seen as vital to maintaining the sector in recent years, although some complained that its restrictive rules impeded sector growth – that said, all felt that for the sector to grow, the EA schemes and commercial projects needed to be balanced by a more robust residential sector, which BBB could be an enabler for.

PFR foundation training course



Online course



24 modules



10 hours to complete plus a live teaching “surgery session”



25 people per session

26. https://members.ciwem.org/CIWEM_MBR/Events/CIWEMEvent_Display.aspx?EventKey=PFRT2G1121&WebsiteKey=7c95955a-2322-4494-9fc7-0858ee2f789d A total of 400 have expressed interest, meaning a roughly 65% uptake rate. Over 100 people have paid to enrol, 80 attended the EA-funded course, and 65 attended the free RMA live seminars and workshops at Flood and Coast 2022

27. Although this was self-reported, and interviews occasionally left doubts at the degree to which Code of Practice had been incorporated in cases where firms had not attended the training, although given the emphasis is not yet on hands-on practice this is not an irreconcilable contradiction.

Focusing on different geographies (exporting) is another tactic, especially for companies that have strong ties with foreign distributors (for manufacturers), or the capacity to send installation teams abroad (less frequent – noted only in the case of Germany floods where the country’s capacity was overwhelmed). Several companies that have solution design capabilities often have clients abroad. The seasonality of floods is variable and typically follows different patterns in different countries, though concern exists for what an extremely large event affecting multiple geographies could do for industry demand.

Differentiating goods and services usually strengthens companies’ ability to provide within other, less specialised markets. For example, certain companies have considered (or have already adapted their manufacturing lines) to include additional features, from opening their facilities to other manufacturers to adding other (non-PFR specific) products along their core lines – this trend is obviously particularly applicable to the larger, diversified companies, although several small specialised companies are attempting to build their non-PFR market.

A best practice point raised during the interviews (and applying equally to the commercial and public sector descriptions below) is the benefit of maintaining separate roles for manufacturers and solution designers (and surveyors/assessors), to avoid creating a “preferential selection” of a company’s own products, over other products that might be better suited for the project at hand. In the same way, rather than installers providing final sign-off on their own installations, it is preferable for a separate/independent party (typically an independent surveyor) to validate the initial survey, ensure property owners are happy, and identify any final works required or missed recommendations from the survey.²⁸

Surveyors, Loss Adjusters, Consultancies

The insurance and surveying ecosystem is also an important aspect of the PFR market. Although it has not been included in the figures above, independent flood risk assessment (iFRA) and survey is one of the areas of the Code of Practice, and generally accepted as an essential pre-requisite.²⁹ Insurers have direct involvement with and understanding of homes and householders. Loss adjusters and surveyors act as key conduits to advise on the inclusion of PFR in any reinstatement following an event, and consultancies are often called in to advise on the latest technologies, resolution routes, and evolution of flood risk. Surveyors conduct the initial flood risk assessment and survey - outline design (steps 1, 2 and part 3 of the CoP), installers take over half way through step 3 (options development) and carry out the detailed design, and surveyors return at the end post install to perform a PIA (post installation assessment).

Surveys typically cost £400-800, and provide the householder with an understanding of their flood risk, any measures installed in their property, and the sorts of options available and recommended in terms of PFR to improve the property’s resilience. Estimates of householders’ uptake of measures following the survey ranged from under half to as much as 75%, with the latter figure more typical of EA schemes where funding will be provided, with householders rarely exceeding/supplementing the grant amount to a significant degree. A few participants noted the lack of a universal standard for surveys as an issue to address in the future, and it was similarly noted that moving to a more standardised process could help bring down survey costs – the EA framework and Code of Practice have laid the foundations for this by establishing a standard.

²⁸ Defra research in 2015 came to similar conclusion regarding the need for impartial advice, which it concluded should be provided by surveyors/assessors who are independent from the PFR industry https://assets.publishing.service.gov.uk/media/60350459e90e07660cc438d1/13061_FD2681_Surveyingforfloodresilienceinindividualproperties_FR.pdf

²⁹ Similarly recommended in Defra report (see *ibid*)

The standard insurance reinstatement process for floods is to rebuild properties to the existing conditions before the event. Build Back Better aims to move the reinstatement process towards resilience by offering additional funds for properties to install PFR measures following an event to reduce their flood risk.³⁰ Several loss adjusters and a small number of insurers already promoted the concept of better reinstatement, prior to BBB, and included a limited number of PFR measures in property reinstatement. The current claim process following a flood - assessing damages, drying time, and reinstatement – was seen as sufficiently long and complex that PFR could be incorporated within normal timelines (highly variable, with up to 6 months as a rough guideline) provided PFR measures were considered at the outset.

Post-installation audits currently play a role in ensuring the effectiveness of installation – it is compulsory for every installation on EA schemes and post installation wet tests will be required for 20% of all installations on the 2023 PFR framework. Post flood effectiveness surveys are also part of the scope for the 2023 PFR framework, which will enable the EA to commission a survey following a flood event. This will further help assess the effectiveness of PFR and identify lessons learnt.

Surveyors are normally viewed as the best-placed professionals to act as a conduit of information to householders, and involved at the outset of the process. Surveyors have been the largest group of attendees at Code of Practice foundation training thus far, although the number (just over 100) of those who have attended remains a very small number of the total number of surveyors. Ensuring more widespread penetration and awareness of the Code of Practice among surveyors is an important step towards embedding PFR in company practice and householder awareness. Further recommendations on how to develop a broader

cohort of independent surveyors, and the role they can play in increasing PFR uptake, can be found in Defra's 2015 report on the subject.³¹ There is an opportunity for building assessors (RICS) to be trained to understand how water interacts with a property to grow the market capacity for surveyors.

Issues and Boundaries

Supply Chains

The supply chain and sourcing issues experienced in the past 3 years (pandemic-related shortages of goods and containers, and Brexit-related disruptions) affected the supply chain for PFR products. By the time the survey was undertaken in late 2022, however, most participants stated that the PFR supply chain had returned to acceptable timelines, with delays of a maximum of 2 weeks for most products, bringing current timelines to 6-12 weeks from order to delivery. This timeline is the maximum experienced by the responding companies for the majority of their products, with certain products delivered within lower timelines (~4 weeks as a guideline). One large customer, however, did note extremely long timelines (up to 8-12 months) for a very limited product type.

The main repercussion remains the cost increase of source materials (passed on to the final customer), which includes transportation cost increases for international goods. Imported materials and products were said to make up around 40% of the supply chain, mainly from Asia for rubber and aluminium, while the rest comes mostly from finished or part-finished inputs from UK-based suppliers. As noted above, this had a variety of effects on final products, in some cases closing price gaps, while in others squeezing tight margins for small suppliers.

30. Additional information available at: <https://www.floodre.co.uk/buildbackbetter/>

31. https://assets.publishing.service.gov.uk/media/60350459e90e07660cc438d1/13061_FD2681_Surveyingforfloodresilienceinindividualproperties_FR.pdf

Certification Processes and Product Quality

Certification of products and services is an important question for effectively all companies (both manufacturers and service providers/installers) in the PFR market.

It was universally agreed that appropriate standards are necessary to ensure positive outcomes for householders. As such, most companies supplying products are active in trying to demonstrate via testing and formal certification that their products perform to a standard, as a prerequisite in the market. However, there is significant variation in product specifications in order to ensure options suitable for the multitude of different UK homes, with different alignments and dimensions (as well as active measures requiring householders to operate them, as well as maintenance requirements). This results in a complicated landscape for many small companies to test and ensure performance.

The British Standards Institute is currently the official body performing certification processes for PFR products (Kitemark³²). Their current standard BS 851188³³ was launched in October 2019, although the majority of the Kitemarked products currently on the market are still certified for the previous standard PAS 1188. A Kitemark can be obtained only through BSI's certification process, which can either be done entirely through a process managed by the BSI and undertaken in the independent HR Wallingford facility, or through BSI verification and sign-off of testing undertaken in 2 other PFR manufacturing facilities and arranged/managed by the company itself. The Kitemark is seen as the lone fully validated standard for products because it gives evidence that the products have been testing to the standard required, and the manufacturing locations are specified and audited every 6 months, so product data is reviewed.

The Kitemarking process requires each product to be certified individually and go through its own sequence of tests, which can require booking out a large testing tank facility that can simulate the water flows of a flooding river (complete with waves and impacts), for a period of 2-3 weeks, with the independent facility's tank costing £2,000+ per day. Further, each variation of the product has to be tested individually, meaning that a door that has a composite panel on the left side has to be tested again if the same panel is moved to the right side, doubling the costs. Each product obtains a bespoke quote for the process and cost, with £30,000 per product cited several times – although one company noted it had completed the process for roughly half that via the self-arranged process. Obtaining a bespoke quotation requires BSI to coordinate several aspects and/or obtain a testing appointment – respondents noted long wait times for responses to inquiries. Kitemarking also requires auditing and certification of any manufacturing facility, which makes it difficult to obtain for any product manufactured abroad.

The other UK testing facilities are within certified PFR manufacturing facilities with measures put in place to guarantee an impartial and secure process. However, many companies viewed these as “competitors” facilities and preferred to test in an independent facility (this was not universal, however, as at least one company had overcome their reluctance to this process, and successfully completed a kitemark by testing within a “competitor's” facility). Those who did not obtain quotes from BSI at the outset often abandoned the certification process, even via other routes, due to the need for BSI to certify in the final stages and their view that without a clear acknowledgement of steps required, this final step could prove to be a roadblock.

32. <https://www.bsigroup.com/en-GB/kitemark/>

33. <https://www.bsigroup.com/en-GB/blog/fire-and-flood-blog/introducing-bs-851188/>
<https://knowledge.bsigroup.com/products/flood-resistance-products-building-products-specification/standard>

A small number of firms have successfully completed the Kitemarking for their products, and as a result have become preferred suppliers with successful businesses. For other small companies and new entrants, the process appears to be more complex, lengthy, and costly than they are able to easily navigate. On the one hand, it is widely recognised that a standardised and rigorous process has been created to ensure the effectiveness of products, and some companies have successfully invested in making this a differentiator for their business. On the other hand, in a small market made up of SMEs this high bar is perceived as a barrier to entry, potentially drives consumers to a more limited set of products, and limits innovation and adaptation within a highly diverse residential market. While the process is suitable for many larger firms, many smaller firms in the market feel excluded from the wider range of commercial opportunities that an official designation would provide. Most agree that in order to ensure a greater and more flexible supply of quality assured products at lower cost, the current set of arrangements needs to evolve.

Many products are labelled and sold as being “tested to standard”. Rather than going through the BSI’s process, it is possible to purchase the current standard, which amounts to a manual, from BSI for £192 and to self-test the products. This method involves considerably fewer parties and fewer administrative steps, and there is a wider range of facilities able to undertake wet testing without simulating a flooding river. However there is very little guarantee and oversight, meaning that the EA scheme and others requiring official certification are unable to use the products. There is also no way to check, and reports of considerable misselling and misrepresentation in the past.

An alternative approach requested by manufacturers, which will be included in the new EA PFR framework, is independent witnessing of testing, which means the possibility of having BSI (or other accredited bodies) officials witness a test done in other certified facilities,

as an alternative to obtaining a full Kitemark. It is hoped this will be less expensive and speed up the process. Further steps have been suggested such as the acceptance of different standards, like ISO and FM Approval (FM 2510). For commercial and institutional products (which are typically bespoke and difficult to use Kitemarked products for), a project sign-off process means that installers and/or solution designers share the responsibility with manufacturers for quality assurance – some form of this may be useful for certain residential products. There have also been proposals for university spaces with flood-related programs to be certified as additional testing facilities (academia is perceived as an independent space that could increase testing capacity that companies would be keen to use). However, there is not currently the demand for product testing to make the business case for widespread expansion of facilities.

Overall, on products, whether Kitemarked or self-tested, there is a growing body of experience to demonstrate the effectiveness of measures, as well as on-site wet testing, which can make an enormous difference to ensure homes are resilient to flooding.³⁴ However, the small volume of installations and lack of major flooding in recent years means there is still considerable learning to be done about highly variable and bespoke ways that a multitude of products can be used. Post-flood effectiveness surveys (noted above as part of the 2023 EA PFR framework) and further audits of installed PFR can also help understand and ensure performance over time.

All manufacturers and installers agree on how fundamental it is to define sector standards, and to pair quality-assured products with effective installation via the Code of Practice, and saw this as being good for business for specialised/differentiated/certified PFR companies. However, a range of views still exist as to the best option for ensuring product quality within a market that balances flexibility and innovation with assured performance.

32 Testimonial and stories available at: <https://www.floodre.co.uk/buildbackbetter/>

Measurement, Documentation, and Awareness

Another fundamental issue is that for most of the life of the PFR industry, there was no simple way to track what measures were in place in people's homes, for people to be aware of the steps necessary to maintain them, and to have a specific understanding of the effect that highly variable suites of measures had on a home's resilience to flooding.

In terms of tracking measures in people's homes, many homeowners were unaware of the measures in place, and it was extremely rare for this information to be transmitted to the home-buyer (or provided to tenants). Newer EA schemes are piloting measures to track what is installed in people's homes, as well as trialling tools such as an app to inform and remind householders about the maintenance measures necessary to maintain their PFR – this can also start to broaden the scope to include recoverability measures and preparedness. The EA's PFR Pathfinder project has also developed a system for tracking measures and past surveys in order to maintain a repository of information on homes' resilience and past surveys.

Flood Re, the EA, Defra, and The Flood Hazard Research Centre (FHRC) at Middlesex University have collaborated on a project off the back of an EA PFR scheme for 160 properties.³⁵ It recorded all resistance measures for 160 properties and recoverability measures for 30 properties within the 160 scheme EA scheme. Preparedness aspects involved giving the property owner access to bespoke flood warnings (river and surface water) to enable them to create a bespoke flood emergency response plan. The pilot collected the data to facilitate a scoring methodology and a proof of concept Flood Performance Certificate (FPC).³⁶ The aim of the proof of concept FPC is to get the property owners to take responsibility and ownership for their climate (flood) resilience / adaptation, to remove the stigma associated with flood risk, and to engage the community going forward. For this initial phase of the project, the score captures the flood performance of a property at the point of evaluation with maintenance assumed.³⁷ The pilot tested data collection via a flood compliance platform, with a scoring system developed by the FHRC. Although covering only 30 properties for recoverability measures it was designed to prove concept and be the basis for mainstreaming PFR by being simple, credible, repeatable and scalable.

35. <https://www.eastpeckhampfr.com/>

36. For more on flood Performance Certificates, see <https://www.floodre.co.uk/wp-content/uploads/Flood-Performance-Certificates.pdf>

37. Maintenance is step 6 of the Code of Practice and will be considered along with installation in the next phase of the project.

Devolved Nations

We have included a brief section on Devolved Nations – although the EA Framework is available for use by all UK Risk Management Authorities, the schemes in Scotland and Northern Ireland, markets operate somewhat differently. Figures covering the Devolved Nations are included in the totals noted at the outset of the report.

Scotland

The Scottish Environment Protection Agency, which is the closest corresponding body to the EA, is not responsible for PFR as in England, so schemes have primarily been led by local authorities who directly authorise schemes and provide funding. Scotland went through a similar trajectory as in England, where grant schemes fed in to a boom-bust cycle that overlooked quality issues resulting in mistrust, which has impeded the appetite to undertake a national-scale initiative similar to the EA. The Scottish Flood Forum has been an active participant in the PFR Roundtable and works with communities to disseminate PFR information. That said, Scotland's PFR market is much smaller than England's, and the remote nature of many areas makes accessing services and goods more costly and complex in many sectors, including PFR. Whereas at least one specialist PFR firm previously existed in Scotland, it ceased operations in recent years, meaning Scottish PFR work at present relies mainly on bringing in firms and supplies from England. A strong network of insurers exists in Scotland, so it is hoped that BBB will help expand its PFR market.

Wales

Natural Resources Wales and the Welsh Government have made efforts to leverage the existing English structure, and the EA's PFR Framework is used by many Local Authorities in Wales. Schemes do exist, such as the South East Wales Technical and Professional Services (SEWTAPS) framework, through which PFR surveys can be delivered by LLFAs, followed by installation and delivery via Lot 2 of the EA scheme. Geographically, it is relatively closer to the concentration of PFR companies in the Midlands, but the small size of the Welsh market and remoteness create a barrier.

Northern Ireland

Northern Ireland has a Homeowner Flood Protection Grant Scheme³⁸ administered by the Department for Infrastructure, where properties that have flooded in the past and continue to be exposed to frequent flooding are eligible for up to 90% of their costs, to a maximum of £10,000. A small cluster of Northern Irish companies exists, including both manufacturing and installation.

38. <https://www.infrastructure-ni.gov.uk/articles/homeowner-flood-protection>

House of the Future

