**Technical Directive for Contract No. EP-C-11-020**

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| Date of Request: | January 5, 2017 | NRMRL ID#: |  | |
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| Technical Directive Sequential No. |  | FY | 17 |

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| Completion of Technical Directive Due **ON OR BEFORE**: | One year from date of issue |

**Background:**

The USEPA’s Office of Air and Radiation is responsible for reporting the nation’s annual anthropogenic greenhouse gas emissions to the United Nations. Research conducted by the USEPA suggests that emissions of methane (CH4), a potent greenhouse gas, from water impoundments (i.e. reservoirs) may be the third most important anthropogenic CH4 source in the US. There are relatively few reports of CH4 emission rates from US reservoirs in the literature, however, and national scale emission estimates are highly uncertain. In the summer of 2017 ORD will begin the National Reservoir Survey (NRS), a 3-year field sampling campaign to produce an unbiased estimate of reservoir-CH4 emissions for the US.

ORD has substantial experience executing national scale surveys through the National Aquatic Resource Survey (NARS) program. NARS surveys are designed to assess the status of the nation’s coastal waters, lakes and reservoirs, rivers and streams, and wetlands. NARS utilizes a Generalized Random Tessellation Stratified (GRTS) survey design which provides a probabilistic subsample of the resource (i.e. lakes and reservoirs) with strong spatial balance. NARS survey designs are typically stratified by 9 US Ecoregions, allowing statistical comparison among different regions of the country.

A critical piece of any GRTS design is the sample frame, which is a GIS file containing the entire population of interest. For example, the sample frame for the lake and reservoir NARS-survey is the National Hydraulic Database (NHD) which contains the size and locations of all lakes and reservoirs in the US. Unfortunately, the NHD does not reliably distinguish between lakes and reservoirs and therefore cannot be used to support a GRTS design for the NRS (i.e. reservoirs only, no lakes).

In the absence of a comprehensive sample frame for US reservoirs, we will use the GRTS design for the 2012 National Lakes Assessment (NLA), a component of the NARS program, as the sample frame for the NRS. 642 of the 1000 water bodies sampled in the 2012 NLA were classified man-made water bodies (Fig. 1). These 642 man-made water bodies (i.e. reservoirs) represent a probabilistic and spatially balanced subset of all reservoirs in the US.



Figure 1. 642 water bodies classified as man-made during the 2012 NLA.

**Task Description**

1. The contractor shall execute a grts survey design for the NRS using the manmade waterbodies sampled in the 2012 NLA as the sample frame (provided by EPA). The survey shall be stratified by ‘ecoregion’ with 7 main sites and 20 oversample sites per ecoregion. The inclusion probability of each reservoir (i.e. weight) derived from NLA 2012 (provided by EPA) shall be adjusted as appropriate for the new survey design.
2. The contractor shall calculate the total surface area of reservoirs in each US ecoregion using functions in the spsurvey package and data from the 2012 NLA (provided by EPA).

**Deliverables:**

The contractor will provide R code for executing Tasks 1 and 2.

**Hours:**

The government estimates that this work will require 40 hours of the contractor's time.