UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 RENNER BOULEVARD
LENEXA, KANSAS 66219

IN THE MATTER OF	)	**Docket No. CWA-07-2014-0060**
	)	
DR. DANIEL J. McGOWAN,	)	
	)	**AFFIDAVIT OF DR. MICHAEL P. GUTZMER**
	)	
Proceedings under Section 309(g) of the Clean Water Act, 33 U.S.C. § 1319(g)	)	

STATE OF NEBRASKA)
) ss.
COUNTY OF Platte)

Michael P. Gutzmer, being first duly sworn upon oath, deposes and states as follows:

1. I am over 18 years old and competent to testify to all matters herein.

2. I am an Environmental Consultant, Project Scientist, Manager and Owner of New Century Environmental, LLC.

3. I have extensive education and experience with environmental assessment and monitoring. A copy of my resume is attached hereto as Exhibit "A" and incorporated herein by this reference.

4. Dr. Dan McGowan, through counsel, asked that New Century Environmental, LLC prepare An Engineering and Environmental Assessment of Sites on Plum Creek, Brown County, Nebraska. I oversaw the project and was the primary contributor to the project. The final report was published on June 28, 2013. A true and correct copy of that report is attached hereto as Exhibit "B" and incorporated herein by this reference.

5. Further, Affiant saith not.

Dr. Michael P. Gutzmer

Subscribed and sworn to before me on May 15, 2015 by Dr. Michael P. Gutzmer, an individual who is personally known to me or who produced satisfactory identification.

Notary Public

MICHAEL PAUL GUTZMER
Project Manager / Principal Ecologist

OBJECTIVE

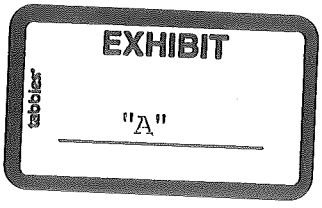
To serve our clients in the most cost effective way providing the most common sense solutions to difficult environmental challenges facing business in the 21st Century and at the same time maximizing environmental stewardship responsibility.

SIGNIFICANT ACCOMPOLISHMENTS/EXPERIENCES

- Twenty five years in the electric power industry conducting environmental assessments, permitting and compliance, and assisting the industry with research and development needs and support.
- Business development success for a growing environmental consulting firm in the Great Plains.
- Doubled consultative sales and built a seven million dollar business with member companies of the Electric Power Research Institute in areas of environmental research and development in Central U.S.
- Over 25 peer-reviewed scientific publications, 75 consultant reports and 300 environmental subject matter articles published in local, regional newspapers and magazines, elevated awareness of nature and conservation programs throughout Nebraska and Midwest.
- Pioneered efforts with first bio-assessment program in Superfund program in Texas.
- ESPN Outdoors finalist for National Conservation Director of BASS in 2003.
- Acknowledged in "The Flora of Nebraska" by Robert B. Kaul, David M. Sutherland and Steven B. Rolfsmeier published in 2006, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, for distribution information and voucher specimens collected for dissertation work focused on Platte county wetlands during 1993-2007.
- Nominated and finalist for Central Community College of Nebraska Outstanding Alumni of the Year Award –April 2008.
- Successful project award for an eco-asset project evaluation for a significant client conducted in the United States –January 2009.
- Successful TWG grants receipt through the USFWS for South Dakota Indian Reservation- Feb. 2010.
- Selected as a panel reviewer for the Administration for Native Americans environmental and regulatory grant program, Washington, D.C. - April 2010.
- Successful TWG grants award for the Winnebago Indian Tribe- February 2011.
- *Plants of Platte County Nebraska Wetlands* book available for publication. M.P. Gutzmer. 2012. The UPS Store Publication office, Columbus Nebraska, 153 pages.

EDUCATION

Doctor of Philosophy degree, Environmental Sciences, August 2004. Post graduate courses in aquatic ecology and environmental science [coursework 1999-2004] – completed distance learning Doctorate program through Lacrosse University [The World Association of Universities and Colleges accredits Lacrosse University. The WAUC is a Global Private Accrediting Agency], 2004. Accepted to University of Nebraska, Lincoln, Doctorate program in Horticulture in 1999 with provisional coursework requirements. 3.92 GPA.



Master of Science degree, Aquatic Biology, minor in environmental toxicology, August 1984. Southwest Texas State University, San Marcos, Texas -*3.25 GPA*
Bachelor of Science degree in Agriculture, December, 1980. University of Nebraska, Lincoln, Nebraska
One year of course work in forestry, wildlife and environmental science, September 1977 to August 1978. University of Montana, Missoula, Montana
Associate of Science degree, May 1977. Platte Technical Community College, Columbus, Nebraska

EXPERIENCE

Environmental Consultant, Project Scientist, Manager, Owner, *New Century Environmental, LLC.* The firm has expertise in environmental permitting, facility-siting, environmental assessment and environmental monitoring. New Century Environmental, LLC also works with Biological Services Inc. and AbsoluteNaturalResources, LLC on collaborative services. Also included in the position portfolio are services which include project management, business development and program development and oversight of staff and resources. Areas of expertise include; fisheries, wildlife, agriculture, wetlands, aquatic ecology, aquaculture, water resource management, waste management, health and safety, education and/or environmental toxicology. October 2007-present.

Environment Regional Manager, *Electric Power Research Institute, Palo Alto California.* Worked in the Marketing and Client Relations (Member Services) group in the Central North America Region (from Manitoba to Mexico) as the Environment Sector Regional Manager and Account Lead for several electric generation companies. This included working specifically and intimately with over 22 large, Midwest state electric generation companies and their environmental departments designing technology updates with EPRI's products, consulting services and technologies. This resulted in becoming familiar with the diverse environmental issues facing electric utility industry in areas of air quality, water issues and compliance, permitting issues, EMF, Occupational, Health and Safety and integrated environmental management portfolios. Interfacing with CEO's, executive management, and plant generation staff to optimize value and elevate awareness of the archive of information available through the research institute. Primarily account management and consultative sales. Responsible for seven million dollar regional business, sales funnel construction and CRM system management (improved sales from 3.94 M in 2002 to 6.7 M in 2007). September 2002-October 2007.

Principle Project Fisheries Ecologist/Wetland Scientist *for the Plateau Ecosystems Consulting, Inc. Arvada, Colorado.* Responsible for coordinating and supervising biological projects, including study design, *budget* maintenance, data compilation, report preparation, and expert witness testimony; responsible for formulating management strategies and completing research projects; supervises and conducts wetland delineation surveys and other habitat investigations. Currently considering investing as a partner as this firm has been selected by Cabela' Inc. of Sidney Nebraska as a Trophy Properties Partner to conduct lake mapping and other environmental consulting throughout Nebraska and Colorado. June 1996-Present.

Senior Environmental Specialist/Environmental Science Supervisor *for the Nebraska Public Power District in the Environmental Sciences Section of the Environmental Division.* Implement regulatory requirements and maintain appropriate monitoring and research programs to ensure compliance with federal and state regulations. Obtain licenses and permits within the environmental areas of the position's responsibility. Provide advice and counsel to District personnel regarding environmental matters. Developed entire Pollution Prevention program for the company in 1997-1998. Recommend practices, procedures and solutions; and develop and maintain positive relations with regulatory agencies, environmental groups, and professional organizations, as well as with customer groups and the public. Provide supervision, guidance, and training for personnel within the department. October 1991 – 2002.

Environmental Specialist *for the Nebraska Public Power District in Columbus, Nebraska.* Collect, analyze, and review data collected under various environmental programs; review reports; and prepare procedures, reports, applications, and submittals for state, federal, and local licenses and permits. Provide technical assistance and training relating to environmental matters to power plants, engineering, regions, areas, and other District personnel. Conduct pollution and/or environmental impact assessments on District properties. Interpret and implement state and federal environmental regulations to ensure District compliance. Coordinate and/or oversee certain environmental programs and consultants working on environmental programs. February 1989 - September 1991

Permit Writer (Program Specialist) *for the Nebraska Department of Environmental Control in Lincoln, Nebraska.* Draft industrial, municipal NPDES, UST, groundwater remediation and pretreatment permits. Follow-up on the various review procedures, responses to inquiries and provide technical assistance and information for NPDES and pretreatment permits. Conduct on-site permit field investigations and prepare the necessary inspection reports. Serve on various Department committees intended to provide technical review, research, and policy guidance. Present permit rationale/facts at Departmental public hearings and court cases and inform public of permitting requirements and procedures. September 1988 - January 1989

Hydrologist II *for the Texas Water Commission in Austin, Texas.* Perform technical and regulatory evaluations of hazardous and solid waste facilities for the State Superfund program. Advise and consult with representatives of the public and industry on organization and operation of the program. Prepare technical reports on the degree of hazard associated with sites and formulate and review remedial action plans. Coordinate with other sections and divisions of the Commission as necessary. Conduct inspection of new and referred sites which include preparing specific sampling plans, prepare hazard ranking packages for selected sites, consultant oversight and on-site coordination for site investigation and monitoring. Additional responsibilities as the senior staff member in the unit included designing and conducting bio-assessments on hazardous waste sites and dealing with toxicity problems as they arose in areas of risk assessment on various sites. May 1987 - August 1988

Environmental Quality Specialist IV *for the Texas Water Commission in Austin, Texas.* Perform technical and regulatory evaluations of hazardous and solid waste facilities for the State Superfund program. Advise and consult with representatives of the public and industry on organization and operation of the program. Prepare technical reports on the degree of hazard

associated with sites and formulate and review remedial action plans. Coordinate with other sections and divisions of the Commission as necessary. Conduct inspection of draft sites which include specific sampling plans, prepare hazard ranking packages for selected sites, consultant oversight and on-site coordination for site investigation and monitoring. July 1986 - May 1987

Environmental Quality Specialist III *for the Texas Water Commission (Texas Department of Water Resources prior to September 1, 1985) in Amarillo, Texas.* This involved conducting hazardous and solid waste, industrial wastewater, municipal and agricultural inspections which evaluate and troubleshoot treatment system operations, collect wastewater samples, develop technical recommendations, conduct surveys, and prepare inspection reports. Conduct enforcement activities related to discharge violations which included: document violations, prepare letters, hold enforcement conferences, assist enforcement as needed, monitor corrective activities, and testify in court in specific cases. Investigate complaints, spills, and fish kills, aid in lake and stream monitoring and interpret analytical results. Maintain equipment and files and conduct damage assessments following a disaster and other duties as assigned. May 1986 to July 1986. (Environmental Quality Specialist II from August 1984 through October 1985; Biologist II from October 1985 through April 1986)

Laboratory Instructor *for the Department of Biology, Southwest Texas State University, San Marcos, Texas.* This involved teaching between 60 to 90 students each semester in the subjects of basic and advanced anatomy and physiology. Duties involved setting up labs, lecturing, and administrating help with basic experiments and dissections during laboratory sessions. It also meant giving and correcting lab reports, quizzes, and tests. August 1982 - June 1984

Fisheries Research Worker/Technician *for the Iowa Conservation Commission at Red Haw State Park in Chariton, Iowa.* Reservoir investigations at the Chariton Research Station centered on collecting biological field data and laboratory analysis. Data analysis and compilation along with property and equipment maintenance were also performed. A portion of the job dealt with dissemination of public information and education. July 1981 - April 1982

Conservation Aide *for the Iowa Conservation Commission at Lake Geode in Danville, Iowa.* The job involved doing a creel census on the lake to determine fishing pressure on a declining bass-crappie-bluegill fishery. Other duties included a fishing distribution study, mapping aquatic vegetation and plankton sampling. May - July 1981

Lab/Field Aide *for the Forestry, Fisheries, and Wildlife Department, University of Nebraska, Lincoln, Nebraska.* Helped Department with EPA-funded project on Maple Creek near Clarkson, Nebraska. Aided in biological monitoring of fish and plankton species, performed wet lab chemistry, stream mapping, and maintenance of equipment for the field and in the laboratory. January - October 1980

Fisheries Field Laborer *for the Montana Department of Fish, Wildlife, and Parks in Kalispell, Montana.* Worked on EPA-funded project on the North Fork of the Flathead River monitoring Dolly Varden (*Salvelinus confluentus*) and their spawning runs in the tributaries to the river (trapping, snorkeling, and electro-fishing). Remainder of time involved a habitat inventory

(developed by Canadian Ministry of Fisheries) in streams found in Glacier Park and Flathead National Forest. June - October 1978 and June August 1979.

CONTINUING EDUCATION COURSES

- EPRI Environmental Advisory Meetings in spring and fall 2003 thru 2007
- Env. Advisory Mtgs. In San Antonio TX 09/03, National League of Cities, Nashville TN, 12/03
- Env. Advisory Mtgs. In Milwaukee WI (09/02), Monterey CA (03/03 and 02/04), and Missoula MT (07/03)
- EPRI Clean Water Act Meeting, Hood River Oregon, July 17-21, 2002.
- APPA/LPPC meeting on Section 316 b of Clean Water Act, Washington, D.C., April 23-25, 2002
- Cooling Water Intake Structures Workshop, Alden Research Laboratory, Holden Massachusetts, 3/26-27/02
- Licensing Renewal Workshop, Southern Company, Birmingham Alabama, December 4-6, 2000
- The 130th Annual American Fisheries Society Meeting, St. Louis, Missouri, August 20-24, 2000
- EPRI Power Generation Impacts on Aquatic Resources Conference, Atlanta, Georgia, April 8-11, 1999
- The 19th Annual Meeting of the Society of Wetland Scientists, Anchorage, Alaska, June 6-13, 1998
- EPRI ASAPP2 Waste Inventory Seminar, Austin, Texas, July 7-10, 1997
- EPA Midwest Pollution Prevention Conference, Region VII, Kansas City, Missouri, July 2-4, 1997
- EPRI Land and Water Quality Committee Meeting, San Diego, California, Feb. 3-6, 1997
- EPRI Land and Water Quality Committee Meeting, Baltimore, Maryland, Sept. 30-Oct. 1, 1996
- The 44th North American Benthological Society Meeting, Kalispell, Montana, June 3-7, 1996
- EPRI Land and Water Quality Committee Meeting, San Francisco, California, January 20-24, 1996
- The 125th Annual Meeting for the American Fisheries Society, Tampa, Florida, August 28-September 1, 1995
- EPRI Land and Water Quality Committee Meeting, San Francisco, California, January 7-11, 1995
- The 124th Annual Meeting for the American Fisheries Society, Halifax, Nova Scotia, August 21-25, 1994
- The 41st North American Benthological Society Meeting, Calgary Alberta May 23-31, 1993
- The 13th Annual Meeting of the Society of Wetland Scientists, New Orleans, Louisiana, June 1-6, 1992
- 1992 Nebraska Water Conference, "Living with Wetland Policies and Politics," Lincoln, Nebraska, March 16-17, 1992
- The 1991 Wetlands Regulation Conference, Washington, D.C., May 21-22, 1991
- Managing the Environmental Impacts of Highway Projects (1.6 CEU), University of Wisconsin, Madison, Wisconsin, November 28-30, 1990
- Habitat Evaluation Procedures (Certification), Colorado State University, Ft. Collins, Colorado, July 16-20, 1990
- EPRI/EPA Environmental Research Conference, Washington, D.C., May 2-4, 1989
- Activated Sludge Workshop, Nebraska Water Pollution Control Federal, Fremont, Nebraska, September 12-16, 1988
- Powerful Business Writing Skills, National Career Workshops, Austin, Texas, May 18, 1988
- Hazardous Materials Clean-Up Technologies and Their Application at Superfund Sites, Dallas, Texas, April 5-6, 1988
- Leadership and Supervisory Skills for Technical Managers & Supervisors, National Career Workshops, Austin, Texas, March 3, 1988

- Procurement Under Grants, Management Concepts Incorporated, Austin, Texas, February 22-24, 1988
- EPA Environmental Risk Assessment (165.6), Houston, Texas, February 9-12, 1988
- EPA National Priorities List Seminar, Region VI, Dallas, Texas, October 14-15, 1987
- Reducing Risks from Environmental Chemicals through Biotechnology sponsored by the Northwest Center for Occupational Health and Safety, University of Washington, Seattle, Washington, July 19-22, 1987
- EPA Hazardous Waste Course; Air Surveillance for Hazardous Materials (165.4), Dallas, Texas, July 6-10, 1987
- EPA-sponsored course on RCRA's Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) and the Compliance Order Guidance (COG), Dallas, Texas, January 27-30, 1987
- EPA-sponsored course on the Principles of Risk Assessment and Risk Assessment in Superfund, Dallas, Texas, December 16-17, 1986
- Industrial Hygiene and Toxicology, Department of Civil Engineering, University of Texas, Austin, Texas, Fall, 1986
- EPA Superfund National Priorities List Seminar, Region VI, Dallas, Texas, July 15-16, 1986
- RCRA Implementation Plan, December 11, 1984, .4 CEU's, Amarillo College, Amarillo, Texas

CERTIFICATIONS

- Professional Sanitarian, No. 2211 (Texas 11/21/84)
- Professional Fisheries Scientist, No. 2092 (11/12/93)
- Professional Wetland Scientist, No. 000161 (10/26/94)
- Certified Environmental Professional No. 96030339 (8/14/96)
- Certified Senior Ecologist (5/12/98)
- Ute's Ladies Tress Surveyor Certificaiton (in progress, Winter 2011)
- Technical Service Provider [TSP-11-7336] for NRCS

PUBLICATIONS

Gutzmer, M.P., 1984. An Evaluation of Nitrite Toxicity to the Crayfish *Procambarus clarkii* M.S. Thesis: Southwest Texas State University.

Gutzmer, M. P. and J. R. Tomasso, 1985. Nitrite Toxicity to the Crayfish *Procambarus clarkii* Bull. Environ. Contam. Toxicol. 34(3); 369-376.

Gutzmer, M. P. and C. E. Epperson, 1989. The Use of Bioassessment in Superfund and Possible Implications. HMCRI 9th National Conference Proceedings, November 1988.

Gutzmer, M. P., September 1990. In Headliners, "District Contracts Beetlemania," *The Dispatcher*, p. 6.

Gutzmer, M. P., February 1991. "Nebraska Chapter Starts Wetland Foundation," Outdoor America (Izaak Walton League publication).

Gutzmer, M. P., March 1992. In Feature Forum, "What is a Wetland?" *The Dispatcher*, p. 3.

Zlotsky A. E., M. P. Gutzmer, and Guy M. Evasco 1992. A Multi-Objective Criteria Analysis for Alternative Route Planning. Water Resources Planning and Management, Proceedings of the Water Resources Sessions/Water Forum '92.

Hotchkiss, R. H., X. Huang and M. P. Gutzmer, 1993. Achieving a Sediment Balance across Dams: Stepping Up a Technology, Proceedings of the Environmental and Natural Resources of the Niobrara River Basin Research Symposium.

Gutzmer, M.P. 1993. Operational Modifications of Sluicing Activities at NPPD's Spencer Hydro to Minimize Impacts to the Niobrara River Fishery. Proceedings of the Niobrara River Basin Research Symposium.

Gutzmer, M. P. and D. P. Overhue, 1995. Wetland construction and enhancement at the Gerald Gentleman Station Railspur Mitigation Site, Progress of the First Year. Proceedings of the National Interagency Workshop on Wetlands "Technology Advances for Wetland Science" April 3-7, 1995.

Harris, D.D. and M.P. Gutzmer 1996. Macrophyte Production Fish Herbivory and Water Quality in a Tailwater Reservoir in Lake Ogallala, Nebraska. *Transactions of Nebraska Academy of Sciences* 23:29-35.

Gutzmer, M.P., J.W. King, and D.P. Overhue, 1996. Environmental Impacts in the Vicinity of Spencer Hydro During Routine Flushing Activities in the Niobrara River, Nebraska. *Transactions of the Nebraska Academy of Sciences* 23:1-8.

Gutzmer, M. P. and D. G. Luce, 1996. Chemical Residues in Representative Fish Species Surveyed From Locations Within the North and South Platte River Systems in Keith and Lincoln Counties, Nebraska. *Transactions of the Nebraska Academy of Sciences* 23: 59-64.

Gutzmer, M.P. and M. M. Peyton, 1997. Upper Platte River Fish Diversity and Abundance between the Confluence of the North and South Platte Rivers and Lexington, Nebraska. Proceedings from the Platte River Basin Ecosystem Symposium, 1997.

Gutzmer, M.P. 1997. Vegetation Dynamics at the Gerald Gentleman Station Wetland Mitigation Site. *Transactions of the Nebraska Academy of Sciences* 24: 27-34.

Gutzmer, M.P. 1999. The American Fisheries Society; Society of fisheries scientists work to improve fishing opportunity. April issue of *Nebraskaland*. Page 9.

Gutzmer, M. P. 2001. Sand Hills Aquatic Vegetation. Published in *Fishing in Nebraska*, Special Edition for *Nebraskaland Magazine* Nebraska Game and Parks Commission, Lincoln Nebraska, Page 90.

Gutzmer, M. P. and R. B. Kaul. 2001. Aquatic Plants of Nebraska. *Museum Notes*. University of Nebraska State Museum, Lincoln, Number 109.

Gutzmer, M.P. et al. 2002. Fish Species Richness below Spencer Hydro Power Project in the Niobrara River, Nebraska, 1993-2001. *Transactions of the Nebraska Academy of Sciences 28*:57-63.

Gutzmer, M.P. 2003. Water and Electricity are Inseparable. *Water Current,* University of Nebraska Water Center. Volume 35. No. 3.

Gutzmer, M.P. 2004. Small Fishes of Nebraska. *Museum Notes*. University of Nebraska State Museum, Lincoln NE, August 2004, Number 119.

Gutzmer, M.P. 2004. Hunting Morels. *Nebraska Life Magazine*. March/April 2004 .

Gutzmer, M. P. 2004. Electric Generation and AFS. In *Fisheries Forum, Fisheries Magazine, American Fisheries Society Magazine*. Volume 29:No. 9, pages 36-37.

Gutzmer, M.P. 2007. The Value of Water. *Rural Electric Nebraskan.* Volume 61, Number 5, May 2007.

Gutzmer, M.P. and R. B. Kaul. 2008. New Floristic Records of the Loup and Platte River Bottomlands, Platte County, Nebraska. *Transactions of the Nebraska Academy of Sciences 31: 15-29*

Gutzmer, M.P. 2011. Plants of Platte County Wetlands. Floral Collections of Platte County Nebraska –a Historical Perspective of Nebraska Riverine Habitats (submitted for publication)

Gutzmer, M.P. and A. T. Byrne. 2013. Age and Growth of Representative Centrachids in Lake Oconee, Platte County, Nebraska over a twenty-five year period. (*Currently being written*).

Gutzmer, M.P. 2012. Children of the Platte River. *NebraskaLand Magazine* (accepted for publication-March 2008). Scheduled for publication late 2010.

Gutzmer, M.P. 2012. *Plants of Platte County Nebraska Wetlands. A Historical and Current Perspective of Nebraska and Platte County Wetlands made possible by a lifelong connection to Nature in our Region of the Great Plains of North America.* The UPS Store publication office. Columbus Nebraska, 150 pages

Gutzmer, M.P. 2012. Eco-assets: Evaluation and Analysis in the 21st Century. (*currently being written*).

Gutzmer, M.P. 2013. Edible Plants of Nebraska. *Nebraskaland Magazine*. (accepted for publication).

Gutzmer, M.P. and A. T. Byrne. 2013. Climate change effects on *Morchella esculenta* in the Platte River Valley, Nebraska. (currently being written).

BOOKS REVIEWED and IN PROGRESS:

Wetlands, Marshes, Grasslands and Prairies of Northeastern United States. Margaret Swindoll, 2002.
And Then the Animals Turned. Timothy J. *Kloberdanz*, Copyrighted 2009.
Portrait of the Platte River. Michael P. Gutzmer and Timothy Kloberdanz (in progress).
Coal-fired Electric Generation in China-, paper review for the Asian Fisheries Society, Winter 2011
Icthyodiversity in the Coal Mining and adjacent Non-Coal Mining drainages of Jaintia Hills, India

CONSULTANT REPORTS

Gutzmer, M.P., and A.T. Byrne. 1997. Evaluation of ecological impacts of a diesel fuel spill on the Sulfur Gulch area, Douglas County, Colorado. Report to Bemas Construction, Inc., Parker, Colorado. 22 pp.

Gutzmer, M.P., and A.T. Byrne. 1998. Fishery management plan for Savannah Evergreen Preserve, New York. Report to Savannah Evergreen Preserve, Clyde, New York. 31 pp.

Gutzmer, M.P., and A.T. Byrne. 1998. Results of a wetland delineation conducted on the Dry Creek Corporate Center, Arapahoe County, Colorado. Report to CarrAmerica Realty Corporation, Washington, DC; and CarrAmerica Development, Inc., Greenwood Village, Colorado. 27 pp.

Gutzmer, M.P., and A.T. Byrne. 1999. Groundwater protection plan for the Cheyenne River Indian Reservation, South Dakota. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 52 pp.

Gutzmer, M.P., and A.T. Byrne. 1999. Threatened, endangered and sensitive flora assessment for the Dry Creek Corporate Center, Arapahoe County, Colorado. Report to CarrAmerica Realty Corporation, Washington, DC; and CarrAmerica Development, Inc., Greenwood Village, Colorado. 19 pp.

Gutzmer, M.P., and A.T. Byrne. 2000. Summary of water quality and fish population monitoring during 1998 -1999 and management plan for Lake Oconee, Nebraska. Report to Sigma Farms, Ltd., Columbus, Nebraska. 37 pp.

Gutzmer, M.P., and A.T. Byrne. 2000. Wagner Lakes management plan: results of 1999 - 2000 investigations and recommendations for water quality improvement and maintenance. Report to Wagner Lakes Association, Inc., Columbus, Nebraska. 27 pp.

Gutzmer, M.P., and A.T. Byrne. 2000. Wetland evaluation and threatened, endangered and sensitive species assessment of the Kobus Lake project site, Butler County, Nebraska. Report to Kobus Earth Moving, Inc., David City, Nebraska. 33 pp.

Gutzmer, M.P., J.P. Hobert, and A.T. Byrne. 1998. A comprehensive wetland monitoring plan for the Cheyenne River Indian Reservation, South Dakota. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 62 pp.

Gutzmer, M.P., J.P. Hobert, and A.T. Byrne. 1999. Assessment and enforcement plan for pesticides on the Cheyenne River Indian Reservation, South Dakota. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 114 pp.

Byrne, A.T., and M.P. Gutzmer. 1997. Aquatic ecological surveys of the Moreau and Cheyenne Rivers, South Dakota, 1997. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 48 pp.

Byrne, A.T., and M.P. Gutzmer. 1997. Ecological considerations of livestock utilization of riparian areas along river systems on the Cheyenne River Indian Reservation, South Dakota. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 22 pp.

Byrne, A.T., and M.P. Gutzmer. 2000. Instream and riparian habitat restoration plan for selected reaches of Virgin Creek, South Dakota. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 26 pp.

Byrne, A.T., and M.P. Gutzmer. 2002. Results of a wetland delineation conducted on the Eureka Heights Village development site in Central City, Gilpin County, Colorado. Report to Law Offices of Michael A. Littman, Arvada, Colorado. 44 pp.

Byrne, A.T., and M.P. Gutzmer. 2004. Ecological resource surveys and management recommendations for the Black Buttes area (Parcel 10), Crook County, Wyoming, 2003. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 56 pp.

Byrne, A.T., M.P. Gutzmer, and J.P. Hobert. 2002. Aquatic and terrestrial biological surveys of the Black Buttes area, Parcel 10, Crook County, Wyoming. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 86 pp.

Byrne, A.T., M.P. Gutzmer, J.P. Hobert, and P.A. Whitesell. 2001. Aquatic biological surveys of the Moreau and Cheyenne Rivers, and selected tributaries, South Dakota, 2001. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota, 68 pp.

Byrne, A.T., J.P. Hobert, and M.P. Gutzmer. 1999. Aquatic biological and riparian wildlife investigations on Virgin Creek, South Dakota. Virgin Creek restoration project, phase I studies, Cheyenne River Indian Reservation. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 52 pp.

Byrne, A.T., J.P. Hobert, and M.P. Gutzmer. 1999. Aquatic biological investigations of the Cheyenne River within the Cheyenne River Indian Reservation, South Dakota, 1998. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 37 pp.

Byrne, A.T., J.P. Hobert, and M.P. Gutzmer. 1999. Instream and riparian habitat studies on Virgin Creek, South Dakota. Virgin Creek Restoration Project, phase I studies, Cheyenne River Indian Reservation. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 22 pp.

Byrne, A.T., J.P. Hobert, and M.P. Gutzmer. 1999. Instream sediment toxicity of the Cheyenne River on the Cheyenne River Indian Reservation, South Dakota. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 22 pp.

Byrne, A.T., P.A. Whitesell, J.P Hobert, M.P. Gutzmer, and M.A. Lauch. 2001. Virgin Creek habitat restoration project, South Dakota: design, construction and preliminary effects. Report to Cheyenne River Sioux Tribe Environmental Protection Department, Eagle Butte, South Dakota. 64 pp.

ACTIVITIES, HONORS, AND INTERESTS

Activities and honors have included Eagle Scout, Phi Theta Kappa (honorary), and Phi Alpha Theta (graduate honorary), College Student Senator, American Legion Scholarship recipient, selected as a Student Conservation Association participant (1974) and as an Izaak Walton League National Conservation Finalist (1975) and former Big Pal of the Year for Big Pals/Little Pals. I also serve on the Platte Valley Pheasants Forever and Ducks Unlimited Chapter Committee, church lector and Board Member (Vice-Chair) for the Todd Valley Wetland Foundation, and serve as a Godparents counselor for thirteen high school students (4th year).

I am a nature enthusiast who enjoys hunting, fishing, camping, skiing, swimming, traveling, Boy Scout merit badge counselor and taxidermy. I have also worked as a subcontractor consulting on issues related to lake management water quality, aquaculture, and other natural resource projects. I am also past Secretary/Treasurer for the state chapter of the American Fisheries Society (1994-97) and NCD Water Quality Newsletter representative and Past- President for the

1998-99 state chapter office term. I am also a Lower Loup Natural Resource District Board of Director for Sub-District 9. I am currently a Technical Advisor for the Nebraska Environmental Trust.

I am also an environmental writer for the *Columbus Telegram* and have published over 200 articles. In July 2003 I was responsible for the idea proposed to form an Electric Power Generation Section within the American Fisheries Society. I was selected as BASS/ESPN Outdoors finalist in 2003 as National Conservation Director, which later declined. Client Relations and Sales recognition was evident by receiving the EPRI Excel Award for outstanding marketing and client relations service, environmental awareness and funding increases in 2004, 2005, 2006 and 2007. Distinguished sales status was achieved for all or parts of 2005, 2006 and 2007. Gutzmer received Ten year service award for contributions to the Lower Loup Natural Resource District in January 2008 and recognized for starting an innovative small environmental business in the *ColumbusTelegrams* feature of *Power and Progress*.

TECHNICAL AND BUSINESS SKILLS

My experiences have included a unique office/laboratory background combined with strong field experience. In the last 30 years I have had several full and part-time positions that have developed technical skills in field sampling, laboratory analysis, experimental design, data analysis and compilation, report writing, budgeting and overall project management concerning research and remediation activities.

Duties at the Texas Water Commission (TWC) sharpened my abilities to communicate fluently and tactfully through both the spoken and written word with staff personnel, governmental agencies, consultants, the communications media, and the general public. A comprehensive background dealing with RCRA, CERCLA, CWA, SDWA and several other water quality programs (lake and stream management) have diversified my background while employed with the TWC. Sampling expertise has also been strengthened through sampling of surface water, groundwater, wastewater, hazardous waste, soil and air. Sampling the parameters involved many different kinds of sample equipment on a broad range of sites. Investigation techniques and abilities were vastly improved through observation and assessment of a variety of polluted and/or heavily impacted environmental areas.

The District has provided an opportunity to become familiar with a variety of environmental monitoring programs, transmission line and rail spur siting studies, Section 404 permitting, NEPA, environmental assessments (wetland delineation and mitigation) pilot research projects, as well as environmental auditing and other permitting functions and special studies involving ecological relationships (aquatic macrophtye studies, sluicing, sediment, transport, watershed studies, Platte River forage fish and fish kill studies, impacts of hydro operation) relating to power plant operation. As a supervisor, I have prepared budgets, coordinated staff work activities, evaluated performance and managed other responsibilities of the Environmental Sciences Group. Living in Nebraska has developed my expertise relating to agriculture, groundwater, irrigation, and other water resource issues.

Working for PECI has developed my abilities to design environmental impact survey assessments, permitting and field studies that are conducted in a scientifically sound manner and cost-effective approach. My project management skills have been utilized for a variety of assessments with a wide range of costs and work scope. These impact and natural resource projects have been conducted in a variety of habitats throughout the United States.

Work with EPRI has brought experience in all environmental programs with electric generation companies across the Nation. Consultative sales and business development skills were considerably enhanced.

Starting my own business has been invaluable in all aspects of directing and conducting all phases of environmental business and consultation.

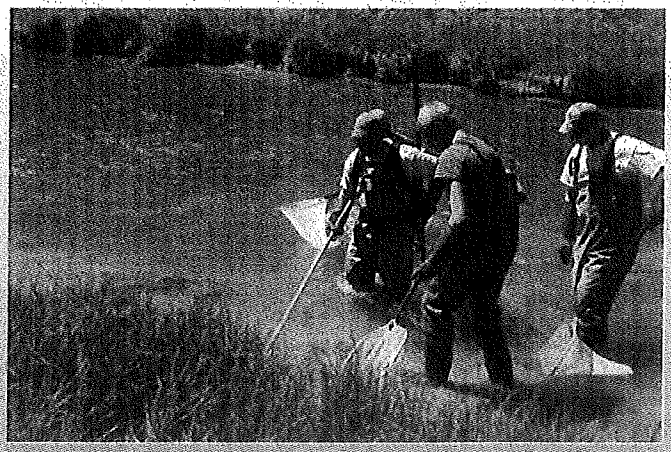
McGowan Dam Study Project

An Engineering and Environmental Assessment of Sites on Plum Creek, Brown County, Nebraska for the McGowan Dam Project

New Century Environmental, LLC

Mead & Hunt

2013



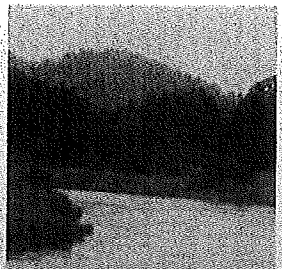


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EXHIBIT

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AN ENGINEERING AND ENVIRONMENTAL ASSESSMENT OF SITES ON PLUM CREEK, BROWN COUNTY, NEBRASKA FOR THE MCGOWAN DAM PROJECT

Prepared for

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June 28, 2013

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EXECUTIVE SUMMARY

New Century Environmental, LLC (NCE) was requested to conduct ecological and physical assessments of Plum Creek and McGowan Reservoir, Brown County, Nebraska to identify and evaluate potential downstream impacts from past sluicing activities from the reservoir, as well as identify effective baseline information for management strategies related to sediment maintenance of the reservoir and protection of downstream resources. After intense evaluation of physical and biological characteristics of Plum Creek conditions, we offer a holistic recommendation of acknowledgment of current conditions and how to consider going forward. It is apparent that overall watershed impairments should weigh heavily into any sediment maintenance activity required by Dr. McGowan, the owner of McGowan Reservoir, and his perceived or resultant control of sediment releases during normal or flooding events.

Mead & Hunt's (NCE subcontractor) geomorphic observations pertaining to the current state of sediment moving through the creek indicated dynamic equilibrium within the creek, except in the headwaters. The current discharge from the low level discharge appeared to be transporting enough sediment through the dam for flow conditions observed. Adjusting the discharge may have little effect on the sediment moving through the creek or could even put the sediment conveyance into imbalance because such adjustments could be close to continuous to compensate for precipitation and change in flows. These adjustments occur naturally in a functional two-stage channel. The geomorphic indicators found in this creek provided a better indication of how sediment moves through the dam and stream. Modeling of the flow through this limited reach of stream will provide little more than an academic study. Therefore, we do not recommend a sediment transport model, other than the fluvial geomorphology to assess future sediment transport through the dam.

The likely evolution of the reservoir will be that sediment will continue to deposit and it will become a stream with wetlands on either side of it. Dredging of the reservoir will be costly and short term at best. Although sand transport will continue as a natural process, the rate and volume of sediment transported through the system could be reduced through better watershed and farming practices in the upper portion of the watershed to reduce erosion of the sand slopes.

It appears colonizing and sustaining populations of fish, periphyton and macroinvertebrates are present at all sample sites and this appears representative of current and improving conditions of Plum Creek. Overall fish species documented and relative abundance of those species at all

four sites appear similar to previous sampling efforts with no major deviations noted. The lack of recent stocking of salmonids appeared evident with no representation in our samples. A more than one time assessment may reveal additional species and overall numbers with a late summer, early fall sampling assessment. The same may also be true for other biota observed.

Aquatic and wetland flora communities are established and an increase in diversity and abundance of native flora in a downstream progression appears to be the trend with observations of establishing submergent and streamside flora (wetland hydrophytes) during our investigation. Biota, in general, appear to have resilient ability expressed in a self-restoration capacity after periodic episodes of increased sediment loads. It appears short periods of *de minimus* sediment removal through the dam indicative of a sluicing event would allude to minimal or short term impacts from the associated activity based on our observations of vegetation re-establishment.

Extensive row-crop agriculture in the form of corn production is prevalent throughout the upper reaches of the Plum Creek watershed and appears to be on the increase with current market pricing. Many areas not typically farmed are being converted from rangeland (high in sand composition) to pivot irrigated corn fields (chemigation also) with exposed sediment conduits for erosion. With all the potential erosional opportunities, sediment transport is predicted to increase in the coming years given current watershed land use. A best management plan approach may be in order to minimize future sedimentation assaults to the Plum Creek drainage.

1. INTRODUCTION

New Century Environmental, LLC (NCE) was requested to conduct ecological and physical assessments of Plum Creek and McGowan Reservoir, Brown County, Nebraska to identify and evaluate potential downstream impacts from sluicing activities from the reservoir, as well as identify effective management strategies for sediment maintenance of the reservoir and protection of downstream resources. The purposes of this report are to present data results of this investigation and provide insight into management alternatives.

This report includes all physical, chemical and biological results from data collected during our surveys, as well as photographic documentation of each site. Guidance from a recent meeting with the US Environmental Protection Agency (EPA) suggested that the following information be ascertained during this *Pre-Consent Order Process*. This report also contains an engineering assessment by Mr. Bryan Ripp, PE, a fluvial geomorphologist with Mead & Hunt of Minneapolis, Minnesota. EPA expects Dr. McGowan, the property owner and operator of the McGowan Reservoir and dam, to sign the *Order on Consent* within a timeframe proposed by the client (but not to exceed 60 days from the April 15th meeting) or sometime in mid-June 2013.

During this time period, Dr. McGowan agreed to:

1. Complete a study or create a map on the volume of sediment remaining above the dam;
2. Review and report on the dam's functionality, and costs associated with restoring dam functionality;
3. Complete an assessment of sediment alternatives to be released over time that depletes the buildup of sediment above the dam, but would result in "*de minimus*" releases of sediment that would not constitute the addition of fill material to Plum Creek; and
4. Report on ecological conditions downstream of the dam and the potential impacts of future releases.

2. Study Area and Background

According to the Nebraska Game and Parks Commission (NGPC 1977), Plum Creek has been an important surface water fisheries emphasis over the past 80 years. Even though in private ownership (and now the Bobcat Wildlife Management area), there has been a longstanding interest in salmonid stocking; primarily brown and rainbow trout. Anglers have sporadically had fishing success for trout; much of it depending on how much stocking occurred. Some natural recruitment (sustained reproduction) has been thought possible; however, stocking has been the primary sustainability approach used regarding any sport fishery management activities.

NGPC characterized the stream varying in width from 30-60 ft and depths ranging from a few inches to almost 4 ft in some pools. This general characterization appeared to be true base on our investigation in 2013. The general meandering nature of Plum Creek created good variety of aquatic habitat according to state agency personnel. The stream bottom consists of primarily sand with some areas of exposed gravel and cobble substrate. The ratio of sand to rock and gravel was estimated to be 6:1 (NGPC 1977). Aquatic vegetation was limited in Plum Creek and most stream banks were heavily grazed.

Plum Creek's origin is Red Deer Lake, located in Cherry County. It flows east across Cherry County into Brown County, where it flows north and empties into the Niobrara River north of Ainsworth. The majority of trout-supporting water is located in Brown County. Historically, the stream has received many stockings of rainbow and brown trout.

Records show that stockings were made from 1932 to 2007. The stream was sampled at two different locations in 1977. One sample station was on the Jack Jones property. The second site was just below Evergreen Creek on the Luther Eggers property. Each area was electro-fished with a Coffelt UUP-15 with a boat transformer and a Sport Yak boat modified for use in stream shocking. Results indicated that in 1977 only 12 brown trout were sampled, with the majority of the fish dominated by cyprinids, catostomids and centrarchids (NGPC 1977).

FIGURE 1 illustrates our study area, in general. Table 1 shows study site descriptions and locations.

We selected a reference site (Plum Creek site PC1) approximately a mile above the Ponderosa Pine Ranch (Dr. McGowan property where dam was located) on the Williams Ranch. Our two

treatment sites were located two miles (Plum Creek site PC2; Wilke Ranch) and four miles (Plum Creek site PC3; Appelt Ranch) below the dam (Fig. 1).

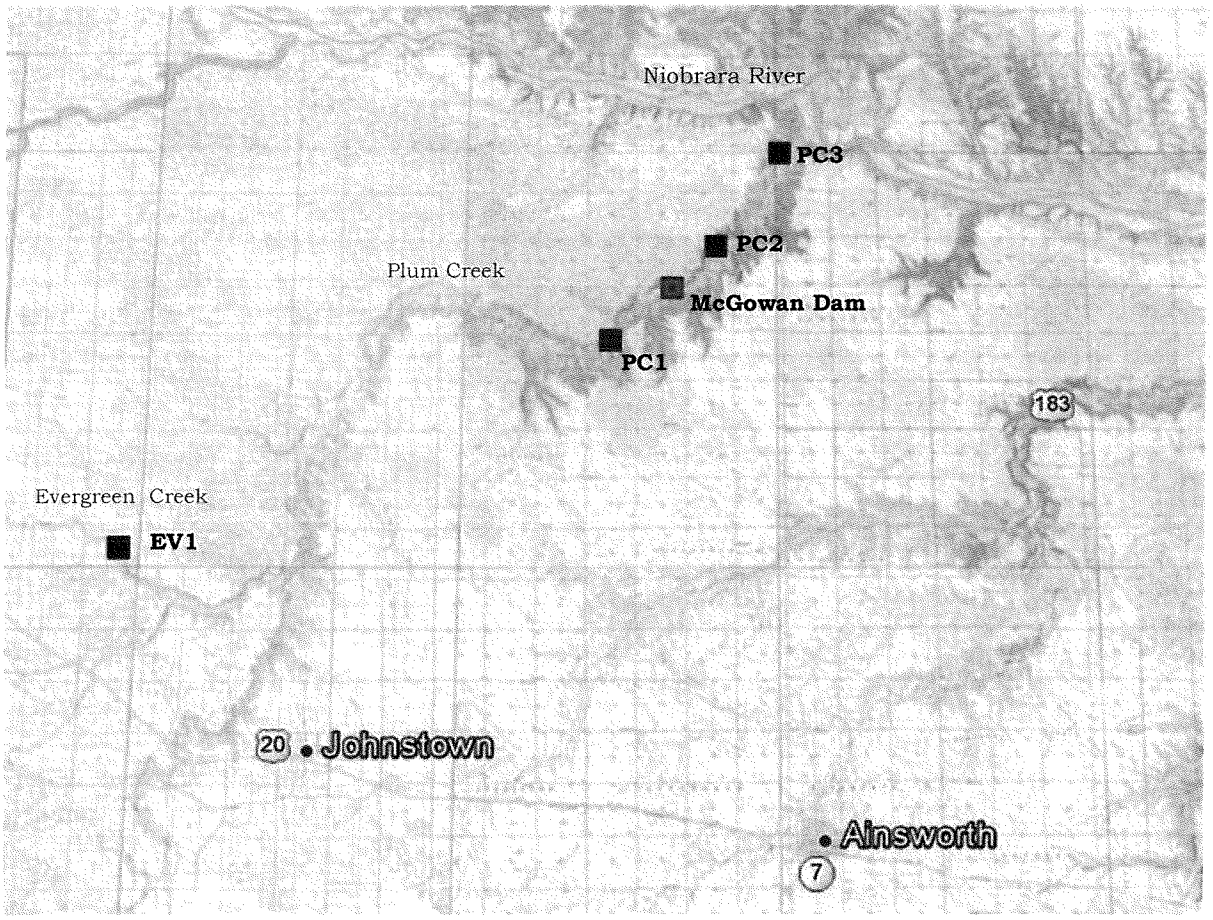

FIGURE 1. – Locations of the study sites on Evergreen Creek and Plum Creek, Brown County, Nebraska, May 2013.

TABLE 1. – Description of study sites sampled on Evergreen Creek and Plum Creek in Brown County, Nebraska, May 2013. Stream orders were determined using the Strahler method (Strahler 1957). Use classification gathered from the Nebraska Department of Environmental Quality's Title 117 – Nebraska Surface Water Quality Standards.

Site	Site Description	Latitude / Longitude
EV1	Site located 33 km upstream from McGowan Dam on Evergreen Creek. Site located in a second order stream, designated Coldwater Class B.	42°37'50.12"N 100° 7'59.85"W
PC1	Site located 4.5 km upstream from McGowan Dam on Plum Creek. Site located on a fourth order stream, designated Coldwater Class B	42°41'30.58"N 99°56'31.80"W
PC2	Site located 3.28 km downstream from McGowan Dam on Plum Creek. Site located on a fourth order stream, designated Coldwater Class B	42°43'15.56"N 99°53'57.14"W
PC3	Site located 9.3 km downstream from McGowan Dam on Plum Creek. Site located on a fourth order stream, designated Coldwater Class B	42°44'58.84"N 99°52'24.20"W

According to the Nebraska Department of Environmental Quality (NDEQ), Plum Creek in our study area has classification uses as an aquatic life designation of *Coldwater Class B* and a water supply use designated as agricultural. It has an aesthetics use classification. Coldwater Class B streams are *"waters which provide, or could provide a habitat capable of maintaining year-round populations of a variety of coldwater fish and associated vertebrate and invertebrate organisms and plants or which support the seasonal migration of salmonids. These waters do not support natural reproduction of salmonid populations due to limitations of flow, substrate composition, or other habitat conditions, but salmonid populations may be maintained year-round if periodically stocked"*.

It was difficult identifying a suitable off-stream, "paired" reference site comparable to our Plum Creek sites. Access to other streams for site selection was limited. We selected an upstream, paired reference site located on Evergreen Creek, another Coldwater Class B designated stream and tributary of Plum Creek. Although the Evergreen Creek site differed greatly in terms of stream width, depth and overall habitat from the downstream Plum Creek sites, it was also a moderate gradient stream like Plum Creek. Because of this, we believed that comparisons and inferences made for biota, not necessarily habitat, were reasonable, in general.

3. METHODS

To assess sedimentation of McGowan Reservoir, and its possible effects on Plum Creek, we conducted: 1) a bathymetric and sediment survey of McGowan Reservoir, 2) a geomorphological survey of Plum Creek, and 3) physical, chemical and biological analyses of Plum Creek and a paired reference site upstream of the McGowan Dam on Evergreen Creek. A physical inspection and evaluation were also performed for the McGowan Dam.

For comparison purposes (i.e., to compare conditions of downstream treatment sites PC2 and PC3 with those of the upstream Plum Creek reference site PC1 and Evergreen Creek paired reference site EV1), we conducted a comprehensive surveys for habitat, periphyton, macroinvertebrates and fish.

Chemical, physical or biological stressors impact the biological characteristics of an aquatic ecosystem (Gibson et al. 1996). For example, chemical stressors can result in impaired functioning or loss of a sensitive species and a change in community structure. Ultimately, the number and intensity of all stressors within an ecosystem will be evidenced by a change in the condition and function of the biotic community. The interactions among chemical, physical and biological stressors and their cumulative impacts emphasize the need to directly detect and assess the biota as indicators of actual water resource impairments.

During the past 150 years, direct measurements of biological communities including plants, invertebrates, fish, and microbial life have been used as indicators of degraded water quality. In addition, biological assessments (bioassessments) can be used as a watershed management tool for surveillance and compliance of land-use best management practices. Combined with measurements of watershed characteristics, land-use practices, instream habitat, and water chemistry, bioassessment can be a cost-effective tool for long-term trend monitoring of watershed conditions (Davis and Simon 1996).

Biological communities act to integrate the effects of water quality conditions in a stream by responding with changes in their population abundances and species composition over time. These populations are sensitive to multiple aspects of water and habitat quality and provide the public with more familiar expressions of ecological health than the results of chemical and toxicity tests (Gibson et al. 1996). Furthermore, biological assessments when integrated with physical and chemical assessments, better define the effects of point-source discharges of

contaminates and provide a more appropriate means for evaluating discharges of nonchemical substances (e.g. nutrients and sediment).

Water resource monitoring using benthic macroinvertebrates is by far the most popular method used throughout the world. Macroinvertebrates are ubiquitous, relatively stationary and their large species diversity provides a spectrum of responses to environmental stresses. Individual species reside in the aquatic environment for a period of months to several years and are sensitive, in varying degrees, to temperature, dissolved oxygen, sedimentation, scouring, nutrient enrichment and chemical and organic pollution (Resh and Jackson 1993). Finally, benthic invertebrates represent a significant food source for aquatic and terrestrial animal and provide a wealth of ecological and biogeographical information.

NCE scientists, and a fluvial geomorphologist from Mead & Hunt, conducted engineering and ecological evaluations of McGowan Reservoir, Plum Creek and Evergreen Creek; all within Brown County, Nebraska, and approximately 10 miles north of Ainsworth. The engineering and ecological investigations were conducted May 28 through June 5, 2013. These surveys involved collection and assessment of general water quality, riparian, wetland, and aquatic flora, periphytic algae, benthic invertebrates and fish. These communities represent the three trophic levels in lotic systems. In addition, detailed habitat assessments and these groups of organisms have often been used as biological indicators for monitoring water quality (Gaufin 1973; Goodnight 1973; Patrick 1973; Weber 1973; Plafkin et al. 1989; Karr 1991; Cummins 1994).

3.1 Bathymetric and Sediment Surveys of McGowan Reservoir

To measure existing sediment levels in the outlet area of the McGowan Reservoir (i.e., near the dam), we mapped this area of the reservoir using our proprietary hydrographic mapping technology. This proprietary method involves the use of hydro-acoustic depth measuring equipment with Differential and RTK GPS receivers to produce accurate and up to date bathymetry maps. A proprietary GPS (sub-foot accurate) and hydro-acoustic sonar system was used to collect water depths at several points throughout the basin. We collected a depth-location data point once per second while we operated our survey boat along several transects throughout the survey area. Because our sediment penetrating sonar technology is ineffective in sand-dominated substrate environments, we constructed a bottom sediment map (including sediment depths and three-dimensional profiles) by recording locations and sediment probe

depths at numerous, equally spaced points along several transects. These data were used to construct both bathymetric and sediment level maps of McGowan Reservoir.

Using similar technology we mapped substrate types and distributions at Plum Creek Site PC2, the first downstream treatment site. A sub-foot accurate GPS was used to record several locations along transects of the stream channel, where at such points an investigator identified and recorded predominant substrate types. This information allowed us to construct a substrate distribution map of the treatment site nearest the dam.

3.2 Geomorphological Evaluation and Dam Observation

A site visit was conducted on June 3-5, 2013, to better define what the processes are upstream and downstream of the reservoir, as well as the function of the dam itself; especially how it might function as a sluiceway or a structure that could safely pass sediment. Mead & Hunt assessed the existing conditions of the dam structure in relation to sluicing sediment through it along with associated costs.

Mead & Hunt formulated assumptions about current sediment transport process to ascertain a more balanced and eco-friendly setting for water and sediment conveyance potentially through sluicing, given existing conditions and limited budget for the McGowan Dam. Mead & Hunt also provided a conceptual plan, including associated costs, to manage the accumulated sediment above the dam, including sediment removal. Further, Mead & Hunt determined the appropriate sedimentation model approach necessary to meet the conditions and goals for Plum Creek to move on to design.

On June 4, 2013, Mead & Hunt conducted a field reconnaissance to assess the geomorphology at five sites, which also represented field sampling sites used by NCE. In addition, we conducted a preliminary field assessment of the Pine Canyon Dam (also known as McGowan Dam). The purposes of these field assessments were to determine:

- The current function of the creek and dam as it relates to water and sediment conveyance and whether the system is in dynamic equilibrium; and
- Assess adjacent land use and changes in land use, if applicable.

For each of the locations, at least four measurements were taken to assess the dominant flow characteristics of Plum Creek. The stream-forming flow for natural and sometimes man-made waterways is referred to as the bankfull flow. For streams, this flow does most of the work in

forming the waterways, as well as effectively moves the most sediment. It is not the greater flows, such at the 100-year flood (1% probable occurrence annually), that does most of the work forming the stream. Rather, it is more frequent floods, such as the 1.5 to 2-year flood (50 to 67% probability of occurrence annually), for balanced waterways and less than annually for disturbed and flash-flood prone waterways.

Therefore, the bankfull height above the water level added to the measured water depth yields the depth of the bankfull channel, and the bankfull width is that for the bankfull channel. Further, there is a base flow channel within the bankfull channel which typically indicates the flow in the channel, typically from groundwater seeping from the banks and the channel bottom. The top of this base flow channel is typically indicated by the lower level of woody vegetation or as seen by the grasses and forbs growing along the banks of the creek, the lower level of persistent vegetation.

Mead & Hunt also inspected and evaluated the dam, including its overall infrastructure and function. This information was used to formulate strategies and recommendations in reference to future dam operation and maintenance.

3.3 Settleable Solids

An analysis of settleable solids was performed for each Plum Creek site; using standard methods (APHA 2005). This sampling effort allowed us to identify, in general, sediment concentrations in the water column during the time of ecological sampling. These data were also used to assist in determination of a safe sediment value.

3.4 Instream and Riparian Habitat

Assessment of physical habitat quality is an integral component for evaluation of resource impairment. Due to its relatively small size, it was possible to collect quantitative habitat data for Plum Creek and the paired reference site on Evergreen Creek. Instream and riparian habitats were measured at each study site using transect techniques (Armour et al. 1983; Platts et al. 1983, 1987). Ten equally spaced transects were established at each station, where measurements of water depth (m) and substrate size were recorded at 1-m intervals (0.75-m intervals at site EV1) In addition, measurements of channel width (m), bank angles, streamside cover, bank stability, bank soil alteration, and overhead canopy were estimated at each transect. Streamflow velocities were measured along one representative transect (also along 1-

m intervals; "six-tenths" method) at each station using an electromagnetic flow meter. Streamflow data were then used to calculate discharge at each station.

Mean stream depths and substrate sizes were compared among each site using analysis of variance (ANOVA; Sokal and Rohlf 1981; Zar 1999) to identify whether significant differences of depth or substrate occurred among sites. All data were tested for normality (i.e., skewness, kurtosis and omnibus; Box 1953; Zar 1999). If data were rejected for normality, then the non-parametric test, Kruskal-Wallis one-way ANOVA was used (Sokal and Rohlf 1981; Zar 1999). If significant differences were observed, then the multiple comparison test, Tukey-Kramer (Tukey 1953; Kramer 1956, 1957; Campbell and Skillings 1985; Hochberg and Tamhane 1987), was performed to evaluate those differences.

3.5 Water Quality

Temperature (°F) (estimated), pH, turbidity (visual), total coliforms, fecal coliforms, microcystin, total ammonia nitrogen, total phosphorus, total Kjeldahl nitrogen (TKN), and nitrate/nitrogen were assessed at site PC3. Settleable solids samples were taken at every 100-m study reach, except site EV1. Water odors, surface oils and turbidity were visually observed at each study location. Sediment odors and oils were assessed in each sampling area. Sediment deposits were also observed in each sampling reach. The flow velocity left very few areas for fine particulate deposition; however, sand seemed to move constantly within the stream bed. Black rocks or anaerobic conditions were not observed at any location.

3.6 Periphyton Communities

Periphytic algae were quantitatively sampled at each Plum Creek site and at Site EV1. Algae were collected by scraping a known area of submerged rock surfaces (Weber 1973). Three separate samples were collected (from three separate rocks) at each site, where they were composited into one sample equaling a total area scraped of 41.55 cm^2. Periphyton for each composite sample were placed in a vial containing Lugol's iodine solution. Upon completion of all surveys, NCE delivered all periphyton samples to an independent laboratory for analysis.

Periphyton were identified and enumerated using a phase contrast, inverted microscope according to techniques described by Uternoehl (1958) and Britton and Greeson (1988); using magnifications from 375X to 1,500X. Specific identifications and counts of diatoms were conducted at 1,500X under an oil immersion objective after mounting organisms in hyrax (Van

der Werff 1955). Results from these analyses provided species lists, density estimates, and calculations of the Shannon-Wiener diversity index (H'). EPA recommended use of this index to measure effects of stress on benthic communities (Weber 1973).

3.7 Macroinvertebrate Communities

There have been many studies demonstrating deleterious effects of land-use activities to macroinvertebrate and fish communities (Karr 1998). A major focus of investigators has been the prevention of further degradation, as well as restoration of streams to their more pristine conditions.

Benthic invertebrates were quantitatively collected at all Plum Creek sites and at site EV1. Macroinvertebrates were collected by taking three replicate samples in riffle and run habitats using a Hess sampler, which enclosed 0.85 m^2. Three Hess samples have been shown to provide reliable estimates of benthic density (Canton and Chadwick 1988). Macroinvertebrate samples were preserved in the field with 95% ethanol containing Rose Bengal biological stain, and delivered to an independent laboratory for analysis. In the laboratory, benthic organisms were sorted from debris, identified to the lowest taxonomic levels using available keys, and enumerated. Chironomids and oligochaetes were cleared and mounted on microslides, where they were then indentified and enumerated. Results from these analyses provided species lists, estimates of density, and calculations of H' for each site.

Macroinvertebrate communities were compared using similarity indices, Community Loss Index (Courtemanch and Davies 1987) and Jaccard Coefficient of Community Similarity (Jaccard 1912; Boesch 1977), which compare sites in terms of presence or absence of like taxa (Plafkin et al. 1989). ANOVA (Sokal and Rohlf 1981; Zar 1999) was conducted to determine if significant differences in density, diversity or number of taxa existed among sites on Plum Creek and Evergreen Creek. Since invertebrates generally exhibit clumped or negative binomial distributions, all data were tested for randomness (Box 1953; Zar 1999). If data exhibited non-normal distributions, then they were transformed (i.e., $\log_{10}$) before use of ANOVA (Eliott 1977). If significant differences existed, then the Tukey-Kramer multiple comparison test (Tukey 1953; Kramer 1956, 1957; Campbell and Skillings 1985; Hochberg and Tamhane 1987), was performed to evaluate those differences. In addition, each taxon was assigned a functional feeding group designation using information from Merritt and Cummins (1996) and Merritt et al. (2008). The relative abundance of each functional feeding group was used to make comparisons among stations in terms of available organic food base (Vannote et al. 1980).

Benthic invertebrate data were also analyzed using metrics described by Plafkin et al. (1989), and modified according to DeShon (1995), Barbour et al. (1996), Fore et al. 1996, and Smith and Voshell (1997). These included number of distinct taxa, EPT index (i.e., number of mayfly, stonefly and caddisfly taxa), percent EPT, percent Ephemeroptera, percent Diptera, percent Chironomidae, and the percent contribution of dominant families.

3.8 Fish Communities

NCE scientists are fully trained and qualified to address fish community assemblages and threatened and endangered species issues. NCE holds scientific collecting permit: *Master Permit 397* which enables us to safely assess presence or absence of fish community assemblages and any rare species.

To effectively assess fish communities in the study reaches a qualitative approach to establish species presence and absence was our goal. Major habitat types were identified and quantitatively sampled using electrofishing (with a Coffelt Mark-10 backpack unit) and seining (with a 10 m x 2 m bag seine with 0.32 cm nylon mesh) techniques. These gear types were used to sample fish in riffle, run and pool habitats.

Electrofishing was conducted by sampling one upstream and one downstream pass along the entire 100-m segment of each study site. As a secondary technique, a minimum of one seine haul per site was performed. One seine haul equaled an upstream pull of approximately 20 m.

All captured fish were identified to species, measured for total length (mm), weighed (g) using Pesola spring scales (Jennings 1989), enumerated, examined for anomalies and released. A minimum of five specimens for each species captured were placed in containers with 10% formalin and returned to the laboratory for verification of species identifications made in the field. Results from these analyses provided species lists and estimates of relative abundance by species and sites. In addition, length-weight data allowed for analysis of general body condition (K_n) for each species, as described by Anderson and Gutreuter (1983). Results from all analyses were used to make some comparisons among stations on the study reaches. A comparison to previous sampling efforts by NGPC and NDEQ were also made.

4. Results and Discussion

4.1 Bathymetry and Sediment Deposition of McGowan Reservoir

Bathymetric and sediment deposition analyses were conducted on McGowan Reservoir to describe existing basin shape, depths and sediment volume. Sub-foot GPS and hydro-acoustic sonar technologies were used to construct depth and sediment maps of McGowan Reservoir. The sediment map provided an estimate of the amount of sediment accumulation still remaining above the McGowan Dam. We collected 12,099 sub-foot accurate location and depth data points and 55 location and sediment depth points.

Surface area of McGowan Reservoir was estimated at 8.2 acres, with maximum and mean depths of 20.6 and 6.0 ft, respectively (Fig. 2). Depths were shallowest within the west and northwest areas of the reservoir (Figs. 2 and 3), which appeared to be a result of sand deposition and accumulation from upstream sources (Fig. 4).

Sediment volume, primarily in the form of sand, was estimated to be 45,309 ft^3 (Fig. 4). Average sediment thickness was 3.4 ft. Most of the sediment was accumulated within the west and northwest portions of the basin (Fig. 4).

4.2 Geomorphological and Dam Conditions

Streams strive to exist in a state of dynamic equilibrium in which the driving forces for channel form are balanced by the resisting forces. The driving forces are the quantity of water and sediment delivered through a stream while the resisting forces are the strength and roughness of the channel materials and the channel shape. When the driving forces exceed the resisting forces, the stress applied by water or sediment exceeds the channel strength and erosion occurs. Conversely, when resisting forces exceed the driving forces, such as in an over-widened channel, the banks and even the channel may build through deposition of sediment. The stream channel responds by altering its shape in plan, profile and cross-section to accommodate the changes in flow volume and applied shear. The channelization of streams often refers to at least some of the following manipulations: changing the cross sectional shape (i.e., channel widening and elimination of the two-stage channel), realigning the plan form (i.e., channel straightening and shortening), constructing diversion channels and constructing artificial flood banks (i.e., levees). Often, the result of channelization is one or more of the

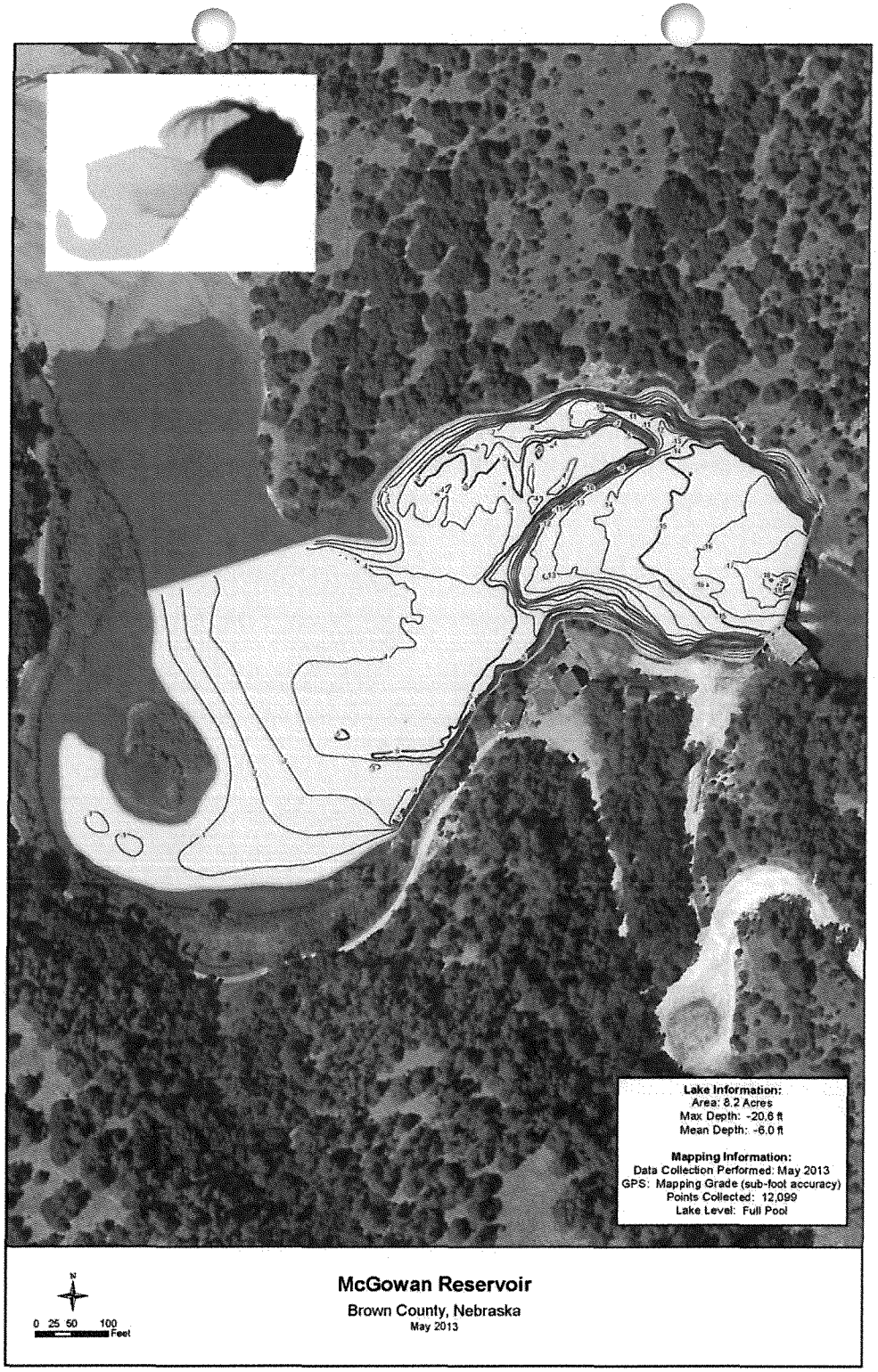

FIGURE 2. – Bathymetric map of McGowan Reservoir along Plum Creek, Brown County, Nebraska, May 2013.

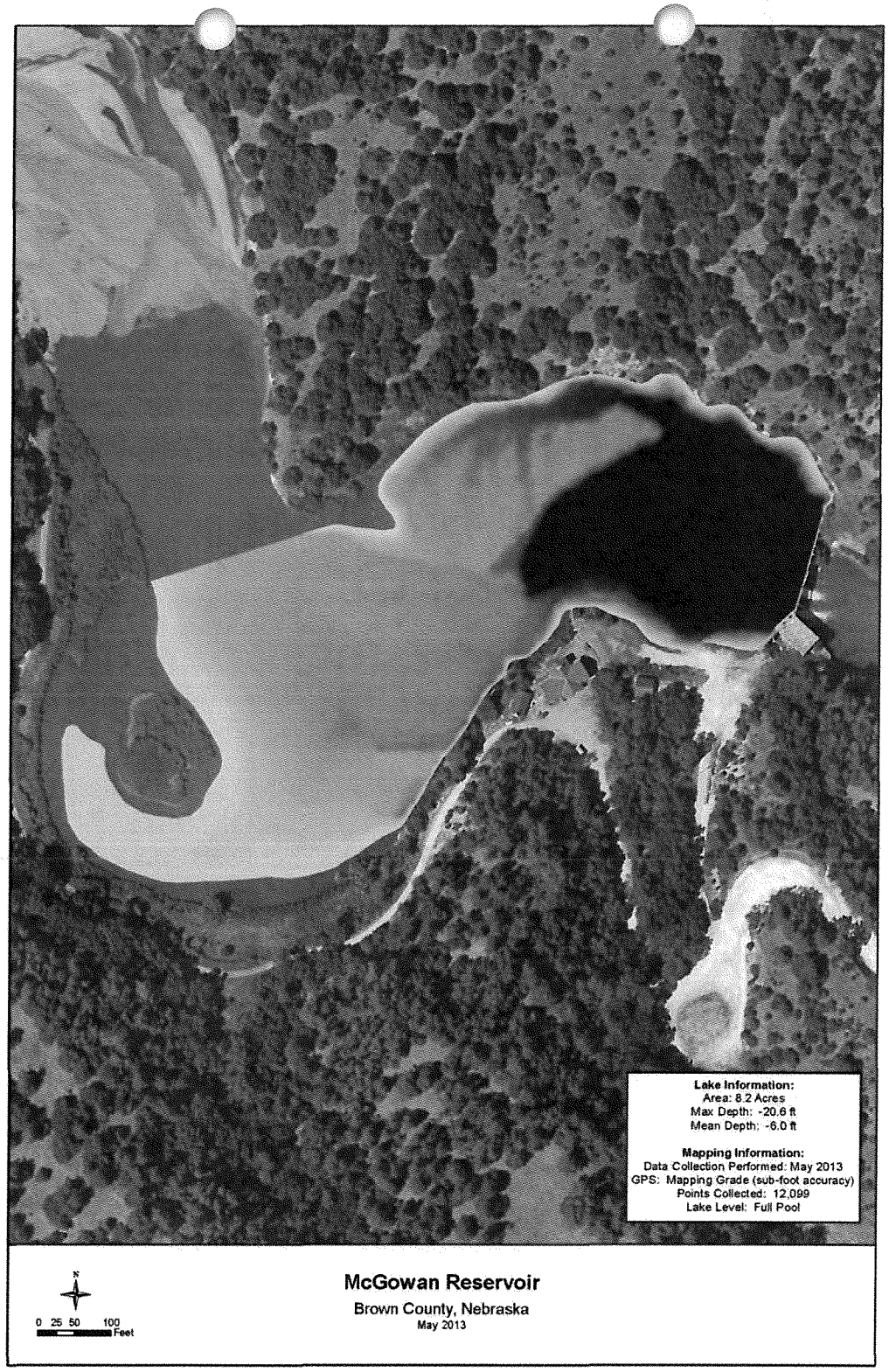

FIGURE 3. – Shaded "three dimensional" bathymetric map of McGowan Reservoir along Plum Creek, Brown County, Nebraska, May 2013.

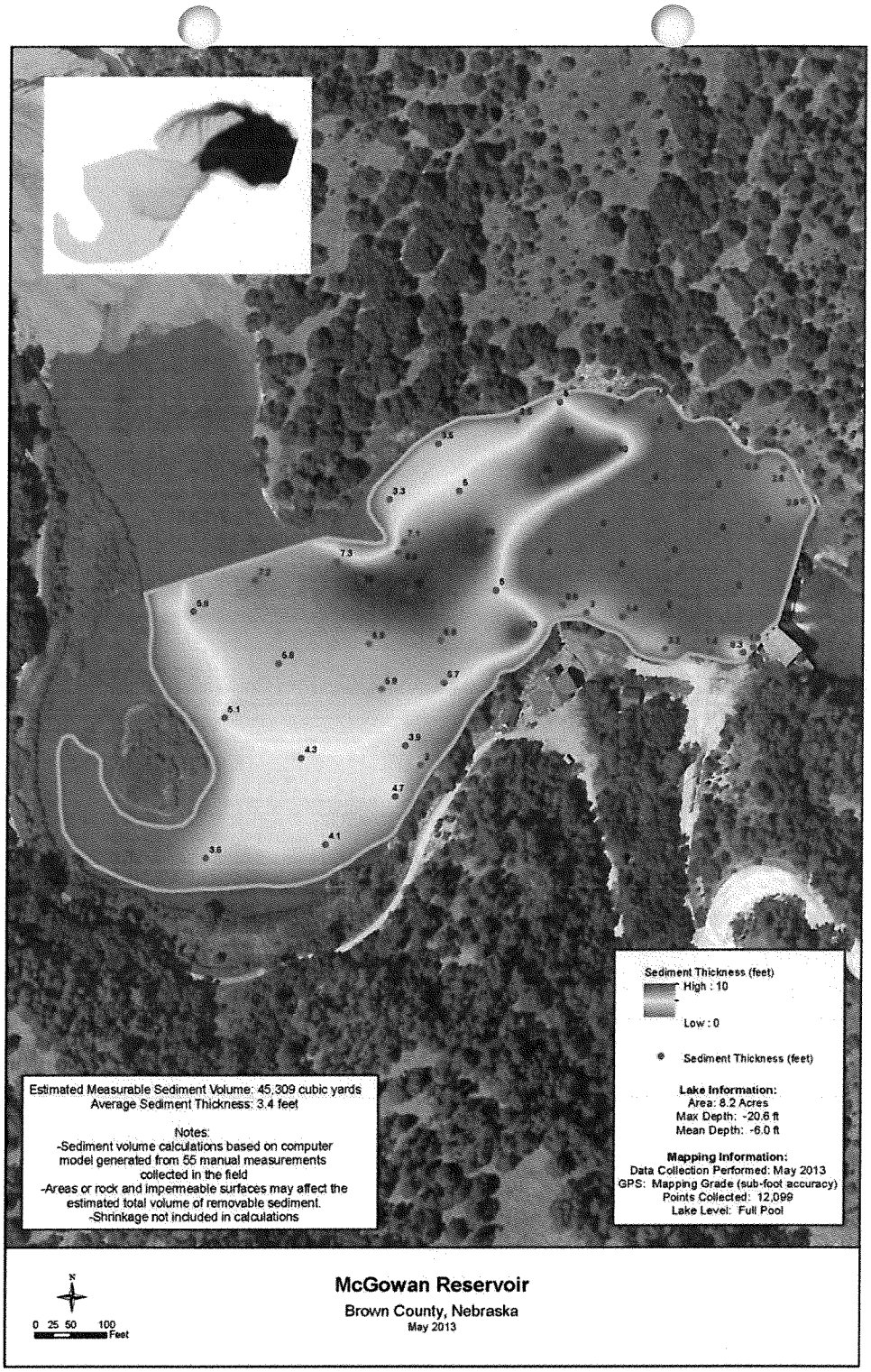

FIGURE 4. – Sediment deposition map of McGowan Reservoir along Plum Creek, Brown County, Nebraska, May 2013.

following: channel instability, low ecological diversity, downstream flooding, poor aesthetics and recreation, impeded recovery and unsustainable maintenance. Mass wasting of stream banks during this impact sequence contributes greatly to high levels of suspended sediments and turbidity, with significant impacts to in-stream fauna, especially site-feeding fish and grazing/shredding forms of aquatic invertebrates. Any cold-water fishery is usually eliminated during this impact process.

The process by which streams often recover from channelization has been described by several investigators and the evolution of channel morphology can be separated into six stages. These include: I) Pre-disturbance, II) Disturbance, III) Incision, IV) Widening, V) Deposition, and VI) Recovery and Reconstruction.

At Stage I, the channel is functioning in its natural state with bankfull floodplains positioned along the low flow channel. While, under select conditions, streams can be stable without these internal elements, bankfull floodplains are a common feature of stable streams, particularly in the Midwest. Bankfull floodplains occur at the elevation corresponding to the dominant discharge. The dominant discharge is the flow that, over time, accomplishes the most work on the stream channel. In undisturbed streams, the dominant discharge typically occurs every 1.5 to 2 years. The bankfull floodplain performs an invaluable function of lowering the bank shear during higher flows and effectively managing the stream energy. Most of the work done by streams is performed by more frequent flows rather than the major flows, such as a 100-year flood. The analogy of moving a shovel full of sediment every day for a year compared to moving a wheel barrow full of sediment once a year illustrates this concept of stream forming flow.

During Stage II, natural or manmade events (channelization) disturb the channel. Characteristically, disturbance eliminates the two-stage channel and may include removal of woody riparian vegetation along the banks. Common forms of manipulation include channel straightening, relocation or widening of the channel into a trapezoidal shape. In the past, these methods were often perceived as the solutions to handling increased peak flows and to better convey sediment.

In Stage III, the stream cuts downward to lower its channel slope to redistribute energy. This incision process migrates upstream. The migrating face of an incision front is referred to as a knickpoint or knickzone. The typical shape of these channels is V- shaped to narrow U-shaped.

Incision proceeds until either: the channel reaches a stable slope, incision reaches a more resistant strata, or the stream banks begin failing because of mass wasting.

Typical channel widening through mass wasting of the stream banks, Stage IV, follows incision. The next phase of channel evolution is Stage V when the channel has sufficiently widened or manually over-widened. The sediment eroded from upstream reaches in the watershed is deposited. The sediment reforms bankfull shelves and narrows the lower channel such that the stream can convey sediment through the system. This is also the phase when culverts and bridge openings become partially filled. This occurs most often when the culvert or bridge opening was over-widened to accommodate a single design flow. In Stage VI, the channel regains the equilibrium condition and efficiently transports both water and sediment. Each of these stages is depicted in the following Figure.

On June 4, 2013, Mead & Hunt conducted a field reconnaissance to assess the geomorphology at five sites, which also represented field sampling sites by NCE, in general. In addition, we conducted a preliminary field assessment of the McGowan Dam (Pine Canyon Dam). The purposes of these field assessments were to determine:

- The current function of the creek and dam as it relates to water and sediment conveyance and whether the system is in dynamic equilibrium; and
- Assess adjacent land use and changes in land use, if applicable.

For each of the locations, at least four measurements were taken to assess the dominant flow characteristics of the creek. The stream-forming flow for natural and sometimes man-made waterways is referred to as the bank full flow. For waterways, this flow does most of the work in forming the waterways, as well as effectively moves the most sediment. It is not the greater flows such at the 100-year flood (1% probable occurrence annually) that does most of the work forming the stream. It is more frequent floods, such as the 1.5 to 2-year flood (50 to 67% probability of occurrence annually), for balanced waterways and less than annually for disturbed and flash-flood prone waterways.

Therefore, the bankfull height above the water level added to the measured water depth yields the depth of the bankfull channel, and the bankfull width is that for the bankfull channel. Further there is a base flow channel within the bankfull channel which typically indicates the flow in the channel, typically from groundwater seeping from the banks and the channel bottom. The top of this base flow channel is typically indicated by the lower level of woody

vegetation or as seen by the grasses and forbs growing along the banks of the creek, the lower level of persistent vegetation.

Site 1 was located approximately 20 miles upstream of the McGowan Reservoir. Two measurement locations were taken upstream of the 11-foot diameter CMP culvert and two measurement locations were downstream of the culvert. Especially upstream of the culvert and immediately downstream of the culvert, the banks were sparsely vegetated and with steep raveling sand banks at numerous locations, possibly indicating incision in conjunction with overland erosion. The creek bottom was primarily unconsolidated and mobile sand. The upstream measurement locations represented Stages II and III, Disturbance and Incision, respectively of the channel evolution model. Upstream of the culvert, the following measurements were taken:

- Water depth, 0.5 ft;
- Bankfull height, 1.0 to 3.0 ft:
- Bankfull width, 15 to 28 ft; and
- Lower limit of persistent vegetation above water level, 0.5 to 1.0 ft.

The farthest downstream location was approximately 200 ft downstream of the culvert and in a more undisturbed area along the banks. This location would represent either Stage I, Undisturbed or Stage VI, Recovered. The following measurements were taken at that location:

- Water depth, 0.75 ft;
- Bankfull height, 1.0 to 3.0 ft:
- Bankfull width, 16 ft; and
- Lower limit of persistent vegetation above water level, 0.5 ft

Site 2 was located approximately one mile upstream of the reservoir, where measurements were taken from three locations. Minor bank erosion was observed but appeared to be in balance with more natural shifting of the creek banks. It was fairy apparent that the creek was groundwater fed, with at least one spring observed along the banks. The water was moving swiftly at a visually estimated 2 to 3 ft/second. According to the property owner, Mr. Will Williams, the creek flowed almost at the level observed, mostly year-round with the exception of higher flows after higher rainfalls. As observed upstream, the channel bottom was primarily unconsolidated and mobile sand. Some mobile bar deposition was observed in the most upstream measurement location as part of a point bar. This site represented Stage I, Undisturbed. The following measurements were taken:

- Water depth, 2.0 ft;
- Bankfull height, 2.0 to 2.5 ft:
- Bankfull width, 39 to 43 ft; and
- Lower limit of persistent vegetation above water level, -0.3 to -0.50 ft (below water level).

Site 3 was located approximately 300 ft downstream of the dam, where the channel starts to narrow from the scour pool established by the spillway and other dam discharges. The right bank was somewhat bare but did not seem to be eroding significantly such that flows was limiting vegetation growth after higher flows, but not during base flow because of the vegetation observed at the toe of the bank but not mid-height. The left bank had significant sand bar deposition, apparently from the 2010 flood, and showed only sparse vegetation cover. The bank showed a bankfull shelf and two higher terraces which were approximately 5 and 8 ft above the water level, respectively. The lower sand terrace was covered with scattered, isolated gravel, whereas the upper terrace was covered with fine sand. The channel bottom consisted of consolidated shale or mudstone with occasional deposits of mobile sand.

The presence of the dam and its operation appeared to create a somewhat hybrid combination of channel evolution because the discharges over the years were not fully synchronized with the natural channel flow upstream and downstream. However, that channel appeared to re-adjust itself back to dynamic equilibrium within 1,000 ft downstream of the dam. Proceeding from the dam downstream, the stages appeared to be Stages II and III, Disturbance and Incision, Stage IV, Widening and Deposition, and finally downstream, Stages VI and I, Recovery and Undisturbed. Further, it appeared that the base discharge was supplying enough sediment to prevent downstream erosion from sediment hungry waters. Within the channel, the following measurements were taken approximately 300 ft downstream of the dam:

- Water depth, 1.5 ft;
- Bankfull height, 3.0 ft:
- Bankfull width, 53 ft; and
- Lower limit of persistent vegetation above water level, 1.0 ft.

Site 4 was approximately one mile downstream of the dam. The significant feature seen along the left bank was a large raveling slide which extended at least 60 ft above the water level. Although it was a significant eroding feature and contributed to the sediment load along this creek, it appeared to result from more natural meander migration and thereby a part of the natural stream process. The other banks opposite and upstream and downstream of this feature showed well established vegetative cover. The channel bottom upstream of the slide was covered with unconsolidated mobile sand, whereas the channel bottom along the slide was

shale or mudstone with some mobile sand cover. Downstream of the slide, boulders and cobble-sized pieces of shale were along the thalweg (main flow line) with unconsolidated and mobile sand along the banks. The following measurements were taken within the channel:

- Water depth, 1.5 to 2.0 ft;
- Bankfull height, 2.0 to 3.0 ft:
- Bankfull width, 43 to 67 ft; and
- Lower limit of persistent vegetation above water level, 0.0 ft.

Site 5 was the farthest downstream and was approximately four miles downstream of the dam. The two most notable features were the riffle/knickpoint and the bare sand covered bank downstream. The riffle, which consisted of shale or mudstone, was also a knickpoint which was probably a very slow moving headcut migrating upstream; the drop along this knickpoint was approximately two feet. Downstream of this knickpoint, the right bank was covered with bare sand to a height approximately 6 ft above water level. This sand deposit potentially dated back to the 2010 flood. The banks appeared fairly stable with some bank erosion along the right bank, probably from meander migration. Upstream and downstream of the knickpoint, the channel bottom was covered with unconsolidated mobile sand. Although the shale riffle was a knickpoint, the rate of which it was moving appeared to be migrating in geologic time and was not necessarily out of balance. Therefore, this site represented Stage I, Undisturbed. The measurements in the channel upstream and downstream of the knickpoint were:

- Water depth, 2.0 to 2.5 ft;
- Bankfull height, 2.0 to 3.0 ft:
- Bankfull width, 51 to 58 ft; and
- Lower limit of persistent vegetation above water level, 0.0 ft.

According to the Nebraska Department of Natural Resources (DNR) Dam Inventory, the dam is classified as a low hazard dam and was last inspected on October 21, 2012. The dam is listed as having the following characteristics:

- Dam height, 35 ft
- Dam length, 147 ft
- Reservoir size, 42 acres
- Normal reservoir capacity, 180 acre-ft (average depth of 4.3 ft)
- Maximum reservoir capacity, 260 acre-ft (average depth of 6.2 ft)
- Drainage acres, 128,000 acres

The dam's only outlets are the 31-foot long spillway, two penstocks originally for hydroelectric generation (units since removed) and a low level discharge outlet near the base of the dam. There is no emergency spillway. Currently water discharges over the spillway, the low level outlet (unknown if fully open) and one penstock. Given the size of the penstock (apparently 6 feet in diameter) and the observed discharge, it appears to be partially open, either because of the gate being partially open or blocked by debris and sediment in front of the trash gate. The inlet for the other penstock no longer has a trash gate and appears closed. Reportedly from Will Williams, the flows from the 2010 flood nearly overtopped the dam and there was some concern that the dam may breach from floodwaters flanking either abutment, especially the right abutment.

Before the low level discharge outlet was opened, the reservoir was nearly full of sand with open water only within 100 feet from the dam. Since the outlet was opened, sand has moved through this outlet and more open water has returned to a limited extent and is much shallower than what the reservoir is rated by the DNR for depth. It should be noted that the current size of the reservoir is approximately 25% of what it is listed by the DNR to have impounded behind the dam.

The overall condition of the dam is marginal at best, slaking concrete was found at numerous locations along the downstream face of the dam and buttresses, especially a slab that was dangling from the spillway face. Reinforcement steel was found exposed at or above the reservoir level at numerous locations along the upstream face of the dam. Further, there was gap of several inches between the downstream dam face and buttress in at least one location. The guardrails around the gate wells are deteriorating as well as those along the bridge extending over the spillway. This bridge also has several deck pieces missing. Other than around the gatewells and top of the powerhouse, there are no guardrails or widened walkways over the dam making access from the right abutment to the left abutment perilous.

Based upon our observations, the sediment conveyance from upstream to downstream of the dam appeared in dynamic equilibrium with the flows since the base outlet was opened. In a sense, the creek had already reached a state of being essentially having *deminimus* sediment out of balance from what is needed to be transported through the creek system. Although the bathymetric and sediment surveys showed sediment has been removed from the reservoir since 2010, the effect of opening the low level discharge appeared limited and extended only up to the first upstream meander of the reservoir. This plug of sediment removed from the reservoir probably was mobilized soon after opening the low level discharge and was flushed