

Tallapoosa Watershed Project



prepared for

*CSREES
Cooperative State
Research, Education
and Extension
Service
U. S. Department of
Agriculture*



by

*Department of
Fisheries and
Allied Aquacultures
Auburn University*



A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds

Annual Report - 2004



February 2005

List of Abbreviations

ACES	Alabama Cooperative Extension System
AU	Auburn University
Camp ASCCA	Alabama Special Camp for Children and Adults
CSREES	Cooperative State Research, Education and Extension Service
LWLM	Lake Watch of Lake Martin
MTCWP	Middle Tallapoosa River Basin Clean Water Partnership
TCWP	Tallapoosa River Basin Clean Water Partnership
UA	University of Alabama

TALLAPOOSA WATERSHED PROJECT

Annual Report – 2004

Year 1

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I. EXECUTIVE SUMMARY

The Tallapoosa Watershed Project (TWP) is a three-year project, which began on September 15, 2003 following a series of planning meetings by researchers, educators and other stakeholder groups. This progress report documents activities and accomplishments of the first calendar year (January-December 2004), which concentrated on the environment and communities of Lake Martin and regions of the Middle and Upper Tallapoosa Basin.

The **Auburn University (AU)** research team made seven monthly trips to Lake Martin from April through October 2004 and measured chlorophyll *a*, total nitrogen (TN), total phosphorus (TP), soluble reactive phosphorus (SRP), total suspended solids (TSS), pH, alkalinity, hardness, turbidity, conductivity, water temperature, dissolved oxygen and Secchi disk visibility at 20 sites on the lake following Standard Methods. AU also measured TN, TP, SRP, TSS, pH, alkalinity and discharge from six stream sites, three river sites and two point sources monthly, February-December 2004. Gages were installed on the six streams (four agricultural and two forested) for the continuous monitoring of water level for developing hydrographs to be used in estimating nutrient and sediment loading.

The **University of Alabama (UA)** research team had six monthly trips to Lake Martin from April through October 2004, coincident with the AU team and the Landsat satellite overpass. Satellite images were used to derive land use and land cover information and map water quality parameters, e.g., chlorophyll *a*. Close-range hyperspectral remote sensing of water quality was conducted with an ASD FieldSpec UV/VNIR spectroradiometer. Watershed modeling was begun using the SWAT model.

The **Lake Watch of Lake Martin (LWLM)** team measured water quality monthly, April-October 2004 (coincident with AU and UA teams) at five shoreline sites and five open-water sites on Lake Martin using the Alabama Water Watch (AWW) test kit for six physicochemical parameters (water temperature, pH, alkalinity, hardness turbidity and dissolved oxygen), TSS and Secchi disk visibility. Close-range hyperspectral remote sensing of water quality was conducted with a StellarNet EPP2000C spectroradiometer for correlation with lake chlorophyll *a* concentrations and for comparison to the spectroradiometer of UA.

An **evaluation of two models of hand-held colorimeters** (LaMotte Smart2 and Hach DR/850) for the analysis of nutrients in water was conducted on five dates by the AU and LWLM teams.

A **teacher workshop** on the approach of TWP and stream bioassessment was conducted for 15 teachers in the Tallapoosa Basin in April 2004. Field trips and instruction about the TWP and watershed management were conducted in **Classroom in the Forest** sessions twice in April and twice in May.

Planning meetings were held for the State of Our Watershed Conference and TWP exhibits to be developed at the Environmental Center of Alabama's Special Camp for Children & Adults

(ASCCA). TWP updates were presented at three Tallapoosa River Basin Clean Water Partnership meetings.

TWP presentations were made at the CSREES Water Quality Conference in Florida in January, the National Water Quality Monitoring Conference in Tennessee in May, the Alabama Water Resources Conference in Florida in September, and the AmericaView 2004 Conference in South Dakota in September.

The **TWP Research and Education/Extension Teams** were established in October 2003. The Education/Extension Team met in October 2004 and the Research Team met in March 2004 for project planning.

TWP Directors Meetings were held in February, August and November 2004 for overall project planning.

A **TWP Intranet** was completed in September 2004 for project partners to input and access the project calendar, research and outreach activities, photos, meeting minutes and other project-related information. A **TWP Website** was registered and is being developed.

The TWP project has collaborated with five **Related Projects** in the Tallapoosa Basin for mutually beneficial activities and additional financial resources, including: 1) the Tallapoosa River Basin Clean Water Partnership (funds for two stream gages and stream bioassessment), 2) Auburn University Environmental Institute (grant to the AU Fisheries Department for teacher workshops, interns in classrooms, and stream bio-monitoring protocols) 3) CSREES (grant to the Alabama Cooperative Extension System (ACES) for a Community-based Restoration Initiative), 4) Alabama Cooperative Extension System (Classroom in the Forest Program), 5) Auburn University Department of Agricultural Economics and Rural Sociology (a cost-efficiency study of TWP research methodologies).

II. PROJECT BACKGROUND

• Directors, Collaborators and Partners

Project Directors

Dr. Bill Deutsch

Project Director (PD) Research Fellow, Department of Fisheries and Allied Aquacultures, Auburn University (AU)

Dr. David Bayne

(Co-PD) Professor, Department of Fisheries and Allied Aquacultures, AU

Dr. Luoheng Han

(Co-PD) Associate Professor, Department of Geography, University of Alabama

John Glasier

(Co-PD) Vice President Lake Watch Lake Martin

Robin Nelson

(Co-PD) Environmental Education Specialist, Alabama Department of Education (ADE) (March 2003 through August 2004), Montgomery, Alabama

Sallye Longshore

(Co-PD) Environmental Education Specialist, ADE (September 2004 to present), Montgomery, Alabama

Collaborators**Dr. Len Vining**

Project Coordinator (March 2003 through March 2004), Agricultural Program Associate, Department of Fisheries and Allied Aquacultures, AU

Omar Romagnoli

Project Coordinator (June 2004 through December 2004), Department of Fisheries and Allied Aquacultures, AU

Eric Reutebuch

Research Associate, Department of Fisheries and Allied Aquacultures, AU

Tommy Futral

County Extension Coordinator, Alabama Cooperative Extension System (ACES)

Dick Bronson

President, Lake Watch Lake Martin (LWLM)

Wendy Seesock

Research Associate, Department of Fisheries and Allied Aquacultures, AU

Partner Institutions**Lake Watch of Lake Martin (LWLM)**

The main goal of LWLM is to maintain, improve and protect Lake Martin and surrounding waters through citizen volunteer water quality monitoring.

Alabama Special Camp for Children and Adults (ASCCA)

The Camp ASCCA Mission is to help children and adults with disabilities achieve equality, dignity, and maximum independence through a program of camping, recreation, and education.

Alexander City Schools

The Alexander City Schools, headed by Superintendent Tommy Bice, includes five public schools ranging from elementary through high school whose teachers and students are direct beneficiaries of the project's environmental education initiatives.

City of Alexander City

Alexander City, situated adjacent to Lake Martin, is the largest municipality in the Middle Tallapoosa watershed. The Alexander City mayor chairs the Middle Tallapoosa River Basin Clean Water Partnership.

Alabama Department of Environmental Management (ADEM)

ADEM is the state agency responsible for enforcing rules and regulations to protect and improve the quality of Alabama's environment and the health of all its citizens.

Alabama Cooperative Extension System (ACES)

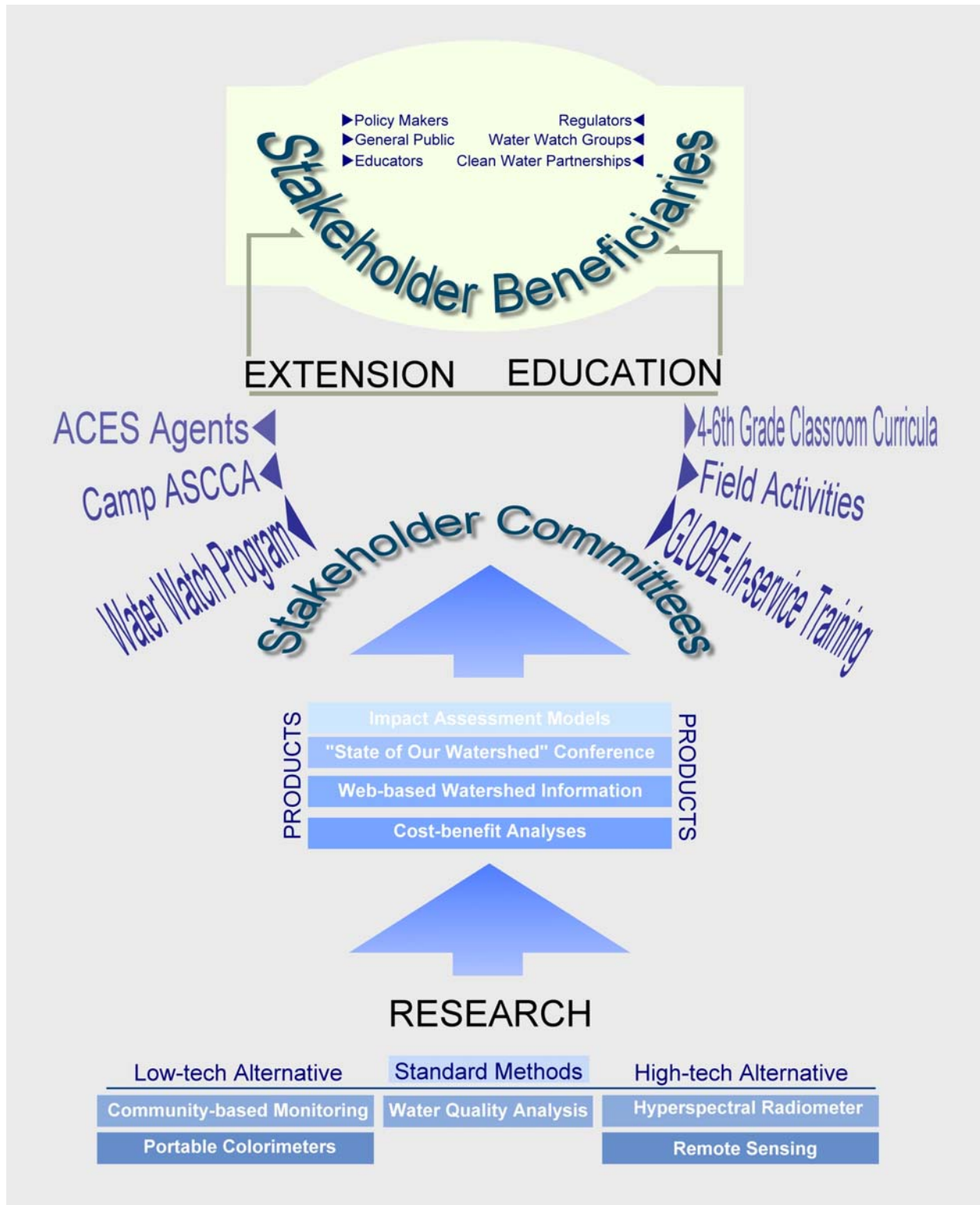
ACES, the primary outreach organization for the land-grant mission of Alabama A&M University and Auburn University, delivers research-based educational programs that enable people to improve their quality of life and economic well-being.

Tallapoosa River Basin Clean Water Partnership (TCWP)

TCWP is a coalition of public and private individuals, companies, organizations and governing bodies working together to protect and preserve water resources and aquatic ecosystems of the Tallapoosa Basin.

Tallapoosa County Schools

The Tallapoosa County School District, headed by Superintendent Ginger East, includes seven public schools ranging from elementary through high school whose teachers and students are direct beneficiaries of the project's environmental education initiatives.



A Model of the Tallapoosa Watershed Project

• Project Description

The TWP integrates a variety of research, education, and extension activities to provide relevant, locally-generated watershed information.

Research will result in a comprehensive assessment of nutrient concentrations and loading in the Tallapoosa River Basin and also compare the cost-efficiency of three levels of monitoring technology, high-tech (remote sensing), Standard Methods (APHA 1998*), and low-tech (citizen volunteer data).

Research results will be adapted for education in the form of in-classroom curricula, teacher workshops, and a public display at the environmental center of Camp ASCCA.

Research results will also be available to stakeholder groups through the Alabama Water Watch and Alabama Cooperative Extension System websites.

The project will benefit the research, outreach and resource management aspects of ADEM and the Tallapoosa River Basin Clean Water Partnership, and should be adaptable for other southeastern watersheds.

*APHA (American Public Health Association), American Water Works Association and Water Pollution Control Federation. 1998. Standard methods for the examination of water and wastewater. 20th edition. APHA, Washington, D.C.

• Project Objectives

The overall goal of this three-year project is to develop cost-effective options for assessing and managing nutrient and sediment loading of surface waters on a watershed scale, and to convey information related to nutrients and other aspects of water quality to a broad range of stakeholders.

The TWP has four components, which relate to research, education and extension objectives:

- 1) Quantify nutrient and sediment loading in the Tallapoosa River Basin using Standard Methods for field and laboratory analyses,
- 2) Develop both high-tech (remote sensing and GIS/modeling) and low-tech (citizen volunteer monitors) options for assessing nutrients,
- 3) Communicate project results to diverse stakeholder groups through web-based technology, high profile community outlets and middle school educational programs (in-class curricula and field activities) and
- 4) Establish an institutional framework and decision-support system that complements the existing Clean Water Partnership.

The approach is intended to be transferable to other watersheds in the southeastern U. S. and to be readily adaptable and relevant to Alabama's future water quality trading program.

III. PROJECT MANAGEMENT

• Project Directors Meetings

Project Directors and partners met to review progress and plan for TWP implementation.

1. Planning Meeting: February 26, 2004. Auburn University, AL.

Participants discussed Lake Watch of Lake Martin (citizen volunteer) lake sampling activities. Attendees: Bill Deutsch, David Bayne, Len Vining, Dick Bronson and John Glasier.

2. Data Review and Planning Meeting: August 3, 2004. Camp ASCCA, Jackson's Gap, AL.

Participants reviewed all research findings to date, discussed adjustments to sampling methods and analyses, planned for future sampling, discussed progress on the TWP intranet, website and reporting and planned for the State of Our Watershed Conference. Attendees: John Glasier, Dick Bronson, Bill Deutsch, Luoheng Han, Omar Romagnoli, David Bayne, Eric Reutebuch, Wendy Seesock, Tommy Futral, Robin Nelson, Stan Roark (ACES, Randolph Co.), Ralph Jones (Lake Wedowee Property Owners Association), Harold Harbert (Georgia Adopt-A-Stream), Eve Brantley (Agronomy & Soils, AU), Dan Gilliland (Camp ASCCA Program Director).

3. Data Review/Planning Meeting: November 23, 2004. Camp ASCCA, Jackson's Gap, AL.

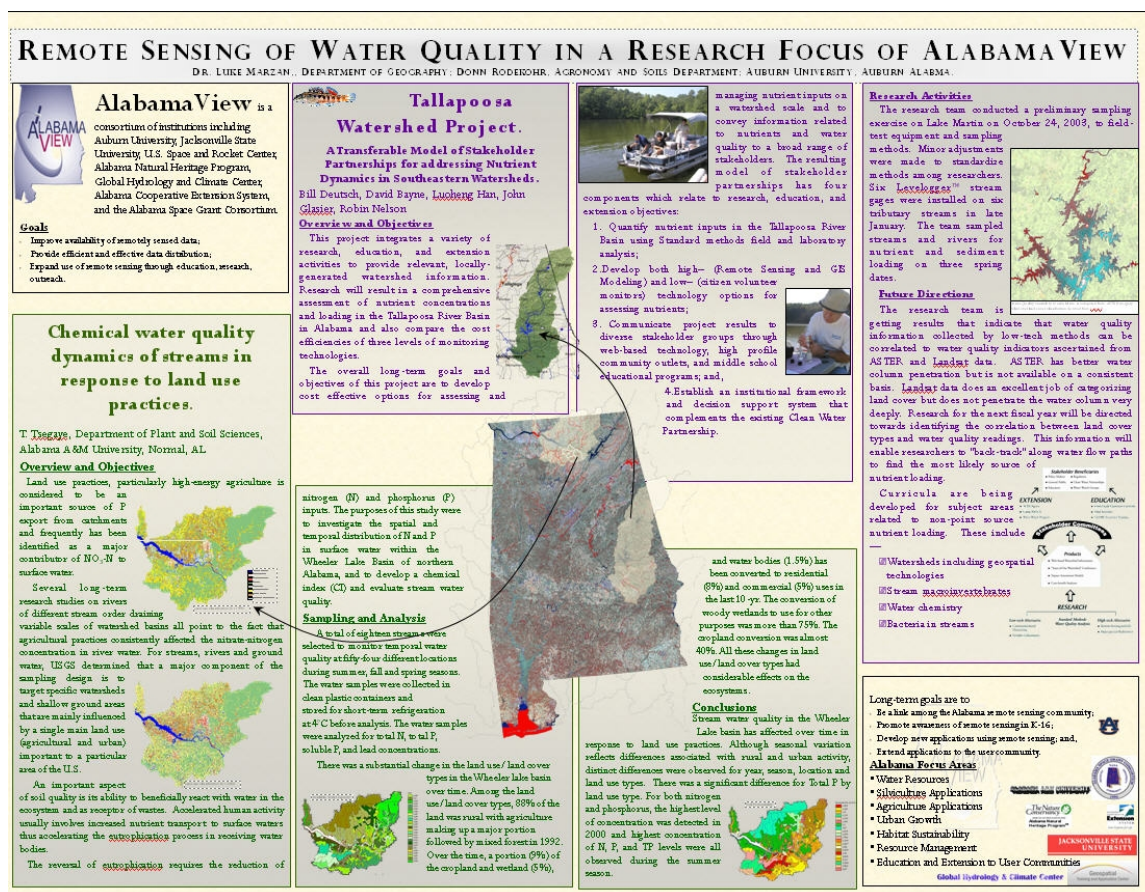
The Auburn University (AU) Research team presented results of water quality sampling on Lake Martin for the complete growing season, and results from nine months of stream sampling. An evaluation of volunteer monitor (LWLM) open-water data versus AU data, and volunteer monitor shoreline versus open-water data were presented. A summary of results of volunteer monitor nutrient testing using two hand-held colorimeters was also presented. University of Alabama presented results from hyperspectral analyses of Lake Martin relative to chlorophyll *a* concentrations measured by AU, as well as a chlorophyll *a* map of lakes Martin and Harris (generated from Landsat satellite imagery and in-situ chlorophyll *a* measurements). Overviews of Education/Extension activities, the TWP intranet, progress report and website, the TWP budget and Related Projects were given. Participants discussed 2005 field sampling and the State of Our Watershed Conference to be held in May 2005. Attendees: John Glasier, Dick Bronson, Bill Deutsch, Luoheng Han, Omar Romagnoli, David Bayne, Eric Reutebuch, Tommy Futral, Robin Nelson, Charles Eick (Curriculum and Teaching, AU), Jenny Fuller (perspective graduate student) and husband Michael Fuller, Dan Gilliland (Camp ASCCA Program Director).

• TWP Conferences and Meetings

TWP representatives presented project overviews or updates at several professional conferences and meetings.

Conferences

1. CSREES National Water Quality Conference: January 11-14, 2004. Clearwater, FL.
Len Vining presented the TWP poster, titled "A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds," as part of the Auburn University ACES poster session.
2. National Water Quality Monitoring Conference: May 18, 2004. Chattanooga, TN.
Bill Deutsch and Sergio Ruiz-Córdova presented the TWP poster, titled "A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds."
3. Alabama Water Resources Annual Conference: Sept. 8-10, 2004. Orange Beach, FL.
John Glasier made two presentations: "The Tallapoosa Watershed Project: A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds" and "Hyperspectral Sensing of Water Quality in Lake Martin, Alabama" (Appendix C, pages 45-47), and Dick Bronson displayed a poster: "Linking Alabama Water Watch Volunteers to Classrooms for Improved Aquatic Science Education" (Appendix C, page 49).
4. AmericaView Conference 2004: September 20-22, 2004. EROS Data Center, Sioux Falls, South Dakota. Donn Rodekoeh, from the AU Department of Agronomy & Soils displayed the poster featuring the TWP, titled "Remote Sensing of Water Quality in a Research Focus of Alabama View". Representatives from at least 16 states were in attendance.



Poster featuring the TWP, displayed at the AmericaView Conference 2004

Meetings

1. Tallapoosa River Basin Clean Water Partnership (TCWP) Steering Committee Meeting: January 8, 2004. Montgomery, AL.

Participants discussed goals and objectives of the educational component of the TWP and plans for the “State of Our Watershed” Conference. Curricula to be used at teacher workshops and pictures of the “Classroom in the Forest” Program were exhibited. Attendees: Tommy Futral, Robin Nelson, Len Vining, Alabama CWP Steering Committee audience.

2. Middle Tallapoosa River Basin Clean Water Partnership (MTCWP) Technical Subcommittee Meeting: February 24, 2004. Alexander City, AL.

Eric Reutebuch gave a presentation titled “Nutrients and Lake Eutrophication.”

3. TCWP Steering Committee Meeting: October 28, 2004. Montgomery, AL.

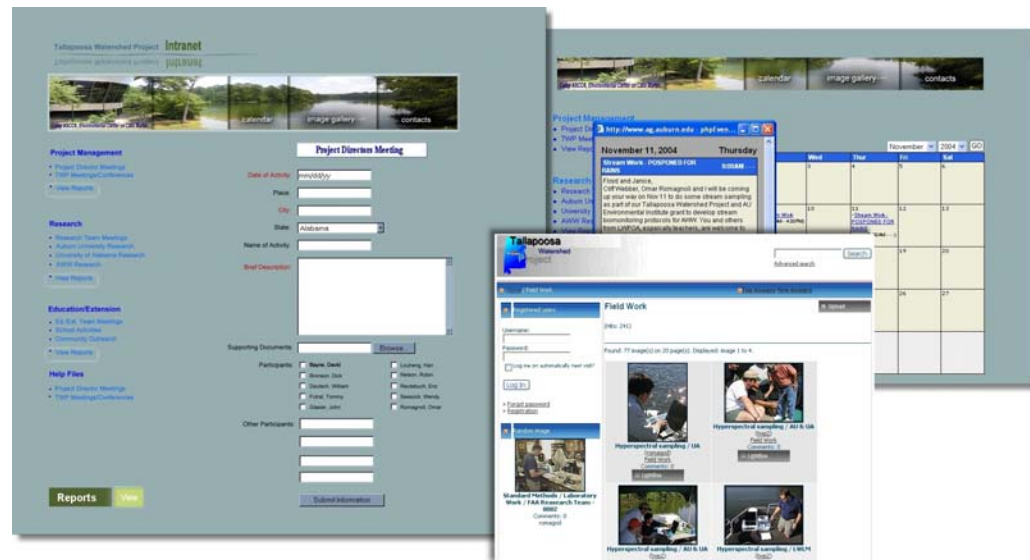
Bill Deutsch gave a TWP background and progress update to the TCWP Steering Committee.

• Resource Development

Written and electronic resources were designed and developed for better communication of TWP activities, accomplishments and impacts to project partners, educators and the general public.

1. TWP Intranet: September 24, 2004.

An Intranet was developed for project partners to access and add to the project calendar, research and outreach activities, photos and meeting minutes.

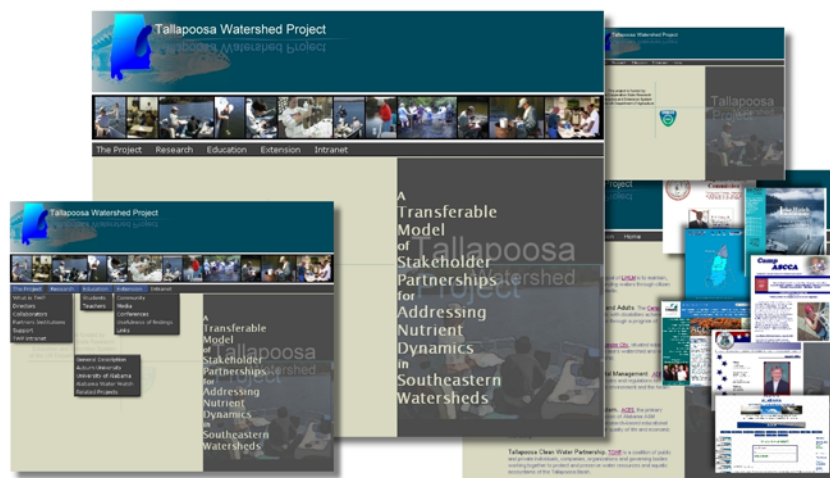


2.

TWP Website Registration: October 14, 2004.

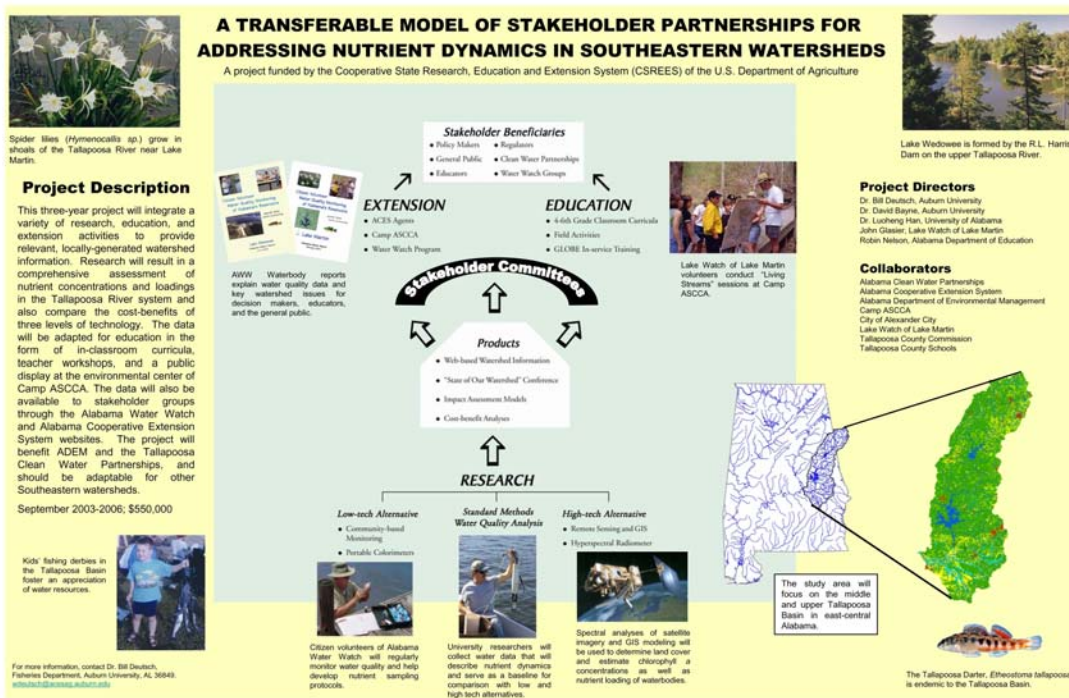
A website is under construction and has been registered under the URL:

<http://www.twp.auburn.edu>. The website resides on the FrontPage server at Auburn University.



3. Project Poster.

The project poster, composed in October of 2003 to communicate TWP goals to the public, was displayed at several meeting and conferences.



• Reports, Publications and Conference Presentations

1. CRIS/CSREES AD-421 Progress Report: October 28, 2004.
A TWP progress report through October was submitted online to the Current Research Information System of the CSREES website. It may be read at: <http://cris.csrees.usda.gov>.
2. A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds. Poster presentation at the CSREES National Water Quality Conference: January 11-14, 2004. Clearwater, FL.
3. A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds. Poster presentation at the National Water Quality Monitoring Conference: May 18, 2004. Chattanooga, TN.
4. The Tallapoosa Watershed Project: A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds. Presentation at the Alabama Water Resources Annual Conference: Sept. 8-10, 2004. Orange Beach, FL (Appendix C, page 47).
5. Hyperspectral Sensing of Water Quality in Lake Martin, Alabama. Presentation at the Alabama Water Resources Annual Conference: Sept. 8-10, 2004. Orange Beach, FL (Appendix C, page 45).
6. Linking Alabama Water Watch Volunteers to Classrooms for Improved Aquatic Science Education. Poster presentation at the Alabama Water Resources Annual Conference: Sept. 8-10, 2004. Orange Beach, FL (Appendix C, page 49)
7. Remote Sensing of Water Quality in a Research Focus of Alabama View. Poster presentation at AmericaView Conference 2004, September 20-22, 2004. EROS Data Center, Sioux Falls, South Dakota (page 11).

IV. RESEARCH

• Research Team Meetings

- A. Research Team Meeting: March 3, 2004. Alexander City, AL.
Participants discussed the coordination of sampling, analyses, and modeling efforts for the 2004 growing season. Attendees: John Glasier, Bill Deutsch, David Bayne, Dick Bronson, Luoheng Han, Jackie Crim, Brandon Cooper (UA), Fred Leslie (ADEM).

University researchers are collecting data that will quantify nutrient and sediment dynamics and serve as a baseline for comparison with low and high-tech alternatives.



Standard Methods

Hyperspectral analysis of surface waters, analysis of satellite imagery, and GIS modeling is being used to estimate chlorophyll *a* concentrations, determine land cover, and determine nutrient and sediment loading of waterbodies.



High-tech Methods

Citizen volunteers of Alabama Water Watch are regularly monitoring water quality and helping to develop nutrient and sediment sampling protocols.



Low-tech Methods

• Auburn University Research

1. Stream Gage Installation: January 27-28, 2004.

David Bayne, Wendy Seesock, Eric Reutebuch and graduate students installed Levellogger stream gages on four agriculture and two silviculture streams. Stream gages were ordered from Solinst Canada Ltd. after reallocation of \$8,000 of the CSREES grant for their purchase.

2. Preliminary Gage Data Downloading: February 4, 2004.

Eric Reutebuch checked all stream gages and ran a preliminary data download to verify that all were operational.

3. Stream Sampling.

Eric Reutebuch, Wendy Seesock, David Bayne and graduate students sampled agriculture and silviculture tributary streams, urban sites and Tallapoosa River sites (11 sites total) for nutrients (TN, TP, SRP), TSS and discharge on the following dates: February 12 and 19, March 11, April 8, May 3, June 2, July 7, August 4, September 7 and 27, October 12, November 3, and December 1 and 9, 2004.

4. Lake Martin Sampling.

David Bayne, Eric Reutebuch, Wendy Seesock and graduate students sampled 20 sites on Lake Martin for chlorophyll *a*, TN, TP SRP, TSS, pH, alkalinity, hardness, turbidity, conductivity, water temperature, dissolved oxygen and Secchi disk visibility on April 15, May 17, June 17, July 20, August 19, September 22 and October 7, 2004. The sampling dates were coincident with LWLM water quality monitoring, UA hyperspectral sampling and Landsat satellite flyovers.

5. Standard Operating Procedure for TSS Analyses: May 2004.

Eric Reutebuch developed a Standard Operating Procedure (SOP) for citizen and municipal technician analyses of TSS in which the city of Alexander City performs filter pad cleaning, drying, pre-weighing and post-weighing and the citizen monitors perform sample water collection and filtering.

6. Gage Data Downloading: May 26, 2004.

Eric Reutebuch and Wendy Seesock downloaded gage data from all stream gages and performed gage maintenance.

7. Color Comparator: August 16, 2004.

Eric Reutebuch ordered a LaMotte Forel-Ule color comparator from Carolina Biological Company for determining lake color. Color was measured on Lake Martin for the remainder of the growing season (through October) using the Forel-Ule comparator.

8. Gage Data Downloading: September 3, 2004.

Eric Reutebuch and Daniel Smith downloaded gage data from all stream gages, cleared memory and restarted gages, and performed gage maintenance.

• University of Alabama Research

1. Hyperspectral Remote Sensing Data Collection.

Luoheng Han conducted hyperspectral remote sensing data collection concurrent with the AU and LWLM teams on April 15, June 17, July 20, August 19, September 22 and October 7, 2004 on Lake Martin. The high-end close range hyperspectral sensor used in this effort was the ASD FieldSpec UV/VNIR. All hyperspectral reflectance data were processed. The relationship between spectral reflectance and major water quality parameters, such as chlorophyll *a*, TSS, and Secchi disk visibility were analyzed.

2. Satellite Remote Sensing.

Luoheng Han acquired Landsat TM images to 1) derive current land use and land cover information which is needed in GIS modeling of nutrients and water quality, and 2) map water quality of Lake Martin, e.g., chlorophyll *a* concentration. Three cloud-free Landsat 5 TM images were purchased from USGS: October 22, 2003, April 15, 2004, and September 22, 2004. Images from the latter two occasions were processed and analyzed. The digital numbers were converted to reflectance values through radiometric correction procedures. A chlorophyll *a* map for Lake Martin was derived from the April 15th image. A supervised land use and land cover (LU/LC) classification was performed using the September 22nd Landsat image. The LU/LC classes include: urban, agricultural land, pasture, disturbed land, evergreen forest, mixed forest, water, and wetland. A field trip to ground truth the LU/LC classification was conducted on October 22, 2004.

3. GIS Modeling.

The SWAT model was used in a GIS platform to predict nutrient (phosphorus, nitrogen) and sediment loading into Lake Martin. Input layers to the model included land use and land cover (derived from a Landsat 5 TM image acquired on September 22, 2004), soils and climate data.

• Alabama Water Watch Research

1. Lake Martin Sampling.

Dick and Mary Ann Bronson conducted citizen water quality sampling and John Glasier conducted hyperspectral sensing on Lake Martin on April 15, May 17, June 17, July 20, August 19, September 22, and October 7, 2004. The low-end close range hyperspectral sensor used in this effort was the StellarNet EPP2000C spectroradiometer.

2. Colorimeter Study: May 13, 2004.

Eric Reutebuch ran a preliminary analysis of TP using the LaMotte SMART2 colorimeter (procedure No. 4024).

3. Citizen Training in TSS and TP (Colorimeter) Analyses: May 20, 2004.

Eric Reutebuch trained a group of citizens in TSS analysis, and TP analysis using the LaMotte Smart2 colorimeter (procedure No. 4024) using water collected from Lake Martin. Participants: John Glasier, Dick Bronson and Chris Abbot (Alexander City Water Works).

4. TSS and Colorimeter Study: June 23, 2004.

Dick Bronson, John Glasier, Eric Reutebuch and Omar Romagnoli conducted analyses of TSS and TP (using the LaMotte SMART2 colorimeter, procedure No. 4024).

5. Colorimeter Study: July 29, 2004 and August 28, 2004.

Eric Reutebuch conducted analysis of TP using the Hach DR/850 colorimeter (procedure No. 8190).



LWLM citizen monitors conducting nutrient analysis at Auburn University

• **Preliminary Research Results**

(See Appendix D for Figures 1-12)

Analyses of Year 1 (2004) research data are ongoing; therefore the following results are preliminary. All Year 1 objectives were accomplished. All lake fieldwork was conducted within one day of the Landsat satellite flyover, except the August outing (which was within two days of the flyover) to maximize relationships between satellite imagery and optically active constituents (chlorophyll *a*, TSS, Secchi disk visibility) of the lake water. Data has been received from the Alabama Department of Environmental Management, and will be included in ongoing analyses.

1. Standard Methods – Auburn University Research

A. Watershed Sampling (stream, river and point source sites, Figure 1)

1) Hydrographs from stream gages indicated that stream flow was highly variable (flashy) in the gaged second order streams; and that for rain-event sampling, water samples should be collected within 6-12 hours after the onset of a rainfall/runoff event to measure nonpoint source nutrient and sediment loading.

2) Agricultural streams were about five times greater in TN and TP concentrations and two times greater in TSS concentration than silvicultural streams (data from 2-10/2004, Figure 2).

3) Sampled point sources (two waste water treatment plants) were 64 times greater in TN concentration, 154 times greater in TP concentration and 18 times greater in TSS concentration than silvicultural streams (data from 2-7/2004, Figure 3).

4) The silvicultural stream with active clear cutting in the watershed (site F-2) had two times greater TSS concentration than the silvicultural stream without clear cutting (site F-1) (data from 2-10/2004, Figure 2).

B. Lake Sampling (20 sites on Lake Martin, Figure 4)

1) Nutrient (TP), Secchi disk visibility and chlorophyll *a* results indicated that the lower end of Lake Martin (near the dam) was oligotrophic, the middle section of the lake transitioned from oligotrophic to mesotrophic, and the upper section of the lake was eutrophic (data from 4-10/2004, Figure 5).

2) Coley Creek Embayment, which receives treated municipal wastewater, was the most enriched site sampled (growing season mean chlorophyll *a* concentration of 18.4 µg/L for the photic zone composite, data from 4-10/2004, Figure 5).

2. High-Tech Alternative – University of Alabama

A. Lake Sampling

1) Two cloud-free Landsat TM images were acquired for the 2004 growing season (April 15th and September 22nd). The other five sampling dates yielded cloudy imagery. A color-coded chlorophyll *a* map for Lake Martin was derived from the April Landsat image, and another chlorophyll *a* map is being processed for the September image. Color-coding of the chlorophyll map generally agreed with *in situ* chlorophyll readings (Figure 6). Refinements to the modeling are ongoing.

2) Analysis of the relationship between hyperspectral reflectance, using the ASD FieldSpec UV/VNIR close range hyperspectral sensor, and optically active water quality parameters (chlorophyll *a*, TSS, Secchi disk visibility) of the lake water has yielded high correlations, and further analyses are ongoing.

B. Watershed Modeling

1) A 2004 land use and land cover map, which is used in the GIS modeling, was successfully generated for the Middle and Upper Tallapoosa River basins from Landsat satellite imagery.

2) The SWAT model was successfully used in a GIS platform to predict preliminary estimates of nutrient and sediment loading into Lake Martin.

3. Low-Tech – Alabama Water Watch Research

A. AWW Water Chemistry Monitoring Compared to Standard Methods

Following are conclusions of AWW citizen monitor results, measured by members of LWLM at four open-water sites (sites 33, 34, 35 and 37) compared to AU Standard Methods results measured side-by-side at four AU sites (sites 11, 14, 18 and 20, Figure 7) on Lake Martin during the 2004 growing season (April-October). All comparisons are of growing season means (n=7 observations per mean).

1) AWW pH means across the four sites were all within 0.1 pH units of Standard Methods means, the mainstem lake was slightly above neutral pH, and the eutrophic embayments had the highest pH (up to 8.5, Figure 8).

2) AWW total alkalinity means across the four sites were all higher than Standard Methods means, but all were within 7.6 mg/L of Standard Methods means (average deviation from Standard Methods mean was 7.2 mg/L), and all sites were relatively low in alkalinity (growing season mean range of 19-24 mg/L, Figure 8).

3) AWW total hardness means across the four sites were all within 2.5 mg/L of Standard Methods means (average deviation from Standard Methods mean was 0.95 mg/L), and all sites had relatively soft water (growing season mean range of 10-14 mg/L, Figure 8).

4) AWW turbidity means across the four sites were all within 3.5 turbidity units of Standard Methods means (average deviation from Standard Methods mean was 1.6 units), and all sites had relatively low turbidity (growing season mean range of 2-9 units, Figure 9). Note that AWW measures turbidity in JTUs, while AU measures turbidity in NTUs.

5) AWW dissolved oxygen means across the four sites were all lower than Standard Methods means, but all were within 2.0 mg/L of Standard Methods means (average deviation from Standard Methods mean was 1.48 mg/L), all were above ADEM's required 5.0 mg/L minimum for Fish and Wildlife Use Classification, and the greatest deviation was in the most eutrophic embayment, Coley Creek (Figure 9).

6) AWW Secchi disk visibility means across the four sites were all within 0.1 meters of Standard Methods means (average deviation from Standard Methods mean was 0.075 meters), and at all four sites the AWW Secchi-based Trophic State was the same as that of AU (Figure 9).

B. AWW Shoreline Water Chemistry Compared to Open-water Results

Following are conclusions of AWW citizen monitor results, measured by members of LWLM at four shoreline sites (sites 2, 3, 7 and 10) compared to four nearby open-water sites (sites 36, 34, 33 and 35, Figure 10) on Lake Martin during the 2004 growing season (April-October). All comparisons are of growing season means (n=7 observations per mean).

1) Shoreline pH means across the four sites were all within 0.1 pH units of open-water means (Figure 11).

2) Shoreline total alkalinity means across the four sites were all within 7.5 mg/L of open-water means (average deviation from open-water mean was 3.9 mg/L, Figure 11).

3) Shoreline total hardness means across the four sites were all within 4.3 mg/L of open-water means (average deviation from open-water mean was 1.9 mg/L, Figure 11).

4) Shoreline turbidity means were similar to open-water means at one pair of sites (site 3 versus site 34, within 0.2 JTUs), but were 2.1 to 4.3 times higher than the open-water means at the other three pair of sites (Figure 12).

5) Shoreline dissolved oxygen means across the four sites were all within 0.7 mg/L of open-water means (average deviation from open-water mean was 0.45 mg/L, Figure 12).

6) Shoreline Secchi disk visibility means were similar to open-water means at two pairs of sites (site 7 versus site 33 and site 3 versus site 34, within 0.3 meters), but deviated significantly from the open-water means at the other two pairs of sites (from 0.5 to 1.4 meters, Figure 12).

C. AWW Nutrient Testing Using Hand-held Colorimeter

Testing was conducted on both LaMotte Smart2 and Hach DR/850 colorimeters for total phosphorus (TP), using a Velp Scientifica ECO 8 block heater for sample digestion.

1) The results of running standard curves on five dates indicated a lower limit of about 0.05 mg/L as P in sensitivity for both colorimeters. Note that during the growing season, only 6 of 280 Standard Methods measurements of TP (2% of all readings) were above 0.05 mg/L.

2) The results of running samples on four dates indicated that the hand-held colorimeters overestimated TP in 85 % of samples tested, and readings ranged from 0.4 to 7.4 times the Standard Methods TP value.

3) TP analysis for citizen volunteers is expensive (start-up cost of about \$1,500) and time-consuming (one analysis of 8-16 samples requires nearly a whole day).

4) TP analysis for citizen volunteers is technically difficult because: a. glassware (pipettes) and sample collecting bottles must be acid-washed, b. the analysis requires multiple steps of digestion, neutralization, color development and reading, and c. TP standards should be prepared and run periodically with samples.

5) TP analysis using hand-held colorimeters may not be appropriate for relatively nutrient-poor waters (Lake Martin), but may be useful for more enriched waters, such as the TWP agricultural streams mentioned above.

D. LWLM Hyperspectral Sampling Compared to the ASD FieldSpec UV/VNIR

Preliminary analysis of side-by-side measurements of the relatively low-cost LWLM StellarNet spectrometer and that of the University of Alabama (ASD FieldSpec UV/VNIR) indicated that the StellarNet performed well and has potential for monitoring chlorophyll in Alabama lakes. Data analyses are ongoing.

E. LWLM Total Suspended Solids Sampling

LWLM citizen monitors and an Alexander City WWTP official successfully completed training in TSS sampling. LWLM monitors collected and filtered lake water samples for TSS analysis and Alexander City personnel processed the samples (drying and weighing on a Mettler balance). Preliminary TSS results compared closely with AU results.

• Research Plans for Year 2

The Alabama Department of Environmental Management (ADEM) and LWLM will sample at multiple sites throughout the growing season on Lake Martin. AU, UA, ADEM and the Lake Wedowee Property Owners Association (LWPOA) will sample at multiple sites on Harris Lake (also known as Lake Wedowee). AU will continue its second year of stream and river sampling. UA will continue working on chlorophyll *a* mapping, GIS modeling of watershed nutrient and sediment loading using SWAT, and analysis of hyperspectral results relative to water chemistry measured by Standard Methods.

V. EDUCATION/EXTENSION

• Education and Extension Team Meetings

1. Education/Extension Meeting: October 27, 2004. Camp ASCCA, Jackson's Gap, AL. Bill Deutsch and a visitor from Thailand toured the new Environmental Center with Dan Gilliland, Camp ASCCA Program Director. Bill and Dan discussed the future TWP exhibit at the center, and other environmental education exhibits that the TWP may assist with.



Project Directors Meeting at Camp ASCCA on August 3, 2004

• School Activities

1. Teacher Workshop: April 28-29, 2004. Camp ASCCA, Jackson's Gap, AL. Tommy Futral coordinated a Teacher Education Workshop, where Bill Deutsch and Robin Nelson trained 16 teachers from Alexander City, Jackson's Gap, Camp Hill, Dadeville, Union Springs, Notasulga and New Site. The teachers learned about watersheds and environmental issues in a watershed. Participants received a notebook on how to conduct a week-long activity on watersheds with their students. The teachers created a 3-D, watershed model during the two-day training and then utilized it to simulate runoff, erosion, and point and non-point source pollution. The participants also received training on macroinvertebrates and stream bioassessment, and received the new MacroMania game to play with their students.

• Community Outreach

1. Television Show: August 19, 2004. Alexander City, AL.
Tommy Futral presented a TWP update on the Channel 64 television station program called, "Front Porch" conducted by Kenny Dean.
2. AWW Annual Technical Conference: February 7, 2004. Auburn University, AL.
John Glasier presented an overview of the TWP. Eric Reutebuch and Jacqueline Crim gave a presentation titled "Nutrient Monitoring Options in AWW." Len Vining presented new educational resources being developed as part of the TWP.

• Education/Extension Plans for Year 2

AWW will continue working with the AU Department of Curriculum and Teaching to conduct teacher workshops and to develop aquatic science curricula that incorporate methods/results from project research. A cost-efficiency study will be continued in collaboration with the AU Department of Agricultural Economics and Rural Sociology for assessing the economics of the different levels of environmental monitoring (hi-tech, Standard Methods, low-tech) used in this project. Research findings will be disseminated to the public via a broad-based extension effort including county extension agents, a TWP website, permanent displays at Camp ASCCA, and a State of Our Watershed Conference in May 2005.

VI. RELATED PROJECTS

• Cooperative State Research, Education and Extension Service (CSREES): Community-based Restoration Initiative

TWP partners collaborated with a CSREES project of Eve Brantley (ACES at AU) that focused on community outreach and installation of rain gardens in the Tallapoosa Basin.

1. Rain Garden Installation: July 12, 2004. Bailey Sportsplex Park, Alexander City, AL.
Tommy Futral, John Glasier, Dick Bronson, Eve Brantley and Charlene LaBlue installed a demonstration rain garden. Cooperators included Master Gardeners, LWLM volunteers, Auburn University students and faculty, and city workers.
2. Rain Garden Installation: July 13, 2004. Radney Elementary School, Alexander City, AL.
Tommy Futral, John Glasier, Dick Bronson, Eve Brantley and Charlene LaBlue installed a demonstration rain garden. Cooperators included Master Gardeners, LWLM volunteers, Auburn University students and faculty, Boys and Girls Club volunteers and city workers.
3. Rain Garden Installation: July 21, 2004. Benjamin Russell High School, Alexander City, AL.
Tommy Futral, John Glasier, Dick Bronson, Eve Brantley and Charlene La Blue installed a

demonstration rain garden. Cooperators included Master Gardeners, LWLM volunteers, Auburn University students and faculty, Boys and Girls Club volunteers and city workers.

4. Rain Garden Tour: August 26, 2004. Radney, Benjamin Russell, and Sportsplex, Alexander City, AL. Eve Brantley, Charlene LaBlue, Tommy Futral, John Glasier and Dick Bronson conducted a tour of rain gardens. Participants came from Birmingham, Montgomery, Auburn and surrounding counties. Attendees shared construction tips.

5. Best Management Practice Designs: August 28, 2004. Alexander City, AL. Auburn University Landscape Design students with the leadership of their Professor, Charlene LaBlue, presented BMP Designs of the Alexander City downtown area that depicted alternate landscape designs for improving storm water runoff problems. Participants included Tommy Futral, John Glasier, Charlene LaBlue, Eve Brantley and Auburn students.

• **Alabama Cooperative Extension System (ACES): Classroom in the Forest Program**

The project collaborated with ACES Tallapoosa County Coordinator, Tommy Futral, for the integration of a Living Streams program that introduced local students to aspects of the TWP.

1. Classroom in the Forest Program: May 7, 2004. Hackneyville, AL. Guy Slyden, Brian Osbourn, James Yarbrough and Mona Gilliland conducted “Classroom in the Forest” for 290, 5th grade students from Radney School. Topics included: Living Streams, Treasure Forest, Fire Equipment, Tree ID, What Lives Here?, Nobody Lives Here, Wildlife Management, Flag a Tree, Oh Deer, and Everything Needs Space.

2. Classroom in the Forest Program: May 4, 2004. Hackneyville, AL. Tommy Futral, John Glasier, Dick Bronson, Danny Baker, Joe Martin, Bobby Jennings and Michael East conducted “Classroom in the Forest” for 85, 5th grade students from Horseshoe Bend School. Topics were: Living Streams, Nobody Lives Here What Does It Matter?, What Lives Here?, Treasure Forest, Flag a Tree, and Everything Needs Space.

3. Classroom in the Forest Program: April 23, 2004. Camp Hill, AL. Tommy Futral, John Glasier, Dick Bronson, Jean Royston, Dick Duncan, Bob Daniel and Jerry Brown conducted “Classroom in the Forest” for 120, 5th grade students from Edward Bell and Reeltown schools. Topics were: Living Streams, Nobody Lives Here, What Does It Matter?, What Lives Here?, Treasure Forest, Flag a Tree, and Everything Needs Space.

4. Classroom in the Forest Program: April 21, 2004. Dadeville, AL. Tommy Futral, John Glasier, Dick Bronson, Michael East, Jeff Brown, Tammy Jones and Rita Brown conducted “Classroom in the Forest” for 130, 5th grade students from several schools. Topics were: Living Streams, What Lives Here?, Nobody Lives Here, What Does It Matter?, Fire Equipment, and Treasure Forest Landowner.

• Tallapoosa River Basin Clean Water Partnership (TCWP)

The TWP collaborated with the TCWP (local stakeholders, including upper, middle and lower sub-basin groups) for funding stream gages and stream bioassessment research, public outreach, and development of watershed management plans.

1. Stream Gages. The TCWP provided \$4,000 for the purchase of two stream gages and accessories. Gages were installed for generating hydrographs of TWP streams.
2. Stream Bioassessment. The Department of Public Works of Alexander City provided \$6,000 for bioassessment research and outreach in the TWP streams (see Appendix B).

• Auburn University Environmental Institute (AUEI) Grant

The AUEI provided a grant to the AU Fisheries Department for developing stream bioassessment protocols, and developing curricula that enhance aquatic science education for middle schools. This project works in streams and with schools of the TWP.

1. Stream Bioassessment.
Field trips for bioassessment with researchers and citizens were planned for November 2004.
2. Teacher Workshop: September 9, 2004. Auburn University, AL.
Bill Deutsch conducted the classroom portion of a Stream Bioassessment workshop for eight, pre-service science teachers from AU. Some of these teachers will pilot aquatic science projects in schools in the Tallapoosa Basin.
3. Teacher Workshop: September 21, 2004. Auburn University, AL.
Sergio Ruiz-Cordova and Omar Romagnoli conducted the field portion of the Stream Bioassessment workshop for eight pre-service science teachers from AU.
4. Stream Ecology lecture: September 29, 2004. Auburn University, AL.
Eight pre-service science teachers attended a lecture by Dr. Cliff Webber on Alabama streams and the macroinvertebrates ecology. The activity was coordinated by Dr. Charles Eick.
5. Teacher Workshop: October 9, 2004. Southern Union College, Opelika, AL.
Bill Deutsch and Jacqueline Haynes-Middleton conducted a workshop on Stream Bioassessment for middle school and high school science teachers of the Auburn/Opelika, AL area.
6. Manuals for Aquatic Science Education.
AWW and the AU Department of Curriculum and Teaching partnered to begin the development of educational versions of the Water Chemistry, Bacteriological and Stream Biomonitoring manuals used by AWW volunteers. Each of the manuals will have a general lesson plan and will be correlated with the Alabama Course of Study so that teachers can incorporate these subjects into their classroom teaching.



TWP Teacher Workshop on Stream Bioassessment on September 21, 2004

• Auburn University Cost-Efficiency Study

The TWP collaborated with Dr. Diane Hite and student Karlee Copeland, AU Department of Agricultural Economics and Rural Sociology, for assessing the cost-efficiency of TWP research methodologies.

1. Planning Meeting: September 2, 2004.

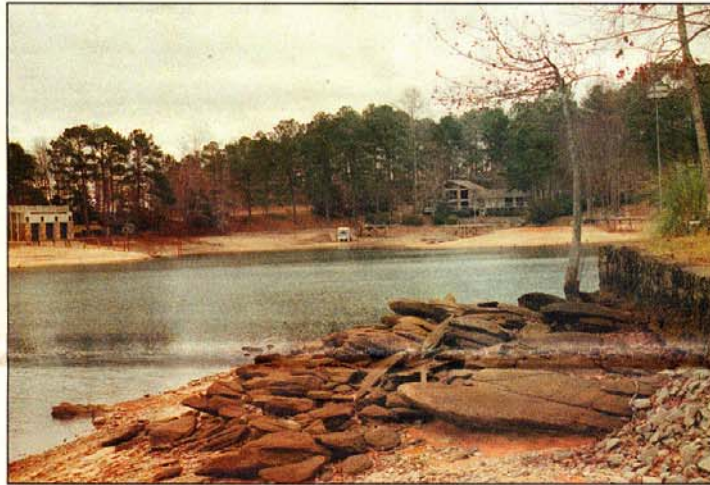
Bill Deutsch and Omar Romagnoli met with Dr. Diane Hite, AU Dept of Agriculture Economics, and her student, Karlee Copeland, to discuss an economic analysis of TWP research. Karlee will conduct a costs-efficiency study of the three levels of technology used in water quality monitoring. This study will be directed by Dr. Hite at no cost to the TWP.

VII. APPENDICES

APPENDIX A

Press Releases

A 3-year study aims to find out whether regular citizens' water assessments produce the same results as lab methods and satellites



File photos / The Outlook

Quality matters: The Tallapoosa Watershed Project will last three years. The first year will focus primarily on Lake Martin and the study will continue to Lake Wedowee.

USDA grant to fund study of watershed

By Laura McAlister
Outlook Managing Editor

A three-year project on the Tallapoosa Watershed hopes to prove that water-quality testing done by regular citizens produces the same results as those done by high-tech lab and satellite work.

Lake Watch and Auburn University recently received a \$550,000 grant from the U.S.

Department of Agriculture to conduct the Tallapoosa Watershed Project.

Dick Bronson, president of Lake Watch, said if the project does prove that regular citizens can accurately test water quality, it would save money in water assessments.

"We can eliminate the expensive part," he said. "Then states or communities could do a better job of water-quality assessments."

I don't know if it will prove that. It might not, but I think we can do a better job (of testing water quality), and I think we can do it less expensively."

For the next three years, regular citizens will be testing the waters of the middle and upper Tallapoosa Basin in east-central Alabama. Standard lab methods also will be used to test the waters, as well as remote sensor

See **WATERSHED**, Page 6A ►

Alexander City Outlook

January 4, 2004

continued from page 1A

satellites.

Although the main objective is to see if these three studies all produce the same results, Bronson said that's not the only purpose of the project.

"We will not just be determining what the sources of pollution are," he said. "We will initiate corrective action."

Lake Martin is the cleanest lake in the state and possibly the cleanest in the southeast. However, Bronson said there are places where nutrient levels in the lake concern him. Nutrient levels are an indicator of pollution.

Correcting those problems is where Bronson said the Tallapoosa County Extension Office could help.

"It may be that people are over spraying chemicals to

make their grass greener," he said. "An extension agent could be key in fixing that. They can get to the farmers or cattle raisers and tell them not to let those chemicals run into rivers or streams that end up in the lake."

The extension office is also helping educate people on the project and the importance of water quality.

Bronson said the environmental center at Camp ASCCA would have a computer lab in it that will be open the public to study the results of the project and learn more about it. Auburn Fisheries also is developing a Web site for the project.

In addition to the computer lab and Web site, an annual state of the watershed address will be given at Camp ASCCA, which also is

open to the public.

The Tallapoosa Watershed Project is the only one of this type that Bronson knows used regular citizens to conduct water-quality assessments.

"I don't know anyone using a grassroots study like this," he said. "But we are the people who live on the lake. We have stake and a care about what happens to it."

Bronson said members of Lake Watch have been testing the water for more than a dozen years, but it wasn't until recently that they got the idea for the study.

About a year ago, Bronson approached Dr. Bill Deutsch about taking the water-quality assessments done by Lake Watch to a new level.

"We knew we could do more," he said. "Bill said he

had an idea to prepare a grant to request a study of the watershed and the sources of pollution."

Money from the grant will mainly be used to fund the lab research as well as satellite assessments, but it also will help fund the research of average citizens.

Bronson said students from both Tallapoosa County and Alexander City public schools would be taking part in the project.

Once it's complete, Bronson said the State Department of Education would be using the results to develop an environmental curriculum.

Bronson said he also hopes it will serve as a model for states and other communities on water-quality assessments.

The Outlook – Alexander City

The Outlook

Lighting the way for the Alexander City & Lake Martin area



Testing the water

Group from China visits area to learn about water quality

By Laura McAlister

Outlook Managing Editor

Whether you're in China or on the shores of Lake Martin, water is basically the same.

That's why a group from China is in Alabama for the next several weeks learning about water quality and aquaculture.

Tuesday, the group met at Camp ASCCA to see how a local group of volunteers are making a difference in the quality of water.

"There's a group of about 15 from China," said Dick Bronson, Lake Martin Lake Watch president. "Some are at the level of our EPA and the rest are extension agents. They are very interested in learning about water quality and aquaculture."

While at Camp ASCCA, Bronson and his wife, Mary Ann, took the group to a stream where they showed them how the different types of macro invertebrates in the water can be used to measure

water quality.

Even though the environment of China is different from that of Alabama, Dr. Bill Deutsch, who brought the group to the state, said water is basically the same everywhere, meaning the same test to measure the water quality of Lake Martin could be used there.

"In China a few years ago, we did this same training," he said. "The organisms there

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Wednesday, July 15, 2004

Vol. 112 - No. 162

www.alexcityoutlook.com



Quality indicators: Dick Bronson, president of Lake Martin Lake Watch shows extension agents from China how to test water quality at a stream at Camp ASCCA. The group is visiting the state to learn about aquaculture.

look the same as they do here. They're always modified, and the species are probably different, but they are very similar."

Deutsch is with the fisheries department of Auburn University and is also program manager of Alabama Water Watch.

The American Soy Bean Association funded the trip to allow the group to learn more about aquaculture, but while here, Deutsch said he also wanted to teach them about the importance of water quality and how volunteers can play a major role in keeping the water clean.

"A lot of times there's not enough money to do this, but groups like Lake Watch show

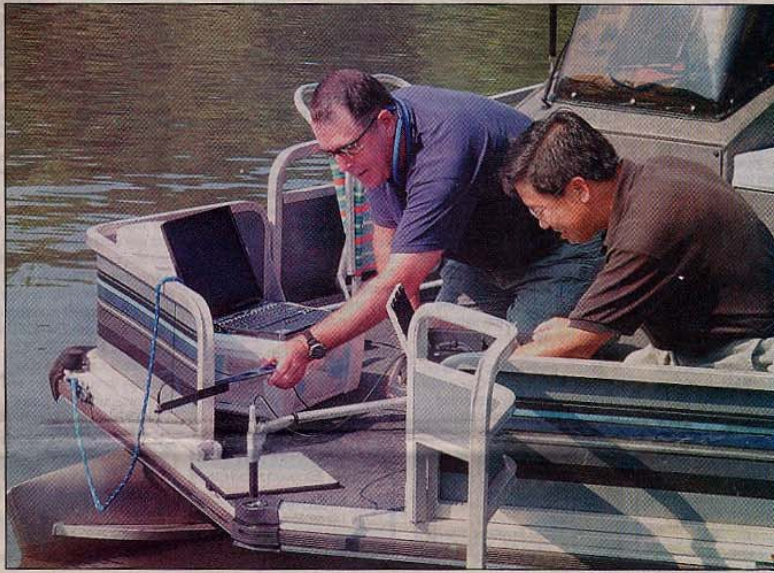
it can be done with local volunteers," he said.

Deutsch is currently working to form a Global Watch. So far, China is a member along with five other countries, and he said the list is growing every day.

Global Watch is designed after organizations like Alabama Water Watch and Lake Watch.

"Alabama Water Watch is one of the more recognized and better established programs," Deutsch said. "While our country's environmental movement started in the '70s, a lot of countries are just beginning to take interest, and without people to participate, it will never happen. They have to really want to and understand."

The Outlook – Alexander City



Laura McAlister / The Outlook

Testing the water: John Glacier, left, and Dr. Luoheng Han test the water in Lake Martin near Coley Creek with remote sensors. The testing is part of a three-year study on the Tallapoosa Watershed to see if high-tech studies produce the same results as every day volunteers do.

Controlling quality

Project strives to save time, money on water testing

By Laura McAlister
Outlook Managing Editor

A study being conducted on the Tallapoosa Watershed hopes to prove that it doesn't take thousands of dollars and a whole lot of time to test water quality.

Since April, water quality tests have been conducted on Lake

Martin on 25 different sites as a part of the Tallapoosa Watershed Project, a three-year study funded by the U.S. Department of Agriculture. The tests include high-tech methods using satellites and remote sensors as well as every day volunteers.

"We're looking at all the different ways the testing correlates," said Dick Bronson, Lake Watch Lake

Martin president. "If we can show that volunteer work is good enough and it correlates with the others, we'll be able to eliminate the most expensive ways."

Wednesday, members of Lake Watch as well as the University of Alabama's geography department,

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The Outlook

continued from page 1A

Auburn University's fisheries department, the Alabama Department of Environmental Management and city employees tested different sites on Lake Martin. So far, much of the group's work is producing similar results.

"We know the amount of nutrients is higher here in the Coley Creek area," said John Glacier with Lake Watch. "There's also a distinct difference in the amount in the upper part of the lake to the lower part."

Although the testers are using different assessments to test water quality, they are all looking for the same things, nutrients. Nutrient levels are an indicator of pollution.

Preliminary results show

that the upper part of the lake around the River Bridge has a higher level of nutrients than the lower part of the lake near Kowaliga.

While the fisheries department constantly tests the water quality of the lake, Dr. Bill Deutsch, a professor with AU's fisheries department, believes the results of the project will show that a satellite located 475 miles above the earth can detect pollutants just as easily.

"Instead of all the physical samplings we can look at the images from the satellite and know where the problem is," he said. "Just think how much time and money that would save."

The satellite has been in place for several years, but

thanks to work done by Dr. Luoheng Han with UA's geography department it is now being used to detect pollutants in the Tallapoosa Watershed.

According to images from the satellite, Coley Creek has some of the highest levels of nutrients in the lake, which is also what the remote sensor testing and volunteer testing has produced.

Bronson said areas of the lake could have higher concentrations of nutrients for several reasons. Coley Creek has higher levels of nutrients because of the wastewater treatment plant there, which Bronson said is to be expected.

"Nutrients are expected to come out of there," he said. "We just have to keep them within a

certain level, and they're within that level now."

In addition to making water quality testing easier and less expensive, Deutsch hopes the watershed project also will encourage residents elsewhere to take an active part in studying area lakes and keeping them clean.

"I think a big part of this project is that people will see what we're doing here, and it might inspire other cities to do it, too," he said.

For the next two months, the group will continue to test sites on Lake Martin. After that, the tests will be conducted on Lake Wedowee.

During the third and final year of the study, both lakes will be tested again.

The Outlook – Alexander City

Lake & Leisure

Your guide to enjoying Lake Martin

Group monitors watershed

Staff Report

TPI

For those who have an interest in the water quality of Lake Martin, here's some good news about a major project concerning the lake and watershed.

In early 2003, representatives of Lake Watch met with Dr. Bill Deutsch, Alabama Water Watch Program Director at Auburn University, to discuss expanding the volunteer monitoring program on Lake Martin that began 12 years ago. During that time, Lake Watch volunteers conducted monthly testing at a dozen sites on the lake, amassing an impressive amount of high-quality data.

The interest in expanding the testing program was prompted by concerns about water quality trends indicating increasing levels of chlorophyll (nitrates & phosphates) in Lake Martin. While the lake and the upper Tallapoosa River are considered the cleanest in Alabama, the data trends reveal degradation from both point and non-point sources of pollution. Point sources are those pollutants that come from pipes including run-off from streets and parking lots, erosion from highway and housing construction sites, faulty septic tanks, clear-cutting forests without buffer areas, large animal operations and too much fertilizers and pesticides.

The Lake Watch discussions with Auburn coincided with an opportunity to compete for a USDA federal grant. A team of collaborators was formed to write a grant proposal and their efforts paid off in the summer of 2003, when Auburn was notified the grant was approved for \$550,000.

The project kicked off in April 2004, and some interesting preliminary data is already emerging that will be reported soon. Lake Watch volunteers work alongside scientists from both Auburn University and the University of Alabama, using a variety of testing devices. This fall, Lake Watch will help conduct detailed biological assessments of a number of local streams in the watershed.

By now, you are likely wondering just what the payoff is for all the federal dollars being spent. Notice again part of the project title ... a transferable model. What the team hopes to prove is that emerging technology supplemented by



Special to TPI

Water quality: Dick Bronson, John Glasier and others test water on Lake Martin.

usually associated with municipal wastewater treatment plants. Non-point sources are tougher to pinpoint because they come from a number of places,

citizen-based monitoring can accurately determine water quality trends and sources of degradation in a cost-effective way. If it works on the Tallapoosa River watershed, it can work in other watersheds.

There will also be a huge spin-off in the education field by upgrading environmental education curriculum and involving local science teachers, students and other stakeholders who can access an informative Web site now under development at Auburn University. This portion of the project got off to a great start in April when Tommy Futral organized a workshop at Camp ASCCA for 15 science teachers from Tallapoosa County. More advanced teacher workshops are planned in the next two years.

The project's largest payoff of most interest to readers will be the protection of this incredible resource called Lake Martin. The project isn't simply to gather data and conduct analyses, it is to determine sources of water quality degradation in the watershed and take corrective action. The end result will be a lake and watershed with more concentrated testing and analysis than any other in the state.

Lake & Leisure

APPENDIX B

Supporting Documents

Letter from the Department of Public Works of Alexander City to Dr. Bill Deutsch, Project Director of the Tallapoosa Watershed Project (TWP) on October 6, 2004 donating \$6,000 for bioassessment in the TWP streams from the Middle Tallapoosa Clean Water Partnership.



Department of Public Works

824 Railey Road
P.O.Box 552
Alexander City, Alabama 35011-0552

Telephone: (256) 409-2020
Fax: (256) 409-2002

Director of Public Works
M. Gerard Brewer

Dir. of Facility Maintenance
H. Glen Riley

Supt. of Waste Management
Terry D. Bishop

October 6, 2004

Administrative Assistant
Suzanne S. Otralek

Superintendent of Streets
Chester D. Cotney

Supt. of Sewer Maintenance
Michael L. Waldrop

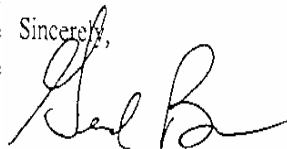
Dr. Bill Deutsch
Director, Alabama Water Watch
Department of Fisheries

Dear Dr. Deutsch:

As chairman of the Middle Tallapoosa Clean Water Partnership Technical committee and with the concurrence of our Partnership's stakeholder committee members, I am donating on behalf of our Partnership a gift of \$6,000 to the Alabama Water Watch Program for your work in the Tallapoosa Watershed.

The Partnership is excited by the work Alabama Water Watch is doing in the Middle Tallapoosa River Basin during 2004-2005. This check is in support of your efforts as you focus on biomonitoring with citizens from our area in streams that drain to Lake Martin. We support your efforts to refine the Alabama Water Watch protocol for macroinvertebrate sampling in streams. The Partnership knows that your plans are to determine the feasibility of citizen monitors learning more detailed macro invertebrate identifications than currently are used by the Water Watch Program. We think this approach has great merit and would make the biomonitoring data more meaningful to local officials and also the Alabama Department of Environmental Management (ADEM). We support those efforts by scientists working with Alabama Water Watch.

This endeavor will not only help improve the ability of citizens to monitor the health of streams within our watershed, it will provide an excellent opportunity for teachers, students and local environmental educators to participate and benefit from these field activities. Accordingly, our Clean Water Partnership offers the enclosed donation for your efforts at enhancing capabilities for biomonitoring of streams in the Middle Tallapoosa River Basin and the technical and educational benefits that will derive from these activities.

Sincerely,


M. Gerard Brewer, P. E.

APPENDIX C

Abstracts of Conference Presentations

Hyperspectral Sensing of Water Quality in Lake Martin, AL

Luoheng Han
Department of Geography
University of Alabama
Tuscaloosa, AL 35487-0322

David Bayne, Bill Deutsch, Eric Reutebuch, and Wendy Seesock
Department of Fisheries and Allied Aquacultures
Auburn University
Auburn, AL 36849-5419

and

John Glasier (Presenter)
Lake Watch of Lake Martin
PO Box 72, Alexander City, AL 35011

Presented at the Alabama Water Resources Annual Conference:
Sept. 8-10, 2004. Orange Beach, FL.
by
John Glasier and Dick Bronson

Abstract

Hyperspectral remote sensing of water quality at close range over Lake Martin was conducted in multiple occasions during 2004 as a part of our Tallapoosa Watershed Project. The objective of this study is to investigate the relationship between spectral signal and major water quality parameters. A spectroradiometer acquiring data in 512 discrete bands with the range from 350 to 1050 nm was used to collect radiance upwelling from the water and a reference panel. Percent reflectance was calculated for each measurement and used in the analysis. Water sampling was conducted simultaneously with the spectral data collection. Water quality indicators including chlorophyll *a*, total suspended solids, Secchi disk depth, and others were measured according to Standard Methods protocols. The spectral signatures of these parameters were characterized. Algorithms were developed to quantify water quality parameters using spectral reflectance data. We tentatively conclude that hyperspectral remote sensing at close-range is an effective alternative to traditional water sampling tools.

The Tallapoosa Watershed Project: A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds

Bill Deutsch and David Bayne, Department of Fisheries and Allied Aquacultures
Auburn University, Auburn, AL 36849-5419

Luoheng Han, Department of Geography, University of Alabama
Tuscaloosa, AL 35487-0322

John Glasier (Presenter), Lake Watch of Lake Martin, PO Box 72, Alexander City, AL 35011

Robin Nelson, Alabama Department of Education, Montgomery, AL 36104

Presented at the Alabama Water Resources Annual Conference
Sept. 8-10, 2004. Orange Beach, FL.

by
John Glasier

Abstract

This three-year project [September 2003-2006] integrates a variety of research, education, and extension activities to provide relevant, locally-generated watershed information. USDA's Cooperative State Research, Extension and Education Service's Integrated Research, Education, and Extension Competitive Grants Program funds this effort. A project overview and results from first-year activities are provided. Research focuses on a comprehensive assessment of nutrient concentrations and loadings in the Tallapoosa River system. The cost-benefits of various levels of technology will be compared to include Alabama Water Watch community-based monitoring, Standard Methods analysis, close-range hyperspectral sensing, satellite remote sensing and GIS modeling. Research data and analyses are being adapted for education in the form of in-classroom curricula, teacher workshops, annual state-of-the-watershed conferences, and a public display at the environmental center of the Alabama Special Camp for Children and Adults (ASCCA) at Lake Martin. Water quality data, analyses and GIS modeling results will be made available to stakeholder groups through the Alabama Water Watch and Alabama Cooperative Extension System websites. The project benefits ADEM, the Tallapoosa Clean Water Partnerships, and should be adaptable for other Southeastern watersheds.

**Linking Alabama Water Watch Monitors to Classrooms for Improved
Aquatic Science Education**

by

Wendi Hartup and Bill Deutsch, Alabama Water Watch

Len Vining, Department of Fisheries and Allied Aquacultures

Charles Eick, Mitzie Sowell and Virginia Wilcox, Department of Curriculum and Teaching

Auburn University

Poster presented at the
Alabama Water Resources Annual Conference
Sept. 8-10, 2004. Orange Beach, FL.

by

Dick Bronson

Alabama Water Watch (AWW) is a statewide citizen volunteer water monitoring program that is coordinated through Auburn University's Department of Fisheries and Allied Aquaculture. Presently, there are about 80 groups actively monitoring streams and lakes in Alabama and Georgia. Many AWW groups, in addition to sampling for various water quality parameters, get involved in their local communities to raise awareness about water issues. These groups often work with educators and student groups. To assist these groups as well as educators, AWW and Auburn University's Department of Curriculum and Teaching have partnered to develop educational versions of the water chemistry, bacteriological and aquatic macroinvertebrate sampling manuals. Each of these manuals will have a general lesson plan and be correlated to the Alabama Course of Study so that the teachers can incorporate these subjects into their teaching for a week. Also, the series Citizen Guide to Alabama Rivers will have an interactive Jeopardy Game for teachers to use in the classroom and will eventually be made available online.

APPENDIX D

Preliminary Research Results

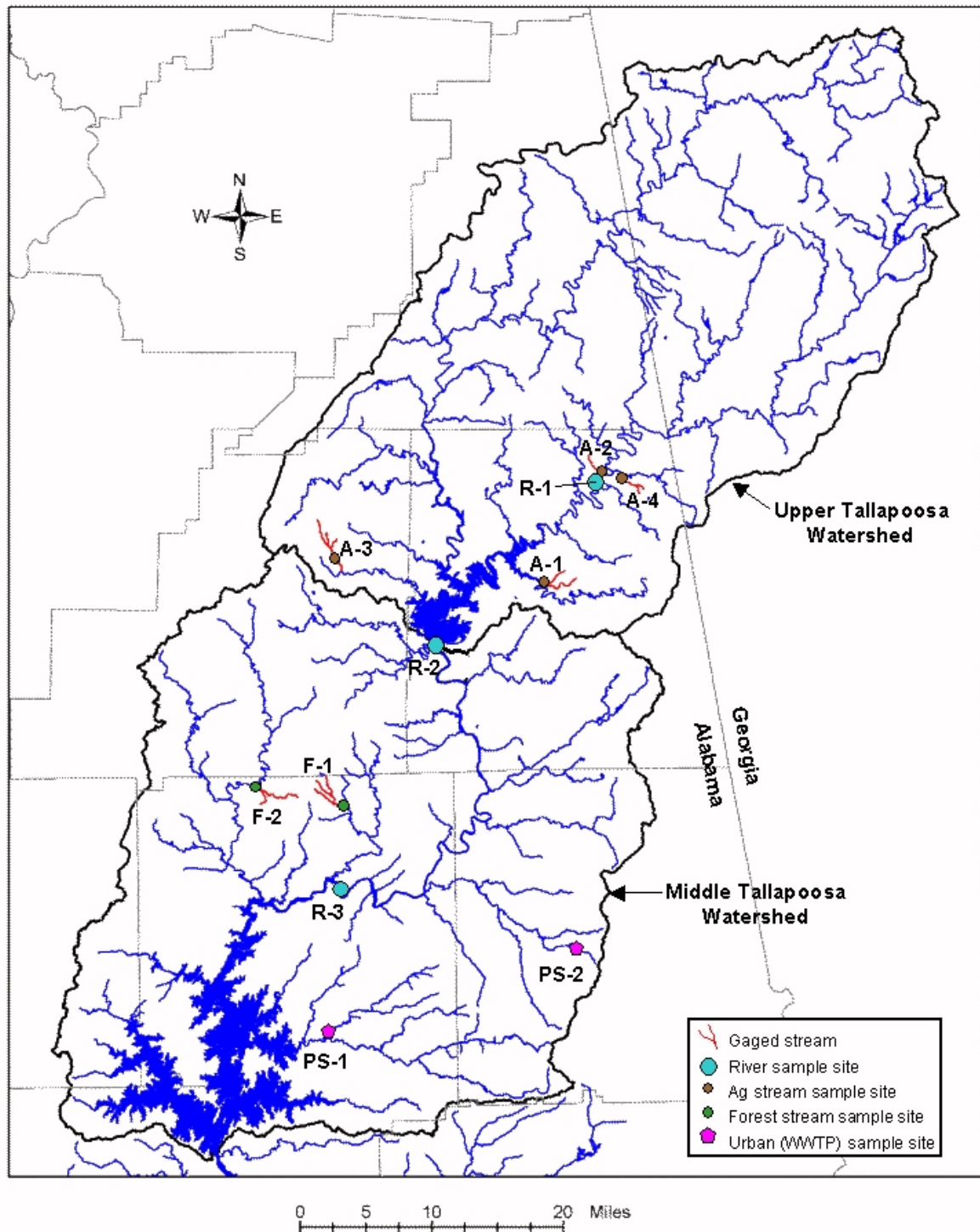


Figure 1. Watershed sampling sites (stream, river and point source sites).

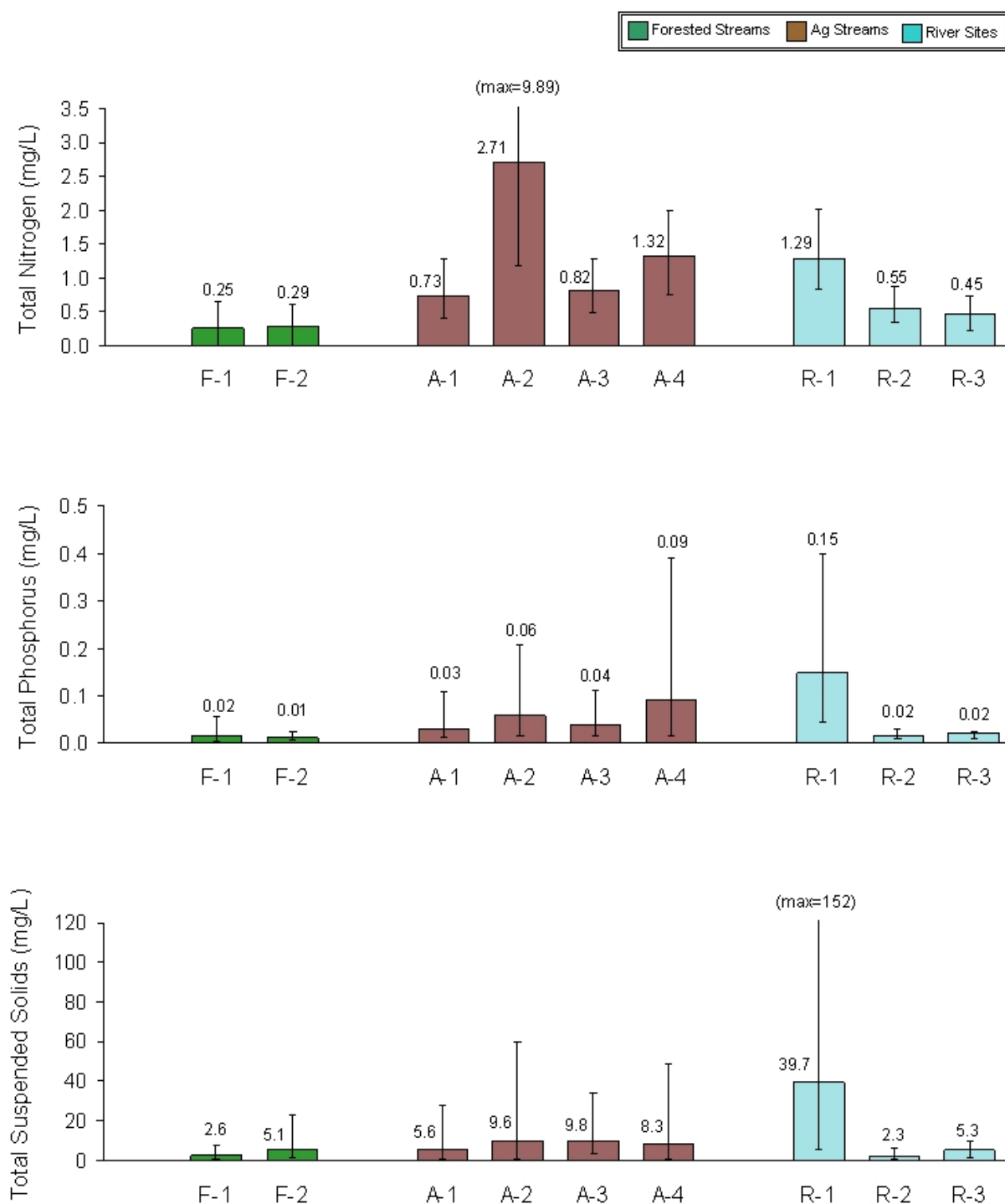


Figure 2. Nutrient (total nitrogen and total phosphorus) and total suspended solids concentrations of stream and river sampling sites from February – October, 2004.

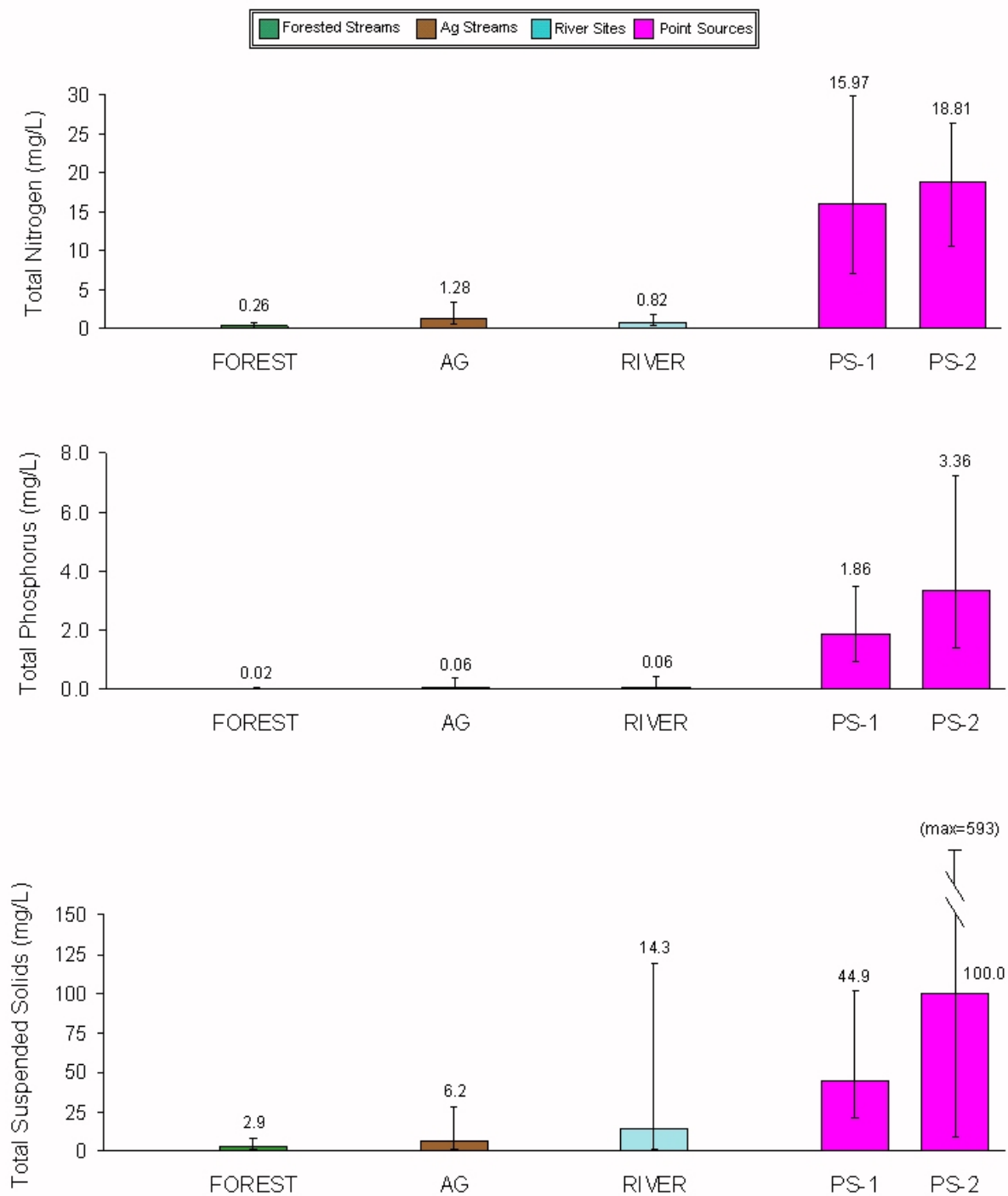


Figure 3. Nutrient (total nitrogen and total phosphorus) and total suspended solids concentrations of stream, river and point source sampling sites from February – July, 2004.

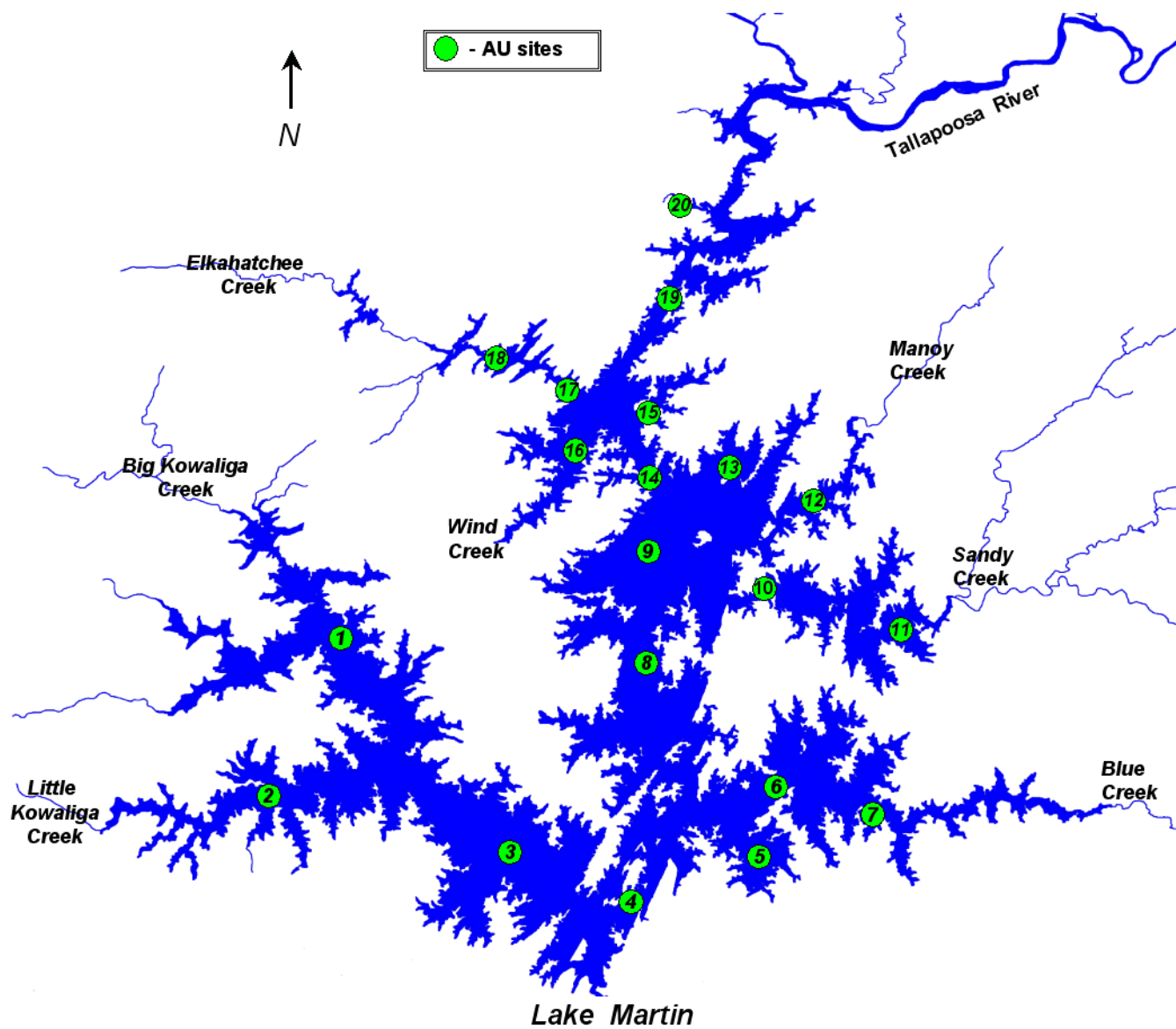


Figure 4. Lake Martin standard methods (Auburn University) sampling sites.

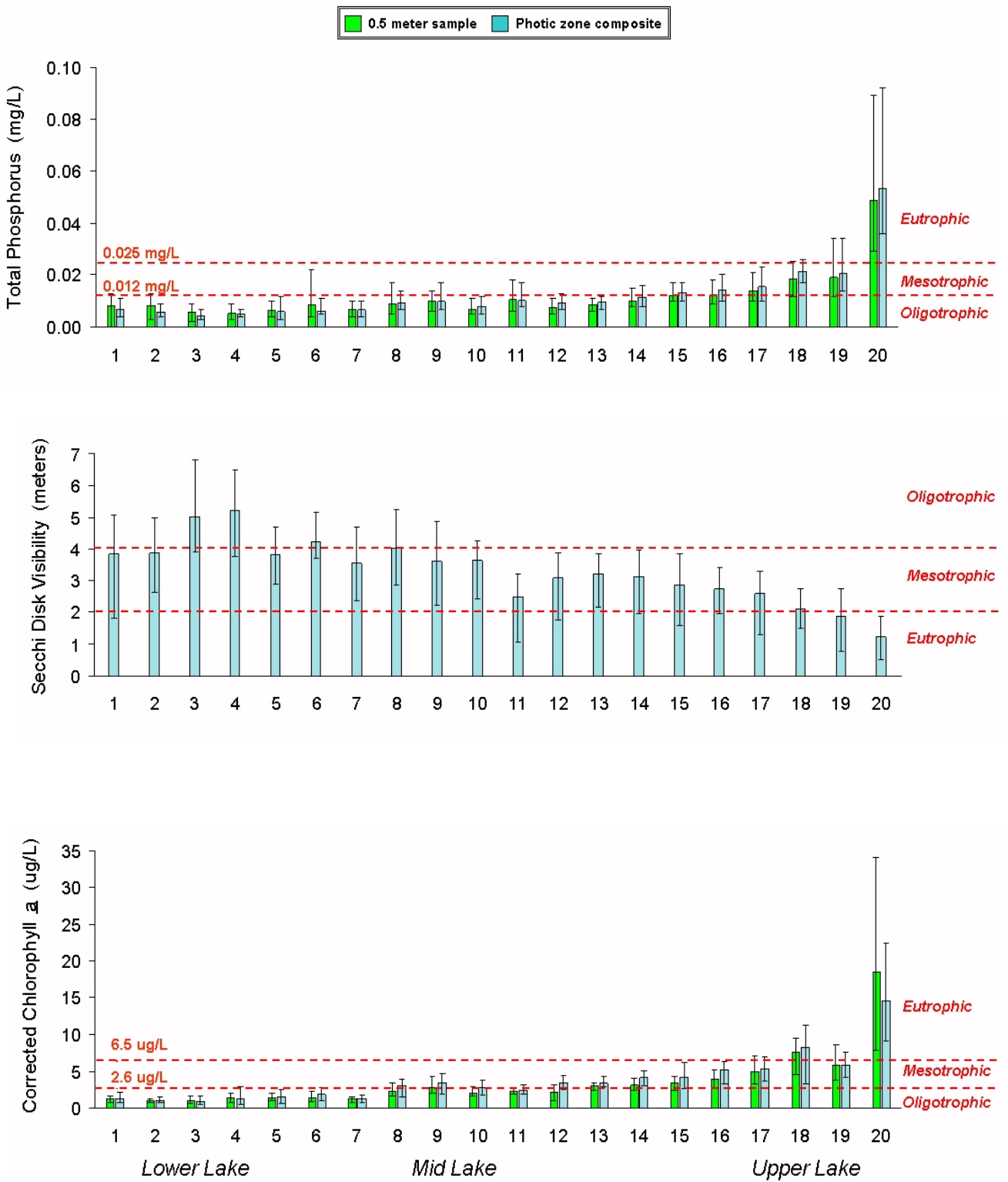
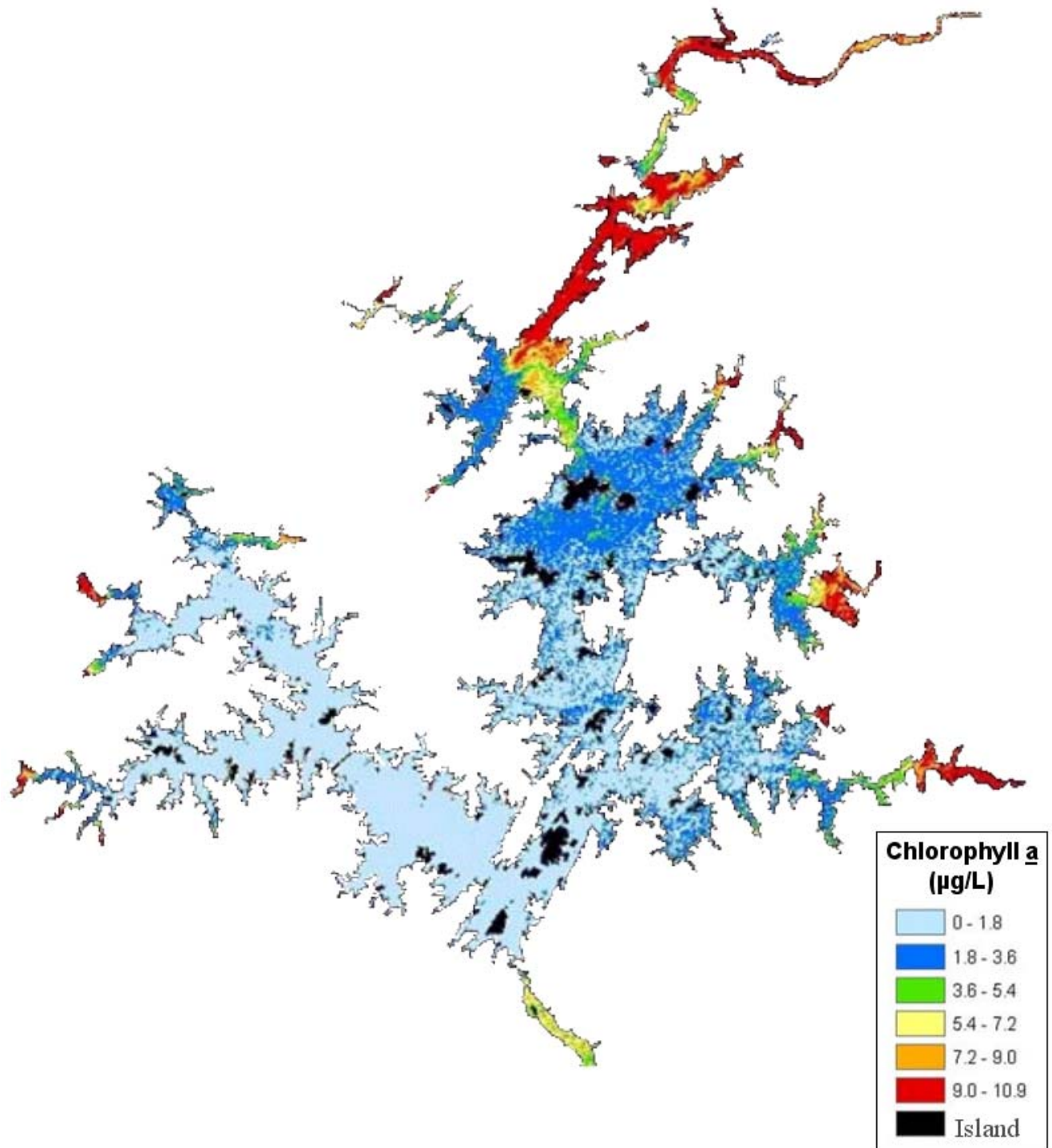


Figure 5. Total phosphorus concentrations, Secchi disk visibility and chlorophyll *a* concentrations

of standard methods (AU) sites on Lake Martin from April – October 2004.



*Figure 6. TWP chlorophyll *a* map of Lake Martin for April 15, 2004 generated from a Landsat TM image and coincident in situ chlorophyll *a* measurements.*

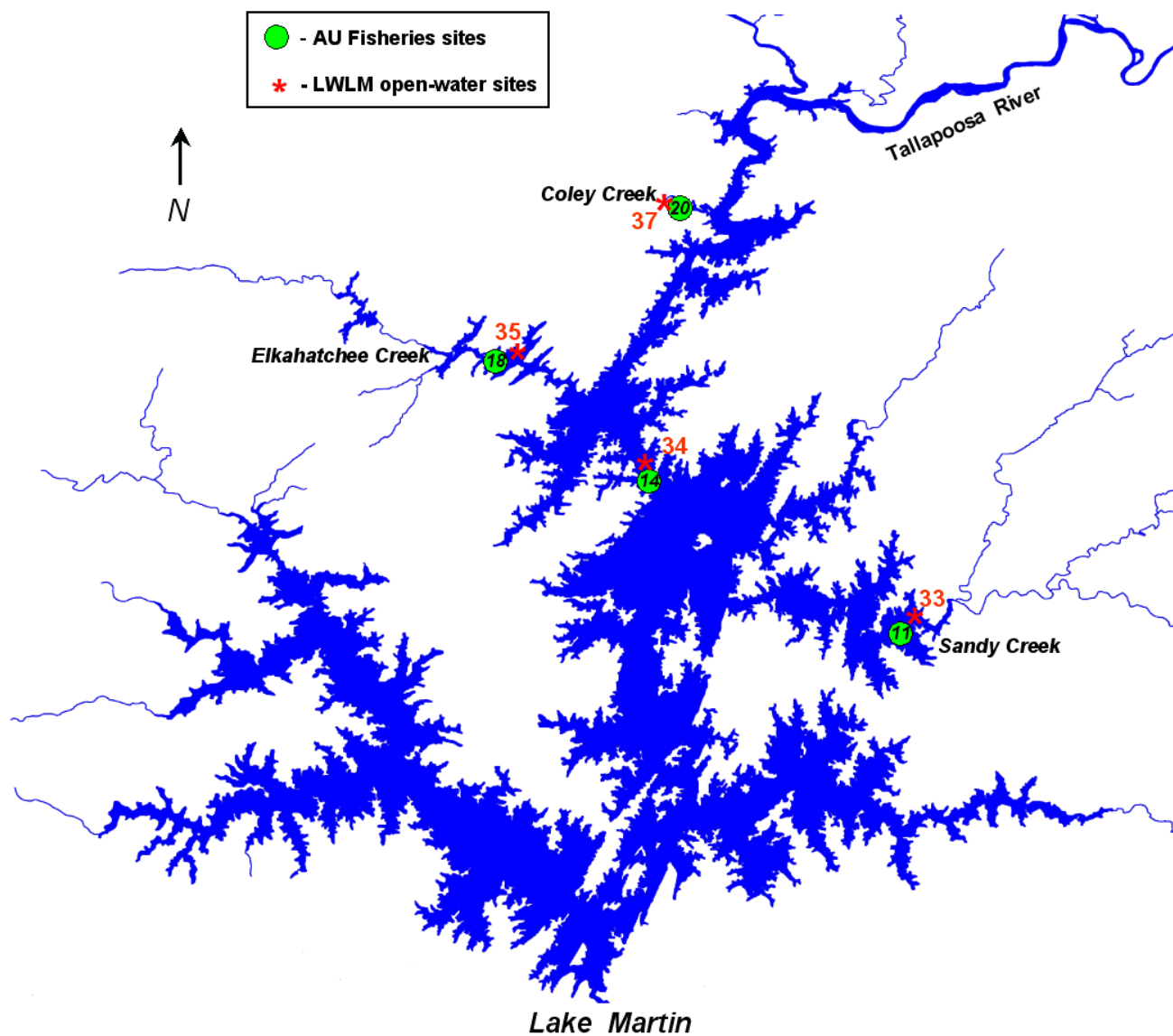


Figure 7. Lake Martin standard methods (Auburn University) sites and Lake Watch of Lake Martin sites used for comparison of growing season water chemistry results.

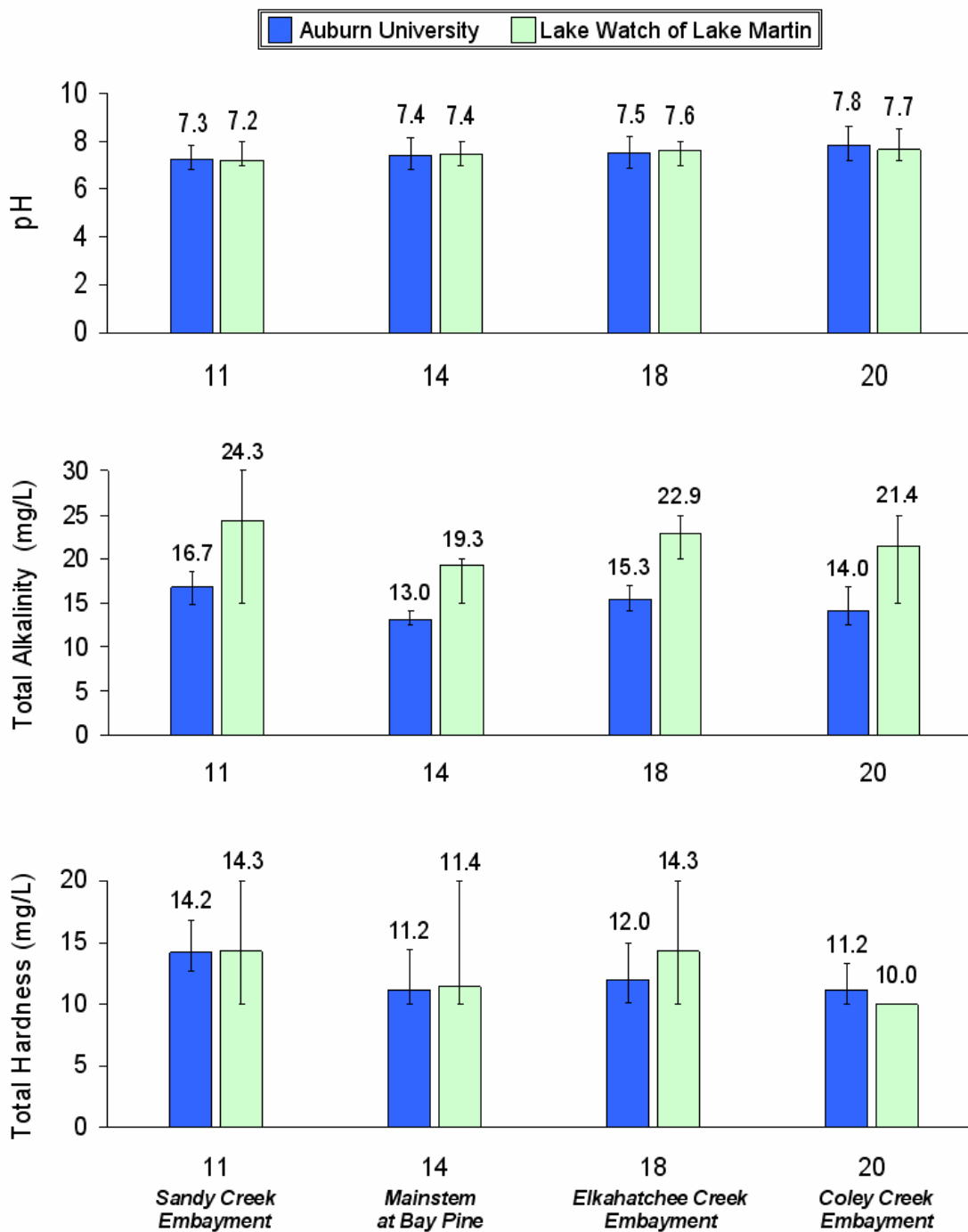


Figure 8. Lake Martin 2004 growing season mean pH, total alkalinity and total hardness for standard methods (AU) compared to Lake Watch of Lake Martin at four lake sites.

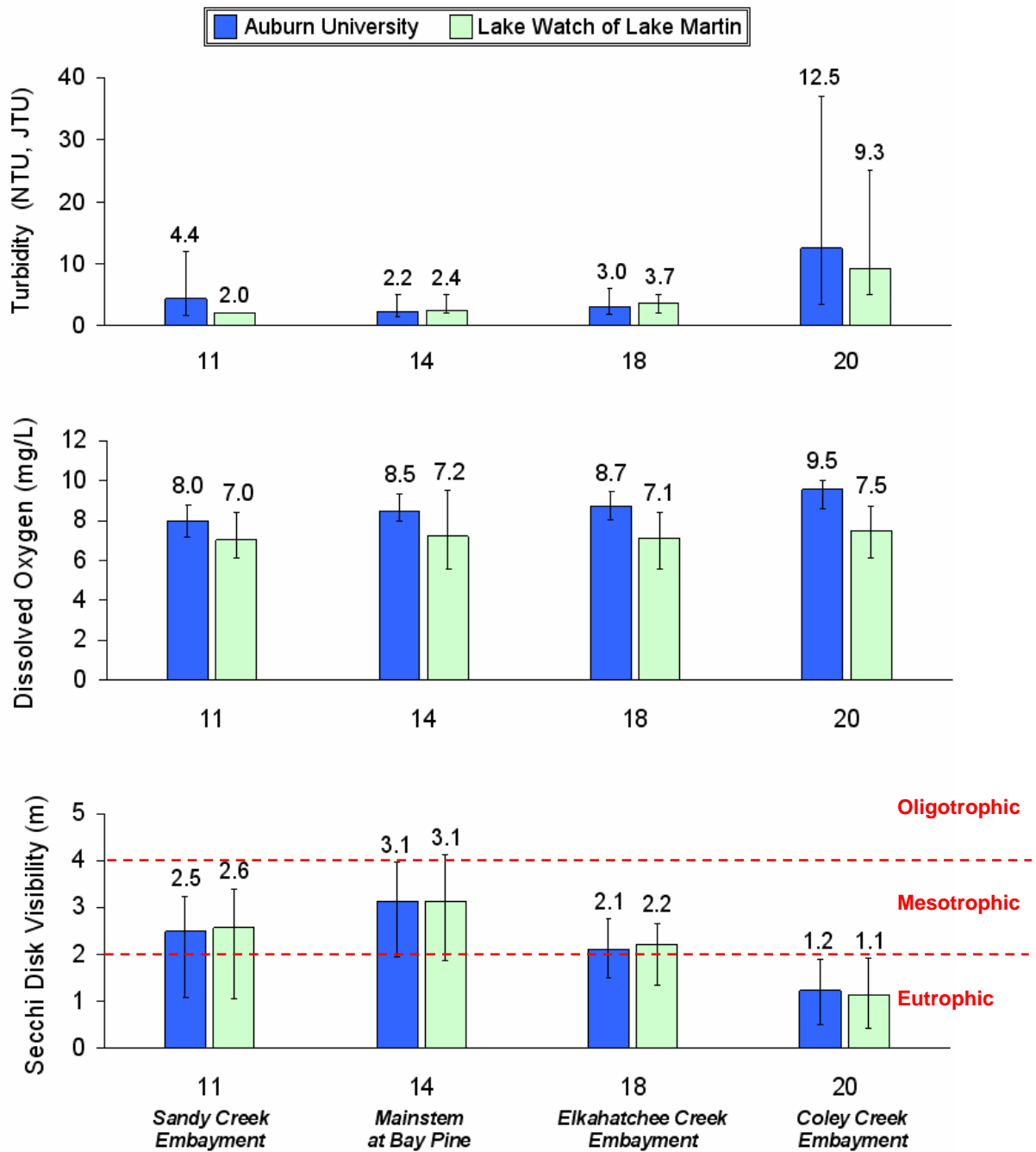


Figure 9. Lake Martin 2004 growing season mean turbidity, dissolved oxygen and Secchi disk visibility for standard methods (AU) compared to Lake Watch of Lake Martin at four lake sites.

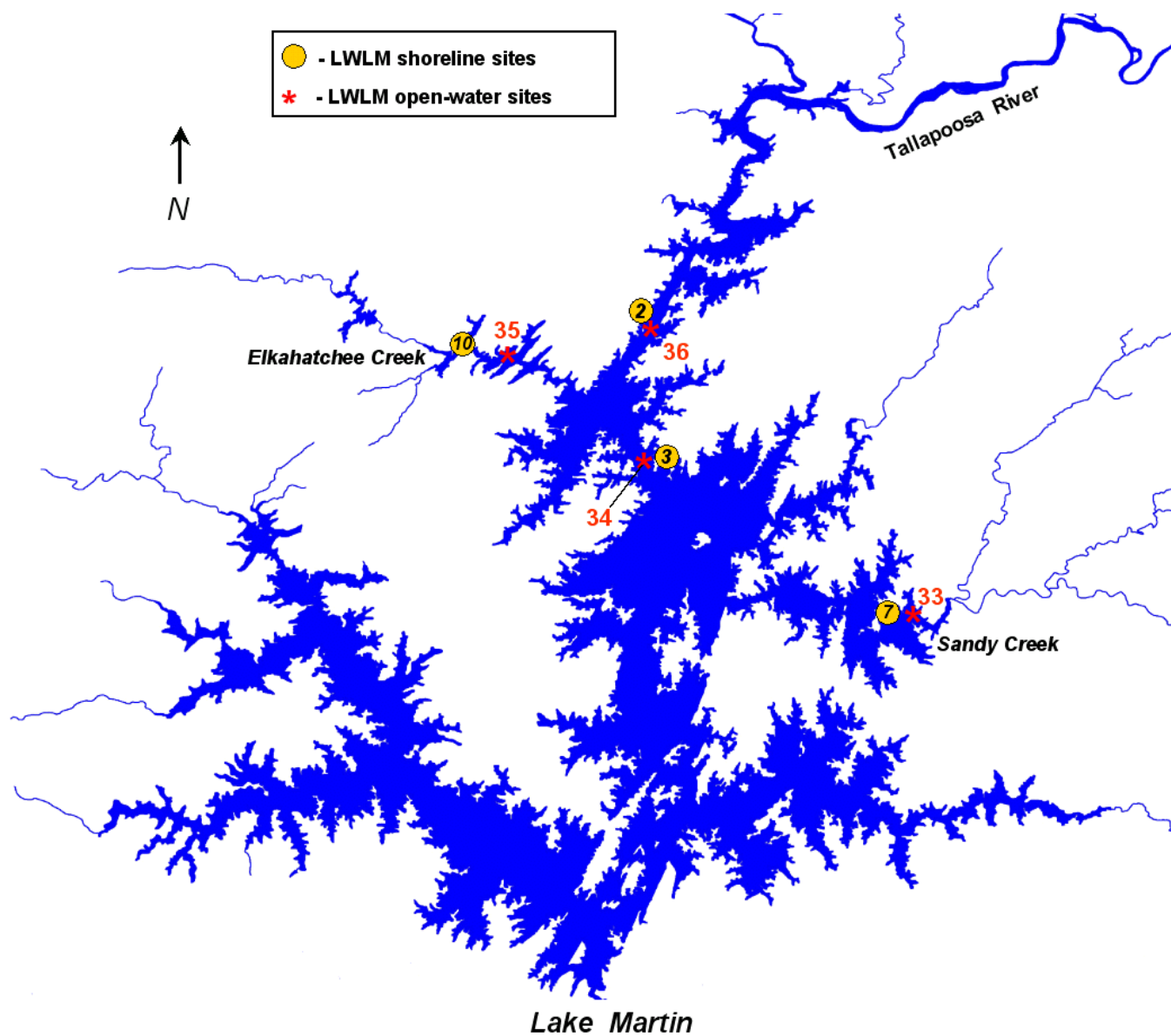


Figure 10. Lake Watch of Lake Martin shoreline sites and open-water sites used for comparison of growing season water chemistry results.

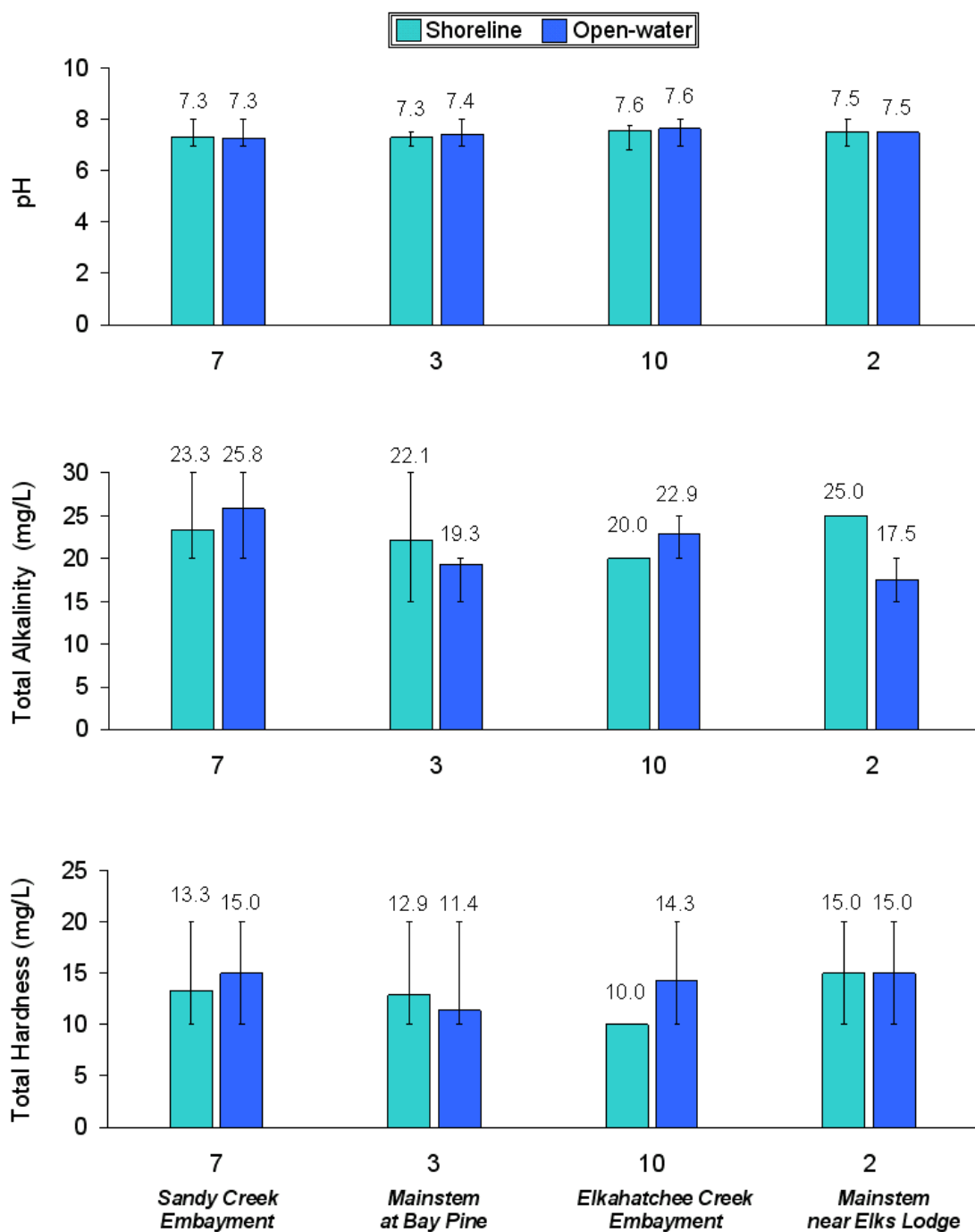


Figure 11. Lake Martin 2004 growing season mean pH, total alkalinity and total hardness for Lake Watch of Lake Martin shoreline and nearby open-water sites.

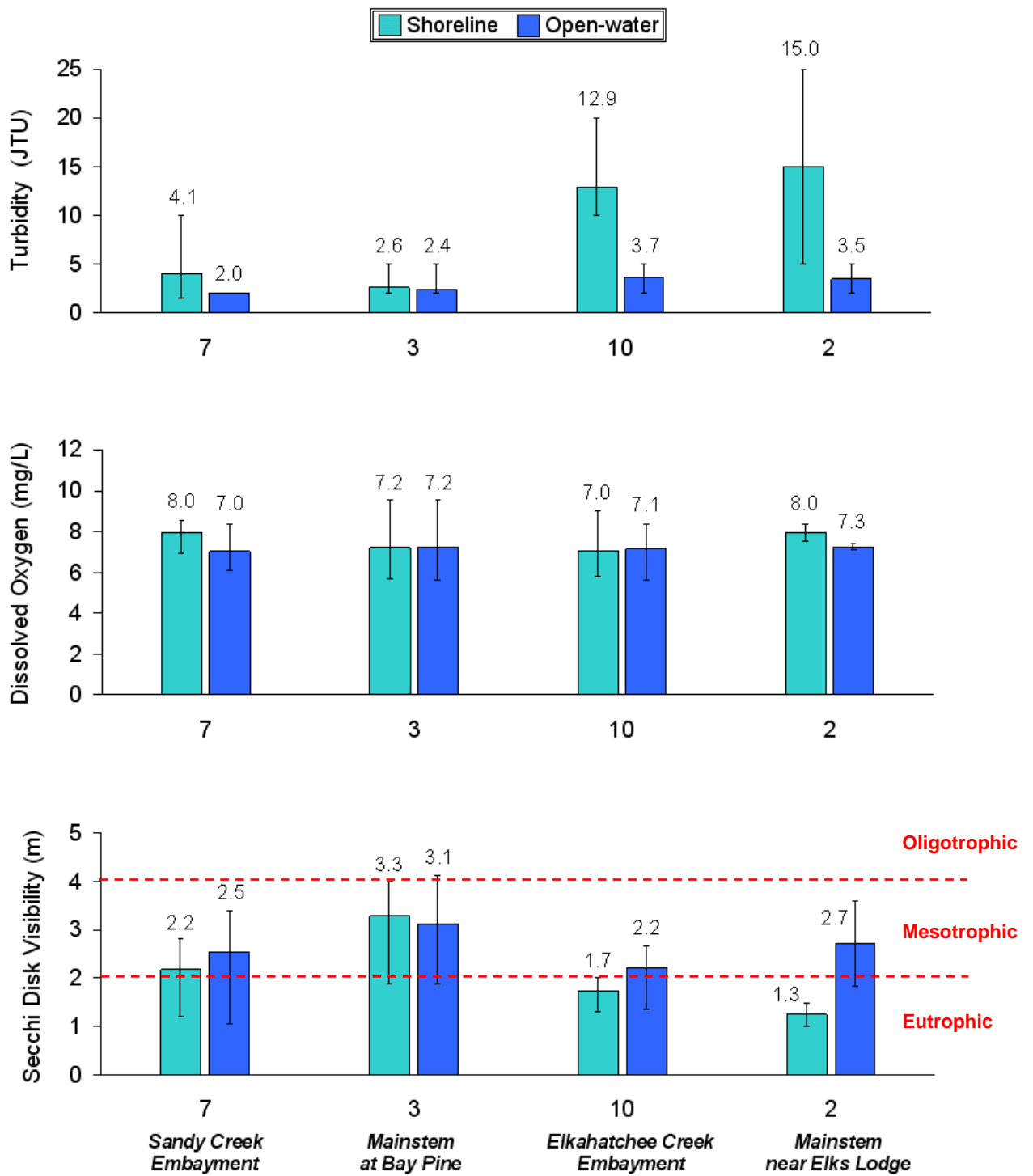


Figure 12. Lake Martin 2004 growing season mean turbidity, dissolved oxygen and Secchi disk visibility for Lake Watch of Lake Martin shoreline and nearby open-water sites.

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