

## **Project Description - *Coalition for Watershed Education (CWE): Listening to the River***

### **a. Impact**

#### **1. Audience**

The project targets three primary audiences:

1. Youth, ages 11-17, who voluntarily join field teams to participate in watershed discovery experiences in the Grand Traverse and Little Traverse Bay watersheds (approximately 250 youth over three years);
2. Public radio listeners served regionally by Interlochen Public Radio who experience one or more of the 30 youth-produced *Soundscapes* radio broadcasts (approximately 10,000 listeners per broadcast segment based on Arbitron surveys);
3. Children, ages 7-12, who visit the *Waterscapes* exhibits in the Grand Traverse and Little Traverse Bay watersheds (30,000 over three years, based on estimated museum/science center visitor counts).

The choice of the target age group for the youth field teams was based on: (1) this group's relatively low achievement in statewide science testing<sup>1</sup>; (2) this group's documented receptiveness to informal science learning (ISE); and (3) evidence from literature reviews that this type of project provides the components necessary for successful science learning by young people.

Student Achievement: Eighth- and tenth-graders in Michigan have consistently scored poorly on standardized science tests. In 2004-05, the last year for which test results are available, just 63% of tenth graders and 64% of eighth graders met or exceeded standards in science. Comparable figures for mathematics were 59% and 62%, respectively<sup>2</sup>. These results have not changed significantly for the past four years. Thus, more than one third of junior and senior high school students in Michigan may lack basic knowledge and skills in science and math. This lack of science understanding carries into adulthood, where nationally, for example, only 41% of adults know how to define a watershed<sup>3</sup>.

Youths' receptiveness to ISE. Young people in the target audience are receptive to ISE because they have more free time (many are not yet driving or working), are not yet focused on the next big step (college or full-time employment) and have not yet opted out of coursework that might affect their career choices (e.g. girls in math or sciences). For this group, the project-related ISE activities will serve as a bridge to real-world experiences. In the words of students who attended the Listening to the River Summit in February, 2005, funded by a planning grant from the National Science Foundation, young people want to "collect real data in real work environments on real projects".<sup>4</sup>

Necessary components: This project exemplifies standards, benchmarks and best practices for effective informal science education, as outlined in the National Science Teachers Association Guidelines for ISE<sup>5</sup>. The Cooperative Extension Service of the U.S. Department of Agriculture further described essential attributes for effective youth water education in its Assessment of Youth Water Education Curricula<sup>6</sup>:

1. Science learning in a real world context;
2. Community service learning and activism;
3. Skill development related to environmental stewardship;
4. A way to make environmental issues immediately relevant to youth; and
5. Building youth leadership skills through developing, planning, organizing and evaluating projects.

The proposed *Listening to the River Project* features all five of these attributes.

The project will create a sustainable infrastructure to recruit and retain young people in field teams. Beyond the core partners, two other key affiliates in this project, the Grand Traverse County Michigan State University Extension (MSU-E/4-H) and the Crooked Tree Council of the Girl Scouts of America (GSA) have demonstrated ability to engage youth in the community. More than 30 4-H groups are active in the Grand Traverse area, and 4-H staffs are hoping to institute both a citizen planning program for youth and an environmental leadership project. Over 300 girls are in the 11-17 age group across the

Crooked Tree GSA Council network. Through these permanent infrastructures, the field investigations can be continued well beyond the life of the grant as 4-H and the Scouts embed watershed discovery excursions into their suite of offerings for youth. Such on-going field investigations provide a means for developing and delivering fresh content for web, radio and Waterscapes exhibits.

Estimates for the second primary audience, radio listeners from among the 81,000 people in the coverage area (Grand Traverse Region), are based on data cited by Interlochen Public Radio. IPR's news service, 91.5-FM, has about 18,000 listeners. Music Radio, 88.7 and 100.9, reaches 28,000 out of 280,000 in its coverage area (NW Lower Michigan). Youth Radio pieces (*Soundscapes*) will be broadcast several times on each station. Based on a Fall 2004 Arbitron survey<sup>7</sup>, it is expected that approximately 10,000 regional listeners will hear each broadcast, plus many more if NPR picks up the broadcasts.

Visitor estimates for the exhibits are conservative. The Great Lakes Children's Museum (GLCM) has more than 35,000 visitors each year. Currently, most are preschool through lower elementary aged children. Because the region lacks a separate science and technology center, strategic efforts are underway at GLCM to extend science learning to upper elementary children. Planned tours of the mini-exhibit and its replication in another watershed will likely guarantee numbers well beyond those viewing the museum-based exhibit. Since the exhibits will be hands-on, based on local sites and designed by area youth, they will address a common concern: keeping the interest of children ages 7-12.

The primary public audiences targeted by this project include a significant underserved, rural population. A secondary professional audience--the staffs and volunteers of community organizations engaged in informal science education will also benefit. Through a conference in Year Three and other dissemination efforts, staff from an additional 100 community organizations will learn about the model..

## 2. Audience Impact

The project's impacts will result primarily from the experiences of young people as they plan and document inquiry-based, technology-rich field explorations in science. The intended impacts are:

1. Greater understanding of science, specifically watersheds, among all three targeted public audiences as measured by before/after surveys of youth/mentor field teams, and convened focus groups of radio listeners (*Soundscapes*) and museum visitors (*Waterscapes*);
2. Greater understanding of the use of technology (e.g. global positioning systems (GPS), geographic information systems (GIS), digital photography, sound and video recording and Web-based content delivery), in field-based explorations, data collection and publishing among youth/mentor field teams as measured during initial orientation/training and during the summer institute; and
3. Increased collaboration among community organizations as measured by surveys during conferences, and through interviews of organization members.

## 3. Impact Evaluation

The evaluation plan has been developed by Inverness Research Associates, Inverness, CA. Inverness Research Associates is well-suited to conduct this evaluation, having over 15 years of experience studying a wide range of science and mathematics education programs in both K-12 schools and in out-of-school settings. (See references under "Project Team/Contractors".)

The overall goal of this evaluation will be to document the effectiveness of *Listening to the River*, to support the project by discovering ways to contribute to its improvement, and to help document and disseminate the model that is developed. Inverness will use both quantitative and qualitative methods to look at a range of components and activities of the project. By using multiple evaluation methods, as described in the full Evaluation Plan offered as a supplemental document to this proposal, Inverness will triangulate the study's findings to create a rich and multi-faceted view of the project's impacts.

The evaluation is organized by project year, with each year having a particular focus.

Year 1: Formative evaluation and design assistance: In the first year of the project, Inverness Research Associates will serve primarily in a formative and design assistance capacity, providing feedback at critical junctures in the project.

In the first year, as more is learned about the project, evaluation instruments for application in the second year will begin to be developed and refined. Inverness may also begin conducting program observations of the field activities focusing on participants' experience in order to pilot evaluation procedures.

Year 2: Examination of participant experience of *Listening to the River*: In the second year, the evaluation will focus on the participants' experience. A range of evaluation approaches will be used to document the nature and quality of the program, and the strengths, weaknesses, and benefits of the project to the participants. Part of the evaluation will involve study of the various activities, relationships and outcomes of the watershed education component.

Year 3: Examination of project sustainability; study of pilot activities; distillation of lessons learned: In the third year of the project, an examination of the ways in which the partner organizations work together to create a web of resources, expertise and materials will be undertaken. Through interviews with staff, partners, and other key participants, evaluators will study the extent to which programs, relationships and structures are in place that will be sustainable beyond the life of the project.

A key part of this year's work will also be to conduct an evaluation of the pilot activities as they take place in the pilot community of the Little Traverse Bay Watershed, using the same methodologies as in Year 2 (at the original site) to study the pilot project.

Inverness will provide the following written documents from the evaluation of *Listening to the River*: informal memos, brief interim reports at the end of Years One and Two, a conference PowerPoint presentation, and a final report in the form of a publishable article.

#### 4. Strategic Impact

This project results in: 1] an approach to coalition building that creates an intermediary organization which unites other community groups into an authentic partnership with a clear purpose; 2] a set of dynamic watershed education strategies for youth. This approach:

- Integrates and capitalizes on the resources found within existing community organizations;
- Uses important new technology to inform and update traditional media deliverables;
- Establishes an infrastructure of sustainable practices in community settings, through field explorations and digital data collections that stimulates and supports a growing repository of fresh content for youth radio segments, museum exhibits and website content; and
- Gives voice to youth in decision-making;

#### b. Innovation

##### 1. Project Deliverables

**Introduction:** A focus on watersheds is integral to the project, providing a powerful educational context for an array of science learning opportunities. It also merges a broad social demographic reaching from the headwater areas (typically rural and less populated) to the higher density populations that are historically established at the river mouth. With the watershed's geography as connector in a community, classic boundaries of political jurisdiction, economic level, age, gender and education can be crossed.

The Grand Traverse Bay Watershed provides a perfect backdrop for the project's investigations into environmental science and the corresponding human interactions. Encompassing 973 square miles on the northwest coast of Michigan's Lower Peninsula, it boasts scenic bluffs, forests, nearly a hundred inland lakes, several hundred miles of streams, intact wetland systems and globally rare ecosystems.

The area has experienced phenomenal growth in population and development the past twenty years. It is also one of the most popular tourist destinations in the Midwest. This growth has placed tremendous pressure on the area's natural resources, particularly its water resources<sup>8</sup>.

**Basis for the Project Design:** The proposed watershed-based informal science education (ISE) project, *Listening to the River*, consists of a series of interdependent deliverables, built on the expertise and capacity of organizations partnering under a new Coalition for Watershed Education. While each component can stand alone as an ISE activity, it is the components' connectedness that makes this project innovative and sustainable.

The partners' previous experiences, data compiled in planning meetings, and reviews of literature on informal science and youth decision-making led the planners to establish several underlying principles that guided the design of *Listening to the River*:

- Youth and mentors choose to be involved because they have a highly personalized interest;
- Each experience links teens to active science investigations through observation and direct experience, with an intentional focus on relevant science fields;
- Multiple pathways and formats are used to engage the participants;
- The process of exploration is inquiry-based and hands-on;
- Time for preparation and reflection is built in;
- Field and production work is done in large blocks of time to allow for flexibility; and
- Field experiences are immediately followed by studio, lab and production time as needed.

#### Component 1: Development of the Coalition for Watershed Education (CWE)

The four Coalition partners described in the project Summary have been the key planners for this proposal. Ongoing development of a Coalition whose representatives are enthusiastic about connecting the project components is crucial for the success of the project – as a formative process and as a product. Inverness Research Associates will guide formative evaluation as noted in the Evaluation Plan.

Education and technology coordinators from Land Information Access Association (LIAA) will convene the consultants from the four core partners and other community organizations as appropriate for planning specific components. The Coalition will initially focus on recruiting and training mentor and youth participants for the *Watershed Discovery* field teams. As other project components unfold, evaluators will help document the various roles and functions\* of the Coalition as it works with different community groups. This will be essential in the development of the *Community Guidebook* that helps sustain the program locally and fosters its implementation in other communities. [\*Note: Specific tasks are outlined in the Project Design section. The roles and functions of the Coalition are described under "Collaboration".]

#### Component 2: Watershed Education Website

At the start of the project, LIAA will create a *Coalition for Watershed Education Website (CWE Website)* that will serve three main purposes:

- Information clearinghouse: program information, dissemination and educational resource;
- Project management: project logistics and vehicle for the collection, aggregation and display of mapped watershed data (available to specific users); and
- Display of interactive watershed discovery experiences, blending multimedia with mapped data.

The website will be based on LIAA's Community Center (CC) software platform, a web-based application blending content management with GIS. The CC will support program management, logistics and youth reflection with interactive forums, news and calendars. Individual teams will create, edit and manage their own portions of the site. The CC will also support field teams with on-line data entry, data sharing, and interactive submission and aggregation of collected digital data (e.g., sound clips, photography, and geospatial data) from watershed field work. As the website grows, it will paint an increasingly vivid picture of the watershed, with geospatial data linked to sound and video. Users will be able to see and hear the

watershed in an entirely new way, and the content can be incorporated into both radio broadcasts and the touch screen technology of the exhibits.

Ultimately, the *CWE Website* will be a celebrated public site for access by all audiences. It will be a collection point for teaching materials relevant to watershed science and a means to disseminate the *Listening to the River* project findings. CC software supports differential user rights and experiences, thereby permitting users to experience the site differently. Site content will accommodate variations in the ages, expectations and learning styles of individual users.

### Component 3: Watershed Discovery

**Overview:** This component is the starting point for all other *Listening to the River* deliverables. All of the data, visual and audio images, perceptions and concepts that youth capture in the field, upload to the website and then transform into *Soundscapes* and *Waterscapes* deliverables emanate from their direct experiences in the watershed.

Conceptually, each deliverable will address the principle objectives of the coalition: to provide hands-on, authentic and relevant experiences for youth in a mentored environment; to explore concepts and issues of concern to the residents of a given watershed; to participate in inquiry-based science investigations by gathering information through observation and direct experience, and to interpret this information using appropriate technology to disseminate and communicate findings to the larger community.

**Component management plan:** LIAA will take the lead on coordinating this component, with the Principal Investigator and technology coordinator guiding the process. LIAA's staff specialists in GPS, GIS, geology and geography will serve as content experts. LIAA will use the expertise of an education/youth coordinator to synchronize the work of the education and youth consultants from the staffs of the core partners.

**Watershed Discovery field, studio and lab work:** Up to 8 field teams of 6 - 10 youth participants will join with mentors and content experts from various community organizations to explore, research and collect data within the watershed. Two types of teams are planned.

1. Multidisciplinary teams led by science content experts and supported by technology specialists, will focus on capturing pertinent information about a specific science concept through multiple technology sources: sound recording, digital video and geographic data capture. These teams will most likely emerge from an already formed 4-H or Scout group made up of youth with varied interests. [Refer to "Water Hydrology" example under Stem Content]
2. Single-focus technology teams, led by technology consultants, will help build skills in a particular technology (e.g. sound recording, digital video, or geographic data capture) with the collected science information secondary to the technology focus. This type of team will most likely emerge from interested individuals or groups, such as home schooled youth, a school journalism club or broadcast class. [Refer to example under STEM Content labeled "GPS".]

[Note: Depending on the grant start date, a smaller number of teams (2-4) may initially pilot the component in Year One.]

Mentors and content experts selected for their willingness to be role models for youth and for their passion for science and/or education, will undergo a day-long orientation and training session in the use of the technology and effective community-based science education strategies (e.g. Richard *Ponzio's Joy of Sciencing*<sup>9</sup>).

The students will also attend a daylong training to get an overview of the project and to select a specific technology focus. In addition, each field experience will be preceded by background reading and brief (30-60 minute) discussions to introduce relevant scientific concepts and prepare the participants for actual field work.

In the field, each team will use a mapping resource kit composed of a handheld computer with GIS software, GPS unit, digital camera, and digital audio recorder to gather digital data relevant to the particular aspect of watershed science or technology that is the focus of that field day. Content specialists

on the staff of the project partners, or consultants hired for a specific purpose will provide technical assistance in the field.

After each field experience, youth teams will go through a process of reflection (group discussions, field journals, on-line follow up). Then teams or individuals will go into science workplaces at the facility of one of the partners (e.g. LIAA computer lab, NMC science lab, sound production studio, etc.) to develop documentation and work on their particular component of the deliverables: website content, radio broadcast, and images and sound for the museum exhibit. This schedule will be determined by need.

**Timeline:** In Year One, the teams go into the field two-four times after school and on weekends between late March and early June, assuming grant notice is received by the previous December. After the 2<sup>nd</sup> field trip, teams will review progress with project partners (mid-course evaluation), then return to the field if necessary.

All teams will participate in a 3-day summer institute (early June at Northwestern Michigan College) to finalize production of the sound broadcasts (*Soundscapes*), web pages, and to participate in a design charrette for the exhibit (*Waterscapes*). [Note: The summer institute may be scheduled later depending on when grant notification is received.]

In Year Two, the Watershed Discovery process expands. One or two “Master Teams” made up of youth from the 1<sup>st</sup> year will be formed. These youths then have the option to serve as youth mentors for 6 - 8 new teams (and later as youth guides for the *Waterscapes* exhibit), going into the field year-round (6 – 8 trips) to replenish the content for the web, radio and exhibit components. Another summer institute will take place.

Late in Year Two and on into Year Three, the focus of the project planners shifts to coordinating the replication of the recruitment and field work in a pilot site: the Little Traverse Bay Watershed, through SEE-North, a regional science center. *Watershed Discovery* excursions will be sustained locally through 4-H and Scouts, and become part of those organizations’ ongoing programming. Letters of support from these organizations are attached.

#### Component 4: Soundscapes Radio Segments

Field team members who elect to pursue the radio broadcast component will work with IPR, a youth radio consultant and LIAA to produce independent radio segments documenting their field work. Similar in feel to NPR’s *Radio Expeditions*, these two- to seven-minute pieces will describe the project, report on a particular aspect of watershed science, and offer some of the collected sounds of the watershed. IPR will provide final production editing for these radio segments and broadcast each segment at least two times, locally. The segments will also be offered to NPR affiliates nationwide.

Participants will first be exposed to the varied uses of radio to tell stories, explain issues and share viewpoints. They will listen to science programs and reports like National Public Radio’s *Radio Expeditions*, *Living on Earth* and *Talk of the Nation Science Friday*, as well as Interlochen Public Radio’s programs *Outdoors* and *Ephemeris* and local reports. Discussions will focus on how information was presented. Is it simplified? Is it engaging? Would it engage someone who wasn’t already interested in the topic? Public Radio’s core values (love of lifelong learning, purpose, power to find solutions, attention to detail) will be discussed as they relate to ISE.

Youth will then be trained in how to gather information, interview sources and refine their stories using focus statements. After field explorations, they will go into the studio to learn to write radio scripts for the ear, not the eye, and to use sound to make compelling radio. Basic journalistic principles will be taught throughout: independence, balance, credibility, accuracy, attention to detail, etc. Youth will learn performance techniques for voicing their scripts and will gain technical skills in the use of field equipment including recording decks and microphones to record natural sounds, ambient sounds and voices. They will use digital audio editing equipment to edit, tape and mix their pieces for broadcast.

Depending on the field team, the day and the topic, these reports may take different angles; however, in all cases they will feature sounds gathered from the watershed. These *Soundscapes* Radio Segments offer a real-world performance of young people's work, providing a popular addition to the regular broadcasts on IPR News Radio, a NPR affiliate.

While the youth teams design and produce their segments, IPR producers will follow the teams and create a longer documentary piece about the project. This long-form piece will essentially be a compilation of the student radio pieces strung together with interviews and behind-the-scenes information that connects all the work into a richer portrait of the *Listening to the River* project and the watershed itself. This documentary of the process will be a valuable teaching and dissemination tool to both highlight and celebrate the value of this particular watershed and watersheds in general.

#### Component 5: Waterscapes: A Traveling Children's Museum or Science Center Exhibit

The *Waterscapes* component integrates and complements the *Watershed Discovery* phase through exhibits that engage the hearts and minds of the public and provide significant opportunities for informal science learning. Three essential concepts were acknowledged in planning the exhibits' design: 1] creation of exhibits that can be adapted to represent a unique watershed while simultaneously communicating essential features common to all watersheds; 2] a collaborative design process; and 3] recognition that CWEs in other communities that follow this model may not have the budget to independently design and fabricate a major exhibition.

Based on this framework, the Great Lakes Children's Museum will simultaneously create two types of exhibits: 1] an immersive, permanent museum exhibit, designed to travel as a rental to other children's museums, science centers and interpretive centers after several years; and 2] a mobile, pack-and-go mini-exhibit for use in various community spaces and with various audiences.

*The Museum Exhibition* is a 1500 sq. ft. immersive exhibit that recreates the experience of exploring a watershed by using the physical characteristics that are common to all watersheds (changes in elevation, texture and porosity of substrate, channelization, and climate) to form the "backbone" of the exhibit space. This "foundation exhibit" will:

1. Incorporate technology that permits field teams to drop in locally-generated content and transform the basic exhibit into a place-specific exhibition;
2. Include manipulable and interactive elements that provide hands-on experience with processes common to all watersheds as well as those that are watershed-specific;
3. Be intentionally designed as a traveling exhibit and, after its initial use by the Great Lakes Children's Museum (estimated at 3 years), will be made available to other venues for rental periods of 3 to 12 months; and
4. Appeal to the target audience of children ages 7 – 12 as well as families, casual visitors and school groups.

The "backbone" of this exhibit will be a construction that physically reinforces watershed features. Activities supporting independent investigation will be embedded in this watershed "excursion", directing visitors through a flow of pictures and mixed media displays, video and sound panels, HDTV monitors (and, possibly, RF tags and guest proximity triggers) that allow locally-generated content to be added to the exhibit. In this way the exhibit can be both generalized and highly location-specific.

*In a walk-through*, visitors will experience the main geological, biological and socio-cultural features of a watershed. Visitors can enter from multiple points within the watershed at their discretion and choose various paths. For example: one path begins at the headwaters and follows the natural flow of water toward the discharge, letting visitors experience how gravity and terrain influence the size and shape of a watershed. Another path meanders among bridges, dams and docks, highlighting the human/watershed interaction. A third path leads the visitor in search of flora and fauna, and sharpens their perspective on the ecology of a watershed. Inquiry-based interactive elements are embedded throughout the exhibit to

encourage visitors to investigate the processes at work in the watershed. At various points in the exhibit, youth-guides (emerging from the *Watershed Discovery* field teams) might offer their perceptions.

The museum exhibition will have national impact since it will be designed at the outset as a traveling exhibit. The GLCM will coordinate the exhibit design process, guide the development of inquiry-based interactive facets, and manage the exhibit when it travels.

*The Mini-Exhibit* is a 500 sq. ft. exhibit designed as a subset of the larger exhibit. Inspired by the sounds and images gathered by field teams in the Watershed Discovery component, it includes moveable walls with flat-panel HDTVs and computer monitors (some touch-screen), large and small mixed-media panels (acting like bulletin boards), many smaller display surfaces (e.g., mounted pictures), banners or similar “fabrics,” photographs, and additional multi-sensory components that “sample” the watershed. The exhibit can be entered from multiple points, with visitors free to follow a sequence of panels, or move randomly from one to another. The arrangement of the exhibit also creates a presentation space for discussions, facilitated activities and performances.

This mobile exhibit will:

1. Give the sense of a watershed in its basic form and design elements without providing an immersive experience;
2. Function as a temporary venue for sharing content during the field work phase, or for presentations by the field teams at conferences and public events;
3. Permit any group following the *Listening to the River* model to engage in an affordable exhibit design process;
4. Be available to small venues and/or rural communities in the watershed that do not have access to the museum exhibition;
5. Become part of the museum exhibition when used as a lobby display.
6. Become a permanent resource for any watershed education partner;
7. Be sent to the pilot replication site in the Little Traverse Bay watershed in Year Three.

The exhibit will be designed using high-quality construction materials and techniques so that it can be assembled and disassembled with relative ease, using familiar hand tools and easily transported. Like a theater set, the exhibit can be built and struck in several places over the course of a year.

The relatively simplicity and modest cost of this exhibit makes its execution achievable by almost any watershed education group. As a community resource, the mini-exhibit will have significant regional impact, be technologically durable, and provide a sustainable program opportunity for years to come.

The Great Lakes Children's Museum Education Coordinator will direct the development of these exhibits, beginning with an initial design prototype phase that could be applied in other watersheds. Both exhibits and their content will be planned from the ground in a group decision-making process that actively engages youth. It will be initiated in the planned summer institutes, and facilitated by mentors and experts from GLCM and skilled exhibit designers with expertise in exhibits.

A corresponding *Kit Book* for other museums and community organizations with guides and templates for customizing their specific content will be a companion piece to *Community Guidebook* planned for dissemination. It will include facility needs and details on breaking down and transporting the exhibits

The *Listening to the River* project will generate a model for creating public exhibits that can be implemented by any CWE that undertakes an investigation of its environment.

#### Component 6: Dissemination Conference for other Interested Community Coalitions

The Coalition partners will develop and deliver a one-day regional conference on watershed-based science and technology education in Year Three. Invitees will include a range of local to national community organizations and individuals (science educators, water resource researchers, technology providers, youth advocates and students) who might be interested in the process and findings of the CWE.

The conference content and format, informed by the coalition experiences during the first two years, will include issues relevant to building a similar coalition, strategies for informal science education, as well as particulars on methods and technologies used in the *Listening to the River* project. Speakers will be project staff members, content specialists from community organizations who have partnered with the Coalition, youth and mentors from the field teams, and the project evaluators.

The conference will take place in the fall of Year Three on the Great Lakes Campus of the Water Studies Institute of Northwestern Michigan College – a facility designed to handle large meetings, where an amazing view of the Grand Traverse Bay embodies the project's focus.

### Component 7: Dissemination Materials

As the project unfolds in the Grand Traverse and Little Traverse Bay watersheds, the Coalition will gather extensive documentation aimed primarily at the development of two separate pieces. The first, *A Community Guide to Watershed-Based Science Education*, will describe how to undertake a local project. The *Guide* will offer a full collection of the component materials, including examples of watershed science field explorations. It will illustrate how the six interrelated components of the project were implemented and include examples of student work and relevant products.

The Coalition, in concert with Inverness Research Associates, will also publish and disseminate an article that summarizes project findings and the coalition model. The audience for this report will be project funders and others interested in starting informal watershed education projects.

The *Guide* will be distributed at the regional conference (in print and CD-ROM), offered through the project website and further disseminated through the websites and publications of national affiliates of the project partner organizations such as Optimist clubs, 4-H and Scouting offices, the American Association of Museums and Public Radio Program Directors Association. The research article will be posted on the project website, distributed to the national affiliates and the research findings presented at targeted state and national conferences of community informal science educators. [Note: the process for disseminating individual components is discussed under each deliverable description.]

## 2. Project Design

Each of the *Listening to the River* project deliverable components has its origins in successful work done previously by the partner organizations. For example, LIAA has worked with field teams of children to compile and distribute mapped multi-media information. The Water Studies Institute currently manages a Freshwater Ecology Project that supports area K-12 science teachers and students in more than 20 research-based science field experiences. The Great Lakes Children's Museum surrounds children and adults with hands-on, interactive, and informal educational environments using a water-based theme. Interlochen Public Radio and LIAA have partnered to develop and produce *Landscapes of Community* radio broadcasts. (Letters of commitment and background of each partner organization are attached.)

One of the clear findings of LIAA's NSF-funded Watershed Summit was strong interest on the part of community groups to interrelate their activities with other organizations that have similar missions. The project planners chose the deliverables with this in mind. Each component encourages synergy and collaboration across organizations.

### **Detailed Project Plan:**

(Months 1-3) YEAR ONE: Initial Steps of Project Planning & Implementation

- Develop a press packet and publicize opportunities to get involved.
- Commence regular planning meetings of the Coalition and advisors.

- Build the LIAA *Watershed Education Website* so it is ready for the mentor/youth trainings.
- Initiate the youth recruitment process: The PI and education/youth coordinator work with the Michigan State University Extension 4-H Education Consultant and Girl Scout youth educators in the 4 counties of the watershed to identify interested youth. Special interest groups emerge from among home schooled/alternative school students, science teachers and ecology clubs. (Letters of support from 4-H and Scouts are attached.)
- Project staff and education/youth coordinator: 1] develop a project overview to present to community groups; 2] design a sign-on process for youth; and 3] set up field teams.
- Project staff and consultants work with 4-H and Scout leaders, the Water Studies Institute, Grand Traverse Conservation District and Optimist Club to identify mentors and content specialists with expertise in ISE topics/watershed issues and set up an incentive process;
  - The ideal mentor will be passionate about the watershed, understand the importance of sharing their time and friendship with young adults, is sensitive to varying interests, age and ability levels, non-traditional learners, and has a good sense of humor.
- Orient and train mentors/specialists and youth:
  - Mentors: One 4-6 hour group session prior to field experiences to include: discussion of good instructional practice, diverse learning styles, project expectations, safety issues, planning time, equipment needs and set up;
  - Youth: Day-long session to prepare for field experience to include: background materials, discussions and lab work to introduce relevant scientific concepts, use of the technologies; baseline evaluation instruments as needed;

(Months 3-6) YEAR ONE: Plan and implement the *Watershed Discovery* component: 1] develop the necessary release forms; 2] determine the best locations and schedule field experiences according to selected science/technology focus; 3] set up transportation to field sites; prepare toolkits; 4] develop field work guidelines for participants; and 5] pilot the field experiences with a small number of teams. The first six months then culminate in the three-day summer institute.

(Months 6-12) YEAR ONE: Major activities include the expansion of the field teams, initial design of the two exhibits, and a start on building the Mini *Waterscapes* Exhibit.

In YEAR TWO, field teams are added, and, by the end of the year, the start-up stages of replicating project deliverables one to five in another watershed begin. Another summer institute is held.

In YEAR THREE, the project team concentrates on facilitating the replication of the project in Little Traverse Bay, sustaining the infrastructure in both watersheds, and on developing and disseminating project materials.

### 3. STEM Content

Several timely regional watershed projects will be used to organize the STEM content in the project's *Watershed Discovery* component. The Boardman River Project of the Grand Traverse Conservation District works to protect and restore the Boardman River, one of the largest sub watersheds in the GTB Watershed, by restoring erosion sites and removing unwanted silt and sand from this blue ribbon trout stream. At the same time, the Army Corps of Engineers and the Michigan Department of Natural Resources are moving ahead with plans to remove four dams along the Boardman River—one of the most comprehensive dam removal projects in the nation.

These two important, ongoing, regional projects offer an opportunity to introduce informal learners to watershed hydrology, while orienting them to timely community issues. Hydrology topics will include the hydrologic cycle, surface water, groundwater, aquifers, porosity and permeability, sediment transport, stream flow, stream stage, and runoff.

Every participant will also be oriented to the technology of digital data collection. Team members electing a specific discipline (e.g. global positioning systems (GPS) and geographic information systems (GIS), digital audio, digital video) will be given more detailed theory associated with their technology discipline. Field work will reinforce theory with authentic, hands-on experiences. This instruction in geospatial science addresses a resource focus within NSF's Human and Social Dynamics priority area.

To guarantee accuracy and age-appropriateness of STEM content, the project will rely on science educators from the core partner organizations, the advisory committee and community organizations.

#### 4. Educational Research & Prior Work

An extensive review of the literature helped define the selection of products, the target age groups and the design and flow of the *Listening to the River* project. Documents on ISE and inquiry by Ellen Wahl<sup>10</sup> and from the National Science Teachers Association<sup>11</sup> led to a design that is inquiry-based, self-directed, engaging for all audiences and builds skills and interests for lifelong science experiences.

A 1996 study by the project's evaluators, Inverness Research Associates<sup>12</sup>, concluded ISE institutions frequently focus only on elementary aged students. Research by the National Institute on Out-Of-School Time notes "fifty-two percent of teens say they wish there were more community and neighborhood based activities during the after-school hours"<sup>13</sup> and identifies two crucial elements in helping youth learn to be productive: connections with adults and peers in diverse settings and challenging learning experiences<sup>14</sup>. This research helped project planners choose teens between ages 11 and 17 as the core participants and team them with adult mentors. The choice of the watershed as an overarching theme for these age groups is supported by the Wildlife Conservation Society: "Often, our most immediate impact is with teenagers. It is vital to imprint the impressionable minds of these soon-to-be-adults with a respect for nature"<sup>15</sup>.

According to The National Conference on Science After-School, one focus "that is particularly well-suited to hands-on science and mathematics"<sup>16</sup>, should be after school projects that link engaging ways of learning with building youths' social skills. A review of curricula and training materials from 4-H Afterschool<sup>17</sup> revealed that programs that involve older youth in after school experiences and training volunteers in experiential learning models have been successful. They include: Give Water a Hand<sup>18</sup>, Youth Experiences in Science<sup>19</sup> and youth environmental awareness programs like Michigan's Reaching Environmental Awareness and Action in Communities Together REACT<sup>20</sup>.

The Coalition will approach the Digital Library for Earth Science Education (DLESE)<sup>21</sup> as a possible source for disseminating data and the project Community Guidebook. Websites with tools like Earth Force Project Green's "Connecting the Watershed and Community"<sup>22</sup> and EPA's interactive site for mapping a watershed, "Surf Your Watershed"<sup>23</sup>, will be incorporated into the training for youth/mentor teams.

The Association of Science-Technology Centers' YouthAlive materials<sup>24</sup> provided guidance on how to actively engage youth in museum and science center programs. Plans for the sound recording and radio broadcast elements were based partially on findings from innovators in acoustic ecology: For example, Jim Cummings' "Listen Up: Opening Our Ears to Acoustic Ecology"<sup>25</sup> article sets forth a new generation of sound recording that is stretching the limits of the genre; and the non-traditional work of Jonathon Strom, who describes the "subtle variations in water's voices and the soft natural quiet of forest landscapes."<sup>26</sup>

Youth training material from the Youth Media Distribution<sup>27</sup>, and NPR's "Next Generation" program, "How to Do Radio"<sup>28</sup> provided ideas for youth training in radio segments.

The project STEM content aligns with the Michigan Curriculum Framework Standards and Benchmarks in Science<sup>29</sup> – especially Content Standard 2: "All students will demonstrate where water is found on earth, describe characteristics of water and how water moves and analyze the interaction of human activities with the hydrosphere."

**Prior Work:** A planning grant, NSF Project Number # ESI-0431707 in the amount of \$47,778, was awarded to Land Information Access Association from August 2004 through July 2005. Titled *Listening to the River: ISE Planning Grant*, the grant was requested to help expand partnerships, refine objectives and

project goals, and to delineate an evaluation program for the proposed *Listening to the River* project. A discussion of each objective and its outcome follows.

*Objective 1: To expand the project partnership with the informal science community;*

*Objective 2: To build connections with additional community ISE providers, regional youth organizations, youth mentors and youth advisors, non-school organizations and groups;*

To address objectives 1 & 2, a core advisory panel and project staff developed a comprehensive census of organizations involved in ISE practice in the Grand Traverse Region. A website [<http://www.liaa.info/soundscapes/>] was designed through which to publish this census, ISE documents and resources. The site was also used for project management.

The census led to a Watershed Summit, where more than 50 experts and students came together to improve the understanding of ISE in the region, stimulate collaborative relationships and explore innovative ideas.

Two evaluators, Dawn Huntwork and Mark St. John of Inverness Research Associates, spent the day observing the process to offer their expert perspective on the Summit and provide help with front-end evaluation for LIAA's subsequent NSF proposal.

A number of key recommendations surfaced from the Summit. These were published in a report: "Building an Appreciation of Watersheds: Informal Science Education SUMMIT", that was sent to all participants.

The present proposal incorporates a number of the Summit recommendations that dealt with the challenge of getting youth involved: direct recruiting of students; using youth as teachers, mentors and advisors; and building ownership by giving youth a voice in design and interpretive opportunities.

Other recommendations led the project team to emphasize collaboration among community organizations. Anecdotal comments from the Summit confirm the need for assistance with collaboration. For example, "I learned how to network – we often work alone, and this was a chance to find out what others are doing and to get to know colleagues in the area. We have learned a lot and created relationships that will continue, " and, "It was great to have students involved and get their perspective – for some that was the most valuable aspect of the summit."

*Objective 3: To further develop a detailed work plan that clearly delineates specific participant roles and responsibilities – resulting in a demonstration model structure.*

The planning grant helped define what each project participant will do, how mentors and teens will be recruited and engaged, incentives for mentors, how to manage materials, and how best to apply technology. Details for each of the deliverables and the management structure described in the Collaboration section offer clear evidence that a project framework and theory of action is now in place.

*Objective 4: To develop and articulate a more effective dissemination plan so the concepts and methods of the project are transferable to other watersheds.*

As the census of organizations emerged, and more community connections were made, many community resources that have larger national networks or comparable organizations in other regions were identified. Three of these organizations (4-H, Scouts, Optimist) have become key participants in the proposed project, and are now working closely with the core partners.

*Objective 5: To engage an expert evaluation team well versed in ISE methods and goals.*

Inverness Research Associates played a critical role in evaluating the planning project and articulating goals and objectives for the present proposal.

## **c. Collaboration**

### **1. Project Team**

a. Senior *Staff and other key professionals* include personnel at each of the core partner organizations with primary responsibility for directing the component(s) of the project built around strengths within their

organization. Each core partner agency will help disseminate project activities to its regional and national counterparts.

Joe VanderMeulen, Ph.D., Executive Director of Land Information Access Association, the project's primary PI, will provide overall project direction and oversee the staff of LIAA

Peter Payette, News Director at Interlochen Public Radio, will coordinate all aspects of the sound recording and radio production components

Mary Manner, M.S., Director of Education for the Great Lakes Children's Museum, will coordinate the design and production of the exhibits, and serves as a science education consultant for all aspects of the project

Marguerite Cotto, Vice President for Lifelong Learning at Northwestern Michigan College, will connect project activities with the resources available in the community college network

Other professional staff at LIAA will participate in project activities as dictated by their area of expertise:

Carl Ferguson, M.S.: Project Coordinator; natural resources and project management

Dave Frey, M.S.: Technology Director; programming & natural resource management

Paul Riess, M.S.: GIS Specialist; GPS, geography and biology

Marilyn Hueller: Graphic arts and publication support

*b. Advisory Committee Members* are professionals with expertise in science and technology education, youth development and advocacy, and watershed and river science. The advisory committee will provide guidance on the development of STEM content, best instructional practice, ensure content accuracy and assist with broad dissemination of the project.

Gary Appel, Senior Program Associate, North Central Regional Education Laboratory

Allison Arnold, Community Learning Center Director, Traverse City Area Public Schools

Anne Brasie, Executive Director, Watershed Center Grand Traverse Bay

Stephen P. Barbus, Dean College of Education, Saginaw Valley State University

Becky Cooper and Tim Ervin, Great Lakes Water Studies Institute at Northwestern Michigan College

Andy Knott, Environmental Coordinator, Grand Traverse Band of Ottawa and Chippewa Indians

Steve Largent, Director, Boardman River Project of the Grand Traverse Conservation District

John Noonan, Executive Director, Great Lakes Children's Museum

Patty O'Donnell, Planner/outreach, Northwest Michigan Council of Governments

Mary Whitmore, Executive Director, SEE-North, Petoskey, Michigan

*c. Consultants* will be employed to augment the program where particular expertise is needed:

Chris Kitzman: Education Consultant: Coordination of education and youth groups, training, field trips, summer institute

Wanda Repke: 4-H Volunteer and Youth Development Coordinator: consultant for youth and mentor recruitment, mentor/volunteer training

Alyne Ellis: Youth radio consultant: youth radio education and production in Year One activities

Mary Whitmore: Science education specialist: consultant and Executive Director of SEE-North, the coordinating agency for the replication site: Little Traverse Bay Watershed.

#### *d. Contractors*

Exhibit Design: Project staff anticipates contracting with skilled exhibit designers with expertise in exhibit technology. Two firms have been contacted for preliminary cost estimates. A proposed treatment from one, Matthew Martin DesignWorks is attached in Supplemental Documents.

Evaluation: Inverness Research Associates: Inverness Research Associates (IRA) is well-suited to conduct this evaluation, having over fifteen years of experience studying a wide range of science and mathematics education programs in both K-12 schools and in out-of-school settings. Relevant projects – described in the Evaluation Plan in Supplemental Documents, include work with Packard Foundation, Community Science Workshops, and Bay Area Discovery Museum and on a range of science exhibition projects throughout the nation.

## 2. Partners

The Coalition is anchored by four community organizations:

- Land Information Access Association-LIAA (technology, project management and facilitation);
- Northwestern Michigan College's Great Lakes Water Studies Institute-WSI (learning, collaborating and convening centered on freshwater);
- Great Lakes Children's Museum-GLCM (exhibit design and education);
- Interlochen Public Radio-IPR (media/broadcast production).

Each of the partnering organizations in this coalition has inherent strengths. These strengths have made them historically successful in pursuit of their individual missions. These unique, individual strengths also make the innovative aspects of this project possible. In addition to project management and facilitation, LIAA is experienced in the use and teaching of GIS and GPS and has well-developed applications to deliver the results of geographic analyses over the web. IPR has a broad and diverse listenership as well as the know-how and facilities to teach the techniques and technology of radio journalism. The GLCM has qualified educational staff and significant experience with educational program development. In addition, they clearly understand museum exhibit development and have facilities for exhibit display. WNM/C/WSI has broad watershed stewardship experience plus extensive resources and facilities through the Community College community. **Note: The roles and responsibilities of the partners are outlined in the Management Chart on the following page.**

## 3. Collaboration Process

None of the project partner organizations could accomplish *this* project alone. It is their collaboration that makes the impact possible. For example, IPR could assemble youth teams to interview or collect sounds from the watershed. However, without the WSI to provide watershed science linkages, the science learning aspect would suffer. Similarly, without LIAA to provide technological assistance, these collected recordings would lose geographical context. Without the GLCM, the opportunity to pass new science learning to a younger audience is lost. It is only through collaboration that the innovative nature of this project is possible and its strategic impact realized. Therefore, project partners and staff will communicate regularly via a project management website, e-mail and monthly meetings to plan and review progress.

The Coalition is well prepared to handle the complex management process of this project. The Coalition has been in place, communicating well and refining the project plans for more than a year. The project has been well-documented and planned, following a clear and coherent sequence of steps as one component builds on another.

For other communities, the makeup of the Coalition will be different; however, local coalition partners in major watersheds across the country should be able to build the necessary capacities, including:

- Fiscal management;
- Watershed education and advocacy;
- GPS, GIS, multi-media, website development;
- Media production and delivery – particularly public and/or community radio;
- Science education exhibit development at children's museums, nature and science centers;
- Linking with higher education community;
- Recruiting, coordinating and organizing youth resources.

**Listening to the River  
Project Management Chart**

<b>Organization</b>	<b>Management</b>	<b>Technology</b>	<b>Education</b>	<b>Support/Administrative</b>
Land Information Access Association (LIAA)	<ul style="list-style-type: none"> <li>Executive Director/PI</li> <li>Overall Project Director</li> <li>Liaison w/Project Partners</li> <li>Budget Management &amp; Contracting</li> <li>Liaison w/Evaluation Team</li> <li>Public Contacts/Outreach</li> </ul>	<ul style="list-style-type: none"> <li>Project Coordinator</li> <li>Oversee Tech. Efforts</li> <li>Liaison w/Tech. Staff</li> <li>Computer Applications &amp; Web Sites</li> <li>GIS/GPS Training &amp; Oversight</li> </ul>	<ul style="list-style-type: none"> <li>Education Coordinator</li> <li>Ed. Content Development</li> <li>Coordinate Youth Groups</li> <li>Coordinate Training</li> <li>Coordinate Field Trips</li> </ul>	<ul style="list-style-type: none"> <li>Administration &amp; Publication</li> <li>Financial Administration</li> <li>Design/Publication Support</li> </ul>
Great Lakes Children's Museum (GLCM)	<ul style="list-style-type: none"> <li>Director of Education</li> <li>Liaison w/Project Partners</li> <li>Budget Management</li> <li>Public Contacts/Outreach</li> </ul>	<ul style="list-style-type: none"> <li>Exhibit Manager</li> <li>Coordinate Exhibit Design</li> <li>Coordinate Exhibit Fabrication</li> <li>Coordinate Exhibit Movement</li> </ul>	<ul style="list-style-type: none"> <li>Science Educator</li> <li>Manage Participant Input on Exhibit Design</li> <li>STEM Content Development</li> <li>Training Support for Youth &amp; Mentors</li> </ul>	<ul style="list-style-type: none"> <li>Dissemination Support</li> <li>To National Museum network</li> <li>Publications Support (writing &amp; editing)</li> </ul>
Northwestern Michigan College (NMC)	<ul style="list-style-type: none"> <li>Vice President</li> <li>Liaison w/Project Partners</li> <li>Budget Management</li> <li>Public Contacts/Outreach</li> </ul>	<ul style="list-style-type: none"> <li>Facility Manager</li> <li>Training/Classroom Facilities</li> <li>Adaptations of Procedures for Community College Radio</li> </ul>	<ul style="list-style-type: none"> <li>Science Educator(s)</li> <li>STEM Content Development</li> <li>Coordinate w/High School Teachers</li> <li>Mentor Recruitment</li> <li>Training Support for Youth &amp; Mentors</li> </ul>	<ul style="list-style-type: none"> <li>Dissemination Support</li> <li>To Community College networks, Water Studies Institute Affiliates</li> <li>Publications Support (writing &amp; editing)</li> </ul>
Interlochen Public Radio (IPR)	<ul style="list-style-type: none"> <li>News Director</li> <li>Liaison w/Project Partners and Youth Radio consultant</li> <li>Budget Management</li> <li>Public Contacts/Outreach</li> </ul>	<ul style="list-style-type: none"> <li>Radio Producer/Editor</li> <li>Manage Radio Productions</li> <li>Reproduction, Editing and Broadcast of Sound Segments</li> </ul>	<ul style="list-style-type: none"> <li>Youth Radio consultant</li> <li>Ed. Content Development</li> <li>Production Support for Youth &amp; Mentors</li> </ul>	<ul style="list-style-type: none"> <li>Dissemination Support</li> <li>To IPR Subscribers</li> <li>To NPR Affiliates</li> <li>Publications Support (writing &amp; editing)</li> </ul>
Traverse City Optimist Club	<ul style="list-style-type: none"> <li>Club President</li> </ul>		<ul style="list-style-type: none"> <li>Program Advisor</li> <li>Mentor Recruitment</li> </ul>	<ul style="list-style-type: none"> <li>Dissemination Support</li> <li>To National Partners</li> </ul>
4-H & Girl Scout Councils	<ul style="list-style-type: none"> <li>Education Coordinator/Program Leader</li> </ul>		<ul style="list-style-type: none"> <li>Program Advisor</li> <li>Youth Recruitment</li> </ul>	<ul style="list-style-type: none"> <li>Dissemination Support</li> <li>To National Councils</li> </ul>