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Oden Creek Restoration – Bringing Together People and Trout

Eye-to-Eye with a Lunker Brown Trout

A 16-inch brown trout peeks out from behind a fallen cedar. Although shy, curiosity draws it closer to the window and soon we are eye-to-eye. We exchange glances until, startled, it darts back under the log. This close encounter happens several times as I look across and under the small trout stream through the six-foot window of the Oden Creek Viewing Chamber. The Viewing Chamber is just one of the attractions that draws over 25,000 visitors to northern Michigan to visit the Oden State Fish Hatchery and Watershed Walk.

Michigan's state hatchery system provides a destination that draws thousands of visitors each year. People visit hatcheries because they are interested in fish. However, once at the hatchery, there is a tremendous opportunity to motivate them to learn about stewardship messages. Simply put, fish hatcheries create "teachable moments" to convey outreach efforts focused on ecology, fisheries and fishing traditions. In this way, Michigan's state hatchery system has become both the object to attract visitors and the vehicle for delivering stewardship messages. The development of the Oden State Fish Hatchery and Watershed Walk is one of six Michigan state hatcheries that were renovated in 2002 to enhance interpretive programming. They have been integrated into the statewide park system coordinated by the Michigan Department of Natural Resources (MDNR) to reach an interested public about Great Lakes stewardship.

Oden State Fish Hatchery and Watershed Walk

The Michigan Department of Conservation constructed a fish hatchery at Oden, Michigan in the 1920s centered around two beautiful, three-acre spring ponds nestled at the base of a beech maple forest. Oden Creek was converted into concrete raceways and a nearby hatchery building to support trout hatchery operations. In 2002, the MDNR built a new state-of-the-art fish hatchery allowing restoration of the 100-acre hatchery site into an interpretive center that focuses on northern Michigan's world-class trout streams. The restoration included the removal of the concrete raceways and the creation of a trout stream that replicates the original sinuosity with a series of riffles, runs and pools.

Although the site is located along a major Michigan highway, the hatchery was not very visible and thousands of tourists would just pass by. The site's character was not inviting with its industrial chain link fence, warning signs, dirt parking lots, and lack of information. Now the entrance is highly visible. A nicely landscaped entrance invites the visitor to a Welcome Center gazebo. It is here that the main theme is clearly stated "Fish are connected to the people of the Great Lakes. Our cultural and environmental heritage reflects this relationship. Here at the Oden State Fish Hatchery and Watershed Walk, you can explore your connection to fish, streams, lakes and the Great Lakes". This theme is re-stated in various ways throughout the interpretive center.

Visitors are greeted by a 90-foot replicate of the historic 1900s "Wolverine Fish Car". This historic re-creation sits prominently at the entrance and functions as a visitor center that focuses on the cultural importance of fisheries, the role of the historic "fish cars" and current fish hatcheries. An interactive computer kiosk allows visitors to learn about the pass, invest in the future and "raise a fish" or send a fish postcard.

The Oden State Fish Hatchery and Watershed Walk project is an excellent example of a private/public partnership. The $2 million project cost was 70 percent funded by a grant from the Great Lakes Fishery Trust (private, non-profit). The MDNR provided 30 percent matching funds and a commitment for future operation and maintenance, including full-time naturalists to greet and teach visitors. The Design Team included SmithGroup JJR (Ann Arbor, Michigan), the MDNR, the Michigan State University Museum and FishPro (Springfield, IL).

The restoration of a one-half mile coldwater trout stream provided the framework that supports the rest of the park amenities including:

- Interpretive program that showcases the new, state-of-the-art fish hatchery.
- A coldwater stream that represents the physical and chemical conditions of an ideal trout stream complete with instream habitat, meanders, riffles, runs and pools.
- Creation of an underwater viewing chamber to allow visitors an eye-to-eye experience with big trout in their natural habitat.
- Re-creation of the original "Wolverine Fish Car" to provide historical context for the importance of fish.
- Development of a fully accessible, mile-long trail that winds along the rehabilitated trout stream that serves as a scale model of a Great Lakes watershed with cedar swamps, headwater streams and upland forests.
- Development of an ecological interpretive program demonstrating the connection of visitors to the Great Lakes ecosystem.

Restoring a Trout Stream

The restored coldwater trout stream is the thread that binds together all of the amenities at the facility. The original hatchery was constructed in the early 1920s on two spring ponds. These springs delivered 1,700 gallons per minute of cold, clean water to Oden Creek. Concrete raceways were constructed within the original drainage way and functioned to raise millions of brown and rainbow trout for over 80 years until the construction of the new hatchery in 2002. The concrete channels ranged from 30- to 50-feet wide and ran 2,100 feet from the spring ponds to US-31, a major tourist route. Transforming these raceways into a natural trout stream provided an opportunity to demonstrate to visitors the characteristics of a healthy trout stream, restoration techniques and the ecological importance of small- to medium-size coldwater streams to fish and the Great Lakes ecosystem.

The first challenge that faced the design team was to thoroughly assess and quantify the flow within the existing raceway channel. We were fortunate that surface water contributions were minimal and the system very stable. Its watershed is small (less than 40 acres) and entirely encompassed within the site. There were no surface water contributions from offsite and the soils were predominately sand, allowing maximum infiltration. However, the entire site floats on an extensive water table. Artesian wells are prevalent, groundwater seeps are everywhere, and after 80 years of hatchery operations there were numerous discharges that were nearly impossible to quantify.

A hydrologic investigation of the groundwater along with a detailed surface water survey and slope analysis was completed. Flow measurements were taken along the existing raceway complex at various lengths. For design purposes the entire concrete channel was divided into five distinct segments based on the hydrologic investigation and measured flow rates. Stationing

points were defined and each segment was closely investigated to identify water contributions and calibrate the flow within the system.

Utilizing the measured flows and slopes, historical documents and field surveys of other trout streams in the immediate area, a generalized concept of the stream's geomorphology was developed. The Rosgen (1996) stream classification was targeted during the design phase to include Stream Types B, C and E depending upon the specific segment and habitat type. Variables of each segment included channel slope, sinuosity, meander width ratio, entrenchment ratios, width/depth ratio, roughness of channel materials and sediment loads.

It was necessary to limit the construction activities within the boundaries of the existing raceway channel to avoid impacts to existing white cedar swamp. Therefore, some limitations were placed on the design parameters. For example: sinuosity was targeted at 1.2, although greater sinuosity would have been desirable to better reflect a more natural condition in the region. Manning's Formula was used to evaluate various scenarios by cross-section alteration of width, depth, slope, and roughness along the stream segment and stationing points. Design parameters included: maintaining a sinuosity of 1.2; pool spacing of 4-5 bankfull channel widths; meander to width ratio of 7:1; and velocity from 0.75 to 1.0 fps. Completion of the design development provided a plan view and cross section for each stationing point. The design concept was presented to the MDNR fisheries biologists and adjusted based on their technical input.

Stabilizing the streambank was very important, particularly since the soils were unconsolidated sands and not very stable. The banks were designed to maximize stability while still providing a natural appearance and valuable aquatic habitat. White cedar and birch trees salvaged from construction of the new hatchery along with selective clearing were used to stabilize the streambank toe and high-energy erosional zones. Logs of 8-10 inches in diameter were stacked two high and secured into the bank. Topsoil was used to backfill behind the logs and soil-filled jute bags were positioned over the logs to hide and create a softer and more natural edge. The jute bags were seeded with native grasses and forbs. As the jute bags decompose, the well-established root system of the grasses and shrubs will maintain the bank stability. Fish structures including half-logs, boulders, lunker structures, artificial overhangs and brush piles were all incorporated to improve aquatic habitat for fish and macroinvertebrates. The depth of the water in the stream during base condition rises to the log edge. There is a six-inch freeboard on the bank to support higher flows, although the stream is very stable and seldom rises but a few inches during wet weather events.

The stream highlights Michigan's world-class trout streams. The design incorporated instream habitat and streambed materials that match the geomorphologic conditions of each stream segment including riffles, pools, runs, point bars, and undercut banks. In general, riffles were placed in the crossover reaches, lunker structures at the apex of meanders, point bars in areas of lowest stress on banks and pools at 4-5 bankfull channel widths. The importance of each of these habitat types for fish is discussed in a continuous series of interpretive displays, "A day in the life of a trout", that leads visitors into the viewing chamber.

The streambed was stabilized with three different sizes and compositions of aggregates. Aggregate consisting of two- to four-inch cobbles and coarse sand were used in riffles areas, coarse sand and 1.5-inch natural gravel were used in pools and runs, and coarse to fine sands were used at point bars. This was an attempt to try to nourish and balance the sediment load of

the stream. As expected there has been some movement downstream of these aggregate materials as they find their natural course.

To further naturalize the stream course, various types of habitat structures were added where appropriate. For example, fallen trees, root wads and stumps, deflection logs, branch piles were placed on the banks and in the stream during construction. Riparian edges utilized bioengineering techniques that demonstrated the effectiveness of live stakes, facines and native vegetation. A JJR registered landscape architect with strong ecological experience was on-site to assist in the placement of these materials consistent with the design to achieve a natural appearance.

Construction

The project was substantially complete in March 2003. The construction was a real challenge for several reasons: 1) the workspace was limited to a maximum 60 feet wide because of the adjacent and regulated white cedar swamp; 2) the high water table and discharge from the new hatchery required constant management; 3) wet conditions and unforeseen structural support of the concrete raceways (including 1918 saw blades) were extensive; and 4) the design required a contractor with a sensitivity to fine detail work within a sensitive environment. Because of these constraints the construction was mostly completed with hand labor by a crew of five and small-scale equipment, i.e. bobcats and backhoes. The contractor, H&D Incorporated (Bay Shore, Michigan), was a major contributor to the success of this project. They took ownership and became a true partner in making sure the design intent was met. They worked closely with the landscape architect, and oftentimes improving the design with field adjustments. Although this type of restoration is unique, the contractor was successful in costing the project accurately with minor change orders.

Lessons Learned

This was a very unique project from its conception through design and final construction. Understanding the target audience, and developing the interpretive messages to meet our expectations for that audience, the re-creation of a historic fish rail car and the complete resurrection of a trout stream from concrete raceways generated a great deal of excitement as well as challenges. Specifically, the greatest challenge for this project stemmed from the existing site conditions, namely excessive groundwater and unstable soils. During the design, the challenge was to accurately quantify the flow of the raceway and use that data to design the stream channel. Fortunately, the stream's volume is close to the design intent, however, the velocity is slightly higher (0.25 fps) than we anticipated. This has resulted in the aggregate materials placed in the streambed to move a bit more quickly than anticipated. The streambed will be monitored over the next couple of years and adjustments may be made to the streambed materials if needed. During the construction, the greatest challenge was working within the narrow drainage way and the extensive dewatering and constant re-routing of the surface and hatchery discharge water.

Final Product

Hatcheries are natural destinations for visitors, offering ready-made opportunities--teachable moments--to communicate and educate on Great Lakes ecosystems, fish and the role each plays in the cultural fabric and heritage of Michigan's communities. The Oden State Fish Hatchery

and Watershed Walk represent a golden opportunity to dramatically expand both the depth and extent of visitor understanding of their role in the management of the state's natural resources. The importance of this project to the State of Michigan was clearly expressed by the MDNR Director, Mr. K. Cool, in a ribbon cutting ceremony that was attended by over 200 dignitaries including state representatives, local officials and environmental organizations.

The restored trout steam begins at the serene spring ponds where visitors can see very large fish swimming the clear, cold water. It flows from the pond as a small headwater stream, three-feet wide and three-inches deep, and leaves the site as a 13-foot wide river. The Viewing Chamber and "Big Fish Pond", both popular attractions, were positioned halfway between the re-created fish car and the new hatchery to encourage visitors to explore the entire site.

Local residents and tourists alike have welcomed the addition of the Oden State Fish Hatchery Watershed Walk. Currently, an average of 250 visitors per weekday and 350-500 visitors per weekend day visit the center. They are spending more time than ever participating in the nature programs, reading the exhibits, interacting with the kiosk, viewing the fish mounts and plasma screens in the Visitor Center. Local schools, environmental organizations and angler organizations are holding training sessions at the Visitor Center and the new fish hatchery. Programs by the on-site naturalists include fly-fishing and fly tying, watershed and water quality, and snakes of northern Michigan. The stream is teaming with trout and it is not unusual to see kingfishers, bald eagles, ospreys, deer and turtles. Recently a visitor came eye-to-eye with a mink fishing in front of the viewing chamber window.

References

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Construction of a trout stream.

The "Wolverine Fish Car" and Visitor Center connect visitors with fish and fishery culture.

Young man watches fingerlings feeding in the riffle.

Viewing Chamber is a major attraction for visitors.

Restored trout stream is enjoyed by young and old alike.

Feeding Lunker Trout at the "Big Fish Pond."

Raceways prior to stream restoration.

Viewing Chamber allows an eye-to-eye encounter with Lunker Trout.

Reconstructed "Wolverine Fish" car where visitors experience the life and times of the early 1900s.

Attractions are designed to accommodate all visitors.