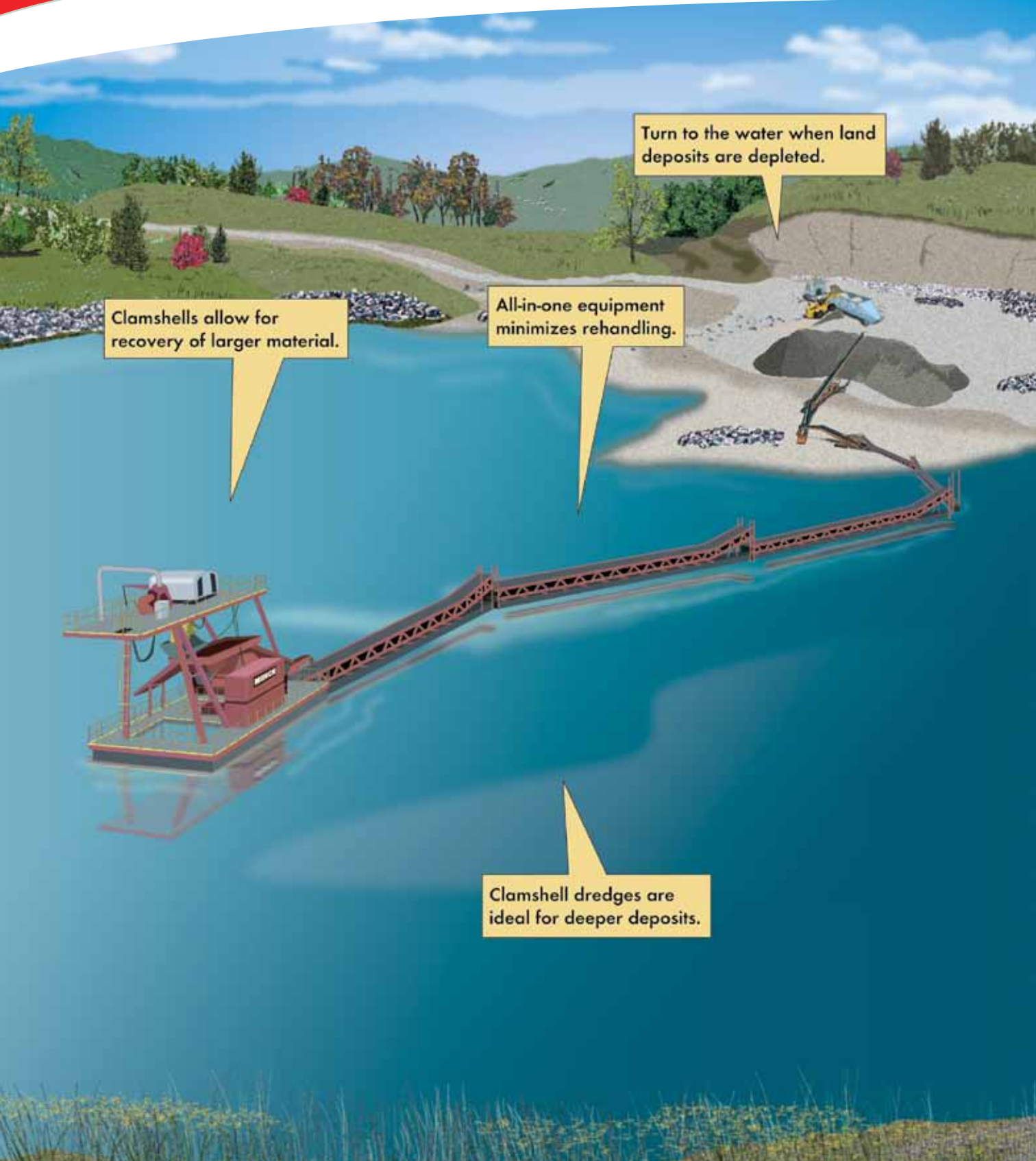


Clamshells Dig Deep



Clamshells allow for recovery of larger material.

All-in-one equipment minimizes rehandling.

Turn to the water when land deposits are depleted.

Clamshell dredges are ideal for deeper deposits.

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Clamshells Dig Deep

According to Ted Carman, sales and service manager for Rohr Corp., “The depths to which you can mine with a clamshell dredge are almost unlimited.” With a more mobile luffing jib dredge, 150 feet is a standard mining depth, and modifications allow mining to 200 feet. A gantry-style dredge can mine to 200 feet as standard and down to 400 feet with modification, he says.

Clamshell buckets range from 4 to 25 cubic yards. Bucket styles include a round nose, which can better handle a more extreme deposit, and square nose, for a lighter deposit. Carman says that round-nose buckets can be harder to handle because of their tendency to roll, but advances in bucket diagnostics systems have made this style more popular. “With onboard diagnostics, operators can track such things as bucket shell position, bucket tilt angle, and opening and closing pressure — in real time — and correct them,” he says.

“About 10 years ago, we knew we would eat all of our land (for mining), and we’d need to mine everything underwater,” says Alan Brugmann, president of Oscar Brugmann Sand & Gravel. “We bought a basic luffing jib dredge to start, with a 6-yard bucket, but we recently put in a gantry-style dredge with an 8-yard bucket. With the luffing jib dredge, we average about 200 to 250 tons per hour. With the gantry, the

hoist rolls back and forth, and we’re digging two holes. Even though the buckets are only 2 yards different in size, we’re getting 325 to 350 tons per hour with the gantry,” he says.

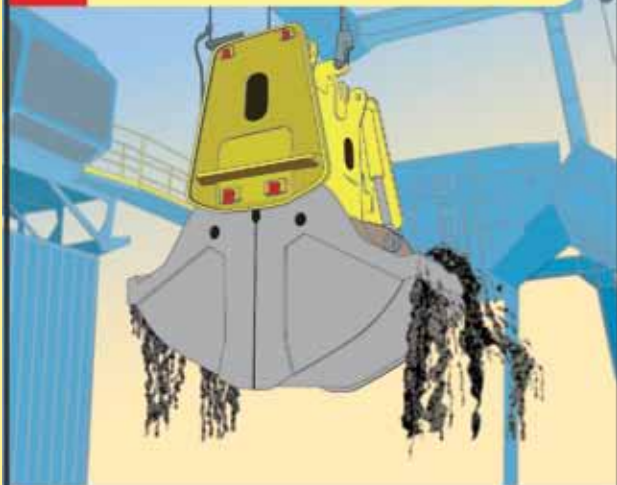
Brugmann notes that clamshell dredges are ideal for operations with large material in their deposits, in addition to depth. “We have a lot of rocks in our deposit, so we have three crushers in our plant,” he says. “We use everything, including big rocks for landscapers in the area. There’s no waste.”

“As with any above-water mine, an underwater operation must start with a good mining plan,” says Brad Barton, vice president and general manager at Concrete NorWest, a division of Miles Sand & Gravel. Concrete NorWest currently operates three clamshell dredges ranging from 6 to 16 cubic yards. “You need to know your deposit depth and type of material,” he says. “How consolidated is the deposit? Is there large material in it, any clay? You know the gravel is down there, but you can’t see it. So a thorough geologic and hydro-geologic assessment is the first thing you need out of the boat.”

Barton says, in addition to a good mine plan, an experienced operator is equally important. “It takes a special person to run a dredge,” he says. “Yes, it’s more automated today, but the operator still has to pay attention and plays an integral part in the extraction process.”

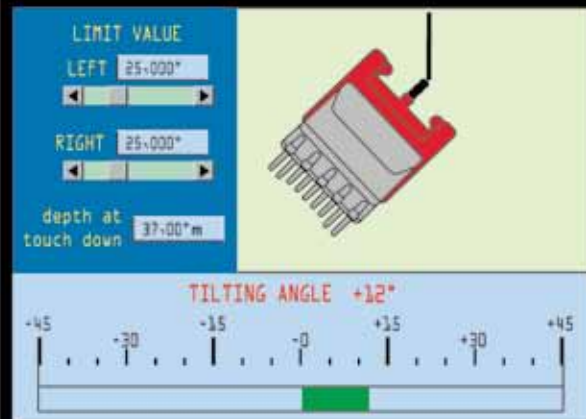
OPERAT

1 Mine deeper with clamshells



In deep deposits and deposits with a lot of oversize material to be recovered, the clamshell dredge is an ideal mining method. Although capital cost is greater than that of a dragline, the material can be mined more completely. And the all-in-one nature of the dredge — feeding the plant directly via conveyors — can reduce the need for additional equipment on land, including loaders, excavators, and haul trucks, ultimately resulting in lower operating costs.

4 Take out the guesswork



New advances in technology have taken much of the guesswork out of clamshell dredge operation. Diagnostic systems, standard on new dredges and retrofittable to older dredges, can be an invaluable benefit when dealing with tough deposits. The systems typically monitor such variables as bucket shell position (with adjustable open and close limits), bucket tilt, closing and opening pressure, oil level and temperature, and oil filter condition.

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2 Mobility and capacity considerations



The two clamshell dredge styles include the gantry (above) and the luffing jib (see no. 3). A luffing jib dredge is the smaller of the two. It can be disassembled and reassembled more quickly and easily, making it more portable. But it has a smaller capacity, allowing up to an 8 cubic yard bucket, and it can mine only to about 150 feet. The gantry-type clamshell dredge, while harder to move, allows buckets up to 16 cubic yards, and it can mine to depths of 300 to 400 feet.

3 Know your deposit



Deposit depth is not the only factor that can affect a dredge choice. Compact material with a lot of clay can dictate bucket choices, including bucket shape and tooth options. Oversize material can indicate a need for onboard or on-shore crushing capabilities. Fine sand may require onboard dewatering. Conveyor transfers and power delivery are also affected by the underwater geology. A hydrogeologic study should be the first step in creating a solid mine plan.



Alan Brugmann is president of Oscar Brugmann Sand & Gravel in Mantua, Ohio. Brugmann began working in the family-owned business at age 14, driving trucks in the pit. Founded in 1929 by his grandfather, Oscar Brugmann Sand & Gravel employs 16 people. Brugmann's brother and two cousins share equal responsibility with him in running the company.

5 Patience and perseverance



Operating a clamshell dredge requires patience. Some shifts might yield 1,500 tons, where others bring in only 200 tons — all in the same deposit. Variables that affect production include rocky or compact material. But operators should avoid the temptation to “cherry pick” the easier sections in tough deposits because the practice can lead to slough and other long-term issues with the deposit. The best operators will persevere and stick with the deposit.

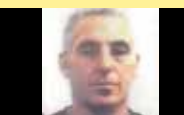
6 Low maintenance ≠ no maintenance



Today's clamshell dredges are surprisingly low maintenance machines. But low maintenance does not mean no maintenance. Scheduled downtime for maintenance reduces the risk of unplanned downtime for repairs. Preventive maintenance includes following manufacturer recommended schedules for greasing. Operators should also conduct routine, pre-shift inspection of the cables, wear panels, bucket, drives, hydraulics, and conveyors.



Brad Barton, vice president and general manager of Concrete Nor'West, has been working in the aggregates industry for 30 years. Concrete Nor'West, a division of Miles Sand & Gravel Co., is located in the Puget Sound region of western Washington. Starting in 1980 working as a grounds person for a small sand and gravel operation, Barton says his education has been experience in the industry.



Ted Carman is sales and service manager for Rohr Corp. His current position concentrates on servicing the company's customer base throughout North America. Carman began his career in the ready-mixed concrete sector; he moved into his current role after graduating from California University of Chico in 2005.

Voices of Experience

Brad Barton

With a clamshell dredge, experience is the best teacher, says Brad Barton, vice president and general manager at Concrete NorWest, a division of Miles Sand & Gravel. With experience, the operator will learn how to adjust technique as the deposit changes over time, mining from day to day and not leaving material behind. “It goes back to having a good site assessment done first thing,” he notes. “Understanding the aggregate deposit, and how the water table will fluctuate on an annual basis.”

That said, Barton explains that the greatest risk for a clamshell dredge, and one that can't easily be predicted, is a cave-in. “I'd have to say that the biggest fear dredge operators have is burying the bucket,” he notes. “In an extreme case, a slide of the material below the water can bury the bucket, and it's difficult — at best — to extract it. You have to cut the cable, bring in a new bucket, and it can take days, or even weeks, to dig out the old bucket with the new one.” Barton says that an experienced operator knows to pay attention to each cycle and can sense an impending cave-in, waiting out a few cycles to let the material fall and settle.

On the maintenance side of clamshell dredge ownership, Barton says it is a machine that offers few maintenance concerns. “From a mechanical aspect, operations with clamshell dredges typically have the same maintenance needs as all aggregates operations,” he says.

The clamshell dredge's larger maintenance concern has to do with the limitations presented by working over water. “You can't always get the dredge to shore, so it naturally complicates the process by being on the water,” he explains.

Alan Brugmann

The best advice I can give with clamshell dredging is to have patience,” says Alan Brugmann, president of Oscar Brugmann Sand & Gravel, based in Mantua, Ohio, near Cleveland. “You're digging and digging, and it can be rocky. Your bucket can go down and tip — and then close on nothing. Especially with a luffing jib, it's like the crane game in an arcade.”

Brugmann explains that his company is a smaller, family-owned operation with production of about 600,000 tons per year. As president, he continues to operate the company's dredges. Oscar Brugmann's first dredge was a luffing jib. Today, the company owns a new gantry-style dredge, as well. “With our smaller dredge, and in our deposit, I would find that there were some days we might only get 200 tons. Others, you'd get 1,500 tons or more. You have to just stick with it,” he says.

“It's a pretty well-known fact that running a dredge takes a different type of person,” Brugmann notes. “I like it. It's quiet. I'm by myself. You would think it would be the same thing over and over, but it changes all the time. I don't get bored.”

For example, he says, when claiming hard, compact material, the bucket has to close more slowly in order to cut through the material. For loose material, the bucket should close more quickly in order to retain it.

Brugmann says he appreciates the onboard diagnostics that help him with each cycle. “But you have to have a feel for it, too. When I run the luffing jib, just by watching the cable, I can almost picture in my mind how the bucket is tipping. Using the joystick, I could almost do it with my eyes closed. That comes with experience. It's hard to describe,” he admits. “But when it's going well, it's a wonderful thing.”

Ted Carman

According to sales and service manager Ted Carman, Rohr Corp., each dredge is unique because deposits differ. However, common trends include better automation and diagnostic capabilities.

Diagnostics systems are invaluable for dredge operators and maintenance personnel because of their ability to continuously monitor operational conditions, as well as maintenance needs. The dredge operator can track, in real time, the bucket shell position, bucket tilt, and pressures for opening and closing the bucket. The diagnostics will also track oil level in the oil reservoir, oil temperature, and the condition of the oil filter. “It's a huge advance having complete observation of the bucket,” Carman says. In addition, technology such as GPS and echo mapping offer “map-as-you-mine” capabilities.

But the real advantage of clamshell dredging has not changed over the years, Carman says. “Clamshell dredges eliminate the need for additional machines in processing the deposit. It can all be done on one machine,” he explains. “For example, if you use a dragline, you have to dump and stockpile the material. You use a loader to load a haul truck and then an excavator or another loader at the plant. Counting the dragline, that's four machines and four operators. With a clamshell, you have one operator feeding the plant directly via conveyors.”

Carman explains that dredges also can be built to house onboard crushers and screens for initial processing before the material is even conveyed to land.

“Using a clamshell dredge, you can mine material for less than \$0.50 total cost per produced ton, with total cost being your initial investment, maintenance, power, and labor,” he says, comparing that cost to mining via dragline, which can create a cost of \$2 per produced ton.