National Lake Assessment 2017
Survey Design

Target Population

All lakes, reservoirs, and ponds within the 48 contiguous United States greater than 1 hectare in surface area that are permanent water bodies. The word "lake" in the remainder of this document includes lakes, reservoirs and ponds. Lakes that are saline are excluded as are those used for aquaculture, disposal-tailings, sewage treatment, evaporation, or other unspecified disposal use.

Survey Design

A Generalized Random Tessellation Stratified (GRTS) survey design for a finite resource was used with stratification and unequal probability of selection defined below.

Stratification

The survey design is stratified by state.

Panels

The survey design has five base panels:

- **NLA17_07RVT2** – Panel of lakes originally sampled twice in NLA 2007, were also sampled in NLA 2012 and **will be sampled twice in NLA 2017**. Note that these lakes will be sampled twice again in NLA 2022.
- **NLA17_07RVT** – Panel of lakes originally sampled once in NLA 2007, were also sampled in NLA 2012 and **will be sampled once in NLA 2017**. Note that these lakes will be sampled again in NLA 2022.
- **NLA17_12RVT2** – Panel of lakes originally sampled twice in NLA 2012 and **will be sampled twice in NLA 2017**. Note that these lakes will be sampled twice again in NLA 2022 and in NLA 2027.
- **NLA17_12RVT** – Panel of lakes originally sampled once in NLA 2012 and **will be sampled once in NLA 2017**. Note that these lakes will be sampled again in NLA 2022 and in NLA 2027.
- **NLA17_17** – Panel of new lakes **to be sampled once in NLA 2017**. Note that these lakes will be sampled again in NLA 2022 and in NLA 2027.

The survey design has four Over Sample panels:

- **NLA17_07RVT_OverSamp** – Over sample lakes to be used as replacements for NLA17_07RVT lakes when they cannot be sampled for any reason.
- **NLA17_12RVT2_OverSamp** – Over sample lakes to be used as replacements for NLA17_07RVT lakes when they cannot be sampled for any reason.
- **NLA17_RVT_OverSamp** – Over sample lakes to be used as replacements for NLA17_07RVT lakes when they cannot be sampled for any reason.

- **NLA17_17_OverSamp** – Over sample lakes to be used as replacements for NLA17_07RVT lakes when they cannot be sampled for any reason.
- Note that no lakes where available for NLA17_07RVT2 over sample lakes.

Unequal Probability Categories

Unequal probability categories were used in the NLA 2007 and NLA 2012 survey designs. The documentation for those survey designs should be consulted for their definition. For the NLA17_17 new lake design, unequal probability categories were defined based on lake area: 1 to 4 ha, 4 to 10 ha, 10 to 20 ha, 20 to 50 ha and greater than 50 ha.

Expected Sample Size

In NLA 2017 904 lakes will be sampled; and 96 of the lakes will be sampled twice for a total of 1000 lake visits. The 904 lakes consist of three sets of lakes. The first set are 226 lakes that were originally sampled in NLA 2007, resampled in NLA 2012 and will be resampled again in NLA 2017. Of these 43 lakes will be sampled twice in NLA 2017. The second set are 218 lakes originally sampled in NLA 2012 and will be resampled again in NLA 2017. Of these 53 lakes will be sampled twice in NLA 2017. The third set are 460 new lakes that will be sampled for the first time in NLA 2017. The intent is to have four main NLA panels with 226 lakes each for a total of 904 lakes: NLA07_TS4, NLA12_TS4, NLA17_TS4 and NLA22_TS4. Each panel name designates the year the panel is first sampled, that it consists of lakes that were sampled and that the lakes will be sampled for 4 NLA cycles. That is, NLA07_TS4 will be lakes sampled in 2007, 2012, 2017 and 2022 and NLA12_TS4 will be lakes sampled in 2012, 2017, 2022, and 2027.

For the NLA17_17 new lake design, the expected number of lakes in each of the five lake area categories was approximately 90 lakes. Based on NLA experience with lake evaluations in 2007 and 2012, an adjustment was made to achieve approximately 90 target and sampled lakes in each category. The number of lakes expected in the five categories were multiplied by 8, 4, 3, 2 and 2. That is, 720, 360, 270, 180 and 180 lakes for 1 to 4ha, 4 to 10 ha, 10 to 20 ha, 20 to 50 ha and >50 ha categories. The first 90 of these were then designated to be “base” and the remaining designated at “Over Sample”. Additional over sample lakes were selected to provide sufficient lakes for states who implement a state-level design and for new lake panel in the NLA 2022 design.

Lake Use and Replacement

Each lake selected to be sampled is given unique site identification (siteID). Site numbers consist of NLA17 -XXXXX where XXX is a number between 10001 and 70000. It is critical this siteID be used in its entirety to make sure that the lakes are correctly identified. Lakes evaluated for potential sampling must have all siteIDs from the largest to the lowest number evaluated within a state and within a PANEL17 level:

- Within a state, lakes in panel NLA17_07RVT2 must all be evaluated and sampled if possible. If a lake in the panel cannot be sampled, then the lowest SITEID_17 available within the state from NLA17_07RVT_OverSamp must be evaluated.

- Within a state, lakes in panel NLA17_07RVT must all be evaluated and sampled if possible. If a lake in the panel cannot be sampled, then the lowest SITEID_17 available within the state from NLA17_07RVT_OverSamp must be evaluated.
- Within a state, lakes in panel NLA17_12RVT2 must all be evaluated and sampled if possible. If a lake in the panel cannot be sampled, then the lowest SITEID_17 available within the state from NLA17_12RVT2_OverSamp must be evaluated.
- Within a state, lakes in panel NLA17_12RVT must all be evaluated and sampled if possible. If a lake in the panel cannot be sampled, then the lowest SITEID_17 available within the state from NLA17_12RVT_OverSamp must be evaluated.
- Within a state, lakes in panel NLA17_17 must all be evaluated and sampled if possible. If a lake in the panel cannot be sampled, then the lowest SITEID_17 available within the state from NLA17_12_OverSamp must be evaluated.

Since the lakes in NLA17_07 and NLA17_12 have been sampled previously, the expectation is that most of them will be available to be sampled again in 2017. Lakes in the new NLA17_17 panel have not previously been evaluated so the expectation is that many of them will not be able to be sampled; hence increasing the number lakes that must be evaluated to meet the sample size requirements.

Sample Frame

The sample frame was derived from the National Hydrography Dataset (NHD). Sample frames for NLA 2007 and 2012 designs were based on NHDPlus and are documented as part of those designs. Note that updates to the sample frame were made based on lake evaluations from those surveys. That updated sample frame was combined with NHD High Resolution lakes with lake areas from 1 to 5 ha. This was done to rectify the known deficiency in NHDPlus for small lakes due to the 1:100,000 scale mapping. Lakes that were in NHD High Res that were also in NHDPlus were eliminated. The NLA 2017 sample frame preserves the lake polygons from prior surveys while improving the coverage for small lakes.

Once the initial shapefile that included all lake objects in NHD was prepared additional attributes were created to identify lakes included in the sample frame and other properties used to construct the survey design. First, lakes that were less than or equal to 1 hectare were excluded.

Lakes included were DES_FTYPEs:

Lake/Pond
Lake/Pond: Hydrographic Category = Perennial
Lake/Pond: Hydrographic Category = Perennial; Stage = Average Water Elevation
Lake/Pond: Hydrographic Category = Perennial; Stage = Date of Photography
Lake/Pond: Hydrographic Category = Perennial; Stage = Normal Pool
Lake/Pond: Hydrographic Category = Perennial; Stage = Spillway Elevation

Lakes excluded were:

Estuary
Playa
Swamp/Marsh
Lake/Pond: Hydrographic Category = Intermittent

Lake/Pond: Hydrographic Category = Intermittent; Stage = Date of Photography
Lake/Pond: Hydrographic Category = Intermittent; Stage = High Water Elevation
Reservoir
Reservoir: Construction Material = Earthen
Reservoir: Construction Material = Nonearthen
Reservoir: Reservoir Type = Aquaculture
Reservoir: Reservoir Type = Cooling Pond
Reservoir: Reservoir Type = Disposal
Reservoir: Reservoir Type = Disposal; Construction Material = Earthen
Reservoir: Reservoir Type = Evaporator
Reservoir: Reservoir Type = Evaporator; Construction Material = Earthen
Reservoir: Reservoir Type = Tailings Pond
Reservoir: Reservoir Type = Tailings Pond; Construction Material = Earthen
Reservoir: Reservoir Type = Water Storage
Reservoir: Reservoir Type = Water Storage; Construction Material = Earthen; Hyd*
Reservoir: Reservoir Type = Water Storage; Construction Material = Nonearthen
Reservoir: Reservoir Type = Water Storage; Hydrographic Category = Perennial
Reservoir; Reservoir Type = Treatment"

Next lakes were excluded that were evaluated during the NLA 2007 and were identified as lakes that did not meet definition of a lake for NLA 2017. These were lakes with evaluation codes of Lake_Saline, Lake_Shallow, Lake_Special_Purpose, Lake_Vegetated, Non_Target, or Not_Lake".

Lake Selection and Sample Frame Summary

See accompanying spreadsheet NLA2017 Design Summary 20150928.xlsx