

**THE CRYSTAL LAKE 'WALKABOUT' -  
ENVIROMENTAL AWARENESS THROUGH 'HANDS-ON' EDUCATION**

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**ABSTRACT**

The Crystal Lake "*Walkabout*" is an interactive "hands-on" program of science education intended to instill and nurture in young people and adults an awareness of their watershed environment through observational monitoring and environmental exploring. The "*Walkabout*" is designed primarily for students, but its philosophy applies equally to property owners and visitors. It focuses on what all can do to preserve the integrity of the Crystal Lake Watershed by enhancing community awareness, providing educational experiences, and promoting future environmental improvements. The "*Walkabout*" is specifically designed for the Crystal Lake Watershed in northwest Lower Michigan and containing the ninth largest inland lake in Michigan, but its structure and philosophy can be extrapolated to other watersheds.

The "*Walkabout*" expressly targets students, but anyone young of heart and open of mind is welcome to participate as a group or to ponder its philosophy individually. Environmental awareness is developed during a "walk about" selected Interpretive Sites, with environmental professionals providing guidance, or personally in one's special place or mind's eye. It is intended to inspire participants to look at their Watershed from several points of view. At various times in their lives, each participant will be making informed choices on water quality, land use, zoning, septic systems, green belts, sustainable development, education, and watershed management.

The "*Walkabout*" includes a 36-page Interpretive Manual that is both An Educational Primer for Students and A Reference Handbook for Property Owners and Visitors. It contains Watershed facts, history, a detailed GIS map, and descriptions of the eight Interpretive Sites. It also includes a series of specific issues, such as hydrology, water quality, land use, nonindigenous species, atmospheric deposition, sediment chemistry, lake levels, and watershed management.

The "*Walkabout*" encompasses a series of Interpretive Sites within the Crystal Lake Watershed, each representing an unique environmental segment: the Lake, tributaries, wetlands, high ridges, sand dunes, Betsie Bay, and Lake Michigan. Hydrology is the unifying theme - how a drop of water might enter, linger, and then pass through the Watershed. The "*Walkabout*" comprises a field trip to four of the eight Interpretive Sites, selected on a biennial basis, that are interpreted by environmental professionals from the cosponsoring organizations. The "*Walkabout*" is presented in four, one-hour sessions: in the Fall to 8th grade students, in the Spring to 6th grade students, and in the Summer to the general public. Each participant receives a colorful T-shirt with the multicolor GIS map of the Crystal Lake Watershed and the "*Walkabout*" Interpretive Manual.

Initiated in 1993, the Crystal Lake "*Walkabout*" has been offered to more than 1,600 students, residents, and visitors. The prime sponsor is the Crystal Lake Watershed Fund, Inc., a nonprofit organization, that supports citizen initiatives for water quality monitoring, septic system control, sustainable development, and land conservancy through education, for watershed management.

## CONCEPT OF THE "WALKABOUT"

The concept of the "**Walkabout**" is borrowed from the Australian Aborigines. Tribal members would take brief leave from their responsibilities of daily living. They would then "walk about" their environment and renew their fundamental spiritual associations. Henry David Thoreau, the noted naturalist, might well have used the same approach in his extended sojourn at Walden Pond:

*"I have met with but one or two persons in the course of my life who understood the art of Walking, that is, of taking walks, who had a genius, so to speak, for sauntering . . ."*  
- Thoreau, *essay on Walking, Atlantic Monthly, June 1862.*

*"A lake is the landscape's most beautiful and expressive feature. It is earth's eye; looking into which the beholder measures the depth of his own nature."* - Thoreau, *Walden, 1854.*

The modern-day context of the "**Walkabout**" is intended to instill and nurture in young people a sense of awareness of their surrounding environment by applying a proven and successful format through an interactive educational program of science education involving "hands-on" observational monitoring and environmental exploring. Comparable programs have been developed throughout the U.S. and other countries under various names, such as: Lake Walk, Stream Walk, Water Watch, Bay Watch, etc. The focus of the Crystal Lake "**Walkabout**" is unique in developing an environmental awareness of the Crystal Lake Watershed. While specific to Crystal Lake, Benzie County, MI, the success of this highly successful program can be extended to other watersheds. The "**Walkabout**" is designed to enhance community awareness, provide hands-on educational experiences, and contribute to future environmental improvement.

As the name "**Walkabout**" suggests, you, the participant, simply "walk" about your watershed environment and think about what you see! Sounds easy? It is! You try to see Crystal Lake and its Watershed from different points of view. Don't look at the Lake as a just a place to swim, or boat, or fish, or watch the sunset. Think of all the water in Crystal Lake - where it comes from, what happens to it in the Lake, and where it goes. Think about the impacts of human activities and land development and water use. Think of how Crystal Lake was in the past, and how it might be in the future. You'll have a little help and guidance to prime your thinking pump.

You may follow a few simple guidelines in observing the watershed environment about you in a group. You are also free to observe what might be of interest to you personally. You might want to think about how you and your friends, or your neighbors and visitors, use Crystal Lake. What about the fish, birds, and plants that live in, on, or near Crystal Lake? How many locations with different environments can you describe around Crystal Lake? How should the Crystal Lake Watershed best be managed to preserve its unique character?

During the Crystal Lake "**Walkabout**" you'll visit several Interpretive Sites within our Watershed. Some of these Sites you may have never seen or heard about before. Each Site, while geographically and environmentally different, is associated with one another within the Watershed in different ways. Listen to the Site Interpreters and watch their demonstrations. Try the activities and suggest others. Be curious! Ask questions! Keep your eyes and ears open. You may hear and read about a few new "words" (underlined). You're sure to finish the "**Walkabout**" with a better understanding of how water moves about our watershed environment.

## WATERSHED ENVIRONMENT

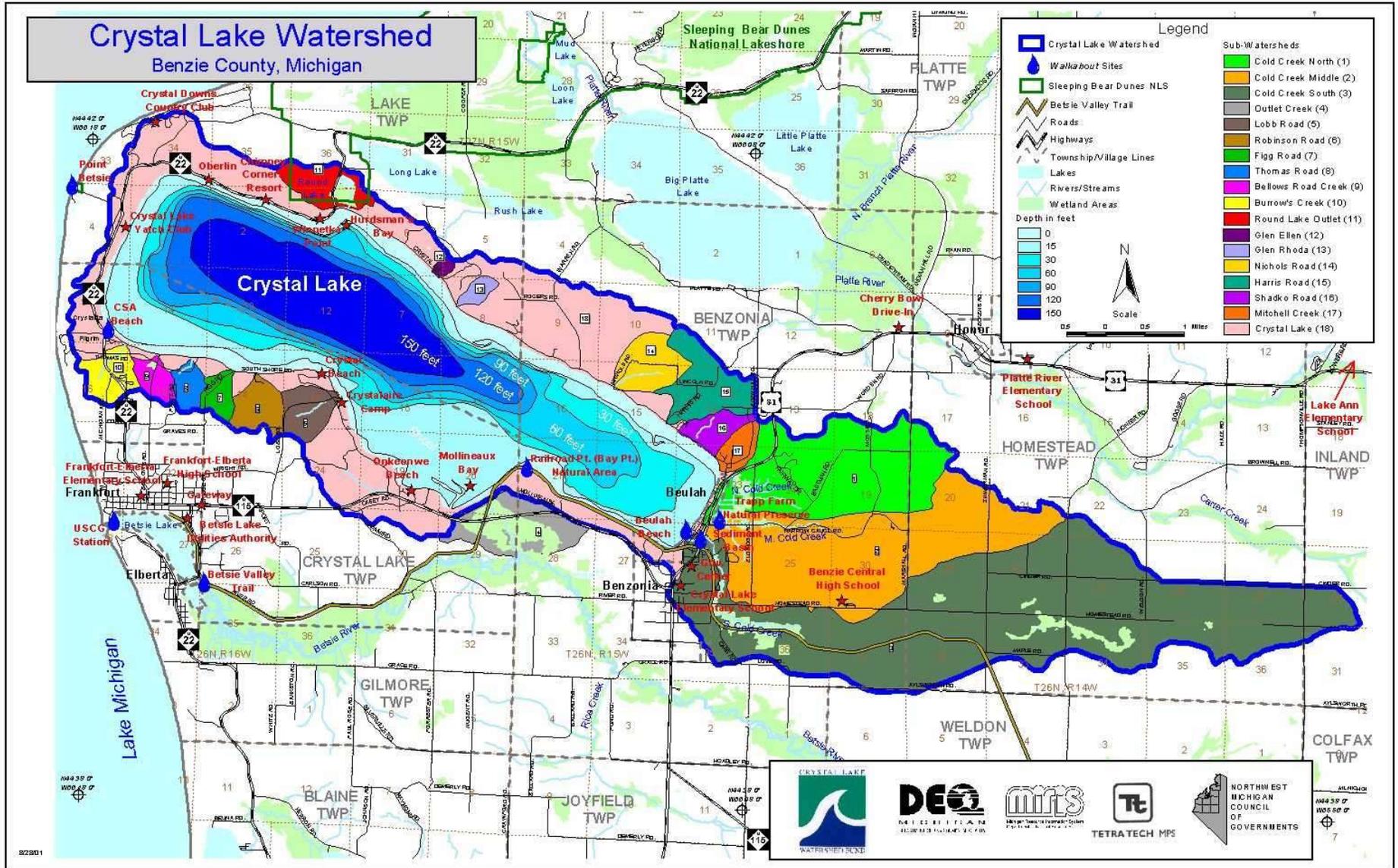
First a few words to describe what we're going to "walk about" (**FIGURE 1**). The Crystal Lake Watershed (Benzie County, NW Lower Michigan) is small compared to the two largerriverine (river) watersheds to the north and south. It contains parts of three townships around the Lake (Benzonia, Crystal Lake, and Lake); parts of three other townships (Homestead, Inland, and Weldon) are drained by Cold Creek, the major tributary. The Villages of Beulah and Benzonia are near the East End of Crystal Lake. The City of Frankfort and the Village of Elberta are near the West End of Crystal Lake (just over the hills), but are actually in the Betsie River Watershed. Benzie County was first surveyed in 1838-9 by Alvin and Austin Burt, who called Crystal Lake, "Cap" Lake (short for Whitecap, for the large waves on the Lake).

Crystal Lake is shaped something like a big footprint. It's a depression in the ground filled with lots of water. The outline of the high ridge around Crystal Lake is like an even bigger footprint with a big "toe". The Crystal Lake Watershed (which make up a "boot" with a big "toe" pointing from NW to SE) contains the Lake and all of the land around it up to the tops of the high hills. Within the Crystal Lake Watershed are seventeen smaller "sub-watersheds" with small creeks flowing into the Lake. Beyond the hills to the North is another larger watershed - the Platte River Watershed. To the South is yet another larger watershed - the Betsie River Watershed. To the West is a very large watershed - the Lake Michigan Watershed. The Crystal Lake Watershed is part of the Betsie River Watershed, which in turn is part of the Lake Michigan Watershed.

There are two ways to define a watershed. One way is to include just the land around the Lake, that is, the land that "sheds" runoff (rain water and melted snow). The preferred way is to include both land and water. The total area (land plus water) making up the Crystal Lake Watershed (43.67 square miles) is not especially large compared to other watersheds in Michigan. What makes the Crystal Lake Watershed unique is that the surface of the Lake is about 35% of the total Watershed (land + water). The Lake has a maximum depth of 165 feet and a surface area of 15.4 square miles (9,854 Acres), which makes it the ninth largest inland Lake in Michigan! It also contains a lot of "crystal" clear water, almost a quarter of a trillion gallons (242,000,000,000 gallons, or 740,000 Acre-ft, or 0.22 cubic miles). If all this water were spread evenly over all of Benzie County (assuming it was flat and water didn't soak into the ground), it would cover the land to a depth of 3'-8", or just about head-high for a five-year-old. Since its original survey, Crystal Lake has changed only slightly in area, but dramatically in level - now set at 600 feet above mean sea level (plus or minus ¼ foot, summer to winter).

Crystal Lake is almost entirely surrounded by steep wooded bluffs, remnants of the last ice age. The Watershed comprises portions of six townships and two villages. The Trapp Nature Preserve contains regional significant wetlands within the Watershed. The Railroad Point Natural area contains some of the high bluffs area. The character of living within the Watershed is predominantly single-family. The area is frequented by local residents, riparian owners, and vacationers. Land and water uses within the Watershed are predominantly recreational with some fruit farming and light manufacturing. Because of its unique geography among Michigan lakes, water quality is exceptional - hence the name, Crystal Lake. The "**Walkabout**" is intended to increase the overall environmental awareness of this unique region.

FIGURE 1. The Crystal Lake Watershed and "Walkabout" Interpretive Sites.



## HYDROLOGY

The unifying theme of the “*Walkabout*” is hydrology, i.e. the science that deals with the occurrence, circulation, distribution, and properties of the waters of the earth and its atmosphere. A “sidewise” view of the Crystal Lake Watershed is useful to explain the hydrologic cycle, that is, how water moves about the Watershed (**FIGURE 2**). Water passes from a vapor in the atmosphere through precipitation (rain and snow) onto the land and water surfaces, and ultimately back into the atmosphere by evaporation from water surfaces and by transpiration from trees and other plants. The total of evaporation + transpiration is called evapotranspiration.

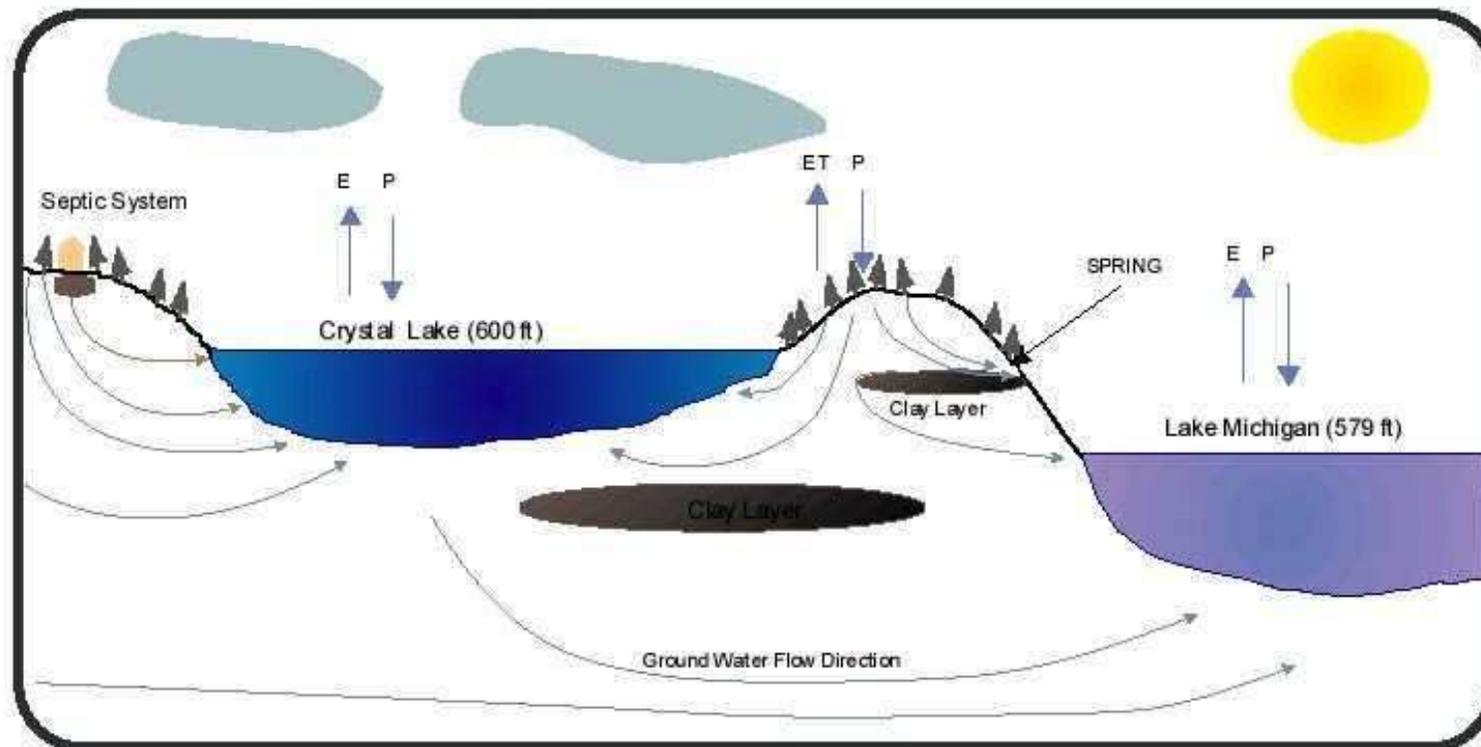
If you dig a hole in the ground, at some point you will reach water. This point is called the water table, which is important for two reasons. Drain fields for septic systems can not be put below the water table because the wastewater has no place to go. Wells for drinking water must be driven far enough below the water table and into a pervious (porous) formation (sand not clay) to get good flow. During the “*Walkabout*” you will visit several Sites in the Crystal Lake Watershed, and learn how the Sites are related hydrologically to one another.

A unique feature of Crystal Lake is its large shoreline perimeter (almost 21 miles, and part of the annual Crystal Lake Team Marathon of 26 miles). This unique shoreline is due to a dramatic drop of some 20 feet in the elevation of the Lake back during the logging days in 1873. This has come to be known as the “Tragedy” of Crystal Lake. Actually, it had an unforeseen “Comedy” (a happy consequence) of exposing a wide expanse of clean sandy beach that is now used for cottages and recreation. The surface of Crystal Lake is still slightly higher (about 20 feet on the average) than the surface of Lake Michigan. A drop of water falling on the high ridges around the Lake can eventually flow into Crystal Lake, either as surface water (over the top of the ground) in tributaries such as Cold Creek, or as groundwater (underneath the ground) and emerge in the Lake as underwater springs. Surface water flows much faster than groundwater. Surface runoff from cleared land or paved surfaces can contain more sediment than groundwater. Water can also flow from Crystal Lake into Lake Michigan either as surface water through Outlet Creek or as groundwater beneath the surface, particularly at the West End of Crystal Lake toward Pt. Betsie. The level of Crystal Lake is controlled by the dam on Outlet Creek to be 600 feet (Great Lakes datum). This level is raised three inches (+3 in to 600.25 ft) in the summer (May 1 - Oct 31) to give more water for boating, and lowered three inches (-3 in to 599.75 ft) in the winter (Nov 1 - Apr 30) to reduce shoreline erosion. Lake Michigan is a much larger lake, whose level rises and falls with season and climate.

## ENVIRONMENTAL QUALITY

The “*Walkabout*” is an opportunity to learn more about environmental monitoring. As we “walk about” Crystal Lake, we become aware of how our activities affect environmental quality. Monitoring of important parameters of environmental quality within the Crystal Lake Watershed by the Crystal Lake Watershed Fund, Inc. (CLWF) ([www.CLWF.org](http://www.CLWF.org)) involves cooperation among local volunteers, resident experts, student interns, academic faculty, and governmental officials. The CLWF programs have been integrated with joint programs of the Benzie/Leelanau District Health Department, the Michigan DEQ, the U.S. EPA, the Michigan Lake and Stream Associations, and the Benzie County Section of the Grand Traverse Regional Land Conservancy.

**FIGURE 2. The Hydrology of Crystal Lake and Lake Michigan.**



**Water Table** - The level at which the water fills up below the ground surface. If you dig a hole in the ground, at some point you will reach water, this point is on the water table.

**Precipitation (P)** - The amount of rainfall and snow on the drainage basin.

**Evaporation (E)** - The amount of water that changes to water vapor and is lost to the atmosphere.

**Evapotranspiration (ET)** - Sum of water lost to the atmosphere from evaporation and transpiration (water lost through plant leaves).

**Clay layers** - Water cannot pass easily through clay layers and thus tends to flow around them. Water may build up or perch on the top of clay layers. Sometimes this leads to the formation of a spring.

**Flow lines** - The direction of ground water flow is shown by the arrows. Ground water may transport pollutants from septic tanks and fertilizers placed on lawns into Crystal Lake. The ground water flows in different directions depending upon location and time of year. Ground water always flows down an energy gradient but can sometimes flow uphill as shown.

Many studies have been done in the Crystal Lake Watershed over the past 80 years. Emphasis has been on “self-help” with local direction and participation. The **CLWF** has participated in several joint programs: the Secchi Disc Program, the Water Quality Testing Program, and the Citizens' Lake Monitoring Program (ML&SA), the Advanced Self-Help Program (MI DEQ), in-kind support of innovative treatment systems (Benzie/Leelanau DHD), monitoring of zebra mussels (MI Sea Grant), and parallel monitoring of regional lakes (Sleeping Bear Dunes National Lakeshore, USGS and NPS). The **CLWF** also has done independent studies of water quality of Crystal Lake. The Interlochen Arts Academy (**IAA**) partnered with **CLWF** to monitor water quality of Cold Creek, the major tributary to Crystal Lake ([www.mlswa.org/School-Lake-Project/Interlochen.htm](http://www.mlswa.org/School-Lake-Project/Interlochen.htm))

The Science Review Panel (SRP) of the **CLWF** is comprised of a cross-section of knowledgeable individuals who have contributed significantly to past studies of Crystal Lake and who have been involved in environmental activities positively affecting the Crystal Lake Watershed. The philosophy of the **CLWF**, the composition of its SRP, and references are available upon request.

## **COSPONSORS, SUPPORTERS, AND PARTICIPANTS.**

Like all good program, the "**Walkabout**" is a product of the willing volunteers within the cosponsoring organizations. Depending upon the selection of the Interpretive Sites, various combinations of thirteen local organizations have cosponsoring the "**Walkabout**" each having a presence and mission within the Crystal Lake Watershed and sharing common interests in environmental awareness and education:

The cosponsors:

The Crystal Lake Watershed Fund, Inc., (**CLWF**) as the founding organization;  
The Grand Traverse Regional Land Conservancy (**GTRLC**), with focus on land conservancy;  
The Grand Traverse Band of Ottawa and Chippewa Indians (**GTB**), Native Americans;  
The Nature Conservancy (**TNC**) MI Chapter, a national organization, state conservancy focus;  
Friends of the Betsie Valley Trail, (**FBVT**) with focus among watershed areas;  
Friends of Betsie Bay (**FBB**), with interests specific to Betsie Bay;  
U.S. Coast Guard - Station Frankfort (**USCG**), search/rescue services, boating/water safety;  
The Congregational Summer Assembly (**CSA**), assemblage of local riparian owners & visitors;  
Friends of Point Betsie Lighthouse (**FPBL**), lighthouse preservation & management;

Supporters include regional institutions:

Benzie Conservation District (**BCD**), watershed protection and conservation;  
Inland Seas Education Association (**ISEA**), a schoolship providing a floating classroom;  
MSUE Betsie Valley Trailway (**MSUE-BVT**), trailway development & management;  
MSUE Michigan Groundwater Stewardship Program (**MSUE-GSP**), groundwater education;  
Tip of the Mitt Watershed Council (**TOMWC**), protection of water quality.

Participants include:

The general public, riparians, visitors, and guests to our Watershed;  
Benzie County Central Schools (**BCCS**), local students with environmental interests;  
Frankfort / Elberta Area Schools (**FEAS**), local students with environmental interests;  
Crystallaire Camp (**CC**), an educational summer camp facility within the Watershed;  
Interlochen Arts Academy (**IAA**), the first U.S. independent high school for performing arts.

Each sponsor/supporter/participant contributes to the overall success of the *“Walkabout”*. Volunteers from the cosponsors have demonstrated experience in environmental education and mentoring. The **CLWF** directed a pilot program for young people entitled “Eco-Explorations” in 1995, and has provided “Hands-on” experiences in water quality monitoring since 1994. The **BCCS & FEAS** have enthusiastic teachers who provide their 6th & 8th grade classes many opportunities to participate in environmental projects including the regional Water Watch. The *“Walkabout”* Coordinator is Dr. Stacy L. Daniels, an environmental professional, who has been involved with environmental activities within the Crystal Lake Watershed for more than forty years. The most important component is the participants, who reward the organizers with their enthusiasm.

## **PROGRAM SCOPE**

The *“Walkabout”* involves observational monitoring by teams of 15-20 young people assisted by one or more Team Leaders. Larger groups are accommodated by conducting the interpretations on parallel time schedules at multiple sites. Team members are encouraged to become proactively involved in environmental concerns at the local level. Participation can include a diverse population of local students and/or residents of the Crystal Lake Watershed, and visitors and neighbors from beyond the Watershed, who share a common interest in developing a mutual awareness of their environment. Team Leaders and Site Interpreters are volunteers from the cosponsoring organizations and the local community.

The *“Walkabout”* has evolved from a modest beginning to a more mature program. The 2004 Program is planned to reach 500 participants in three events (Spring, Summer, Fall). To provide a focal point for young people to relate to, the *“Walkabout”* is integrated with a central curriculum theme of how a single drop of water behaves in the overall hydrologic cycle and moves about the Crystal Lake Watershed. During the *“Walkabout”*, participants are encouraged to observe and remember certain defined environmental concepts and watershed features.

Such environmental features may include (but are not limited to): physical features, such as the natures of rocks and sand; presence of plants, fish, and wildlife; impact of cottages and docks; location of topographic identifiers like roads and tributaries; and character of land uses like wooded hills and lawns. Emphasis is placed on individual and team interpretations of what features are included within the Watershed environment of each unique Interpretive Site. Basic water quality monitoring involves the collection of environmental samples - rocks, plants, water, for later identification and analysis. Some guidance is provided in introductory sessions conducted by local volunteers with experience in environmental interpretations and water quality monitoring.

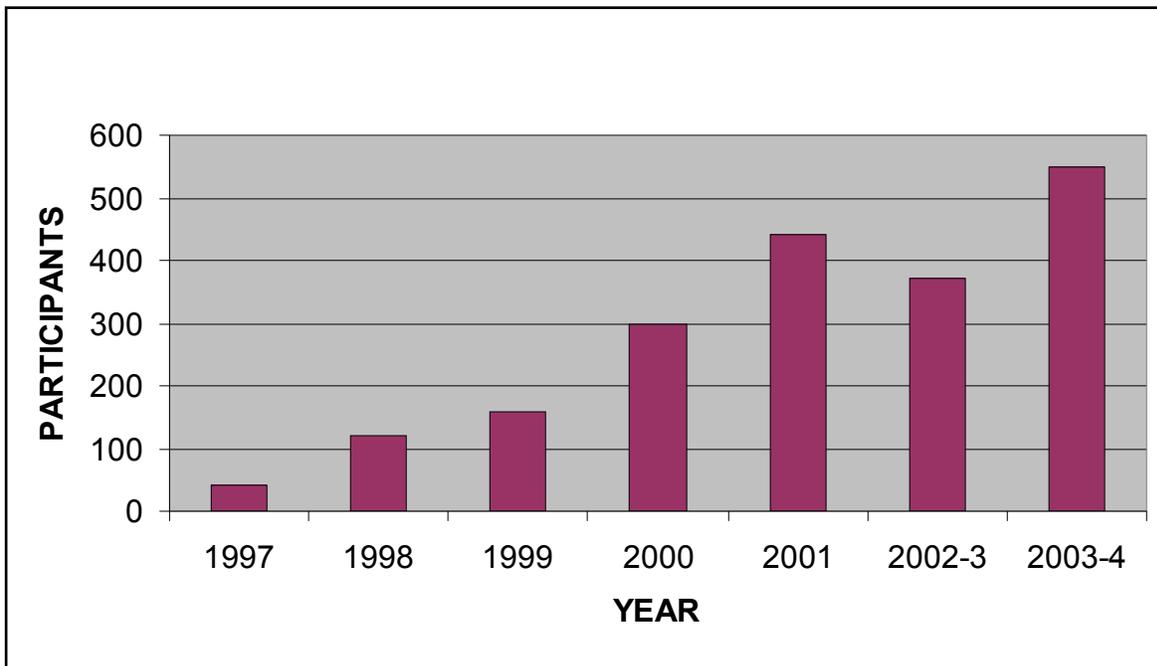
## CURRENT PROGRAM

The *“Walkabout”* consists of interpretive visits to four of eight fixed sites on a biennial basis. Each Site represents defined features within the Watershed: the Lake (East & West ends), a tributary stream, a lake, wetlands, a river wetlands, a high bluff region, a dunes area, and the Great Lakes. All Interpretive Sites are located on public properties or properties administered by the cosponsors, and used by permission. The common theme is "hydrology", i.e. how a single drop of water may pass through any and all of the Interpretive Sites.

During the school year, two events are scheduled: Fall - 8th grade students, and Spring - 6th grade students. For each of these events, 240 students are divided into four groups of 60 each that rotate among the four sites during four, one-hour periods (with a lunch break). Three Site Interpreters are assigned to each Interpretive Site to allow for smaller group sessions. The Summer event is planned for approximately 50 participants from the general public.

The *“Walkabout”* has grown from 40 participants in 1997, 120 in 1998, 160 in 1999, 300 in 2000, and 440 in 2001 (FIGURE 3). Beginning in 2002-3, the program was placed on a school-year basis, and split into Summer '02, Fall '02, and Spring '03 events, totaling 370 participants. Changing to multiple events facilitated scheduling for audiences of different learning abilities and maturity levels, permitted smaller Student-to-Interpreter ratios, and improved traffic flows. The Interpretive Manual could be better integrated into the school curricula during the school year.

**FIGURE 3. The Growth of the Crystal Lake *“Walkabout”*.**



The 2004 *“Walkabout”* has opportunities for older youth to act as advisors in both development and implementation. These include: (1) assembly of the Interpretive Manual, (2) collection of supplemental information, (3) identification of local support, (4) promotion to visitors and other youths, (5) environmental sampling and analysis, (6) participation as Team Leaders and support of Site Interpreters, (7) documentation and reporting, and (8) program evaluation.

## RESOURCES

The "*Walkabout*" needs various items for "show-and-tell" demonstration purposes. The CLWF has extensive limnological equipment for sampling and analyzing physical, chemical, and biological parameters of environmental quality. These include: a Hydrolab® multiprobe for monitoring depth, temperature, dissolved oxygen, pH, conductivity, redox, and turbidity; a data logger and personal computer for data collection; a global positioning system (GPS) for identifying Watershed locations, and various devices for sampling water, sediment, plankton, and benthic invertebrates, and measuring water levels. Mr. Jack Randall, formerly with the Science/Math Department at IAA pioneered the development of low-cost water quality probes (with Texas Instrument Company), and software designed specifically for hand-held calculators and personal computers (Vernier Software). Current models of these devices, provided to IAA in the 2001 pilot of the state-wide program to monitor lakes and streams in Michigan sponsored by Michigan Lake & Streams Associations (ML&SA), are available. Other commercial, governmental, and academic facilities have done water analyses in past programs.

## BUDGET

The "*Walkabout*" requires a financial base to sustain the current program and to provide for future improvements. It is supported by a combination of grants, fees, and in-kind services. Grantees have included: 1997, Dow Chemical Company (\$2,750); 1999, Benzie Area Youth Advisory Council (\$600); 2000, John N. Barnes Fund for Environmental Education (\$1,700); and 2001, Land Use and Conservation Planning Fund (\$2,400) and Benzie Area Youth Council (\$2,400). In 2002-3, public fees of \$10 and student fees of \$3 partially offset costs. It is expected that the cosponsors and participating schools will continue to provide in-kind donations of volunteer time, equipment, and transportation for the 2004 "*Walkabout*". Supplemental funding continues to be pursued thru grant requests to partial offset the costs for supplies..

The costs to conduct the "*Walkabout*" are relatively modest. For example, total cost for the 2004 "*Walkabout*" for 500 participants is estimated to be \$21,328. This includes a net cost of \$4,900 (23%), for supplies, including partial costs for T-shirt printing and preparation of the Interpretive Manual (shirts, artwork, printing, notebooks, paper, maps). A match of \$16,428 (77%) includes \$4,328 for remaining supplies (sheet protectors, copy work, lunches for volunteers, etc.); \$759 for supplemental educational materials, publicity, photography, and displays; \$1,261 for transportation; \$10,080 for personnel (as in-kind services by teachers and volunteers), and an offset of (\$2,000) in participant fees. The net cost per participant is ~ \$10.

## PUBLICITY AND PROMOTION

Planning for the "*Walkabout*" begins early in the year for three events. Site Interpreters must be identified well before each event. Preparation of the Interpretive Manual and publicity occur concurrently. The 2004 "*Walkabout*" will include the Spring event for 6th grade students in mid-May, the Summer event in early August for the general public, and the Fall event for 8th grade students in early October. All events are evaluated using a feedback form (optional), and combined with personal inputs and observations to make recommendations for future events.

The *“Walkabout”* has been publicized in several ways. For the Summer event, printed flyers are printed in the local newspapers, placed in local stores and post offices, posted on the Internet and by email, and distributed by volunteers. For the Spring and Fall events, arrangements are made directly with the teachers of area schools. In addition to its use during the *“Walkabout”* events, the Interpretive Manual has proven useful in the overall promotion of the Crystal Lake Watershed. Displays and presentations have been made at state and national conferences.

## IMPACT

The *“Walkabout”* is designed to meet the needs of community enhancement, hands-on science education, and environmental improvement for young people. The objective is to create future citizens that can make informed choices regarding environmental issues, i.e. water quality, land use, zoning, septic tanks, green belts, sustainable development, and watershed management within the unique environment of the Crystal Lake Watershed.

The *“Walkabout”* serves multiple purposes: (1) It involves young people as future citizens and decision-makers, (2) It provides them with an opportunity to learn by “hands-on” experiences to develop environmental consciousness, (3) It promotes interest in the science of the environment and understanding of the scientific method of observation and assessment, (4) It provides a visible and tangible contribution by the participants, and (5) It serves to assist in the education of other young adults and citizens that may become involved in a future *“Walkabout”*.

## EVALUATION

The *“Walkabout”* was conceived to address an identified need to provide environmental education specific to the Crystal Lake Watershed to a diverse audience including young people in the age group of 9 -19. To be truly successful, the *“Walkabout”* must continue to remain relevant to the interests of the young participants. Feedback forms allow each participant to comment on the program. The replies are used to evaluate strengths and weaknesses of the program and recommend changes. Participants are encouraged to take pictures. A digital camera used for documentation in 2003 resulted in a collection of candid photographs of participants joining in the activities. Both press releases and event coverages are initiated with local newspapers, and radio and television stations.

The *“Walkabout”* is well publicized to solicit participants and to transmit results. Participants receive a multi-colored *“Walkabout”* T-shirt with a GIS map of the Watershed on the front and logos of the cosponsors and schools on the back; and an Interpretive Manual (2003 Ed., 36pp) outlining the *“Walkabout”*: purpose, description, definitions, topographical map, watershed facts and history, descriptions of the Interpretive Sites, selected curriculum themes, and supplemental educational materials. The Crystal Lake *“Walkabout”* Interpretive Manual (**Appendix B**) is both An Educational Primer for Students and A Reference Handbook for Property Owners and Visitors. A list of concerns for property owners and visitors to the watershed is also included. Participants are challenged to learn about the Crystal Lake Watershed, to help us all manage it wisely, and to keep its waters as clear and as beautiful for your children tomorrow as they are for you today. Student participants are instructed: "Act safely and respect the rights of others. Leave the Watershed as you found it. Observe, learn, and have fun!"

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The Crystal Lake Watershed Fund, Inc. (CLWF) is a nonprofit organization of concerned citizens interested in protecting the integrity of Crystal Lake, Benzie County, MI, for the enjoyment of future generations. The CLWF, together with governmental, academic, and professional partners, develops and supports initiatives for water quality monitoring, septic system control, sustainable development, and land conservancy through education, for watershed management. The CLWF is found on the Internet at [www.CLWF.org](http://www.CLWF.org)

FIGURE 4A.

The Crystal Lake "Walkabout".



**FIGURE 4A.**      **The Crystal Lake "Walkabout".**



## APPENDIX A. Descriptions of the "*Walkabout*" Sites (A-H).

The Crystal Lake "*Walkabout*" encompasses eight Interpretive Sites representing different geographical and environmental parts of our Watershed. The first three Sites (A, B, C) were the subjects of EcoExplorations, a prototype educational program for young adults initiated in 1993, and continuing as the Crystal Lake "*Walkabout*". Site D was added in 1997 to emphasize the high ridge boundary of the Crystal Lake Watershed. The first four Sites (A, B, C, D) are all in the East End of the Crystal Lake Watershed. In 2000, four new Sites (E, F, G, H), all in the West End of the Crystal Lake Watershed, were added that stress the importance of the Crystal Lake Watershed, and how it connects to the neighboring riverine and lacustrine watersheds further "downstream" (the Betsie River Watershed and the Lake Michigan Watershed).

### Crystal Lake "*Walkabout*" – List of Interpretive Sites (See Front Cover & T-Shirt)

- Site A. Crystal Lake (Lake, East End).**  
(At Beulah Public Dock, 44° 37' 57.59" N, 086° 05' 35.13" W)
- Site B. Cold Creek/Sediment Basin (Tributary).**  
(In Downtown Beulah, 44° 37' 44.81" N, 086° 05' 36.09" W)
- Site C. Trapp Farm Nature Preserve (Lake Wetlands).**  
(On Narrow Gauge Road, 44° 37' 56.22" N, 086° 05' 12.09" W)
- Site D. Railroad Point Natural Area (High Ridge).**  
(On Mollineaux Road, 44° 38' 28.37" N, 086° 08' 12.86" W)
- Site E. Crystal Lake (Lake, West End).**  
(At CSA Beach, 44° 37' 55.68" N, 086° 14' 41.53" W)
- Site F. Betsie Valley Trail (River Wetlands).**  
(Near River Road & M22 Bridge, 44° 37' 47.24" N, 086° 14' 34.49" W)
- Site G. Betsie Bay (Bay / Great Lakes).**  
(In Downtown Frankfort, 44° 37' N, 086° 13' W)
- Site H. Pt. Betsie (Dunes / Lighthouse).**  
(On Pt. Betsie Rd. at Lake Michigan, 44° 41' 26.73" N, 086° 15' 18.69" W)

Significant physical features of all eight Interpretive Sites are briefly summarized. Environmental issues, public concerns, and/or educational aspects of current interest affecting each and every Interpretive Site are discussed in detail. As you will see, the eight Interpretive Sites are a cross-section of the diverse yet collective ecologies found within the Crystal Lake Watershed. Collectively, they define and impact the unique qualities of life experienced by students, property owners, and visitors to the Crystal Lake Watershed. The "hands-on" activities of the "*Walkabout*" are designed to emphasize these features. The 9<sup>th</sup> Interpretive Site of the Crystal Lake "*Walkabout*" is left to the individual readers' personal choice.

## APPENDIX B. Crystal Lake "*Walkabout*" Interpretive Manual (Table of Contents)

Inside Front Cover: (1) Welcome Letters (2) Agenda (3) Feedback

### Dedication and Acknowledgments.

#### Tab 2 What to Expect During the Crystal Lake "*Walkabout*".

- (1) What is the Crystal Lake "*Walkabout*" about?
- (2) What will you do on the Crystal Lake "*Walkabout*"?
- (3) What will you see on Crystal Lake "*Walkabout*"?

#### Tab 3 The Crystal Lake Watershed.

#### Tab 4 General Information About the Crystal Lake Watershed.

- (1) Facts About the Crystal Lake Watershed.
- (2) The Hydrologic Cycle of Crystal Lake.
- (3) The Layers of Crystal Lake.

#### Tab 5 Descriptions of the "*Walkabout*" Sites (A - H).

#### Tab 6 A "Hands-On" Experience in Water Quality Monitoring.

#### Tab 7 Cold Creek and the Sediment Basin.

#### Tab 8 Nonindigenous Species.

#### Tab 9 Atmospheric Deposition and Sediment Chemistry.

#### Tab 10 Is Your Lake Really Level?

#### Tab 11 The Betsie Valley Trail.

#### Tab 12 The Great Lakes.

#### Tab 13 Geology and Dune Ecology.

#### Tab 14 Participants/Sponsors/Supporters/Contributors: (1993-03).

#### Tab 15 Crystal Lake Watershed Management.

- (1) Crystal Lake Watershed Management Plan.
- (2) Definition of Watershed Management.
- (3) Crystal Lake Watershed References.
- (4) Significant Events in Crystal Lake Watershed History.

#### Tab 16 Concerns for Property Owners and Visitors to the Watershed.

### Inside Back Cover: Supplemental Information.

- (1) Lake Michigan Watershed (MI Sea Grant).
- (2) Your Lake & You (ML&SA / NALMS / MI DEQ).
- (3) Watersheds: Where We Live (USGS).

## APPENDIX C. Example Cover Letter to Student Participants.

October 16, 2003

To: Participants of the Crystal Lake "*Walkabout*".

Welcome to the **Crystal Lake "*Walkabout*"**, an unique experience of observational monitoring and environmental exploring especially designed for young adults. Anyone who is young of heart and open of mind is welcome. Of all the inland lakes of Michigan, Crystal Lake is one of the most beautiful: to look at, swim in, fish in, boat on - everything you would ever want to do and enjoy at a lake, you can do at Crystal Lake. It is there for all of us to share and protect.

The "*Walkabout*" will make you look at the Crystal Lake Watershed from different points of view. Sometime in the future you will be making informed choices on water quality, land use, zoning, septic tanks, green belts, sustainable development, education, and watershed management.

You will receive a T-shirt showing the Crystal Lake Watershed and an Interpretive Manual containing maps and FACs. During the "*Walkabout*", you will be visiting four of eight geographically and environmentally different "Sites", that will be interpreted by an environmental professional who will tell you how it relates to the Watershed.

You'll learn about the Watershed, and about "hydrology" - how water moves about our Watershed. You'll have chances to see and do things. Take notes and pictures. Your challenge is to learn about the Crystal Lake Watershed: to help us all manage it wisely, and to keep its waters as clear and as beautiful for your children tomorrow as they are for you today. Enjoy the **Crystal Lake "*Walkabout*"** and learn about its unique Watershed.

Remember: act safely and respect the rights of others. Leave the Watershed as you found it.  
**Observe, learn, and have fun!**

Yours for the Crystal Lake Watershed, 2003 Fall Cosponsors: Crystal Lake Watershed Fund, Inc.; MSUE MI Groundwater Stewardship Program; Friends of the Betsie Valley Trail; Grand Traverse Regional Land Conservancy; Tipp of the Mitt Watershed Council.

## APPENDIX D. Example Cover Letter to Property Owners & Visitors.

October 16, 2003

To: **Property Owners & Visitors**, Crystal Lake Watershed

Whether you "*Walkabout*" the Crystal Lake Watershed as a student, a property owner, or a visitor, you share the many remarkable vistas of a unique environment. The Crystal Lake Watershed is more than a place where individuals live around or near a lake, visit for a time, or just pass through. We all are responsible for its stewardship.

The **Crystal Lake "*Walkabout*"** involves observational monitoring and environmental exploring especially for students. Anyone young of heart and open of mind is also welcome to partake in the program as a group, or ponder its philosophy as an individual. Environmental awareness is developed through "hands-on" learning during a "walk about" several environmentally significant sites, which are in the Manual, or personally in one's special place or mind's eye.

The Interpretive Manual that describes the "*Walkabout*" has evolved both as An Educational Primer for Students; and as A Reference Handbook for Property Owners and Visitors. At various times, you are involved in making informed choices on water quality, land use, zoning, septic tanks, green belts, sustainable development, education, and watershed management. The Manual will inspire you to look at the Crystal Lake Watershed from several points of view.

The Manual contains information and offers ideas on several environmental topics. It contains a detailed colored map of our Watershed, descriptions of eight geographically and environmentally different sites, a section on watershed management, and a list of concerns for Property Owners and Visitors. Supplemental publications ("Lake Michigan Basin", "Your Lake and You", and "Watersheds: Where We Live") describe the importance of living in a watershed and steps you can take to protect it.

Your challenge is to learn about the Crystal Lake Watershed, to help us all manage it wisely, and to keep its waters as clear and as beautiful for your children tomorrow as they are for you today. Enjoy the **Crystal Lake "*Walkabout*"** and learn about our unique Watershed.

The Crystal Lake Watershed Fund, Inc.

## APPENDIX E.

### Crystal Lake Watershed Management.

The Crystal Lake Watershed is a valuable natural resource. Protecting the integrity of its high quality waters and unique environment is a worthy objective. Its management is important for three reasons: (1) to determine what we know about our Watershed from the past, (2) to plan to use our Watershed in an environmentally sustainable manner today, and (3) to implement projects to protect our Watershed for the future. The Michigan Department of Environmental Quality has recently formalized the process of developing watershed management plans. Watershed management is not a new undertaking for the Crystal Lake Watershed. Scientific studies of all the “ologies”, i.e. geology (soil), hydrology (water), ichthyology (fish), limnology (lakes), biology (plants and animals), etc., done over the past 160 years form a database for decision-making. Definitive reports of issues and resource plans already have been developed by citizen and governmental committees. The “Crystal Lake Watershed Management Plan” has been, and will continue to be, a continually evolving entity, comprised of various pieces from different sources, and unfolding through the participation of committed stakeholders.

The following is cited from The Michigan Watershed Homepage:

[http://www.deq.state.mi.us/swq/watershd/wsm\\_def.htm](http://www.deq.state.mi.us/swq/watershd/wsm_def.htm) "Watershed Management is an iterative process of integrated decision-making regarding uses and modifications of lands and waters within a watershed. This process provides a chance for stakeholders to balance diverse goals and uses for environmental resources, and to consider how their cumulative actions affect long-term sustainability of resources. The Guiding Principles of the process are Partnerships, Geographic Focus, & Sound Management (strong science & data)."

"Human modifications of lands and waters directly alter delivery of water, sediments, and nutrients, and thus fundamentally alter aquatic systems. People have varying goals and values relative to uses of local land and water resources. Watershed management provides a framework for integrated decision-making, where we strive to: (1) assess the nature and status of the watershed ecosystem; (2) define short-term and long-term goals for the system; (3) determine objectives and actions needed to achieve selected goals; (4) assess both benefits and costs of each action; (5) implement desired actions; (6) evaluate the effects actions and progress toward goals; and (7) re-evaluate goals and objectives as part of an iterative process."

"As a form of ecosystem management, watershed management encompasses the entire watershed, from uplands and headwaters, to floodplain wetlands and river channels. It focuses on the processing of energy and materials (water, sediments, nutrients, and toxics) downslope through this system. Of principal concern is the management of the basin's water budget that is the routing of precipitation through the pathways of evaporation, infiltration, and overland flow. This routing of groundwater and overland flow defines the delivery patterns to particular streams, lakes, and wetlands; and largely shapes the nature of these aquatic systems."

"Watershed management requires use of the social, ecological, and economic sciences. Common goals for land and water resources must be developed among people of diverse backgrounds and values. An understanding of the structure and function--historical and current--of the watershed system is required, so that the ecological effects of various alternative actions can be considered. The decision process also must weigh the economic benefits and costs of alternative actions, and blend current market dynamics with considerations of long-term sustainability of the ecosystem."

## **APPENDIX F. Concerns for Property Owners and Visitors to the Watershed.**

The 9<sup>th</sup> “**Interpretive Site**” of the Crystal Lake “**Walkabout**” is left to the readers’ choice. Perhaps almost unspoken for each of us is that special “place near the Lake” where we live, work, play, and think. Lake and Watershed properties might seem to be the prime responsibilities of government, institutions, or individual property owners. These properties, however, are also the responsibilities of visitors and summer renters to insure that they are used wisely and maintained appropriately. There are many ways that we may look at the Crystal Lake Watershed - as a student, a visitor, an owner of watershed property (a “lakie”, a “townie”, a “fudgie”, etc.). All have differing perspectives, but all share the benefits - the use and enjoyment of our Watershed for fishing, boating, swimming, recreation, working, and living. We also share the same concerns for maintaining a proper balance between reasonable environmental protection and sustainable development. Together, we are all stewards of the environment that makes up Crystal Lake and its surrounding Watershed.

Several unique features and aspects of the Crystal Lake Watershed make it either very resistant or potentially vulnerable to adverse environmental impacts. Concerns (\*) that property owners and watershed stewards should consider:

- Septic Systems, Holding Tanks, and Sewers.
- Lawns, Gardens, Fertilizers, and Pesticides.
- Natural Greenbelts, Land Conservancies, and Scenic Vistas.
- Boating, Swimming, and Fishing.
- Litter, Trash, Garbage, and Household Hazardous Materials.
- Zoning, Land Use, Water Access, Construction, and Development.
- Land Cover, Trees, Other Vegetation - the Viewshed.
- Critical Areas - Steep Slopes, Wetlands, Dunes, and Other Critical Habitats.
- Erosion and Shoreline Protection.
- Soil, Sediment, and Nutrient Runoff.
- Aquatic Vegetation, Fish, and Waterfowl.
- Algae, Bacteria, and Mold.
- Nonindigenous Plants, Animals, and Microorganisms.
- Aesthetics and Noise.

These concerns range from (1) general items affecting the entire Watershed to (2) specific items within individual properties. Assessments of relative degrees of risk to human health and the Watershed environment are both qualitative and quantitative. Decisions for control are sometimes subjective, but ultimately are based on the “bottom line” - how much will it cost to prevent or to control. Management practices must continue to be prioritized and evaluated for effectiveness, rather than simply assuming that perceived problems are cured by applied solutions.

(\*) This list of concerns is based upon an earlier publication focused on the Crystal Lake Watershed: Decker, R. William, Chair, Ad Hoc Committee, Benzie County Board of Public Works, “**Crystal Lake - Life or Death**”, A Lake Owners’ Manual, Benzie County, Michigan, 1987, 32 pp+ 8 figures. It is also based in part on numerous related publications on scientific studies and policy documents that already exist to advise property owners.