The Cleanup of the Kinnickinnic River, A Model for Multi-Stakeholder Collaboration

PULLOUT

Kinnickinnic River, Milwaukee, Wisconsin: Ryba Marine Construction Company mechanically dredged approximately 167,000 yd^3 of PAH- and PCB-contaminated sediment on this U.S. Environmental Protection Agency, Great Lakes Legacy Act project.

On November 2, 2009, a *Kinnickinnic River Cleanup Celebration Event* was held at the **Paul Davis Restoration** property on the banks of the river in **Milwaukee, Wisconsin (WI)** to highlight the completion of the dredging work, which was accomplished one month ahead of schedule and under budget. Locally referred to as the **KK River,** successful environmental dredging of the river was the result of many years of planning and collaboration among the **US Environmental Protection Agency (EPA)**, the **Wisconsin Department of Natural Resources (WDNR)**, the **US Army Corps of Engineers (USACE)**, the **Port of Milwaukee**, the **City of Milwaukee**, and local stakeholders such as the **Business Improvement District No. 35.** By removing 167,000 yd^3 of contaminated sediments from the river, this project successfully gained another step towards protecting the Great Lakes and delisting the Milwaukee Estuary Area of Concern (AOC). It also restored navigability, spurred revitalization of the riverfront, and augmented local confined disposal facility (CDF) expansion plans.

The project was jointly funded by EPA and WDNR using US$14.3M from the Great Lakes Legacy Act (GLLA) fund and US$7.7M from a State of Wisconsin (WI) bond fund under Governor Doyle's *Grow Milwaukee* initiative. The GLLA, signed into law in November 2002, focused on cleaning up contaminated sediments in AOCs—within the Great Lakes (ecosystems tributary to the great lakes). Since 2004, the EPA has completed six GLLA cleanups, removing over 960,000 yd^3 of contaminated sediments from Great Lakes waterways and reducing risks to human health and wildlife at a cost of almost $119M. Sixty-eight million in GLLA funds have leveraged $51M in non-federal dollars from state, local, and private partners.

The KK River cleanup resulted in the removal of approximately 1,200 lbs. of polychlorinated biphenyls (PCBs) and 13,000 lbs. of polycyclic aromatic hydrocarbons (PAHs) that were contaminating the river. The dredged material was transported by barge and disposed of in a special cell within the Milwaukee Area CDF at Jones Island, owned by the City of Milwaukee and operated by the USACE. "The City of Milwaukee is grateful for the many partnerships that have made this project a success," said Milwaukee Mayor **Tom Barrett** during the public *KK River Cleanup Celebration Event* on November 2. "Milwaukee's economy and quality of life are directly linked to the health of Lake Michigan and its tributaries."

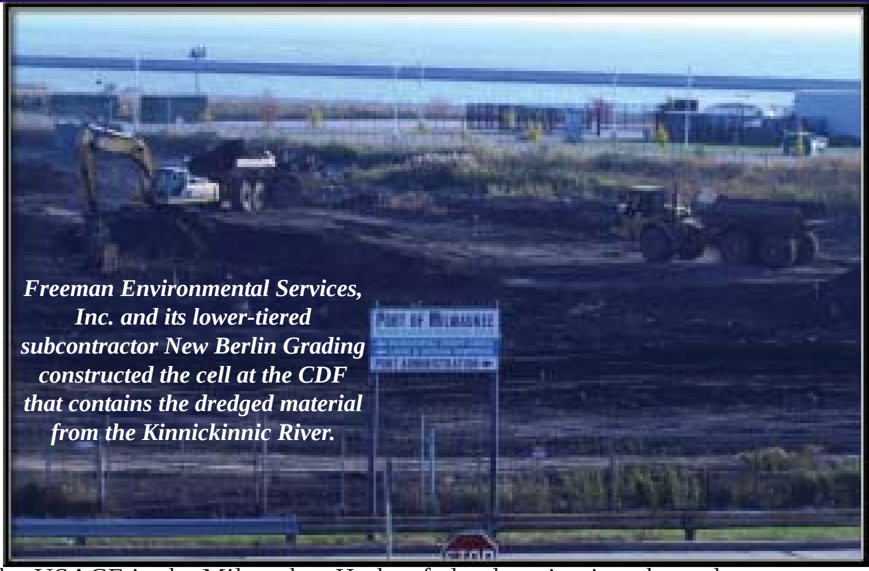
Project Background

The KK River discharges into Lake Michigan through the federal navigation harbor in Milwaukee, Wisconsin. The

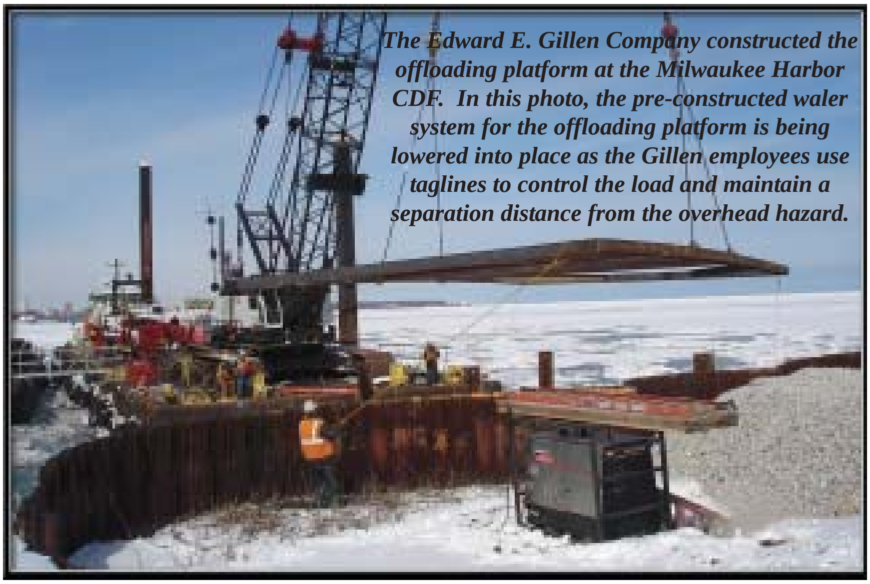
(from pg. 19)

KK River project area is approximately 2,000 ft long and 200 ft wide and is located between Becher Street (upstream end) and Kinnickinnic Avenue (downstream end) in a mixed industrial and commercial setting. The KK River is part of the Milwaukee Estuary AOC, and the project area is the furthest upstream stretch with a significant accumulation of contaminated sediment. The project area was historically dredged to a depth of 21 ft for commercial navigation prior to the 1940s.

As deep draft commercial traffic upstream from Kinnickinnic Avenue declined, maintenance of the channel depth was discontinued. Subsequently, water depth in the channel and other parts of the project area gradually declined to shallow conditions (0 to 10 ft of water) as sediment accumulated. Deep draft navigation depths are maintained by USACE in the Milwaukee Harbor federal navigation channels located downstream of the project area.



Freeman Environmental Services, Inc. and its lower-tiered subcontractor New Berlin Grading constructed the cell at the CDF that contains the dredged material from the Kinnickinnic River.



The Edward E. Gillen Company constructed the offloading platform at the Milwaukee Harbor CDF. In this photo, the pre-constructed waler system for the offloading platform is being lowered into place as the Gillen employees use taglines to control the load and maintain a separation distance from the overhead hazard.

Between the 1900s and 1970s, the river had been affected by urban growth and development, with point and nonpoint discharges and spills. These historical events resulted in significant contamination: PAH contamination was present up to 244 milligrams per kilogram (mg/kg) and PCB contamination was present up to 36 mg/kg. Regulatory and non-regulatory programs—including point source controls, spill reporting and response, hazardous site cleanups, and brownfield redevelopment programs—have significantly reduced the input of contaminants into the KK River. More recently, stormwater control requirements are beginning to address nonpoint sources. But even with these improvements, the KK River was named as one of the 10 most endangered rivers in the United States by the conservation organization American Rivers in 2007.

Currently, in addition to the contaminated sediment issues, this part of the KK River is evolving into an area for recreational- and commercial-based enterprises that requires deeper navigation depths.

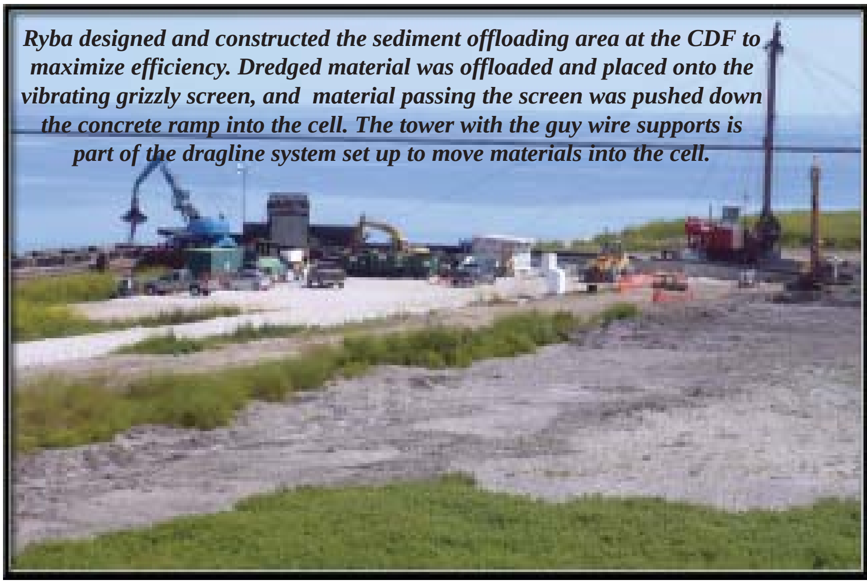
Description of the Sediment Cleanup

The WDNR, USACE, and EPA managed the remedial investigation, feasibility study, and design activities for the KK River. In 2008, EPA issued a work assignment to CH2M HILL to perform the remedial activities. The major components of the selected cleanup remedy included the following:

* CDF Cell: Construction of a specially designed cell within the CDF to contain contaminated sediments from the KK River;

* Off-loading Platform: Construction of an offloading platform to enable barges to tie up and allow offloading equipment to transfer sediments from the barges into the CDF;

* Shoreline Stabilization: Construction of shoreline stabilization features to ensure dredg-

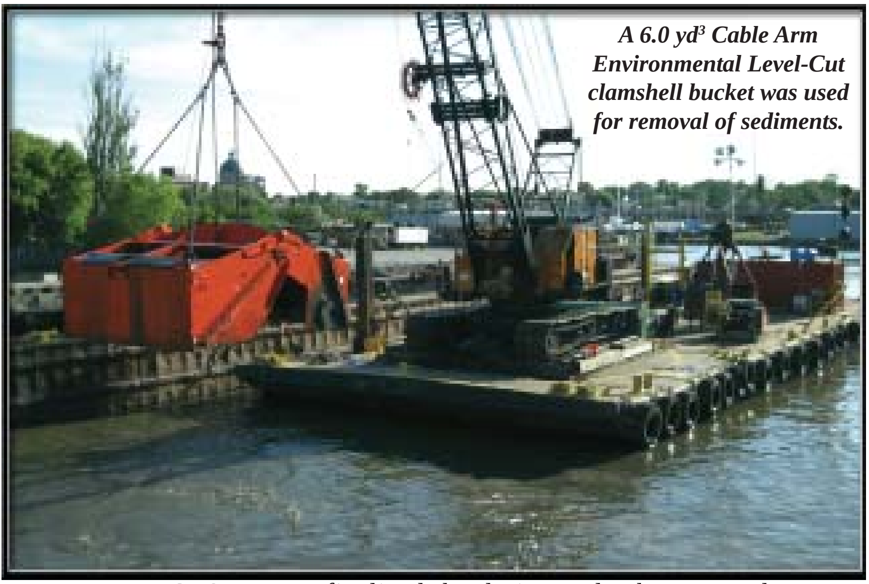


Ryba designed and constructed the sediment offloading area at the CDF to maximize efficiency. Dredged material was offloaded and placed onto the vibrating grizzly screen, and material passing the screen was pushed down the concrete ramp into the cell. The tower with the guy wire supports is part of the dragline system set up to move materials into the cell.

Ryba designed and installed an air curtain at the downstream end of the project area, as the use of silt curtains would have been problematic given the sudden increase in river velocity occurring during storm events and the need to allow boat traffic to pass frequently during dredging operations.

ing activities would not destabilize shoreline areas in the project area. Local property owners contracted directly with the Edward E. Gillen Company (Gillen) of Milwaukee to perform the work;

* Sediment Remediation: Dredging of 167,000 yd^3 of contaminated sediments within the KK River between Becher Street and Kinnickinnic Avenue with transport and disposal of sediments to the CDF. This also included residuals management activities, including confirmation sampling and analysis, to determine the nature and/or extent of dredging residuals and activities required to cover, isolate, or otherwise manage generated and undisturbed residuals. Generated residuals are created when the dredge disturbs the sediments and fine materials are resuspended into the water column and eventually resettle to the bottom. Undisturbed residuals or inventory is contaminated sediment that is not dredged.



A 6.0 yd^3 Cable Arm Environmental Level-Cut clamshell bucket was used for removal of sediments.

Preparation for Dredging CDF Cell Construction and the Offloading Platform

The CDF cell was designed to hold approximately 180,000 yd^3 of material, which was more than the 165,000 yd^3 estimated to be generated during the KK River dredging project. A series of underdrains beneath the cell channels the water from dredged material placed in the CDF cell to a collection sump. Water is then removed from the sump and pumped to a nearby sewer manhole for treatment by the **Milwaukee Metropolitan Sewerage District**. Daily testing for turbidity and weekly testing for PCBs is required as a condition of the discharge permit. Analytical testing has indicated no detection of PCBs from the start of the dredging project.

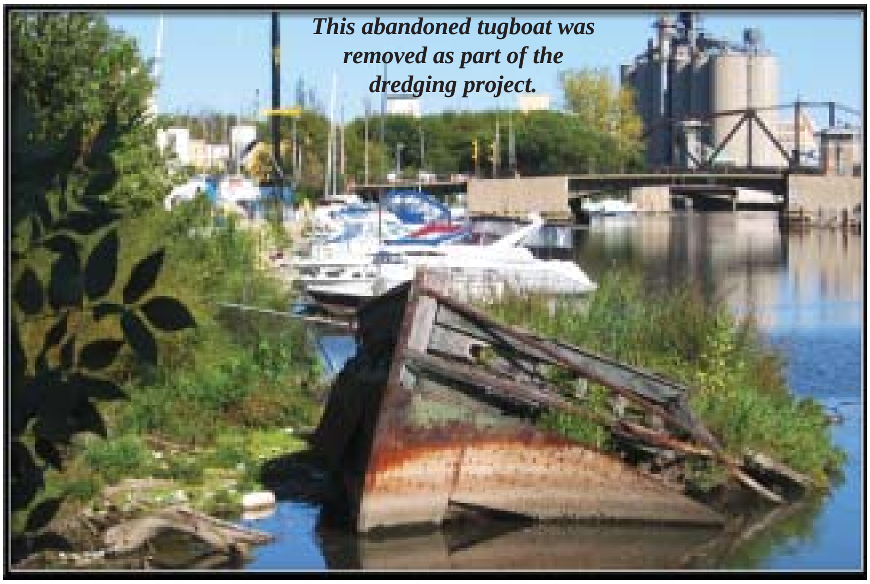
CH2M HILL finalized the design and subcontracted construction of the CDF cell to **Freeman Environmental Services, Inc. (Freeman)** of Herrin, Illinois (IL), and their lower-tiered subcontractor, **New Berlin Grading** of Waukesha, Wisconsin (WI). Construction of the cell occurred from October 2008 through December 2008.

The offloading platform was designed and built at the CDF through a subcontract to **Gillen** and was completed by March 2009. All subcontracts issued by CH2M HILL followed a competitive procurement process in accordance with Federal Acquisition Regulations.

Dredging

CH2M HILL issued the dredging subcontract to **Ryba Marine Construction Company (Ryba)** of Cheboygan, Michigan (MI), in May 2009. Mobilization activities included construction of the concrete pad at the material offloading area, performance of a pre-dredge bathymetric survey, and completion of equipment setup for the mechanical dredging and transport of material to the CDF. Ryba used an innovative *air bubble* curtain in lieu of a silt curtain to control turbidity at the downstream end of the project site. This air curtain consisted of a perforated pipe with specially designed air nozzles installed at the bottom of the river.

The pipe ran across the entire center chan-



This abandoned tugboat was removed as part of the dredging project.

(from pg. 21)

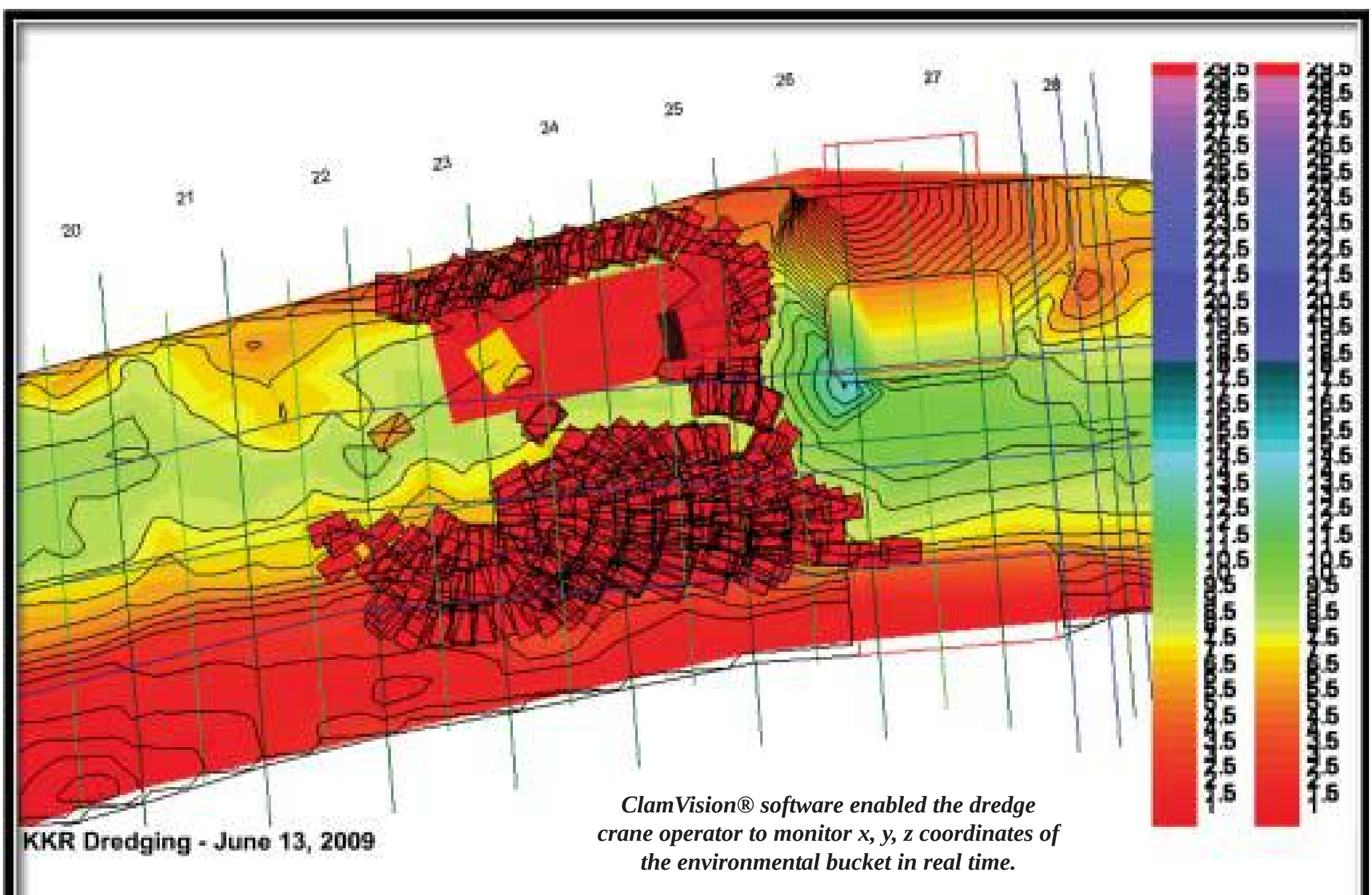
nel of the river and was attached to the protective dolphins on the downstream side of the Kinnickinnic Avenue Bridge. Silt curtains extended between the dolphins and the shorelines. Compressed air was continuously forced through the pipe, creating a wall of bubbles to reduce turbidity passing downstream. The use of the air curtain enabled recreational and project vessels to pass through unimpeded without requiring the labor-intensive task of periodically moving a silt curtain.

The propeller and driveshaft was removed in one piece.

Full-scale mechanical dredging activities began in June 2009. Dredged material was removed using a 6.0 yd^3 **Cable Arm Environmental Level-Cut clamshell bucket**, except where excessive debris was present. In these cases, a conventional clamshell bucket was used. The conventional clamshell bucket also was used to remove an abandoned wooden tugboat that was present within the dredge prism. The digging crane was outfitted with ClamVision® software, enabling the operator to monitor the elevation of the bucket as sediment was dredged, increasing productivity and reducing the overdredge quantity. Dredging was generally performed 24 hrs per day, seven days per week over the course of the project.

Dredged material was placed in a material scow and transported approximately 3 miles to the CDF, where it was off-loaded and screened to remove debris greater than 2.0 ft in diameter. The debris was washed to remove any sediment, then segregated and sent offsite for disposal or recycling. The remaining dredged material was pushed down a concrete ramp that sloped down from the offloading platform into the cell. In the beginning of the project, dredged material could flow reasonably well into the corner of the cell with the assistance of a long-reach excavator; however, after several weeks, it became a production bottleneck as the material backed up at the bottom of the ramp.

In addition, the dimensions (600 ft X 1,000 ft) and the soft bottom of the CDF cell prevented equipment from



ClamVision® software enabled the dredge crane operator to monitor x, y, z coordinates of the environmental bucket in real time.

After dredging, Ryba placed sand cover using a specially designed sand spreader for thinner areas (6.0 to 12 in.) and a conventional clamshell bucket for thicker areas (up to 3.0 ft).

pushing the dredged material off the ramp and into the far reaches of the cell. Ryba mobilized a dragline system that utilized a Sauerman bucket to move the dredged material into the cell. The dragline system utilized a series of pulleys and winches to move the Sauerman bucket back and forth across the cell, and a bulldozer was used as a moveable anchorage point for the bucket cable so the material could be evenly distributed within the cell. The installation and operation of the dragline system eliminated the bottleneck and proved to be essential for keeping the project on schedule.

Dredging was performed in a phased approach during the project. Phase 1 involved removing dredged material to an elevation of approximately 10 ft below Lake Michigan Low Water Datum (LWD) so that fully loaded barges could traverse the entire project area. Phase 2 of dredging included removing dredge materials to design elevations (typically, 20 feet below LWD in the 80-ft-wide center channel, sloping up to 11 ft below LWD at the shoreline). Phase 3 involved the dredging of additional areas based on confirmation samples collected after the completion of Phase 2.

A total of 138,000 yd^3 of sediment was dredged during Phases 1 and 2. The third phase of dredging included the removal of 29,000 yd3 of sediments (sediment quantities are currently approximate pending results of the final survey). All dredging activities were completed in early October.

Phase 4 included the placement of a residuals cover layer over those areas that did not meet cleanup objectives after Phase 3 of dredging. Cover materials included both sand and riprap. The thickness of sand cover varied depending upon the residual PAH and/or PCB levels in the sediment. A total of 42,000 t of sand and 650 t of riprap were placed as cover materials to address residual contamination left after dredging. Phase 4 was completed by the end of October 2009.

A Sauerman bucket was used on the dragline system to move sediment into the cell at the CDF.

Four Utility Relocations, Three Bridges, Three Marinas, and a Railroad Crossing—A Lot of Coordination

Four bridges (three vehicular and one railroad) cross the river within the project area. Two of the vehicular bridges are bascule bridges that required coordination with the City of Milwaukee to open them so dredging could be performed below them. The City of Milwaukee coordinated extended periods of bridge closure to allow this work to occur. More extensive coordination was required with Canadian Pacific (CP) Railroad to dredge underneath their 100-year-old rotating bridge.

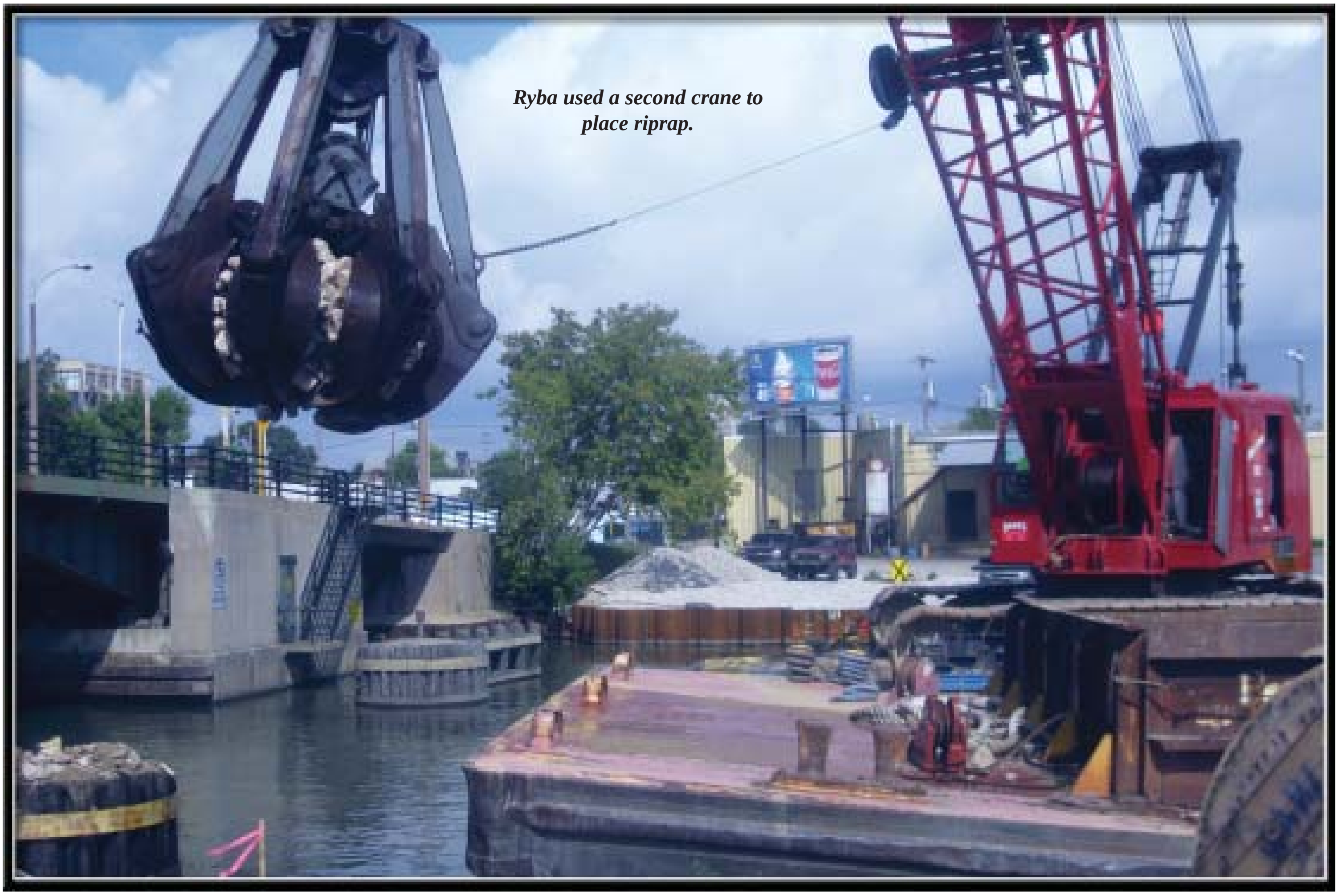
Due to high volumes of rail traffic during the day, the only feasible alternative was to establish *track blocks* during the overnight hours; the track blocks occurred for a maximum of six hours long, and multiple track blocks were required on successive nights. Lowering of the channel depth also created concern that scour might increase near the bridges; therefore, CH2M HILL performed a scour analysis for the City bridges, and additional scour protection was installed for two of the City bridges and will be installed for the CP Bridge shortly.

Four existing utilities required relocation as part of this project. Three of the utilities are owned by the City: the bridge control cables for the S. 1st Street Bridge, the bridge control cables for the Kinnickinnic Avenue Bridge, and a fiber optic line providing 911/police/fire communications for the City. The fiber optic line was temporarily removed from service because it is a redundant system, but will be reinstalled in 2010. The bridge control cables were replaced during the dredging project. The fourth utility was a fiber optic line owned by **Rogers Telecom** of Toronto, Canada. It was relocated during the dredging project and is now well below the dredge elevation.

Three marinas operate within the project area. Project stakeholders worked with marina operators before the start of dredging activities to best prepare them for the impact to their businesses, and also to determine if there were ways to minimize impacts to the marina's operations during dredging. Once Ryba was secured as the dredging subcontractor, Ryba worked directly with marina operators to coordinate boat launches in the spring and the return of boats in the fall. Laminated cards with project information were produced and provided to local marinas for distribution to their boaters.

Health and Safety

Another important aspect of the project was attention to health and safety. Tailgate safety meetings were held at the start of each work day and included all shifts and all subcontractors working on the project. Activity Hazard Analyses were required to be reviewed for all distinct tasks as well. This effort paid off. Through the completion of dredging and sand placement activities, a total of 39,000 hrs was worked by CH2M HILL and its subcontractors, Freeman,



Ryba used a second crane to place riprap.

Gillen, and Ryba, without a lost-time incident.

Interesting Debris

No large dredging project in an urban area would be complete without encountering interesting debris. Two unlabeled drums were removed from the river during dredging, which were off-loaded onto the concrete pad at the CDF, placed in overpack drums, sampled and characterized, and then disposed of offsite at a hazardous waste facility. In addition to shopping carts, bicycles, and other items, Ryba found nine bowling balls, which enhances Milwaukee's reputation as the unofficial bowling capital of the world.

Dredging Sparks Innovation, Riverfront Redevelopment and Revitalization, and Job Training

Even before the dredging concluded, the promise of a clean, navigable waterway was the incentive for a brownfield cleanup and development of the area to include a refurbished office building and boater's lounge, additional boat slips, moorings and fisherman wharves, and riverwalks. Plans are under development to remove concrete-lined channel beds on the upper reaches of the KK River and provide habitat restoration.

During the dredging, a job training partnership was arranged with the local nonprofit group **Milwaukee Community Services Corp**. One of the young adults who *shadowed* the CH2M HILL construction managers and sampling teams obtained a permanent job collecting samples based on the experience he gained on the KK River project.

The collaboration and patient coordination efforts of the stakeholders, contractors, and subcontractors on the project, along with the use of innovative methods like the air bubble curtain and dragline/Sauerman bucket dredged material disposal method at the CDF, helped deliver a successful project, with the dredging work completed ahead of schedule and under budget. The successful implementation of the remedial activities on the KK River promises to fuel the existing revitalization effort along the river for years to come.

Participants at the KK River Cleanup Celebration Event on November 2, 2009, included Wisconsin Governor Jim Doyle (speaking), Senior Advisor to the EPA Administrator Cameron Davis (behind Governor Doyle), USACE Detroit Region Deputy Commander LTC Michael Brooks (in camouflage), and Milwaukee Mayor Tom Barrett (next to LTC Brooks).

PULLOUT

DREDGING TECHNIQUES TO MEET QUALITY GOALS

The following comments come from more than 15 years of completed environmental dredging projects with Cable Arm Clamshell buckets.

1. Precision dredging requires a crane in top mechanical condition; precision instrumentation can be wasted on a poorly functioning crane.

2. Provide an accurate pre-dredge survey on a grid dense enough (1 to 2m) to provide at least one sounding within every bucket footprint.

3. Use a differential global positioning system, bucket and crane instrumentation, tide gauge, and dredging software (ClamVision). This will enable tracking of the bucket location in 3 dimensions (X, Y, & Z) to control excavation. Be sure that your dredging software provides the operator with current and target depths for each bucket location.

4. Provide independent quality assurance/control of the hydrographic surveys. Identify GPS reference marks to confirm the accuracy of surveying and positioning of GPS equipment. Triple check the coordinate transformations, datum conversions, and tide settings within the dredging software; these are the most frequent sources of errors.

5. Monitor turbidity in accordance with the approved work plan. Identify and control sources of turbidity other than dredging (i.e. prop wash, spudding, dragging cables or silt curtains, storm events, outfalls within work area, etc.). Link turbidity measurements to dredging activities/practices and show the cause-effect relationship to the crew.

6. When digging "to grade", remove soft sediment with a Cable Arm Environmental Clamshell bucket. Compare samples and test sediments using the same methods, before and after dredging. Also, precisely determine the sampling locations and depths, before and after dredging.

7. Locate sediment receiving containers or scows close to the work area to minimize cycle times. The receiving container must be large enough for easy bucket entry. A drip pan should be at the discharge point to receive the closed, filled bucket. Install a chute sloped into the material barge. This will collect any leakage while the bucket is in transit from the drip pan to the material barge. Rinse the emptied bucket in a wash tank prior to re-entering the water column.

8. Expect debris such as logs, tires, and rocks. Have a plan to deal with materials that won't allow the bucket to seal. Expect excess water when dredging to bucket refusal. Develop a plan to deal with debris and excess water, both on the water and ashore.

9. Lower the bucket through the water column at a controlled speed. Use the depth instrumentation and target depths from the dredging software to avoid overfilling the bucket. Use the horizontal bucket position to provide adequate overlap for each bite.

10. Communicate project goals to the entire dredging team. Explain the differences between environmental and production dredging.

11. Allocate time in the project schedule to train crane operators in the new instrumentation and procedures for precision dredging. Allow the operator to make test runs in clean sediment before dredging contaminated materials.

12. Involve the crew. Track project status on a real-time basis and provide daily updates. Provide feedback that includes both successes and areas for improvement. Establish realistic performance expectations.

info@cablearm.com
www.cablearm.com