

Designer's Risk Register Form

| | | | | | | | | | |
|--|------------|------|------|------|------|------|------|------|------|
| Project name: Felin Puleston Weir Removal | | | | | | | | | |
| Project location: Felin Puleston, Nr Wrexham | | | | | | | | | |
| Client: Welsh Dee Trust | | | | | | | | | |
| | Initial | Rev1 | Rev2 | Rev3 | Rev4 | Rev5 | Rev6 | Rev7 | Rev8 |
| Date | 11-11-2022 | | | | | | | | |
| By | SB | | | | | | | | |
| Checked | GH | | | | | | | | |
| Approved | GH | | | | | | | | |

ASSUMPTIONS - River, floodplain and water schemes that involve working with natural processes and the natural environment often means working with incomplete spatial datasets (e.g. complete utilities services coverage, current survey and topographic data, hydrological estimates etc). This results in risks associated to the construction and post completion phase of the project that cannot always be identified at the design stage, and it is not uncommon for unexpected issues to be encountered during and post construction. This often requires decisions to be made in a short timeframe on site to ensure works can continue to progress and to reduce downtime. It is therefore recommended that a Dynamic Rivers staff member or other competent field specialist supervises the works on site at specific points to ensure any modifications on site are appropriate in accordance with the original design and to reduce the risk of future issues arising. Dynamic Rivers cannot be held responsible for decisions taken by others on site.

Working with natural processes through river and floodplain restoration means that some changes as the system stabilises are unpredictable and not possible to quantify through the design process following completion of the works. A river and / or floodplain restoration scheme is often most reactive during and immediately post completion of works, with some systems taking several years to stabilise depending on climatic conditions and flood flows during that time. During this period, the site and scheme will be particularly susceptible to adjustment, particularly during high flow events, therefore it is strongly recommended that monitoring of the constructed scheme is undertaken, particularly after large floods as mitigation works may be necessary to ensure the future functioning of the scheme. This should be considered by the client and communicated to those impacted by the works.

1. In accordance with the Construction (Design and Management) Regulations, Regulation 9, the hazards associated with the work activity have been considered and eliminated, where possible.
2. The residual hazards and the provision made in the design solution to manage them, thus reducing the risks from the hazard are shown below. In accordance with HSE advice only the significant hazards are recorded on this form.
3. In order to put these provisions in context, assumptions about the method of construction have been stated. However, this does not restrict the contractor to the construction methods implied by this.
4. It is understood that a competent contractor will carry out the construction, maintenance and demolition work in accordance with relevant regulations and recognised good industry practice.
5. It is recommended and assumed that the works are overseen by a competent geomorphologist who is familiar with the design.

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|--|--|--|
|------|--|--|--|--|--|

Designer's Risk Register Form



| | | | | | |
|---|----------------------|---|---|---|--|
| 1 | General work on site | <p>The site is located on a floodplain and river and is therefore at risk of flooding.</p> <p>Working near water around the restoration site. There is a risk of drowning, flooding, high velocity flows and associated hazards such as hypothermia and environmental pollution.</p> <p>Risk of water borne diseases e.g. leptospirosis.</p> <p>A proportion of the works will take place in very wet floodplain areas. The principal contractor is responsible for ensuring safe working practices are followed in this area where there is a risk of soft ground to people and machinery.</p> | <p>Specified that all works to be carried out under low flow. In river and floodplain works to stop if flooding into the floodplain and high flows in the channel / floodplain. All equipment should be moved out of the river and floodplain. Works schedule should be for spring/summer/autumn period when risk of flooding is reduced.</p> <p>Compound / plant to be located / stored outside of known flood event extents.</p> <p>Dry working to be undertaken wherever possible.</p> <p>All works to be undertaken with use of a banksman.</p> <p>Site workers and operatives to wear buoyancy aids and to avoid entering the watercourse.</p> <p>No workers should enter the river channel. Suitable PPE including buoyancy aid should be available on site in case of emergency.</p> <p>No lone working on site.</p> <p>Throw line to be available on site.</p> <p>First aid trained personnel to be on site with appropriate first aid kit.</p> | <p>Drowning.</p> <p>Flooding.</p> <p>Associated hazards such as hypothermia and environmental pollution.</p> <p>Risk of water borne diseases e.g. leptospirosis.</p> <p>A proportion of the works will take place in very wet floodplain areas. The principal contractor is responsible for ensuring safe working practices are followed in this area where there is a risk of soft ground to people and machinery.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Contractor to consider construction sequence produced for contractor's reference.</p> <p>Contractor to design temporary works and put in place appropriate precautions to deal with flood risk during construction (monitor weather conditions and water levels).</p> <p>Contractor to sign up to EA flood alerts.</p> <p>Works to be programmed such that no critical sections are left open at the end of the working day, or over a weekend, in case a flood event occurs.</p> <p>All works to be undertaken with use of a banksman.</p> <p>Site workers and operatives to wear buoyancy aids and to avoid entering the watercourse.</p> |
|---|----------------------|---|---|---|--|

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|---|--|--|
| | | | <p>Consult with ecologist with regards to management of habitats and species on site.</p> <p>Mark trees on site that are not to be removed.</p> | | |

Designer's Risk Register Form

| | | | | | |
|---|----------------------------------|--|---|--|--|
| 2 | Working in vicinity of services. | <p>The design drawings and report show the results of a services search for the likely impacted reach of the Afon Clywedog and surrounding area for Felin Puleston weir. Best endeavours have been used to transfer the map information to the design drawings but some error in the location of these may be present as a result. This shows there are BT Openreach and electricity lines crossing the watercourse close to the footbridge upstream of the weir. These are unlikely to be impacted by the proposed works and a bed check feature has been designed to reduce the risk of bed incision propagating upstream and impacting this infrastructure.</p> <p>All services should be considered carefully by the contractor undertaking the works in terms of safe working procedures, access and crossing these utilities. It should be noted that standard services searches do not identify all local land drains. If encountered, these should be managed on site by the contractor and client. The contractor should review the services search drawing prior to construction and for potential access routes as some may be crossed to deliver the works. The client and/or contractor should undertake another services search prior to the works. The contractor should C.A.T4 / radio-detection scan, in liaison with the provider, and locate these services prior to excavation commencing if deemed required.</p> <p>Contractors should be made aware of their location as it is possible that some may be crossed / passed under to</p> | <p>Service searches have been conducted for the site. These have been mapped as accurately as possible by Dynamic Rivers.</p> <p>Dynamic Rivers accept no liability of any kind for the accuracy, currency or completeness of the information provided on this supplied plan. This plan is a compiled cartographical representation of information received from numerous mapping sources of varying scales, quality and resolutions. The source utility companies do not guarantee the correctness of the data provided.</p> <p>Only use this plan in conjunction with the compiled responses which include further detail, legends, notes and warnings. It is critical that the location of any utility services and apparatus is confirmed on site prior to any excavation work.</p> | <p>It is the clients responsibility to make any utility provider aware of work being undertaken in close proximity to any services.</p> <p>Risk of damaging services during construction.</p> <p>Contractor to be aware of existing services locations prior to undertaking the works to identify if any will be crossed or passed under in order to access the site.</p> <p>Encountering private services, e.g. land drains that will need to be dealt with on site by the contractor with agreement by the landowner and client.</p> <p>There may be error in the supplied service search maps from the provider, any uncertainty should be verified with the utility supplier.</p> <p>Client/contractor to check with utility provider with regards to safe working distances/heights from services present on site e.g. any work/access underneath overhead powerlines, excavation in close proximity to underground services.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Location of services outlined in supplied services search.</p> <p>Contractor to undertake another services search prior to works commencing.</p> <p>Contractor to undertake C.A.T4. / Radio-detection scanning.</p> |
|---|----------------------------------|--|---|--|--|

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|---|--|--|---|
| | | <p>undertake the proposed works. The contractor should set up goalposts in the vicinity of overhead lines so that machinery operators are aware of its presence. They should also locate any buried services before excavation begins in liaison with the service provider. Track mats may be required across buried services.</p> <p>Other private services, such as land drains not already mapped, that are not picked up by utilities service searches, could be encountered during the works. This should be monitored and managed by the contractor and client on site.</p> | | | |
| 3 | Movement of excavated soil, gravel / cobble/small boulders, gabions, concrete and for temporary works (e.g. gravel filled dumpy bags). | The works involve the movement of excavated soil material and gravel/cobble/small boulders, gabions and concrete potentially weighing several hundred kg. There is a risk of dropping material. | None. | Injury from falling material etc. | <p>Contractor to be informed of perceived residual hazards.</p> <p>Contractor to consider construction sequence produced for contractor's reference.</p> <p>Safe working zones to be established between operative and plant.</p> |

Designer's Risk Register Form



| | | | | | |
|---|--|--|---|---|---|
| 4 | <p>Construction impact on bank stability and impact on natural processes.</p> <p>Activation of an active/wandering, single thread channel.</p> | <p>The stability of the banks in the vicinity of the works of the existing channel and surrounding drains / channels should be monitored during the works particularly when the bank is loaded or damaged during construction or otherwise disturbed. This is particularly the case following wet weather. The stability of the bridge upstream of the weir should be monitored during the works and following removal of the weir. No engineering assessments/inspections have been undertaken on this structure, the upstream gabions at Wrexham Tyres or the upstream services as part of the designs.</p> <p>Modelling has shown there is unlikely to be impacts upstream as far as the gabions that are currently unstable at Wrexham Tyres as a result of the proposed scheme. This has been further mitigated by the use of bed-check/rapid features in the design. However, this should be continued to be monitored as part of a monitoring programme following construction.</p> <p>The design is promoting fish passage and natural processes associated to an active single thread river system through this reach, therefore natural levels of erosion and deposition are to be expected into the future throughout the restored reach, areas where walling and gabions have been removed and through the widened channel and floodplain area local to the weir but at a rate to be</p> | <p>Any signs of damage during and post construction should be monitored and mitigated.</p> <p>Post-construction erosion, bank stability and deposition should be monitored and mitigated where deemed necessary.</p> <p>The steep sections where rapids are proposed, and in the channel widening section, could be subject to local change over time and in response to flood events. These features and stretches of river should be continually monitored, particularly after a flood event.</p> <p>Monitoring of impacts to processes around the bridge, upstream gabions at Wrexham Tyres and upstream services. Some remedial works to rapids may be required depending on the severity of the flood event.</p> | <p>Collapse of bank and fall from height.</p> <p>Persons being buried.</p> <p>Collapse / erosion of bank due to loading during works.</p> <p>Working with natural processes means some future changes can be unpredictable as the system stabilises over time.</p> <p>Existing banks, gabions, revetment and embankments remain at risk of future failure – including the gabions upstream at Wrexham Tyres.</p> <p>Remedial works required to bridge and upstream services and upstream gabions.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Condition of banks and margins to be monitored during works (operatives with binoculars if required) and recorded prior to works commencing. All plant to be set back from the edge of the river.</p> <p>Contractor should take photographic record of all infrastructure along the reach prior to works commencing.</p> <p>Post-project monitoring program.</p> |
|---|--|--|---|---|---|

Designer's Risk Register Form



| | | | | | |
|--|--|---|--|--|--|
| | | <p>expected for a river system of this type as it naturalises. Tree planting has been recommended to provide a buffer strip around the margins of the proposed channel widening over the right bank. The reach upstream of the weir may become more energetic over time linked to removal of the weir and installation of the rapid features. This should be monitored post construction. A bed check feature has been designed to help mitigate this risk.</p> <p>The proposed channel widening area will result in wetter floodplain conditions and more frequent out of bank flows along the reconnected/lowered area. The channel widening area is likely to be active, with associated erosion and deposition occurring during elevated flows. The proposed floodplain works will result in wetter floodplain conditions all year round, resulting in vegetation change over time. Improved floodplain connectivity may encourage deposition of gravels/cobbles over time within the main channel created, with associated low level bank erosion around deposits as they develop. Deposition of material across the channel widening area is also likely over time, with associated erosion.</p> <p>Expected future change of the area is described further in the supporting technical note.</p> | | | |
|--|--|---|--|--|--|

Designer's Risk Register Form

| | | | | | |
|---|---|--|---|---|---|
| 5 | Construction impact on floodplain and valley side function. | <p>The stability of the banks in the vicinity of the works of the existing channel and surrounding drains / channels should be monitored during the works particularly when the bank is loaded or damaged during construction or otherwise disturbed. This is particularly the case following wet weather. The stability of the bridge upstream of the weir should be monitored during the works and following removal of the weir. No engineering assessments/inspections have been undertaken on this structure, the upstream gabions at Wrexham Tyres or the upstream services as part of the designs.</p> <p>Modelling has shown there is unlikely to be impacts upstream as far as the gabions that are currently unstable at Wrexham Tyres as a result of the proposed scheme. This has been further mitigated by the use of bed-check/rapid features in the design. However, this should be continued to be monitored as part of a monitoring programme following construction.</p> <p>The design is promoting fish passage and natural processes associated to an active single thread river system through this reach, therefore natural levels of erosion and deposition are to be expected into the future throughout the restored reach, areas where walling and gabions have been removed and through the widened channel and floodplain area local to the weir but at a rate to be</p> | <p>Any signs of damage during and post construction should be monitored and mitigated.</p> <p>Post-construction erosion, bank stability and deposition should be monitored and mitigated where deemed necessary.</p> <p>The steep sections where rapids are proposed, and in the channel widening section, could be subject to local change over time and in response to flood events. These features and stretches of river should be continually monitored, particularly after a flood event.</p> <p>Monitoring of impacts to processes around the bridge, upstream gabions at Wrexham Tyres and upstream services. Some remedial works to rapids may be required depending on the severity of the flood event.</p> | <p>Collapse of bank and fall from height.</p> <p>Persons being buried.</p> <p>Collapse / erosion of bank due to loading during works.</p> <p>Working with natural processes means some future changes can be unpredictable as the system stabilises over time.</p> <p>Existing banks, gabions, revetment and embankments remain at risk of future failure – including the gabions upstream at Wrexham Tyres.</p> <p>Remedial works required to bridge and upstream services and upstream gabions.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Condition of banks and margins to be monitored during works (operatives with binoculars if required) and recorded prior to works commencing. All plant to be set back from the edge of the river.</p> <p>Contractor should take photographic record of all infrastructure along the reach prior to works commencing.</p> <p>Post-project monitoring program.</p> |
|---|---|--|---|---|---|

Designer's Risk Register Form



| | | | | | |
|--|--|---|--|--|--|
| | | <p>expected for a river system of this type as it naturalises. Tree planting has been recommended to provide a buffer strip around the margins of the proposed channel widening over the right bank. The reach upstream of the weir may become more energetic over time linked to removal of the weir and installation of the rapid features. This should be monitored post construction. A bed check feature has been designed to help mitigate this risk.</p> <p>The proposed channel widening area will result in wetter floodplain conditions and more frequent out of bank flows along the reconnected/lowered area. The channel widening area is likely to be active, with associated erosion and deposition occurring during elevated flows. The proposed floodplain works will result in wetter floodplain conditions all year round, resulting in vegetation change over time. Improved floodplain connectivity may encourage deposition of gravels/cobbles over time within the main channel created, with associated low level bank erosion around deposits as they develop. Deposition of material across the channel widening area is also likely over time, with associated erosion.</p> <p>Expected future change of the area is described further in the supporting technical note.</p> | | | |
|--|--|---|--|--|--|

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|---|---|--|---|
| 6 | Access to and from site. | <p>Risk to members of public from plant movements.</p> <p>Access routes are to be confirmed with the client and landowner along the reach. If crossing of the watercourses / ditches is required to access the site, a temporary bridge may be required that will be specified by the contractor.</p> <p>Contractor to avoid tracking over archaeological sensitive areas on site.</p> <p>Steep sided banks / valley side will require careful consideration for access by the contractor.</p> <p>Working near woodland/trees is required to create some features. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation.</p> | <p>Public access route closure/fencing/diversion of footpaths.</p> <p>Works area to be fenced off from members of the public and re-routed via alternate paths.</p> <p>Contractor should fence off archaeological sensitive areas.</p> <p>Banksman to be provided by the contractor at all times.</p> | <p>Injury / death from collision with vehicles.</p> <p>Banksman required – to be provided by the contractor.</p> <p>Contractor will need to specify temporary access bridge requirements if these are required to access the sites.</p> <p>Steep sided banks / valley side will require careful consideration for access by the contractor.</p> <p>Working near woodland/trees is required to create some features. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Access route to site to be defined and all delivery drivers made aware of risks.</p> |

Designer's Risk Register Form

| | | | | | |
|---|-----------------------|---|---|---|--|
| 7 | Increased flood risk. | <p>Works do not cause an increase to out of bank flooding that increases risk to property / housing or people. There are some changes in flood extents along the study reach and within the works area, as shown in the accompanying technical note.</p> <p>However, more frequent out of bank flows and flood extent increases under low order floods in the target floodplain reconnection / channel widening / floodplain lowering areas can be expected as part of the works as a result of the proposed connection areas. This is an objective of the overall project as these help to reduce flood energy local to the proposed weir removal. These areas of the proposed works will likely be summer and/or winter wet.</p> <p>Impacts to flood risk should be reviewed against any future development of the local floodplain area.</p> <p>Temporary works (dependent on contractor approach) may partly block the channel / floodplain reducing its capacity. If an event occurs, this could result in out of bank flows and premature flooding.</p> <p>Risk of flooding to adjacent land and areas adjacent to and upstream of works.</p> | <p>Improved connectivity to the local floodplain through channel widening is an objective of the study through the proposed weir removal and restoration works with associated wetland development across the lowered area.</p> <p>Recommended that contractor places a limit on height and extent of temporary works, such that if a large event occurs the temporary works will over top and not reduce channel capacity.</p> <p>Limit width of channel which is closed off at any one time where possible (if this is deemed required by the contractor).</p> <p>Proposed spreading areas should be outside of the NRW flood zones.</p> <p>There will be a period of time where works are partly complete. If a flood were to occur at this point during the construction, then unpredicted flooding could occur. This risk cannot be removed as part of the design process.</p> | <p>Altered flood regime across the study reach.</p> <p>Drowning.</p> <p>There will be a period of time where the weir, rapids etc are partly removed / or works partly complete. If a flood were to occur at this point during the construction, then unpredicted flooding could occur. This risk cannot be removed as part of the design process.</p> <p>Existing banks, revetment, gabions and embankments remain at risk of future failure.</p> <p>The flooding regime could change over time as the river and floodplain naturalises and responds to the proposed works. This is part of natural processes.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Construction to consider temporary works approach and sequence.</p> <p>Contractor to monitor weather forecast and river levels.</p> |
|---|-----------------------|---|---|---|--|

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|---|--|---|--|
| 8 | Spreading of non-native species / biosecurity | <p>Spreading of non-native species during works by moving machinery/ equipment and by boots.</p> <p>All plant and equipment including boots and waders to be disinfected prior to use in the river.</p> | None – no non-native species surveys carried out as part of the project. | <p>Increased area of non-native species.</p> <p>Damage, injury, death to protected species and habitats.</p> | <p>Comply with the NRW requirements to prevent the spread of invasive species.</p> <p>Contractor responsible for suitable biosecurity measures on site.</p> |
| 9 | Tree works, fence removal and vegetation clearance. | <p>Some tree works and felling may be required to deliver some of the works and for machinery access purposes. This is to be determined by the contractor.</p> <p>Any fencing removed is to be replaced with agreement from the landowner and client. No designs of fence or gate removal undertaken by Dynamic Rivers.</p> | None. | <p>Fence/gate replacement may be required.</p> <p>Tree surveys and protected species habitat surveys may be required e.g. bats.</p> <p>Specialist tree work method statements are to be produced by the tree work contractor as required.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Site walkover to be undertaken by client with the contractor to determine any required tree works following marking out of the works. This should also be undertaken with overview of an ecologist for bat potential assessment prior to removal.</p> |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none">• Not obvious to a competent contractor or other designer, or• Unusual, or• Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|---|--|---|---|
| 10 | Material quantities. | <p>Increased expenditure due to design changes during construction based on local conditions encountered during the works (particularly anticipated volume of sediment for removal and volume for feature creation). This is particularly the case for the proposed rapid and bed check volumes where local variations in bed level may influence the volumes given, and for estimate of material to remove for the weir and bed regrading (depth/levels may vary along its length). Design is based on LiDAR and new check survey that is subject to inherent error. Survey levels may be subject to local change due to the presence of silt and vegetation. This may mean that formation levels may change based on encountered ground conditions and could impact on calculated infill and excavation volumes.</p> <p>Temporary works have not been costed.</p> <p>Excavated material could be subject to expansion (dependent on type) and may initially require additional spreading area/storage volume until it compacts. Contractor would normally account for this in material movement costs or as part of their material management plan.</p> | <p>LiDAR and survey has been checked as far as possible.</p> <p>Some re-use of material possible on site. To be determined during works.</p> | <p>Adjusted material quantities and subsequent impact on project costs as a result of underlying data error.</p> <p>Changes in formation levels to those given in design drawings.</p> <p>Expansion of excavated material to be considered by contractor in their material management plan/costs.</p> | <p>Client should have suitable contingency funds if further material is required for import, or if more material is required to be excavated.</p> <p>Contractor should be made aware of associated risks and can account for them in advance.</p> |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|---|---|--|--|
| 11 | Inadequate compaction of features and use of incorrect materials results in washout of placed features. | Created small boulder/gravel/cobble features at risk of washout if contractor does not ensure suitable compaction of features and use of stated material sizes, mixes and types as described on the design drawings. | Geomorphologist to supervise the contractor during creation and compaction of features. | Existing banks, gabions, embankments and revetment remain at risk of future failure. | Contractor to carefully review design drawings and material requirements and to follow guidance provided by on site geomorphologist during feature creation. |
| 12 | Material spreading mobilisation risk. | Proposed spreading locations (to be determined by the client if relevant) for excess excavated material could be subject to mobilisation should flooding occur before vegetation is allowed to re-establish. | Advised client that excess material should be spread outside of the floodplain area. Advised that contractor compacts spread material initially. | Mobilisation of spread material if flooding/surface flow occurs across it. | n/a |
| 13 | Works sequencing and flood risk | A sequence of works has been provided within the accompanying Method Statement. There will be a period of time during construction where elements are part built and / or part removed. This will have implications with regards to local flood patterns, extents and timings should a flood occur when these are part constructed. This should be communicated and agreed with landowners prior to works commencing. | Works sequence provided, but risk associated to this cannot be completely removed through the design. | Altered flood extents, patterns and timings during construction. | Method Statement provided with the design package. |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|---|--|--|
| 14 | Unconsented works in the river and floodplain pre, during or post construction of the scheme | Any unconsented works across the river and floodplain pre, during or post construction of the scheme will mean predicted impacts associated to the scheme from this study are potentially compromised and Dynamic Rivers will not be liable. | None. | Altered flood and geomorphological change across the river and floodplain as a result of any unconsented works being undertaken pre, during or post construction of the scheme. | None. |
| 15 | Changes to the design by third parties | Any third-party changes to the design across the river and floodplain pre, during or post construction of the scheme will mean predicted impacts associated to the scheme from this study are potentially compromised and Dynamic Rivers will not be liable. | None. | Altered flood and geomorphological change across the river and floodplain as a result of third-party changes being undertaken pre, during or post construction of the scheme. | None. |
| 16 | Ordnance Survey Map Error | The existing 10K Ordnance Survey mapping for the site shows some error with regards to alignment against the LIDAR data. | Coordinates can be provided to delineate feature position based on available LIDAR. | Contractor to be made aware of error with regards to review of the overview drawings. | Drawings and coordinates show proposed locations of works. |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|---|--|--|
| 17 | Fine sediment management and mitigation | <p>Suggestions have been made for management of fine sediment runoff and transport within the river and floodplain during construction. Whilst these will help to reduce fine sediment runoff and transport downstream, these measures will not completely mitigate this issue despite best endeavours. This should be noted by the client.</p> <p>Recommended that dry working is undertaken.</p> | <p>Fine sediment mitigation measures suggested within the Method Statement. This should include turbidity measuring of the watercourse downstream during the works, with turbidity working limits advised, work must cease where levels exceed 20 NTU. Any incident exceeding 40 NTU should be considered for self-reporting to the appropriate regulatory authorities. All data are to be recorded and presented to the client on a weekly basis. The contractor will also provide a named environmental adviser who will be responsible for overseeing sensitive phases of construction.</p> <p>Recommended that dry working is undertaken.</p> <p>Turbidity working limits advised – see Method Statement.</p> | <p>Some fine sediment may still wash into the main rivers/ditches despite recommended mitigation measures, particularly if large rainfall events occur or if a flood occurs across exposed soil.</p> | <p>Mitigation measure advice provided as part of the design package.</p> |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|---|--|--|
| 17 | Excess material spreading | It has been assumed as part of the estimated costs that excess excavated material will be spread locally (aside from weir material, that should be removed from site), outside of the active floodplain area / flood zones as agreed by the NRW. | None. Spread sites should be assessed for surface flow risk to avoid material remobilisation. | Projects costs would significantly increase if all material was to be transferred off site or sent to landfill. Excess material should not be spread in the active floodplain area without agreement with the NRW. | Flood extent information has been provided as part of the project reporting. |
| 18 | Modelling limitations linked to data | <p>Hydraulic modelling is a simplified representation of the topographic surface and reality with uncertainties linked to the underlying topographic data, model resolution required to produce sensible model run times and hydrological estimates used/calculated.</p> <p>Modelling has not considered spreading of material within the active floodplain area / flood zones.</p> <p>Best practice has been used for modelling of tree features in the channel and floodplain where relevant. However, there is inherent variability in these features in reality that cannot be accurately represented in hydraulic models, therefore modelled impacts of these features are indicative only.</p> | The models are run on the finest resolution possible, and data is checked as far as is reasonably possible. | <p>Uncertainty in hydrological estimates and any error in the underlying topographic data could produce errors in the hydraulic model outputs.</p> <p>Modelling has not considered spreading of material within the active floodplain area / flood zones.</p> <p>Uncertainty in impacts on flood extents, hydraulics, depths etc linked to representation of in-channel and floodplain wood features in the model. This could lead to error in modelled flood extents and hydraulic model outputs.</p> | Technical note summarising the modelling undertaken. |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|--|--|--|
| 19 | Hydrology | <p>Hydrological estimates used for hydraulic modelling purposes are subject to error, particularly for ungauged catchments. This uncertainty could impact on feature functioning and modelled flow and flood extents and depths.</p> <p>Flow estimates for ditches within the model domain (where relevant) have been estimated for the purposes of the modelling assessment as standard hydrological techniques do not allow for calculation of flows in ditches.</p> | The hydrology has been checked as far as possible. | <p>Uncertainty in hydrological estimates could produce errors in the hydraulic model outputs.</p> <p>Uncertainty in flow estimates linked to ditches could produce errors in the hydraulic model outputs.</p> | Technical note summarising the hydrology and modelling undertaken. |
| 20 | Works constructed to design specification | Risk of works not being constructed as specified. | <p>Design drawings and method statement provided.</p> <p>Recommended that designer assists the contractor in setting out, supervises the works during construction and undertakes a final supervision visit before contractors demobilise.</p> | Risks still remain, particularly when designer not present on site during works between visits. A final supervision visit helps to minimise this risk. | Design drawings and method statement provided to the contractor. |
| 21 | Unexploded Ordnance | Risk of unexploded ordnance being excavated/found on site during works. | Search of freely available maps via Zetica UXO reveals the site to be in a low-risk area for unexploded ordnance. However, this does not mean none are present. | <p>Unexploded Ordnance encountered on site resulting in project delays.</p> <p>Client to consider undertaking a detailed UXO assessment.</p> <p>Contractor to consider whether a cat and genny scan required.</p> | n/a |

Designer's Risk Register Form



| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> • Not obvious to a competent contractor or other designer, or • Unusual, or • Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|---|--|---|---|
| 22 | Land Use | The proposed works are unlikely to significantly change the current land use as no significant works are proposed in the floodplain and the flooding regime has not been significantly altered. However, the widening being undertaken local to the weir removal reach will be more frequently wetted than experienced currently, this should be considered by the landowner and communicated to the landowner by the client prior to construction. | None | Wetter floodplain conditions means a change of land use is likely required by the landowner. | Summer and winter estimated wetted extents have been provided with the accompanying technical note. Post-project monitoring programme recommended. |
| 23 | Working near woodland | Working near woodland/trees is required to create some features. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation. | None. | Working near woodland/trees is required to create some features. Contractor should ensure they have appropriate machinery and working procedures to ensure a safe working environment and to minimise damage to trees and vegetation. | n/a |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|--|--|---|
| 24 | Working in semi-confined space | Any personnel required to work in the river during construction may require confined spaces training and have suitable PPE. Contractor responsible for developing a suitable evacuation procedure and to ensure safe working throughout the construction period. | None | Injury as a result of working in a semi-confined space making evacuation difficult. Contractor responsible for developing a suitable evacuation procedure and to ensure safe working throughout the construction period, including provision of suitable PPE. | Contractor responsible for developing a suitable evacuation procedure and to ensure safe working throughout the construction period, including provision of suitable PPE. |
| 25 | Changes to the design by third parties | Any third-party changes to the design across the river and floodplain pre, during or post construction of the scheme will mean predicted impacts associated to the scheme from this study are potentially compromised and Dynamic Rivers will not be liable. | None. | Altered flood and geomorphological change across the river and floodplain as a result of third-party changes being undertaken pre, during or post construction of the scheme. | None. |

Designer's Risk Register Form

| Ref. | Feature, element, process or work activity e.g. construction of retaining walls, installing dry risers, constructing manholes | Description of constraints, hazards and associated risks | Designer's interventions to eliminate or reduce risk | Significant residual risks remaining i.e. <ul style="list-style-type: none"> Not obvious to a competent contractor or other designer, or Unusual, or Likely to be difficult to manage | Information to be provided to enable project partners to manage the risk |
|------|--|--|--|--|--|
| 26 | Livestock | <p>Prior to and during the works period, livestock will be required to be relocated out of the works area to ensure the safety of livestock and operators on site are not compromised.</p> <p>Livestock may be at risk of drowning during flood conditions following the proposed works.</p> | None. | <p>Tenant farmer to ensure livestock and moved from the site works area prior to works commencing.</p> <p>Responsibility of the contractor to ensure the site is secure to prevent livestock accessing the site during the works.</p> <p>Proposed works do not significantly increase flood risk, therefore there is already a risk of livestock drowning.</p> | None. |

Designer's Risk Register Form



| | | | | | |
|----|--|--|---|---|---|
| 27 | Upstream bridge, services and gabions at Wrexham Tyres | <p>The stability of the banks in the vicinity of the works of the existing channel and surrounding drains / channels should be monitored during the works particularly when the bank is loaded or damaged during construction or otherwise disturbed. This is particularly the case following wet weather. The stability of the bridge upstream of the weir should be monitored during the works and following removal of the weir. No engineering assessments/inspections have been undertaken on this structure, the upstream gabions at Wrexham Tyres or the upstream services as part of the designs.</p> <p>Modelling has shown there is unlikely to be impacts upstream as far as the gabions that are currently unstable at Wrexham Tyres as a result of the proposed scheme. This has been further mitigated by the use of bed-check/rapid features in the design. However, this should be continued to be monitored as part of a monitoring programme following construction.</p> <p>The design is promoting fish passage and natural processes associated to an active single thread river system through this reach, therefore natural levels of erosion and deposition are to be expected into the future throughout the restored reach, areas where walling and gabions have been removed and through the widened channel and floodplain area local to the weir but at a rate to be</p> | <p>Any signs of damage during and post construction should be monitored and mitigated.</p> <p>Post-construction erosion, bank stability and deposition should be monitored and mitigated where deemed necessary.</p> <p>The steep sections where rapids are proposed, and in the channel widening section, could be subject to local change over time and in response to flood events. These features and stretches of river should be continually monitored, particularly after a flood event.</p> <p>Monitoring of impacts to processes around the bridge, upstream gabions at Wrexham Tyres and upstream services. Some remedial works to rapids may be required depending on the severity of the flood event.</p> | <p>Collapse of bank and fall from height.</p> <p>Persons being buried.</p> <p>Collapse / erosion of bank due to loading during works.</p> <p>Working with natural processes means some future changes can be unpredictable as the system stabilises over time.</p> <p>Existing banks, gabions, revetment and embankments remain at risk of future failure – including the gabions upstream at Wrexham Tyres.</p> <p>Remedial works required to bridge and upstream services and upstream gabions.</p> | <p>Contractor to be informed of perceived residual hazards.</p> <p>Condition of banks and margins to be monitored during works (operatives with binoculars if required) and recorded prior to works commencing. All plant to be set back from the edge of the river.</p> <p>Contractor should take photographic record of all infrastructure along the reach prior to works commencing.</p> <p>Post-project monitoring program.</p> |
|----|--|--|---|---|---|

Designer's Risk Register Form



| | | | | | |
|--|--|---|--|--|--|
| | | <p>expected for a river system of this type as it naturalises. Tree planting has been recommended to provide a buffer strip around the margins of the proposed channel widening over the right bank. The reach upstream of the weir may become more energetic over time linked to removal of the weir and installation of the rapid features. This should be monitored post construction. A bed check feature has been designed to help mitigate this risk.</p> <p>The proposed channel widening area will result in wetter floodplain conditions and more frequent out of bank flows along the reconnected/lowered area. The channel widening area is likely to be active, with associated erosion and deposition occurring during elevated flows. The proposed floodplain works will result in wetter floodplain conditions all year round, resulting in vegetation change over time. Improved floodplain connectivity may encourage deposition of gravels/cobbles over time within the main channel created, with associated low level bank erosion around deposits as they develop. Deposition of material across the channel widening area is also likely over time, with associated erosion.</p> <p>Expected future change of the area is described further in the supporting technical note.</p> | | | |
|--|--|---|--|--|--|

Designer’s Risk Register Form

