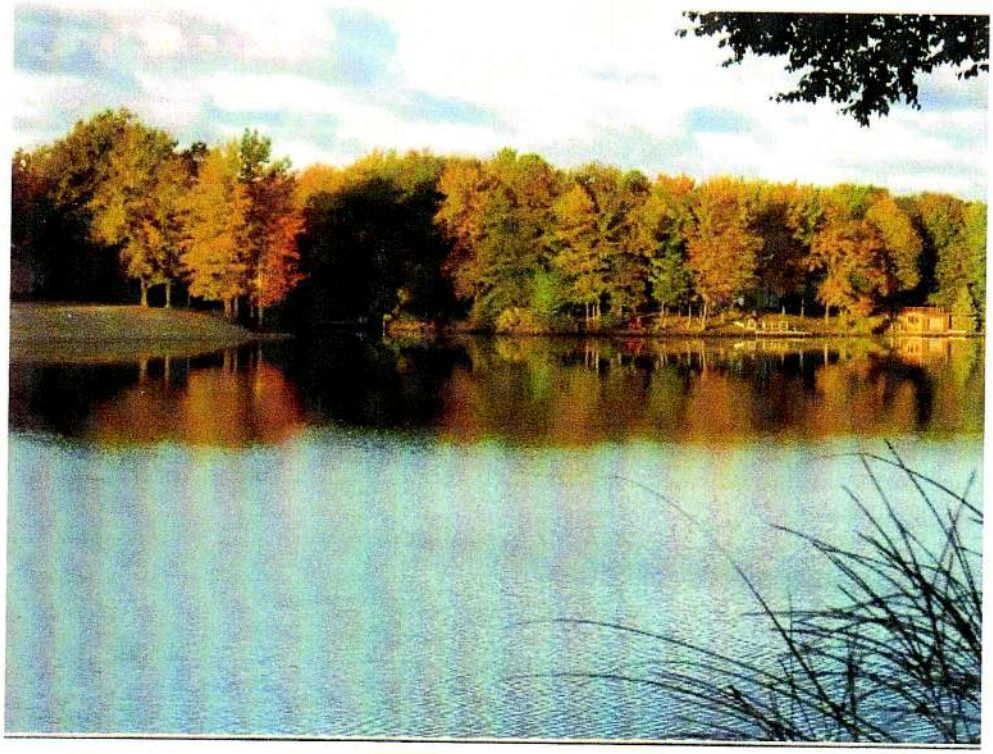
Lake Management Report



July 9th 2010

President: Fred Innamorato
Dean Blanton
Bob Cook
Rupe Harris
Walt Samson
Joe Steinbricker
Jerry Szweda

Introduction

We have provided this booklet so that the board may have available a complete up-to-date record of the immediate and long-term objectives, proceedings, and outcomes that the Lake Management Committee undertakes.

The long-term goals of this LMC are to investigate and formulate a weed management program, a sediment management program, and a water quality plan.

Table of Contents

By-Laws

The Lake Management Committee has developed a set of By-Laws to establish the duties and responsibilities of Lake Management. The LMC presents the By-Laws to the board on the following page.

LMC Recommendation:

The Lake Management Committee recommends to the board that the By-Laws are approved and placed into effect.

Roaming Rock Lake Management

By-laws

ARTICLE I. NAME. The Roaming Rock Lake Management Committee .

ARTICLE II. PURPOSE. The purpose of the Committee shall be to promote understanding and comprehensive management of the lake and watershed ecosystems and fishery.

ARTICLE III. OBJECTIVES. The objectives of the Committee is to:

- **Promote and provide a forum for sharing of information and experiences on scientific, administrative, and financial aspects of lake and watershed management.**
- **Assist in the development of Lake Roaming Rock restoration and protection programs in accordance with appropriate management strategies and techniques.**
- **Encourage support and development of local, state, and national programs promoting lake and watershed management.**
- **Foster a partnership for the mutual benefit of Stockholders, organizations, agencies, local units of government, and individuals concerned with lake and watershed improvement and protection through the use of a well qualified lake management consultant. (see section XIII)**
- **There shall be no action of any kind taken on restoration or management of Lake Roaming Rock with out a written management program developed by a Qualified Lake Management Consulting Firm .**

ARTICLE IV. DUTIES OF THE Chairman and Vice-Chairman.

SECTION A. The Chairman shall have general supervision of the affairs of the committee. He/she shall preside at all meetings of the Committee. He/she shall see that all By-laws and any rules and regulations as may be adopted by the Association and the Board are enforced. He/she shall execute all contracts and other instruments which shall have been first approved by the Board.

SECTION B. The Vice-Chairman shall assists the Chairman and shall preside at meetings in the absence or vacancy of the Chairman.

ARTICLE V. COMPENSATION. The Committee shall serve without pay, but may be reimbursed for actual expenses while conducting Committee business, providing that these expenses receive authorization from the Board. Required expenditures shall be paid by the Association. Providing proper receipts are required . Ink for computer printer for Committee use and mileage shall be as of May 2010, $.55 per mile. This can be adjusted for inflation at any time by the Board.

ARTICLE VI. MEETINGS.

The following meetings are held by the Lake Management Committee. The dates, times, and places will be scheduled by the Lake Management Committee and duly published.

A. Workshop Meetings

These meetings are for the Lake Management Committee to discuss the official business of the Committee . Residents are encouraged to attend but may not participate in the discussions.

B. General Meetings

General meetings are held no fewer than eight (8) times a year at the R.R.A. Clubhouse . The dates, times shall be established by the Lake Management Committee and duly published. These meetings are open to the members who may voice their opinions, concerns and ideas.

ARTICLE VII. Committee eligibility

Any RRA member in good standing is eligible for the Committee. Active Board Members may not sit on the Lake Management Committee at any given time. The Lake Management Committee Chairman must be appointed by the Board and with a majority vote to seat the Chairman. The Chairman can pick his/her Vice-Chairman . There are no more than eight (8) people on the Committee at any given time.

ARTICLE VIII. Lake Management Consulate Qualifications

Section A :

Lake Management Consulting Firm shall have the minimum of 15 years experience. Individuals assigned as the principal point of contact between the consulting firm and the Association

Must have the minimum of a Bachelors degree in Biology and/or an Allied Natural Science degree and a minimum of 10 years experience in the field of Lake Management, or 5 years with a Master degree or higher. Lake Management Consulting firm must have their own laboratory to perform Test Biomonitoring, Aquatic and Ecological Surveys, Lake Management, and Laboratory services.

- **Section B : Consulting Firm Staffing must include of the following full time staff:**
- **PhD level Scientists**
- **Laboratory Technicians**
- **Aquatic Biologist w/ B.S. Biology**

Insurance

Lake Management Consulate must be protected by Worker's Compensation Insurance, Commercial General Liability Insurance, Professional Liability Insurance and Automobile Liability Insurance with a minimum of one million dollars coverage on each . They must furnish certificates of Insurance upon the request of the Board or the Lake Management Committee.

ARTICLE IX Lake boundary and self medication of the lake

Our lake has what they call a normal pool elevation 850.00 which is documented. The lot owner owns to that elevation 850.00 . The Association also has an easement from that pool elevation onto that lot. The Association owns the land beyond that point which is private property belonging to the Association . If a lot owner wants to apply chemicals , or build a boat dock, or anything else on the Association property without the proper written approval in advance from the Association they can be prosecuted. Applying chemicals would carry a $1000.00 fine from the Association . A test may be implemented by the Association for chemicals or other toxins in the lake sediment if such things are present the lot owner will also be responsible for the cost of any testing that may be required and removal of any such toxins that may be found in the sediment at the discretion of the Board of Directors . Hefty fines and possible jail time may be imposed by the State of Ohio for contaminating the State water ways of Ohio.

ARTICLE X Lowering of the Lake **It has been determined through** research and well written literature and **by Lake** Aquatic Biologist **and our Lake** Consulate that there are more significant and overall long-lasting negative impacts on lowering Rome Rock Lake every year. Therefore, the lake can only be lowered every three years starting in 2012, with the exception of emergencies, flooding, and special work related RRA projects such as dredging. No individual projects such as seawall or dock repair will be allowed except on the year of scheduled lowering of the lake.

ARTICLE XI Yearly Budgeting

The business year for the Committee is the same as the RRA Board . The Lake Management Committee Chairman, or designee(s) must meet with the R.R.A. Board annually at a scheduled meeting to present the next years physical budget. In order to agree to what can physically be accomplished in that year. Normally this takes place within the last (60) sixty days of the year.
Within (30) days after the end of the business year, the Chairman, or designee(s) for the past year prepares and submits a summary report to the Board of Directors. The report lists accomplishment, expenditures, and general plans for the new year.

ARTICLE XII Lake Management Specialist
The LMC Chairman names these specialists

1. **Scribe: Maintains records of meetings and all other Committee activities. These records include financial information on funds authorized and expended and description of the expenditure.**
2. **Publicist: Assures residents are aware of Committee activities and plans.**
3. **Archivist : Collects, assembles and archives all documents that reflect on the activity of the Committee.**

These By-laws has be implemented and Approved by the Lake Management Committee on this day June 22,2010

Chairman : Fred Innamorato _____

Vice-Chairman Dean Blanton _____
Committee Members:

Robert Cook _____

Rupert Harris _____

Water Samson _____

Joe Steinbicker _____

Jerry Szweda _____

Board President Bob Sobczak _____ **Date :**_____

Committee Priorities

The LMC has identified two main objectives for its focus this year. The first is to conduct a weed survey of the lake and implement a weed management plan. The second objective is conducting a sediment survey and establishing a sediment management plan that addresses dredging and silt ponds. The combination of these objectives will provide the committee with a scientific, factual understanding of our lake and allow the committee to make reasonable decisions in the future.

June 22, 2010

Mr. Fred Innamorato
Chairman, Lake Management Committee
Roam Rock Association, Inc.
P.O. Box 8
Roam, Ohio 44085

Re: 2010 Priorities

Dear Fred:

You requested that I outline my recommendations for priority activities to be undertaken by the Lake Management Committee this year. In general, I think weed management and sediment management are the two top concerns of most residents and therefore should probably be the focus for the LMC in 2010. The following paragraphs outline my thoughts and rationale on these two priorities. I've also listed several other items that I think can be tackled concurrently.

Weed Survey and Management Plan- Although nuisance aquatic plant growth appears to be limited at the present time due to the drawdown last winter, weed management is traditionally a major source of complaints and topic for discussion. As you are aware, EnviroScience completed the aquatic plant survey last week and the report will be sent to you later this week or early next. This survey describes the current condition and will provide a good baseline for future surveys. We are also working on a detailed description of treatment technologies to provide the LMC with some additional options for control of aquatic plants in the lake. Following the LMC's review, we will need to work with the LMC to develop an overall strategy for dealing with nuisance weed growth and complaints as they start to surface later this summer.

Sediment Management- there are two parts to this that need to be worked almost simultaneously. The first and maybe most important is dredging. We have provided the LMC with a proposal for measuring sediment depth and volumes in the major coves. Assuming that the board moves forward with this and we complete this brief study, the coves can be prioritized and a program for removal can be developed.

The second part of sediment management involves evaluating the feasibility of silt ponds. To reduce the quantity of nutrient and sediments entering the lake and extend the time needed before dredging is needed again, the LMC should consider authorizing us to move forward with an evaluation and recommendations for creation of silt ponds in the vicinity of several coves. As you will recall we have provided the LMC with a separate proposal for doing this.

There are also two other areas that I recommend limited effort be directed toward this year. The first of these is water quality. I think an important and relatively easy objective should be to re-establish a volunteer monitoring program and augment it with some basic water quality monitoring to be done by EnviroScience. The volunteer effort would track basic trends including

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transparency and algae blooms. Our contribution would include limited DO monitoring at depth as this information would help evaluate the feasibility of an aeration system in the future. All of this can be accomplished at very little cost and will allow us to catalog and compare information on the lake from year to year and compare trends in Roaming Rock with other lakes in Ohio.

The other priority area is aeration. As we've discussed numerous times, aeration could have numerous benefits but there are a number of technical challenges with doing it in a lake the size of Roaming Rock. I think an objective of the LMC should be to continue to gather information from a variety of equipment manufacturers to evaluate this idea more closely.

As indicated, these are just my thoughts and recommendations. I'd be happy to discuss these ideas in more detail with you, the LMC and the Association's Board at your convenience. Please don't hesitate to contact me should you require clarification or have further questions.

Sincerely;

Martin A. Hilovsky
President

Weed Management Program

The weed management program the LMC expects to undertake in the future is still under review. In the immediate future, the committee expects to maintain the use of the weed harvester and arrow system based on the LMC written procedure. However, research is underway on alternative means of harvesting weeds and preventing excessive weed growth. We also expect that these methods will provide environmentally safe alternatives for individual lot owners to deal with nuisance weeds around their docks and waterfronts. One such alternative is the Aqua Cleaner Vegger, a suction harvester which is further described at the end of this section. As we learn more, the committee will inform the board.

Additionally, the LMC has already contracted EnviroScience to perform a weed survey of our lake. This survey is complete and is included on the following pages.

The LMC strongly believes the use of herbicides is undesirable and is not to be utilized as a general method for weed control. Rather the committee recommends judicious use of herbicide application as a last resort alternative when all other options are either unavailable or not feasible for reasons determined by the Lake Management Consultant. Additionally, the Lake Management Consultant must establish a procedure and provide written guidelines prior to application and have complete oversight of the field application.

Aquatic Vegetation Survey for Lake Roaming Rock, Roaming Shores, OH

Prepared for:

The Roam Rock Association

Prepared by:

EnviroScience, Inc.
3781 Darrow Rd.
Stow, OH 44224

July2, 2010

1.0 Introduction

Lake Roaming Rock is a 550-acre lake located in Ashtabula County in Northeast Ohio. It has a highly developed shoreline and is used intensively for recreation and fishing. An impoundment of a section of Rock Creek and portions of the associated Plum Creek and Sugar Creek tributaries form the lake and the continuous flow of water allows for nutrient input from up river and resultant sedimentation to occur. In addition, runoff from the lawns and other activities around the lake add to the lake's nutrient load. This allows for a more fertile lake substrate on which a variety of aquatic plants can establish. Most of these plants are native and provide habitat and resources for fish and waterfowl. However, non-native aquatic plants, such as the exotic Eurasian watermilfoil (*Myriophyllum spicatum*), can quickly out compete the native plants and interfere with recreation, decrease property values, and damage the ecology of the lake.

Without careful monitoring and management, beautiful lakes can become unsightly and unpleasant. An understanding of potential aquatic plant problems is one of the first steps in the process of effectively managing any water body. This can be achieved through regular lake-wide plant surveys. At the request of the Roam Rock Association, EnviroScience Inc. conducted a detailed aquatic vegetation survey on June 7 and 8, 2010, to assess the present conditions of the plant community within Lake Roaming Rock.

2.0 Project Objectives and Review of Available Information

The major objective of the aquatic plant survey is to determine the condition, density, and distribution of the native plant community in the reservoir. The survey also focuses on exotic and possibly invasive plants species suspected of being present in the lake. Collected data serves as a baseline for future surveys. Finally, the report generated outlines available treatment and control options and

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the collected data forms the basis for recommendations for future aquatic plant management efforts.

As a first step in the project, in the late Spring of 2010, EnviroScience met with members of the Lake Management Committee (LMC) to discuss prior year activities and conditions. EnviroScience also met with Aqua Doc Lake and Pond Management of Chardon, Ohio, the only herbicide applicator authorized by the LMC to work on Lake Roaming Rock.

These discussions revealed that the Summer of 2009 was characterized by very heavy nuisance plant growth in many of the coves and shallow areas of the lake. Nate Robinson, Aqua Doc's project manager stated that the major nuisance species being treated was Coontail, with localized populations of Eurasian watermilfoil also being present.

At the present time, nuisance aquatic plant treatment is primarily the responsibility of the individual property owner. The Association owns and operates a mechanical weed harvester and this has been used to augment efforts by individual lot owners to clear some of the coves of nuisance vegetation.

Notwithstanding the Association's limited harvesting efforts, each lot owner may also hire the LMC-selected contractor on an annual basis to treat nuisance aquatic plants around their dock and water front. This treatment has generally involved application of a contact herbicide such as Diquat which provides short-term, but fast treatment.

In the Fall of 2009, the Association drew down the lake level by approximately 8 feet to facilitate dock maintenance and sediment removal from several coves. Although this drawdown was expected to inhibit plant growth for much of the 2010 season, the LMC felt that conducting a plant survey in early summer was important for several reasons. The first of these was to establish a baseline for

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all aquatic plant management efforts and to determine the exact composition of the macrophyte community. An early summer survey was also deemed necessary because a number of homeowners had already contracted with Aqua Doc for 2010 treatments and there was a desire on the part of both the homeowners and the contractor to start any necessary treatments as early as possible.

3.0 Aquatic Vegetation Survey Methods

Aquatic vegetation survey procedures used by EnviroScience are patterned after those developed by the Michigan Department of Environmental Quality contained in the Standard Procedures for Surveying Aquatic Plants. The survey is designed to ensure easily replicable surveys of the existing aquatic plant communities.

The survey is carried out by sampling individual Aquatic Vegetation Assessment Sites (AVAS's) throughout out the lakes' littoral zone (i.e. areas where water depth is <20 feet). The locations of the AVAS's are determined by dividing up the lake's shoreline into segments approximately 100 to 300 feet in length. Each AVAS is sampled by using visual observation (depending on water clarity), and weighted rake tows. Each plant species observed as well as an estimate of density are recorded on a Standard Aquatic Vegetation Assessment Site Species Density Sheet (AVAS) developed by the State of Michigan (App. B). On the AVAS density sheets the approximate percent cover was reported rather than narrative ranges. On the summary sheet, however, these percentages were translated into cover codes A, B, C, and D to describe the approximate coverage of each plant within the AVAS area, as outlined in the following table.

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Cover Code	Approximate Cover Range
A	1-2%
B	3-20%
C	21-60%
D	61-100%

4.0 Survey Results

Due to the poor water clarity on June 7 and 8, visual surveys between rake tows could not be performed. Severe storms prior to those dates caused the water to be chalky and lake water levels were above normal. Rake tows were performed at specific sites around the lake, most within the littoral zone with some in the middle of large coves and the lake proper. Species to be classified were placed in a plastic bag, appropriately labeled, and identified using taxonomic keys at the completion of the survey. The location of each AVAS was determined using differential GPS technology. Lake Roaming Rock was divided into 190 AVAS sample locations as part of this survey (Figure 1).

The June survey identified 10 different aquatic plant species: 7 submersed and 3 floating-leaved species. The plants found at each location are listed in Appendix A. Only two exotic species were found during the survey. The first is Eurasian watermilfoil, which was found in 11 AVAS locations, making up 1.9 percent cumulative cover (CC). (App. B. Table 3). The second exotic species is Brittle naiad, which was found at 8 AVAS locations (4.4 CC) is considered noxious and invasive in some other states, therefore, future monitoring of the densities of this plant are warranted.

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Figure 1. Transect Locations.
Lake Roaming Rock.
May 2010. Sheet 1 of 2.

Transect Location

- EWM Absent
- EWM Present

500 250 0 500 Feet

150 75 0 150 Meters

N

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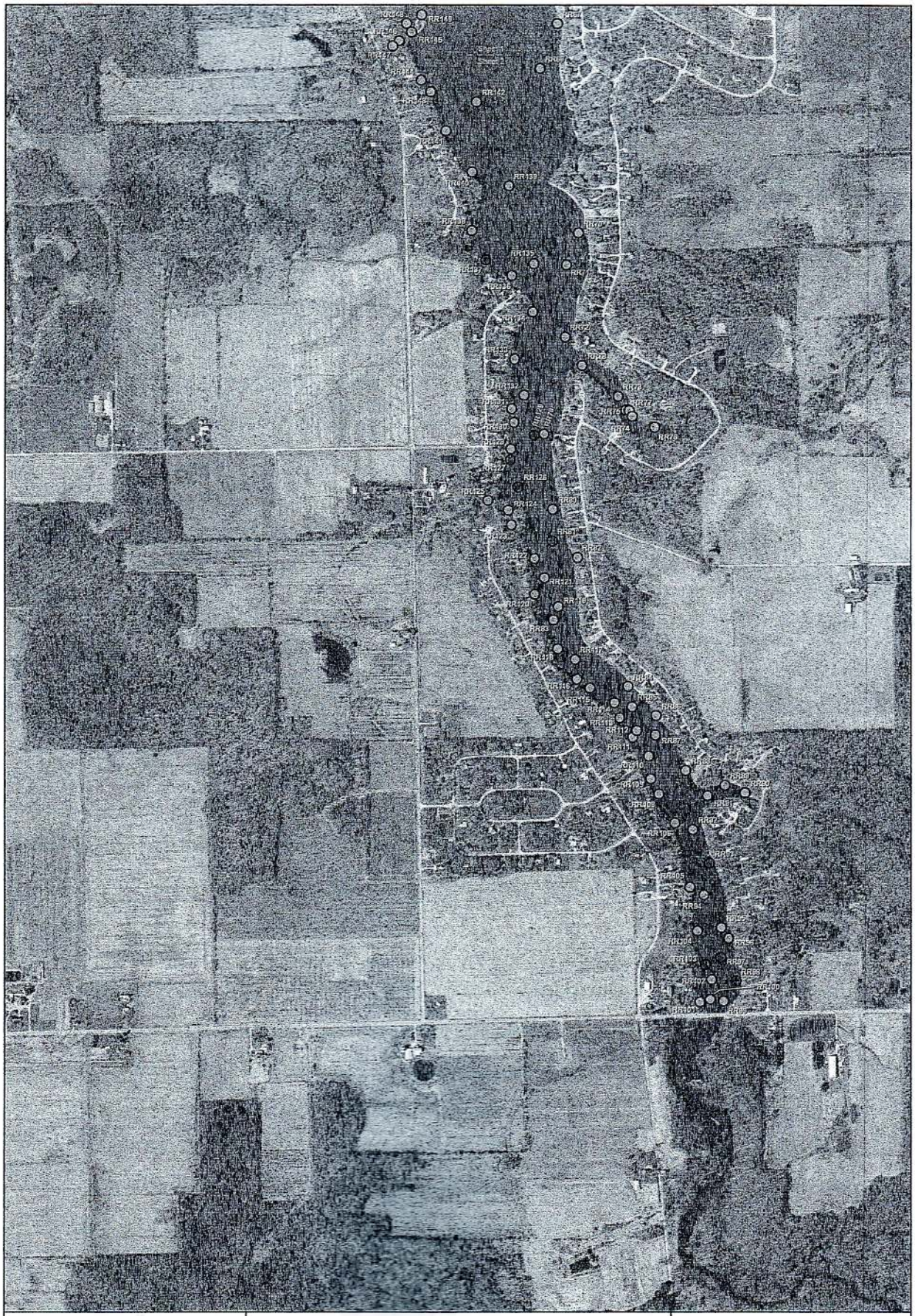

Figure 1. Transect Locations.
Lake Roaming Rock.
May 2010. Sheet 2 of 2.

Transect Location

- EWM Absent
- EWM Present

500 250 0 500 Feet

150 75 0 150 Meters

N

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According to the calculated cumulative cover (CC) value, the dominant native plant species in Lake Roaming Rock is Coontail (12.3 CC), found in 70 of the 190 AVAS. Other submersed native plants were found less frequently. These include species such as Small pondweed (2.7 CC), Long leaf pondweed (4.0 CC), Common waterweed or Elodea (1.0 CC).

Floating leaf native plants include White water lily (6.6 CC) and Spadderdock (1.0 CC), along with Small duckweed (1.0 CC).

Due to high water levels and the highly developed shoreline with many man-made seawalls, no emergent native plants were collected in rake tosses.

5.0 Discussion

As noted above, the survey was conducted relatively early in the growing season. This coupled with the heavy drawdown the previous winter makes it clear that the condition of the aquatic plant community at the time of the June 7-8 survey was not representative of the typical condition or the situation that concerned the LMC and many lake residents the previous summer. Despite this, meaningful conclusions can be drawn and recommendations for action can be made.

At the present time, Coontail is the dominant member of the plant community. Information from Aqua Doc indicates that this was also the major nuisance during the summer of 2009. Coontail is a completely submersed plant commonly seen in lakes with moderate to high nutrient levels. It is generally a dark, olive green color, and is often rather hard and crusty to the feel. This is especially true where it grows in hard water lakes (the calcium in the water becomes deposited on the leaf surface, making it seem crunchy). Coontail spreads to new areas either through germination of its seeds, or by regrowth of stem fragments. Coontail does not produce roots, instead it absorbs all the nutrients it requires from the

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surrounding water. If it is growing near the lake bottom, it will form modified leaves which it uses to anchor to the sediment. However, it can float free in the water column, and sometimes forms dense mats just below the surface. Because it gets nutrients from the water, it grows best where these nutrient levels are high. It will also tolerate a wide range of water hardness, cool temperatures, and low light conditions. Because Coontail overwinters as an evergreen plant, this species provides important habitat to many invertebrates and fish year- round. Waterfowl feed upon both foliage and fruits. Coontail is found throughout North America.

A major species of concern for the homeowners of Lake Roaming Rock is Eurasian watermilfoil (EWM) due to its invasive potential and tendency to dominate plant communities in northern lakes. At the time of the survey, the EWM was found in 11 / 190 locations and in a sparse density. The native aquatic plant community in Lake Roaming Rock at the time of the survey was dominated by Coontail. At high densities it can form surface mats that resemble EWM beds. That coupled with similarities in leaf structure and overall appearance can create the deception that a lake is infested with the exotic EWM when in fact it is not. This type of misidentification can lead to improper management choices, in particular, the application of herbicides at rates determined for EWM that will not help control some native plants. Expert plant identification is the key to determining the proper plant management strategy for any waterbody.

A healthy lake ecosystem will be the positive outcome of proper lake management. A variety of methods are currently available for controlling nuisance aquatic plants. These include physical, mechanical, chemical, and biological methods. All aquatic plant management techniques have positive and negative attributes. Selection of a method needs to be based on economic, environmental, technical, and sometimes regulatory constraints.

5.1 Control Techniques

Control techniques of nuisance aquatic plants include biological, chemical, mechanical/physical and cultural methods. One important consideration in making management decisions is to recognize that the idea of complete eradication of nuisance aquatic plants is typically unrealistic except in exceptional circumstances. Once a species becomes established in a foreign place, the goal should be detection and management to levels that do not cause ecological, societal or economic impacts. Management plans should ultimately be chosen based on an individual lake's environmental conditions. EnviroScience's 2005 comprehensive report entitled "Lake Diagnostic Study and Management Plan Development for Lake Roaming Rock" provides a framework for basing future management decisions. An overview including advantages and disadvantages of control methods will be discussed below in order to guide management decisions at Lake Roaming Rock.

Biological Control

Biological control of aquatic weeds is typically associated with invertebrate herbivores. For example, Eurasian watermilfoil has been shown to be controlled through several different biological control agents. These include the milfoil weevil, an aquatic beetle (*Euhrychiopsis lecontei*); the naturalized milfoil moth, which has an aquatic larval stage (*Acentria ephemerella*); the milfoil midge (*Cricotopus myriophylli*); and a native caddisfly (*Oecetis* sp.). Thus far, the milfoil weevil has shown the most promising results of control of Eurasian watermilfoil, which is supported by both academic and private research. Other species of insects can be effective at controlling infestations of additional invasive species, such as purple loosestrife. The immediate benefit of a biocontrol program is that it reduces the amount of chemicals (an environmental pollutant) used to control the weed. Well-designed biocontrol programs can also be

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sustainable over the long term. As biocontrol agents grow in numbers, control may be more effective. However, that being said, fluctuations in the agent's effective population size are not predicable, so results can vary from lake to lake and year to year. Also the culturing of biocontrol agents is a labor intensive process, thereby making the implementation of such programs in the initial years seemingly more costly than other forms of aquatic macrophyte management.

Another form of biological control is the introduction of grass carp, an herbivorous fish. Although grass carp can be effective at reducing vegetation in some lakes, Eurasian watermilfoil is not the preferred food source for grass carp. Therefore, the beneficial native macrophyte community is generally completely consumed first, which ultimately increases turbidity in the lake. Additionally, because rooted aquatic macrophytes stabilize lake nutrients, the removal of such plants entirely can result in the increased suspension of sediment and nutrients, causing increasingly frequent algal blooms. Lake Roaming Rock has already employed the use of grass carp in the past, and it was not beneficial to the system. Therefore, this technique is not recommended.

Chemical Control

Many different aquatic herbicides are used to control nuisance aquatic vegetation. Chemical herbicides can have an immediate, observable effect in the reduction of biomass. However, many of these herbicides have one or more aquatic use restrictions that limit the availability of the waterbody for recreation, agriculture/gardening, and livestock watering for from 1 to 30 days. Although many herbicides are purported to be selective, over-use or inappropriate choice of herbicide can have non-target effects on native macrophytes as well as on aquatic invertebrate and fish populations. Therefore, judicious use of aquatic herbicides

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through targeted spot treatment, rather than lake-wide application, could be integrated into a management plan at Lake Roaming Rock, if and when other options are not available or feasible for one or more reasons.

"Contact herbicides" kill the portion of the plant that they come in contact with. Contact herbicides generally work quickly on the treated portions of the plant. However, these types of herbicides will leave the root system of the plant intact and therefore allow for future regrowth. "Systemic herbicides" are those chemicals that penetrate the plant tissue and are translocated throughout, therefore they are capable of killing the entire plant. In any case, herbicides cannot eradicate aquatic nuisance plants but only offer short-term control. The results are continued costly annual treatments. Seven herbicide compounds are registered for use in aquatic systems. The following paragraphs briefly summarize the use characteristics and restrictions association with the five most commonly used for Eurasian watermilfoil (EWM) control.

- **Diquat dibromide – i.e. Reward® , RedWing®-** is a non-selective contact herbicide that can act within a very short time, causing a rapid die-off of the plant shoots. It is restricted for use in some water bodies because it will bind to particulate and dissolved organic matter. *The label on the Reward® container states that it is toxic to invertebrates. Research has shown that it also is moderately toxic to practically nontoxic to birds and slightly toxic to fish.* The EPA requires a 14-day interval between treatment of water with diquat dibromide and use of treated waters for domestic, livestock, or irrigation purposes. Swimming, fishing, and watering of domestic animals should not be allowed for at least 14 days after application of the herbicide to water.
- **Fluridone – i.e. Sonar®** is a fairly-selective systemic herbicide used to treat dicot species like Eurasian watermilfoil. It is slow acting and must be in contact with plants at low concentrations for up t 60 days to

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be effective. This feature alone makes it very difficult to use in flowing water or in lakes and reservoirs having fast flushing rates. According to the manufacturer, lake water containing Sonar used at the maximum-labeled rate (150 ppb) may affect domestic plants, especially plants in the *Solanaceae* family (tomato, potato, eggplant, peppers etc.) and is therefore, unsuitable for irrigation.

- **Triclopyr – i.e. Renovate 3®** is a selective systemic herbicide with the ability to remove milfoil and allow non-invasive native monocots and tolerant dicots to survive. Use restrictions include that it should not be applied directly to un-impounded rivers or streams and treated water may not be used for irrigation for 120 days following application. In addition a 12-hour swimming restriction is recommended to minimize eye irritation. If a flooding event occurs within 120 days of application, there is a potential for triclopyr to damage upland sensitive species, particularly grapes, vegetable crops and flowers.
- **2,4-D – i.e. Aqua-Kleen®, Navigate®, and DMA*4IVM** - is a relatively fast-acting selective systemic herbicide used for control of Eurasian watermilfoil and other broad-leaved species. There are two formulations of 2,4-D approved for aquatic use. Both the granular and liquid formulations have been shown to be relatively selective to Eurasian watermilfoil when used at the labeled rate, leaving most native aquatic species relatively unaffected. Susceptible weeds include: Water milfoils, Water star grass. Slightly to moderately resistant weeds include: Bladderwort, White water lily, Yellow water lily or Spatterdock*, Water shield, Coontail* (* Repeat treatments may be needed)
- **Endothall – i.e. Aquathol®** is a fast-acting non-selective contact herbicide generally considered to be an effective herbicide for spot treatment. According to a Washington State DOE study, using low levels over a lake's littoral zone does cause adverse impacts in the

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short term, since many vascular plants are affected by the treatment. It may be applied in a granular or liquid form. Endothall is toxic to some species of fish.

There are several environmental impacts that must be considered when choosing the appropriate aquatic herbicide. Primary effects on organisms, including humans, from herbicides are usually the first level of concern when it comes to environmental impacts. Registration of a pesticide involves bioassays of the active ingredient across a few taxa of organisms. However, not all phyla are screened so questions remain as to the sensitivity of endangered and not-target species found in aquatic systems. The statements, "No laboratory work was conducted on the effects of triclopyr TEA against amphibians," "It is anticipated that amphibians will be affected by triclopyr TEA both acutely and chronically at concentrations similar to fish," and "Triclopyr is *slightly toxic* to birds when orally consumed in the diet," leave considerable doubt as to the overall safety of some approved herbicides and their long-term effects on all trophic levels and organisms that may be present in a system.

However, even if an herbicide is determined to have no direct effect on a particular organism, a number of indirect effects remain that may impact the aquatic biota and environment. The most significant secondary effect is the reduction of dissolved oxygen (DO) in the water from the decomposition of dying and dead plants. This dramatic change can cause aquatic invertebrate and vertebrate mortality or a transformation from the dominant forms to ones that tolerate low DO levels. Warm water fish such as bass, carp, catfish, shiners, and sunfish can survive and reproduce with relatively low DO, but cold water fish will survive for only a short period and are unlikely to successfully complete a life cycle.

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Along with the change in DO, an abundance of decaying plants produce excess nutrients that are released in the form of phosphates and ammonia. Algal blooms often result from this nutrient overload. Of equal concern is the release of unionized ammonia (NH3), which has been reported as toxic to freshwater organisms. Also, when temperature and pH decrease, the toxicity of ammonia increases. Nitrite, produced during the oxidation of ammonia, has been proven to be toxic to fish.

Another area of concern is the use of surfactants in conjunction with aquatic herbicides. Surfactants or adjuvants are mixed with herbicides immediately prior to application to increase herbicide effectiveness by assisting in adherence of the chemical to plant surfaces. Surfactants do not directly cause plant mortality so they are not subjected to the same testing as the active ingredients.

Although EnviroScience did not observe any large algal blooms in Lake Roaming Rock at the time of the survey, the lake has had problems with algae in the past. There are several products available for algae control, although the most typically used are copper-containing compounds, such as copper sulfate and chelated copper. Unfortunately, copper containing compounds can have adverse effects on the invertebrate community. This in turn can affect the fish that feed on invertebrate species. Additionally, copper from these treatments accumulates in the sediment and can build up to levels where the sediment is considered a hazardous waste under Ohio law when it is disposed of following dredging. If a copper algaecide must be used, chelated copper is a safer option than copper sulfate, as it does not release as much free copper into the water column. An alternative algaecide is sodium carbonate peroxyhydrate otherwise known as percarbonate. One trade name for this product is GreenCleanPro®. This is a contact algaecide that appears to have less environmental impacts than copper compounds.

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Mechanical/ Physical Control

Mechanical and physical methods for the control of aquatic weeds include mechanical-harvesting, bottom barriers, hand-pulling and suction-harvesting. All methods can be quite expensive over large areas and may need to be repeated several times in one season. However, even so, they do provide instantaneous relief from nuisance infestations of aquatic weeds that interfere with recreational activities.

Mechanical harvesting with the 'lawn-mower' boat is a technique currently employed at Lake Roaming Rock. While providing immediate relief from nuisance growth over relatively large areas, this technique has some limitations and drawbacks. These include being generally non-selective, a tendency to remove significant numbers of small fish,, invertebrates and amphibians, and the inability to operate in shallow areas and close to docks. Additionally, this process can actually facilitate the spread of plants such as Eurasian watermilfoil and Coontail since it produces fragments that escape the collection process and can float to other portions of the lake and start new colonies. Bottom barriers and hand-pulling can be effective but usually are restricted to small areas. Bottom barriers are effective at preventing growth of any aquatic vegetation in the area in which it is placed, but can prevent the growth of native macrophytes important for fish populations and water quality as well as interfere with benthic macroinvertebrates. Hand-pulling a small area around individual docks may suit private property owners on Lake Roaming Rock. However, care must be taken to collect all fragments and to properly dispose of the plant material. Based on the limited water clarity of Lake Roaming Rock, it is likely that this method would be both time-consuming and relatively inefficient. Hand-pulling by certified, trained

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scuba divers is one of the highest cost control methods because of the time, labor and equipment needed to accomplish adequate control.

Suction harvesting has had promising results in the ability to selectively and effectively remove the entire plant by sucking it, roots and all, into a hose attached on a specially designed boat. It is most useful for small, dense infestations, or widely-spaced, moderately-sparse infestations. However, it does result in increased sedimentation into the water column temporarily and can be a costly alternative when used in large areas. Additionally, algal blooms from nutrient release can result from the disturbance of bottom sediments. Algal blooms can reduce oxygen in the upper stratified layers of the lake, thereby affecting fish and insect species. Suction harvesting is an expensive method due to the need for specialized scuba divers and equipment, however, the ability to target nuisance plant populations with high specificity in both plant species and location may make this a viable option for Lake Roaming Rock.

Cultural Control

Cultural methods can also be important in slowing or stopping the spread of invasive aquatic plant species. The most successful and simple cultural method of slowing the spread of plants such as Eurasian watermilfoil, would be to limit traffic through or avoid beds of milfoil where present. Additionally, it is important to implement systematic cleaning and disinfection of aquatic gear (especially boats and trailers), as these are likely vectors of introduction. This is evidenced by the presence of Eurasian watermilfoil in the boat launch area of Lake Roaming Rock and past infestations of zebra mussels and the exotic plant Azola. Since Eurasian watermilfoil and Coontail spread effectively through small fragments that can be produced through the action of propellers and can easily become attached to boats and trailers and then spread from lake to

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lake, it is imperative that people become aware of the role that they play in transporting invasive plants. Furthermore, lake residents should be informed as to water quality benefits of shoreline buffers and erosion control through vegetated buffers. This will decrease sediment load into the lake. However, care should be taken to ensure that the plants chosen for the buffers do not include other invasive, fast-spreading plants such as yellow flag iris (which was observed in low densities on the shore near the boat launch) and purple loosestrife.

Cultural methods are a low-cost and safe preventative way of slowing the spread of invasive plants. The challenge is educating the public about the issues. An effective education campaign can be a successful tool, if implemented correctly and lake-wide. Most people will be convinced to play a role in plant management through demonstration of utilitarian benefits (improved boat mobility, better fishing habitat, better swimming/recreational attributes). Lake Roaming Rock is at an advantage in that there are many public facilities where educational material about aquatic invasive plants can be posted and distributed.

6.0 Recommendations

EnviroScience is committed to providing lake-wide sustainable and long-term management options that are environmentally and scientifically sound. It should be noted that some of these techniques may require prior approval by certain state agencies before implantation. In order to achieve this goal in Lake Roaming Rock, EnviroScience recommends an integrated approach, as outlined below.

1. An important initial step in controlling the spread of aquatic invasive plants is prevention. Therefore, EnviroScience recommends that the Roam Rock Association launch an educational campaign by disseminating educational

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materials regarding the importance of cultural methods of aquatic invasive species management. This can be accomplished in a couple of ways. One is to add comprehensive information and photographs of aquatic plants, healthy buffer practices, etc. through the existing Web site (www.roamingshores.org). Another method is to produce posters or fliers that could be read by property owners and visitors of Lake Roaming Rock at key locations. Rock Point Marina, West Beach and East Beach would be ideal areas for posting educational information regarding the spread of invasive aquatic plants and the benefits of native aquatic plants for water quality, invertebrates, fish and waterfowl.

2. Because the vegetation survey was conducted early in the growing season following a winter drawdown, it is first recommended that EnviroScience reassess problem areas (i.e. where Eurasian watermilfoil was recorded in the June 2010 vegetation survey) prior to the implementation of management activities. These areas include: the marina; the southern portion of the lake, just north of SR 6; and along the eastern shore of the lake, near RL 16 and RL 18 Nature Trails. This reassessment will allow EnviroScience to identify the plants present and recommend the best management technique for each particular targeted area in the lake.
3. Following reassessment of these areas, and in broad open areas where the nuisance plants other than Eurasian watermilfoil are moderately dense, mechanical harvesting could be used as a management tool. However, we do not believe that this should be the primary management tool because its use for Coontail and Eurasian watermilfoil will result in these species continuing to spread to other areas of the lake. Harvesting should never be employed in areas where Eurasian watermilfoil is the dominant species or in areas where it comprises a major part of the overall plant community.

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Standard Aquatic Vegetation Assessment Site Species Density Sheet

Code No.	Plant Name	Aquatic Vegetation Assessment Site Number							
		NO. 97	NO. 98	NO. 99	NO. 100	NO. 101	NO. 102	NO. 103	NO. 104
1	Eurasian watermilfoil	A	A					A	
2	Curly leaf pondweed								
3	Chara								
4	Thin leaf pondweed								
5	Robbins pondweed								
6	White stem pondweed								
7	Richardsons pondweed								
8	flatstem pondweed								
9	Large leaf pondweed								
10	Variable pondweed								
11	Leafy pondweed								
12	Water stargrass								
13	Mare tail								
14	Arrowhead								
15	Northen watermilfoil								
16	Whorled watermilfoil								
17	Coontail	C	B	B	D	B	C	C	B
18	Spatterdock								
19	Elodea								
20	Bladderwort								
21	Bladderwort (mini)								
22	Buttercup								
23	Najas spp.								
24	Brittle naiad								
25	Sago pondweed								
26	water merigold								
27	small pondweed	A	A		A			A	
28	White waterlily								
29	Yellow waterlily								
30	Watershield								
31	Small duckweed								
32	Great duckweed								
33	Watermeal								
34	Arrowhead								
35	Pickerelweed								
36	Arrow arum								
37	Cattail								
38	Bulrush								
39	Iris								
40	Swamp Loosestrife								
41	Carex spp								
42	Rush spp								
43	Burr Reed								
44	American Pondweed								

Code No.	Plant Name	Aquatic Vegetation Assessment Site Number							
		NO. 105	NO. 106	NO. 107	NO. 108	NO. 109	NO. 110	NO. 111	NO. 112
1	Eurasian watermilfoil								
2	Curly leaf pondweed								
3	Chara								
4	Thin leaf pondweed								
5	Robbins pondweed								
6	White stem pondweed								
7	Richardsons pondweed								
8	flatstem pondweed								
9	Large leaf pondweed								
10	Variable pondweed								
11	Leafy pondweed								
12	Water stargrass								
13	Mare Tail								
14	Arrowhead								
15	Northern watermilfoil								
16	Whorled watermilfoil								
17	Coontail	B		A			A		A
18	Spatterdock								
19	Elodea	A							
20	Bladderwort								
21	Bladderwort (mini)								
22	Buttercup								
23	Najas spp.								
24	Brittle naiad								
25	Sago pondweed								
26	water merigold								
27	small pondweed								
28	White waterlily								
29	Yellow waterlily								
30	Watershield								
31	Small duckweed								
32	Great duckweed								
33	Watermeal								
34	Arrowhead								
35	Pickerelweed								
36	Arrow arum								
37	Cattail								
38	Bulrush								
39	Iris								
40	Swamp Loosestrife								
41	Carex spp								
42	Rush								
43	Burr Reed								
44	American Pondweed								

Lake Roaming Rock

June 7-8, 2010

Standard Aquatic Vegetation Assessment Site Species Density Sheet																				
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number								
Code No.	Plant Name	NO. 81	NO. 82	NO. 83	NO. 84	NO. 85	NO. 86	NO. 87	NO. 88	Code No.	Plant Name	NO. 89	NO. 90	NO. 91	NO. 92	NO. 93	NO. 94	NO. 95	NO. 96
1	Eurasian watermilfoil	A								1	Eurasian watermilfoil					A			
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail	A		A		B	B	C		17	Coontail	B	A	B	B	C	B		A
18	Spatterdock									18	Spatterdock								
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad								
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed								A	27	small pondweed		A		A	A			
28	White waterlily									28	White waterlily								
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet																			
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number							
Code No.	Plant Name	NO. 65	NO. 66	NO. 67	NO. 68	NO. 69	NO. 70	NO. 71	NO. 72	Code No.	Plant Name	NO. 73	NO. 74	NO. 75	NO. 76	NO. 77	NO. 78	NO. 79	NO. 80
1	Eurasian watermilfoil									1	Eurasian watermilfoil								
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail			A	C			A		17	Coontail	A	A	B		B			
18	Spatterdock									18	Spatterdock								
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad								
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed									27	small pondweed			A					
28	White waterlily				A					28	White waterlily			C					
29	Yellow waterlily									29	Yellow waterlily			A					
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet																			
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number							
Code No.	Plant Name	NO. 49	NO. 50	NO. 51	NO. 52	NO. 53	NO. 54	NO. 55	NO. 56	Code No.	Plant Name	NO. 57	NO. 58	NO. 59	NO. 60	NO. 61	NO. 62	NO. 63	NO. 64
1	Eurasian watermilfoil									1	Eurasian watermilfoil								
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail	A		A			A	A	A	17	Coontail	A	D						
18	Spatterdock									18	Spatterdock								
19	Elodea								A	19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad								
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed			A			A		A	27	small pondweed	A							
28	White waterlily									28	White waterlily								
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet

Code No.	Plant Name	Aquatic Vegetation Assessment Site Number NO. 33	NO. 34	NO. 35	NO. 36	NO. 37	NO. 38	NO. 39	NO. 40	Code No.	Plant Name	Aquatic Vegetation Assessment Site Number NO. 41	NO. 42	NO. 43	NO. 44	NO. 45	NO. 46	NO. 47	NO. 48
1	Eurasian watermilfoil									1	Eurasian watermilfoil								
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail				B	C	B	B		17	Coontail				A	A	A		
18	Spatterdock									18	Spatterdock								
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad				A					24	Brittle naiad								
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed				A					27	small pondweed								
28	White waterlily				A					28	White waterlily						A		
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed				A					31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet																			
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number							
Code No.	Plant Name	NO. 17	NO. 18	NO. 19	NO. 20	NO. 21	NO. 22	NO. 23	NO. 24	Code No.	Plant Name	NO. 25	NO. 26	NO. 27	NO. 28	NO. 29	NO. 30	NO. 31	NO. 32
1	Eurasian watermilfoil									1	Eurasian watermilfoil								
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail		A				B	A	B	17	Coontail	B				A	C	A	B
18	Spatterdock							A		18	Spatterdock								
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad	B							A
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed						A			27	small pondweed								
28	White waterlily									28	White waterlily	A							A
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed						A			31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed					A			A

Standard Aquatic Vegetation Assessment Site Species Density Sheet

Code No.	Plant Name	Aquatic Vegetation Assessment Site Number NO. 1	NO. 2	NO. 3	NO. 4	NO. 5	NO. 6	NO. 7	NO. 8	Code No.	Plant Name	Aquatic Vegetation Assessment Site Number NO. 9	NO. 10	NO. 11	NO. 12	NO. 13	NO. 14	NO. 15	NO. 16
1	Eurasian watermilfoil									1	Eurasian watermilfoil								
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	Flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail									17	Coontail	A						B	A
18	Spatterdock									18	Spatterdock	A							
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad								B
25	Sago pondweed									25	Sago pondweed								
26	Water merigold									26	water merigold								
27	Small pondweed									27	small pondweed								
28	White waterlily									28	White waterlily								
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Appendix B

Standard Aquatic Vegetation Assessment Site Species Density Sheets

LAKE Lake Roaming Rock COUNTY- Astabula SURVEY DATI June 7 & 8, 2010

Standard Aquatic Vegetation Summary Sheet SURVEY BY: Nancy Cushing &Lara Roketenetz

		Total number of AVAS's for each Density Catagory				Calculations				Sum of Previous Four Columns	Total Number of AVAS's	Quotient of Column 9 divided by Column 10		
		A	B	C	D	Catagory A x 1	Catagory B x10	Catagory C x 40	Catagory D x 80					
Code No	Plant Name	1	2	3	4	5	6	7	8	9	10	11	Code No	Plant Name
1	Eurasian milfoil	10	1			10	10			21	11	1.9	1	Eurasian milfoil
2	Curly leaf pondweed												2	Curly leaf pondweed
3	Chara												3	Chara
4	Thinleaf pondweed												4	Thinleaf pondweed
5	Flatstem pondweed												5	Flatstem pondweed
6	Robbins pondweed												6	Robbins pondweed
7	Variable pondweed												7	Variable pondweed
8	Whitestem pondweed												8	Whitestem pondweed
9	Richardsons pondweed												9	Richardsons pondweed
10	Illinois pondweed												10	Illinois pondweed
11	American pondweed	2	1			2	10			12	3	4.0	11	American pondweed
12	Floating leaf pondweed												12	Floating leaf pondweed
13	Water stargrass												13	Water stargrass
14	Wild Celery												14	Wild Celery
15	Small pondweed	31	2	1		31	20	40		91	34	2.7	15	Small pondweed
16	Leafy pondweed												16	Sagitteria
17	Northern milfoil												17	Northern milfoil
18	M. verticillatum												18	M. verticillatum
19	M. herterophyllum												19	M. herterophyllum
20	Coontail	33	22	8	3	33	220	320	240	813	66	12.3	20	Coontail
21	Elodea	4				4				4	4	1.0	21	Elodea
22	Bladderwort												22	Bladderwort
23	Bladderwort-mini												23	Bladderwort-mini
24	Buttercup												24	Buttercup
25	Najas spp.												25	Najas spp.
26	Brittle naiad	5	3			5	30			35	8	4.4	26	Brittle naiad
27	Sago pondweed												27	Sago pondweed
28	Water Merigold												28	Water Merigold
29	Spadderdock	2				2				2	2	1.0	29	Spadderdock
30	White water lily	6		1		6		40		46	7	6.6	30	White water lily
31	Yellow water lily												31	Yellow water lily
32	Nuphar sp.												32	Nuphar sp.
33	Watershield												33	Watershield
34	Equisitum												34	Equisitum
35	Spirodella												35	Spirodella
36	Small Duckweed	4				4				4	4	1.0	36	Watermeal
37	Arrowhead												37	Arrowhead
38	Smartweed												38	Smartweed
39	Quillwort												39	Quillwort
40	Cattails												40	Cattails
41	Three square bulrush												41	Bulrushes
42	Iris												42	Iris
43	Swamp Loosestrife												43	Swamp Loosestrife
44	Carex spp.												44	Purple Loosestrife
45	Rush spp.												45	Rush spp.

Table 3. Aquatic Plant Species Encountered in Lake Roaming Rock		
Common Name	**Scientific Name**	**Cumulative Cover**
Submersed Plants		
Eurasian watermilfoil	***Myriophyllum spicatum***	**1.9**
Coontail	***Ceratophyllum demersum***	**12.3**
Brittle naiad	***Najas minor***	**4.4**
Small pondweed	***Potamogeton pusillus***	**2.7**
American/long-leaf pondweed	***Potamogeton nodosus***	**4.0**
Elodea/common waterweed	***Elodea Canadensis***	**1.0**
Floating-leaved Plants		
Spatterdock	***Nuphar variegate***	**1.0**
White water lily	***Nymphaea odorata***	**6.6**
Small duckweed	***Lemna minor***	**1.0**

Appendix A

Standard Aquatic Vegetation Assessment Site Species Density Sheet, Summary Sheet and Table

However, these barriers can be difficult to deploy and they also prevent the growth of native macrophytes and can therefore indirectly affect the invertebrate and fish community in the areas where they are employed.

8. If algae becomes a problem later in the season, it is recommended that a non-copper containing compound, such as sodium carbonate peroxyhydrate (percarbonate) be used to control the algal blooms. Using non-copper based products is an especially important consideration if milfoil weevils are used to control Eurasian watermilfoil in the lake, as copper compounds can affect the success of a stocking project by reducing effective population sizes of the weevil.

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3781 Darrow Road, Stow, OH 44224
(800) 940-4025 Fax: (330)688-3858.
www.enviroscienceinc.com

4. In areas where nuisance aquatic plant growth is not widespread and occurs closer to shore and around obstructions where mechanical harvesting is not feasible, diver operated suction harvesting may an effective means of removing both vegetative and root biomass. This technique is particularly useful where treatment is desired on a lot by lot basis. This technique is also suitable for use during the growing season, because it is more selective than general herbicide applications. However, selectivity is based on the diver's ability to locate and identify the target plants under water, therefore, consideration must be given to water quality conditions (i.e. water levels and turbidity) during this treatment option.
5. In areas with extensive, dense infestations of Eurasian watermilfoil (should this occur later in the growing season or in the future), and if sufficient water clarity and oxygenation is available, milfoil weevils (*Euhrychiopsis lecontei*) are a viable biocontrol option in those low-traffic areas of the lake. This option is considered a long-term sustainable and environmentally-friendly approach. However, the success of the program will depend on water quality considerations, as well as suitable off-shore over-wintering habitats for the weevils. EnviroScience recommends a multi-year weevil stocking plan for lakes in which there is a need, as well as sufficient habitat, for the weevils.
6. Herbicide spot treatment with systemic herbicides may be a viable option in those areas with nuisance weeds where suction harvesting or biocontrol options are not available. However, it should be noted that some non-target effects may be realized. Non-target effects can be minimized if herbicides are applied earlier in the growing season, before many native plants have begun to grow.
7. Benthic barriers may be effective at controlling growth of nuisance weeds in limited areas around individual docks. This will allow for easy egress from private docks to the lake proper and help quell the complaints of lakefront property owners that often occur when plants reach their peak.

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Standard Aquatic Vegetation Assessment Site Species Density Sheet

Code No.	Plant Name	Aquatic Vegetation Assessment Site Number NO. 113	NO. 114	NO. 115	NO. 116	NO. 117	NO. 118	NO. 119	NO. 120	Code No.	Plant Name	Aquatic Vegetation Assessment Site Number NO. 121	NO. 122	NO. 123	NO. 124	NO. 125	NO. 126	NO. 127	NO. 128
1	Eurasian watermilfoil									1	Eurasian watermilfoil						A	B	
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail		A	A	A	B				17	Coontail		D	C	A	A	B	B	
18	Spatterdock									18	Spatterdock								
19	Elodea			A						19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad								
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed		A	A	A					27	small pondweed			A	A		A	A	
28	White waterlily									28	White waterlily								
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed		A	A						31	Small duckweed		A		A				
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet																				
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number								
Code No.	Plant Name	NO. 129	NO. 130	NO. 131	NO. 132	NO. 133	NO. 134	NO. 135	NO. 136	Code No.	Plant Name	NO. 137	NO. 138	NO. 139	NO. 140	NO. 141	NO. 142	NO. 143	NO. 144
1	Eurasian watermilfoil	A								1	Eurasian watermilfoil	A							
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail	A								17	Coontail	B							
18	Spatterdock									18	Spatterdock								
19	Elodea		A							19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad								A	24	Brittle naiad								
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed		A					A	A	27	small pondweed	A							
28	White waterlily									28	White waterlily								
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet																			
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number							
Code No.	Plant Name	NO. 145	NO. 146	NO. 147	NO. 148	NO. 149	NO. 150	NO. 151	NO. 152	Code No.	Plant Name	NO. 153	NO. 154	NO. 155	NO. 156	NO. 157	NO. 158	NO. 159	NO. 160
1	Eurasian watermilfoil									1	Eurasian watermilfoil								
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail							A		17	Coontail						A		
18	Spatterdock									18	Spatterdock								
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad								A	24	Brittle naiad								B
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed				B		B		A	27	small pondweed						A	A	C
28	White waterlily									28	White waterlily						A		
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet																			
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number							
Code No.	Plant Name	NO. 161	NO. 162	NO. 163	NO. 164	NO. 165	NO. 166	NO. 167	NO. 168	Code No.	Plant Name	NO. 169	NO. 170	NO. 171	NO. 172	NO. 173	NO. 174	NO. 175	NO. 176
1	Eurasian watermilfoil									1	Eurasian watermilfoil								
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail		A							17	Coontail								
18	Spatterdock									18	Spatterdock								
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad								
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	small pondweed	A								27	small pondweed								
28	White waterlily									28	White waterlily								
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed		B							44	American Pondweed								

Standard Aquatic Vegetation Assessment Site Species Density Sheet																			
		Aquatic Vegetation Assessment Site Number										Aquatic Vegetation Assessment Site Number							
Code No.	Plant Name	NO. 177	NO. 178	NO. 179	NO. 180	NO. 181	NO. 182	NO. 183	NO. 184	Code No.	Plant Name	NO. 185	NO. 186	NO. 187	NO. 188	NO. 189	NO. 190		
1	Eurasian watermilfoil									1	Eurasian watermilfoil					A	A		
2	Curly leaf pondweed									2	Curly leaf pondweed								
3	Chara									3	Chara								
4	Thin leaf pondweed									4	Thin leaf pondweed								
5	Robbins pondweed									5	Robbins pondweed								
6	White stem pondweed									6	White stem pondweed								
7	Richardsons pondweed									7	Richardsons pondweed								
8	flatstem pondweed									8	flatstem pondweed								
9	Large leaf pondweed									9	Large leaf pondweed								
10	Variable pondweed									10	Variable pondweed								
11	Leafy pondweed									11	Leafy pondweed								
12	Water stargrass									12	Water stargrass								
13	Mare tail									13	Mare Tail								
14	Arrowhead									14	Arrowhead								
15	Northen watermilfoil									15	Northern watermilfoil								
16	Whorled watermilfoil									16	Whorled watermilfoil								
17	Coontail									17	Coontail		B	A			A		
18	Spatterdock									18	Spatterdock								
19	Elodea									19	Elodea								
20	Bladderwort									20	Bladderwort								
21	Bladderwort (mini)									21	Bladderwort (mini)								
22	Buttercup									22	Buttercup								
23	Najas spp.									23	Najas spp.								
24	Brittle naiad									24	Brittle naiad		A						
25	Sago pondweed									25	Sago pondweed								
26	water merigold									26	water merigold								
27	Small pondweed									27	small pondweed		A	A					
28	White waterlily									28	White waterlily								
29	Yellow waterlily									29	Yellow waterlily								
30	Watershield									30	Watershield								
31	Small duckweed									31	Small duckweed								
32	Great duckweed									32	Great duckweed								
33	Watermeal									33	Watermeal								
34	Arrowhead									34	Arrowhead								
35	Pickerelweed									35	Pickerelweed								
36	Arrow arum									36	Arrow arum								
37	Cattail									37	Cattail								
38	Bulrush									38	Bulrush								
39	Iris									39	Iris								
40	Swamp Loosestrife									40	Swamp Loosestrife								
41	Carex spp									41	Carex spp								
42	Rush spp									42	Rush								
43	Burr Reed									43	Burr Reed								
44	American Pondweed									44	American Pondweed								

Proposal for Aquatic Plant Survey and Aquatic Plant Management Plan Development for Lake Roaming Rock

Prepared for:

The Roam Rock Association, Inc.
Rome, OH

Prepared by:

EnviroScience, Inc.
3781 Darrow Rd.
Stow, OH 44224-4035

March 17, 2010

EnviroScience Project No: 571-3353

Project Scope – Aquatic Plant Survey and Developing Recommendations for Long-term Management of Lake Roaming Rock

1.0 Introduction

Many riparian property owners in the northern United States face similar problems with maintaining the quality of the beautiful natural resources of lakes and ponds. Lakeside property owners range from cities to private citizens, and nearly everyone can enjoy some type of recreational activity during both summer and winter months. However, sometimes, a problem arises in the chemical or biological balance of a lake. Human activities can be detrimental to water quality, aquatic plant community growth, or fish habitat. Without careful monitoring and management, beautiful lakes can become unsightly and unpleasant to visit.

EnviroScience, Inc. is pleased to submit a proposal to the Roam Rock Association for aquatic plant survey services to assess present conditions and to guide current and future management programs in Lake Roaming Rock. EnviroScience is committed to helping lake owners develop and implement environmentally sound recommendations for ecologically friendly lake management.

2.0 Project Overview

The objectives of this project include:

1. Expert consultation with lake association board members to, review existing information on aquatic plant management efforts in the lake, and clarify goals and objectives for management of Lake Roaming Rock.

2. Conducting a detailed aquatic vegetation survey to document the condition of the native plant community and to document the presence and spread of exotic species also suspected of being present in the lake. This survey will serve as a baseline for future aquatic plant management efforts.

3. Developing a generalized strategy and management plan for ongoing aquatic plant management to achieve recognized goals and objectives of the Lake Roaming Rock community.

Task 1: Expert Consultation/ Data Review

The first tasks necessary to develop an environmentally sound lake management program include developing understanding of past aquatic plant management

efforts and determining present conditions of the lake. A well-rounded management plan takes into account not only past and current conditions, but also future expectations. Although EnviroScience has extensive knowledge of the lake, we have little information about the past herbicide applications.

As part of this initial effort, EnviroScience will meet with the association board, interview AquaDoc and review available records pertaining to aquatic plant control.

Task 2: Aquatic Plant Survey

In order to develop a baseline for future management, EnviroScience proposes to conduct a detailed aquatic vegetation survey in early to mid-June 2010. We recommend that organized plant management activities such as herbicide application be delayed until completion of this survey.

Aquatic vegetation survey procedures used by EnviroScience are patterned after those developed by the State of Michigan and have been designed to ensure easily replicable surveys of the existing aquatic plant communities.

The survey is carried out by sampling individual Aquatic Vegetation Assessment Sites (AVAS's) throughout out the lakes' littoral zone (i.e. areas where water depth is <20feet). The locations of the AVAS's are determined by dividing up the lake's shoreline into segments approximately 100 to 300 feet in length. Each AVAS is sampled by using visual observation (depending on water clarity), and weighted rake tows. Each plant species observed as well as an estimate of density are recorded for each AVAS. Plant species are identified by numbers designated on the survey map's plant species list and densities are recorded by using the following table key:

(a) = found: One or two plants of a species found in an AVAS, equivalent to less than 2% of the total AVAS surface area.
(b) = sparse: Scattered distribution of a species in an AVAS, equivalent to between 2% and 20%of the total AVAS surface area.
(c) = common: Common distribution of a species where the species is easily found in an AVAS equivalent to between 21% and 60% of the total AVAS surface area.
(d) = dense: Dense distribution of a species where the species is present in considerable quantities throughout an AVAS, equivalent to greater than 60% of the total AVAS surface area.

AVAS's are not confined solely to a lake's shoreline. Where a lake possesses an extensive littoral zone, additional AVAS's are drawn out near the extent of submerged vegetation growth. This is accomplished by adding transect lines divided in proportion to the shoreline AVAS's.

Task 3: Lake Report and Management Program Development

Once the data gathered in Tasks 1 and 2 have been compiled and analyzed, a written report will be presented to the Lake Management Committee of Roam Rock Association. This report will include:

- a summary of the consultation and available information
- detailed geographic information system (GIS) maps identifying the location of sampling sites and major beds of aquatic plants
- a description of major invasive species identified including approximate acreage of each found

The report will also include a framework for an aquatic plant management plan. The plan will discuss and identify priority lake areas and species requiring active management, a summary of management options, and detailed recommendations for implementation. After review of the report by the Lake Management Committee, EnviroScience personnel will return to the lake for discussion of the proposed management plan with the members of the lake association and potential contractors.

We believe that a formal management plan will serve as a framework for funding priorities, provide useful information to residents, and provide an outlet for comments and even criticism, thereby alleviating some of the pressure which typically falls on the Association's board and a few individuals.

3.0 Costing

The costs associated with performing each task are outlined in a summary table below. Included in this estimate are costs associated with expert consultation, travel expenses, all field activities, report generation and a follow-up meeting to discuss long-term goals for the lake. As it is unclear what level of coordination will be needed, we are not costing extensive follow-up or coordination with AquaDoc, the Association's herbicide contractor.

Task 1: Data Review/ Consultation	**Unit Rate**	**Units**	**Total**
Senior Scientist	$95.00	2	$190
Biologist I	$65.00	2	$130
Total Hours		4	
Total Salaries			$320
Total Task 1			**$320**

Task 2: Aquatic Plant Survey	**Unit Rate**	**Units**	**Total**
Senior Scientist	$95.00	2	$190
Bio II, Field and reporting	$80.00	14	$1,120
Field Tech	$45.00	12	$540
Total Hours		30	
Total Salaries			$1,850
Misc. Office, copies, etc	$35.00	1	$35
Boat & GPS Rental	$100.00	1	$100
Mileage	$0.55	180	$99
Total Task 2			**$2,084**
Task 3: Reporting/ Management Plan Development	**Unit Rate**	**Units**	**Total**
Senior Scientist	$95.00	6	$570
Field Tech –GIS Mapping	$80.00	4	$320
Total Hours		11	
Total Salaries			$890
Misc. Office, copies, etc	$45.00	1	$45
Mileage	$0.55	180	$99
Total Task 3			**$1,034**
Total Project Cost			$3,438

TERMS AND AGREEMENT

EnviroScience, Inc. will provide ecological consulting services to the Roam Rock Association, Inc. as outlined in this proposal for the fees stated above. The price in this proposal is valid for 120 days. Invoices will be prepared and submitted upon completion of each task. Payment terms are net 30.

Respectively Submitted by:

Martin Hilovsky
President

ACCEPTED AND AUTHORIZED TO PROCEED:

Signature _____ Date _____

Table of Contents

EnviroScience Corporate Profile and Experience

EnviroScience has provided biomonitoring services to federal, state, and municipal governments, as well as industrial and private clients since 1988. Our attention to detail and personalized service has allowed us to rapidly grow to one of the regions largest and most respected toxicity laboratories. Likewise, our successful completion of projects ranging from small studies on intermittent streams to major surveys on the Ohio River has given our aquatic survey group a reputation for excellence and made us a leader in this specialized field. EnviroScience has also conducted a large number of wetland delineations and terrestrial surveys for a number of satisfied clients. These include projects for the Departments of Transportation in states throughout the Midwest, municipalities, commercial developers and private land owners.

NAME:	**EnviroScience, Inc.**
SERVICE:	Biomonitoring
ORGANIZATION:	Incorporated within the State of Ohio
PERSONNEL:	2 Principals, 34 Employees
	23 Scientists (4 Ph.D., 8 M.S., 11 B.S.)
	6 Technicians
	5 Laboratory Assistants
	1 Certified Wastewater Treatment Operator (Ohio)
	9 Certified SCUBA Divers
LOCATION:	Stow, Ohio
	(800) 940-4025

EnviroScience specializes in providing high quality biomonitoring services both in the laboratory and in the field. Because biomonitoring is our only business, we make it our business to stay at the forefront of the regulatory and scientific developments in this rapidly changing field. The company has three divisions corresponding to the major areas of emphasis: Aquatic and Ecological Survey, Lake Management, and Laboratory Services. The first of these provides a full range of biological surveys, with aquatic surveys and wetlands surveys being the specialties. The Lake Management group provides complete lake and reservoir services including treatment using MiddFoil®, a biological process for Eurasian watermilfoil control. Laboratory Services includes bioassay testing and TIE/TRE projects.

EnviroScience has conducted aquatic and ecological surveys to satisfy National Pollutant Discharge Elimination System (NPDES) permit requirements, Department of Transportation requirements, U.S. Army Corps of Engineers (USACE) guidance documents, combined sewer overflow evaluations, and evaluations of construction impacts and wastewater treatment plant expansions. We maintain close contact with state and federal authorities to ensure that our protocols and techniques for data analysis and reporting are up to date and meet the requirements for our clients. Our combination of solid experience and state-of-the art equipment ensures that our survey projects are done right and completed on time.

EnviroScience's bioassay laboratory provides toxicity testing services to NPDES permittees and others in an eight state region. For more than a decade, our team of professionals has provided timely, high quality results. Each person on our staff of scientists and technicians has both the solid experience and strong technical training needed in this very specialized field.

In addition to its core staff, the company draws on a network of consulting employees with particularly high levels of expertise in one or more disciplines ranging from archaeology to vertebrate zoology. Our consulting employees are generally Ph.D. scientists having on average 20 years of experience in their respective disciplines. Among them are principle authors of text books and manuals on lake management, wetland construction, and rare and endangered plants in the Midwestern United States. By bringing in experts on an as needed basis who have literally 'written the book' in a particular field, we can support our clients with world-class expertise and resources at a reasonable cost.

The following pages provide a more detailed description of our services and a few project summaries which describe recent work performed by our biologists.

Lake Management

Lake Management Services

Although lake diagnostic work is a relatively recent area of emphasis for the company, EnviroScience, Inc. has already successfully completed several large projects for lake associations, state agencies, park districts, and local municipalities. These projects have ranged from full-scale watershed and lake diagnostic studies to less intense macrophyte control programs and fishery evaluations.

Our full scale diagnostic studies include the assessment of water quality through the collection of data on temperature and dissolved oxygen profiles, nutrient levels, transparency, fish and plant communities, and algae densities in the lake. Watershed analyses, involving land use and nutrient input to lakes, are also part of the studies. Many of these projects have made use of EnviroScience's GIS capabilities, which greatly enhances our ability to graphically present complex environmental data.

As with many of our ecological projects, EnviroScience draws on a strong network of university faculty and research staff to support many of our lake projects as consulting scientists. Our partnership with some of the country's top experts in lake management and rehabilitation allows us to bring their expertise to bear on a wide range of problems in our clients' lakes and reservoirs.

Depending on the need, our lake management group offers both biological and chemical programs for the control of aquatic macrophytes. The MiddFoil® program involves the stocking of a native weevil, *Euhrychiopsis lecontei*, as a biological control for the exotic weed, Eurasian watermilfoil, *Myriophyllum spicatum.*

- *MiddFoil® Process.* Currently, EnviroScience is the only company in the United States to commercially supply the milfoil weevil, a native weevil used to control Eurasian watermilfoil. We have stocked thirty lakes, from Massachusetts to Wisconsin between 1998 and 2000. Our commitment to the satisfaction of our customers, and the success of the program, ensures that our MiddFoil® projects are done well and to the highest standards.

  In addition to the stocking of weevils, the MiddFoil® program includes a detailed monitoring component. Baseline data on the plant community composition,

indigenous weevil densities, and general lake conditions are collected before stocking in early summer. Follow-up monitoring surveys include further data collection, and are conducted at the end of the first summer and, again, at the end of the following summer. These surveys monitor the growth of the weevil population and changes in the plant community as the weevil population becomes established. They also monitor the overall success of the stocking and the damage to the Eurasian watermilfoil over multiple years.

- *Diagnostic Evaluations and Watershed Studies.* EnviroScience performs a full range of diagnostic studies and evaluations to identify problems in the lake and within the watershed. These studies often include both biological and water quality studies of the lake and influent tributaries in order to characterize the complex dynamics affecting the lake's waster quality. Our use of state-of-the-art tools such as Geographic Information Systems (GIS) enables our clients to visualize the collected data in ways not possible before, thereby speeding and improving the quality of decision making.

- *Fishery Management.* EnviroScience also conducts detailed fishery evaluations with subsequent recommendations for management, restoration and stocking. From conducting electroshocking surveys for the assessment of population dynamics, to providing detailed stocking and management plans, EnviroScience's fishery biologists have the necessary equipment and expertise to assess and manage fish populations in a variety of lakes. We understand that each lake is different and that each community has different goals, objectives and needs. We work with lake boards throughout the Midwest to tailor management plans which meet our clients needs using their available budgets.

Project Summaries

MiddFoil® Process
Paradise Lake, Emmet/Cheboygan County, Michigan

Client:
Paradise Lake Association
Marilyn Smith
231.537.4645

Inland Lakes and Wetlands Unit -

Location:
Cheboygan County, Michigan

Key Services Provided:
- AVAS Survey (98-00)
- MiddFoil® Process
- Plant Community Composition
- Lake Mapping

No. of Weevils Stocked:
10,000 - 1998
3,000 - 1999

Project Date:
1998-2000, 2005
2001- 2004

MIDEQ

Map of Paradise Lake

Project Description

Paradise Lake is located along the border of Emmet and Cheboygan Counties, Michigan. The lake has a surface area of 1,900 acres with a mean and maximum depth of 6.0 feet and 18.0 feet, respectively. Over half of the shoreline is developed with single family homes, with approximately 40% left in its natural state. Recreational activities on Paradise Lake include boating, water and jet-skiing, fishing and swimming. Most of the lake sediments were comprised of sand, but highly organic sediments cover this sand in some areas of the lake. The Eurasian watermilfoil (EWM) beds were located in these areas.

The stocking of approximately 13,000 weevils over the course of a two year period has resulted in heavy damage to all the EWM beds in Paradise Lake that were monitored during this study. The weevils are overwintering successfully and returning to and spreading throughout the lake along with its population becoming successfully established. The overall increase in native aquatic plants observed during this study is a positive finding and should increase the likelihood of a continued EWM decline as the plants continue to compete with the milfoil for light and nutrients.

In 2005, EnviroScience Inc.'s biologists re-visited Paradise Lake to observe EWM beds for weevil life cycles. A few EWM beds were discovered throughout the lake and during observations of each of these EWM beds numerous weevil life stages were observed, such as adult weevils and weevil eggs. Therefore, indicating a successful weevil population was still thriving at Paradise Lake.

A survey of the littoral zone, performed according to Michigan DEQ methods, AVAS, was conducted to monitor changes in the macrophyte community as the MiddFoil® program continued in Paradise Lake. In June 2001, each AVAS was surveyed approximately 50 to 300 meters from shore either at slow-no wake speed from the boat or from the water using snorkeling gear. In August, locations where macrophyte growth was noted during the first survey were re-sampled in the same fashion. Areas which had no growth were briefly examined at an average distance of 150 meters from shore.

When comparing 2001 AVAS data to 1999/1998 AVAS data, it appears that the percent cover of those plants common to all four years has decreased. Although the plant community appears to be decreasing in percent coverage, the increase in native plant species and the decrease in EWM coverage is a positive indication that the healthy native plant community is still present in Paradise Lake and should continue to thrive as the EWM in the lake continues to decline.

Lake Management

Roam Rock Association, Inc., Rome, Ohio

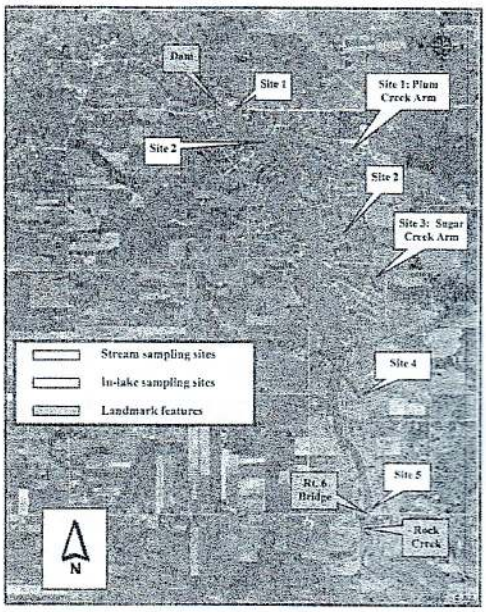
Client:
Roam Rock Association, Inc.
Bruce Bower
216.524.3432

Location:
Ashtabula County, Ohio

Key Services Provided:

- Water Quality Monitoring
- Electrofishing
- Management Plan Development

Project Date: 2004-2005



Map of Lake Roaming Rock

Project Description

Roam Rock Association is the governing body of Lake Roaming Rock and the surrounding residential community. The lake is an impoundment formed by damming Rock Creek in 1968. Over it's approximately 40 year existence, Lake Roaming Rock has become increasingly eutrophied, infested with several exotic aquatic plants and has seen an overabundance of rough fish such as grass and European carp. In recent years, high internal nutrient loading and an influx of nutrients from its agricultural watershed have resulted in frequent blooms of noxious blue-green algae during the summer months. Despite these problems, Lake Roaming Rock supports a high quality fishery and is heavily used for other forms of recreation.

In conjunction with Robert Carlson of Kent State University, EnviroScience, Inc. biologists began a diagnostic study in 2004 which reviewed available historic information, performed in-lake and tributary sampling to document current water quality and determine current trophic status. The results of the study indicate that the lake is growing increasingly eutrophic over time and that internal cycling is an important factor in the periodic algal blooms plaguing the lake. Recommendations regarding rough fish removal and installation of a hypolimnetic aeration system were made to address the high internal cycling of phosphorus in the lake.

Sawyer Lake Aquatic Vegetation Survey and Exotic/Invasive Species Management

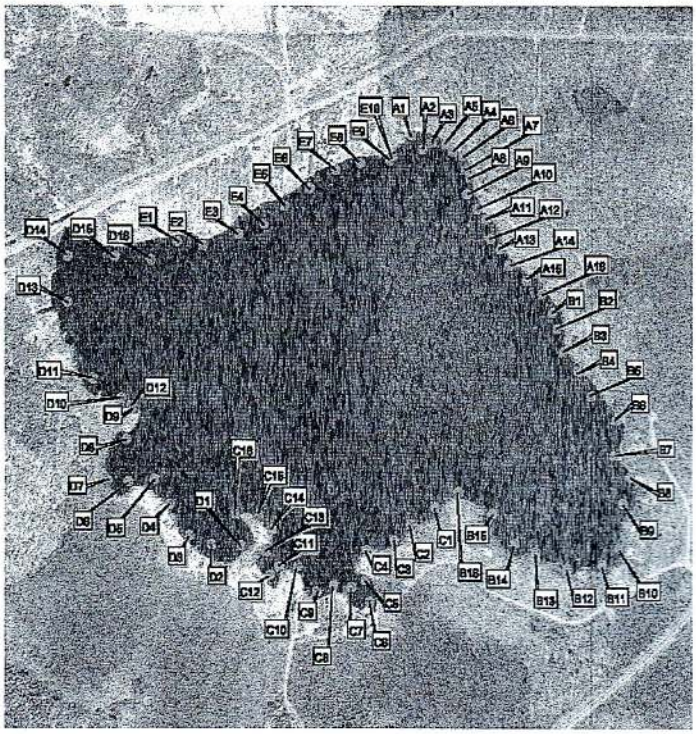
Client:
Sawyer Lake Association
Rick Conn
920-430-2587

Location:
Dickenson County, Michigan

Key Services Provided:

- Implemented Biological Control of Eurasian Water Milfoil
- Performed Comprehensive Submerged Aquatic Vegetation Survey

Project Date:
2003 - 2006



AVAS map of Sawyer Lake

Project Description

The Sawyer Lake Association, in Dickenson County Michigan, chose EnviroScience to implement a biological control program, consisting of the introduction of a native aquatic weevil (Euhrychiopsis lecontei), in an attempt to manage their Eurasian Water Milfoil problem. Before and after the introduction of the weevil, limited surveys were conducted to establish vegetation baselines and monitor progress at stocked sites. Stocking events and limited bi-annual surveys have continued throughout the four-year project timeline.

In addition to the basic surveys associated with the biological control program, a comprehensive lake-wide aquatic vegetation survey was conducted in accordance with Michigan Department of Environmental Quality guidelines. Commonly known as an Aquatic Vegetation Assessment Site (AVAS) survey, it consisted of throw-rake sampling within the littoral zone along transects perpendicular to the lake's shoreline. Individual plant species and relative densities found at each sample site were recorded.

Key Personnel

Martin A. Hilovsky

Title:	President	
Specialty:	Aquatic Ecology, Aquatic Plant Management, Toxicity Reduction Evaluations, NPDES permitting, regulatory affairs	
Experience:	Total Experience	25 Years
Education:	Kent State University	B.S. 1977
	Kent State University	M.S. 1981

As Principal in Charge, Martin Hilovsky has general responsibility for business operations, and is responsible for the company's overall performance on this project. He has over 25 years experience with wastewater treatment, NPEDES permitting, water quality studies and environmental mitigation projects. Eight years of this experience was spent with Ohio EPA permitting, inspecting and approving plans in the Industrial Wastewater Section. Mr. Hilovsky has extensive project management experience, having been responsible for numerous projects ranging from innovative hazardous waste clean-ups to construction of wastewater treatment facilities. Mr. Hilovsky spent five years working for the NASA Glen Research Center in Cleveland Ohio, managing a wide variety of investigations and remedial projects at GRC and its satellite facility Plum Brook Station, a former arsenal in the initial stages of a remedial investigation / feasibility study.

Cortney L. Marquette

Title:	Aquatic Biologist	
Specialty:	Fish Taxonomy and Lake Management Studies	
Experience:	Education Experience	6.0 Years
	Total Consulting Experience	5.0 Years
	Time with Firm	
	Full Time	1.0 Years
	Seasonal	2.0 Years
Education:	University of Akron	B.S. Ecology 2000

Ms. Marquette is a key member of the lake management and ecological survey team where she specializes in aquatic surveys. In 2006, she assumed responsibility for managing EnviroScience's MiddFoil® program, whose focus is the use of a native insect for biological control of the invasive aquatic plant Eurasian watermilfoil. Ms. Marquette has a well rounded scientific education focusing on the fields of aquatic ecology and ichthyology. As an EnviroScience biologist, her primary responsibilities include managing freshwater mussel surveys using scuba and snorkeling techniques; as well as several other stream/lake studies. Recently, she has been focusing on lake management issues; evaluating invasive species control, vegetation identification, fisheries evaluations and sediment loadings. She has completed numerous scientific fish, aquatic vegetation and other various limnological studies.

AQUACLEANER™

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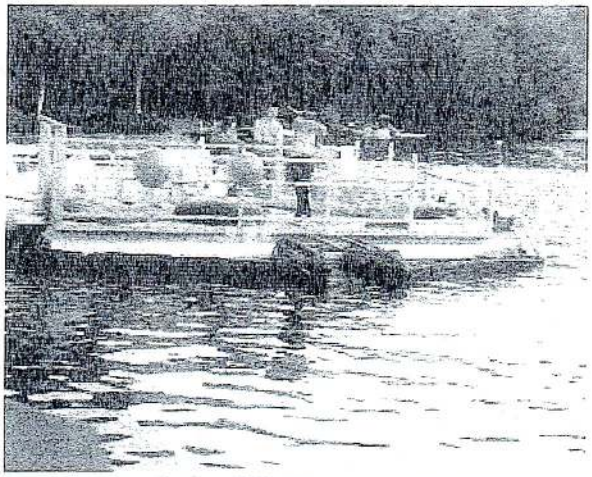
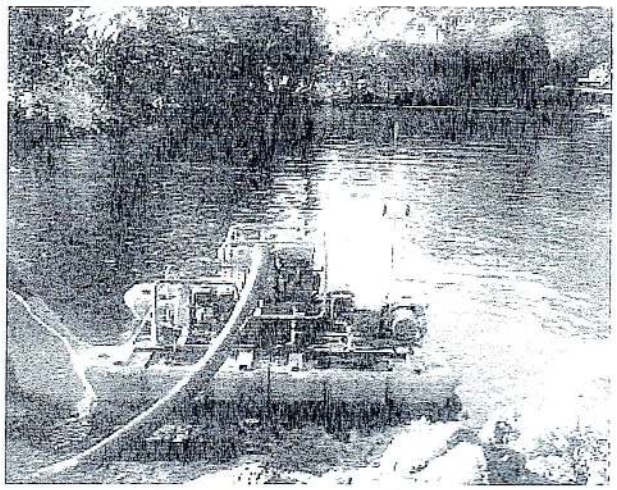
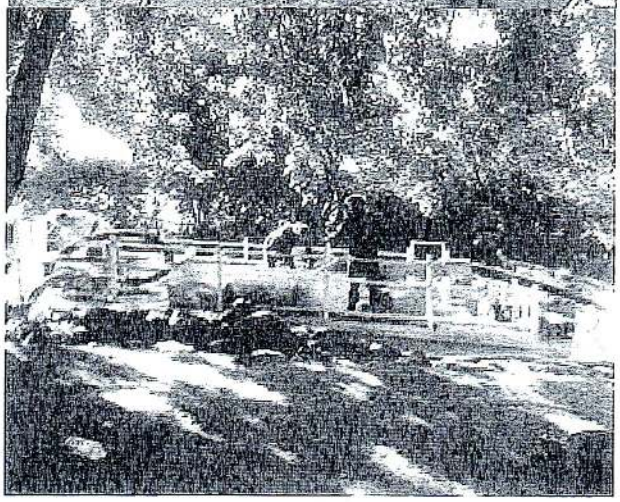
"Leaders in the Field of Waterfront Restoration Technology"

The Aqua Cleaner Waterfront Restoration System







Waterfront Restoration

Aquacleaner Environmental is on the leading edge of technology in the field of Suction Harvesting and Spot Dredging Equipment. Suction Harvesting offers the best short and long-term solutions to controlling and eradicating the spread invasive vegetation. Dredging is no longer a nasty 8-letter word, but rather is a natural step in the restoration of any body of water. Lake Bottoms get soft and fill in through many means, which only helps further their demise.

Services Available

Lake Wide Restoration	Lake Assessments	Environmental Clean-Ups
Homeowner Restoration	Pond Assessments	Dredging (spot dredging & large scale)
Break Wall Construction	Flood Pump Outs	Boat House Pump Outs

4750 Woerner Rd Manitou Beach Mi 49253 (517) 438 – 0120 Corporate Office (585) 752 -7930

Mission Statement

At ***Aquacleaner Environmental***, our goal is to design, build and implement a new generation of machines that will aid in the reclamation of your water front property. We can remove problems that hinder the use of the your waterways, making them more accessible, while remaining conscious of our environment and the need to protect it. Regardless of the nature of each job, our equipment can restore your waterfront property to what it was years before all the debris filled it in. We surround ourselves with the best and brightest specialists in the waterfront restoration industry. Our staff all has personal experience and a passion for the water and the ecosystem it supports. Our equipment is based on fundamentally sound principals in keeping environmentally conscious. We perform various services and sell our equipment only after checking on all legal ramifications and procedures, always keeping in mind the delicate balance that exists between nature and man.

The Aqua Cleaner System

The core of our services comes from the strength and abilities of the Aqua Cleaner. The Aqua Cleaner's are several unique pump designs, one a Suction Harvester and the other the smallest Gas Powered Dredge Machine. Both machines come in several different size configurations depending on the required applications.

The Aqua Cleaner Vegger is a Suction Harvester that is designed to suck up any type of solids that will pass through a hose. These include aquatic vegetation, leaves, rocks, zebra mussels, sticks and other debris. S.H. has been around since the 80's but nobody has refined it and made it easier to use, bigger and more efficient. Trying to capture debris while moving at least 800 gpm is a difficult task and knowing how to operate a nozzle is even more trying. U.W.S. makes it as easy as using your lawn mower.

The Aqua Cleaner Dredger is designed strictly as a portable dredge machine that will suck up silt, sand and other soft organic material. It uses water agitation to create a slurry and can pump over 1000' away without a booster.

Aqua Cleaner Vegger

A powerful suction harvester that operates with a man under the water extracting unwanted plants by the rooting system so that they don't grow back as fast. The machine is equipped with a duel bagging system that allows the water to pass through them, while capturing the plants, rocks, sticks, leaves and assorted debris. This machine is an environmentally friendly means of dealing with an overwhelming problem.
Vegetation Capacity – 50 to 500 Square feet per hour depending on the type of plant, density, and rooting system. 5' x 10' pontoon with 2 pumps, diver air compressor and comes with a 4", 5" and 6" hose configuration.

Aqua Cleaner Octopus- A large pontoon boat (24' – 28') suction harvester designed for large vegetation and debris removal with multiple nozzles feeding it onto our large pontoon boat, where it can be de watered, and then shipped to a dump barge.

Aqua Cleaner Dredger

Bigger is not better when it comes to home or spot dredging. One person, who stands in the water with a custom-built control rod, operates our dredge machine. The water agitator creates a slurry, which then goes through the suction hose. It is the most environmentally sound method of dredging that is capable of removing between 10 – 20 cubic yards per hour (1 – 2 dump trucks) and can pump up to 1000' away.

Aqua Winch – A portable, self contained winch with motor that can be placed at the waters edge and will pull up to 10,000 lbs items out of the water. When used with our Aqua Claw Rake it can remove large amounts of Cat Tails or other tuber rooted plants.

Aqua Cutter – A self-contained pressure water that will cut any organic rooting system, and is mounted on a small pontoon or operated on shoreline, and has a built in feeder pump.

STOP THE CYCLE

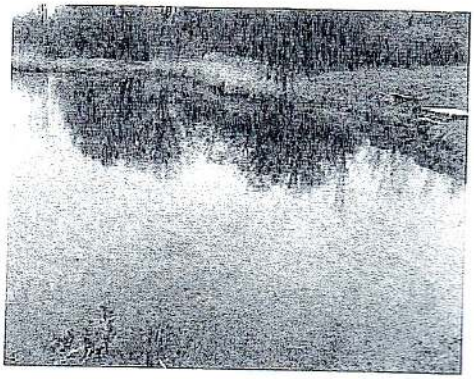
Aquatic vegetation grows and dies each year, sending the carcass of the plant to the lakes bottom. There they decompose and fragment, which only increases the density of the plants in following season's and adds to the build up of organic sediment. Suction Harvesting slows this process down and over repeated use, will stop this vicious cycle. In contrast with chemical treatments or weed cutters, we also offer the advantage of selectivity. If you want only the milfoil removed but want the lily pads to remain untouched, we can easily accommodate your desires. In the end it may be necessary to dredge out a given area to remove the organic sediment and reduce the nutrient load.

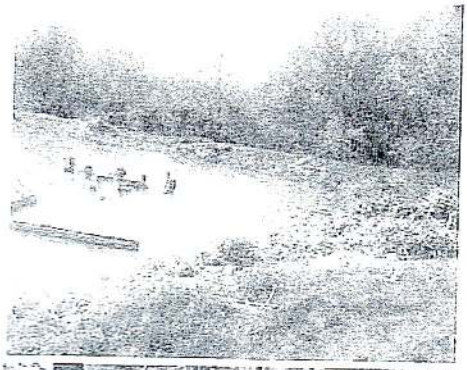
Dredging:

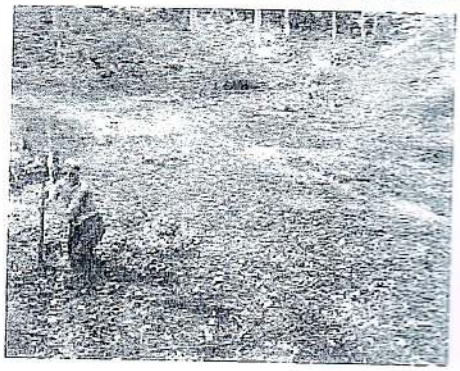
The traditional method for removing soil entailed having a large construction excavator operate either from your dock or out on a barge. This process is imprecise and not very effective. Scooping large volumes of soil from a water way is intrusive, disrupting the ecosystem and doesn't afford a close tight cleaning. In ponds the risks are far greater. Pumps are the preferred method of dredging but the norm in the industry are large, aggressive machines, which move huge amounts of water and silt which are very hard to manage in a small contained area like your backyard of your lakefront property.

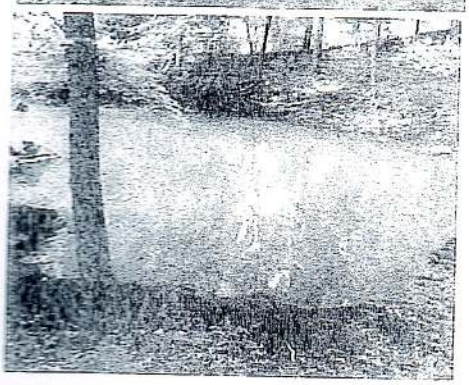
The Aqua Cleaner operates by sucking up silt and water together and pumping it to a desired location. The most cost effective method involves pumping the material into a field and letting the water and sediment dissipate and be absorbed into the ground. Our second option is to pump the silt and water (slurry) into a dewatering bag that sits on your property. The water slowly leaches out and over a short period of time, the silt contained in the bag will harden and can then be removed. Silt is typically composed of a very pure, organic material (great for composting), which can be spread over your lawn or given to local landscapers or farmers.
Site Plan For Dredging: A) Mark off area to be dredged. B) Build staging area C) Pump out soil into the staging area and allow to de water and dry D) Move soil onto dump trucks E) Cart away soil

The benefits of the Aqua Cleaner Dredging System are many. Aqua cleaner can return your property to the original hard packed bottom. We can get into all tight spaces around docks and barges and carve out a more precise removal of soil. We can assist you in obtaining all permits and disposal requirements.









LAKE ROAMING ROCK
LAKE MANAGEMENT COMMITTEE
WEED CUTTING PLAN
VERSION 1.0

Weeds are a vital part of the Lake Roaming Rock ecosystem. Some weed growth is necessary, but there are years when excessive weed growth severely hampers boating, swimming and related water activities. There are several methods used for weed control, one being the use of a mechanical weed harvester. This plan addresses this method..

The weed harvester and the resources to operate it are the responsibility of the Rome Rock Association (RRA) General Manager. The General Manager is responsible to adequately review these guidelines with the operator(s) of the harvester to ensure they have a thorough understanding of them.
The General Manager is also responsible to monitor the progress of the harvesting with emphasis on preventing excessive harvesting.

The Lake Management Committee (LMC) is dedicated to preserving and improving the quality of the Lake and is composed of knowledgeable members and has access to highly qualified outside experts. LMC is a principal advisor to the RRA on subjects, including weed harvesting, as outlined in the following plan.

1. Weed growth is highly variable LMC monitors the conditions during the weed growing season and advises the RRA General Manager when it appears weed growth is approaching a stage that will justify launching the harvester, and proposes a date to begin cutting. (Some years weed growth has been minimal and weed harvesting was not required.)

2.Two general types of weed harvesting are a) Clearing areas that residents request be cut and b) opening channels to provide unobstructed entrance and exit to the main lake for boats of residents living in weed choked inlets and coves.

a) Individual Requests - The established method used in the past works well. Residents call at the RRA Office and collect "arrow" signs. The resident places the signs on the shoreline and the arrows indicate that mowing is requested between the signs. The RRA schedules the mowing operation and assures residential harvesting is limited to only areas between the green arrows

b) Clearing Channels - The harvester operator soon becomes intimately familiar with the overall weed in the lake and is instructed to maintain a channel four feet deep, (or as deep as possible in more shallow water) the length of the lake and in each inlet and cove. Normally the cut channel is centered and strictly limited to the center of the cove and no more than 20 feet wide.

3. It is a general opinion that weed clippings that are not captured and removed fall to the floor of the lake and prorogate. The operator of the weed harvester must take great care to assure all clippings are removed from the lake.

4. For purposes of weed cutting scheduling, Lake Roaming Rock is divided into two areas, North and South. The dividing line is Callender Road crossing. Annual harvesting begins in the South and is completed before moving north. Work is scheduled to assure an area is completed before relocating to another area (ie- seek efficiency by scheduling by area rather than resident request date.

5. Weeds contribute to the life of the Lake by slowing sedimentation. The south end of the lake is shallow and weeds are very prevalent. This is a natural habitat for wildlife and fish but also serves an effective barrier to sediment movement into the main lake. Harvesting in this section of the lake is to be strictly limited between green arrow signs.

Weed growth at the inlets to coves also prevents sediment movement into the Lake, and to areas beyond where residents live. These areas are strictly off limits to the harvester.

Sediment Management Program

The LMC is in the process of developing a detailed plan with EnviroScience to conduct a sediment survey. With this information, the committee will better understand which coves should be prioritized for dredging and the feasibility of constructing silt ponds. EnviroScience will conduct the survey as follows: survey lake inputs and record accumulated sediment, compare present-day lake depth to historical data, and identify areas of highest sediment accumulation. Details are provided on the following pages.

June 17, 2010

Mr. Fred Innamorato
Chairman, Lake Management Committee
Roam Rock Association, Inc.
P.O. Box 8
Roam, Ohio 44085

RE: Proposal: Revised depth survey and sediment profiling of lake inputs, Lake Roaming Rock Reservoir.

Dear Fred:

Attached, please find EnviroScience, Inc.'s (ES) revised cost-plus cost for the above referenced project (Attachment A). This proposal reflects costing for the scope described below.

EnviroScience, Inc. has completed projects of similar scope throughout the U.S. I have attached some representative project summaries (Attachment B) that outline our lake management and GIS experience. Our full qualifications package is immediately available upon request.

Scope of Work

The goals of this project are:

1. Survey key lake inputs (streams and drainage inputs) and record depths of accumulated sediment on the lake bottom above original grade;
2. Compare present-day lake depth to historical data;
3. Identify and map areas of the relatively highest sediment accumulation, and
4. Provide recommendations for restoration and prevention efforts.

ES will provide:

1. One Senior Scientist / GIS Scientist
2. One Survey-Grade Hydrographic / GPS system
3. One AC power source (generator or 12V to AC power inverter system)
4. Sediment profiling rods (max 40ft)

Roam Rock Association, Inc. will provide:

1. Access to the lake
2. (Optional) One 18ft+ work boat and experienced driver capable of long periods of low idle, shallow draft, and an open bow. Note: This vessel will get dirty and possibly dinged by metal sampling rods
3. (Optional) A scan, JPEG or CAD file of previous lake bathymetry

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Methods

ES will conduct sediment depth sampling on a minimum of six (6) selected inlets on Lake Roaming Rock or other locations believed to be major sources of sedimentation. Additional sites will be surveyed if time allows. Sediment and depth surveys will be completed from a work boat and experienced driver provided by Roam Rock Association, Inc. (Roam Rock). As an option, ES can provide a workboat and an additional field technician.

Lake depth and the depth from the existing lake bottom to hardpan / rock will be collected using a survey-grade depth sounder (SyQwest Hydrobox) and dGPS. Hardpan will be defined here as soft, mud-like sediments. Hardpan would include compacted clay, rocks, gravel, etc. that would likely define the original lake bottom. This method will not exactly define the original lake bottom where large substrates such as gravel and cobble have washed into the reservoir. However, this method should quantitatively identify areas of ongoing sedimentation including silts and other fine particulates.

Existing lake bottom depths will be automatically collected by the sonar and input into a laptop computer. At regular intervals at along transects, the depth of the hardpan return will be read off the depth sounder display and the depth of the sediments and GPS location recorded. Depth and substrate transects will be targeted at suspected sources of sediment in inlets and other areas identified by Roam Rock Association, and not comprehensive surveys of the inlets as previously proposed.

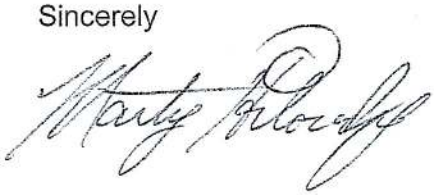
Quality Control

To ensure the sonar's definition of the depth of lake bottom to hardpan is correct, ES will confirm the sonar readout under various substrate and depth conditions using manual methods. For example, a metal rod will be dropped to the bottom and the depth measured, and then the pole will be gently pushed into the sediment until hard bottom is encountered. ES will conduct at least 10 manual measurements to calibrate the sonar.

We estimate that this task will require two (2) 8hr days of boat time, plus mobilization and data analysis. A detailed cost for this project is provided in Attachment A.

If you have any questions or comments regarding this work please do not hesitate to contact me at 330-688-0111 or Greg Zimmerman who leads our Columbus Office at 614-866-8540 (office) or 614-738-6175 (mobile).

Sincerely



Martin A. Hilovsky
President

Attachments: Attachment A: ES Cost Proposal
Attachment B: Representative Project Summaries

Attachment A.
Lump Sum Cost Detail

EnviroScience Inc.
Cost Estimate Prepared For:
Rome Rock Association, Inc.
Lake Management / Columbus
123-4567
Depth Survey and Sediment Profiling of Lake Inputs

Task 1:	Depth and Sediment Profiling	No. People	Unit Rate	No. Units	Total
Senior Scientist I		1	$90.00	20	$1,800.00
Total Hours					20
Total Salaries					$1,800.00
Other Direct Costs (ODC's):		**No. Units**	**Unit Rate**	**No. Days**	**Total**
TRAVEL	Mileage (rate is per mile)	130	$0.50	2	$130.00
E-TR-GPS3	Trimble GeoXT GPS Unit #3	1	$100.00	2	$200.00
E-HB-ECHO	Hydrobox EchoSounder	1	$100.00	2	$200.00
D-LA-HOTW	Laptop / AC Power Package	1	$100.00	2	$200.00
Total ODC's					$730.00
Task 1 Total					**$2,530.00**

Task 2:	Analysis and Reporting	No. People	Unit Rate	No. Units	Total
GIS Analyst II		1	$85.00	36	$3,060.00
Total Hours					36
Total Salaries					$3,060.00
Other Direct Costs (ODC's):		**No. Units**	**Unit Rate**	**No. Days**	**Total**
OFFICE	Office Supplies & Shipping	1	$50.00	1	$50.00
Total ODC's					$50.00
Task 2 Total					**$3,110.00**

Task 3:	OPTIONAL: ES Boat and Driver	No. People	Unit Rate	No. Units	Total
Field Technician		1	$45.00	20	$900.00
Total Hours					20
Total Salaries					$900.00
Other Direct Costs (ODC's):		**No. Units**	**Unit Rate**	**No. Days**	**Total**
B-18-GRIZ	Boat Rental - 18' Grizzly Boat (40 hp)	1	$100.00	2	$200.00
Total ODC's					$200.00
Task 3 Total					**$1,100.00**

TOTAL PROJECT COST WITH OPTIONAL TASK 3: BOAT AND DRIVER	**$6,740.00**
TOTAL PROJECT COST WITHOUT TASK 3:	**$5,640.00**

EnviroScience, Inc. ▪ Columbus Office ▪ 6751 A-1 Taylor Road ▪ Blacklick, Ohio 43004 ▪ (614) 866-8540

Attachment B.
Representative ES Projects

Project Summaries

The following are some examples of projects recently completed or currently in progress.

Bathymetric Analysis of Lake Greenwood, Indiana

Client: SAIC / Comarco Systems, Inc.
Contact: Anita Netherland (812) 384-3587, Ext. 117
Route 6, Box 28
Bloomfield, IN 47424
Start Date: August, 2000
End Date: December, 2000

Abstract:
EnviroScience provided lake diagnostic services to SAIC / Comarco Systems, Inc. in the fall of 2000. A bathymetric analysis of Lake Greenwood was performed, and the goal of this project was to assess the potential impact of non-point source sediments on the integrity of the lake. The final products of this project included the development of a detailed lake contour map using GIS technology, and the development of area to volume and depth to volume curves.

LACUSTRINE HABITAT EVALUATION
CLAYTOR LAKE, VIRGINIA

CLIENT:
Katherine Fontaine
Burgess & Niple, Inc.
(614) 459-2050 ext. 420

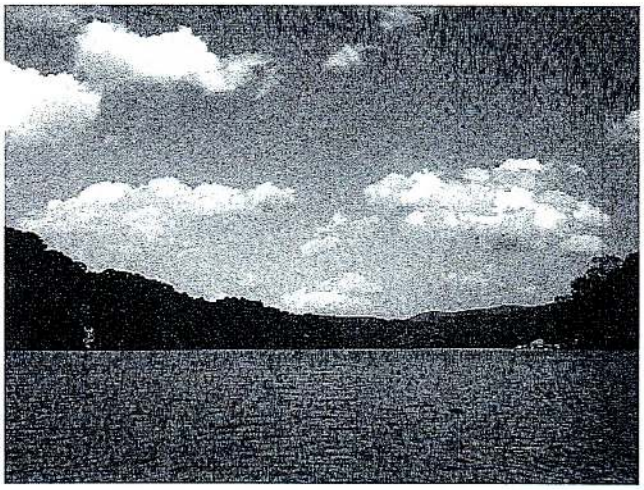
LOCATION:
Claytor Lake, Pulaski County, Virginia

KEY SERVICES PROVIDED:

- Lacustrine Habitat Evaluation

PROJECT DURATION:
Started: May 2008
Completed: June 2008

TOTAL PROJECT COST:
$13,825.00



CLAYTOR LAKE, VIRGINIA

PROJECT DESCRIPTION:

EnviroScience, Inc. was contracted by Burgess & Niple, Inc. to perform a habitat evaluation of selected lacustrine zones of Claytor Lake, Pulaski County, Virginia. Claytor Lake is a 4,475 acre deepwater impoundment of the New River that is characterized by low nutrient retention, and excessive sedimentation in its upper reaches. The evaluation quantified baseline and future lacustrine habitat for the United States Army Corps of Engineers Claytor Lake Feasibility Study, and assisted in the selection of alternatives formulated to achieve restoration goals for Claytor Lake. Sampling was conducted in May 2008 in nearshore lacustrine zones of Claytor Lake. Twelve sites were investigated for habitat suitability of selected fish species using water quality parameters, bathymetric morphology, qualitative sediment characterization, and nearshore qualitative habitat assessment. The sites were located within designated reaches of Claytor Lake.

Water chemistry data revealed levels of pH, dissolved oxygen, and temperature typical for nearshore zones of temperate reservoirs during spring, and relatively low levels of total dissolved solids and turbidity. Substrates at most sites consisted of a combination of silt, sand, gravel, and cobble. Shoreline habitat was excellent in some parts of the lake, but was limited offshore. This study identified locations of Claytor Lake which would benefit from additive habitat enhancement including stake beds, pallet structures, or similar fish attractors, which would support target fish populations. Through the habitat evaluation, it was also determined that some areas of the lake would require a semi-regular management regime to combat sediment deposition from the New River, in order to maintain suitable spawning conditions throughout the selected reaches, and to increase boater navigability.

SAWYER LAKE AQUATIC VEGETATION SURVEY AND EXOTIC/INVASIVE SPECIES MANAGEMENT

CLIENT:
Sawyer Lake Association
Rick Conn
(906) 282-2474

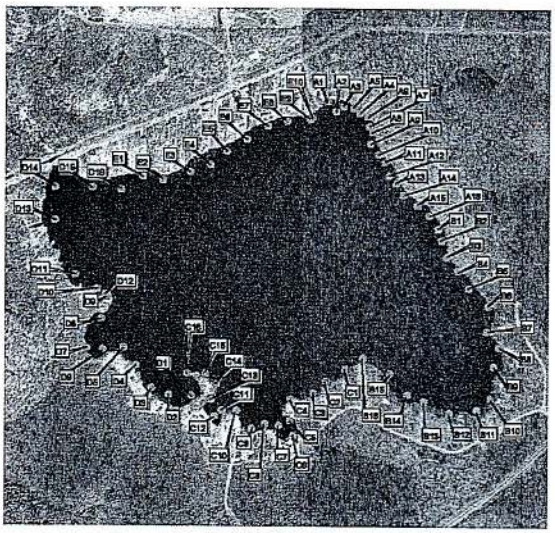
LOCATION:
Dickenson County, Michigan

KEY SERVICES PROVIDED:

- Implemented Biological Control of Eurasian Water Milfoil
- Performed Comprehensive Submerged Aquatic Vegetation Survey

PROJECT DATE:
2003 - 2006

TOTAL PROJECT COST:
$77,254.00



AVAS MAP OF SAWYER LAKE

PROJECT DESCRIPTION:

The Sawyer Lake Association chose EnviroScience to implement a biological control program, consisting of the introduction of a native aquatic weevil (*Euhrychiopsis lecontei)* in an attempt to manage their Eurasian watermilfoil problem. Before and after the introduction of the weevil, surveys were conducted to establish vegetation baselines along with monitoring the progress at stocked sites. Stocking events and limited bi-annual surveys have continued throughout the four-year project timeline.

In addition to the basic surveys associated with the biological control program, a comprehensive lake-wide aquatic vegetation survey was conducted in accordance with Michigan Department of Environmental Quality guidelines. This survey is commonly known as an Aquatic Vegetation Assessment Site (AVAS) survey, which entails throw-rake sampling within the littoral zone along transects perpendicular to the lake's shoreline. Individual plant species and relative densities found at each sample site were recorded.

UPPER STRAITS LAKE MIDDFOIL® PROGRAM
ORCHARD LAKE, MICHIGAN

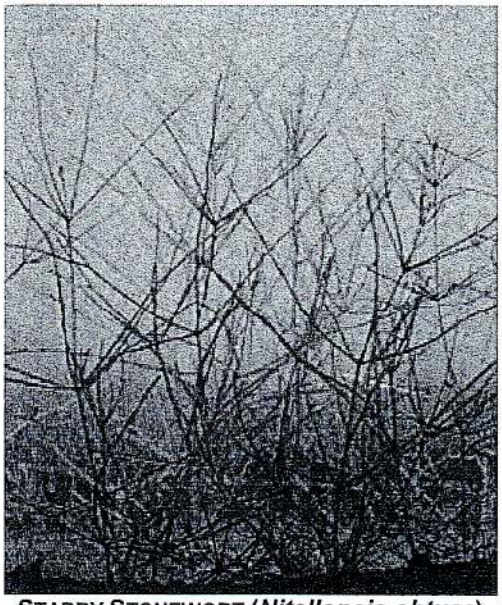
CLIENT:
Upper Straits Lake Association
Jim Cherfoli
(248) 682-8875

LOCATION:
Orchard Lake, Michigan

KEY SERVICES PROVIDED:
- Aquatic Vegetation Assessment Survey (AVAS)

PROJECT DURATION:
October 2007

TOTAL PROJECT COST:
$3,929.00



STARRY STONEWORT (*Nitellopsis obtuse*)

PROJECT DESCRIPTION:

Upper Straits Lake is a 323 acre lake located in Oakland County, Southeastern Michigan. Qualitative vegetation sampling was performed on October 2 and 3, 2007 using the Michigan DEQ guidance contained in *Standard Procedures for Surveying Aquatic Plants*. The lake shoreline was divided into 90 transects. In each of these zones, the presence and relative density of each aquatic plant species was determined, and the information was recorded on the Standard Aquatic Vegetation Assessment Site Species Density Sheet (AVAS) developed by the State of Michigan.

The survey identified eighteen different aquatic plant species including thirteen submergent and five emergent species. Two exotic species were found, Eurasian watermilfoil and Starry stonewort (*Nitellopsis obtusa*). Biologists also identified a milfoil weevil (larva) in this area along with damage indicative of weevils on a few of the milfoil stems collected on the rake tow. EnviroScience provided management options for the EWM and Starry stonewort based on the invasive tendencies of both plants. However, Starry stonewort had not been observed in the lake prior to the survey and therefore is not presently perceived as a nuisance species.

Siphon Drainage System

The committee has conducted a complete review of the siphon drainage system and has determined the system is not practical. Based on EnviroScience research, we have serious concern that the EPA will implement regulatory measures to control the discharge of the siphon system into streams and rivers downstream of our lake. The regulatory measures will impose either of the following two restrictions:

- Cease the discharge (shut down the system)
- Install **costly** methods to treat the discharge. Associated costs "will likely **far exceed** the cost of the siphon system itself" (ES Letter, June 15, 2010)

Below are cost estimates provided by CT consultants for design and construction:

- **Estimated Construction Cost**: $498,600 - $584,700
- **Design Fee**: $33,000. (approximately $7900 already spent)

Additionally, EnviroScience notes that since there are very few siphon systems installed in the U.S., there is little information regarding the actual proven benefits to improve water quality.

LMC Recommendation:

In light of the possible EPA requirements and associated treatment costs, marginal benefits to water quality, and the significant cost for construction, the LMC recommends the board does not proceed with the Siphon Drainage System.

June 15, 2010

Mr. Fred Innamorato
Chairman, Lake Management Committee
Roam Rock Association, Inc.
P.O. Box 8
Roam, Ohio 44085

Dear Fred:

As requested, I've reviewed the available information on the siphon system being proposed for Lake Roaming Rock. As you are aware, CT Consultants, Inc. (CT) was commissioned and recently completed a conceptual hydraulic study to develop alternatives to improve lake drawdown capabilities and provide a means for removing poor quality water from deep water areas near the dam.

During the CT study, five basic goals or objectives for the subsurface removal system were described. Four of these five objectives focused on providing additional capability to lower the lake level, either routinely (in response to storm events or to facilitate activities such as dock repair or dredging) or on an emergency basis. An additional objective involved the ability to remove high nutrient and low dissolved oxygen from the deep areas of the lake.

Although the CT study appears to be well done, the technical merits of the engineering analysis they conducted are beyond EnviroScience's and my areas of expertise. Likewise, it is difficult for us to comment on the absolute need for improvement of existing drawdown capabilities as this is something that the Association needs to determine. I suspect that there are divergent opinions on the need for an annual drawdown, or periodic drawdowns of 10 feet or more.

I can comment, however, on the water quality aspects of the proposed siphon system. While I agree that removal of poor quality water from the deeper areas of the lake may be a good thing, too little information exists to conclude that removal of the water from the deep in the water column (hypolimnion) will produce a noticeable beneficial improvement in the upper reaches of the water column (the epilimnion) where residents come in contact with it. As we've discussed, the water in Lake Roaming Rock tends to stratify in the summer months. Colder water below 10-15 feet becomes anoxic . When this happens, phosphorus and sulfides are drawn out of the sediments. When the lake turns over in the fall, these nutrients are mixed in the water column where they can produce nuisance plant and algae growth.

Because there are very few of siphon systems in operation in the US, there is little hard information regarding the water quality impacts or benefits resulting from their operation. However, the potential

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negative impacts associated with the discharge of the siphon system can be described and quantified. A rapid discharge of hypolimnetic water from a siphon system to Rock Creek can reasonably be expected to have serious negative impact on water quality and the biota downstream of the dam. The discharge of high levels of phosphorus to Rock Creek, the Grand River and ultimately Lake Erie is a concern given the State of Ohio's initiatives to reduce phosphorus loading to Lake Erie. For this reason the discharge could ultimately be regulated by Ohio EPA as part of the Grand River TMDL process.

A more immediate concern, however, is the potential impact that low DO and high sulfide water could have on the fishery in Rock Creek and the Grand River. In particular, hydrogen sulfide tend to be generated and released when this water comes in contact with air and small quantities of hydrogen sulfide (as low as 0.002ppm) can be lethal to fish.

I made several informal inquiries to the Ohio EPA Northeast District Office in Twinsburg regarding regulatory requirements that may come into play when installing and operating a siphon system such as the one being proposed for Lake Roaming Rock. Although the installation and operation of the system could be regulated under the National Pollutant Discharge Elimination System (NDPES) permit program, Ohio EPA has to date, elected not to do so. Rather, it appears that they take a 'wait and see' approach, allowing the installation and operation to proceed without regulatory permit or oversight.

Where the Agency definitely does exercise their regulatory authority is when the discharge from a siphon system results in documented water quality impairment and/or fish kills. In such cases they will issue administrative orders which will provide the responsible party with two choices: Permanently cease the discharge or install treatment to mitigate the problem. According to my contacts at Ohio EPA, this has already happened with several lakes in the state, including at least one in North East Ohio.

Although an evaluation of treatment options is well beyond the scope of this effort, I am quite certain that the cost of treating the discharge from the siphon system will likely far exceed the cost of the siphon system itself.

Given the questionable, or at least unquantified, environmental benefit of a siphon system, and the potential regulatory issues and costs associated with the discharge, I do not recommend that the RoamRock Association move forward with the engineering design without a more complete evaluation of both the water quality benefits and downstream impacts associated with such a system.

Please don't hesitate to contact me should you require clarification or have further questions.

Sincerely;

Martin A. Hilovsky
President

CT Consultants
engineers | architects | planners
Since 1922

June 8, 2010

Mr. Robert Sobczak, President
Rome Rock Association
P.O. Box 8, 1875 US Route 6
Rome, Ohio 44085

Re: Proposal for Engineering Services for the Design of a Reservoir Siphon Drainage System for the Rome Rock Association

Dear Mr. Sobczak:

CT Consultants, Inc. is pleased to submit this proposal for the referenced project. We understand that the Association desires to construct a siphon system to control lake levels for routine maintenance and total draining as may be necessary. A study was conducted to determine an appropriate size siphon to drain the lake at the prescribed maximum permissible rate of 4 feet per week. A 30 inch siphon was determined to be the appropriate size. The siphon is to be an above ground design with provisions to allow for a priming connection and a future pool recirculation system.

We propose to provide engineering services relative to the above to the Association in accordance with the terms and conditions set forth herein.

I. SCOPE OF SERVICES

Upon authorization, we will proceed with the following scope of services.

Design Services

A. We will conduct a physical survey of the selected siphon location area noting existing above ground features to prepare a complete background drawing of the siphon alignment. Any existing utilities will be researched and plotted as necessary for the information furnished by the Utility Companies.

B. We will develop a preliminary design layout of the siphon system for review by representatives of the Association.

C. We will prepare final design details, notes and specifications for a complete installation of the siphon system including necessary project requirements and furnish copies of the contract and bid forms for use by the Association.

D. We will develop an opinion of probable construction cost at the completion of the design.

E. We will submit plans to ODNR, US Army Corps of Engineers and other appropriate reviewing Agencies for their review and approval.

CT will be available to assist the Association as needed to provide additional services for the completion of applications, documentation and all other items as needed by public agencies for the approval of the improvement plans.

Bidding and Award Services

It is understood that the Association will provide all Bidding and Contract Award Services. CT will be available to assist the Association as needed and provide services directed as an additional service. See Additional Services Section of this Proposal.

Construction Services

Per Appendix A:

II. INFORMATION / SERVICES PROVIDED BY CLIENT

The Client shall provide information or services that may include, but are not necessarily limited to, the following:

A. Furnish CT with available information pertinent to the work, including items reports, record drawings, and other relative data that may be relied upon.
B. Provide design objectives and constraints, capacity needs, and construction budget limitations.
C. Arrange for access to and make all provisions for CT to enter upon public and private property as required for CT to perform services under this proposal.

D. Examine documents and drawings prepared by CT and render timely written responses.

E. Give prompt notice to CT whenever the Client observes or otherwise becomes aware of any development that affects the scope or timing of CT's services.

III. FEE AND BILLING FOR BASIC SERVICES

CT will provide the services outlined herein for the following lump sum and hourly fees, which will not be exceeded without prior written authorization from the Client:

Design Phase

Survey Field Work (lump sum)	$2,000
Improvement Plan Design, Contract Specifications and Bid Forms (lump sum)	$12,500

Construction Phase

Construction Administration (lump sum)	$2,250
Inspection (5 weeks – 50 hours/week, 250 hours at $65/hr)	$16,250
TOTAL	**$33,000**

Monthly invoices will be prepared based on our estimate of the percent of work complete for lump sum line items, and on CT's standard hourly rate schedule effective at the time of executing this proposal for hourly line items. The respective rate applied will be for the assigned CT personnel working on the project. Monthly invoices will be due and payable within 30 days of receipt.

IV. ADDITIONAL SERVICES

Upon written authorization approving additional agreed upon costs, CT is available to provide additional project services including but not limited to the following:

Bidding and Award Services:

A. We will assist Association in advertising for and obtaining bids or proposals for the Work and, where applicable, maintain a record of prospective bidders to whom Bidding Documents have been issued, if any, and receive and process contractor deposits or charges for the Bidding Documents.

B. We will provide information or assistance needed by Association in the course of any negotiations with prospective contractors.

C. We will consult with Association as to the acceptability of subcontractors, suppliers, and other individuals and entities proposed by prospective contractors for those portions of the Work as to which such acceptability is required by the Bidding Documents.

D. We will attend the Bid opening, prepare Bid tabulation sheets, and assist Association in evaluating Bids or proposals and in assembling and awarding contracts for the Work.

E. We will participate in a Pre-Bid meeting if, Pre-Award meetings or a Pre-Construction Conference prior to commencement of Work at the Site.

Other Additional Services:

A. Services resulting from significant changes in the scope, extent, or character of the portions of the Project designed or specified including, but not limited to, changes in size, complexity, Association schedule, character of construction, or method of financing; and revising previously accepted studies, reports, Drawings, Specifications, or Contract Documents when such revisions are required by changes in Laws and Regulations enacted subsequent to the proposal or are due to any other causes beyond Engineer's control.

B. Participate or attend special meetings related to public participation or presentations.

C. Assistance with funding exploration or application work.

D. Design of recirculation or permanent siphon priming system.

E. Assistance with providing applications, documentation and all other items as needed by public agencies for the approval of the improvement plans.

IV. SCHEDULE

We will complete a preliminary set of construction documents for your review within 45 days of receipt of written authorization.

VI. CLOSURE

If you concur with these terms and conditions and wish us to proceed with the aforementioned work, please sign and date this proposal (below) and initial the enclosed Standard Terms and Conditions. Upon receipt of one (1) copy of this signed proposal and the Standard Terms and Conditions, we will proceed with this work. Fees and terms stated herein are valid for sixty days from the date of this proposal.

Thank you for the opportunity to provide professional services; we look forward to working with you and the Rome Rock Association.

Respectfully submitted,

CT CONSULTANTS, INC.

Scott Wood, P.E.

cc: Clyde C. Hadden, P.E., P.S., CFM, CT Consultants, Inc
Tom Voldrich, P.E., CT Consultants, Inc
Tom Gwydir, P.E., CT Consultants, Inc

RSW:mmm

Attachments/Appendix A and CT Standard Terms and Conditions

ROME ROCK ASSOCIATION

_____ _____
Official Date

_____
Title

Appendix A

A.1.01 *Construction Phase*

A. Engineer shall:

General Administration of Construction Contract. Consult with Owner and act as Owner's representative as provided in the General Conditions. The extent and limitations of the duties, responsibilities and authority of Engineer as assigned in said General Conditions shall not be modified, except as Engineer may otherwise agree in writing. All of Owner's instructions to Contractor will be issued through Engineer, who shall have authority to act on behalf of Owner in dealings with Contractor to the extent provided in this Agreement and said General Conditions except as otherwise provided in writing.

Selecting Independent Testing Laboratory. Assist Owner in the selection of an independent testing laboratory to perform testing as determined necessary by the Owner and the Engineer.

Pre-Construction Conference. Participate in a pre-construction conference prior to commencement of Work at the Site.

Baselines and Benchmarks. As appropriate, establish baselines and benchmarks for locating the Work which in Engineer's judgment are necessary to enable Contractor to proceed.

Visits to Site and Observation of Construction. In connection with observations of Work in progress:

a. Make visits to the Site at intervals appropriate to the various stages of construction, as Engineer deems necessary, in order to observe as an experienced and qualified design professional the progress and quality of the Work. Such visits and observations by Engineer, and the Resident Project Representative, if any, are not intended to be exhaustive or to extend to every aspect of the Work in progress or to involve detailed inspections of the Work in progress beyond the responsibilities specifically assigned to Engineer in the Task Order and the Contract Documents, but rather are to be limited to spot checking, selective sampling, and similar methods of general observation of the Work based on Engineer's exercise of professional judgment as assisted by the Resident Project Representative, if any. Based on information obtained during such visits and such observations, Engineer will determine in general if Contractor's work is proceeding in accordance with the Contract Documents, and Engineer shall keep Owner informed of the progress of the Work.

b. The purpose of Engineer's visits to, and representation by the Resident Project Representative, if any, at the Site of the Specific Project, will be to enable Engineer to better carry out the duties and responsibilities assigned to and undertaken by Engineer during the Construction Phase, and, in addition, by the exercise of Engineer's efforts as an experienced and qualified design professional, to provide for Owner a greater degree of confidence that the completed

Work will conform in general to the Contract Documents and that the integrity of the design concept of the completed project as a functioning whole as indicated in the Contract Documents has been implemented and preserved by Contractor. Engineer shall not, during such visits or as a result of such observations of Contractor's work in progress, supervise, direct, or have control over the Work, nor shall Engineer have authority over or responsibility for the means, methods, techniques, sequences, or procedures of construction selected by Contractor, for safety precautions and programs incident to the Work, or for any failure of Contractor to comply with Laws and Regulations applicable to Contractor's furnishing and performing the Work. Accordingly, Engineer neither guarantees the performance of any Contractor nor assumes responsibility for any Contractor's failure to furnish and perform its work in accordance with the Contract Documents.

Defective Work. Have authority to disapprove or reject Contractor's work while it is in progress if, on the basis of such observations, Engineer believes that such work will not produce a completed project that conforms generally to the Contract Documents or that it will prejudice the integrity of the design concept of the completed project as a functioning whole as indicated in the Contract Documents.

Clarifications and Interpretations; Field Orders. Issue necessary clarifications and interpretations of the Contract Documents as appropriate to the orderly completion of the Work. Such clarifications and interpretations will be consistent with the intent of and reasonably inferable from the Contract Documents. Engineer may issue Field Orders authorizing minor variations from the requirements of the Contract Documents.

Change Orders and Work Change Directives. Recommend Change Orders and Work Change Directives to Owner, as appropriate, and prepare Change Orders and Work Change Directives as required.

Shop Drawings and Samples. Review and approve or take other appropriate action in respect to Shop Drawings and Samples and other data which Contractor is required to submit, but only for conformance with the information given in the Contract Documents and compatibility with the design concept of the completed project as a functioning whole as indicated in the Contract Documents. Such reviews and approvals or other action will not extend to means, methods, techniques, sequences or procedures of construction or to safety precautions and programs incident thereto. Engineer has an obligation to meet any Contractors submittal schedule that has earlier been acceptable to Engineer.

Substitutes and "or-equal." Evaluate and determine the acceptability of substitute or "or-equal" materials and equipment proposed by Contractor.

Inspections and Tests. Require such special inspections or tests of the Work as deemed reasonably necessary, and receive and review all certificates of inspections, tests, and approvals required by Laws and Regulations or the Contract Documents. Engineer's review of such certificates will be for the purpose of determining that the results certified indicate compliance with the Contract Documents and will not constitute an independent evaluation that the content or procedures of such inspections, tests, or approvals comply with the requirements of the Contract Documents. Engineer shall be entitled to rely on the results of such tests.

Disagreements between Owner and Contractor. Render formal written decisions on all claims of Owner and Contractor relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the execution and progress of the Work. In rendering such decisions, Engineer shall be fair and not show partiality to Owner or Contractor and shall not be liable in connection with any decision rendered in good faith in such capacity.

Applications for Payment. Based on Engineer's observations as an experienced and qualified design professional and on review of Applications for Payment and accompanying supporting documentation:

c. Determine the amounts that Engineer recommends Contractor are paid. Such recommendations of payment will be in writing and will constitute Engineer's representation to Owner, based on such observations and review, that, to the best of Engineer's knowledge, information and belief, the Work has progressed to the point indicated, the quality of such is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents and to any other qualifications stated in the recommendation), and the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work. In the case of unit price work, Engineer's recommendations of payment will include final determinations of quantities and classifications of the Work (subject to any subsequent adjustments allowed by the Contract Documents). The responsibilities of Engineer contained in paragraph A.1.05.A.6.a are expressly subject to the limitations set forth in paragraph A.1.05.A.6.b and other express or general limitations in this Agreement and elsewhere.

d. By recommending any payment, Engineer shall not thereby be deemed to have represented that observations made by Engineer to check the quality or quantity of the Work as it is performed and furnished have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in this Agreement and the Contract Documents. Neither Engineer's review of the Work for the purposes of recommending payments nor Engineer's recommendation of any payment including final payment will impose on Engineer responsibility to supervise, direct, or control the Work in progress or for the means, methods, techniques, sequences, or procedures of construction or safety precautions or programs incident thereto, or Contractor's compliance with Laws and Regulations applicable to the Work. It will also not impose responsibility on Engineer to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or to determine that title to any portion of the work in progress, materials, or equipment has passed to Owner free and clear of any liens, claims, security interests, or encumbrances, or that there may not be other matters at issue between Owner and Contractor that might affect the amount that should be paid.

Contractor's Completion Documents.

e. Receive and review maintenance and operating instructions, schedules, and guarantees.

f. Receive bonds, certificates, or other evidence of insurance not previously submitted and required by the Contract Documents, certificates of inspection, tests and approvals, Shop Drawings, Samples and other data approved as provided under paragraph A.1.05.A.10, and the annotated record documents which are to be assembled by Contractor in accordance with the Contract Documents to obtain final payment. The extent of such Engineer's review will be limited as provided in paragraph A.1.05.A.10.

g. Engineer shall transmit these documents to Owner.

Substantial Completion. Promptly after notice from Contractor that Contractor considers the entire Work ready for its intended use, in company with Owner and Contractor, conduct an inspection to determine if the Work is Substantially Complete. If after considering any objections of Owner, Engineer considers the Work Substantially Complete, Engineer shall deliver a certificate of Substantial Completion to Owner and Contractor.

Final Notice of Acceptability of the Work. Conduct a final payment inspection to determine if the completed Work of Contractor is acceptable so that Engineer may recommend, in writing, final payment to Contractor. Accompanying the recommendation for final payment, Engineer shall also provide a notice in the form attached hereto as Exhibit E ("Notice of Acceptability of Work") that the Work is acceptable (subject to the provisions of paragraph A.1.05.A.14.b) to the best of Engineer's knowledge, information, and belief and based on the extent of the services provided by Engineer under this Agreement.

B. *Duration of Construction Phase*. The Construction Phase will commence with the execution of the first Construction Agreement for a Specific Project or any part thereof and will terminate upon written recommendation by Engineer for final payment to Contractors. If a Specific Project involves more than one prime contract as indicated in the Task Order, Construction Phase services may be rendered at different times in respect to the separate contracts.

C. *Limitation of Responsibilities.* Engineer shall not be responsible for the acts or omissions of any Contractor, or of any of their subcontractors, suppliers, or of any other individual or entity performing or furnishing any of the Work. Engineer shall not be responsible for failure of any Contractor to perform or furnish the Work in accordance with the Contract Documents.

CT CONSULTANTS
STANDARD TERMS & CONDITIONS

The following conditions and provisions define the basic terms relating to the services and compensation agreed to and as outlined on the attached Letter Agreement and/or Work Authorization.

OWNER: _____

ENGINEER: CT CONSULTANTS, INC.

AGREEMENT DATE: _____

INITIAL: _____

ARTICLE 1 - SERVICES OF ENGINEER

1.01 Scope

A. ENGINEER shall provide all Services set forth herein and upon this Agreement becoming effective, ENGINEER is authorized to begin unless otherwise stipulated to by the OWNER.

ARTICLE 2 - TIMES FOR RENDERING SERVICES

2.01 General

A. ENGINEER's services and compensation under this Agreement have been agreed to in anticipation of the orderly and continuous progress of the Project through completion. Unless specific periods of time or specific dates for providing services are specified in this Agreement, ENGINEER's obligation to render services hereunder will be for a period which may reasonably be required for the completion of said services.

B. If in this Agreement specific periods of time for rendering services are set forth or specific dates by which services are to be completed are provided, and if such periods of time or dates are changed through no fault of ENGINEER, the rates and amounts of compensation provided for herein shall be subject to equitable adjustment. If OWNER has requested changes in the scope, extent, or character of the Project, the time of performance of ENGINEER's services shall be adjusted equitably.

C. For purposes of this Agreement the term "day" means a calendar day of 24 hours.

2.02 Suspension

A. If OWNER fails to give prompt written authorization to proceed with any phase of services after completion of the immediately preceding phase, or if ENGINEER's services are delayed through no fault of ENGINEER, ENGINEER may, after giving seven days written notice to OWNER, suspend services under this Agreement.

B. If ENGINEER's services are delayed or suspended in whole or in part by OWNER, or if ENGINEER's services are extended by Contractor's actions or inactions for more than 90 days through no fault of ENGINEER, ENGINEER shall be entitled to equitable adjustment of rates and amounts of compensation provided for elsewhere in this Agreement to reflect, reasonable costs incurred by ENGINEER in connection with, among other things, such delay or suspension and reactivation and the fact that the time for performance under this Agreement has been revised.

ARTICLE 3 - PAYMENTS TO ENGINEER

3.01 Methods of Payment for Services and Reimbursable Expenses of ENGINEER

A. *Preparation of Invoices.* Invoices will be prepared in accordance with ENGINEER's standard invoicing practices and will be submitted monthly to OWNER by ENGINEER, unless otherwise agreed. The amount billed in each invoice will be calculated as set forth in the Agreement including additional services and reimbursable costs, if any.

B. *Payment of Invoices.* Invoices are due and payable within 30 days of receipt. If OWNER fails to make any payment due ENGINEER for services and expenses within 30 days after receipt of ENGINEER's invoice therefor, the amounts due ENGINEER will be increased at the rate of 1.0% per month (or the maximum rate of interest permitted by law, if less) from said thirtieth day. In addition, ENGINEER may, after giving seven days written notice to OWNER, suspend services under this Agreement until ENGINEER has been paid in full all amounts due for services, expenses, and other related charges. Payments will be credited first to interest and then to principal.

C. *Disputed Invoices.* In the event of a disputed or contested invoice, only that portion so contested may be withheld from payment, and the undisputed portion will be paid.

D. *Payments Upon Termination.*

1. In the event of any termination, ENGINEER will be entitled to invoice OWNER and will be paid for all services performed or furnished and all Reimbursable Expenses incurred through the effective date of termination.

2. In the event of termination by OWNER for convenience or by ENGINEER for cause, ENGINEER, in addition to invoicing for those items identified in paragraph 3.01, shall be entitled to invoice OWNER and shall be paid a reasonable amount for services and expenses directly attributable to termination, both before and after the effective date of termination, such as reassignment of personnel, costs of terminating contracts with ENGINEER's Consultants, and other related close-out costs, using normal methods and rates.

ARTICLE 4 - OPINIONS OF COST

4.01 Opinions of Probable Construction Cost

A. ENGINEER's opinions of probable Construction Cost provided for herein are to be made on the basis of ENGINEER's experience and qualifications and represent ENGINEER's best judgment as an experienced and qualified professional generally familiar with the industry. However, since ENGINEER has no control over the cost of labor, materials, equipment, or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, ENGINEER cannot and does not guarantee that proposals, bids, or actual Construction Cost will not vary from opinions of probable Construction Cost prepared by ENGINEER. If OWNER wishes greater assurance as to probable Construction Cost, OWNER shall employ an independent cost estimator.

ARTICLE 5 - GENERAL CONSIDERATIONS

5.01 Standards of Performance

A. The standard of care for all professional engineering and related services performed or furnished by ENGINEER under this Agreement will be the care and skill ordinarily used by members of ENGINEER's profession practicing under similar circumstances at the same time and in the same locality. ENGINEER makes no warranties, express or implied, under this Agreement or otherwise, in connection with ENGINEER's services.

B. ENGINEER shall be responsible for the technical accuracy of its services and documents resulting therefrom, and OWNER shall not be responsible for discovering deficiencies therein. ENGINEER shall correct such deficiencies without additional compensation except to the extent such action is directly attributable to deficiencies in OWNER-furnished information.

C. ENGINEER shall perform or furnish professional engineering and related services in all phases of the Project to which this Agreement applies. ENGINEER shall serve as OWNER's prime professional for the Project. ENGINEER may employ such ENGINEER's Consultants as ENGINEER deems necessary to assist in the performance or furnishing of the services. ENGINEER shall not be required to employ any ENGINEER's Consultant unacceptable to ENGINEER.

D. ENGINEER and OWNER shall comply with applicable Laws or Regulations and OWNER-mandated standards. This Agreement is based on these requirements as of its Effective Date. Changes to these requirements after the Effective Date of this Agreement may be the basis for modifications to OWNER's responsibilities or to ENGINEER's scope of services, times of performance, or compensation.

E. OWNER shall be responsible for, and ENGINEER may rely upon, the accuracy and completeness of all requirements, programs, instructions, reports, data, and other information furnished by OWNER to ENGINEER pursuant to this Agreement. ENGINEER may use such requirements, reports, data, and information in performing or furnishing services under this Agreement.

F. OWNER shall make decisions and carry out its other responsibilities in a timely manner and shall bear all costs incident thereto so as not to delay the services of ENGINEER.

G. ENGINEER shall not be required to sign any documents, no matter by whom requested, that would result in the ENGINEER's having to certify, guarantee or warrant the existence of conditions whose existence the ENGINEER cannot ascertain. OWNER agrees not to make resolution of any dispute with the ENGINEER or payment of any amount due to the ENGINEER in any way contingent upon the ENGINEER's signing any such certification.

H. During the Construction Phase, ENGINEER shall not supervise, direct, or have control over Contractor's work, nor shall ENGINEER have authority over or responsibility for the means, methods, techniques, sequences, or procedures of construction selected by Contractor, for safety precautions and programs incident to the Contractor's work in progress, nor for any failure of Contractor to comply with Laws and Regulations applicable to Contractor's furnishing and performing the Work.

I. ENGINEER neither guarantees the performance of any Contractor nor assumes responsibility for any Contractor's failure to furnish and perform the Work in accordance with the Contract Documents.

J. ENGINEER shall not be responsible for the acts or omissions of any Contractor(s), subcontractor or supplier, or of any of the Contractor's agents or employees or any other persons (except ENGINEER's own employees) at the Site or otherwise furnishing or performing any of the

Contractor's work; or for any decision made on interpretations or clarifications of the Contract Documents given by OWNER without consultation and advice of ENGINEER.

5.02 Authorized Project Representatives

A. Contemporaneous with the execution of this Agreement, ENGINEER and OWNER shall designate specific individuals to act as ENGINEER's and OWNER's representatives with respect to the services to be performed or furnished by ENGINEER and responsibilities of OWNER under this Agreement. Such individuals shall have authority to transmit instructions, receive information, and render decisions relative to the Project on behalf of each respective party.

5.03 Use of Documents

A. All Documents are instruments of service in respect to this Project, and ENGINEER shall retain an ownership and property interest therein (including the right of reuse at the discretion of the ENGINEER) whether or not the Project is completed.

B. Copies of OWNER-furnished data that may be relied upon by ENGINEER are limited to the printed copies (also known as hard copies) that are delivered to the ENGINEER. Files in electronic media format of text, data, graphics, or of other types that are furnished by OWNER to ENGINEER are only for convenience of ENGINEER. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk.

C. Copies of Documents that may be relied upon by OWNER are limited to the printed copies (also known as hard copies) that are signed or sealed by the ENGINEER. Files in electronic media format of text, data, graphics, or of other types that are furnished by ENGINEER to OWNER are only for convenience of OWNER. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk.

D. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the party delivering the electronic files. ENGINEER shall not be responsible to maintain documents stored in electronic media format after acceptance by OWNER.

E. When transferring documents in electronic media format, ENGINEER makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by ENGINEER at the beginning of this Project.

F. OWNER may make and retain copies of Documents for information and reference in connection with use on the Project by OWNER. Such Documents are not intended or represented to be suitable for reuse by OWNER or others on extensions of the Project or on any other project. Any such reuse or modification without written verification or adaptation by ENGINEER, as appropriate for the specific purpose intended, will be at OWNER's sole risk and without liability or legal exposure to ENGINEER or to ENGINEER's Consultants. OWNER shall indemnify and hold harmless ENGINEER and ENGINEER's Consultants from all claims, damages, losses, and expenses, including attorneys' fees arising out of or resulting therefrom.

G. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

H. Any verification or adaptation of the Documents for extensions of the Project or for any other project will entitle ENGINEER to further compensation at rates to be agreed upon by OWNER and ENGINEER.

5.04 Insurance

A. The ENGINEER shall maintain the following insurance:

1. Workmen's Compensation
2. Employer's Liability Insurance
3. General Liability Insurance
4. Automobile Liability Insurance

B. OWNER shall maintain similar insurance and shall cause ENGINEER and ENGINEER's Consultants to be listed as additional insureds on any general liability or property insurance policies carried by OWNER, which are applicable to the Project.

C. If requested, OWNER and ENGINEER shall each deliver to the other certificates of insurance evidencing the coverage's indicated. Such certificates shall be furnished prior to commencement of ENGINEER's services and at renewals thereafter during the life of the Agreement.

D. All policies of property insurance shall contain provisions to the effect that ENGINEER's and ENGINEER's Consultants' interests are covered and that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder.

E. At any time, OWNER may request that ENGINEER, at OWNER's sole expense, provide additional insurance coverage, increased limits, or revised deductibles that are more protective than those specified. If so requested by OWNER, with the concurrence of ENGINEER, and if commercially available, ENGINEER shall obtain and shall require ENGINEER's Consultants to obtain such additional insurance coverage, different limits, or revised deductibles for such periods of time as requested by OWNER, and the agreed to fee shall be supplemented to incorporate these requirements.

5.05 Termination

A. The obligation to provide further services under this Agreement may be terminated:

1. *For cause,*

a. By either party upon 30 days written notice in the event of substantial failure by the other party to perform in accordance with the terms hereof through no fault of the terminating party.

b. By ENGINEER:

1) upon seven days written notice if ENGINEER believes that ENGINEER is being requested by OWNER to furnish or perform services contrary to ENGINEER's responsibilities as a licensed professional; or

2) upon seven days written notice if the ENGINEER's services for the Project are delayed or suspended for more than 90 days for reasons beyond ENGINEER's control.

3) ENGINEER shall have no liability to OWNER on account of such termination.

c. Notwithstanding the foregoing, this Agreement will not terminate as a result of such substantial failure if the party receiving such notice begins, within seven days of receipt of such notice, to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt thereof; provided, however, that if and to the extent such substantial failure cannot be reasonably cured within such 30 day period, and if such party has diligently attempted to cure the same and thereafter continues diligently to cure the same, then the cure period provided for herein shall extend up to, but in no case more than, 60 days after the date of receipt of the notice.

2. *For convenience,*

a. By OWNER effective upon the receipt of notice by ENGINEER.

B. The terminating party may set the effective date of termination at a time up to 30 days later than otherwise provided to allow ENGINEER to demobilize personnel and equipment from the Site, to complete tasks whose value would otherwise be lost, to prepare notes as to the status of completed and uncompleted tasks, and to assemble Project materials in orderly files.

5.06 Controlling Law

A. This Agreement is to be governed by the law of the state in which the Project is located.

5.07 Successors, Assigns, and Beneficiaries

A. OWNER and ENGINEER each is hereby bound and the partners, successors, executors, administrators and legal representatives of OWNER and ENGINEER (and to the extent permitted by paragraph 5.07.B the assigns of OWNER and ENGINEER) are hereby bound to the other party to this Agreement and to the partners, successors, executors, administrators and legal representatives (and said assigns) of such other party, in respect of all covenants, agreements and obligations of this Agreement.

B. Neither OWNER nor ENGINEER may assign, sublet, or transfer any rights under or interest (including, but without limitation, moneys that are due or may become due) in this Agreement without the written consent of the other, except to the extent that any assignment, subletting, or transfer is mandated or restricted by law. Unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under this Agreement.

C. Unless expressly provided otherwise in this Agreement:

1. Nothing in this Agreement shall be construed to create, impose, or give rise to any duty owed by OWNER or ENGINEER to any Contractor, Contractor's subcontractor, supplier, other individual or entity, or to any surety for or employee of any of them.

2. All duties and responsibilities undertaken pursuant to this Agreement will be for the sole and exclusive benefit of OWNER and ENGINEER and not for the benefit of any other party. The OWNER agrees that the substance of the provisions of this paragraph shall appear in any Contract Documents.

5.08 Dispute Resolution

A. OWNER and ENGINEER agree to negotiate all disputes between them in good faith for a period of 30 days from the date of notice prior to exercising their right to arbitrate, or under law. In the absence of such an agreement, the parties may exercise their rights under law.

5.9 Hazardous Environmental Condition

A. OWNER represents to Engineer that to the best of its knowledge a Hazardous Environmental Condition does not exist.

B. OWNER has disclosed to the best of its knowledge to ENGINEER the existence of all Asbestos, PCB's, Petroleum, Hazardous Waste, or Radioactive Material located at or near the Site, including type, quantity and location.

C. If a Hazardous Environmental Condition is encountered or alleged, ENGINEER shall have the obligation to notify OWNER and, to the extent of applicable Laws and Regulations, appropriate governmental officials.

D. It is acknowledged by both parties that ENGINEER's scope of services does not include any services related to a Hazardous Environmental Condition. In the event ENGINEER or any other party encounters a Hazardous Environmental Condition, ENGINEER may, at its option and without liability for consequential or any other damages, suspend performance of services on the portion of the Project affected thereby until OWNER: (i) retains appropriate specialist consultant(s) or contractor(s) to identify and, as appropriate, abate, remediate, or remove the Hazardous Environmental Condition; and (ii) warrants that the Site is in full compliance with applicable Laws and Regulations.

E. OWNER acknowledges that ENGINEER is performing professional services for OWNER and that ENGINEER is not and shall not be required to become an "arranger," "operator," "generator," or "transporter" of hazardous substances, as defined in the Comprehensive Environmental Response, Compensation, and Liability Act of 1990 (CERCLA), which are or may be encountered at or near the Site in connection with ENGINEER's activities under this Agreement.

F. If ENGINEER's services under this Agreement cannot be performed because of a Hazardous Environmental Condition, the existence of the condition shall justify ENGINEER's terminating this Agreement for cause on 30 days notice.

5.10 Allocation of Risks

A. Indemnification

1. To the fullest extent permitted by law, ENGINEER shall indemnify and hold harmless OWNER, OWNER's officers, directors, partners, and employees from and against any and all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) caused solely by the negligent acts or omissions of ENGINEER or ENGINEER's officers, directors, partners, employees, and ENGINEER's Consultants in the performance and furnishing of ENGINEER's services under this Agreement.

2. To the fullest extent permitted by law, OWNER shall indemnify and hold harmless ENGINEER, ENGINEER's officers, directors, partners, employees, and ENGINEER's Consultants from and against any and all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) caused solely by the negligent acts or omissions of OWNER or OWNER's officers, directors, partners, employees, and OWNER's consultants with respect to this Agreement or the Project.

3. To the fullest extent permitted by law, ENGINEER's total liability to OWNER and anyone claiming by, through, or under OWNER for any cost, loss, or damages caused in part by the negligence of ENGINEER and in part by the negligence of OWNER or any other negligent entity or individual, shall not exceed the percentage share that ENGINEER's negligence bears to the total negligence of OWNER, ENGINEER, and all other negligent entities and individuals and in no case shall this liability exceed the maximum fee amount.

4. In addition to the indemnity provided under paragraph 5.10.A.2 of this Agreement, and to the fullest extent permitted by law, OWNER shall indemnify and hold harmless ENGINEER and its officers, directors, partners, employees, and ENGINEER's Consultants from and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) caused by, arising out of or resulting from a Hazardous Environmental Condition, provided that (i) any such cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other

than completed Work), including the loss of use resulting therefrom, and (ii) nothing in this paragraph 5.10.A.4. shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence or willful misconduct.

5.11 Notices

A. Any notice required under this Agreement will be in writing, addressed to the appropriate party at its address on the signature page and given personally, or by registered or certified mail postage prepaid, or by a commercial courier service. All notices shall be effective upon the date of receipt.

5.12 Survival

A. All express representations, indemnifications, or limitations of liability included in this Agreement will survive its completion or termination for any reason.

5.13 Severability

A. Any provision or part of the Agreement held to be void or unenforceable under any Laws or Regulations shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and ENGINEER, who agree that the Agreement shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

5.14 Waiver

A. Non-enforcement of any provision by either party shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Agreement.

CT Consultants
engineers | architects | planners
Since 1922

May 11, 2010

Mr. Robert Sobczak, President
Rome Rock Association
P.O. Box 8, 1875 US Route 6
Rome, Ohio 44085

Re: Report of Findings and Alternatives
Rome Rock Lake Conceptual Study

Dear Mr. Sobczak:

CT Consultants, Inc. (CT) is pleased to submit for your review, our letter report of findings for the conceptual hydrology and hydraulic study for Lake Roaming Rock. The objectives of the study were to analyze the existing lake conditions in order to develop alternatives to stabilize lake levels (reduce excessive fluctuations during storm events), improve lake drawdown capabilities, improve the capability to remove/recirculate low dissolved oxygen water from deep water areas near the dam and provide a means to drain the lake in the case of needed repairs for the earthen dam embankment.

As part of this study, existing drawings, mapping, reports and previous hydrologic and hydraulic modeling available for the lake were obtained to a create a hydrologic and hydraulic model. The low flow storm events for a 1 inch rainfall, as well as 2, 3, 4, 6, 9 month and the more severe 2, 5, 10, 25, 50 and 100-year storm events were analyzed to model a range of storms to evaluate alternates for the study.

A PMF (Probable Maximum Flood) storm event was **not** incorporated into the hydraulic and hydrology model, since the primary focus of the study was to manage the customary flow conditions and rain events that occur at Lake Roaming Rock. The Probable Maximum Precipitation (PMP) is the greatest depth (amount) of precipitation, for a given storm duration, that is theoretically possible for a particular area and geographic location. ODNR used 29.9 inches of rain over a 72 hour period as the PMF in their calculations for Lake Roaming Rock.

The development of alternatives for this conceptual study resulted from the analysis of the (3) unique hydrologic and hydraulic conditions of draining the impounded water within Lake Roaming Rock (Water Level 850 to 820), baseflow conditions through the lake and a 1 inch rainfall event. The impounded water volumes were based on an assumed geometry for the existing lake. The baseflow conditions were based on the monthly flow conditions recorded at the USGS Rock Creek Gage Station from 1942 through 1966. The peak flow and volume of storm water runoff for the 1 inch rainfall event was determined through data defined for the watershed area contributing to Rome Rock Lake and input into the Hydraflow Hydrographs Program.

8150 Sterling Court Mentor, Ohio 44060 phone: 440.951.9000 fax: 440.951.7487 www.ctconsultants.com

Predicting the timing and intensity of any rainfall event is very difficult. A 1 inch rainfall event for this area of northeast Ohio is likely to occur approximately one time in any given month.

These (3) volume of water/storm water values were evaluated via the initial approach to this conceptual study focusing on developing either a modified lake spillway system, a siphon system or a combination of these two systems. As the study progressed and additional review meetings were conducted with the Lake Management Committee and Rome Rock Association, the scope of the study was narrowed down to (5) basic goals for Lake Roaming Rock to control the different water/storm water conditions.

1. Lower the Lake Level approximately 5 feet annually for Fall Maintenance of Docks, Vegetation, etc.
2. Lower the Lake Level approximately 10 feet every 5 years for Substantial Maintenance of Dredging, Utilities, Docks, Vegetation, etc.
3. Remove and/or recirculate and aerate low dissolved oxygen water from deep water areas of the lake.
4. Construct a system to drain Lake Rome Rock in the case of needed emergency repairs.
5. Construct a system that will safely maintain the previously defined lowered lake levels with only minor increases in water surface elevations during 1 inch rainfall storm event.

Additionally, the following parameters were utilized for the development of alternatives for this conceptual study.

1. Maximum lake drawdown rate of 4 feet per week. A drawdown from elevation 850 to 820 at this rate would take approximately 7.5 weeks or 53 days.
2. Leave in place and utilize the existing 30 inch outlet drain.
3. Minimize water level increases to 1 foot during a minor storm event for the 5 foot - annual lowered lake condition.
4. Minimize water level increases to 2 feet during a minor storm event for the 10 foot - 5 year lowered lake condition.
5. Utilize existing Village pumping equipment to prime the proposed siphon system.

Summary of Findings and Recommended Alternatives

As a result of redefining the scope during the course of this conceptual study, it has been determined that a siphon system would be the most feasible approach to meeting the (5) goals previously defined for Lake Roaming Rock. In reviewing the various siphon system options, in regards to the time determined to completely drain the lake and the capacity to maintain water surface levels for the (3) different lake drawdown conditions, we recommend either the 24 inch or preferably the 30 inch Siphon System Alternative.

These (2) alternatives were calculated to drain the impounded lake water in 44 days (24 inch siphon) and 28 days (30 inch siphon). The 12, 16, 18 and 20 inch siphon systems were calculated to drain the impounded lake water in 175, 100, 78 and 64 days. The lake drawdown for each of these siphon systems was greater than the goal of 53 days at the drawdown rate of 4 feet per week. The table below shows the additional flows resulting from the baseflow within Rock Creek that would need to be accounted for when draining the lake.

USGS Rock Creek Gage Station Average Monthly Baseflows at Lake Roaming Rock

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Average Monthly Baseflow (cfs)	132	149	196	141	85	37	13	17	5	22	42	83

As shown in the Summary of Siphon System Hydraulic Calculations, the capacity of the 24 inch siphon system ranges from 50 to 91 cfs and the 30 inch siphon system ranges from 79 to 142 cfs. The 24 and 30 inch siphon systems should be capable of routing the additional baseflows noted in the above table for given periods of the year; the 24 inch system from approximately June through November and the 30 inch system from approximately May through December.

The calculated times for the 24 and 30 inch siphon system to drain Lake Roaming Rock for the combined volume of water from the average baseflow values and the impounded water within the lake is provided in the table for the periods of the year that would result in drawdown of approximately 53 days. The volume of water to be routed through the siphon systems for a 1 inch rainfall event was negligible; the flows only added approximately ½ day to the total drawdown time.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Total Drawdown Time 24 inch Siphon (days)	Beyond Capacity of Siphon System					89	53	56	47	62	107	Beyond Capacity of Siphon System
Total Drawdown Time 30 inch Siphon (days)	Beyond Capacity of Siphon System				97	38	30	31	28	32	40	89

The Opinion of Probable Construction Costs for the 24 inch siphon system is $170,700. The Opinion of Probable Construction Costs for the 30 inch siphon system is $194,700. The preferred alternative would be the 30 inch siphon system, the additional capacity provided beyond the 24 inch system would allow (2) additional months for any necessary drawdowns of the lake. The additional cost of $24,000 for the 30 inch siphon system would be a minor cost for the increased capacity and flexibility of this system. The priming station ($100,000) and recirculation systems ($290,000) are optional components that can be added to either siphon system at a later date.

A summary of the alternative analysis for each of the siphon systems (12 through 30 inch) are presented in the Summary of Siphon System Hydraulic Calculations (Exhibit 1), Summary of Preliminary Opinion of Probable Construction Costs and detailed breakdown of unit costs (Exhibit 3). The summary of the hydraulic calculations illustrate flow rates and drawdown durations in 5 foot increments for the 30 feet to drain the lake (850 to 820) , the number of days to drain the lake and the outflow rates for each of the 5 foot increments. A layout for the conceptual siphon system is provided in Exhibit 2.

Engineering judgment should be exercised in regard to any proposed lake drawdowns, considering anticipated storm events, anticipated baseflows for the watershed, overall timeframe of drawdown period and the drawdown rate permitted by ODNR.

The following (2) options were also investigated as part of this conceptual study but not considered as feasible alternatives.

1. A modified spillway system approach was considered to be impractical since this option would be extremely expensive to excavate to depth of 30 feet below the existing lake level in order to construct an outlet to drain the lake.

2. Boring through the earthen embankment of the dam for the installation of a lake drain was an additional approach that was investigated but eliminated since this option was strongly discouraged by ODNR.

Should you have any questions or require additional information, please do not hesitate to call.

Respectfully submitted,

CT CONSULTANTS, INC.

Scott Wood, P.E.

RSW:mmm

cc: Clyde C. Hadden, P.E., P.S., CFM
Tom Voldrich, P.E. CT Consultants, Inc.

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APPENDIX

The following sections provide a brief summary of the methodology and results determined from our conceptual analysis. As defined by the revised proposal of June 15, 2009, a less-detailed and more conceptual analysis was completed for this study as compared to the original scope defined by our proposal of April 20, 2009.

Data Collection and Review

ODNR Inspection Reports (Previous and 2008/2009 Reports) provided data for the existing conditions at Lake Roaming Rock.

1. Class I Dam construction completed in 1967
2. Contributing watershed drainage area – 73.5 square miles (47,040 acres)
3. Normal Lake Water Surface Area @ Elevation 850 – 460 acres
   Lake Water Surface Area @ Elevation 854 – 595 acres
4. Volume of water impounded by dam @ Elevation 850 – 6,091 acre-feet
5. (3) Outlet/Spillway Structures

- Lake Drain – 36 inch CMP w/30 inch liner @ Elevation 840
- Principal Spillway – 180 foot wide Ogee Shaped Weir @ Elevation 850
- Auxiliary Spillway – 110 foot wide Ogee Shaped Weir @ Elevation 852
- Emergency Spillway – 80 feet wide @ Elevation 854
- Top of Earthen Embankment – 730 feet wide @ Elevation 861

USGS and Ashtabula County Mapping were utilized to develop the hydrology and hydraulic modeling for the dam. This mapping verified that the watershed drainage area and lake water surface areas were similar to the ODNR data.

Existing Engineering Drawings of the Dam were utilized to review and develop the schematic layout of the proposed Alternatives. Existing Utility records were not available for the study. However, it was noted by the Village that a water main and sanitary sewer force main are located through the entire length of the earthen embankment of the dam.

Flow data was obtained from USGS from the Rock Creek Gage Station that was in operation from 1942 through 1966. It was apparently in the vicinity of Lake Roaming Rock and was removed as part of the construction of the dam. The data from the gage station monthly average stream flow data and one day peak stream flow data for each year for Rock Creek. This data was extremely beneficial in estimating a base flow value for the dam at various periods throughout the year. (See attached Exhibit 4 USGS Surface –Water Monthly Statistics for the Nation)

Field Survey

The site was visited on (3) separate occasions to review the hydrologic and hydraulic characteristics required to create the models, as well as to make overall observations for the existing conditions at the lake and dam facilities. The lake was observed during the Fall 2009 drawdown period. This site revealed the shallow depth of the lake in the vicinity of the auxiliary and emergency spillways.

Hydrologic and Hydraulics Analysis

A hydrologic and hydraulic model was developed for the existing watershed and dam utilizing the Hydroflow Hydrographs Program for a 1 inch rainfall event as well as 2, 3, 4, 6 and 9 month rainfall frequencies and the 1, 2, 5, 10, 25, 50 and 100 year return period storm events. This model reviewed the storage and flow routing characteristics of the existing lake. The table below provides a summary of the peak inflow, outflow and existing lake surcharge elevations for various storm events.

Existing Lake Roaming Rock Conditions Peak Flows into Lake, Peak Flows Discharged from Lake and Surcharge Water Surface Elevation (Normal Water Surface Elevation – 850)			
Storm Event (Month or Year)	Peak Flow into Lake (cfs)	Peak Flow Discharged from Lake (cfs)	Surcharge Water Surface Elevation
1 inch rainfall	45	13	850.06
2 month	95	36	850.14
3 month	213	101	850.28
4 month	315	161	850.39
6 month	556	310	850.60
9 month	873	521	850.85
1 year	1,254	780	851.11
2 year	2,088	1,365	851.61
5 year	3,561	2,467	852.37
10 year	4,950	3,481	853.01
25 year	7,138	5,132	853.90
50 year	9,070	6,687	854.59
100 year	11,246	8,502	855.28

EXHIBIT 1

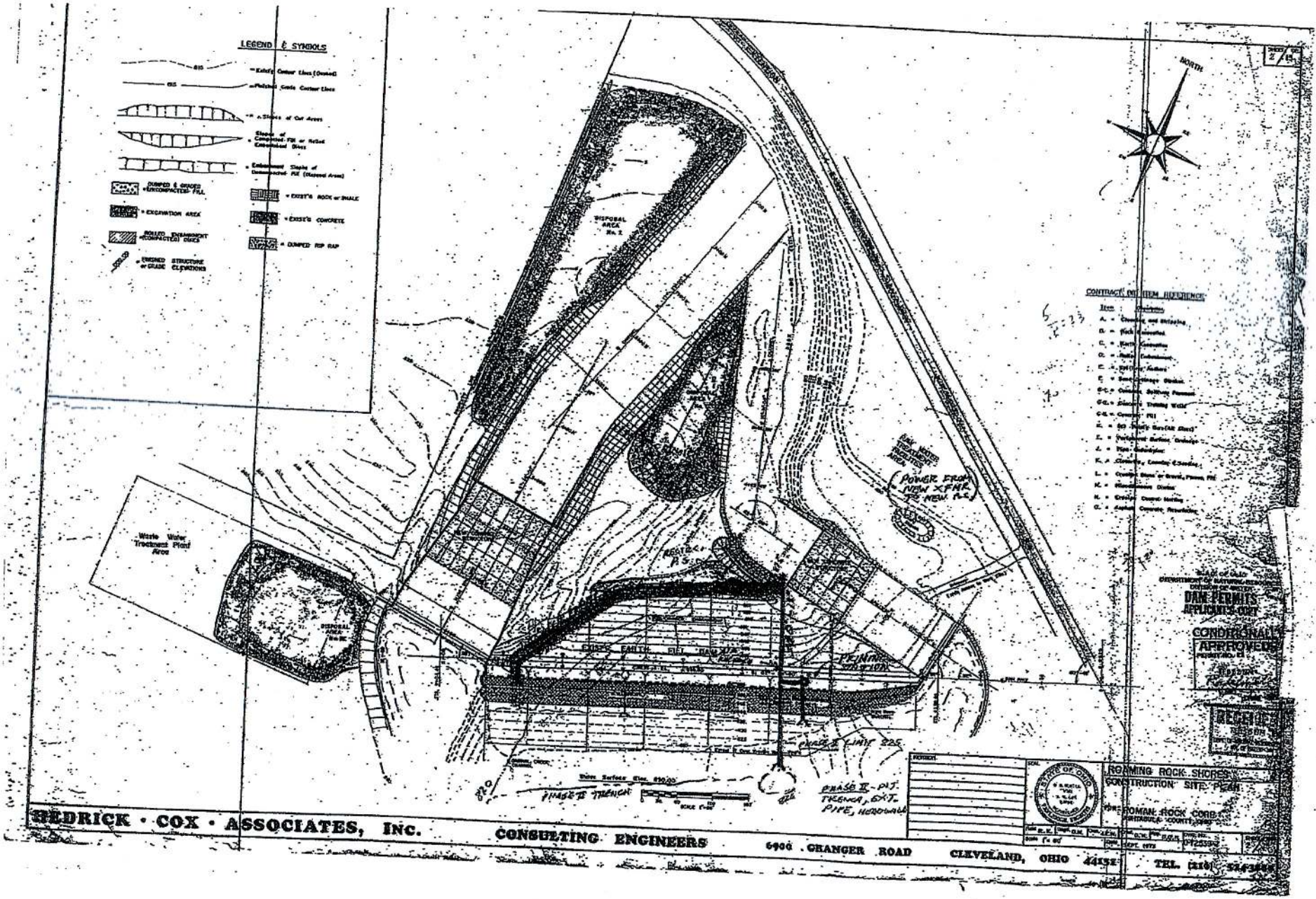
LEGEND & SYMBOLS
NORTH
Waste Water Treatment Plant Area
DISPOSAL AREA No. 2
DISPOSAL AREA No. 3
POWER FROM NEW XFMR. TO NEW P.C.
CONTRACT ITEM REFERENCE
DAM PERMITS
APPLICANTS COPY
CONDITIONALLY APPROVED
RECEIVED
PHASE II - PIT, TRENCH, EXT. PIPE, HEADWALL
PHASE II TRENCH
ROAMING ROCK SHORES
CONSTRUCTION SITE PLAN
ROMAN ROCK CORP.
HEDRICK · COX · ASSOCIATES, INC. CONSULTING ENGINEERS 6900 . CHANGER ROAD CLEVELAND, OHIO 44132 TEL. (216)

EXHIBIT 2

Summary of Siphon System Hydraulic Calculations - Alternatives 12 inch through 30 inch

Depth	Siphon Head	Siphon head less friction	SINGLE BARREL SIPHON OPTIONS (10"-30")																
			Q(CFS)/12	V(fps)/12	headloss	Q(CFS)/16	V(fps)/16	headloss	Q(CFS)/18	V(fps)/18	headloss	Q(CFS)/20	V(fps)/20	headloss	Q(CFS)/24	V(fps)/24	headloss	Q(CFS)/30	V(fps)/30	headloss
30	35	13	23	29	21.8	40	29	21.8	51	29	21.8	63	29	21.8	91	29	21.8	142	29	21.8
25	30	11	21	27	18.2	37	26	18.9	47	27	18.2	58	27	18.2	84	27	18.2	131	27	18.2
20	25	10	20	25	15.4	35	25	15.4	45	25	15.4	55	25	15.4	80	25	15.4	125	25	15.4
15	20	8	18	23	12.8	32	23	12.8	40	23	12.8	50	23	12.8	71	23	12.8	111	23	12.8
10	15	6	15	19	8.6	27	19	8.6	35	20	9.6	43	20	9.6	62	20	9.6	96	20	9.6
5	10	4	13	17	6.9	22	16	6.1	28	16	6.1	35	16	6.1	50	16	6.1	79	16	6.1

Volume Distribution	Time (days)	Time (days)	Time (days)	Time (days)	Time (days)	Time (days)
0-5	52.9	30.4	23.9	19.3	13.4	8.6
5-10	33.1	18.8	14.8	12.0	8.3	5.3
10-15	34.8	19.9	15.5	12.7	8.7	5.6
15-20	25.1	14.1	11.3	9.0	6.4	4.1
20-25	18.6	10.3	8.0	6.5	4.5	2.9
25-30	10.7	6.3	5.0	4.0	2.8	1.8
total	176.2	99.9	78.4	63.5	44.0	28.2

Depth	Siphon Head	Siphon head less friction	DOUBLE BARREL SIPHON OPTIONS (10"-30")																
			Q(CFS)/12	V(fps)/12	headloss	Q(CFS)/16	V(fps)/16	headloss	Q(CFS)/18	V(fps)/18	headloss	Q(CFS)/20	V(fps)/20	headloss	Q(CFS)/24	V(fps)/24	headloss	Q(CFS)/30	V(fps)/30	headloss
30	35	13	46	30	22.5	80	29	21.0	102	29	21.8	126	29	21.8	182	29	21.8	284	29	21.8
25	30	11	42	27	17.5	74	27	17.5	94	27	17.5	116	27	17.5	168	27	17.5	262	27	17.5
20	25	10	40	26	16.0	70	25	15.4	90	26	16.0	110	25	15.4	160	26	16.0	250	26	16.0
15	20	8	36	23	12.8	64	23	12.8	80	23	12.3	100	23	12.8	142	23	12.3	222	23	12.3
10	15	6	30	19	8.6	54	20	9.1	70	20	9.6	86	20	9.1	124	20	9.1	192	20	9.1
5	10	4	26	17	6.5	44	16	6.1	56	16	6.1	70	16	6.1	100	16	6.1	158	16	6.1

Volume Distribution	Time (days)	Time (days)	Time (days)	Time (days)	Time (days)	Time (days)
0-5	26.5	15.2	11.9	9.7	6.7	4.3
5-10	16.6	9.4	7.4	6.0	4.1	2.7
10-15	17.4	9.9	7.7	6.3	4.3	2.8
15-20	12.6	7.1	5.7	4.5	3.2	2.0
20-25	9.3	5.2	4.0	3.2	2.2	1.4
25-30	5.4	3.2	2.5	2.0	1.4	0.9
total	87.6	49.9	39.2	31.7	22.0	14.1

	Volume Distribution by 5ft depth increments	Assumed % volume	volume-cf	Upper 10 ft
850-845	0-5	35%	105,197,400	165,310,200
845-840	5-10	20%	60,112,800	
840-835	10-15	20%	60,112,800	
835-830	15-20	13%	39,073,320	
830-825	20-25	8%	24,045,120	
825-820	25-30	4%	12,022,560	
	total	100%	300,564,000	135,253,800

EXHIBIT 3

Summary of Preliminary Opinion of Probable Construction Costs - Siphon System Alternatives

Pool 850-820		Siphon Project	Priming Station	Recirculation System	Total Project Cost
Siphon Size	Days				
12	175	$108,600	$100,000	$290,000	$498,600
16	100	$120,300	$100,000	$290,000	$510,300
18	78	$127,700	$100,000	$290,000	$517,700
20	63	$144,100	$100,000	$290,000	$534,100
24	44	$170,700	$100,000	$290,000	$560,700
30	28	$194,700	$100,000	$290,000	$584,700

12" Siphon				
Description	Units	Qty	Unit Cost	Total Cost
1 Influent Structure	Each	1	$5,000	$5,000
2 12" DIP Siphon Pipe	LF	330	$70	$23,100
3 12" Gate Valve and fence	Each	1	$6,000	$6,000
4 Armor Stone	CY	89	$200	$17,800
5 Headwalls,RipRap	LS	1	$5,000	$5,000
6 100 GPM Priming Station*	LS	1	$75,000	$75,000
7 Siphon Piers and Anchors	Each	18	$600	$10,800
8 Restoration	LS	1	$4,000	$4,000
9 Embankment repair allowance	LS	1	$5,000	$5,000
10 Trenching of Lake Bottom for channel	LF	400	$10	$4,000
11 6,000 GPM Recirculation Station**	LS	1	$150,000	$150,000
12 Inlet Control Valve & Vault	LS	1	$5,000	$5,000
13 16" DIP Recirculation Pipe	LF	450	$90	$40,500
14 Recirculation line Piers	Each	25	$400	$10,000
15 Pipe Fittings	Each	5	$175	$875
16 Power Feeds, breakers, xfmer, meter	LS	1	$50,000	$50,000
Sub Total				$412,100
10%Bond,Mobil,Contingency				$41,200
Total Construction				$453,300
Project Overhead - 10%				$45,300
Total Project				$498,600

* Simplex Pump Stations includes single pump, suction pipe, valves and vault, wetwell, pump station p air release and vault, electrical and instrumentation

* *Simplex Pump Stations includes single pump, 18" suction pipe, discharge valve and vault, wetwell, pump station 16"discharge piping, manhole, electrical and instrumentation

16" Siphon				
Description	Units	Qty	Unit Cost	Total Cost
1 Influent Structure	Each	1	$5,000	$5,000
2 16" DIP Siphon Pipe	LF	330	$90	$29,700
3 16" Gate Valve and fence	Each	1	$8,000	$8,000
4 Armor Stone	CY	89	$200	$17,800
5 Headwalls,RipRap	LS	1	$6,000	$6,000
6 100 GPM Priming Station*	LS	1	$75,000	$75,000
7 Siphon Piers and Anchors	Each	18	$600	$10,800
8 Restoration	LS	1	$4,000	$4,000
9 Embankment repair allowance	LS	1	$5,000	$5,000
10 Trenching of Lake Bottom for channel	LF	400	$10	$4,000
11 6,000 GPM Recirculation Station**	LS	1	$150,000	$150,000
12 Inlet Control Valve & Vault	LS	1	$5,000	$5,000
13 16" DIP Recirculation Pipe	LF	450	$90	$40,500
14 Recirculation line Piers	Each	25	$400	$10,000
15 Pipe Fittings	Each	5	$175	$875
16 Power Feeds, breakers, xfmer, meter	LS	1	$50,000	$50,000
Sub Total				$421,700
10%Bond,Mobil,Contingency				$42,200
Total Construction				$463,900
Project Overhead - 10%				$46,400
Total Project				$510,300

* Simplex Pump Stations includes single pump, suction pipe, valves and vault, wetwell, pump station p air release and vault, electrical and instrumentation

**Simplex Pump Stations includes single pump, 18" suction pipe, discharge valve and vault, wetwell, pump station 16"discharge piping, manhole, electrical and instrumentation

18"Siphon				
Description	Units	Qty	Unit Cost	Total Cost
1 Influent Structure	Each	1	$5,000	$5,000
2 18" DIP Siphon Pipe	LF	330	$100	$33,000
3 18" Gate Valve and fence	Each	1	$10,000	$10,000
4 Armor Stone	CY	89	$200	$17,800
5 Headwalls,RipRap	LS	1	$5,000	$5,000
6 100 GPM Priming Station*	LS	1	$75,000	$75,000
7 Siphon Piers and Anchors	Each	18	$700	$12,600
8 Restoration	LS	1	$4,000	$4,000
9 Embankment repair allowance	LS	1	$5,000	$5,000
10 Trenching of Lake Bottom for channel	LF	400	$10	$4,000
11 6,000 GPM Recirculation Station**	LS	1	$150,000	$150,000
12 Inlet Control Valve & Vault	LS	1	$5,000	$5,000
13 16" DIP Recirculation Pipe	LF	450	$90	$40,500
14 Recirculation line Piers	Each	25	$400	$10,000
15 Pipe Fittings	Each	5	$175	$875
16 Power Feeds, breakers, xfmer, meter	LS	1	$50,000	$50,000
Sub Total				$427,800
10%Bond,Mobil,Contingency				$42,800
Total Construction				$470,600
Project Overhead - 10%				$47,100
Total Project				$517,700

* Simplex Pump Stations includes single pump, suction pipe, valves and vault, wetwell, pump station p air release and vault, electrical and instrumentation

* *Simplex Pump Stations includes single pump, 18" suction pipe, discharge valve and vault, wetwell, pump station 16"discharge piping, manhole, electrical and instrumentation

20"Siphon				
Description	Units	Qty	Unit Cost	Total Cost
1 Influent Structure	Each	1	$8,000	$8,000
2 20" DIP Siphon Pipe	LF	330	$110	$36,300
3 20" Gate Valve and fence	Each	1	$12,000	$12,000
4 Armor Stone	CY	89	$200	$17,800
5 Headwalls,RipRap	LS	1	$8,000	$8,000
6 100 GPM Priming Station*	LS	1	$75,000	$75,000
7 Siphon Piers and Anchors	Each	18	$800	$14,400
8 Restoration	LS	1	$4,500	$4,500
9 Embankment repair allowance	LS	1	$5,000	$5,000
10 Trenching of Lake Bottom for channel	LF	400	$10	$4,000
11 6,000 GPM Recirculation Station**	LS	1	$150,000	$150,000
12 Inlet Control Valve & Vault	LS	1	$5,000	$5,000
13 16" DIP Recirculation Pipe	LF	450	$90	$40,500
14 Recirculation line Piers	Each	25	$400	$10,000
15 Pipe Fittings	Each	5	$175	$875
16 Power Feeds, breakers, xfmer, meter	LS	1	$50,000	$50,000
Sub Total				$441,400
10%Bond,Mobil,Contingency				$44,100
Total Construction				$485,500
Project Overhead - 10%				$48,600
Total Project				$534,100

* Simplex Pump Stations includes single pump, suction pipe, valves and vault, wetwell, pump station p air release and vault, electrical and instrumentation

* *Simplex Pump Stations includes single pump, 18" suction pipe, discharge valve and vault, wetwell, pump station 16"discharge piping, manhole, electrical and instrumentation

24"Siphon				
Description	Units	Qty	Unit Cost	Total Cost
1 Influent Structure	Each	1	$10,000	$10,000
2 24" DIP Siphon Pipe	LF	330	$140	$46,200
3 24" Gate Valve and fence	Each	1	$15,000	$15,000
4 Armor Stone	CY	89	$200	$17,800
5 Headwalls,RipRap	LS	1	$10,000	$10,000
6 Pipe Fittings	Each	5	$200	$1,000
7 100 GPM Priming Station*	LS	1	$75,000	$75,000
8 Siphon Piers and Anchors	Each	18	$1,000	$18,000
9 Restoration	LS	1	$5,000	$5,000
10 Embankment repair allowance	LS	1	$5,000	$5,000
11 Trenching of Lake Bottom for channel	LF	400	$10	$4,000
12 6,000 GPM Recirculation Station**	LS	1	$150,000	$150,000
13 Inlet Control Valve & Vault	LS	1	$5,000	$5,000
14 16" DIP Recirculation Pipe	LF	450	$90	$40,500
15 Recirculation line Piers	Each	25	$400	$10,000
16 Pipe Fittings	Each	5	$175	$875
Power Feeds, breakers, xfmer, meter	LS	1	$50,000	$50,000
Sub Total				$463,400
10%Bond,Mobil,Contingency				$46,300
Total Construction				$509,700
Project Overhead - 10%				$51,000
Total Project				$560,700

* Simplex Pump Stations includes single pump, 8" suction pipe, valve and vault, wetwell, pump station 4"discharge piping, air release and vault, electrical and instrumentation

* *Simplex Pump Stations includes single pump, 18" suction pipe, discharge valve and vault, wetwell, pump station 16"discharge piping, manhole, electrical and instrumentation

30"Siphon				
Description	Units	Qty	Unit Cost	Total Cost
1 Influent Structure	Each	1	$10,000	$10,000
2 30" DIP Siphon Pipe	LF	330	$200	$66,000
3 30" Gate Valve and fence	Each	1	$15,000	$15,000
4 Armor Stone	CY	89	$200	$17,800
5 Headwalls,RipRap	LS	1	$10,000	$10,000
6 Pipe Fittings	Each	5	$200	$1,000
7 100 GPM Priming Station*	LS	1	$75,000	$75,000
8 Siphon Piers and Anchors	Each	18	$1,000	$18,000
9 Restoration	LS	1	$5,000	$5,000
10 Embankment repair allowance	LS	1	$5,000	$5,000
11 Trenching of Lake Bottom for channel	LF	400	$10	$4,000
12 6,000 GPM Recirculation Station**	LS	1	$150,000	$150,000
13 Inlet Control Valve & Vault	LS	1	$5,000	$5,000
14 16" DIP Recirculation Pipe	LF	450	$90	$40,500
15 Recirculation line Piers	Each	25	$400	$10,000
16 Pipe Fittings	Each	5	$175	$875
Power Feeds, breakers, xfmer, meter	LS	1	$50,000	$50,000
Sub Total				$483,200
10%Bond,Mobil,Contingency				$48,300
Total Construction				$531,500
Project Overhead - 10%				$53,200
Total Project				$584,700

* Simplex Pump Stations includes single pump, 8" suction pipe, valve and vault, wetwell, pump station 4"discharge piping, air release and vault, electrical and instrumentation

**Simplex Pump Stations includes single pump, 18" suction pipe, discharge valve and vault, wetwell, pump station 16"discharge piping, manhole, electrical and instrumentation

EXHIBIT 4

USGS Surface-Water Monthly Statistics for the Nation

The statistics generated from this site are based on approved daily-mean data and may not match those published by the USGS in official publications. The user is responsible for assessment and use of statistics from this site. For more details on why the statistics may not match, click here.

USGS 04211000 Rock Creek near Rock Creek OH

Available data for this site | Time-series: Monthly statistics | GO

Ashtabula County, Ohio
Hydrologic Unit Code 04110004
Latitude 41°39'05", Longitude 80°50'10" NAD27
Drainage area 69.2 square miles
Gage datum 813.03 feet above sea level NGVD29

Output formats: Tab-separated data | Reselect output format

00060, Discharge, cubic feet per second,
Monthly mean in cfs (Calculation Period: 1942-04-01 -> 1966-09-30)
Period-of-record for statistical calculation restricted by user

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1942				133.2	163.3	64.2	42.0	129.7	2.22	29.6	116.5	221.1
1943	172.3	181.8	156.1	90.4	132.4	61.4	49.0	0.439	0.283	1.40	5.20	8.38
1944	22.6	136.8	183.7	236.2	66.6	3.81	0.010	0.000	0.000	0.000	1.10	8.36
1945	22.4	264.4	205.5	69.0	100.6	30.8	17.8	4.11	43.5	190.0	89.0	102.0
1946	102.6	111.0	174.9	8.30	197.7	51.7	1.41	0.068	0.000	1.72	9.74	61.5
1947	227.3	31.1	150.9	269.0	221.3	242.8	10.4	6.54	13.4	0.145	1.49	30.7
1948	40.1	158.1	299.1	128.7	107.2	5.70	10.0	10.8	1.38	12.7	54.5	96.1
1949	177.7	124.4	118.5	72.8	115.2	7.73	14.3	1.94	1.72	0.268	7.88	74.6
1950	381.7	239.5	364.0	188.6	74.9	32.7	1.70	2.45	15.4	1.91	88.7	225.8
1951	214.4	250.7	305.5	117.1	37.4	30.9	23.3	0.729	0.513	0.277	96.6	225.1
1952	410.8	127.3	125.4	98.6	65.4	1.81	0.168	1.02	0.413	0.200	13.8	39.1
1953	146.8	60.4	71.1	69.8	160.4	30.9	0.258	1.05	0.000	0.000	0.223	12.1
1954	82.3	81.7	279.6	270.2	44.8	63.4	0.090	0.000	0.000	132.9	85.9	187.5

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1955	86.7	203.9	208.3	94.1	6.00	7.81	0.500	1.50	0.000	12.8	67.3	105.6
1956	9.37	300.9	265.6	183.9	161.4	119.0	43.1	176.7	17.0	4.36	8.14	68.4
1957	136.0	136.7	75.2	310.6	29.7	47.8	6.32	0.000	0.000	0.445	3.25	127.4
1958	73.3	122.4	100.1	56.8	49.1	5.56	95.3	70.2	27.0	14.0	98.7	54.2
1959	253.6	250.6	170.5	138.1	30.2	17.1	5.39	2.05	0.853	99.6	139.1	186.7
1960	160.7	108.3	192.9	94.4	154.7	14.7	2.45	1.35	0.400	0.132	1.74	1.43
1961	6.47	169.9	172.5	322.0	44.8	17.5	1.75	0.310	0.910	2.86	43.8	41.9
1962	67.2	89.4	149.8	83.1	11.3	1.71	0.000	0.000	0.007	1.43	29.8	17.4
1963	19.4	8.21	215.1	61.1	7.36	5.43	3.58	1.13	0.000	0.000	2.42	10.9
1964	69.9	21.5	368.5	220.8	42.3	2.01	0.584	1.68	0.117	0.071	0.407	33.8
1965	224.2	190.9	231.3	61.9	33.2	50.8	0.603	0.019	0.080	14.7	41.5	56.6
1966	71.5	198.3	109.2	135.6	57.1	1.10	0.461	21.7	0.750			
Mean of monthly Discharge	132	149	196	141	85	37	13	17	5.0	22	42	83

The previously defined hydrologic and hydraulic model was modified to incorporate a 50 foot wide spillway at an elevation 3 feet lower than the existing lake level (elevation 847). This option was developed in order to investigate the rise in water surface elevations for various storm events during a lake drawdown. The table below provides a summary of the peak inflow, outflow and existing lake surcharge elevations for various storm events.

Modified Lake Roaming Rock Conditions Peak Flows into Lake, Peak Flows Discharged from Lake and Surcharge Water Surface Elevation (Lowered Water Surface Elevation – 847)			
Storm Event (Month or Year)	Peak Flow into Lake (cfs)	Peak Flow Discharged from Lake (cfs)	Surcharge Water Surface Elevation
1 inch rainfall	45	4	847.08
2 month	95	13	847.18
3 month	213	41	847.39
4 month	315	70	847.55
6 month	556	144	847.91
9 month	873	252	848.32
1 year	1,254	392	848.77
2 year	2,088	729	849.68
5 year	3,561	1,794	850.86
10 year	4,950	2,957	851.58
25 year	7,138	4,788	852.50
50 year	9,070	6,409	853.21
100 year	11,246	8,241	853.93

This option to modify the existing emergency spillway or provide an additional spillway to allow for the ability to lower the existing lake level did yield a reasonable result in lowering the lake level and demonstrated that lake levels would rise only approximately 1.8 feet for a rainfall of up to a 1 year storm event. However, as a result of a site visit during the Fall 2009 lake drawdown and additional discussions concerning the ultimate goals of the Lake Management Committee, the scope of the study was directed primarily toward developing siphon system alternatives. The shallow depth of the lowered lake and discussion of a potential shallow rock layer in the vicinity of the emergency spillway area during the Fall 2009 site visit revealed that constructing a lowered spillway would be a difficult and expensive option. Additionally, this lowered spillway option would not ultimately satisfy (3) of the study goals; 1) lowering the lake level by a depth of approximately 10 feet every 5 years, 2) the ability to drain the lake in the case of emergency repairs and 3) the ability to remove oxygen-poor water from the bottom of the lake.

The siphon system would be able to provide for annual lake drawdown that can maintain a reasonably consistent water surface level for an extended period of time, recirculate water from the bottom levels of the lake and drain the lake, if necessary. This schematic plan was based on the premise that the siphon system would be placed overtop of the existing earthen embankment. This alignment would reduce the risks associated with excavating through the earthen embankment of the dam to a depth of approximately 15 feet necessary for a gravity system and the impacts to existing utility mains within the dam embankment. A range of pipe sizes (12" through 30") were reviewed for the siphon system to be compared to the various flow conditions anticipated for the volume of impounded water to be removed to lower the lake water surface combined with the base flow conditions during various periods of the year and flows for various rainfall events. Based on the existing construction plans for the dam, it has been assumed that the bottom of the lake is at an elevation of 820, resulting in a drawdown of 30 feet (850 – 820) to drain the lake. The hydraulic calculations cover a range of drawdowns from 1 foot per week as defined by ODNR to several feet per week.

The table below shows the estimated volume of water impounded by Lake Roaming Rock based on a normal water surface elevation of 850 to bottom of lake elevation of 820.

Existing Lake Roaming Rock – Volume of Impounded Water					
Elevation	Contour Area (sf)	Average Area (sf)	Increment (ft)	Incremental Volume (cf)	Total Volume (cf)
820	0				
		667,920	2	1,335,840	1,335,840
822	1,335,840				
		2,003,760	2	4,007,520	5,343,360
824	2,671,680				
		3,339,600	2	6,679,200	12,022,560
826	4,007,520				
		4,675,440	2	9,350,880	21,373,440
828	5,343,360				
		6,011,280	2	12,022,560	33,396,000
830	6,679,200				
		7,347,120	2	14,694,240	48,090,240
832	8,015,040				
		8,682,960	2	17,365,920	65,456,160
834	9,350,880				
		10,018,800	2	20,037,600	85,493,760
836	10,686,720				
		11,354,640	2	22,709,280	108,203,040
838	12,022,560				
		12,690,480	2	25,380,960	133,584,000
840	13,358,400				
		14,026,320	2	28,052,640	161,636,640
842	14,694,240				
		15,362,160	2	30,724,320	192,360,960
844	16,030,080				
		16,698,000	2	33,396,000	225,756,960
846	17,365,920				
		18,033,840	2	36,067,680	261,824,640
848	18,701,760				
		19,369,680	2	38,739,360	300,564,000
850	20,037,600				

Lake Drawdown

The committee has investigated the benefits of a drawdown, and they are listed below:

- Shallow water weed root systems are exposed to the drying and freezing of the winter weather
- Community members are able to work on their docks
- The possibility of winter flooding is decreased

However, there are also several principle disadvantages to drawdowns.

- Drawdowns will promote either algae blooms or aquatic plant growth due to the increase in nutrients from dead biomass
- Slower moving organisms such as snails, insects, and crayfish are killed in the drawdown, highly disrupting the lower end of the food web
- All other organisms higher up on the food web will feel negative impacts
- Winter drawdowns undermine the LMC's Weed Management Program

In the short run winter drawdowns may alleviate weed conditions, but over the long-term frequent drawdowns may undermine our Weed Management Program. According to EnviroScience, since the drawdowns are not selective in plant control, native plant species that compete with the invasive plants are wiped out in the drawdowns as well. The resulting conditions favor the invasive species (mainly Eurasian Milfoil) since it grows back much more quickly than the native plants and gives it a stronger opportunity to take our lake over since there is less competition. The LMC feels we should explore other options and drawdowns should be considered as part of the weed management program.

LMC Recommendation:

Given the above information on lake drawdowns, the LMC recommends that the board drawdown the lake no more than once every three years.

June 17, 2010

Mr. Fred Innamorato
Chairman, Lake Management Committee
Roam Rock Association, Inc.
P.O. Box 8
Roam, Ohio 44085

Dear Fred:

You requested that I review available literature regarding the ecological effects of winter drawdown and make a recommendation to the Lake Management Committee of the Roam Rock Association regarding the frequency of drawdown. The following paragraphs present the pros and cons of drawdown as I see them.

A principal benefit of winter drawdown is the low-cost removal of aquatic plants that grow in shallow water by exposing the root systems to drying and freezing. Other benefits of frequent, periodic drawdown include allowing access to the shoreline and docks for structural maintenance, protection of shoreline structures from ice damage, and increasing flood storage capacity of the lake.

Unfortunately, though, there are a number of well-documented adverse impacts associated with periodic water level drawdown in lakes and reservoirs.

Most water bodies, including Roaming Rock maintain a balance between macrophytes (rooted aquatic plants) and algal growth. Despite a tendency toward balance, oftentimes one or the other will dominate. A given lake may even shift from one condition toward the other. This is the 'something is going to grow' principal.

In the case of drawdown, as the macrophytes are killed, rotting biomass releases nutrients to the water column. The excess nutrient problem in Lake Roaming Rock is compounded because there is less standing plant material the following year to make use of this suddenly higher than normal nutrient supply. Overall, the degree of nutrient competition in the lake favors increased algal populations due to their ability to quickly uptake the available nutrients. This can produce algal blooms of the type you are all too familiar with. Small lakes frequently have been seen to shift from clear, plant-dominated conditions to turbid, algal dominated systems following a drawdown.

Impacts, including mortality, to aquatic animals is also a big risk during drawdown. Faster moving organisms like fish may be able to move to unimpacted areas during a drawdown; still, these fish may be confined to smaller, shallower areas where they fall prey to other fish or suffer from low oxygen conditions. Slower moving, more sedentary organisms like mussels, snails, insects, crayfish and

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amphibians, often can't move or are unable to find suitable habitat and may succumb to the drawdown. Overall, drawdown can have significant and long-lasting impacts on non-target organisms like snails, macroinvertebrates, the fishery and waterfowl.

Even though these impacts may seem small and be difficult to measure, they may produce undesirable shifts in the entire aquatic food web in a lake like Roaming Rock. Impacts to organisms lower in the food web (such as plants and insects) will have negative impacts on organisms higher in the food web (such as fish and waterfowl). Additionally, removal of the shelter provided by these plants can reduce young of the year survival in fish populations.

Finally, although drawdown can produce relatively weed free conditions for short periods of time, over the long-term, frequent drawdown may result in the plant community shifting from a diverse assemblage of desirable native species toward monocultures or invasive nuisance species. Drawdown is not s selective method of plant control. Desirable native species are removed along with the exotic invasive species. The resulting bare sediment is a condition which favors those species that colonize the fastest. Not surprisingly, these tend to be non-native nuisance species such as Eurasian watermilfoil and Curlyleaf Pondweed. Over time then, drawdown can promote the replacement of a diverse native plant assemblage by monocultures of invasive exotic species.

For these reasons, if the Roam Rock Association is going to do scheduled winter drawdowns, I recommend that they be done no more frequently than every three years.

Please don't hesitate to contact me should you require clarification or have further questions.

Sincerely;

Martin A. Hilovsky
President

The following references were utilized in preparing this recommendation:

Cooke, G.D., E. B Welch, S.A. Peterson, and S.A. Nichols. 2005. *Restoration and Management of Lakes and Reservoirs. 3rd Ed.* Boca Raton, FL: CRC Press.

Holdren, C.W. Jones, and J. Taffart. 2001. *Managing Lakes and Reservoirs.* N. Am Lake Manage. Soc. and Terrene Inst., in coop/ with Off. Water Assess. Watershed Prot. Div. U.S. Environ. Prot. Agency, Madison, WI.

McComas, S. 2003. *Lake and Pond Management Guidebook.* Boca Raton, FL: CRC Press

NYSFOLA. 2009. *Diet for a Small Lake: The Expanded Guide to New York State Lake and Watershed Management.* New York State Federation of Lake Associations, Inc.

Winter Drawdown- Pros and Cons

A principal benefit of winter drawdown is the low-cost removal of aquatic plants that grow in shallow water by exposing the root systems to drying and freezing. Other benefits of frequent, periodic drawdown include allowing access to the shoreline and docks for structural maintenance, protection of shoreline structures from ice damage, and increasing flood storage capacity of the lake.

Unfortunately, though, there are a number of well-documented adverse impacts associated with periodic water level drawdown in lakes and reservoirs.

Most water bodies, including Roaming Rock maintain a balance between macrophytes (rooted aquatic plants) and algal growth. Despite a tendency toward balance, oftentimes one or the other will dominate. A given lake may even shift from one condition toward the other. This is the 'something is going to grow' principal.

In the case of drawdown, as the macrophytes are killed, the rotting biomass releases nutrients to the lake. The excess nutrient problem is compounded because there is less standing plant material the following year to make use of this suddenly higher than normal nutrient supply. Overall, the degree of nutrient competition in the lake favors increased algal populations due to their ability to quickly uptake the available nutrients. Small lakes frequently have been seen to shift from clear, plant-dominated conditions to turbid, algal dominated systems following a drawdown.

Impacts, including mortality, to aquatic animals is also a big risk during drawdown. Faster moving organisms like fish may be able to move to unimpacted areas during a drawdown; still, these fish may be confined to smaller, shallower areas where they fall prey to other fish or suffer from low oxygen conditions. Slower moving, more sedentary organisms like mussels, snails, insects, crayfish and amphibians, often can't move or are unable to find suitable habitat and may succumb to the drawdown. Overall, drawdown can have significant and long-lasting impacts on non-target organisms like snails, macroinvertebrates, the fishery and waterfowl.

Even though these impacts may seem small and be difficult to measure, they may produce undesirable shifts in the entire aquatic food web in a lake like Roaming Rock. Impacts to organisms lower in the food web (such as plants and insects) will have negative impacts on organisms higher in the food web (such as fish and waterfowl). Additionally, removal of the shelter provided by these plants can reduce young of the year survival in fish populations.

Finally, although drawdown can produce relatively weed free conditions for short periods of time, over the long-term, frequent drawdown may result in the plant community shifting from a diverse assemblage of desirable native species toward monocultures or invasive nuisance species. Drawdown is generally not selective as a plant control mechanism. Desirable native species are removed along with the exotic invasive species. The resulting bare sediment is a condition which favors those species that colonize the fastest. Not surprisingly, these tend to be non-native nuisance species such as Eurasian watermilfoil, Curlyleaf Pondweed and Coontail. Over time then, drawdown can promote the replacement of a diverse native plant assemblage by monocultures of invasive exotic species.

For these reasons, I recommend that if the Roam Rock Association is going to do scheduled winter drawdowns at all, they be done no more frequently than every three years.

Complete List of Recommendations

LMC Recommendation: By-Laws

The Lake Management Committee recommends to the Board that the By-Laws are approved and placed into effect.

LMC Recommendation: Siphon System

In light of the possible EPA requirements and associated treatment costs, marginal benefits to water quality and significant cost for construction, the LMC recommends the board does not proceed with the Siphon Drainage System.

LMC Recommendation: Drawdowns

The LMC recommends that the Board drawdown the lake no more than once every three years.