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National Green Infrastructure Facility – a specialised 'living laboratory' to assess the value of urban green infrastructure

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Green Infrastructure (GI) offers multiple and integrated benefits to urban areas, including relieving pressure on 'grey' infrastructure systems by locally managing surface runoff within cities to reduce the risk of urban flooding. Although the use of GI has been shown to attenuate flooding, monitored and quantifiable data determining the effectiveness of GI is imperative for supporting widespread adoption of GI within cities and to provide an evidence-base to inform the design and maintenance procedures of such systems and ultimately influence key decision makers .

The National Green Infrastructure Facility (NGIF) based in Newcastle-upon-Tyne, UK, is a purpose-built, publicly accessible, 'living laboratory' and demonstration site established in 2017, funded by the UK Collaboratorium for Research on Infrastructure and Cities. The NGIF explores how a wide range of green features such as trees, shrubs and soils can help reduce flooding in cities and make them more resilient and sustainable to future changes in climate and urban pressures. The facility hosts a number of novel GI features of varying scale, monitored with dense sensor networks to allow the in-situ measurement of key hydrological, climatic and biophysical variables (e.g. precipitation, temperature, soil moisture, water depth, runoff and outflow rates) which are able to provide quantified evidence of the hydrological performance of sustainable drainage systems (SuDS). Such systems generate detailed insights into how SuDS and nature-based solutions can be used to improve surface water management, optimise geo-energy for building heating/cooling and how systems can be used for urban water treatment.

GI features across the NGIF include an experimental and fully functional swale, providing protection to the area of Newcastle-upon-Tyne in which the feature is located, 10 lysimeter bioretention cells, a series of rain-garden 'ensembles' and a monitored green roof system. All experimental features are subjected to prevalent environmental conditions and act as fully functional GI systems, but conditions can also be augmented and simulated to ensure that the GI features act as semi-controlled experimental systems to determine responses outside of the natural instrumented record. All environmental data is recorded at high temporal (< 5 minutes) and spatial resolution and is publicly accessible in real-time via the NGIF API.

This presentation provides an overview of the NGIF and discusses the current research activities

taking place across the site. Data is presented from each of the GI systems to demonstrate and discuss their performance and responses during natural and simulated events, including extremes, and to assess their effectiveness in responding to localised changes in climate. Future research directions and collaborative opportunities are also highlighted.