

Appendix D

Field Survey Methodology

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D.1 Field Surveys

Field surveys consisted of an aerial component and a ground component. The aerial team counted the boats that are on the water at the same time that the ground-based teams counted empty boat trailers at public boat launches and marina slips that are rented but empty. Counts were conducted in the morning and the afternoon on both Saturday and Sunday of four summer weekends, including the Fourth of July and Labor Day weekends during the 2016 recreation season.

Based on coordination with Beaver Lake managers, the lake was divided into five study zones (**Figure D-1**). The study zones were identified as areas that have different physical characteristics that relate to different patterns of boat use and management strategies. For example, the southern end of the lake (Zones 4 and 5) is very narrow and can be shallow, making this area more attractive to fishermen while the middle section of the lake (Zones 2 and 3) contains wide spaces that allow for sailboats and attract water skiers. Data were collected by specific location to the maximum extent possible, i.e., by specific boat launch or marina location.

D.1.1 Boat Survey Schedule

Coordinated aerial and ground surveys were conducted on four survey weekends, including the Fourth of July weekend (July 2/3), two additional weekends in July (July 16/17 and July 23/24), and Labor Day weekend (September 3/4). Aerial surveys are dependent on the weather, and weather conditions may prohibit helicopter operations or clear visibility of the lake. Therefore, one contingency weekend was included in the potential schedule (**Table D-1**). Although surveys were initially planned for the weekend of July 9/10, the Corps cancelled the planned field surveys based on a poor weather forecast. The contingency weekend, the third weekend of July (July 23/24) was surveyed instead.

Table D-1. Primary and Alternate Aerial Survey Dates

	Primary Survey Dates	Alternate Survey Dates
Flyover #1	July 2 – 3	July 2 – 3
Flyover #2	July 9 – 10	July 16 – 17
Flyover #3	July 16 – 17	July 22 – 23
Flyover #4	Sept 2 - 3	Sept 2 - 3

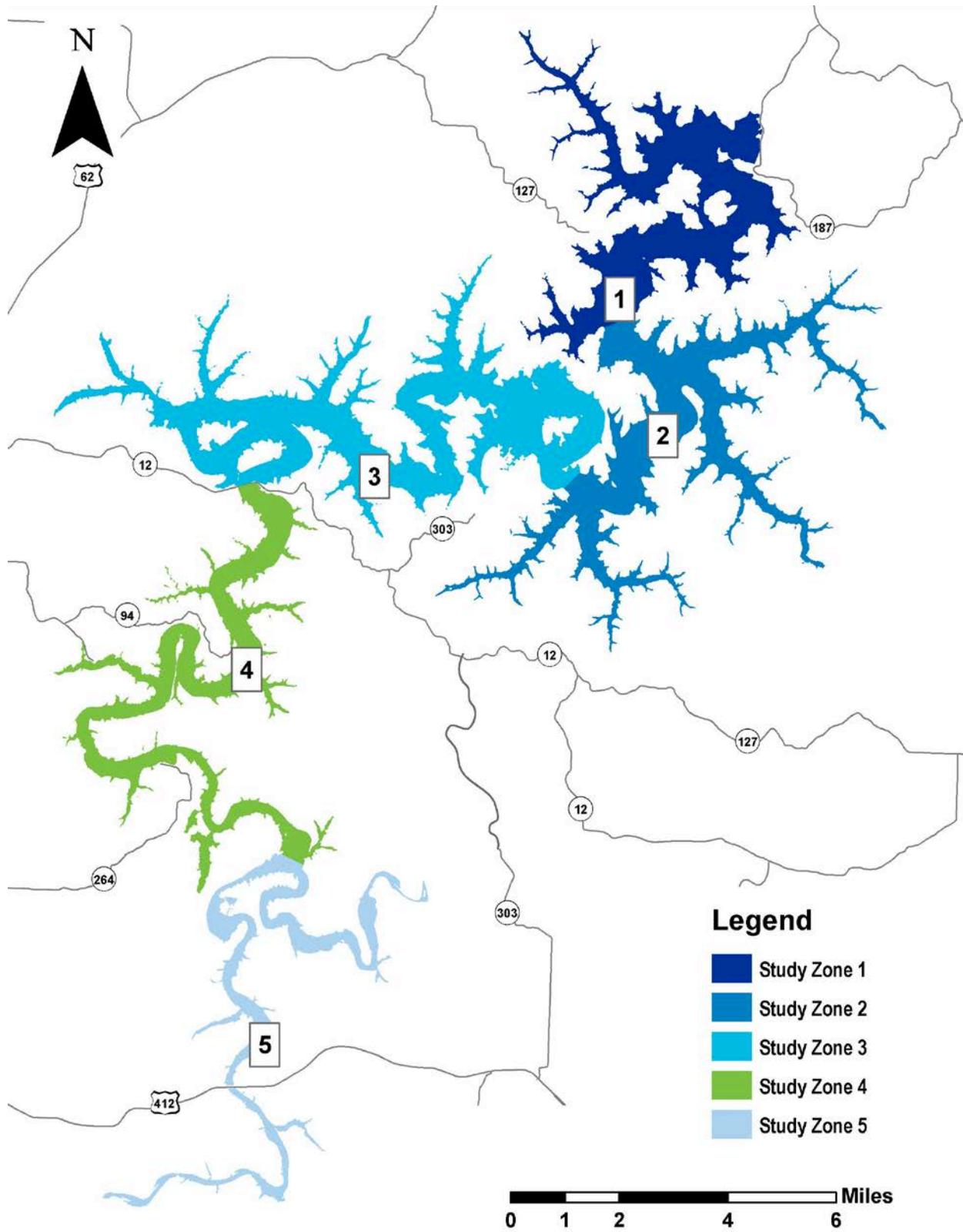


Figure D-1. Lake Study Zones

D.1.2 Aerial Counts

A flyover was conducted in the morning and the afternoon of each day for a total of four helicopter flyovers each weekend. The direction of travel (north to south or south to north) was varied so that the morning and afternoon counts were sampled equally in both directions (**Table D-2**). Morning flyovers were conducted between 9am and noon and afternoon flyovers between 1pm and 4pm. Actual starting and ending times are noted in the data tables for each flyover in

Table D-3.

Table D-2. Flyover Direction by Lake Study Zone

Day	AM/PM	Flyover Sequence by Lake Study Zone				
Weekend 1						
Saturday	AM	1	2	3	4	5
	PM	5	4	3	2	1
Sunday	AM	5	4	3	2	1
	PM	1	2	3	4	5
Weekend 2						
Saturday	AM	5	4	3	2	1
	PM	1	2	3	4	5
Sunday	AM	1	2	3	4	5
	PM	5	4	3	2	1
Weekend 3						
Saturday	AM	1	2	3	4	5
	PM	5	4	3	2	1
Sunday	AM	5	4	3	2	1
	PM	1	2	3	4	5
Weekend 4						
Saturday	AM	5	4	3	2	1
	PM	1	2	3	4	5
Sunday	AM	1	2	3	4	5
	PM	5	4	3	2	1

Prior to each flyover, the helicopter pilot made a determination of whether to conduct the survey based on weather and safety considerations. Due to safety considerations, the Saturday morning flyover on July 2 was only partially completed; the Sunday morning flyover on July 3 was cancelled due to weather.

Two flyovers were attempted on each date as shown in **Table D-3**, once in the morning (9 am to noon) and once in the afternoon (1 pm to 4 pm). These flyovers were scheduled to coincide with the peak recreational use periods for the morning and the afternoons, respectively. Actual flight times varied slightly based on weather conditions, number of boats on the lake, and efficiency of staff in recording data.

Table D-3. Aerial Survey Dates and Conditions

Day	Date	AM/PM	Actual Time	Weather Conditions
Weekend 1				
Saturday	July 2	AM	9 am to 11 am	Cloudy to clearing
		PM	1 pm to 4 pm	Partly cloudy, high 80's
Sunday	July 3	AM	Aborted	Rain/Lightning
		PM	1:30 pm to 4 pm	Cloudy to clearing, low 80's
Weekend 2				
Saturday	July 16	AM	9 am to 12:48 pm	Slight overcast
		PM	1:10 pm to 3 pm	Clear, high-80's
Sunday	July 17	AM	8:46 am to 11 am	Clear, mid to high 80's
		PM	1 pm to 3 pm	Clear, low 90's
Weekend 3				
Saturday	July 23	AM	9 am to 11 am	Clear, high 80's
		PM	1 pm to 3:15 pm	Clear, mid 90's
Sunday	July 24	AM	9 am to 11:15 am	Clear, low to mid 80's
		PM	1 pm to 3:05 pm	Clear, mid 90's
Weekend 4				
Saturday	September 3	AM	9 am to 11 am	Clear, mid 70's to low 80's
		PM	1 pm to 3 pm	Clear, low to mid 80's
Sunday	September 4	AM	9 am to 11 am	Clear, mid 80's
		PM	1 pm to 3:30 pm	Clear, mid to high 80's

Each flyover included a visual count of the number and type of boats on the water. The counters in the helicopter were provided with paper maps of the entire lake for recording location and boating activity (see **Figures D-2 and D-3** for an example of the helicopter data collection maps). Each page of the map sets provided for the helicopter crew depicted one helicopter survey zone. Each map set included 21 maps, with each map area representing a portion of the lake that could be depicted on a legal size sheet at a reasonable scale (**Figure D-3** shows helicopter survey zone 1 as an example). A fresh set of maps is provided to the helicopter counters for each flyover. (Note: Zones 22 and 23 shown on **Figure D-2** were not included in the survey of the lake as directed by the Corps because these areas are very narrow and are frequently too shallow to support much boating activity.)

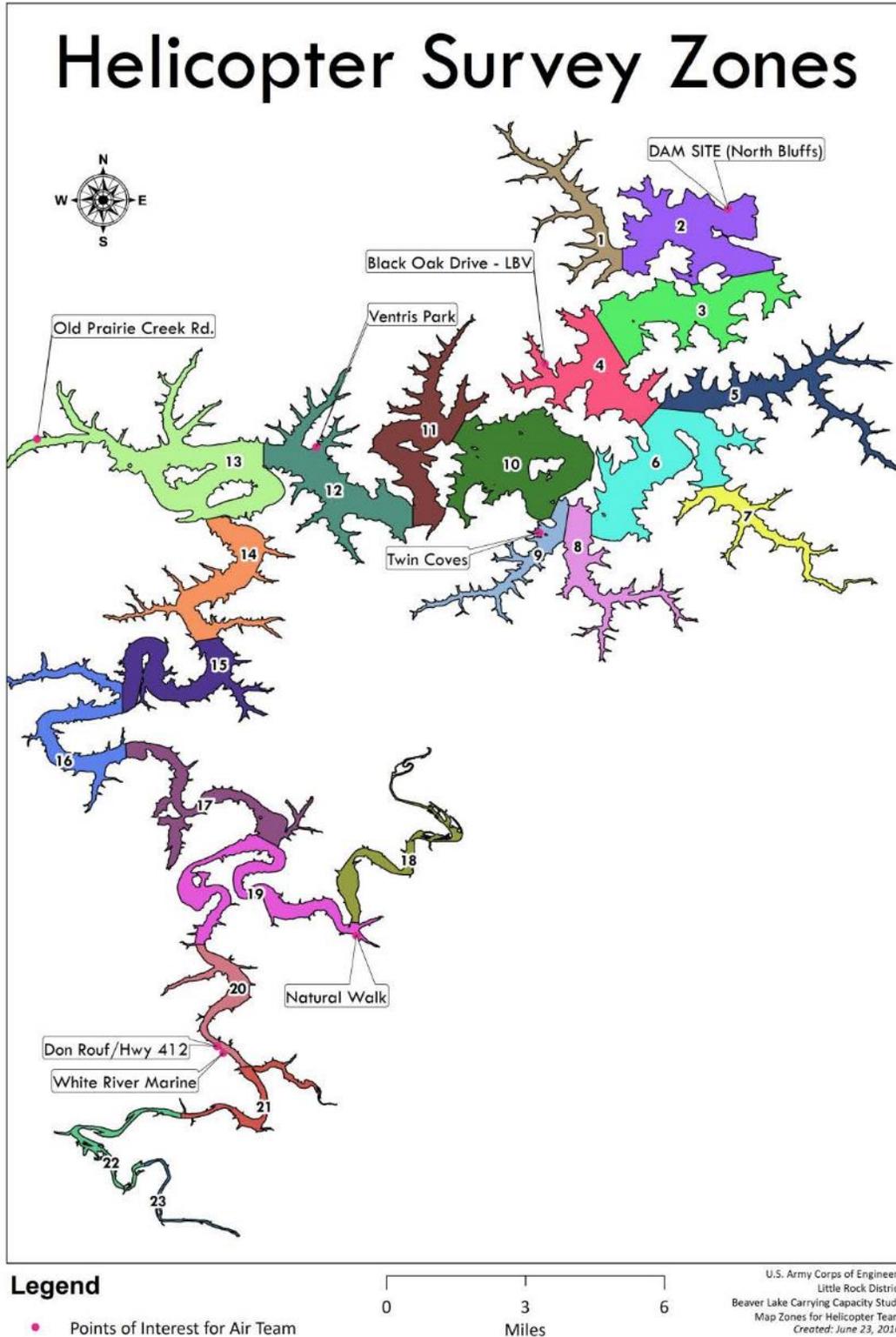


Figure D-2. Helicopter Survey Zones

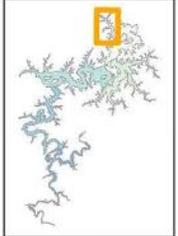
* Note – Zones 22 and 23 shown on the map were not included in the flyovers.

Date: _____

Time: _____

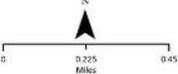
1





Lake Zone 1

Boat Type	Code
Fishing/Bass	F
Pontoon/Houseboat	P
Skating/Wake	W
Sailboat	X
Speedboat	S
Canoe/Kayak	C
Jet Ski	J



0 0.225 0.45
Miles

Field Team Member: _____

Figure D-3. Sample Helicopter Data Sheet, Helicopter Zone 1

The helicopter counters recorded the approximate location and boat type/activity on the paper maps during each flyover, and the number of boats by zone were recorded from those maps. The boating activity types recorded were determined with the Corps staff and included fishing (F), pontoon boats and houseboats (P), waterskiing and wake boats (W), sailboats (X), speedboats (S), canoes/kayaks (C), and jet skis or personal watercraft (J).

In addition, photographs of the lake were taken from the air during each flyover to provide additional documentation of boat use and confirmation for congested locations where an accurate count may be more difficult while in the air (example **Figure D-4**). The photographs were also used in performing a quality assurance review of the hand annotated map sheets.



Figure D-4. Congested Area of Beaver Lake, July 23 PM Flyover

Eight boat launch locations that are somewhat remote were identified to be surveyed from the air (shown on **Figure D-5**). The helicopter crew flew over these locations during each aerial survey and take photographs of the parking areas so that the number of empty boat trailers could be counted. After the first two weekends, it was determined that the ground crews could more easily survey three of these launch sites, and Old Prairie Creek Road, Black Oak Drive, and Dam Site – North Bluffs were eliminated from the helicopter flyover responsibilities.

D.1.3 Marina and Boat Ramp Counts

Ground-based field teams surveyed the boat ramps, marinas, and campgrounds around the lake at the same time as the helicopter flyovers. In coordination with the Corps, the public boat launch access points to be surveyed were determined (**Figure D-5**). Survey locations included all public boat ramps at campgrounds and marinas around the lake as well as several of the more popular public road ends. The

number of empty boat trailers were counted at each boat launch area. All marinas (**Figure D-6**) were visited during each survey and the number of empty slips tallied.

The areas to be surveyed were grouped and pre-set routes mapped to allow four two-person ground teams to cover all of the survey areas within the same time period as each helicopter flyover. The direction of travel (approximately north to south or south to north) mirrors the direction of helicopter travel for each survey period. Ground crews noted starting and ending times and the weather in their area. All of the data were captured on data sheets for each survey period (**Appendix D.2**).

At boat launches and campgrounds, the survey teams counted empty boat trailers and noted the number of designated parking spaces. For each boat ramp parking lot surveyed, the following information was collected:

- Number of vehicles with empty boat trailers parked in designated parking areas
- Number of vehicles with empty boat trailers parked in undesignated areas
- If there was a campground within or close to the recreation area where the boat ramp was located, the number of empty boat trailers located at campsites or other parking areas within the campground were also counted.

To determine the number of boats on the water from each marina location, the number of rented but empty boat slips at each marina was tallied. At marinas where there is a public boat ramp, the number of empty boat trailers in boat ramp parking lots were also counted. For each marina, the following information was collected:

- Number of slips currently rented
- Number of slips available for rent
- Number of empty but rented slips
- Number of vehicles with empty boat trailers parked in designated parking areas
- Number of vehicles with empty boat trailers parked in undesignated areas

At marinas, the teams walked the docks and noted the number of empty slips. Data was collected from the marina operators on the total number of slips and the number rented.

In addition to commercial marinas, resort operators were requested to self-report the number of boats departing from their docks during each of the survey periods. The Corps coordinated with the resort owners who were provided with data sheets to record the information (**Appendix D.4**).

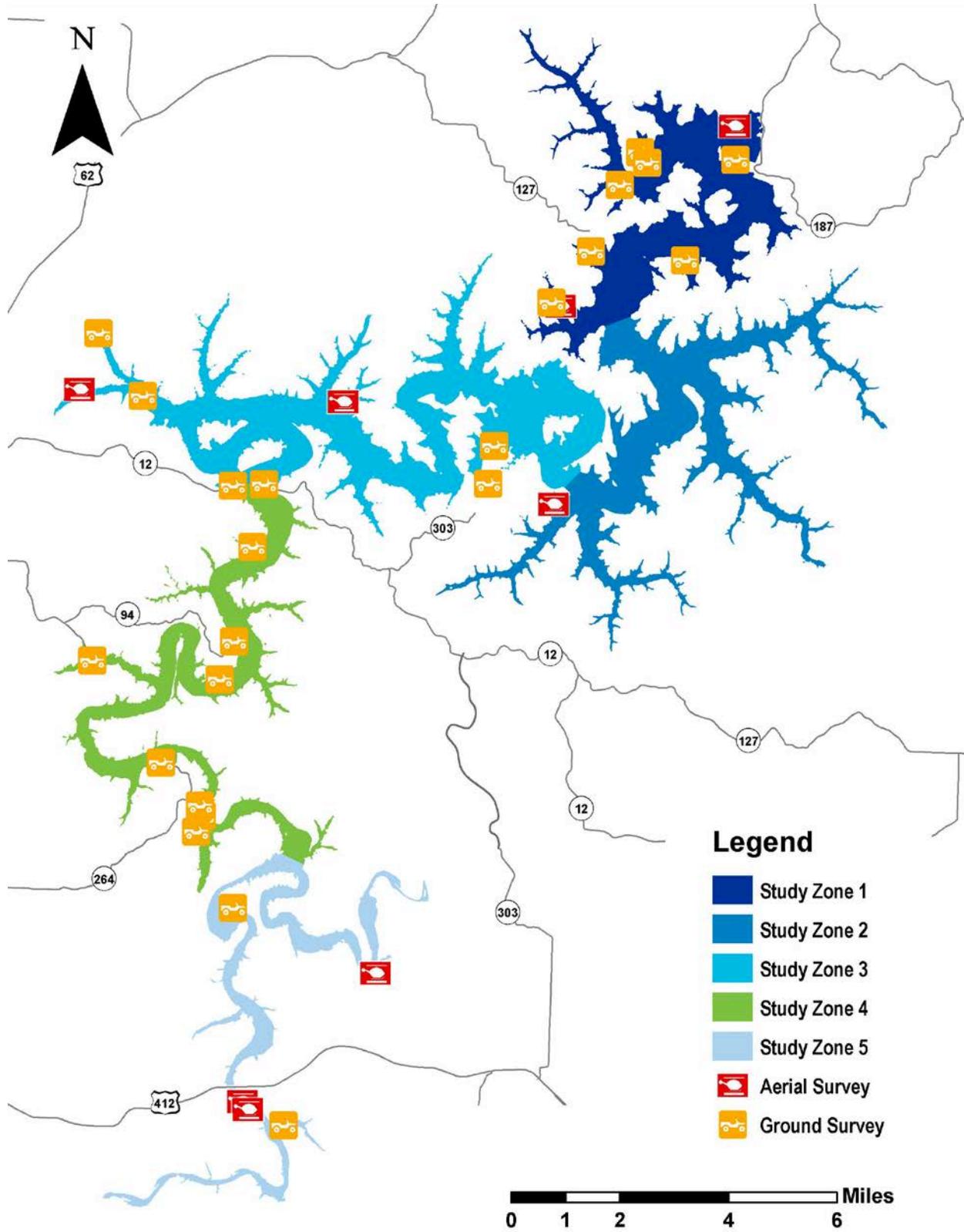


Figure D-5. Boat Launches at Beaver Lake

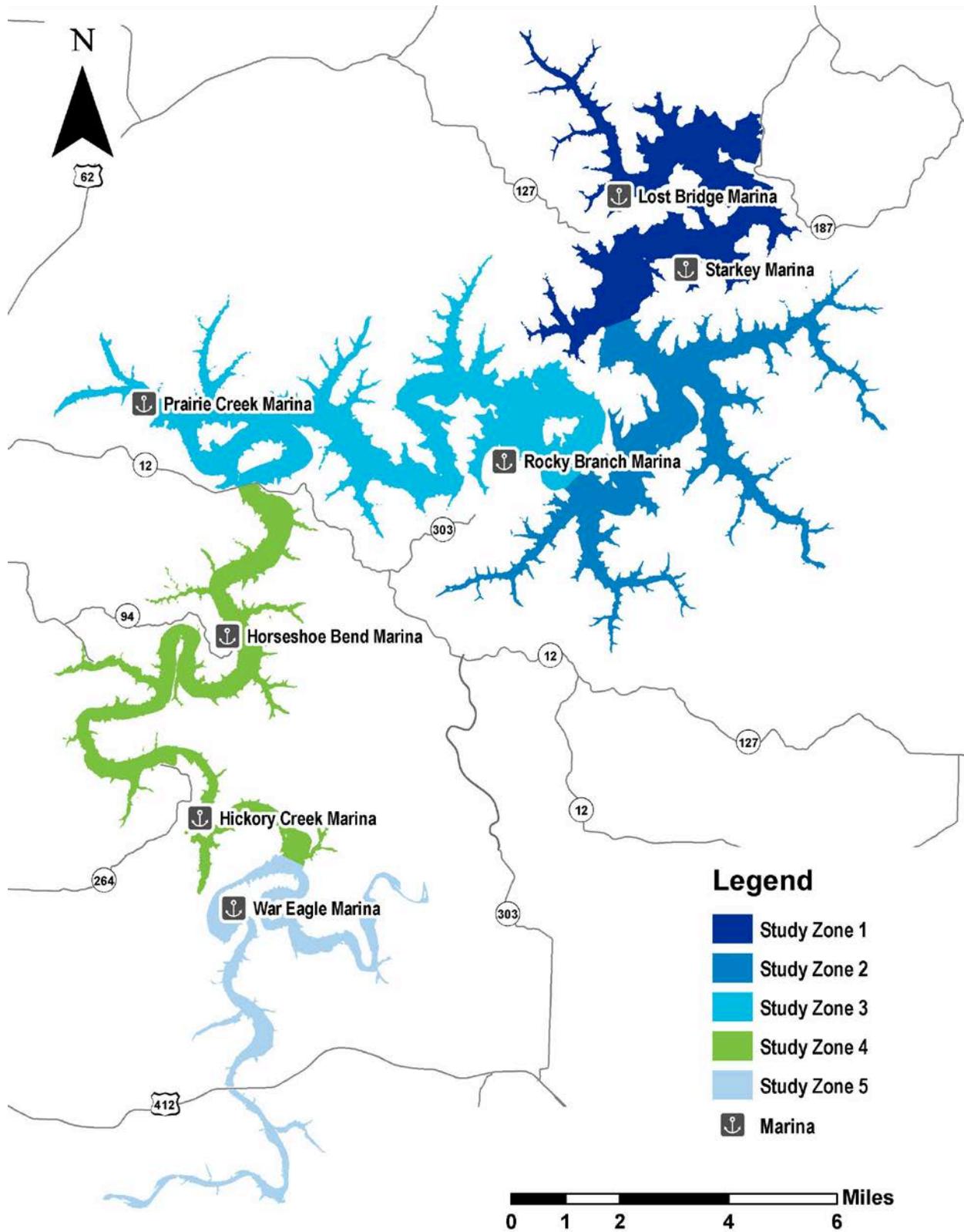


Figure D-6. Marinas Surveyed by Ground Crews

D.1.4 Team Training

The teams all received the same training and used the same data collection forms in order to minimize observer bias in the results. All ground survey staff attended a training presentation prior to the first survey weekend. A copy of the training materials is included in **Appendix D.3**.

Each of the four teams conducted a “dry run” on the Friday before the first survey weekend. The purpose of this dry run was to familiarize each team with the locations of the launches and campgrounds that they would need to survey. Much of Beaver Lake is in a rural setting with winding and poorly marked roads. The dry run allowed the staff the opportunity to learn the survey route so that the actual survey could be conducted efficiently and within the study time frame. The dry run also allowed the crews an opportunity to meet the marina staff and get access codes to docks where there are locked gates.

At the beginning of each weekend, an abbreviated refresher training session was held to remind the crews about the methods, discuss any issues that may have arisen during the previous survey weekend, and update the staff on health and safety considerations. Each team was provided with a “letter of introduction” from the Corps, authorizing the staff to enter Corps’ land to conduct the data collection, and serving as an introduction in the event that they were challenged while in the field. A copy of the letter is included with the training materials in **Appendix D.3**.

Most weekends, there were one or two new staff, but they were always paired with an experienced crew person to maintain efficiency and consistency in data collection. Each team had at least one staff person who worked all survey periods on that route.

D.1.5 Health and Safety

Health and safety of the field crews is extremely important. A health and safety plan was developed that included an activity hazards analysis and procedures for avoiding and/or responding to the most likely hazards. The initial field crew training covered a wide variety of potential health and safety hazards. At the start of each survey weekend, a refresher health and safety briefing was presented to the field crews. Each team member was required to sign a health and safety form acknowledging their understanding of potential hazards.

Each team was provided with a first aid kit for their vehicle and safety vests. Each team’s materials also included a listing of the nearest hospitals and/or clinics and directions on how to find emergency facilities. At the end of each shift, teams were required to check in with the primary team leader.

D.2 Sample Marina and Ramp Survey Data Collection Forms

MARINA & RAMP SURVEY FORM

Directions:

This form will document the number of rented, but empty boat slips at a marina and the number of empty boat trailers at boat ramp parking lots, marinas, and campgrounds. Some recreation areas may have more than one boat ramp and associated parking area. When the boat ramp is located within a campground, the number of empty boat trailers located at campsites or parking areas within the campground must also be counted.

When accessing the marinas, please follow specific access instructions for each marina located within your field team binder. It will be different for each marina, depending on their preference. While at the marina, please check with your marina contact person to determine the number of boat slips rented **for that day** at the facility. There is a field within the table to enter this information.

At marinas, campgrounds, and boat ramps **place a survey invitation postcard on the windshield of all vehicles with an empty boat trailer**. Record survey code (date) on each postcard prior to placing them on windshields (mm-dd). Please record an estimate of how many postcards that were distributed at each location.

While doing the data collection, please document conditions with a few photographs that can be used for the report. It would be good to capture crowded or unsafe conditions at the facilities. You will be provided with instructions on how to transfer these photos.

Remember, the purpose of this field work is to determine the number of boats on the lake that were launched from this facility at the time of the count. Accuracy in the counting process is very important.

Rocky Branch

Park Road, Rogers, AR 72756

CAMPGROUND & RAMP

There are two campgrounds and two ramps at the Rocky Branch location. Please make a note so that others can identify which data is in the first table and which is the second.

A	SAT. AM	SAT. PM	SUN. AM	SUN. PM
Number of Empty Boat Trailers in Parking Lot				
Number of Empty Boat Trailers at the Campground				
Time				
Weather Conditions				
Number of Survey Postcards Distributed				

B	SAT. AM	SAT. PM	SUN. AM	SUN. PM
Number of Empty Boat Trailers in Parking Lot				
Time				
Weather Conditions				
Number of Survey Postcards Distributed				

Notes/Comments: _____

D.3 Field Survey Team Training Materials

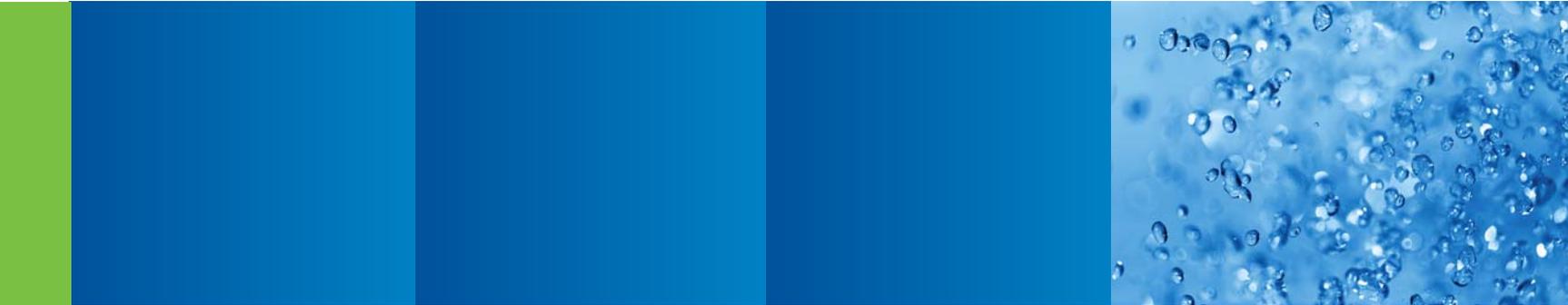
Beaver Lake Recreational Boating Carrying Capacity Study

Field Team Training

July 1, 2015

The logo for CDM Smith, consisting of the letters "CDM" stacked above "Smith." in a bold, white, sans-serif font on a dark blue background.

**CDM
Smith.**

A horizontal decorative bar at the bottom of the slide. It features a green vertical bar on the far left, followed by four blue rectangular segments of varying shades, and a section on the right showing a close-up of water bubbles.

WATER + ENVIRONMENT + TRANSPORTATION + ENERGY + FACILITIES

Agenda

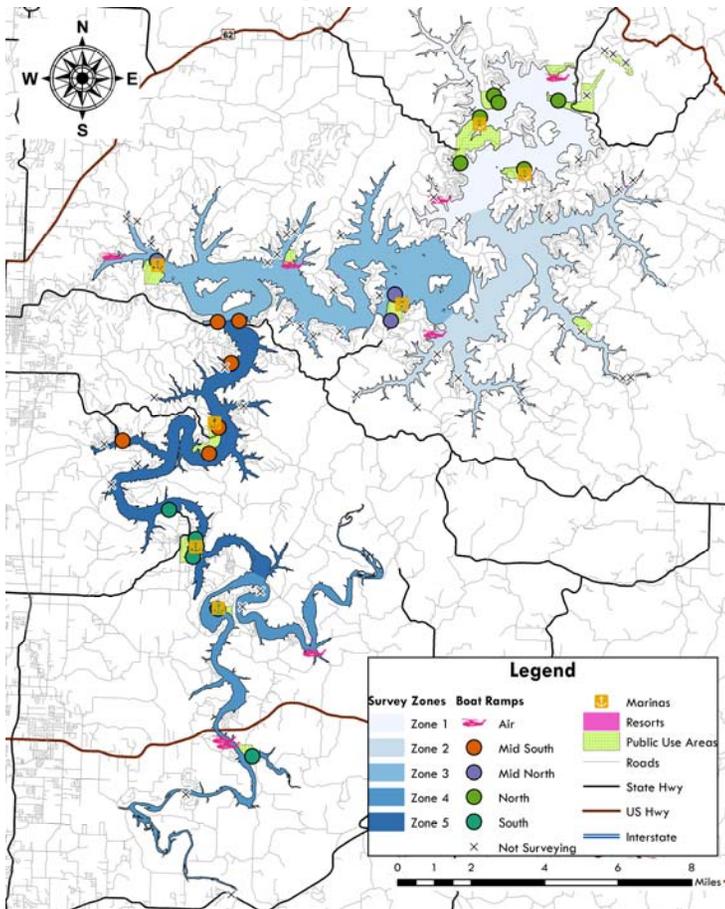
- Introductions and Purpose of Meeting
- Beaver Lake Overview
- Field Survey Locations/Components
- Field Survey Logistics
- Health and Safety
- Supplies and Equipment
- Coordination

Beaver Lake Overview

- More than 38,000 acres of project land with 487 miles of shoreline
- Largest supplier of water for Northwest Arkansas, serving more than 420,000 customers
- Attracts boaters, swimmers, campers, fisherman, and scuba divers
 - 673 campsites
 - 7 commercial marinas
 - 1,986 slips



Field Survey Locations



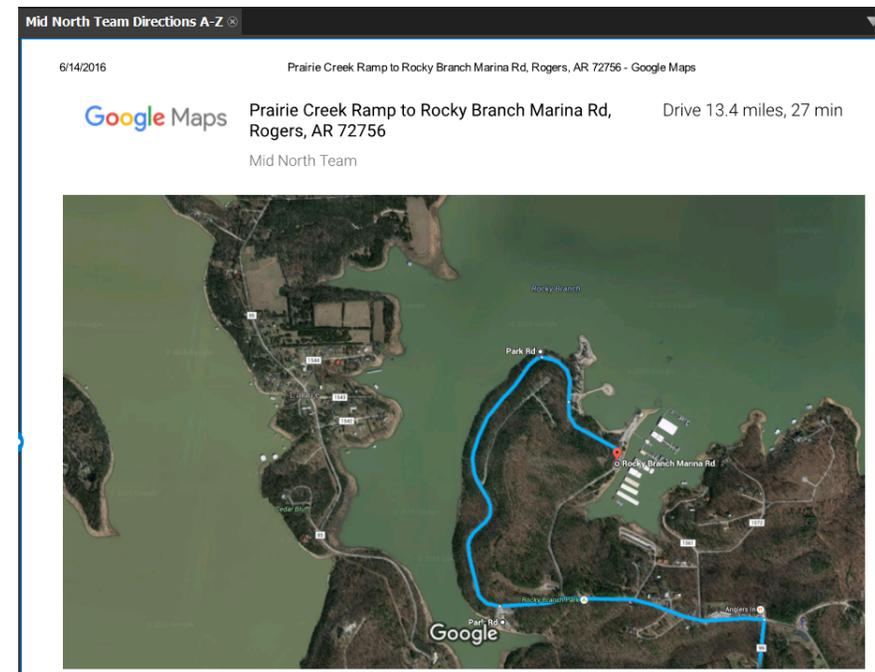
- 5 Teams
 - North
 - Mid-North
 - Mid-South
 - South
 - Helicopter
- Simultaneous Surveys
 - Saturday and Sunday

Field Survey Timing

- Morning Start Time is scheduled at 9 am
- Afternoon Start Time is scheduled at 1 pm
- Be at the first location at those times
- Routes should take approximately 2.5-3 hours
- Kate and the helicopter pilot are responsible for determining if a delayed start time will be needed, for weather-related reasons
- Be prepared to be flexible!
- You will be notified if changes are made

Field Survey Timing

- SATURDAY:
 - location A to Location Z in the morning
 - Location Z to Location A in the afternoon
- SUNDAY:
 - Location Z to Location A in the morning
 - location A to Location Z in the afternoon
- Switch next weekend
- Binders have information for directions from place to place for each sequence



Field Survey Components

- Aerial Boat Counts
 - Aerial counts by boat type by lake zone
- Boat Ramp and Campsite Surveys
 - Empty trailer counts to determine boat origination ratios
- Marina Surveys
 - Rented but empty marina slips to determine boat origination ratios
- Ramp /Marina Exit Surveys
 - Field teams will place postcards on every windshield of vehicles with a boat trailer at marinas, ramps, and campgrounds to build database for surveys later this year

Field Survey Logistics

- Boat Ramp/Campground Empty Trailer Counts
 - Record the # of empty boat trailers
 - Parking areas and campsites
 - Maps of Campgrounds included in field team binders – drive or walk entire campground
- Exit Survey Postcards
 - Record the survey code on each postcard (mm-dd)
 - Place postcards on the windshield of every vehicle with an empty boat trailer
 - Ramps, Marinas, and Campgrounds
 - Do your best here! Counts are most important, postcards are second. Make sure you leave enough time to get all counts done for the sequence.

Field Survey Logistics

- Marina Slip Counts
 - Follow directions in field team binders regarding contact and access with marinas
 - Meet with contact person each day to determine the total number of rented slips
 - Walk all docks to count and record the number of empty slips

MARINA & RAMP SURVEY FORM

Team 1 – South

Dates: _____

Lake Zone Number(s): 4 & 5

Survey Team Names: _____

Hickory Creek

Hickory Creek Park Marina, Lowell, AR 72745
CAMPGROUND, MARINA AND 2 RAMPS

You can classify the ramps as 1 or 2 however you like but please specify how it was done and characteristics of each so that your classification could be replicated.

	SAT. AM	SAT. PM	SUN. AM	SUN. PM
Number of Empty Boat Trailers in Parking Lot (Ramp 1)				
Number of Empty Boat Trailers in Parking Lot (Ramp 2)				
Number of Empty Boat Trailers at the Campground				
Number of Empty Boat Trailers in Parking Lot (Marina)				
Total Number of Slips at Marina	186	186	186	186
Number of Slips Rented at Marina*				
Number of Empty Slips				
Number of Boats on Lake from Marina**				
Name of Marina Staff Person Contacted				
Time				
Weather Conditions				
Number of Survey Postcards Distributed				

**Ask Marina contact for this information*

***This will equal the number of boats from wet slips that are out on the lake (Empty – (Total – Rented))*

Notes/Comments: _____

Helicopter Flyovers

- Aerial boat counts will be occurring at the same time
- Gives an accurate count of boats on the lake
- This is why timing is critical!

H&S.....YOUR Safety is Top Priority!

- Review Hazard Analysis Sheets, hospital routes, and contact information provided in team binders
- Sunscreen, hats, bug repellent, safety vests
- Always be aware of your surroundings, especially in parking lots and boat docks. These locations will be very busy this weekend
- Weather considerations – heat and thunderstorms
 - Stay hydrated, pack lots of water (some areas are remote)
 - Pull over if it is raining hard and unsafe to drive
 - Do not get out of the car if you have heard thunder or have seen lightning until the storm passes

Health and Safety

- Driving considerations
 - Hands free only! – use the passenger to help navigate
 - Many roads will be remote and curvy
 - Make sure you have plenty of gas when you head out

- ******SIGN THE H&S FORM******

What to do if someone....

- Asks you “What are you doing?”
- If someone who is intoxicated is bothering you?
- Other “what if” questions.....

Who to Contact

- Team leads will be the point of contact
 - Donie – First point of contact
 - Kate – Second point of contact
- Do not hesitate to ask questions
- Donie/Kate will contact Corps staff if needed

Supplies and Equipment

- First aid kit
- Safety vest
- Field team binder/packet
- Survey postcards
- Federal Contractor ID Cards
- Paper/Pens/Clipboard
- Cell Phone
- Car charger
- Water/Sunscreen/Hats

Logistics for Saturday and Sunday

- Saturday Morning Meeting
 - **8AM** Double Tree Bentonville Lobby
 - 301 SE Walton Blvd, Bentonville
- Please check in with Donie via text at the end of the afternoon shift; and upon returning to hotel



DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
BEAVER PROJECT OFFICE
2286 NORTH SECOND STREET
ROGERS, ARKANSAS 72756

July 1, 2016

Dr. Timothy D. Feather
Vice President, CDM Smith
1050 North Reed Station Road, Suite D
Carbondale, Illinois 62902

Dear Dr. Feather:

This letter serves as official authorization for employees of CDM Smith to enter Corps-owned or managed lands located on Beaver Lake in order to perform a recreational carrying capacity study on Beaver Lake. The purpose of the study is to assess and document current recreational boating activity and use level of the project.

Study activities will be conducted at all major recreation areas, including marinas, resorts, launch ramps, and access points beginning on July 4th weekend and extending until Labor Day weekend. Survey interest cards will be distributed and boat surveys will be conducted on land by trailer counts and on water by helicopter.

It is requested that facility managers and leaseholders of Corps-owned land allow reasonable access and cooperation in order to support completion of survey activities. Should any leaseholder or facility manager personnel have questions, please contact me by email at scan.p.harper@usace.army.mil or call 501-340-1702. You can also call Real Estate Specialist Cheryl Wanko at 501-340-1200.

Thank you for your cooperation.

Sincerely,

A handwritten signature in black ink that reads "Sean P. Harper". The signature is fluid and cursive.

Sean P. Harper
Operations Project Manager

D.4 Resort Survey Form

RESORT SURVEY FORM

Date: _____ Day of Week: _____ Time: _____

Resort Name: _____

Resort Address: _____

Name of Resort Staff Person: _____ Phone: _____

Instructions: The US Army Corps of Engineers appreciates your time in helping us complete the Beaver Lake Recreational Boating Carrying Capacity Study. Please utilize this form to document the number of rented, but empty boat slips at the resort during the times specified below. We would appreciate completion of this form on all the following days and times. A team member will contact weekly to record your specified counts.

Dates to Complete Form	Times to Complete Form	
July 2 and 3	10 am	2 pm
July 9 and 10	10 am	2 pm
July 16 and 17	10 am	2 pm
September 3 and 4	10 am	2 pm

RENTED BUT EMPTY SLIPS

Saturday AM: _____

Saturday PM: _____

Sunday AM: _____

Sunday PM: _____