POND REHABILITATION AND ESTABLISHMENT OF A SITE-BASED ENVIRONMENTAL EDUCATION CURRICULUM[1]

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Abstract: A pond rehabilitation and environmental educational project were proposed by Cliffs Michigan Mining Company (CMMC) and approved by the Michigan Department of Environmental Quality (MDEQ) and the United States Environmental Protection Agency (USEPA) as partial fulfillment of conditions for a stream mitigation permit. The goals of the project were the rehabilitation of a pond on a tributary of a local trout stream, enhancement of public access and appreciation, and the initiation of a site-based environmental education curriculum dealing with aquatic and riparian ecosystems. CMMC undertook a suite of actions to rehabilitate the fresh water pond created by an underground mining operation in 1912 and make accessible to local schools the aquatic and riparian ecosystems of the pond. The rehabilitated pond and riparian zone also provides an accessible natural area available to citizens of the nearby town for such activities as hiking, biking, walking, fishing and nature study. The project was a partnership with the local governmental unit and local school districts. Vegetative enhancement included the planting of native shrubs and wildflowers along with showy herbaceous plants in the pond, on the riparian fringe and the surrounding area. A signed interpretive trail was designed and developed around the pond. Local schools built and installed picnic tables, benches and a kiosk. CMMC developed pond lesson plans and a teaching kit tied to the Michigan Curriculum Framework and hosted a workshop for teachers from nine local schools. Classes regularly utilize the pond during the school year by conducting environmental studies. Nesting boxes, wildflower gardens, bat houses, frog deformity surveys and water quality studies are a few of the activities that have been conducted at the pond.

Additional Key Words**:** streams, stream mitigation, and environmental education

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Background

Cliffs Michigan Mining Company (CMMC), the largest mineral producer in Michigan, is an iron ore mining, concentrating and pelletizing facility located on the Marquette Iron Range in Michigan's Upper Peninsula. CMMC produces 13.0 million long tons of high quality iron ore pellets annually, accounting for all the iron ore mined and processed in Michigan. With eight developed pits, activity is projected well into the 21st century. Mining operations consist of two facilities with the East Facility located in close proximity to the Village of Palmer, Michigan. Warner Creek, State Highway M-35, a mainline railroad track and a buffer strip of undeveloped land separate Palmer from the East Facility.

A small tributary of Warner Creek was impounded in 1912 as a fresh water source for the Isabella Mine (closed in 1934) forming a one-acre pond lying south of Palmer's baseball fields. The pond on the tributary of Warner Creek is located about 1/3 mile above the creek. The resulting pond once served as a skating rink for generations of local children growing up in Palmer until the 1940's. Over the years the pond fell into disuse and eventually became a trash-dumping site. Now known as Pineview Pond, an abandoned railroad grade and road flanks the pond on the north and south respectively. These plus a road west of the pond and a berm created the impoundment that formed the pond. The riparian zone of the pond has fairly diverse vegetation, particularly the south side, consisting of native upland and wetland plant species that provided habitat for wildlife as well as being aesthetically pleasing. A small tributary flowed into and out of the small impoundment. Cliffs Michigan Mining conducted a baseline ecological stream and site assessment in 2000.

Pond Ecology

Sweep net samples of submergent vegetation in the littoral zone and visual assessments show a diversity of aquatic macroinvertebrates. Pond macroinvertebrates include the predaceous diving beetle (*Coleoptera dytiscidae*), water scorpions (*Insecta hemiptera nepidae*), planorbid snails (*Gastropoda planorbidae*), water mites (*Arachnida*), water boatmen (*Insecta hemiptera corixidae*), water striders (*Insecta hemiptera gerridae*), broad-shouldered water striders (*Insecta hemiptera veliidae*), water fleas (*Crustacea cladocera*), backswimmers (*Insecta hemiptera notonectidae*), giant water bugs *(Insecta hemiptera belostomatidae)*, small minnow mayflies *(Insecta ephemroptera Baetidae)*, northern case make caddisflies *(Insecta trichoptera limnephilidae)*, and whirligig beetles (*Insecta coleoptera gyrinidae*).

Pond vertebrates include the Iowa darter (*Etheostoma exile*), blunt-nosed minnow (*Pimephales notatus*), brook stickleback (*Culaea inconstans*) and brook trout (*Salvelinus fontinalis*). Green frogs (*Rana clamitans*) and painted turtles (*Chrysemys picta*), are also abundant in the pond.

Mammals observed at the pond include white-tailed deer, beaver and raccoon. Ducks, geese and belted kingfishers have also been observed.

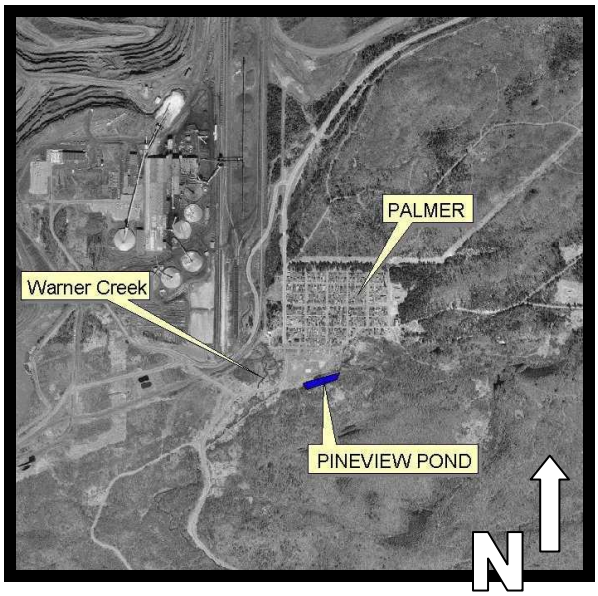

Figure 1. Location of the Pineview Pond

Integrated Actions

As part of a mine expansion permitting process, CMMC proposed several stream improvement mitigation projects in the Warner Creek Watershed that focused on Pineview Pond. These included Pineview Pond riparian area rehabilitation, enhanced recreational access and establishment of a site-based environmental educational curriculum dealing with aquatic and riparian ecosystems. Both the Michigan Department of Environmental Quality (MDEQ) and the United States Environmental Protection Agency (USEPA) approved the pond related projects as partial fulfillment of conditions for the mining permit. The pond project consisted of an integrated suite of actions that included:

- Protecting the pond and surrounding wetlands with rehabilitated aquatic and riparian ecosystems
- Developing an environmental education curriculum designed to nurture the natural curiosity of children about their world by making connections between the real world and the classroom in a wetland environment.
- Providing the citizens of Palmer and surrounding areas access to a natural area with activities such as walking, nature study and fishing.

Figure 2. Pond before rehabilitation

Figure3. Trail surface and benches for resting

Pond And Riparian Area Rehabilitation

Trash cleanup was the initial rehabilitation action for Pineview Pond, its riparian area and tributary. This work began in 2001 with trash cleanup by approximately 100 employees of Cliffs Michigan Mining Company and 50 local residents. Trash was removed from the tributary upstream, downstream of the pond, and the pond itself and the pond outlet. This included the removal of over 200 discarded tires from the pond area and items such as a rusted automobile gas tank and a cast iron bathtub from the pond outlet. Including the pond, the total distance affected by the cleanup was approximately 2,500 lineal feet. Additionally, CMMC removed considerable trash and debris that had been dumped at the proposed access site on the northwest edge of the pond. Topsoil was spread and graded and the site was hydro-seeded and mulched in preparation for native plantings. A trail was cleared and brushed around the pond to create an interpretive trail using the abandoned railroad grade and the road that flank the pond on the north and south respectively. The Michigan Department of Natural Resources (MDNR) Fisheries Division determined that brook trout winter in the pond. In 2003, three Spawning beds were established in the pond for brook trout as one component of this project. Additionally, bird nesting boxes and bat houses were constructed by students and installed as another component.

In the pond, submersed aquatic vegetation was nearly non-existent and emergent plants were very sparse. A plan was developed to plant native plantings within the pond and around the riparian fringe and to plant wetland herbaceous plants to enhance this sparse native plant community. Further enhancement of the site for education and interpretation included additional plantings of native herbaceous plants and native shrubs in the access area. Native plant seeds were spread around the riparian edge while tubers of aquatic plants were placed in the pond. As the planted aquatic vegetation has spread and diversified the richness and abundance of invertebrates has increased.

Species of aquatics and emergents planted using tubers or roots included white water lily (*Nymphaea odorata*), sweet flag (*Acorus calamus*), water plantain (*Alisma plantago-aquatica*), marsh marigold (*Caltha palustris*), and giant burreed (*Sparganium eurycarpum*).

Native herbaceous species planted in riparian and emergent zones of the pond included New England aster (*Aster novae-angliae*), flat-topped aster (*A. umbellatus*), swamp aster, (A.

punecius), smooth aster (*A. laevis*), panicled aster (*A. simplex*), Joe-pye weed (E*upatorium maculatum*), boneset, (*E.perfoliatum*), vervain (*Verbena hastata*), fireweed (*Epilobium angustifolium*), swamp milkweed (*Asclepias incarnata*), black-eyed susan (*Rudbeckia hirta*), cut-leaved coneflower (*R. laciniata*), branched coneflower (*R.. triloba*), sweet black-eyed susan (*R. subtomentosa*), beebalm (*Monarda fistulosa*), blue flag (*Iris versicolor*), lanceleaf coreopsis (*Coreopsis lanceolata*), lobelia, (*Lobelia siphilitica*), false dragon's head (*Physostegia virginiana*), oxeye or false sunflower (*Heliopsis helianthoides*), Ohio goldenrod (S*olidago ohioensis*), Smooth penstemon (*Penstemon digitalis*), fox sedge (*Carex vulpinoidea*), porcupine sedge (*Carex hystricina*), rattlesnake grass (*Glyceria canadensis*), sneezeweed (*Helenium autumnale*) turks cap lily (*Lilium superbum*), and monkey flower (*Mimulus ringens*).

Trees and shrubs planted in the access area included red oak (*Quercus rubra*), mountain ash (*Sorbus americana*), green ash (*Fraxinus pennsylvanica*), highbush cranberry (*Viburnum opulus* subsp. *trilobum*), nannyberry (*V.lentago*), alternate-leaved dogwood (*Cornus alternifolia*), serviceberry (*Amelanchier laevis*), ninebark (*Physocarpus opulifolius*), hawthorn (*Crataegus douglasii*), bittersweet (*Celastrus scandens*), red osier dogwood (*Cornus stolonifera*), American wild plum (*Prunus americana*), white pine (*Pinus strobus*), white cedar (*Thuja occidentalis*), white spruce (*Picea glauca*) and Norway spruce (*Picea abies*).

Educational Curriculum And Interpretation

A presentation on wetlands and native species was given to teachers and students at the local elementary school in 2001. Two areas in the park, or access area, were then chosen for wildflower gardens. Several classes of elementary students then planted seeds and plants in these gardens. Students from the local high school planted many of the trees and shrubs along the border of the park and riparian fringe.

The close proximity of the pond to the town and to local schools made this an excellent site for project-based environmental education. In 2003, CMMC developed a series of pond-based lesson plans that included activity sheets and outdoor classroom teaching kits. All activities were "hands-on" and tied to the Michigan Curriculum Framework. Tying the activities to the Michigan Curriculum Framework allowed teachers to meet their curricular obligations and set the stage for continuation of future pond lessons. The teaching kits included field guides to pond life, shallow pans, ladles, scoops, sampling nets, magnifying lenses, eyedroppers, tweezers, buckets, strainers, specimen containers, petri dishes, test tubes, rulers, pens and sketchpads. A teacher's workshop was conducted at CMMC facilities with 20 teachers from 9 local schools attending. To date eight local schools as well as Cub Scouts and Boy Scouts have used the pond for outdoor classroom environmental education.

Students have been encouraged to be active learners and problem solvers who appreciate and understand the interdependence of all living things. The students are able to study cause and effect and sustainability, both out of the textbook and in the environment where it exists. Educational activities were designed to foster a sense of stewardship in the students and teachers. In effect, they become part of a monitoring effort that tracks the condition of the pond and its stream through time. The educational program, coupled with recreational enhancement of the site, has resulted in a greater sense of ownership and stewardship of the pond and the entire Warner Creek watershed.

Examples of educational activities students have conducted at the pond and stream include:

- Inventory of plants and animals.
- Water quality monitoring and aquatic ecosystem studies.
- Riparian studies such as amphibian surveys. (Fig. 4)
- Ecology and entomology studies.
- Studies of seasonal changes as well as plant and animal life cycles.
- Adaptation studies of trees, shrubs, and herbaceous plants.
- Construction and placement of nesting boxes.
- Planting of wildflower gardens.
- GPS mapping of the pond and stream.

As part of the educational curriculum an interpretive trail with six thematic stations known as "Raccoon Ramble" was designed to explore the various habitats around the pond from the point of view of a raccoon. A local master watercolor artist provided an attractive and artistic rendering of the signs. School groups regularly take advantage of this nature trail to learn more about the pond and its riparian habitats while conducting outdoor classroom activities. The continued use of the pond as an outdoor environmental education site, in spite of increasing local school budget shortfalls that often resulted in restrictions on travel, is testimony to the success of the objectives of this project.

Enhancement Of Recreational Access

The north edge of the pond provided a natural setting for a park and interpretive site. This area was developed to be the focal point for the pond and access to the interpretive trail. The park and pond were designed to be an area where adults and children alike can observe a diversity of living organisms.

In 2002, a sign was placed at the park entrance recognizing all parties involved in the success of this project. Crushed limestone was installed along the entrance road and the parking area of the new park. The Village of Palmer installed poles and provided night lighting. The abandoned railroad grade was brushed out and crushed limestone installed to provide a smooth walking surface between the rails, which served to delineate the trail and to contain the limestone. The interpretive trail continues to the east end of the pond, eventually crossing a student-built bridge over the pond inlet, linking it with the road on the pond's south side. The trail completely circumnavigates the pond. High school students were employed during the summer to wheelbarrow limestone gravel between the rails, turning it into the walking trail.

Six picnic tables for the park area and five benches for the interpretive trail were built and installed by a local high school industrial arts class under the supervision of their instructor. The tables provide an outdoor classroom setting for school groups. The benches, which are strategically placed along the trail, provide places to stop and enjoy the natural setting. The shop class also built a four-sided interpretive "kiosk" that now stands at the eastern end of the park (Fig. 5). Teachers and students use the kiosk to showcase projects they undertake at the pond. The governing board of the local township continues additional recreational site development.

Future help from Michigan Department of Natural Resources (MDNR) recreation grants is anticipated.

Figure 4. Conducting deformed frog survey

Figure 5. Students building the kiosk

Summary

Cliffs Michigan Mining Company's suite of integrated actions at Pineview Pond has positively effected stream improvement in Warner Creek Watershed. The public access has created a sense of stewardship of the stream in the local community. The educational component, with its school projects, is leading to perpetuation of stream and pond health well in the future.

Once a trash-dumping site, Pineview Pond has now become a community pond. With the involvement of CMMC, local officials, and local schools the pond is fostering a new sense of community pride and is proving to be a magnet for individuals of all ages and abilities.

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