DECISION MAKING PROTOCOL FOR SOLID WALL INSULATION PROJECTS

A Guide to Decision Making for Solid Wall Insulation Retrofit Projects on Traditional Buildings

FINAL DRAFT – Prepared for Blackpool Council by NDM Heath Ltd and the STBA, July 2014

NDM HEATH LTD
Sustainable Energy Services

STBA
SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE

DECISION MAKING PROTOCOL FOR SOLID WALL INSULATION PROJECTS

Background

Following the lessons learned from recent solid wall insulation (SWI) projects across Lancashire, a number of common problems were identified (e.g. poor workmanship, detaining issues, consistency of quality and finish, effects on building fabric and so on). This highlighted the need to develop a greater understanding of this area, to develop and workable and effective means of limiting ad hoc, poor quality and inappropriate retrofits, and to encourage good-quality SWI projects that improve energy efficiency and occupant wellbeing without affecting heritage value or building fabric.

Blackpool Council therefore commissioned this Decision Making Protocol to aid development teams in selecting, specifying and monitoring SWI projects in their area, reducing risks and encouraging replication across the region.

How to Use the Decision Making Protocol

This Protocol is based on a series of decision trees, leading users through a trail of questions to reach appropriate decisions for retrofit projects. It allows users to make rapid decisions as to:

a) whether to implement solid wall insulation (SWI);
b) whether external or internal SWI is more appropriate; and
c) what considerations are necessary before, during and after installation to minimise risk and maximise benefits.

In all cases, further research is recommended before proceeding with a project. The extent and nature of this is dependent on the answers reached by users. Sources of further information are included at the end of this Protocol.

This Protocol is designed for older, traditionally-built housing with solid brick or stone walls, but elements of it may also be applied to other property types where SWI is being considered.

Contents

1. KEY PRINCIPLES

Solid wall insulation (SWI) can be a very successful measure for addressing issues such as comfort, fuel cost and CO_2 emissions, and (when applied externally) can help to protect buildings in certain locations and climatic conditions. However, decisions in relation to SWI and traditional buildings can be complex, and inappropriate installations can cause negative impacts such as loss of heritage features, moisture build-up, mould growth, poor air quality and associated health issues. While some of these issues may be immediately apparent, others may not materialise for a number of years by which time substantial and costly remedial works may be required.

In order to provide a sound basis for SWI installations, this Protocol starts from the premise that projects should adhere to a number of key principles (listed below). It is recognised that some of these principles may take more time than others to implement; this will be dependent on individual project conditions. However, these principles are based on current research and advice for insulating traditional buildings, and are designed to minimise risks before projects even begin. Brief explanatory text is provided for each key principle; links for more detailed information are given at the end of this document. **If any of these principles is not being followed, careful consideration and further research are recommended before going ahead with a project, and attention to detailing and on-site implementation become even more important.**

1. **All treated buildings are in appropriately sound condition, free from defects and in particular damp**
   Applying IWI to unsound walls (e.g. walls with failing masonry, pointing or rainwater goods) is likely to lead to moisture-related problems, such as trapped moisture, damp, condensation, mould and so on (damp issues are covered in more detail in Section 2). This can be less of an issue for EWI as some repairs (e.g. pointing, masonry) may not always be needed, but any damp should be addressed regardless of whether EWI or IWI is proposed. If potential moisture-related risks are present, advice should be sought from a building surveyor or other specialist to ensure any proposed system is appropriate

2. **External wall insulation (EWI) is selected over internal wall insulation (IWI), unless there are specific reasons to choose IWI**
   EWI is generally deemed preferable over internal wall insulation (IWI) in the first instance for older traditionally-constructed buildings, on both technical and facilitation grounds. With appropriate application, EWI is likely to carry fewer risks than IWI in relation to thermal bridging, interstitial condensation and other moisture-related issues; it allows the walls' thermal mass benefits to be retained (e.g. storing heat, warming the wall fabric and thereby reducing the risk of interstitial condensation); and it can also help protect building facades in exposed locations. In terms of facilitation EWI should be easier and faster than IWI to apply at scale, and involve less householder liaison and disruption; this makes it more straightforward for both project

managers and installers. However, there are instances where IWI may be deemed more suitable – for example, where EWI would have an unacceptable impact on the external appearance of a property. It should also be noted that hybrid systems are sometimes appropriate (e.g. IWI on the front elevation and EWI elsewhere)

3. **Fully vapour-permeable insulation systems able to transfer moisture are used, including linings and finishes ***

   This maintains the vapour permeability, capillarity and porosity of traditional walls, allowing moisture transmission between the inside and the outside of the structure. It also maximises chances of any trapped moisture (pre-existing or future) being able to disperse

   ** This principle assumes the passage of moisture has not been blocked previously by the application of impermeable materials*

   ** There may be exceptions to this principle. A detailed assessment is necessary in areas exposed to high levels of wind-driven rain, for example, to identify the most appropriate insulation and render type needed to achieve a balance between repelling external moisture ingress and allowing the dispersal of internal moisture. In addition, individual systems may specify circumstances under which permeable insulants are not appropriate (e.g. in wet rooms). In flood risk areas, particular care is also required when specifying the insulation system: permeable insulation systems may be more likely to absorb water and require replacement than impermeable systems, but in either case it may be recommended to remove the insulation temporarily to allow the wall fabric to dry out fully.*

4. **Careful detailing is employed throughout, particularly around openings, junctions, eaves, seals and any areas of thermal bridging**

   Careful detailing reduces the risk of issues including inappropriate appearance, moisture ingress and thermal bridging. Thermal bridges are likely to lead to heat loss and lower surface temperatures, attracting moisture and its resultant problems. Ensuring coverage is as comprehensive as possible will reduce the amount of untreated wall and corresponding risks. Detailing should be designed in conjunction with Blackpool Council to ensure it is directly related to the buildings in question and in line with the Council's recommended detailing

5. **Workmanship on site is properly managed by contractors and independently monitored through a Clerk of Works or similar**

   Meticulous attention to detail is required when applying SWI to older traditional buildings, but translating theoretical good practice onto site practices brings many challenges (e.g. frequently changing site staff, time pressures, language barriers, intricate and/or unfamiliar detailing and so on). Many of these issues can be avoided by contractors deploying sufficient levels of supervision and by independent monitoring through a robust quality management system. For heritage-grade buildings (e.g. listed buildings or buildings in conservation areas or similar) it is important that there is a process in place to ensure all people working on the building are aware of its significance and independent monitoring/inspections can take place

6. **Systems and detailing are consistent, both within individual projects and across multiple projects**
   A harmonious appearance is important, including those areas with no formal protection (e.g. through listing or conservation area designation). Learning from past experience is important to identify successful systems and detailing that may be replicated across future sites. Decision-making, procurement methods and inconsistent detailing can often lead to a 'patchwork' effect (in the case of EWI) that is generally considered undesirable

7. **Systems and detailing are in line with any relevant conservation considerations & requirements**
   Particular care is required when dealing with heritage-grade buildings, but this also applies to buildings that are similar but have no formal protection, and to those adjacent to heritage-grade buildings/areas. This principle flows both ways: development teams should take account of national, regional and local conservation requirements in designing the SWI system, and conservation bodies / officers should understand the technically-preferable detailing needed to prevent undesirable impacts (e.g. covering original features to prevent thermal bridging and other potential issues)

8. **SWI is considered holistically, as part of a whole-house retrofit programme**
   This approach will help ensure SWI is applied appropriately, as part of a comprehensive upgrade package and bringing in any associated measures (e.g. ventilation systems, properly adjusted roof verges and eaves, other insulation measures) to reduce the risk of any unintended consequences. Ventilation and heating system requirements in particular should be assessed

9. **Occupants are involved in the process, and post-project advice is provided**
   This is important to avoid inappropriate behaviours. It may include advice on revising heating regimes, ventilating homes, selecting finishes and so on

2. CONSIDERATIONS FOR BLACKPOOL STOCK

Blackpool is situated on the West coast of England, in an area defined as being exposed to 'severe' levels of wind-driven rain (see map below). This is an important consideration both for building condition and for any application of SWI.

External wall insulation (EWI) is often recommended over internal wall insulation (IWI) in such areas, as it should reduce the risk of moisture-related issues within the walls. It can also help protect building façades from weathering effects. However, buildings in such locations can be more likely to have higher moisture levels within the wall fabric (depending on the construction materials), making it particularly important that moisture levels and any potential damp issues are assessed adequately before proceeding with SWI (see 'Damp', below).

This also means that care is needed when selection a SWI system. As noted previously (Key Principle 3, above), systems that allow moisture transfer are often preferable for older, traditionally-constructed buildings as they were built to 'breathe' and allow moisture to permeate through the walls. However, in highly exposed areas care is required to achieve a balance between protection from driving rain and continued dispersal of internal moisture. System selection becomes particularly important in such situations, and can be complex (e.g. render systems can be vapour permeable but also prevent capillary action, mineral wool systems can be problematic if they become wet, and so on). If impermeable SWI systems are selected in such areas, it becomes particularly important to ensure that a) walls are not damp prior to application and b) meticulous detailing is applied to prevent moisture ingress; if these precautions are not observed the risk of moisture-related issues will increase.

In addition, Blackpool's coastal location makes many of the properties susceptible to sand and sea spray (salt) being blown onto and into them (including within wall cavities). This can increase the weathering effects on building façades, making EWI a more attractive option (where appropriate) to help protect the buildings.

UK zones for exposure to driving rain (Building Regulations 2000)

While it is important to consider the above issues, it should also be noted that Blackpool's location in a 'severe' exposure zone does not mean all housing stock faces the same issues. In reality each property's exposure varies depending on immediate location and surroundings, as these affect sheltering levels and number of exposed façades.

Guidance is available (e.g. Building Regulations) on the relationship between the above exposure zones and cavity wall insulation, and much of this may be applied when considering SWI projects (particularly IWI). Such guidance is likely to cover issues such as wall thickness and construction type, porosity of materials and the ability or otherwise of moisture to track through any cracks, gaps or interfaces.

Damp

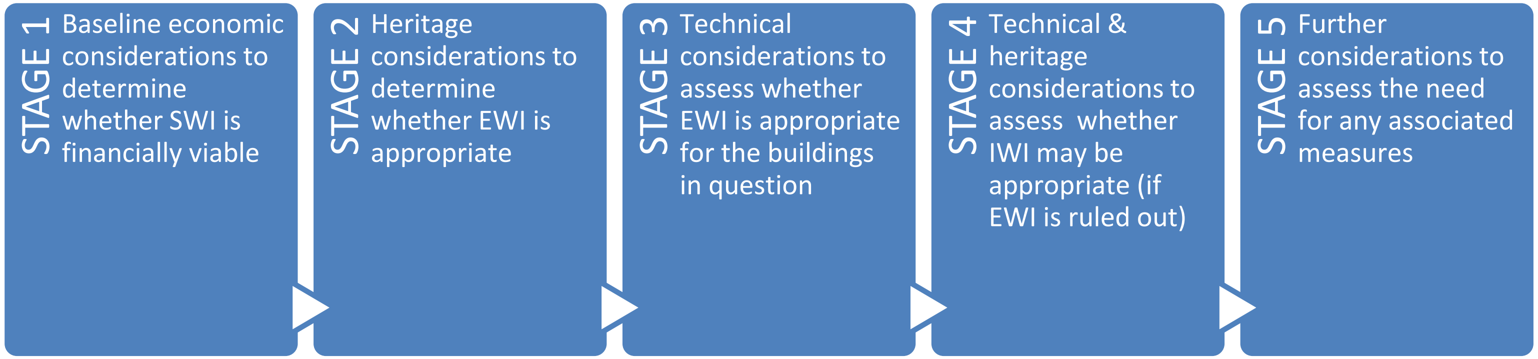
When assessing damp in Blackpool properties, special consideration of the above issues is recommended. Appropriately qualified damp assessors should be used together with suitable assessment methods. This may include the use of electrical resistance moisture meters and/or capacitance measurements, but these should be used with caution and treated as guides to aid surveyors rather than as definitive assessments. Other features should also be taken into account, such as the varying moisture tolerances of different building materials (e.g. engineering brick, common brick, facing brick, sandstone and so on), mortar types (e.g. lime / cement), and so on.

If detailed testing is not possible on all properties to be treated, it may be beneficial to undertake detailed testing on representative sample properties in order to build up a likely picture for all stock.

3. SWI DECISION TREES

The following pages contain a number of decision trees designed to take users through the decision-making process for potential SWI projects.

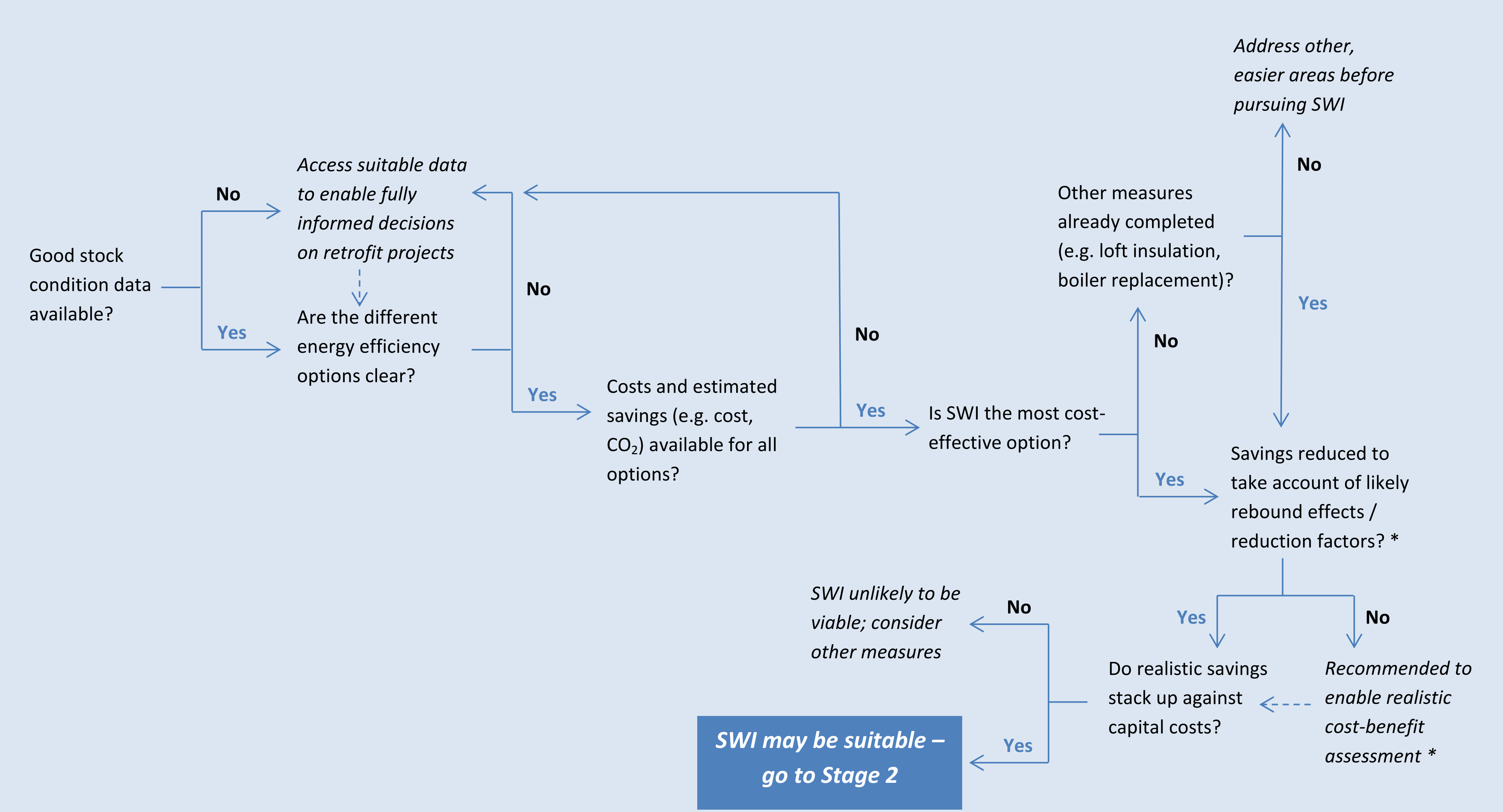
The decision trees are split into five different stages, each representing a separate level of analysis. These are presented in a sequential order and should be followed as such. The diagram below illustrates the different stages of the process:



These stages represent good practice under ideal conditions. It is inevitable that such conditions may not always exist for retrofit projects, so it may not always be possible to address all considerations fully. The aim of this Protocol is both strategic as well as specific, allowing users to make informed decisions at the very least, even where ideal conditions do not exist. The potential impacts (positive and negative) can only be known if users are aware of the principles and stage-by-stage considerations recommended in this document.

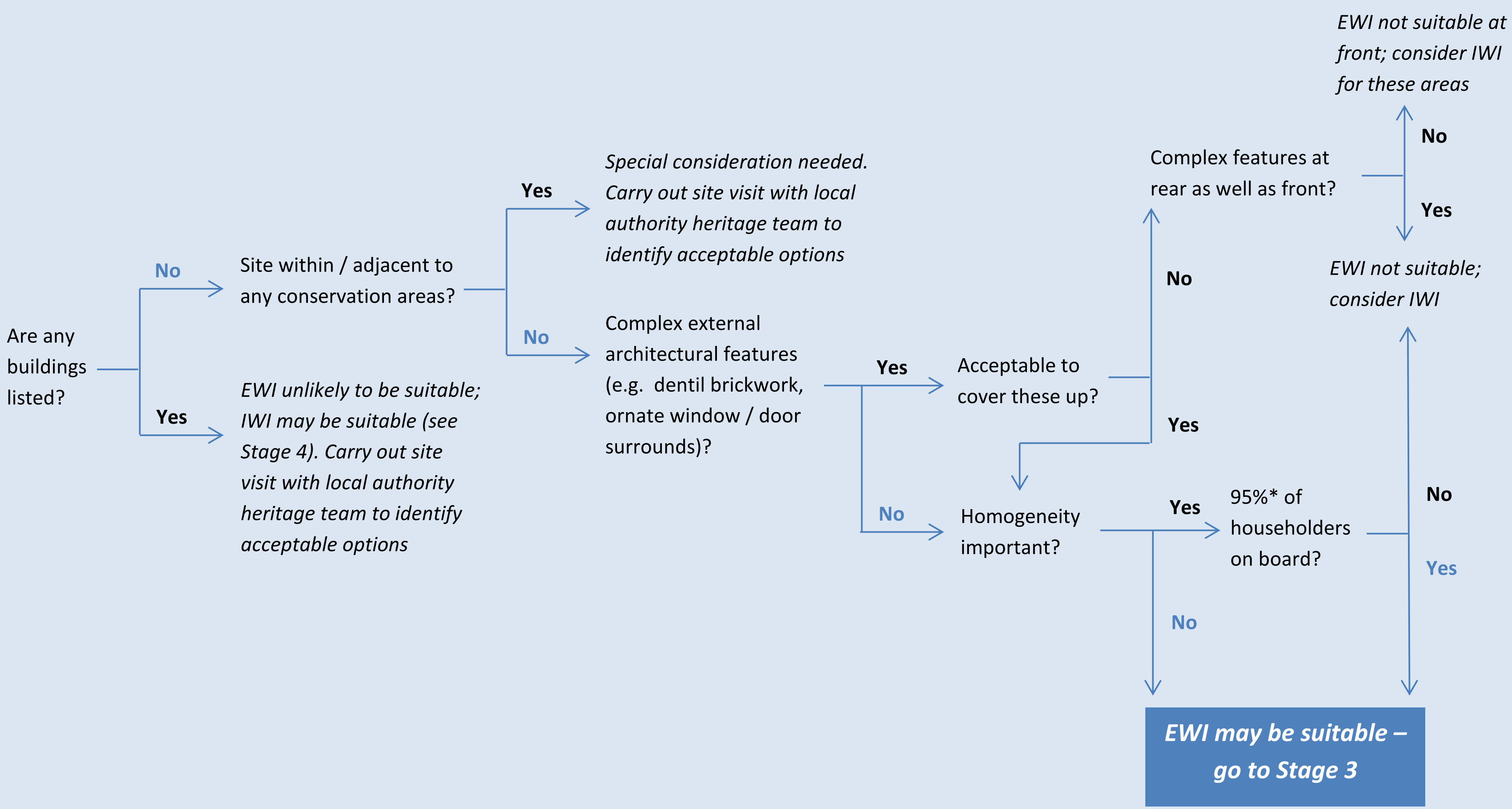
Users will also notice that some of the answers in the decision trees are shown in blue. These highlight the most straightforward scenario for successful SWI installations, and are for illustrative purposes only – in reality, this route will not often be achievable as complexities are common when dealing with older housing stock.

STAGE 1: ECONOMIC JUSTIFICATION



** Revisions should also help counter some of the other potential causes of inaccurate estimates (e.g. inaccurate modelling tools, imperfect installations and so on). Obtaining suitable data will make revised estimates much more accurate, e.g. accurate U-values and energy consumption, as assumptions in these areas lead to misconceptions about actual impacts.*

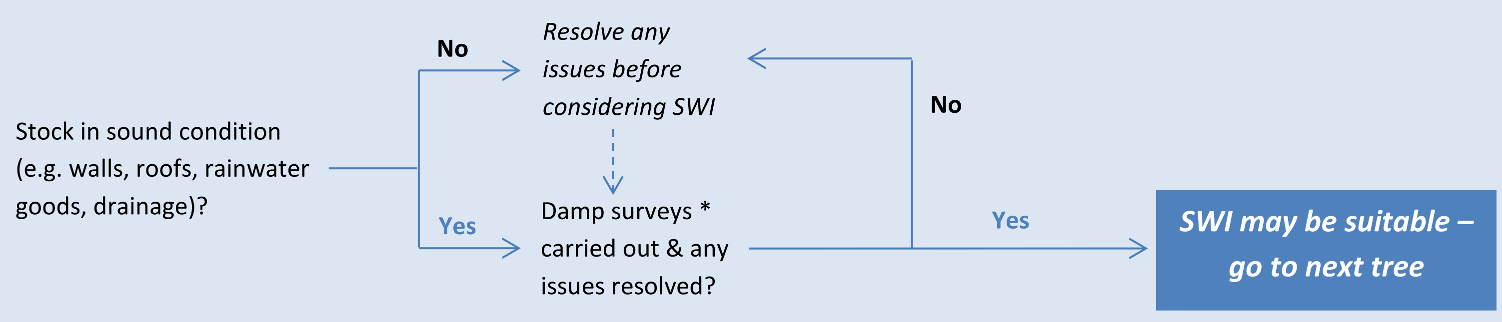
STAGE 2: HERITAGE VALUE (EWI)



** Suggested minimum figure. This figure may be amended by Blackpool Council to reflect locally acceptable proportion of treated vs untreated properties.*

STAGE 3: TECHNICAL FEASIBILITY (EWI)

This first, short decision tree addresses the fundamental issue of property condition – satisfactory answers at this stage are recommended before proceeding further.

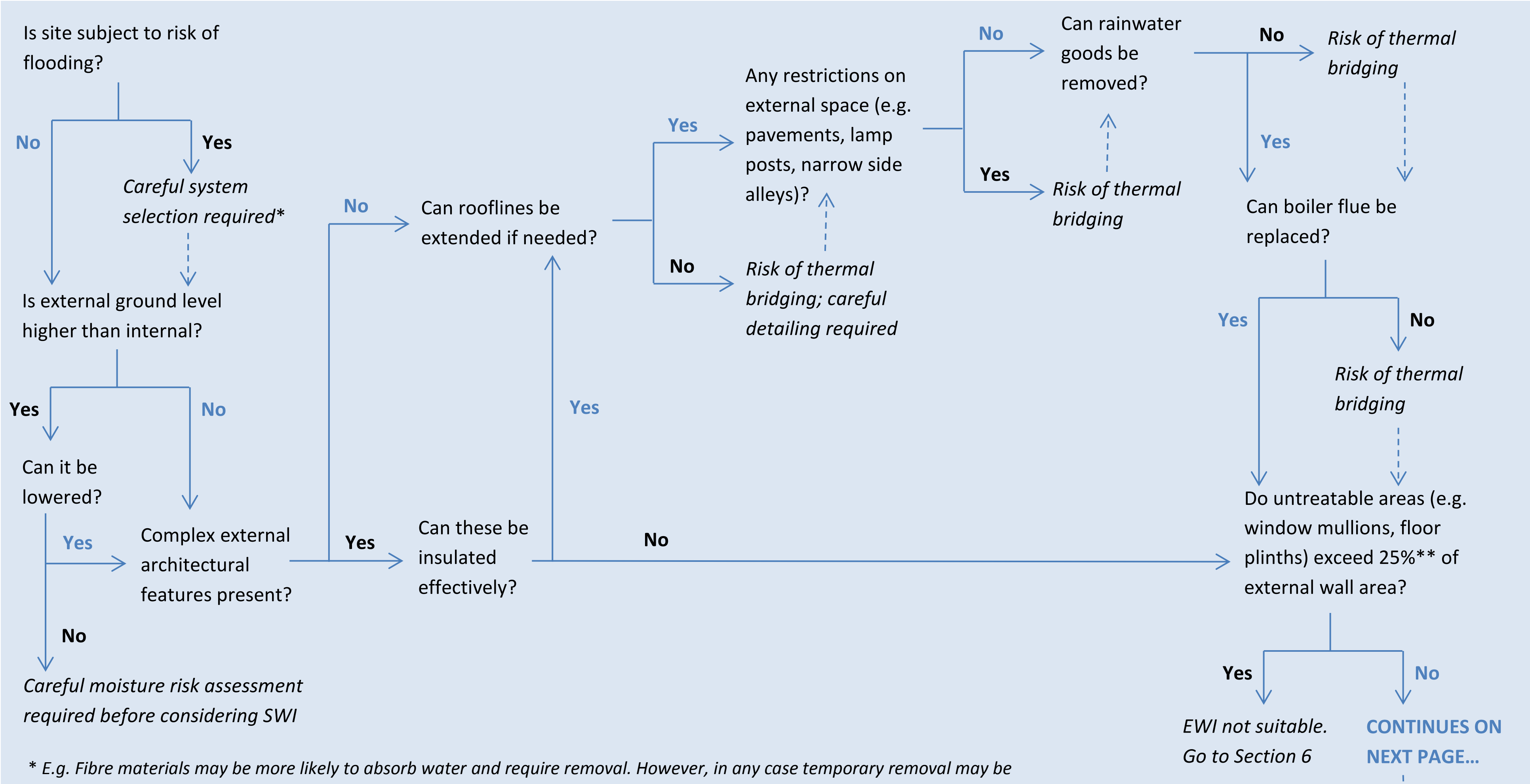


** Robust damp surveys are of particular importance for stock in areas such as Blackpool; see Section 2 for more details.*

If the above questions receive positive responses, users may continue to consider SWI in more detail. This process may be aided by deciding in advance on the approach to be taken for addressing complex features (e.g. bay windows, mullions, porch roofs, dentil brickwork). In general:

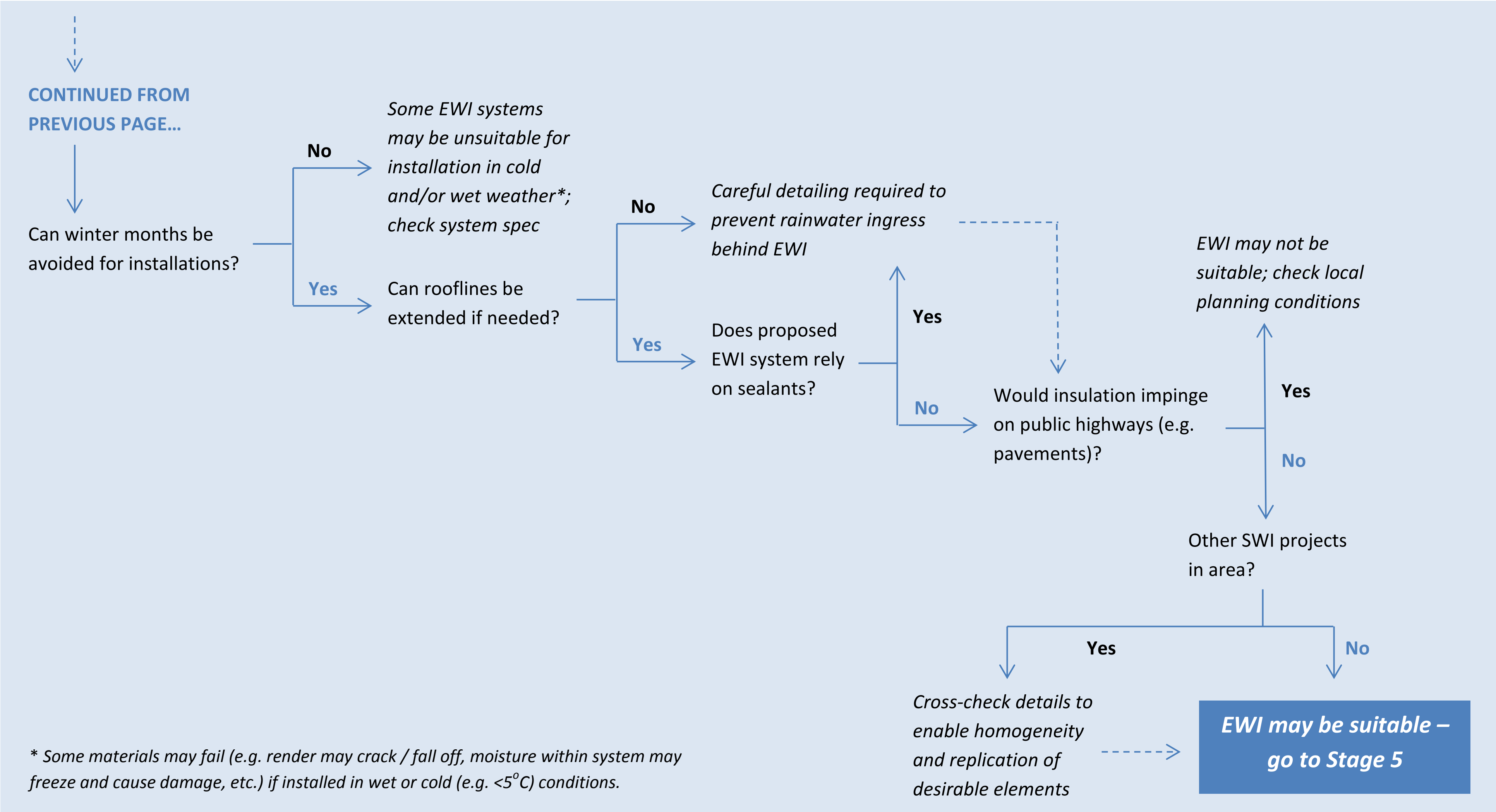
- Identify all potentially challenging wall areas, and assess whether these may be insulated effectively
- Decide whether coverage & replication of architectural features is appropriate
- Maximise wall coverage, minimising thermal bridging

STAGE 3: TECHNICAL FEASIBILITY (continued)



** E.g. Fibre materials may be more likely to absorb water and require removal. However, in any case temporary removal may be recommended to allow the wall fabric to dry out.*

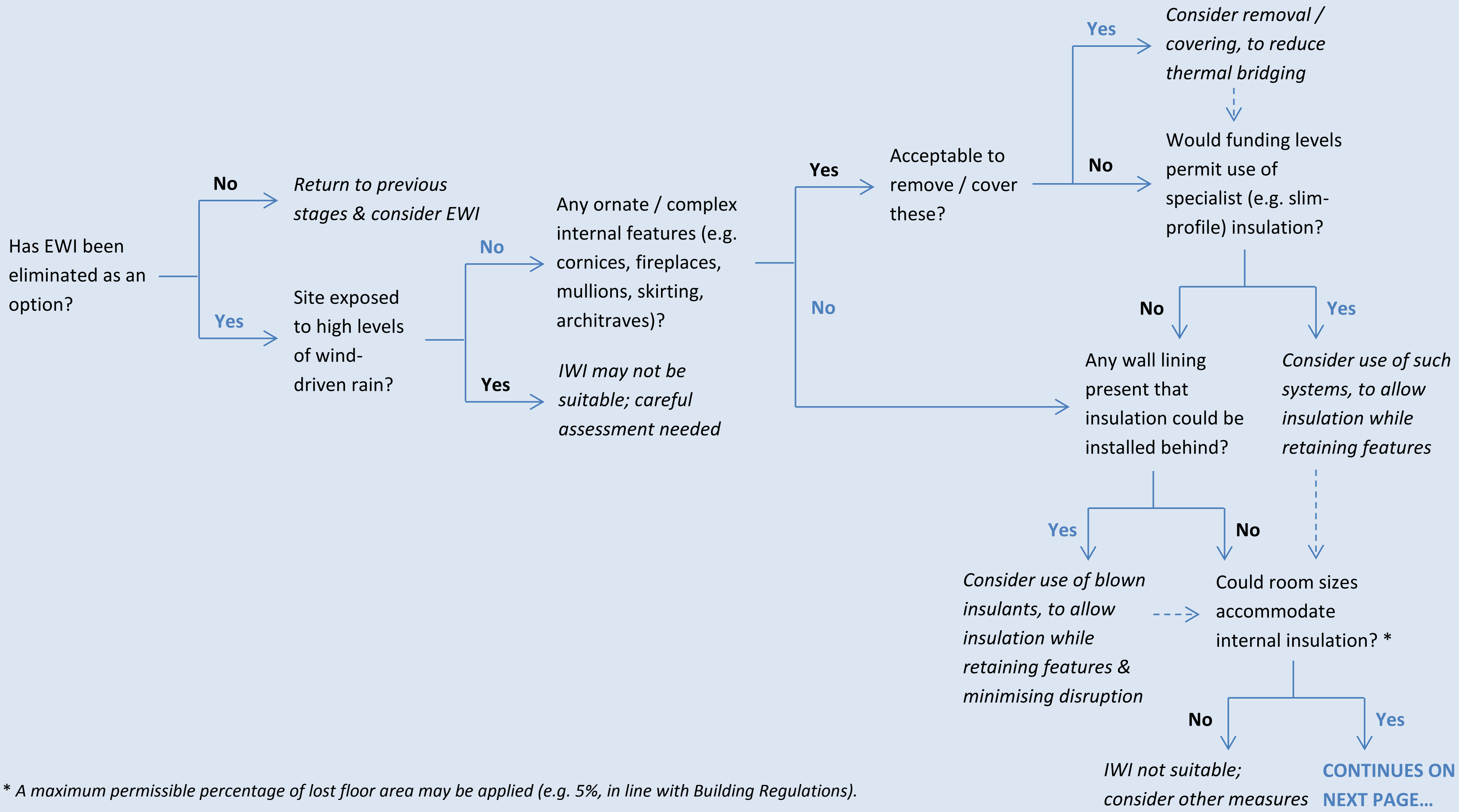
*** Suggested maximum figure. This figure may be amended by Blackpool Council to reflect locally acceptable proportion of untreated wall area.*



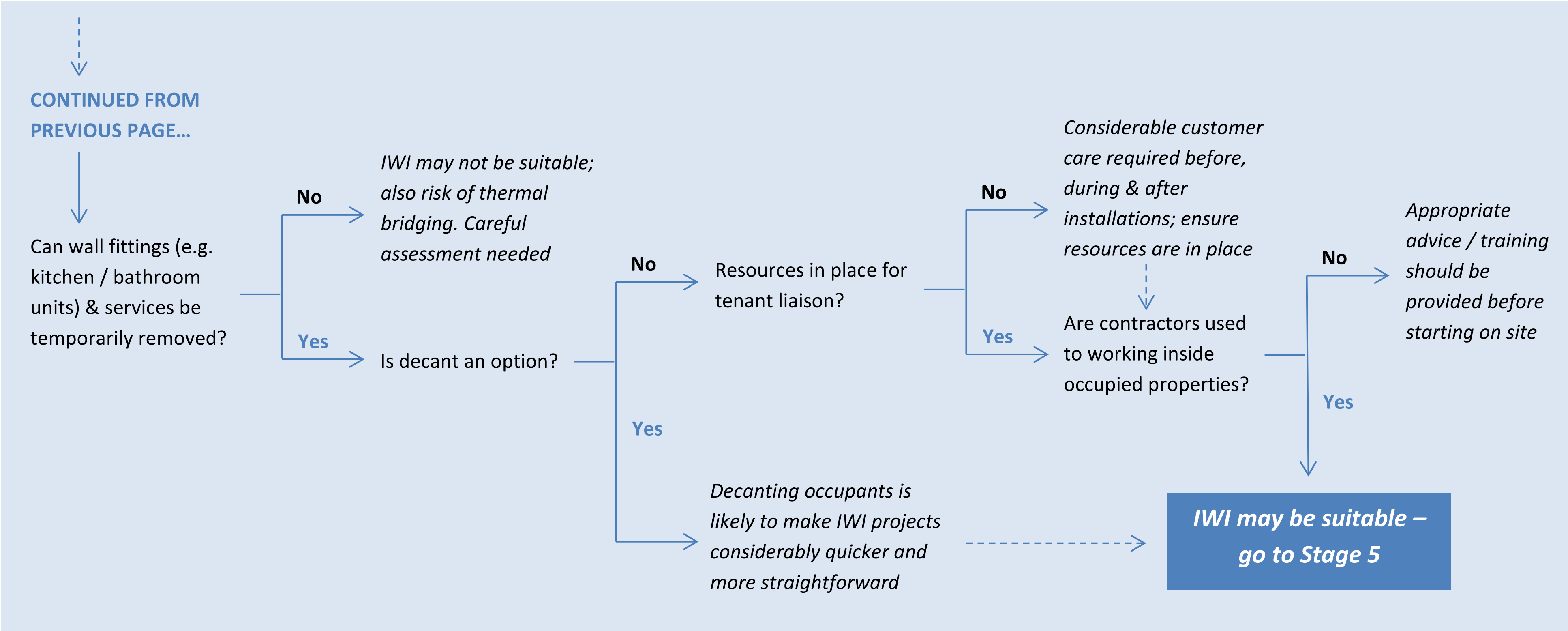
** Some materials may fail (e.g. render may crack / fall off, moisture within system may freeze and cause damage, etc.) if installed in wet or cold (e.g. <5°C) conditions.*

If EWI is found to be unsuitable, users may either a) address any issues and reconsider EWI, or b) proceed to **Stage 4** to consider IWI.

STAGE 4: IWI



* *A maximum permissible percentage of lost floor area may be applied (e.g. 5%, in line with Building Regulations).*


CONTINUED FROM PREVIOUS PAGE…
Can wall fittings (e.g. kitchen / bathroom units) & services be temporarily removed?
No
IWI may not be suitable; also risk of thermal bridging. Careful assessment needed
Yes
Is decant an option?
No
Resources in place for tenant liaison?
No
Considerable customer care required before, during & after installations; ensure resources are in place
Yes
Are contractors used to working inside occupied properties?
No
Appropriate advice / training should be provided before starting on site
Yes
Yes
Decanting occupants is likely to make IWI projects considerably quicker and more straightforward
IWI may be suitable – go to Stage 5

STAGE 5: ASSOCIATED MEASURES

In many cases SWI may require other, related works to be carried out, regardless of whether EWI or IWI is selected. These may range from enabling works (e.g. repairs & maintenance, removal of rainwater goods or internal linings) through to additional upgrade measures (e.g. ventilation systems) and occupant advice (e.g. likely impacts of SWI, how to adjust behaviours accordingly). This last stage presents some of the wider-ranging associated works that should be considered, both to minimise risk and promote a joined-up approach: as these are not sequential they are presented in a simpler list format.

CONSIDERATION	ISSUE
Are all Key Principles (see Section 1) being followed?	Following these principles should naturally lead to consideration of most of these associated measures; not adhering to them is likely to increase risks
Have related works been carried out in advance?	While this may not always be possible, completing relevant upgrade works (e.g. repairing / replacing windows, repairing rainwater goods) before installing SWI should reduce the likelihood of related problems occurring in the future
Has overheating risk been assessed & retrofit strategy amended accordingly?	SWI can change indoor climate (e.g. temperature, relative humidity, air quality). In some cases this may be considerable, and it can lead to risks of overheating and moisture-related issues. Assessment of these risks allows associated measures (e.g. ventilation system, heating controls / programming, occupant education) to be identified and implemented where necessary
Is any monitoring possible?	While funding does not always permit monitoring, it is likely to provide valuable data on the impacts and overall effectiveness of SWI. Monitoring can cover numerous levels of detail ranging from qualitative occupant surveys to quantitative scientific testing (of e.g. temperature, energy consumption, relative humidity, interstitial moisture), and can be carried out before, during and after installations. All such data can be invaluable, particularly where doubts exist about pre-existing moisture issues, estimated values (running costs, U-values) and so on

4. SUMMARY

By following the process in this Decision Making Protocol, users should have identified key issues in proposed SWI retrofit projects and appropriate routes forward. It must be stressed that this does not provide a route to risk-free installations. Rather, it is intended to identify major potential risks at an early stage, allowing them to be considered and addressed as far as possible before projects commence. Once users have been through all stages, further research is recommended to ensure a sound understanding and holistic perspective; sources of further information are provided at the end of this document.

At the time of producing this Protocol, SWI in older, traditionally-constructed buildings is the subject of considerable research. As such findings, advice and best practice are subject to change. It is therefore recommended that this Protocol is reviewed on a regular basis to enable new or changing advice to be incorporated.

5. FURTHER INFORMATION

Background reading is recommended before taking any decision on SWI projects on older, traditionally-constructed stock. The following give greater detail on the principles and considerations included in this Decision Making Protocol, providing a combination of research, advice and case studies.

Changeworks:

- Solid Wall Insulation in Scotland (2012)

English Heritage:

- Energy Efficiency in Traditional Buildings (2012) – *range of guides covering insulation of different building elements*
- External Wall Insulation in Traditional Buildings: Case Studies of three large-scale projects in the North of England (2014; pending)

Historic Scotland:

- Short Guide 1: Fabric improvements for Energy Efficiency in Traditional Buildings (2012)
- Technical Papers (2008 – present)
- Refurbishment Case Studies (2012 – present)

Society for the Protection of Ancient Buildings (SPAB):

- The SPAB Research Reports 1-3 (2011 – present) – *research reports covering U-values, moisture risk and hygrothermal modelling*

Sustainable Traditional Buildings Alliance (STBA):

- Responsible Retrofit Guidance Wheel (2014) – *guidance tool*
- Knowledge Centre (2014) – *repository of up-to-date research and guidance*
- Responsible Retrofit of Traditional Buildings (2012)

NDM HEATH LTD
Sustainable Energy Services

STBA
SUSTAINABLE TRADITIONAL
BUILDINGS ALLIANCE