Institution: University of Hull

Unit of Assessment: 14 Geography and Environmental Studies

1. Unit context and structure, research and impact strategy

1.1 Unit context and structure

Geography and Environmental Studies (UoAC14) at the University of Hull (UoH) combines research expertise in the **Department of Geography, Geology and Environment (GGE)**, the **Department of Biological and Marine Sciences (BMS),** and the University-level interdisciplinary **Energy and Environment Institute (EEI)** to produce internationally leading research on the interdependencies and interactions between physical, organismal and human environments at molecular, regional, national, international and planetary scales, and across time-periods stretching from the Precambrian to the present.

The Unit's research is structured around three Research Themes and groupings that align with, and underpin, Departmental, Institute and University research priorities:

- ***Dynamic Earth and Changing Environments****;*
- ***Sustainable Futures and Social Worlds***;
- ***Resilient Bodies, Populations and Places*** (see Figure 1).

Our research structure fosters vibrant, productive, interdisciplinary and transdisciplinary sustainable collaborations that address real-world human-environment problems of pressing significance for society and economy in the UK and internationally.

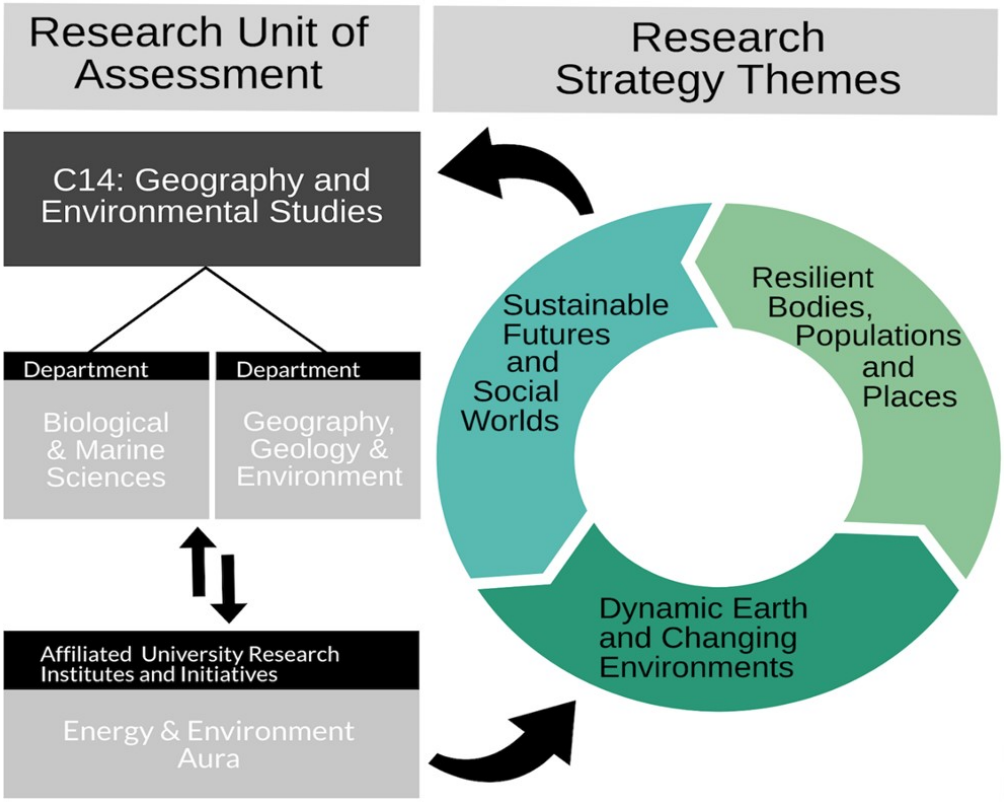

Figure 1: UoAC14 Geography and Environmental Studies at Hull: research structure and themes

In rapidly changing societal, environmental and higher educational contexts, UoAC14 Geography and Environmental Studies at Hull has demonstrated flexibility, continuity and resilience in its research structure since REF2014. The 2014 submission encompassed the Department of Geography, Environment and Earth Sciences (GEES), the School of Biological, Biomedical and Environmental Sciences (SoBBES), the Hull International Fisheries Institute (HIFI), and the Institute of Estuarine and Coastal Studies (IECS). This structure has evolved, expanded and

deepened significantly from the ***Energy and Environment*** strategy identified in REF2014 and the UoH's Strategic Plan 2011-15.

Our unit's research structure equips staff to conduct cutting-edge interdisciplinary research on themes situated at the interface of the environment, economy, public policy, human and animal welfare, climate change, and sustainability.

The UoAs major achievements over this REF period include:

- **A significant increase in eligible research staff** from **34.5** in REF2014 to **49.6** in this submission (Table 1). This growth reflects **appointments of 20 new research-focused staff** across the Unit, plus promotions for existing staff based on research performance.
- **Substantial growth and a doubling in total research income** from all sources from **£10.1 million** (M) in REF2014 to more than **£20.6M** for REF2021. We continue to target blue-chip UK Research Council funding, but we have developed a strategic focus on larger platform funding opportunities and a step-change in our participation in large multi-team, multi-disciplinary and cross-institutional research projects funded by the European Union (EU) and industry, and national research funding agencies in the USA and Australia.

UoAC14	REF2014	REF2021
Research staff returned (FTE)	34.5	49.6
Total research income (£M)	10.1M	20.6M
Research income per capita (£k)	292k	407k
PhD students graduated (FTE)	55	93.6
Annual PhD completion rate	11	15.6

Table 1: Research Indicators UoAC14 Hull, 2014-2021

- **Total PhD completions have significantly increased** from **55** (REF2014) to **93.6** in REF2021. We have significantly increased our participation and visibility in UKRI research training partnerships and networks funded by ESRC, AHRC, EPSRC, NERC, the EU and Horizon2020. We have attracted UoH funding for 9 PhD research clusters involving partners in industry, government and charities (e.g. Siemens, Environment Agency, Yorkshire Water, Team GB). We also support international PhD scholarships via the Commonwealth and China Scholarship Council schemes. Our recently announced Leverhulme Doctoral Scholarships Centre for Water Cultures is currently recruiting for September 2021, and this award reflects our reputation for excellent PhD research training.
- **External recognition by national and international professional societies and industrial, statutory and government bodies.** Twelve international prizes, medals and fellowships were awarded by professional societies to our research staff in the REF period.
- We have a more inclusive, diverse, international community with an improved gender balance since the 2014 REF (Table 2). We will **sustain this emphasis on EDI** by embedding the recruitment methods used in the AURA CDT (and recognised as best practice by EPSRC) across the UoA.

REF2021	36% Female	64% Male	24% Early Career Academics	20% Non-UK Nationals	8% BAME
REF2014	30% Female	70% Male	6% Early Career Academics	14% Non-UK Nationals	0% BAME

Table 2: Changes in EDI descriptors in the Unit of Assessment, REF2014 to REF2021

We have successfully coordinated our three research strategy themes across our community, and evolved a structure of 'clusters' to establish and grow smaller-scale group projects that can then flourish within this wider framework. This enables productive cooperation, responsiveness and flexibility in research planning and delivery. It allows new initiatives to emerge quickly, effectively

and sustainably. Our approach has delivered a pipeline of innovation and resulted in a period of sustained success with research funding, outputs and impact.

1.2 Research and impact strategy: enabling structures and achievements

Since REF2014 we have consolidated and enhanced existing research strengths, developed a broad yet coherent range of new research projects and initiatives, and refocused our research strategy around three thematic areas which align with Institute and University research strategies. The research themes in 1.1 have developed within the unit but also include relevant researchers across campus as this bottom-up, thematic-led approach enhances our research range and capability.

Our **research strategy** revolves around enabling effective interdisciplinary collaboration within and beyond the UoA. Therefore, activities within each research theme are organised around project-led ***clusters.***

- These clusters draw upon the unit's broad range of staff and skills, and they are assembled to deliver a specific goal, deliverable or impact. Clusters can form within a single Department and/or across Institutes and the wider University. They work equally well for defined specialist research and interdisciplinary research. They deliver research income from diverse sources, generate high quality and impactful research outputs, and generate new partnerships and collaborations with external organisations to deliver important gains for knowledge exchange and impact.
- At the individual scale, we invest in our staff who are talented, focussed and productive enough to earn highly competitive posts. We develop their academic careers and ask them to be research *effective* rather than simply research active. This means producing excellent and visible publications, high-quality grant applications, quality postgraduate supervision and effective collaboration with other researchers and research-users.

Our **impact strategy** builds on the effective partnerships we develop with research-users. We build users' needs into the design stage of research programmes to ensure robust impact that is tailored to individual projects and the wider societal and environmental contexts where the research takes place. Our impact agenda has progressed considerably from REF2014 due to the creation of EEI and Aura, and a clearer University-wider focus on impact and engagement.

- The **Aura Innovation Centre** (AIC) recently opened at the Bridgehead Business Park on the outskirts of Hull. A £12M investment of University and European Regional Development Funding, it provides a nucleation point and space for large businesses and SMEs to access the University to collaborate and innovate. It also houses the dedicated Innovation Managers and Team, research labs and equipment that connect business with academics to support shared activities, development and commercialisation (including through ERDF-funded £8M of University-administered Sparkfund Innovation Vouchers and R&D Grants).
- The University Directors of Business Engagement and Enterprise support this infrastructure, as does a Knowledge Transfer Partnership (KTP) Champion and dedicated KTP support. Transparent university support also includes HEIF funding (through application with an external user), dedicated Impact Officers and Impact Accelerator Awards also support this agenda.

Our research strategy themes therefore provide considerable scope and flexibility for research staff to form clusters that examine a variety of societal and environmental challenges across different spatial scales and time periods. Their success is evidenced by the high quality research outputs, income and achievements within each theme:

1.2.1 ***Dynamic Earth and Changing Environments*****.** Research staff in this theme work in project-led research clusters that address: (i) the management of marine and freshwater ecosystems; (ii) monitoring and modelling environmental systems; (iii) changing aquatic environments; (iv) the co-evolution of Earth and life; and (v) crustal geology.

i. Our research into the ***management of marine and freshwater ecosystems*** cluster has produced high quality outputs that impact significantly on the sustainable management of ecosystems and natural resources in Europe, North America, Australasia, the Middle East, Africa and East Asia. Building on the contributions and reputations of HIFI and IECS in REF2014, our funded projects investigate:

- Climate change and European aquatic resources (CERES, European Commission (EC) (**Elliott**, **Cowx**));
- Water management and food security in the Shatt Al-Arab (UN Food and Agriculture Organisation (**Cowx**));
- Innovative tools for marine status assessment (DEVOTES, EC (**Elliott**));
- Fish-friendly hydropower systems (FITHydro, EC (**Cowx, Bolland**));
- Evidence based approach to effect of decommissioning on marine conservation and ecosystem services (NERC (**Elliott**)),
- Inland waterways sediment characterisation of EU Watch List pollutants (INTERREG Sullied Sediments project (**Rotchell**, **Mayes**)).
- Research on water resources and river flows (Yorkshire Water (**Bolland**, **Dodd**, **Noble**, **Nunn, Thomas**)) ensures the enhancement and future protection of fisheries while securing more resilient water supplies for societal use.

ii. Reinforcing research and impact strengths identified in REF2014, we continue our international leadership in ***monitoring and modelling environmental systems*** through a broad group of EEI-based staff focused upon flood hazard and risk, environmental fluid dynamics, hydrology, and geomorphology (**Baar, Ahmed, Hope, Malarkey, Simmons, Wu, McMahon, Skinner, McLelland, Parsons, Coulthard, Bellerby, Dorrell, Thomas, Fernandez-Arrieta**). This research underpins:

- an ERC-Consolidator Award (**Parsons**),
- a NERC Advanced Research Fellowship (**Dorrell**),
- Leverhulme Research Fellowships (**Baar**, **Fernandez-Arrieta**)
- and the award of the 2020 EGU Ralph Bagnold Medal to **Coulthard** and the 2015 Geological Society of London Bigsby Medal to **Parsons**.

Our state-of-the-art Total Environment Simulator flume and basin facility is a key resource for this cluster. It underpins our leading role in the EU HYDRALAB consortium of 25 institutions that are pioneering innovation in experimental hydraulic modelling and improving physical models for Climate Change Adaptation in the HYDRALAB-Plus (Horizon 2020) programme. We also lead on the development of new technologies for Earth observation, supported by STFC funding for drone-mounted spectral analysis engineering (**Ferrier**). Our NERC-funded projects include Susceptibility of Catchments to Intense Rainfall and Flooding (SINATRA), Combination Hazard of Extreme Rainfall, Storm Surge and High Tide on Estuarine Infrastructure (**Coulthard, Skinner**) and a NERC Large Grant exploring how flood hazard and risk evolve globally into the future (**Parsons, McLelland**).

Our research on monitoring and modelling environmental systems has further led to the development of innovative new experimental methods including environmental DNA (eDNA) monitoring (**Lawson-Handley, Haenfling**). Funded by Scottish Natural Heritage and the Scottish Environmental Protection Agency (SEPA), we are developing and testing this novel methods for non-invasive monitoring of biodiversity in water bodies via DNA traces. Our researcher can then generate Big Bioinformatics Data on entire ecological communities and these data are already impacting on environmental policy and biodiversity management practices in the UK and Europe.

iii. Research on ***changing aquatic environments*** also addresses our changing world. A core focus on this cluster is the analysis of molecular stress and its effect on chemical communication. This work has underpinned internationally-leading outputs (from **Wollenberg Valero, Hardege, Roggatz**), and won university support for a PhD cluster researching changing aquatic environments (**Wollenberg Valero, Hardege, Roggatz).** Other funding was

earned from NERC (CHEMpop (**Nunn, Hardege, Wollenberg Valero**)) and The Royal Society (**Wollenberg Valero**). Our work on aquatic microplastic contamination, transport and impacts (**Rotchell, Parsons, Deutz, Dorrell**) highlights the significant presence of microplastics in environments considered pristine such as Antarctica, in estuarine and marine contexts, and the food chain.

iv. Our research on the ***co-evolution of Earth and life*** shapes international debates about past climate, and ecological and evolutionary change from the pre-Cambrian period to the Holocene (**Bird, Bond, Dean, Bunting, Caswell, Reed, Wollenberg Valero**). We are international leaders in advising stakeholders on the management of natural capital as we move into the Anthropocene (**Forster, Breithaupt, Hardege, Elliott**). This cluster's research attracts significant investment from science funding bodies such as European Council (EC) (**Elliott**), NERC (**Bond, Parsons**), Leverhulme (**Baar**), ERC (**Parsons**), Royal Society (**Bond, Parsons**), and private sector organisations (**Dodd, Nunn, Noble, Bolland**). Our profile in this area results in the appointment of our researchers as advisers to national scientific bodies (e.g. **Nunn**: Natural England; **Elliott**: Marine Scotland Science Advisory Board; **Parsons**: NERC Science Committee).

v. To capitalise on NERC funding to build research capacity in the earth sciences, we have created a cluster of activity around ***crustal geology*** (**Bird, Caswell, Dempsey, Williams, Widdowson**). This cluster has generated innovative, world-leading research into volcanic hazards and the tectonic history of Earth. To support further developments in this cluster we invested £500k into a capital project improving our inductively coupled plasma (ICP) geochemistry suite and associated rock preparation facilities. Staff in this cluster were named in the 2018 NERC Research Impact Awards, they have presented at major science communication fora including the Cheltenham Science Festival, and they are actively engaged in International Ocean Discovery Program (IODP)-funded Expeditions.

1.2.2 *Sustainable Futures and Social Worlds*. This second thematic grouping addresses (i) flood resilience, (ii) low carbon energy alternatives, (iii) the circular and bio economies, and (iv) sustainable cities and regions.

i. This cluster applies our expertise in water science to the societal challenges of future ***flood hazard, risk and resilience***. We have secured significant European Regional Development Funds (ERDF) for the £3.4M Flood Innovation Centre (FIC). This business innovation hub focuses research and innovation towards the development of new technologies, products and services that address flood rescue and flood resilience.

   In addition, with support from Defra, Yorkshire Water and Arup, we are also developing the Ark National Flood Resilience Centre (www.arkfloodcentre.co.uk). The £14.5M Centre is designed to create a research and innovation nucleation point. It will offer simulations of flood conditions across full-scale urban and rural, and swift and still water scenarios. These will underpin integrated research, innovation and community engagement programmes, and enable advanced training in flood response, recovery and resilience. It will incorporate Continuing Professional Development (CPD) and MSc courses to train a generation of researchers to face flooding challenges (**Parsons, McLelland, Coulthard, McDonagh, Thomas, Skinner, Baar**).

ii. Our research on ***low carbon energy alternatives*** covers a range of interdisciplinary projects and collaborations designed to generate broader societal, environmental and economic benefits in a 'post-carbon' world (**Parsons, Ahmed, McLelland, Deutz, Waldman, Elliott, Gibbs**). In collaboration with Project Aura (designed to facilitate academia-industry collaborations over North Sea wind power and low carbon futures), with Sheffield, Durham and Newcastle Universities, and with industry partners Siemens and Ørsted, we secured joint EPSRC/NERC funding to lead the Aura Centre for Doctoral Training in offshore wind energy and the environment (£5.5M). This programme will eventually graduate over 80 PhD researchers across five cohorts. It integrates academic and industry expertise to address the challenges facing the offshore wind industry, and how to accelerate the low carbon transition (**Waldman, Parsons, McLelland**).

   The EPSRC-NERC Aura CDT builds on the momentum of the *Energy Estuary 2.0* and *Zero Carbon Humber* initiative which promotes a green energy innovation ecosystem in the Humber

region by connecting researchers from across UoH with 40 high profile businesses and organisations (including Associated British Ports (ABP), Drax, Equinor, Northern Powergrid, Siemens Gamesa, Yorkshire Water, Croda, Drax, local authorities and health organisations). This initiative explores routes towards a *Zero Carbon Humber*, which received £245M from BEIS to drive a combined Hydrogen and Carbon Capture and Storage scheme across the Humber. Pilot projects range in scale from a mobile carbon capture unit, to a green Hydrogen demonstrator at Saltend on the Humber, to a low carbon £12M power station that will supplement the National Grid and provide low-cost heating, cooling and electricity. These projects have the potential to create up to 10k new 'green jobs' in the region by 2030.

The aligned INCUBIS project, 'An Industrial Symbiosis Incubator for Maximizing Waste Heat/Cold Efficiency in Industrial Parks and Districts,' is a EU Horizon 2020 project co-led by this Unit (**Deutz**) alongside international partners. INCUBIS explores the potential for energy savings in the Humber and evolves policy recommendations relating to energy technology. Other research in this cluster evaluates the economic and environmental impacts of low-carbon energy schemes, and the development of expert systems for the integrated management and planning of the *Energy Estuary 2.0* vision (**Elliott, Forster, Waldman**).

iii. Research on the ***circular and bioeconomies*** includes the EU-funded project: Circular Economy: Sustainability Implications and Guiding Progress (CRESTING) (**Deutz, Jonas**). This Marie Skłodowska-Curie Actions-Innovative Training Network (MSCA-ITN) is training PhD students across seven European universities to interrogate the social and territorial contexts through which circular economies develop.

Related projects in this cluster include Evolving a Circular Plastics Economy (a UKRI Innovation Initiative, £1.1M EPSRC); THYME (Research England); and Resource Recovery and Remediation of Alkaline Wastes (NERC) (**Parsons, Deutz, Ferrier, Ahmed, Mayes**). THYME connects research into the bioeconomy across Hull, Teesside and York Universities to boost applied research into this key sector for Yorkshire. The RRRAW project (**Mayes**, **Deutz**) explored how hyperalkaline industrial waste can be remediated, and how bio-based waste can be recycled into higher value new products. It also addressed repurposing greyfield industrial sites for bio-based manufacturing to develop the region's bioeconomy.

iv. Building on strengths identified in REF2014 around urban political ecology, our human geography and environmental policy researchers (**Jonas, Deutz, Gibbs**) explore how the transition to more ***sustainable cities and regions*** transforms local economic development, state spatial planning, and city-regional governance. Funded by EPSRC, British Academy, Regional Studies Association, and The Center for Intermodal Transportation and Economic Competitiveness (USA), this research critically examines the sustainability of mass urban transit infrastructure (**Jonas**), the uneven adoption of industrial symbiosis and green technologies within cities and regions (**Deutz, Gibbs**), and local, alternative pathways to de-growth and sustainable development (**Jonas, Gibbs**). Our research on variegated city-regional governance in Europe, North America and China (**Jonas**) is shifting the conceptual focus of city-regionalism research from geo-economic to geopolitical processes.

1.2.3 Our ***Resilient Bodies, Populations and Places*** research explores (i) the interplay between organisms and their environment, particularly in molecular and evolutionary genomics and organismal interactions, (ii) human and non-human society-environment relations, (iii) historical geographies of resistance and resilience, and (iv) culture and wellbeing in the city.

i. Our ***interplay between organisms and their environments*** research produces internationally leading outputs on social behavioral interactions (**Morrell**) and the origins of parental care (**Gilbert**). One focus of this cluster is agri-environments, with research on the survival of bees in nutritionally-altered environments **(Gilbert, Morrell**), agro-pathogens (**Lunt**), plant biology (**Li**) and **Breithaupt** and **Hardege** investigate how the behaviour of organisms alters in response to sensory cues (industry-funded PhD (Clearwater Fine Foods Inc.). Hull research into evolutionary genomics produces internationally leading outputs (**Li, Joyce, Gomez, Lunt**) identifying genomic change associated with speciation and reproductive isolation, the evolution of sex chromosomes, and the role of hybridization in generating biodiversity. The Defra-funded project SoundWaves focusses on high-profile innovative field

and experimental work on the effects of noise and vibration on marine organisms (**Elliott, Breithaupt**).

ii. Research on ***human and non-human society-environment relations*** finds natural and social scientists collaborating on a range of interdisciplinary projects. **Holloway's** research on human-animal relations, technologies and endemic livestock disease (Wellcome Trust) sits within a collaboration between human geographers, historians, economists and epidemiologists across six universities. Other colleagues in this cluster are likewise engaged in multi-disciplinary, cross-institutional collaborations (funded by ESRC, British Academy, EPSRC, MRC). **Robson** investigates the impact of new technologies on mobility and livelihoods in southern Africa, and social cash transfers and youth poverty in rural Lesotho and Malawi (ESRC); **Deutz** explores waste and recycling in sustainable livelihoods across the region (EPSRC). **Wollenberg Valero** modelled the ecological factors promoting EBOLA spillover events, and **Parsons, Cowx and Ahmed** assessed the impact of changing flood frequency on food security in the Mekong delta in Myanmar, Cambodia and Vietnam. The applied nature of these projects, and their international reach, reflect our commitment to international development agendas.

iii. The interdisciplinary research cluster around ***historical geographies of resistance and resilience*** brings together human geographers (**McDonagh**, **Slatter**, **Jonas**) working on women's property ownership, gender and the landscape, material culture and religious spaces, responses to environmental shocks in the global city, and historical geographies of enclosure and resistance. Working closely with the Wilberforce Institute for the Emancipation of Slavery (Hull), and with funding from AHRC, British Academy, ESRC and Leverhulme, this cluster pushes our concerns for human geographies into the past. **McDonagh's** research into how propertied women managed eighteenth and nineteenth century agricultural landscapes received the 2018 Joan Thirsk Memorial Prize and the Women's History Network Prize.

iv. Research on ***culture and wellbeing in the city*** (**Holloway**, **Jonas**, **McDonagh**, **Deutz**, **Thomas, Coulthard**, **Parsons**, **Skinner**) explores the role of culture, leisure and water in improving livelihoods and the wellbeing of marginalised urban communities. With funding from Yorkshire Water (Ofwat), World Bank, Rockefeller Foundation, we investigate how wellbeing is enhanced by living with water (**Parsons, McDonagh, Coulthard**, **Skinner**). This cluster also worked closely with the University's UK City of Culture 2017 role as Research Partner, and with the Culture Campus programme, to deliver research projects (Heritage Oriented Mega Events in Europe (EU/AHRC £166.5k) and Cities of Culture Research Network (AHRC, £43.6k)); conferences (Spaces and Flows 8th International Conference on *Enculturing the City*, UoH in 2017); and performance arts - including the MELT project with the National Youth Theatre (**McDonagh**). This cluster also produced state-of-the art handbooks and edited collections that connected their research with academic and public audiences (**McDonagh**, **Deutz, Jonas**).

1.3 Future research aims and strategy

We strive for an inclusive, diverse research community where individuals, clusters and thematic groups can realise their potential and make distinctive contributions to debates at the regional, national and global scales. We celebrate our researchers by recognising their achievements. In the 2021-28 period we will increase the quality, focus, impact and visibility of our research by empowering colleagues to:

- Generate high quality, visible Open Access research outputs that meets REF 4*/ 3* criteria for originality, significance and rigour: **target, one 3-4* paper per annum**;
- Develop high quality, external grant applications that increase the diversity of our research funding whilst responding rapidly to the emerging post-Brexit, post-COVID funding landscape **target, one high quality grant application per annum**;
- Graduate one PhD student every third year;
- Design and implement research that generates high quality impact by building strong partnerships and realising its enterprise potential via UoH's new Knowledge Exchange

Strategy; **target, one high quality Knowledge Exchange project per annum (for KE facing staff)**

- Foster a research environment that is supportive, collaborative, interdisciplinary and innovative by upholding the equality, diversity and inclusivity principles of the Athena SWAN charter and national Concordats on research integrity, data management and open access, career development and public engagement.

We have a number of supporting mechanisms to achieve these aims:

- Enabling colleagues to prioritise regular, quality time for research, original thinking and idea-development through actively managing a transparent workload model, and aiming for a workload balance between research and teaching (via research semesters, study leaves, reading weeks, writing retreats);
- Lead the UoH's 'Living with COVID' response to COVID-19, which monitors the pandemic's impact on research (and differential implications for career progression and promotion) and explores how to overcome these challenges;
- Research sabbaticals within the EEI through a dedicated Partner and Affiliates scheme that funds replacement teaching cover allowing staff dedicated time to focus on research outcomes. Staff in GGE and BMS voted to suspend their sabbatical scheme and distribute the resource to reduce routine teaching loads.
- Continue to build our postgraduate research community by recruiting PhD and MSc by Research students for defined projects which have a clear, strategic contribution to our thematically-driven research strategy;
- Increase the citation rate and visibility of our research outputs by supporting Open Access publication and preprint submission where appropriate, and by using media and social media to increase its visibility. We will use research metrics responsibly (following the Leiden Manifesto for Research Metrics, of which the University is a signatory), and encourage reproducibility in research via participation in the UK Reproducibility Network (UKRN);
- Enable the development of impact plans and case studies through pump-priming resources from the University's Research and Enterprise Office.

2. People

2.1 Staffing Strategy

Our staffing strategy aims to nurture and sustain our research strategy. We build upon experienced research leadership and a balanced profile of senior, mid-career, and junior researchers to ensure sustained research success for the future. Our strategy focuses on: (1) sustaining research leadership; (2) developing emerging research strengths; and (3) supporting staff development and training. The University's Academic Careers Framework (ACF) recognises and values contributions across research, teaching, and knowledge exchange. Our revised Annual Appraisal scheme provides mentoring for all staff, addresses promotion options annually, builds confidence, and provides constructive feedback on research objectives and outcomes.

2.1.1 ***Sustaining research leadership***: The REF period has seen promotions and appointments across the career profile, including four staff promoted to Chair (**Deutz, Holloway, Bond, Ferrier**) and four to Reader (**Breithaupt, McDonagh, Bunting, Mayes**). The creation of Emeritus Professorships within the EEI have allowed former staff (**Gibbs, Frostick**) to continue providing leadership experience.

We support developing research leaders through Advance HE Research Leaders training every second year (with applications open to all). Ten colleagues participated in 2018, and six have subsequently taken on significant leadership roles.

We also support women colleagues to join the Aurora leadership programme. To date 26 women have completed this programme, and five were sponsored in 2019. Nine have gone on to undertake significant leadership roles. In 2019 a further 5 were sponsored to participate in this developmental and networking course.

2.1.2 ***Developing emerging research strengths***: Our research strategy builds upon existing research themes and strengths and takes advantage of new research funding opportunities. In this REF cycle, we have built a new cluster in crustal geology (**Bird, Dempsey, Widdowson, Caswell**) and founded the EEI (with three new academic positions and eight independent research fellows). We have renewed and enhanced our established research strengths with full time appointments in historical geography (**Slatter**), evolutionary biology (**Gilbert, Wollenberg Valero**), and palaeoclimate (**Dean**). This sustained investment in research-focused staff has generated a net increase in submitted staff from 34.5 to 49.6 FTE in this REF period (a 43.8% increase).

We recruit a balance of exciting Early Career Researchers and more-experienced researchers to establish new areas - including low carbon energy alternatives (**Forster, Waldman**) and crustal geology (see above). EEI has gained a NERC Advanced Fellow award (**Dorrell**), two Leverhulme Research Fellowships (**Baar, Fernandez-Arrietta**), and five Chancellor Research Fellows (**Hope, Hackney, Thomas, Roggatz, Skinner**). These appointments reinforce extant strengths and themes and develop new areas. The benefits are higher-quality outputs, increased scale and diversity of research income, and improved impact portfolios.

2.1.3 ***Supporting staff development and training*****:** Staff development and training is a core focus and we invest significantly in this. UoH is a member of VITAE (Careers Research and Advisory Centre (CRAC)), which supports researcher's professional development at all stages. Hull has held the HR Excellence in Research Award since 2012 and its practices align with the principles of the European Charter for Researchers and Code of Conduct for Recruitment. Our Staff Development Team provides opportunities for researchers to extend their skills with formal courses, self-guided online training, and informal mentoring and group activities.

Staff are especially encouraged to participate in the Departmental and EEI **Mentoring Schemes**. Five members of the unit have completed Advance HE mentor training and can deliver specific, target-oriented mentoring (where mentees outline the support they want (e.g. promotion)). Less formal, more general supportive mentoring relationships between colleagues are also encouraged and cover all aspects of academic careers. All new colleagues are given an appropriate mentor (or two) to help orientation.

Our **Visiting Researcher scheme**, where highly successful researchers visit Hull to deliver a lecture, a postgraduate event, and specific support to colleagues also aids staff development. Recent visitors include Dr. Robyn Pickering (University of Cape Town), who spent time with postgraduates discussing turning data into thesis chapters and publications, and Prof. Kenneth Storey (Carleton University), who advised Biology staff on molecular-scale stress responses in organisms. EEI has hosted sabbatical visits by three Japanese, two USA, two Chinese scholars and researchers from the Southern Institute for Water Resources Research in Vietnam.

Against a backdrop of significant change in the sector and, more recently, the challenges of COVID-19, we have worked tirelessly to maintain and increase a shared sense of identity, inclusivity and belonging through cross-disciplinary seminars, the highly successful annual postgraduate research conference and the annual EEI conference (each open to all researchers across the Unit).

We also reinforce our **research culture** with a programme of away days, research paper and proposal reading groups, informal coffee and cake catch-ups, research cluster meetings, *ad hoc* lectures, pub talks, and the annual EEI Summer Charity Challenge which last year saw over 30 EEI staff complete the Yorkshire three peaks walk raising over £2000 for flood victims from Cyclones in Mozambique. **Robson** was funded to train as a writing retreat facilitator and then ran a series of off-campus structured writing retreats (including residential events). For those unable to travel, our *Wordy Wednesdays* writing group is a 'bottom-up' event organised by staff who meet on Wednesday afternoons to support and encourage each other's research writing, and exchange strategies for getting this key and challenging part of our work completed.

Grant writing skills are developed through the Grant Writing Challenge, whereby university Research Development Managers and senior colleagues guide a cohort of early career academics

through a structured, six-month series of sessions to produce a competitive grant application. ThinkWrite Grant- and article-writing workshops are also held annually.

During preparations for this REF submission, all research-active staff participated in **evaluating research outputs** through a simulated panel process. In this way, less experienced colleagues took part in the internal evaluation and discussion of colleagues' work, plus the feedback cycle for their own work. This has accelerated our capacity to evaluate the research of ourselves and others; it also underpins a culture where colleagues' work - regardless of discipline, grade or experience - is valued, respected and acknowledged. We believe these open, diverse, interdisciplinary and discussion-based fora are also the best way to protect from unconscious bias and to ensure research evaluation is something colleagues do collectively and openly.

Finally, we recognise the crucial importance of **celebrating contributions and success**. In 2017 we introduced annual research awards to recognise research and engagement activities. Seven categories stretched across all career stages, roles and collaborations, as well as leadership. These events are catered and build excellent research culture.

2.2. Research Governance

The research governance of the UoA is led by a single Research Committee (RC), which manages research activities across the two Departments (GGE and BMS) with representation from EEI (Figure 2).

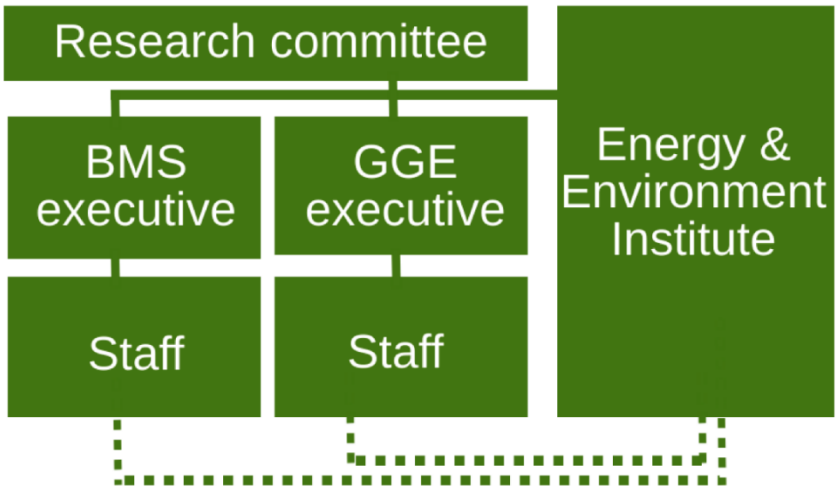

Figure 2: UoAC14 at Hull: Research Leadership

The RC comprises the Directors of Research and Postgraduate Research for BMS and GGE, Deputy Director EEI, Postgraduate and Postdoctoral representatives, and colleagues co-opted for their additional technical knowledge. The RC links directly with the EEI Directorate and the Executive Groups of GGE and BMS, with the EEI Directorate reporting directly to PVC-Research. In this way, research strategy, news and opportunities are disseminated fully and evenly throughout our UoA and beyond. Our flexible 'bottom up' approach to research leadership strives to support and resource projects at an appropriate level to maximise academic impact and generate value for money.

Research funding opportunities can be circulated by Directors of Research and the EEI Directorate: often positioning a newly-formed cluster to respond to Expression of Interest calls for funding schemes (like the Global Challenges Research Fund (GCRF), NERC and EU Horizon 2020). More frequently, research ideas and collaborations emerge from mentor meetings, appraisals, seminar discussions, reading and writing groups, and casual conversations over coffee.

We mobilise our cluster structure if a new research opportunity is identified. Requests for small pump-priming funds, facilities access or capital investment are evaluated and refined by the RC, and resulting proposals put to relevant Executive Groups. Where appropriate, the EEI may support the assembly of specific clusters via its established Partner Scheme (for formal and extended secondments up to 100% FTE) and Associate Scheme (for *ad hoc* or less time-consuming projects). The secondment of 'Partners' is funded by a 'buy in', where resource covers the vacated departmental work to prevent excessive load on other colleagues. To ensure fair access, these arrangements are managed under a Human Resources (HR) contract according to rules in the EEI 'interface agreement' which has been implemented across the wider University.

The development of research proposals and collaborative partnerships is supported by our Research Development Managers (with specialist area-facing expertise), and the technical details of applications are supported by the Research Funding Office. They are coordinated through the University's Research Management System, Worktribe. All research proposals benefit from mandatory, rigorous peer review, and major submissions to 'blue chip' funders (e.g. UKRI, EU) require a two-phase written submission in which colleagues who have had success with that scheme provide direct support, review and written feedback to maximise the quality of proposals before submission. Peer review is also available for publications, organised on request by Directors of Research.

2.3 Ethics

UoH is a full member of the UK Research Integrity Office (UKRIO) and is committed to upholding the principles of the *Concordat to Support Research Integrity*. All staff and researchers undergo compulsory Research Integrity training, sign the University's Code of Good Research Practice, conduct research in an ethical manner and implement research integrity policies. All projects are managed via the Research Management System from idea to deliverables, and their ethics are approved before work commences. When submitting proposals researchers must demonstrate how they address UKRIO and university ethics guidelines, and their awareness of appropriate sensitivity to different environmental and cultural contexts, of the potential harm of their research on vulnerable populations, plants and animals, and of minimising detrimental environmental impacts.

As evidence of our commitment to ethical research, researchers from UoAC14 hold leadership positions in ethics within the University and externally. The Associate Dean for Research and the EEI Director oversee the implementation of the University's Code of Good Research Practice within these areas. Holloway and Breithaupt are co-chairs of the Faculty's Ethics Committee, and four (**Breithaupt**, **Holloway**, **Joyce**, **Thomas**) serve on the University's Animal Welfare Ethical Review Body. **Robson** is the Founding Chair of the Save the Children UK Research and Evaluation Ethics Committee, served on the committee from 2016 to 2019, and authoring peer reviewed journal articles on the growing importance of ethics education in geography. Our researchers leading the CRESTING MSCA-ITN project (**Deutz**, **Jonas**) require ECRs at partner European institutions to adopt UoH research ethics protocols for their research on the circular economy. The Unit also leads a campus-wider drive to reinforce Reproducibility in research, and the UoH is a member of the UK Reproducibility Network with bimonthly Bioinformatics and Reproducibility Group meetings to share best practice through informal tutorials on, e.g., using an Open Science Framework.

2.4 Equality and Diversity

Equality, diversity and inclusion are central to the research environment in our Unit and members of our unity contribute to the University-level EDI committee (**Joyce**, **Parsons**). We achieved Athena SWAN Bronze in 2018 and its principles have been fully absorbed into our research governance through the joint GGE-BMS-EEI Research Committee. In refreshing its research strategy in 2019, the committee reaffirmed its commitment to embedding Athena SWAN and Stonewall values into all aspects of the unit's research culture and environment, with an application for Athena SWAN silver planned for 2022-23.

Our initiatives include:

- Implementation of a supportive Staff Performance and Development Review (appraisal) process which rewards 'quality rather than quantity' and champions a work-life balance underpinned by equality of opportunity for all staff which is accordance with our Athena SWAN Action Plan.
- A transparent workload allocation where all roles are visible, where workload is monitored for bias (gender, race, disability), and where workload is proportional to FTE (so part time staff are not disadvantaged).
- Our flexible working policy fits around family life, with key meetings within 9.00am-3.00pm.
- Annual staff appraisals specifically ask about career progression so colleagues less likely to self-advance are encouraged to apply at the same rate as others; the mentoring scheme should also reinforce his message.
- Leadership roles on Executive Committees across the Unit are advertised openly with all staff having the opportunity to contribute. Following the ten principles of the Athena SWAN charter, we have taken clear steps to address the absence of women from senior academic roles.
- Equality, Diversity and Inclusion, and Health, Safety and Wellbeing, are standing agenda items on all formal meetings.
- All staff are required to undertake unconscious bias training, as well as mandatory Equality and Diversity training.
- We host invited speakers in departmental seminars and the weekly EEI Colloquium and have worked to achieve diverse set of speakers including a KPI of a 50:50 proportion of male/female speakers.

Members of the unit are also pioneering and leading EDI in other contexts. For example, **Parsons** was a founding member of the European Geoscience Union EDI Committee and has led their Governance Review on a theme associated with underrepresented groups in the structure of the Union.

2.5 Training and Supervision of Postgraduate Researchers

UoA14 sustains a vibrant postgraduate research population which has grown significantly through REF2021 (from an average intake of 10 PhD students in REF2014 to 30+ in 2019-20). PhD completions increased from an average of 11 per year (REF2014) to more than 15 (with an increase after 2017 due to our new doctoral training partnerships (DTPs) and Aura Centre for Doctoral Training (CDT)).

In total 93.6 students graduated with a PhD from our Unit in this REF period.

Our staff supervise research postgraduates through a clearly identified research training and supervisory programme administered by the University's Doctoral College (where **McDonagh** was appointed Director, 2020).

- This supervisory programme uses The Universities UK Concordat to Support Research Integrity and VITAE to frame provision.
- The Postgraduate Training Scheme can earn an accredited Diploma in Research Skills. It also offers subject-specific skills, methods training and career development skills.
- All PhD researchers are supervised by a committee of main, second and third supervisors which meet at least monthly.
- Progression relies upon the PhD researcher completing annual progress reports and a viva-voce examination by an independent external (and written six-month reports).
- The doctoral college and library provide dedicated 24-hour access for research students. They also run support activities including Postgraduate Drop-in sessions, a Postgraduate Writing Support Group and PhD Thesis Boot Camp.
- The Doctoral College also provide continuing professional development for supervisors.

Our contribution to the UK Doctoral Research and Training Base has grown substantially since 2014 and our UoA is widely integrated with national (UK) and international (EU) doctoral training networks. We lead, or are members of, the:

- **AHRC Heritage Consortium**. Led by Hull, in partnership with Bradford, Huddersfield, Leeds Beckett, Northumbria, Sheffield Hallam and Teesside. Its doctoral training promotes training across academia and heritage professionals to maximise future heritage provision.
- **CRESTING (Circular Economy: Sustainability Implications and Guiding Progress)** research training network (2018-2022). Led by Hull, this is a MSCA-ITN project funded by EU Horizon2020 that supports 15 Early Stage Researchers (registered PhDs) across eight partner institutions in six European countries and Universities in China and Nigeria.
- **EPSRC/NERC Aura CDT** in Offshore Wind Energy and the Environment. Led by Hull, with Sheffield, Durham and Newcastle Universities, and over 20 industry partners.
- **ESRC White Rose DTP**, in collaboration with the Universities of Leeds, Sheffield, York, Bradford, Sheffield Hallam, and Manchester Metropolitan for leading social science training.
- **NECAH North of England Consortium for Arts and Humanities.** Led by Hull and consisting of Bradford, Huddersfield, Leeds Beckett, Sheffield Hallam and Teesside universities.
- **NERC PANORAMA DTP**, a collaboration between Leeds, Hull and York universities training cohorts in environmental sciences for industry, government, NGOs and academia.
- **THYME**, an innovative collaboration between the universities of York, Hull and Teesside to generate knowledge exchange between universities operating in the bioeconomy across Yorkshire, Humberside and the Tees Valley.

This wider and deeper engagement with UK doctoral training organisations has also enhanced the research environment for other PhD researchers. Around 50 PhD projects per annum are awarded competitively by the University and are organised into 'PhD Research Clusters' of connected projects where the PhD students and supervisors support each other and produce greater returns.

In this REF cycle our Unit won nine PhD Research Clusters across our three research themes:

1) "Sensing and Safeguarding the Water Environment": seven PhD researchers, including 3 co-supervised in UoAC14 (**Mayes, Rotchell**).
2) "Wild Birds in an Industrial Landscape: the Humber Estuary": three PhD researchers and one Post-Doctoral Research Assistant (PDRA) in UoAC14. **(Parsons)**
3) "Catastrophic Flows": six PhD researchers in UoAC14 (**Williams, Coulthard, Parsons, McLelland**).
4) "Parental Care": two PhD researchers and one PDRA co-supervised in UoAC14 (**Morrell, Gilbert**).
5) "Molecular Stress in Changing Aquatic Environments": three PhD researchers in UoAC14 (**Wollenberg Valero, Hardege, Parsons**).
6) "Plastics in the Environment - From Source to Sink": seven PhD researchers (**Parsons, Dorrell, Hardege, Wollenberg Valero, Caswell, Hope, Thomas, Skinner, Roggatz**).
7) "Gender, Place and Memory 1400-1900": eight PhD researchers, including four co-supervised in UoAC14 (**McDonagh**).
8) "Living with Water": three students supervised or co-supervised in UoAC14 (**McLelland, McDonagh, Coulthard, Parsons, Thomas**).
9) "City of Culture": four PhD researchers, including three supervised or co-supervised by staff in UoAC14 (**Jonas, Holloway**).

PhD researchers in EEI have a Research Training and Support Grant and can request additional project funding from the EEI Research Support and Training Fund (£50k allocated per year). PhD students in GGE and BMS can access a Faculty-wide Research Support Fund (£250k per year) for conferences, fieldwork and training costs (with around £30k per annum supporting the unit's postgraduate researchers). We actively encouraged applications from early career academics,

those retuning from parental or sickness leave, and others seeking a return to research. We offered extra provision and support for parents with dependents if required. PhD researchers can also access matched conference funding from the Doctoral College.

UoHs response to the Covid-19 pandemic included funded extensions for PhD students (and PDRA projects, if needed), plus support with IT and workstation equipment for researchers working off-campus. Additional Research Culture and Community Seminars aim to sustain the research environment and community (and tackle isolation) when normal university conditions were suspended.

2.6 Post-Doctoral Research Associates

We have addressed issues related to how PDRAs can fall between the categories of PhD researchers and academic staff, such that all PDRAs within the UoA enjoy full access to the support mechanisms listed above, and are represented on our Research Committee. Additionally, the Faculty Research Support Fund considered broader career development of our PDRA's and offers explicit support for research activity (pump-priming) and dissemination (e.g. conference attendances) that reach beyond the project that employs them, allowing them to develop their independent research profiles in showcasing previous research and or pursuing new avenues of research for the future.

3. Income, infrastructure and facilities

3.1 Research Income

Since REF2014 UoAC14 at Hull has more than doubled the total research income from all sources, from £10.1M to more than £20.6M in the current REF period,

- Blue chip UKRI funding grew significantly: from £2.0M in REF2014 to more than £5.6M. We also had considerable success targeting other prestigious funding (Wellcome Trust, British Academy), and secured a step-change in leading large multi-team, multi-disciplinary and cross-institutional research projects.
- We also earn research income from diverse sources including UK central and local government (£4.2M), charities (£0.7M), business and commercial organisations (£3.6M), and the EU (£5.1M).
- Notably, we secured significant research income from the European Commission and led multi-disciplinary projects funded through Horizon2020 and ERC (HYDRALAB, CRESTING, CERES, FITHydro, GEOSTICK) and INTERREG (TiDE, IMMERSE, Sullied Sediments).
- Approximately 46% of our income comes from government, charities, and industry and commerce, reflecting our impactful work and our focus on the challenges confronting industry, government and third sector organisations.

All research proposals are developed in close collaboration with the University Research Development Managers and the Research Funding Office (who organise internal peer review of proposals, and provide regular bulletins on research funding opportunities).

3.2 Infrastructure and Facilities

3.2.1 Strategic Investment

Strategic investment in infrastructure and facilities since 2014 has transformed our capability to develop new research and to undertake core activities better. The University's commitment to supporting research excellence is demonstrated by VIPER: a £2.1M High-Performance Computer (HPC) facility that is among the most powerful academic HPCs in the UK and the highest rated in the English North. VIPER comprises 180 computer nodes each with128GB memory, 4 nodes with 1TB of memory, and 2 visualisation nodes with dual NVidia GTX 980 Ti cards. It allows us to solve large, complex and challenging problems in a fraction of the time of conventional computing. Since 2016 our UoA staff have logged around 25% of its use (over 22,861,072 core hours and 572,954

'jobs' (UoH data, July 2020). VIPER has been especially transformative for our bioinformatics, remote sensing and geophysical flows research by enabling in-house simulation and manipulation of very large datasets.

The University has also invested £2.2M in the complete refurbishment of a dedicated building for EEI, which now accommodates over 120 people in a bespoke, collaborative innovation space structured into interdisciplinary themes and clusters. The design allows for colleagues from across campus to hot-desk in the institute for focused research time, and to enable further collaboration. The building has recently been awarded SKA Gold: the first building in Yorkshire to receive this highest sustainability rating award from the Royal Institution of Chartered Surveyors.

Our rolling upgrade of core facilities has seen Faculty-led investments improve General, Instrument and Clean laboratories shared by clusters in GGE and BMS. These facilities significantly extend and enhance our capabilities across our research themes.

- Our research laboratories include provision for molecular biology and genomics capability; a bioinformatics laboratory (for population genetic analysis and modelling, genomic project analyses, metabarcoding and phylogenetic studies); an environmental DNA Laboratory (for sterile recovery of DNA from environmental samples); and sector-leading aquaria and related facilities.
- Our Controlled Environment Laboratories permit mid-to-long term experimentation in geo- and environmental science, and the Rock Preparation Laboratory supports geology research.
- Our laboratory-based analytical capability has been enhanced by an Agilent 8800 Triple-Quadrupole Mass Spectrometer and Nu Analytics laser ablation sampler (£500k) to support new areas of geochemistry, plus a £60k (part NERC-funded) investment in rock preparation and thin sectioning facilities.
- Our environmental plastics research benefits from two Nicolet iN10 MX infrared imaging microscopes specifically configured for microplastic analysis (£97k). Two new liquid chromatography mass spectrometers have also enhanced our capability to measure organic pollutants in the natural environment (£315k).
- Our state-of-the art experimental flume facilities have received significant investment of ~£800k through the period (part funded by ERC-Consolidator), with an additional £1M investment from a recent NERC Capital Programme grant.

3.2.2 Strategic Investment: Research Themes

Investment in infrastructure and facilities is targeted strategically to support clusters of researchers working within research themes. Recent highlights include:

i. *Dynamic Earth and Changing Environments.* Arising from an extended collaboration between the University, Hull City Council and partner organisations, our UoA operates the Total Environment Simulator (TES) at the Millennium Project 'The Deep' on Hull's city-centre waterfront. TES is a unique resource, and was highlighted in the Royal Society's 2018 publication "A snapshot of UK research infrastructures" as a world-class research facility. It is booked solidly for 24 months in advance by a combination of EU-funded projects, inter-university NERC- and UKRI- funded research, and visiting international scholars. It is a 16m x 6m x 2m flume with recirculating flow, rainfall simulators, wave generators, the only submersible 3D laser PIV system in the UK, 3D laser Doppler anemometry (LDA), laser bed scanners, and an array of profiling acoustic Doppler velocimeters (ADVs) and pressure transducers. Since REF2014 we have replaced the TES floor (£40k), refurbished the wavemaker (£160k), upgraded the lighting system, and added temperature control (£300k).

Matching this facility are field capabilities including a RIB vessel; a suite of state-of-the-art shallow geophysics instruments; a field spectroradiometer; differential global positioning systems; remote sensing drones; six Acoustic Doppler current profilers; continuously recording sondes; a laser granulometer; RESON and Norbit multibeam swath bathymetric sonar facility (£280k); and lacustrine, bog and marine coring equipment. In partnership with Natural England, we have invested in telemetry equipment distributed across a number of UK river systems (Severn, Trent, Yorkshire Ouse, Great Ouse, Witham and Tawe, Aire and Swansea Bay), and we collaborate with

Durham, Bournemouth and Swansea universities, the Zoological Society of London and the Environment Agency to monitor movement of a number of high conservation status diadromous fish species (including European eel, Atlantic salmon, sea lamprey, river lamprey and twaite shad).

ii. *Sustainable Futures and Social Worlds.* HYDRALAB+, a network of 24 institutions across Europe, has been awarded a major European Union research grant of almost €10M to use The Deep facility to develop experimental models to improve predictions of how rivers, estuaries and coasts will be affected by environmental (especially climate) change. Climate change has also prompted substantial investment in the £3.4m Flood Innovation Centre (which includes a range of stress sensors, 3D printers and circuit board manufacturing suite (£160k), alongside a planned £14.5M investment in Ark, the National Flood Resilience Centre). In collaboration with Yorkshire Water the THYME programme has established a multi-spectral drone surveying system (£85k) and sensors for a fully integrated digital catchment and sustainable urban drainage exemplar to monitor water fluxes and landscape processes (£420k).

iii. *Resilient Bodies, Populations and Places.* In addition to University investments, our genomic and environmental monitoring research capability has been enhanced by purchase of a MiSeq facility (£81k). We also regularly upgrade the equipment and software used to conduct qualitative research (laptops, digital audio and video recorders, interview transcription software) to support research in human geography and environmental policy.

4. Collaboration and contribution to the research base, economy and society

4.1 Research collaborations, networks and partnerships

Our unit's research strategy fosters and supports extensive, sustained collaboration and partnerships. We work with the researchers, universities, professional societies and networks that sustain our disciplines. We engage with governments, business and charitable organisations, and we contribute to the economy, to society and the environment. Indicative examples include:

- The Living with Water (LWW) Partnership is a collaboration alongside Yorkshire Water, the Environment Agency, City of Hull and other Local Authorities. Hull has been selected as one of five founding cities globally to test the City Water Resilience Approach (CWRA) developed by the Rockefeller Foundation's and Arup to futureproof vulnerable cities from flood-risk., and our extensive flooding research into flooding in Hull will contribute to the CWRA.
- Can Tho University and the Southern Institute for Water Resources Research in Vietnam are key partners and part on a large Institutional Links Programme fostered and maintained by the British Council.
- The CRESTING (circular economy) research project and training network emerged organically from extensive collaborations between our researchers and colleagues at the universities of Utrecht, Graz, Troyes, Messina, NOVA de Lisboa, Aberta, Chieti (Pescara), Ibadan and Nanjing.
- The GU8 Global Universities Partnership is a key vector that drives research collaborations in ecotoxicology and environmental stressors, with Xiamen and Le Havre as key partners.
- Longstanding research collaborations between UoH, EEI and the universities of Teesside and York underpin the THYME project's agenda to fuse innovations in the regional bioeconomy sector.
- Collaborations fostered by EEI and Aura have brought together major academic partner (Durham, Hull, Sheffield) and industry partners (Siemens and Ørsted) to address offshore wind and the broader low carbon agenda.
- Collaborations with the Deep aquarium on both aquatic research and husbandry as well as dissemination of research to the public is a key partnership.

We take a strategic approach to nurturing such partnerships. We provide time and support for researchers to organise and attend conferences, to serve public and private bodies, and to engage in knowledge exchange through public events and media as detailed below.

4.2 Visiting academic posts

Our staff hold a range of visiting posts: **Robson**: Research Fellow in the African Studies Centre, Leiden University; **Rotchell**: Visiting Professorships at the University of Hawaii, USA, and the State Key Lab for Coastal and Estuarine Research, Shanghai; **Jonas**: Docent Professor of Urban and Regional Development, University of Oulu; **Cowx**: Adjunct Professor in Michigan State University, USA; **Elliott**: Sir Walter Murdoch Distinguished Adjunct Professor, Murdoch University Perth, Australia, Visiting Research Professor Xiamen University China, and Honorary Senior Researcher, South African Institute for Aquatic Biodiversity; **Parsons**: Visiting Researcher University of Illinois, USA, and Visiting Professor at the State Key Lab for Coastal and Estuarine Research, Shanghai.

4.3 National and international conferences and workshops

Over the REF period we have been proactive in organising and presenting at international conferences and workshops. These include: the 2014 British Sedimentological Research Group and the 2017 British Society for Geomorphology (**Parsons, Hackney**); COP24 in Poland (**Parsons** presenting alongside Lord Prescott on "Estuarial Clean Growth", with the Humber as an exemplar of a low carbon corridor); the 2017 Spaces and Flows 8th International Conference on "Enculturing the City" (**Jonas**); Trans-Iapetus Workshop 2017 (**Bird**); Advances in eDNA-based Approaches to Fish Ecology and Management 2019 (**Haenfling; Lawson-Handley**); ECSA56 Bremen and ECSA57 Perth, International Estuarine & Coastal Sciences Association (**Elliott**); Fisheries Society of British Isles symposium on Fisheries Stock Enhancement (2014, 2019) (**Cowx**): ECSA56 Bremen and ECSA57 Perth, International Estuarine & Coastal Sciences Association (**Elliott**); UK semiochemicals Network 2019 and International Society of Chemical Ecology conference, Atlanta (**Hardege**); the 2017 (**Parsons**) and 2018 (**Bond**) Lyell Meetings of the Geological Society of London; and 5th Galileo Conference of the European Geosciences Union in 2019 in Utrecht (**Bond**). **Elliott** was funded by the British Council to run Early Career Researcher workshops in South Africa (2018) and Brazil (2019) on enhancing marine sustainability training and developing collaborations.

4.4 Awards and recognition

- **McDonagh** was 2018-2019 President of the British Science Association's Geography Section and winner of the 2018 Joan Thirsk Memorial Prize & the 2018 Women's History Network Prize for her monograph *Elite Women and the Agricultural Landscape, 1700-1830* (Routledge, 2017);
- **Coulthard** was awarded the 2020 Bagnold Medal, one of the most prestigious medals in his research field, by the Geomorphology Division of the European Geosciences Union;
- **Parsons** was awarded the Bigsby Medal of the Geological Society of London, 2015;
- **Dorrell** won the 2018 Gerhard Jirka Award for Young Researchers, International Association for Hydro-Environment Research, and a NERC Advanced Research Fellowship;
- **Jonas** and **Gibbs** were awarded prestigious Fellowship Research Grants by the Regional Studies Association in 2016 and 2017;
- **Rotchell** was awarded a Chinese 1000 Scholars Visiting Fellowship (2016) ;
- **Deutz** is President and past Vice-President of the International Sustainable Development Research Society (ISDRS);
- **Mayes** won the 2015 best paper award for an article published in the Springer journal *Mine Water and the Environment*;
- **Cowx** was awarded the 2015 Fisheries Society of the British Isles Beverton Medal for his contribution to fish biology and fisheries science;
- **Barr** and **Fernandez-Arrieta** both won Leverhulme Research Fellowships.
- **Elliott** was awarded Laureate of the Honorary Winberg Medal, 2014, of the Russian Hydrobiological Academic Society;

- **Widdowson** was appointed Vice President and Trustee of the Mineralogical Society of Great Britain and Ireland in April 2020.

4.5 Editorial roles and peer review colleges

Our staff have held major editorial roles (main or associate editor) for the following journals during the assessment period:

- *Earth Surface Dynamics* (**Coulthard**, founding editor; **Parsons**);
- *Geological Society of America Bulletin* (**Bird**),
- *Children's Geographies* (**Robson**);
- *Urban Geography* (**Jonas**);
- *Ecotoxicology* (**Rotchell**);
- *Palaeogeography Palaeoclimatology Palaeoecology* (**Bond**),
- *Estuarine Coastal and Shelf Science* (**Elliott**),
- *Marine Pollution Bulletin* (**Elliott**);
- *Fisheries Management and Ecology* (**Cowx**).
- RGS-IBG Historical Geography Research Group Monograph Series (**McDonagh**),
- *Historical Geography* (**McDonagh**)
- '2018 Reviewer of the Year' by the Geological Society in recognition of wider research citizenship, (**Bond**).

UoA staff serve on the following peer review colleges:

- AHRC (**McDonagh**); ESRC (**Jonas, Robson, Deutz, Holloway**); NERC (**Mayes**, **Coulthard, Parsons**: Panel A Chair); UKRI FLF (**Parsons**); and Canada Research Chairs (**Jonas**).
- **Elliott** serves on national research review panels in Poland, Finland, Germany, the Netherlands, Canada and the USA.

4.6 Public committees, steering groups, trusteeships, and consultancies

A number of staff serve on public committees and as advisers, consultants, trustees, and members of steering groups for regional, national and international business and non-governmental organisations. Examples include:

- **Nunn** (Advisor to Natural England on the Common Standards Monitoring (CSM) Guidance for spined loach);
- **Forster** (Advisor to E.On, GreenPort Hull),
- **Mayes** (Advisor to British Steel, UK Environment Agency);
- **Jonas** (Trustee Humber Learning Consortium, Advisor to Hull City Council, Community Led Economic Development Local Action Group, Klimastadt Bremerhaven);
- **Robson** (Chair, Save the Children UK Research and Evaluation Ethics Committee);
- **Rotchell** (Chair, East and North Yorkshire Waterways Partnership);
- **Parsons** (Executive Board Member, The Deep; Executive Board, Living with Water Partnership; Division President, European Geoscience Union; Yorkshire and Humber Climate Commission, Science Panel);
- **Cowx** (Chair and Trustee, East Yorkshire Rivers Trust; Member Independent Steering Committee, WorldFish Centre; Advisor International Union for Conservation of Nature, Freshwater Fisheries Specialist Group);
- **Elliott** (Director of Humber Nature Partnership and International Estuarine & Coastal Specialists Ltd, member of UK Marine Science Coordination Committee, UK Marine Facilities Advisory Board, Marine Scotland Science Advisory Board, French Scientific Council for Estuaries and the United Nations World Oceans Assessment II Writing Panel). Elliott gave evidence about marine conservation to the House of Lords European Committee in 2014.

4.7 Media activities and public engagement

Our staff take a very proactive approach to media and public engagement. They work with the University's marketing team and the science communications officer to communicate our research and engage with diverse audiences through public lectures, press reports, on-line blogs and websites, and social media. We have a disproportionately large profile in *The Conversation*, and their editors led regular media training for us in the period.

- We led numerous engagement activities at the British Science Festival hosted by UoH in 2018, including Forster on "satellites and the sea," McDonagh on "at the edge of the Humber" and Parsons as a panelist in the flagship *Huxley Debate*). Staff, including Ahmed and Skinner, have also led regional "Pint of Science" events.
- We broadcast regularly on local, national and overseas radio and TV. Coulthard and Parsons appear regularly on BBC Look North discussing flood risk; Williams commented on the 2018 eruption of Anak Krakatau, Indonesia, for BBC online and BBC Radio 2; Jonas appeared on BBC Radio Humberside discussing "greening our cities"; and Parsons appeared on Channel 4 news reports about the 2007 UK floods and the planned Ark National Flood Resilience Centre.
- Rotchell's microplastics research was cited in a House of Lords Special Session on plastics in the environment. It also featured in several media reports (in 2018 World Oceans Day reporting by the BBC, ITV, *The Times*, *The Independent* and *The Guardian*) and in the Nov 2019-Feb 2020 Ferens Art Gallery exhibition by the artist 'Estabrak' entitled *Sea: the Remains Between*.
- Our plastics in the environment research was central to a social media-based campaign led by UoH called #myplasticpledge which included researcher-led videocasts curated during the British Science Festival, and Parsons on the Radio4 Today programme discussing how plastics will be the marker horizon of the Anthropocene.
- Waldman and McDonagh have contributed to the development of the National Youth Theatre's MELT performing arts extravaganza based on climate change and renewable energy, and Forster's research on post-Brexit UK fisheries featured in *The Guardian* (March 2020).

4.8 External collaborations and contributions to research base, economy and society

Our impact agenda continues to develop thanks to supporting structures across the University that incentivise our researchers to engage with public and private sector stakeholders, politicians and decision makers. Our three research themes reach beyond traditional disciplinary boundaries, and therefore offer impact on wider economy, society and environment. We use a sample of our activities in each theme that indicate the potential for future research impact across our Unit:

4.8.1 *Dynamic Earth and Changing Environments:*

- Our researchers (**Hardege, Rotchell, Roggatz, Wollenberg Valero**) in this theme are engaged in an extensive programme of community and educational outreach about microplastics in the environment. This involves innovative collaborations with educators, schoolchildren, art gallery and aquarium managers and visitors, and social media users.
- **Elliott's** UK Government and Ministerial appointments on marine science advisory bodies (the UK Marine Science Coordination Committee; the UK Marine Facilities Advisory Board; and the Baltic and North Sea Coordination and Support Action Scientific Advisory Board) ensures that our expertise remains central to marine science planning policy.
- **Bond** has formal, collaborative agreements with national bodies outside the UK including the Russian Academy of Sciences, the Geological Survey of Canada and the Federal Institute for Geosciences and Natural resources in Germany.

4.8.2 *Sustainable Futures and Social Worlds*:

- **EEI**-led impact-driven activities on this theme focus around the ERDF-funded Flood Innovation Centre's role to develop new flood rescue and resilience technologies to benefit all regions and communities.
- The Plastics Collaboratory aims to partner external organisations and policy makers to identify gaps and leaks in the plastics circular economy (**Parsons, Deutz**). Funded by EPSRC and Innovate UK, this multidisciplinary project involves 25 academics at UoH working closely with various companies, charities and local authorities to investigate new and different ways of making, using and recycling plastics. The overall aim is to facilitate the co-design and implementation of specific innovations based on insights from academics, stakeholders and consumers from each level of the plastics value chain.

4.8.3 *Resilient Bodies, Populations and Places*:

- Researchers in this theme (**Lunt, Haenfling, Joyce, Nunn**) will host the Darwin Tree of Life Fish Genomics Consortium, which coordinates the collection and genome sequencing of all UK freshwater fish species for the Wellcome Sanger Institute. The project aims to read the genomes of all known species of animals, plants, fungi and protists in the British Isles.
- Our research on human-animal relations and technologies (**Holloway**) aims to foster interdisciplinary dialogue between social scientists, epidemiological modellers, farmers and livestock managers, to enhance future human-animal wellbeing.
- Finally, we have an innovative initiative around water cultures which combines natural scientists, human geographers and historians in dialogue about how diverse cultures and people across different time-periods manage water resources in resilient, sustainable ways (**McDonagh, Parsons, Coulthard, McLelland**).

In summary, our vibrant research straddles economy, society and environment and is rigorous, innovative, sustainable and forward-looking. We deliver a connected range of interdisciplinary projects to investigate and monitor the underlying causes and consequences of pressing human-environmental problems. Our '*glocal*' approach addresses local and regional agendas that generate a global resonance. For instance, the *Energy Estuary 2.0* project (a Project Aura/EEI initiative for the Humber) was generated for the region but was later incorporated into a policy brief presented to the United Nations Conference of the Parties COP24. Our research likewise emerges from our city-region to shape research and impact agendas at wider national and international scales.