Biological impairment in Kansas reservoirs and lotic ecosystems due to erosion and sediment.
KUCR project KAN64236

Abbreviated Quality Assurance Project Plan (QAPP), June 2010
Update 1: 18 June 2010
Update 2: 08 July 2010
Update 3: 06 Oct. 2010

Overview

In summer and fall of 2010 the Central Plains Center for BioAssessment (CPCB) will sample the Kansas reservoirs Banner Creek Lake, Centralia Lake, and Atchison County Lake (named Clear Creek Lake on some maps) and their tributaries to assess biological impairment due to sedimentation. Banner Creek serves as the reference watershed. Three stream sites on Banner Creek will be sampled while two stream sites will be sampled on Centralia Lake's tributary Black Vermillion River, and one stream site will be sampled on Atchison Co. Lake's tributary Clear Creek (Table 1).

Table 1. Lakes and tributary study sites. See Appendix 1 for site maps. Coordinates are in NAD83.

lake	stream	code	location	latitude	longitude	transect	description
Banner	Banner Creek	B1	upper site	39.44754	-95.81076	1	Downstream from USGS 392652095484100 (BA1). Follow foot path east side of road M.
Banner	Banner Creek	B2	middle site	39.44747	-95.81005	1	
Banner	Banner Creek	B3	lower site	39.44709	-95.80898	1	
Centralia	Black Vermillion	C1	upper site	39.69001	-96.12675	6	Downstream of USGS 394126096073500 (CE1).
Centralia	Black Vermillion	C2	lower site	39.69060	-96.12693	1	
Atchison	Clear Creek	A1	only site	39.63734	-95.43303	5	Upstream of USGS 393817095260100 (CL1), between 326th and Decatur Rds.

Lake sampling

In situ samples

At 10 sites in each lake *in situ* water chemistry (DO, pH, conductivity, salinity, air and water temperature, turbidity) will be measured with a Horiba U-10 water quality checker. In Banner and Centralia Lakes these sites will be near the locations of the sediment cores collected by KBS in 2009. In Atchison Lake CPCB will determine the *in situ* and sediment core locations. Latitude and longitude of each site will be recorded, and secchi depth measured.

One-liter water samples

Two *in situ* sites in Banner and Centralia Lakes and one in Atchison Lake will be designated as primary sites at which a 1-liter grab sample of water will be collected at 0.25 m depth. One of the primary sampling sites will be located in the main basin of each reservoir, the others in Banner and Centralia will be at the upstream ends. At the main basin site the Horiba U-10 will be used to take *in situ* measurements at various depths to determine if the lake is stratified. If stratified, a bottom water sample will be collected with a Van Dorn sampler. Thus a maximum of 16 lake water samples will be collected during the project (8 in the spring, 8 in the fall). Water samples will be transferred to labeled 1-l amber glass jars, stored on ice, and returned to the CPCB lab for processing of suspended chlorophyll a, TN and TP (Ebina *et al.* 1983), TSS, and VSS (21st Ed. Standard Methods (APHA)

2540). A duplicate field sample will also be taken at either a lake or a stream site, as well as a sample in a nutrient spiked sample. For details regarding accuracy and precision requirements, see EPA Award X7 97703210 QAPP (http://www.cpcb.ku.edu/research/assets/2009MODIS/QAPP_modis_r1_2009Jul25.pdf).

Sediment samples

A single sediment core will be taken at or near the water chemistry sites, and subsamples (surface, 15 cm, 30 cm and 1 m, if possible) of the core samples will be analyzed for particle size, bulk density and TP and TN. Thus a total of 10 sediment cores will be collected during this project (5 in the spring and 5 in the fall), yielding a minimum of 30 measurements (10 cores for surface, 15 cm, and 30 cm samples). Each section of a core will be sliced off into a stainless steel bowl, mixed with a stainless steel spoon, and transferred to a labeled glass jar. Jars will be kept cool until mailed to Kansas State University.

Table 2. Samples collected at each lake during each sampling event in 2010. One-liter water samples will be returned to the CPCB lab for analyses of TN, TP, chlorophyll a, TSS, and VSS. An additional water sample will be collected as a field duplicate, plus an additional sample in a bottle spiked with nutrients. Thus a maximum of 16 1-liter water samples will be collected each sampling event.

Lake	*In situ* water chemistry	Secchi depth	Primary water samples (1-liter)		Zooplankton tow	Phytoplankton (1-liter)	Sediment cores	Stream samples (1-liter)
			surface	bottom if stratified				
Banner	10	10	2	1	1	1	2	3
Centralia	10	10	2	1	1	1	2	2
Atchison	10	10	1	1	1	1	1	1

Zooplankton

A single vertical plankton net tow will be conducted at each impoundment sampling site to collect quantitative samples for zooplankton identification and enumeration. Zooplankton will be collected with 80-µm mesh plankton net having a mouth diameter of 20 cm; the sample will be transferred to a 500-ml plastic bottle and preserved with 70% ethanol (70 ml of 100% ethanol for each 30 ml of sample volume) then placed in the cooler for transport to the lab for processing. The vertical tow will start approximately 10 cm above the substrate surface and extend to the surface. The actual tow distance will be recorded and the filtered volume of water calculated for each tow.

From Table 4-7 in Survey of the Nation's Lakes Revision No. 0 Field Operations Manual Date: February:

Sample Collection

1. Label the sample container.
2. Prior to each use, carefully clean and thoroughly rinse the interior of the plankton nets and buckets with DI water.
3. Carefully inspect the nets and buckets for holes or tears.
4. Attach the collection buckets to the "cod" end of the nets and secure.
5. Attach the bridled end of the plankton net to a ¼" calibrated line with markings every 0.5 m
6. Carefully and slowly lower the first net in a constant upright position over the side of the boat.
7. Continue lowering the net until the mouth of the net is 0.5 meters above the lake bottom.
8. Retrieve the net by pulling back to the surface at a steady constant rate without stopping (0.3 m or 1 ft per second).

9. Once at the surface, slowly dip the net up and down in the water without submersing the net mouth and help rinse contents into the collection bucket.
10. Complete the rinsing of the net contents by spraying water against the outside of the net with a squirt bottle or similar tool.
11. Holding the collection bucket in a vertical position, carefully remove the bucket from the net.
12. Concentrate the contents of the collection bucket by swirling the bucket without spilling the contents. Excess lake water will filter out of the bucket from the screened sides.

Sample Processing

1. Carefully remove the mesh bucket from its net. Set the bucket in a 500-mL container filled three-fourths full with lake water to which an Alka-Seltzer tablet has been added. Alternatively, club soda may also be used. The CO2 narcotizes the zooplankton to relax their external structure prior to preservation in 95% ethanol. This facilitates taxonomic identification. Wait until zooplankton movement has stopped (usually about 1 minute).
2. Record the sample ID number and check on the Sample Collection Form that it is preserved.
3. Use small volumes of DI water from a squirt bottle to rinse the contents of the mesh net bucket into the polyethylene jar. Rinse bucket with DI water three to four times or until the majority of zooplankton have been removed. Drain the remaining filtrate into the sample container. Fill the jar of zooplankton to the mark (~80 mL or a little more than half full) with 95% ethanol.
4. In some cases, the volume of zooplankton collected in bucket may exceed 125 mL. Do not try to force all of the sample into a single bottle or the preservative will not function properly and the sample may be lost. In such cases, use a second bottle to preserve the additional amount of sample. On the lake field form, note the number of jars.
5. Record the length of the tow on the lake field form and on the sample labels.
6. Seal the lids of the jars by wrapping electrical tape in a clockwise direction so that the lid is pulled tight as the tape is stretched around it.

Phytoplankton

A near surface phytoplankton sample will be obtained using a 1.5 L Van Dorn bottle submerged vertically so that the top of the Van Dorn bottle is about 10 cm below the water surface. A 25-ml sample will be preserved with 1 to 3 ml of Lugol's solution. Different water chemistry and density of algal material require different concentration of preservative; hence a general guideline is that there be sufficient Lugol's to turn the sample the color of weak tea. A series of phytoplankton and zooplankton metrics will be calculated from identified and enumerated subsamples of 300 to 600 taxonomic units.

Tributary sampling

Reach layout

See Table 1 for the number of tributary sites at each lake. At each site, the center transect will be marked with flagging tape and latitude and longitude recorded. A reach length 20 times the average of 5 widths will be delineated. Ten to 12 transects will be laid out and numbered sequentially from downstream to upstream.

Water quality

At the downstream transect (transect 1) before the crew has entered the water a 1-liter surface sample will be collected in a labeled amber glass bottle that will be preserved on ice and return to the lab for processing suspended chlorophyll *a*, TN and TP (filtered and unfiltered Ebina *et al.* 1983), TSS, and VSS (21st Ed. Standard Methods (APHA) 2540). *In situ* measurements (DO, pH, conductivity, salinity, air and water temperature, turbidity) will be measured with a Horiba U-10 water quality

checker at the center transect. The Horiba U-10 will be two-point calibrated prior to each sampling event.

Habitat

To assess habitat we will use the Habitat Development Index (HDI, Huggins and Moffet 1988) and the Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) (Ohio EPA 2006, http://www.epa.state.oh.us/dsw/document_index/docindx.html). If possible the same person will evaluate habitat at all sites and all events. Velocity will be measured at one transect with a Swoffer flow meter following protocol established by the United States Geological Survey (Rantz et al. 1982) and using a form developed for the UESPA National Stream Surveys. Digital photos will be taken at each site.

Sediment

We will examine the extent of pool sedimentation using a modification of the V* methodology of the U.S. Forest Service (Lisle and Hilton 1992, Hilton and Lisle 1993). By definition V* is the amount of fine sediment in a pool relative to the total volume of fine sediment and water. V* is most appropriately used in reaches with mild gradients such as Rosgen B2, B3, or C channel types (see Rosgen 1996). Rather than measuring sediment only in pools, we will measure sediment at each of the 10 – 12 transects along the entire reach. A survey line is extended along the middle of the entire reach, and at the perpendicular transects a stainless steel probe is used to measure the depth of fine sediment at intervals along each transect (Figure 1). Two transects are placed where the centerline bends, and the inside angle is recorded.

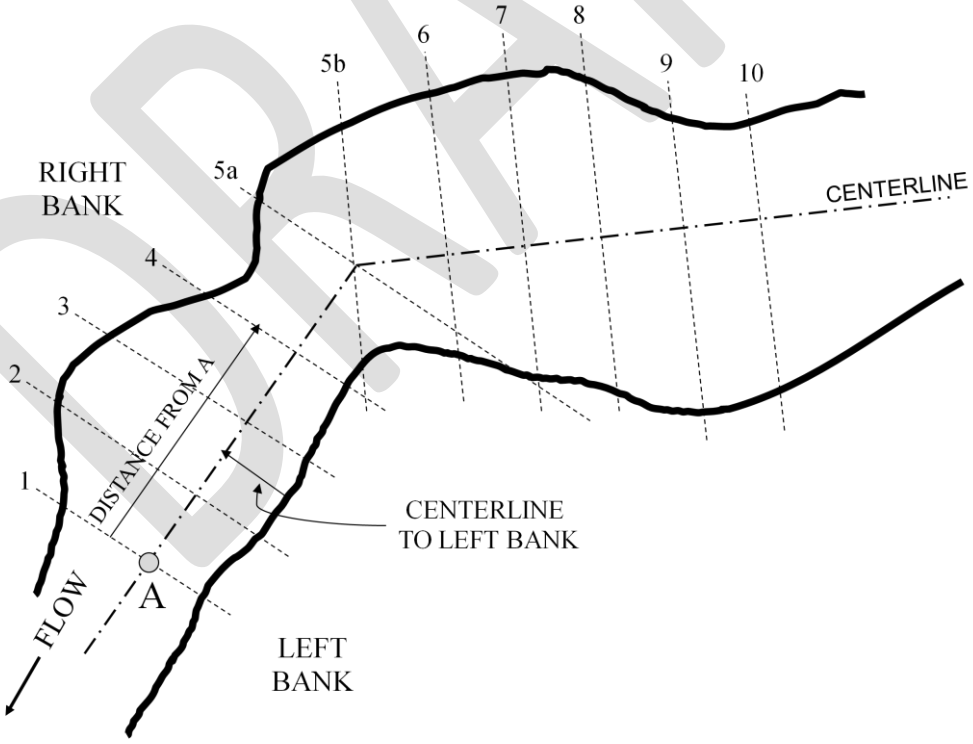

Figure 1. Placement of transects along which sediment depths are measured using a stainless steel probe.

Bob insert steps here, a la the NRSA tables.

Macroinvertebrates

HDI protocols will be used to collect macroinvertebrate samples. Within the stream reach, an aquatic kick net (500-µm mesh opening) will be used to collect macroinvertebrates from a variety of habitats for a total of 3 minutes. Habitats within each macrohabitat (i.e. pool, riffle, run or glide) in each site will be sampled in proportion to its occurrence in the site. On bottom substrates, approximately 0.09 m^2 ($1ft^2$) of substrate will be disturbed to a depth of 1-2 cm. A sweep of similar area will be used in vegetated habitats, root wads and areas associated with woody debris. The samples from a site will be combined into a sample jar and samples preserved with 10% buffered formalin and rose bengal solution.

The samples will be returned to the CPCB lab for sorting and identification using the CPCB Standard Operating Procedures (available to download from the CPCB webpage at http://www.cpcb.ku.edu/datalibrary/assets/library/protocols/BenthicLabSOP.pdf). Samples will be sorted to remove **300 ± 10%** organisms from the sample, using a modified Caton gridded tray. The sample will be sorted until the number of organisms meets the subsample requirements or the entire sample is sorted. Sorted organisms will be placed into 80% alcohol for storage and later identification. All samples will be processed within 180 days of sample collection. Specimens will be identified to the lowest practical taxonomic level. References for each taxon are listed in the SOP. Voucher specimens of difficult to identify taxa as well as rare taxa will be retained for a minimum of three years.

Literature Cited

APHA, AWWA, WEF. 2005. Standard Methods for the Examination of Water and Wastewater, 21st Ed. American Public Health Association, American Water Works Association, and Water Environment Federation, Washington, D. C.

Ebina, J., T. Tsutsui and T. Shirai. 1983. Simultaneous determination of total nitrogen and total phosphorus in water using peroxodisulfate oxidation. Water Research 17:12. 1721-1726.

Appendix 1. Photos of Atchison, Banner, and Centralia Lakes showing approximate CPCB stream sampling sites.

Figure 1. Atchison County Lake showing USGS gaging stations ATL and CL1 and CPCB's (pink) and KWO's (yellow) survey reaches on Clear Creek.

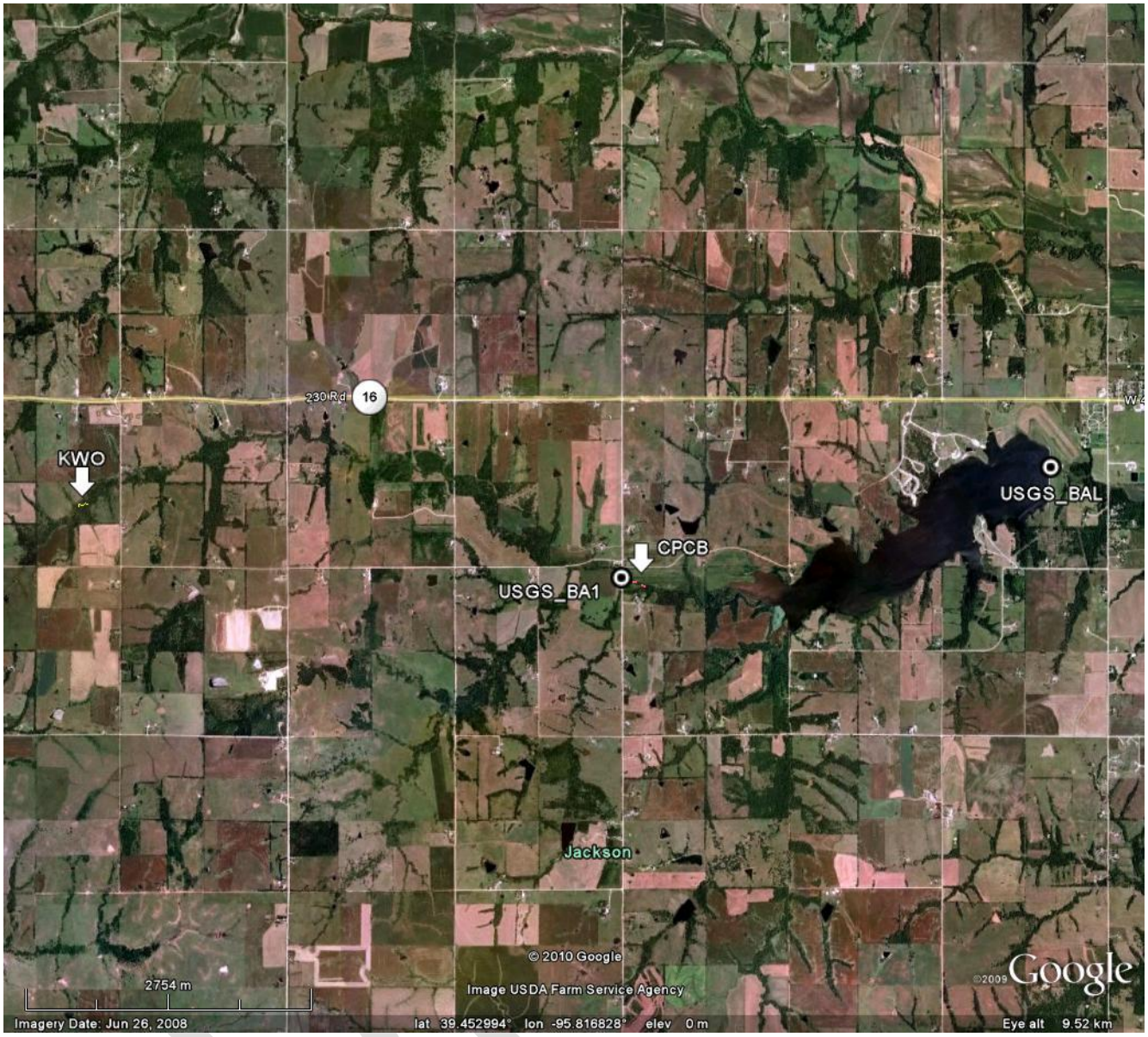

Figure 2. Banner Creek Lake showing showing USGS gaging stations BA1 and BAL and CPCB's (pink) and KWO's (yellow) survey reaches on Banner Creek.

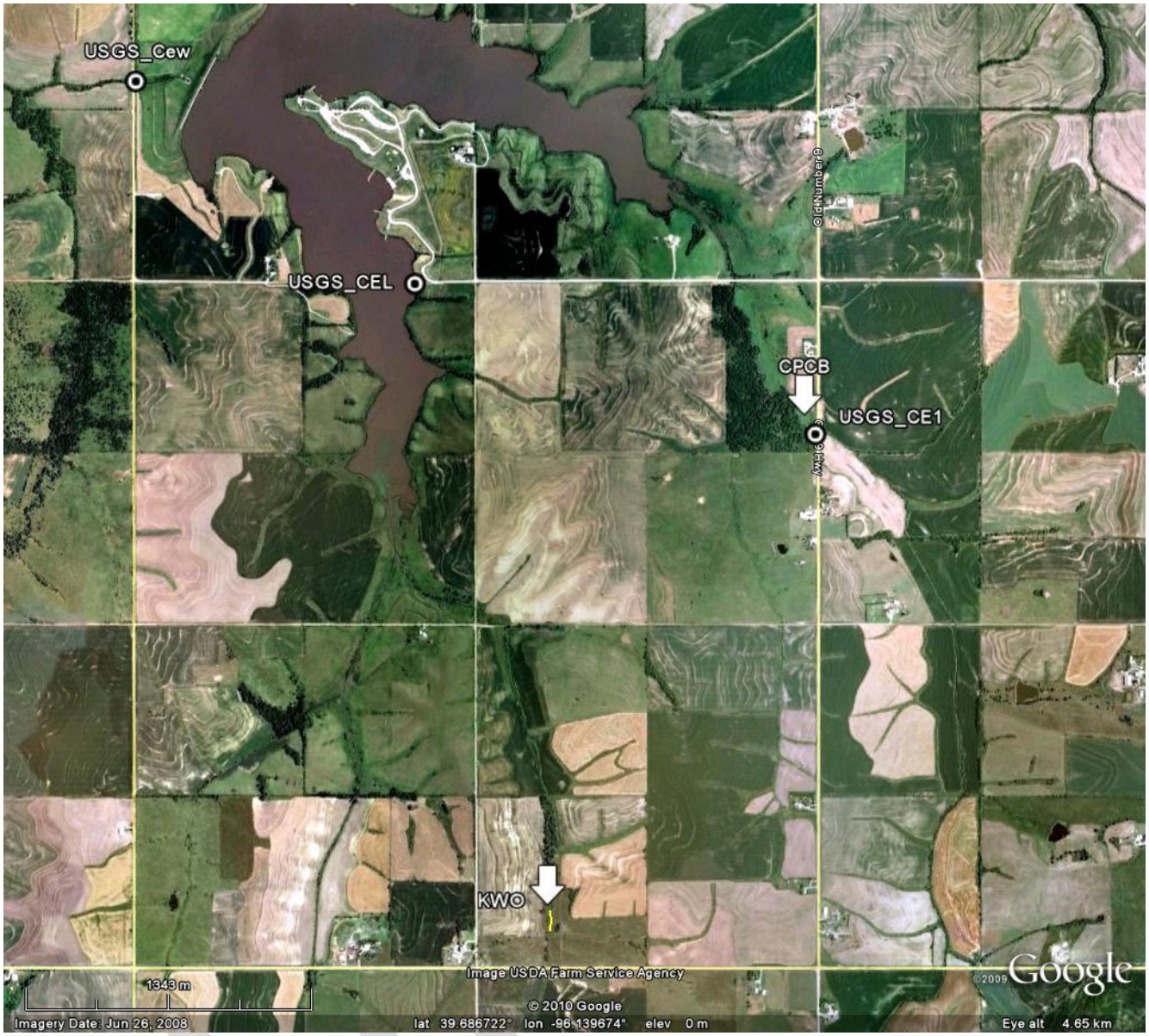

Figure 3. Centralia Lake showing USGS gaging stations CE1, CEL, and Cew, and CPCB's (pink) and KWO's (yellow) survey reaches on the Black Vermillion River.