Project Groundwater

Specification – Flood Alerts Front End Development

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1. Purpose

Buckinghamshire Council (BC) are seeking an organisation to **develop a web application dashboard for groundwater flood warnings** for Project Groundwater.

This specification provides the background to the programme and sets out the scope of works required.

2. Introduction

The new government policy statement on flooding and coastal erosion was published in July 2020 and sets out the UK Government's long-term ambition to create a nation more resilient to future flood and coastal erosion risk. Alongside the policy statement, the Environment Agency (EA) published its new National Flood and Coastal Erosion Risk Management (FCERM) Strategy for England. This also focusses on improving overall resilience and provides a framework to guide the activities of those involved in flood and coastal erosion risk management.

Alongside the Government policy and the FCERM strategy, Defra (Department for Environment, Food and Rural Affairs) launched a £200m flood and coastal resilience innovation programme. Project Groundwater is funded by Defra as part of the Flood and Coastal Resilience Innovation Programme which is managed by the Environment Agency to develop and test new approaches to help communities become more resilient to the effects of flooding and climate change.

The flood and coastal resilience innovation programme seeks, through the 25 projects, to demonstrate how practical innovative actions can work to improve resilience to flooding and coastal erosion. These resilience actions can be individual or a combination of actions. Resilience actions could include:

- nature based solutions
- sustainable drainage systems
- approaches for making existing properties more flood resilient
- encouraging local businesses to improve their flood resilience
- building community and voluntary sector capacity to respond and recover

The aims of the Defra led programme are to:

- encourage local authorities, businesses and communities to test and demonstrate innovative practical resilience actions in their areas
- improve the resilience of 25 local areas, reducing the costs of future damage and disruption from flooding and coastal erosion
- improve evidence on the costs and benefits of the innovative resilience actions and demonstrate how different actions work together across geographical areas

- use the evidence and learning developed to inform future approaches to, and investments in, flood and coastal erosion risk management

There are 10 resilience actions and 3 policy challenges:

- Integrated water management solutions
- Nature based solutions
- Property flood resilience
- Community infrastructure resilience
- Monitoring and management of local assets
- Minimise damages and disruption to small and medium sized businesses
- Community and voluntary sector action to be better prepared and recover more quickly
- Local emergency response equipment
- Enhanced flood warning systems
- Investigate policy challenge areas
    - Balancing agricultural, flood and environmental priorities in low-lying agricultural land.
    - Meeting the need for major new developments in areas with flood risks
    - Retrofitting drainage and water management arrangements in urban areas

Buckinghamshire Council has been selected as one of the 25 projects. This followed the successful submission of an Expression of Interest detailing the proposed projects in early 2021.

1.1. Background to Project Groundwater

Vision

Project Groundwater will forever transform how communities prepare and respond to groundwater flooding.

Mission

By working together, Project Groundwater will develop innovative and sustainable solutions to groundwater flooding that will:

- share understanding and increase awareness
- actively monitor flood events and improve warning systems
- prepare communities to respond to and withstand flood events

Values

As a community-focused partnership, Project Groundwater is underpinned and directed by four core principles:

- **Collaboration** – so that those impacted by groundwater flooding can be at the heart of everything we do

- **Innovation** – because communities deserve the best service possible which existing systems and technology may not achieve
- **Sustainability** – because the risk of groundwater flooding will continue into the future
- **Transparency** – because we understand the real-world impacts of groundwater flooding and want to maintain people's trust in the project

The aim of Project Groundwater therefore is, through innovative solutions and stakeholder engagement, to build resilience to groundwater flooding for communities, focusing particularly on 9 communities at risk. Current gaps in how communities and organisations (Lead Local Flood Authorities (LLFAs), the Environment Agency, Thames Water, Fire and Rescue Services and the voluntary sector) can respond to groundwater flooding, have driven the development of the workplan for Project Groundwater, to be delivered through six work packages. The work packages will seek to address issues including:

- *Poor community cohesion and engagement:* Underlying all issues of groundwater flooding is the absence of a collaborative approach to engagement with stakeholders. Developing a collaborative approach helps include local understandings of the risks, facilitates communication within communities, ensures stakeholders help in designing appropriate options and actions, and are involved in the response and evaluation of actions.
- *Unsuitable groundwater monitoring:* Boreholes are typically located for water resource purposes and may not be regularly and consistently monitored by the responsible Risk Management Authority (typically the Environment Agency).
- *Insufficient mapping coverage of groundwater flooding to guide responses:* Mapping where groundwater can emerge and flow at the surface is not consistently available across the catchments to enable the preparation of a range of practical responses. A proven innovative technique for flood risk mapping of the unconfined chalk is available, but this has not been used as the basis for community resilience.
- *No suitable warning service:* The Environment Agency Groundwater Alert service either provides no coverage or does not meet community needs to protect, respond to, and recover from groundwater events. The current system does not provide engagement or interaction with local knowledge from stakeholders or partners.
- *Unsuitable property and community flood resilience techniques:* Standard techniques designed for fluvial, or surface water flooding perform poorly for groundwater flooding due to the large volumes and long durations which impact assets from the surface as well as through the ground.
- *Groundwater flooding is not considered as part of resilient places:* SuDS (Sustainable Urban Drainage Systems) and other natural flood management (NFM) techniques are not designed to work with high groundwater levels. This type of flood risk is

often overlooked by the planning system which results in a lack of awareness and little available information to design places resilient to groundwater flooding.

Stakeholder partnership lies at the heart of Project Groundwater, enabling the delivery of practical and evidence-based resilience actions for, and with, the communities and stakeholders at risk. The vision is that Project Groundwater will use innovative monitoring, modelling, mapping, warning and stakeholder and community engagement to transform how groundwater flooding is addressed in the future.

The strategic objectives for Project Groundwater are to:

- Improve awareness of and confidence in monitoring, mapping, modelling and warning data.
- Improve decision making and create a timely and effective response to groundwater flooding.
- Test and assess cost-effective flood measures for communities affected by groundwater flooding.
- Reduce flood damages and costs through Property Flood Resilience (PFR), Natural Flood Management (NFM) and Sustainable Urban Drainage Systems (SuDS).
- Equip communities to move quickly and efficiently to implement plans, respond and act on groundwater flood warnings.
- Develop connections between communities to give greater strength in resources, advice, support, and mutual aid.
- Produce an evidence base on the effectiveness of measures.

Groundwater Resilience And Community Engagement

There are seven work packages which will help to deliver Project Groundwater, all with their own stakeholders. This figure outlines the work packages and how they align with each other. At the core of Project Groundwater is the nature of the project being one of innovation and the possibilities to learn and share these results on a national basis.

The partnership is already well established with the following 34 organisations working with us:

Aurora Engagements

Axia-Origin

British Geology Survey

Buckinghamshire Council

Chesham Flood Action Group

Chiltern Chalk Streams (Chilterns AONB)

Community Impact Bucks

Creative Third Sector Solutions

Chalfont St Peter Parish Council

Environment Agency

Environment Agency (HNL)

Environment Agency (Thames)

Forestry Commission

Geoff Parkin

Groundwork South

Hertfordshire County Council

HR Wallingford

Jacobs

JBA Consulting

Jewell Facilitation

Lakeside Solutions

Luton Borough Council

Marlow Town Council

Mary Dhonau Associates

National Trust

Open University

Oxfordshire County Council

Property Care Association

Slough Borough Council

Thames 21

Thames Water

Thames21

West Berkshire District Council

Whitehouse Construction Co Ltd

Current status of work packages

Workstream	Lead Organisation	Status	Forward Look
Monitoring	Jacobs	Initial scoping complete – identified upgrades to borehole network required	Investigating drones, gulley sensors and other tech
Modelling & Mapping	Jacobs	First phase complete with improved groundwater modelling methodology developed	Improved mapping to be produced for whole project area
Warning	Jacobs	Scoping complete. National workshop held. Groundwater level forecasts, hazard mapping and community actions to be developed in collaboration with Jacobs, BGS, EA, Flood Forecasting Centre.	Front end web application dashboard development out for tender.
Placemaking (NFM, SuDS, Planning)	JBA	Initial scoping and literature review underway	Scoping to be complete by February
Resilience	-	Scoping complete by HR Wallingford. Working group established. Isle Utilities horizon scan complete.	Currently out for tender for lead.
Community Engagement	Groundwork South	Engagement Strategy and Plan complete. Initial survey dissemination underway	Engagement to begin in earnest in 2023

Communications	BC / Jacobs	Comms strategy complete. Website and social media live. Brand guidelines complete.	Full public launch planned for February.
Evaluation, Learning & Innovation	Axia Origin	Innovation workshop held. Planning for legacy underway.	Activities to ensure collaboration and partnership working planned

2. Programme

The successful organisation will be expected to develop the front end web application dashboard of the groundwater flood warning service over the next year. This is anticipated to be followed by three years of maintenance and improvement to be agreed beyond this initial contract.

3. Tasks and outcomes

3.1. Outcome

The integrated groundwater warning service will combine information from existing (e.g. EA and Met Office warnings) and new channels (e.g. groundwater levels linked to hazard maps and community actions). The service will be driven by forecasts of groundwater level provided by BGS within the bespoke web application, and will inform community warnings issued through the web application, community communication methods and, potentially in the future, through the EA's Flood Warning Service infrastructure.

The three primary pieces of information displayed on the web application dashboard for each community (Figure 1) will be location-specific (i) fluvial flood and weather warnings issued by Environment Agency, Met Office and Flood Forecast Centre (ii) groundwater level forecasts provided by BGS and related hazard maps developed by Project Groundwater and (iii) related actions in community flood plans.

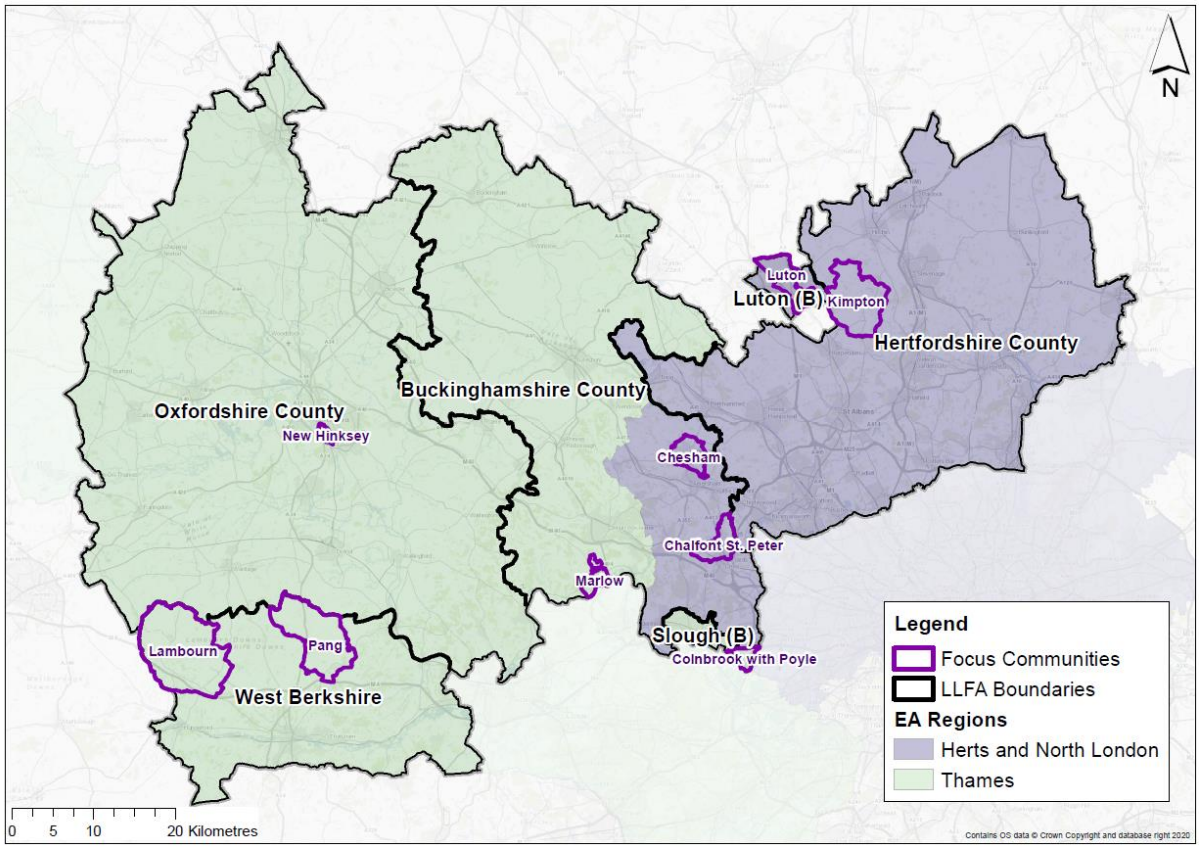

Figure 1: Project Groundwater Study Area and Focus Communities. The web application will initially be developed for the seven communities on the Chalk (Lambourn, Pang, Marlow, Chalfont St Peter, Chesham, Kimpton and Luton). The two communities on gravels / combined geology (New Hinksey and Colnbrook with Poyle) are not initially included due to practical limitations to provide warnings (i.e. lack of monitoring and forecast availability).

3.2. Tasks

The following three main tasks are anticipated to be needed to develop the Minimum Viable Product (MVP) integrated groundwater flood warning service to be operational in seven Project Groundwater Chalk focus communities for testing from October 2023. Supporting activities including online access to borehole levels, frequency analysis and production of groundwater flood risk mapping are being undertaken in parallel.

The MVP web service can be hosted on an accessible server of choice, but with the intention that this can be transferred to a permanent client-determined hosting site in the future. Future integration with web applications provided by the Environment Agency or Flood Forecast Centre is anticipated and the system should be designed and built to make future integration as straightforward as possible.

Task 1: Support Groundworks-led community co-design of user interface and functionality of web-application

a) Discover: Provide technical input into, prepare for and attend consultations with the seven communities to glean insights into issues experienced by stakeholders. Create empathy maps and persons to understand user needs and behaviours.

b) Define: Clear and concise statement of the problem being addressed.
c) Develop: Generate potential solutions through ideation and test prototyped solutions with end users.
d) Deliver: The refined and validated solution to be developed as Minimum Viable Product (MVP).

Task 2: Deliver MVP Web-Application. Develop the overall web application for which BGS will provide groundwater level forecasts. Parameters for the MVP are estimated in Table 1 below. The MVP should be published, maintained, reviewed and refined between October 2023 and April 2024. Continuation beyond this will be subject to review and additional agreement.

a) Implement web-application to include :
    - Cloud storage and open-source based web GIS server
    - Groundwater flood map results library
        - Prepare spatial database containing hazard maps for seven communities (70 map layers in total anticipated) based on GIS raster and vector layers provided by the modelling workstream
        - Map layers indexed by community and groundwater level
    - Receive and store BGS-provided 15 and 30-day groundwater level forecasts every morning for 16 boreholes (Table 2). Forecast levels will be delivered via API
    - Mange public sign up and access for SMS and email provision of warnings

b) Design and setup standard web interface, customised for seven community locations, to incorporate provision of the following, with parameters estimated in Table 1:
    - Geographically-relevant EA and Met Office warnings and hydrological data
    - Serving of the most relevant pre-run flood maps based on latest groundwater level forecasts
    - Serving of pre-defined actions from community flood plans
    - Broadcast of warnings via personal channels (SMS, email)

c) Publish, maintain, review and refine MVP web application between October 2023 and April 2024.

Task 3: Produce a concise summary report of work undertaken, in draft and final version, including recommendations for further development

Table 1: Parameters for the MVP web application

Parameter	Value
Portals focused on Chalk communities	7 focus Chalk communities (Lambourn, Pang, Marlow, Chalfont St Peter, Chesham, Kimpton, Luton)
EA borehole data	Approx. 40 boreholes with levels updated daily via EA API: https://environment.data.gov.uk/hydrology/doc/reference
EA river level/flow data	Approx. 50 flow gauging stations updated hourly via same EA API: https://environment.data.gov.uk/hydrology/doc/reference
EA flood warnings	Approx. 50 flood warning areas (including 7 existing groundwater flood alert areas, 3 new groundwater flood alert areas and ~40 fluvial flood alert areas) via EA API: https://environment.data.gov.uk/flood-monitoring/doc/reference#flood-warnings

Met Office severe weather warnings	Via Met office API: https://www.metoffice.gov.uk/services/data/datapoint/api-reference
Flood Forecasting Centre flood guidance statements	Via FFC API: https://www.gov.uk/government/organisations/flood-forecasting-centre/about-our-services
Groundwater flood hazard maps	Anticipate approx. 70 map layers within the library (10 map layers (above and below ground, depths and extent for various probability events) for each of 7 focus communities)
Community flood action plans	Anticipate multiple actions from 9 flood plans, one for each focus community

Table 2: Boreholes in each community area

Project Groundwater Community	Boreholes
Lambourn	GIBBET COTTAGES (SU47/141)
	Ashdown Park (SU28/65A)
	Longacre OBH (SU38/46B)
Pang	GIBBET COTTAGES (SU47/141)
	The Barracks (SU48/71)
	Hodcott 2 OBH (SU48/72B)
Marlow	STONOR PARK (SU78/045A)
	Ray Farm (SU89/82)
Chesham	ASHLEY GREEN STW (SP90/064)
	Ballinger Common (SP90/63)
Chalfont St Peter	AMERSHAM ROAD (SU99/067)
	Cherry Acre (SU99/65)
Kimpton	LILLEY BOTTOM (TL12/122)
	Luton OBH (TL11/170)
Luton	LILLEY BOTTOM (TL12/122)
	Putteridge Bury (TL12/01)

4. Evaluation Criteria

Tenders received will be evaluated on an 50% quality; 50% price ratio.

The submitted price should cover the delivery of the tasks and outcomes. Price should be broken down into estimated time and rates to cover the three remaining years of the project.

The quality element will be assessed on the proposal and will be scored against the following criteria:

a) Values of the organisation (15%)

- Do they align with Project Groundwater's values? (i.e. collaboration, innovation, transparency & sustainability)
- Do they align with the values of the overall Defra programme?

b) Technical competence (15%)

- Does the organisation have experience in developing comparable front ends?

- Does the organisation have experience in the fields related to the project? (For example floods, environment, community resilience, local government etc)
- Is the organisation bringing a diverse range of experience and skills to the project?

c) Quality of proposal (20%)

- Does the proposal meet the aims of the workstream?
- How innovative is the proposal?
- Will the proposal deliver the desired outcomes?
- Are risks identified and approaches to manage them provided?

5. Contract Terms

Standard Buckinghamshire Council term and conditions to be used; or comparable terms favourable to Buckinghamshire Council (see Appendix).

6. Appendices

*Groundwater Flood Alerts: Review of Approaches and Considerations (*note Project Groundwater was formerly called GRACE)*

Buckinghamshire T&C's