**Nutrient Sensor Action Challenge** 

**Registration**

Upload the completed form to challenge.gov by clicking on the

“**Submit Solution**” tab on the [Nutrient Sensor Action Challenge](http://www.challenge.gov/nutrient-sensor-action-challenge-stage-II) page.

**General Information**

**Project Lead:**

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| First name: | | | Thomas | | Last name: | | Johengen |
| Organization: | | | | CIGLR – University of Michigan | | | |
| Title: | Research Scientist | | | | | | |
| Phone: | | 734-741-2203 | | | Email: | Johengen@umich.edu | |

**Contact for matters of communication and media:**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| First name: | | | Thomas | | Last name: | | Johengen |
| Organization: | | | | CIGLR-University of Michigan | | | |
| Title: | Research Scientist | | | | | | |
| Phone: | | 734-741-2203 | | | Email: | Johengen@umich.edu | |

Do you agree to allow EPA to share project information with journalists for potential coverage of the project?

☒ Yes

☐ No

Are there others who should be notified via email about webinars and other updates? (provide as many as needed)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First name: | | | Alex | | Last name: | | Beaton | |
| Organization: | | | | National Oceanography Centre-Southampton, UK | | | | |
| Title: | Research Engineer | | | | | | | |
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Is there is any information about the project that should be treated as confidential?

☒ Yes

☐ No

If yes, please explain:

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| Patent protected technology of nutrient analyzers |

**Project Description and Potential for Impact [limit 250 words]**

Describe the specific nutrient issue that the project will address.

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| Since the 1990s, Lake Erie has been experiencing increased water quality impairment related to the excessive supply of nutrients into the lake. These impairments include: (1) algal toxins for harmful cyanobacterial blooms (HABS), (2) the size and duration of the hypoxic hypolimnion in the central basin, and (3) the prevalence of *Cladophora* fouling beaches in the eastern basin.To combat these growing impairments, the Governments of Canada and the United States formalized revised binational phosphorus reduction targets for Lake Erie under the 2012 Great Lakes Water Quality Agreement (GLWQA). The GLWQA final target loading recommendations that include: (1) a 40 percent reduction in spring total and soluble reactive phosphorus loads from the Maumee River (U.S.), and (2) a 40 percent reduction in total phosphorus entering the Western Basin and Central Basin of Lake Erie – from the United States and Canada |

How will the addition of data and information from nutrient sensors inform and improve specific decisions and actions pertaining to nutrient management?

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| To determine progress toward meeting the new phosphorus loading targets and verifying the response in the lake, active surveillance of ambient concentrations within the lake is essential. Phosphorus concentrations can be highly variable in time and space, obscuring long-term trends if monitoring frequency is insufficient to discern signal from noise. Deployment of continuous *in situ* monitoring sensors to provide nearly continuous data would be a critical component of the Adaptive Management planning strategy that is currently under development by the GLWQA Annex 4 subcommittee. |

What are the potential impacts and benefits of the project?

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| The proposed Action Plan will take advantage of six years of initial development of a real-time continuous water quality monitoring network for WLE, and over $300K in annual funding support through the EPA Great Lakes Restoration Initiative (GLRI). The Nutrient Sensor Challenge (NSC) provides us with the opportunity to improve upon the existing system reliability, efficiency, and cost of operation. |

**Sensors**

Provide the following information for each type of sensor that will be used in the project.

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| Manufacturer/Model | NOC lab-on-chip nitrate sensor  NOC lab-on-chip phosphate sensor |
| Parameter being measured | Nitrate and Phosphate |
| Sensor Price | Not commercialized yet, estimated at $14, 600. |
| Maintenance Requirements | Inlet Filter and reagents every 6-8 weeks, based on hourly sampling. |
| Accuracy | Nitrate: 2% or 0.02 mgN/l.  Phosphate: 2% or 2 µgP/L |
| Precision | Nitrate precision is 0.01 mg/L  Phosphate precision is 1 µgP/l |
| Range | Nitrate range is 0.03 to 1000 µM (0.0004 to 14 mg/L-N).  Phosphate range is 0.06 to 40 µM (2.0 to 1200 µg/L-P). |

**Monitoring [limit 250 words]**

What is the general schedule for the project? Include: sensor deployment, maintenance and calibration, data analysis, and approximate date that data will be available to the Challenge Administrator.

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| Currently, NOAA-GLERL and CIGLR operate a network of four continuous monitoring buoys in Western Lake Erie (WLE) under funding support of the GLRI. Buoys are deployed from May through October and serviced on an approximate monthly basis. Real-time data are served to a NOAA-GLERL data portal and passed by FTP to the GLOS data portal. (<https://www.glerl.noaa.gov/res/HABs_and_Hypoxia/>) (<http://habs.glos.us>).  Data from this project will be made available in similar “Demonstration” web portals established by GLERL and GLOS, making the data available in near real-time. Final Results package including data comparisons with independent laboratory analysis of comparative grab samples will be available by December 1, 2018. |

Describe location (provide map or link to a map) and monitoring frequency for each sensor.

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| Two NOC Phosphate analyzers and two NOC Nitrate analyzers will be placed in western Lake Erie on existing buoys at WE2 and WE4 by the end of May and operated through September of 2018. Instruments come with onboard standards to calibrate every analysis. Stability and accuracy of onboard standards will be checked at the beginning and end of each service cycle (6-8 weeks).  NOC analyzers have the ability to sample every 30 minutes, but will be scheduled at two hour frequency to match current instruments and to prolong service cycles. |

If applicable, describe any existing monitoring data being collected in the area and whether these data will be integrated:

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| In addition to independent continuous nutrient measurements from the existing GLERL-CIGLR monitoring network, we also operate a weekly vessel-based monitoring program in from June to mid-October. The monitoring program generates complete water quality information on nutrients, HABs, and toxin levels. The laboratory data will provide independent ground-truthing of the in-situ nutrient analyzers and define the overall water quality conditions under which measurements were made. |

**Data Architecture [limit 250 words]** [Web service endpoint and authentication information are due to Challenge Administrator by November 1, 2018.]

Describe the plan for sensor data collection and management. Please provide any information about plans to meet data and web interface standards. Also identify any software products you intend to use that support the use of the standards.

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| Standard sensor interfaces (RS232) are used to integrate NOC Phosphate and Nitrate sensors into each buoy system. In addition to the nutrient sensors, the buoy operates a meteorological package and a multi-parameter EXO2 sonde which generates water quality data on algal biomass, pH, DO, CDOM, turbidity, conductivity and temperature. A GLERL Linux processor retrieves data hourly from buoys using Loggernet and archives data securely in the lab. Real-time data plots are created from a PostgreSQL database server running at GLERL. Data are transferred to the GLOS HABs Data portal by FTP. |