To: Board of Commissioners, Lake Sinissippi Improvement District
From: Greg Farnham
Date: February 9, 2010

Re: Comparative Cost Analyses and Considerations of Sediment Dredging

Now that we've completed the technical project with the US Army Corps of Engineers, we need to investigate options for sediment dredging in the lake and river and decide where we go from here. Superficially, it appears that we only have to consider two options: hire subcontractors to do the work or acquire a dredge and do the work ourselves. However, within those options the devil is in the details.

I've investigated a number of the details over the past few weeks and would like to share with you what I've learned and how these details impact the decision process.

I see the interrelationship of these details in many different dimensions, much like multi-dimensional checkers.

- Sediment Quantities
- Sediment Placement Volumes
- Equipment Specifications and Selection
- Equipment Ownership and Operating Costs
- Financing
- Cost to the Taxpayer
- Operating Parameters and Costs of Placement
- Regulatory Permits
- Personnel
- Supervision and Management

<u>Sediment Quantities</u>

First, it is important that we quantitatively compare apples with apples when assessing the volumes of sediment to be removed from lake sites.

The industry generally considers the volume of sediment to be dredged as the in-situ sediment volume as it rests on the lake or river bottom. The in-situ sediment will have a certain percentage of moisture, usually bound or otherwise trapped water within the semi-solid particulate matrix. So, if we wish to dredge 100 CY (cubic yards) of sediment from the lake bottom and the sediment has an in-situ moisture content of 10% (90% solids), then after the sediment has dewatered and desiccated at the upland placement site the actual volume of dried sediment will be only 90 CY. If the in-situ moisture content were 20%, then the dewatered volume of sediment would be 80 CY, and so on.

However, this is only part of the story regarding sediment quantities.

The pump on a hydraulic dredge is not capable of pumping in-situ sediment with high solids content and, therefore, the sediment must be diluted with lake water to form a slurry of low solids content. The dredge that was used for the Geotube breakwater project in 2005 pumped sediment slurry at a solids content of about 12%; the US Army Corps Lake

Sinissippi Alternatives Report references a solids content of 10% for calculating the capacities of potential upland placement sites. For illustration purposes I'll assume a solids content of 10%.

The parameter of slurry solids content is significant in terms of the quantity of sediment slurry that must be pumped and stored at placement in order to remove a given quantity of in-situ sediment. For example, to dredge 100 CY of in-situ sediment we need to determine the volume of sediment slurry so as to size a sufficiently large placement site. That relationship can be described mathematically as:

$$Q_1 \times X = Q_2 \times Y$$

where, Q_1 is the quantity of in-situ sediment to be dredged
X is the solids content of the in-situ sediment
Q_2 is the quantity of pumped sediment slurry
Y is the solids content of the pumped sediment slurry

In this example, Q_1 is 100 CY of sediment on the lake bottom with 10% moisture content in-situ (X = 90% solids content). The desired solids content for pumping is 10% (Y) and we want to find Q_2, the quantity of sediment slurry that will be pumped to and held in an upland placement site.

$$100 \text{ CY} \times 0.90 = Q_2 \times 0.10$$
$$Q_2 = 900 \text{ CY}$$

If Y is changed to 20%, for example, then the equation will be

$$100 \text{ CY} \times 0.90 = Q_2 \times 0.20$$
and,
$$Q_2 = 450 \text{ CY}$$

In general, the quantity of in-situ sediment to be moved (Q_1) multiplied by the ratio of in-situ solids content to pumped slurry solids content (X/Y) will yield the quantity of slurry to be pumped (Q_2). Thus, in the first example

$$Q_1 \times (0.90/0.10) = Q_2$$
$$100 \text{ CY} \times 9 = 900 \text{ CY}$$

and in the second example

$$Q_1 \times (0.90/0.20) = Q_2$$
$$100 \text{ CY} \times 4.5 = 450 \text{ CY}$$

In both examples, the final volume of dewatered sediment at the placement site will be 90 CY.

Sediment Placement Volumes

As I mentioned above, the parameter of solids content of the pumped slurry becomes especially significant when sizing upland placement sites.

To dredge 100,000 CY of in-situ sediment (90% solids) at a 10% solids content of pumped slurry, would require 900,000 CY of slurry to be moved to an upland placement site where the slurry would be held for a sufficient time to decant the clear water and allow the sediment to dewater and desiccate.

A quantity of 900,000 CY of slurry is huge! If a 5-foot (1.67 yd) high earthen berm were constructed to hold the pumped slurry, then the surface area of the containment berm would need to be 538,922 yd^2. If this areal size were in the shape of a square, the dimensions of the square would be 734 yd x 734 yd, or 2,202 ft x 2,202 ft, which is almost 1/5 of a square mile!

The significance of this factor also comes into play when we look at the economy and efficiency of production rates of dredging. I'll review this again in a later section, but for purposes of a brief explanation let's assume we're using a small dredge with a rated capacity of 125 CY/hr. Given planned and unplanned downtime, I'll assume that the dredge has a nominal production rate of 75% of capacity, or 94 CY/hr. To maximize efficiency and economy, we would normally run the dredge 1,260 hours during the season (1,260 hours is the standard working hours per year in Region 4, US Army Corps).

94 CY/hr x 1,260 hrs = 118,440 CY of in-situ sediment

Assuming the same solids content as in the above example, this quantity of sediment (Q_1) would be transformed into 1,065,960 CY of sediment slurry (Q2) to be pumped and stored at upland placement sites. This is a non-trivial challenge!

The Lake Sinissippi Alternatives Report specifies that a containment basin for placement of 3,000 CY of sediment would need a volume of 37,500 CY, assuming 10% solids, 90% water and a safety factor of 35%. This is a similar ratio of dredged sediment to containment volume as in the above example.

Other references recommend that the volume of a containment basin should be at least 1.3 times the volume of sediment to be dredged, with at least a foot of freeboard; this, of course, is significantly smaller than the US Army Corps' recommendation and the examples above. Presumably, the smaller containment volume could be used in the case of sediment with a high concentration of heavier particles, such as sand and gravel, which would quickly settle out of suspension. With rapid settling of particulates, the slurry water would clear quickly and the decant water could flow over the crest of the containment weir and drain to the lake. Decantation and drainage of return water from the settling basin could be at the same rate as filling of the basin with sediment slurry from the dredge pump.

Not so with sediment of high concentration of silt, clay and organic material, as we have in Lake Sinissippi. The time for fine silt and clay particles to settle out of suspension can be a matter of an hour to 24 hours. In this situation, the rate of decantation from the basin, whether by gravity or pump, would be less than the in-fill rate of the dredge pump. Running the dredge pump continuously in excess of the decantation rate would risk overtopping the containment berm.

Equipment Specifications and Selection

I contacted Ellicott Dredges, Baltimore, MD, and IMS Dredges, Prairie Village, KS (with factory in New Richmond, WI). I learned that Ellicott specializes in large cutterhead dredges for sediment with high sand content and large volume productions – I didn't pursue Ellicott further. IMS manufactures smaller augerhead dredges with self-propulsion, i.e. no cable winches or spuds. In the references section is an email from the IMS sales director with price quotations of three pieces of equipment: 7012 HP, 5012 HP and 5012 LP. Specification sheets of each of the models are included in the Dredge Specifications section.

I discussed with the IMS sales director the general physical conditions of our lake and sediment and general volumes of sediment to be moved. The director recommended Model 7012 HP as the most cost-effective dredge for our purposes, given a sediment content of high silt, clay and light sand with a semi-solid consistency. Model 5012 LP is a smaller dredge with similar capability.

Note: I didn't investigate other dredge manufacturers, suppliers of used dredges, etc or spend more time in evaluating types of dredges best suited for our lake conditions -- this is not the purpose of my report. My contact with Ellicott and IMS was to obtain current pricing for new equipment in the 8-inch to 12-inch discharge size range of dredges. I wanted to use those numbers in several different cost analysis worksheets to get a general idea of the costs of ownership and operation. If the Lake District goes further with this investigation, then at some point we would be wise to hire a dredging consultant to advise on equipment specifications and selection.

Equipment Ownership and Operating Costs

Equipment costs include the capital costs of purchasing or leasing the equipment and the regular, usual and customary recurring costs of operating the equipment. There are also a number of personnel and indirect costs that must be determined to arrive at a final estimate of total cost of owning and operating equipment.

One reference indicated that the initial capital cost of equipment is usually 25% of the total cost incurred during the useful life of the equipment ("Cost of owning and operating construction equipment." Chapter 2 in Construction Equipment Management for Engineers, Estimators and Owners by D.D. Gransberg et al. 2006. CRC Press, Boca Raton, FL). Thus, a piece of equipment that lists for $100,000 could cost the owner about $400,000 in ownership, operating, personnel and indirect expenses over its expected life.

Ownership Costs:

- Initial Capital Costs including dredge equipment price, discount, extra equipment, taxes, cost of shipping and cost of assembly
- The cost of a transportation trailer is not included in the prices quoted by the dredge manufacturer – I added an amount to capital cost to cover purchase of a commercial trailer for the dredge
- Investment Costs including allowance for depreciation and interest costs or lease payments

Operating Costs:

- Fuel Consumption Cost is a function of engine size, type of fuel, engine condition, engine power factor, operating time factor and fuel cost
- Filter, Oil and Grease Cost is a function of engine size, engine condition, cost of parts and supplies, oil change frequency, crankcase capacity, make-up oil between changes, service cost, hydraulic fluid, service truck and shop allowance, handling and disposal of hazardous materials
- Repair and Maintenance Cost is a function of equipment condition, major overhaul, mechanics' labor, cost of parts and supplies, service truck, repair shop overhead
- Special Items such as cutter blades

Personnel:

- Operating Labor Cost including wages and labor burden expenses of FICA/FUTA/SUTA taxes, insurance and workers' compensation

Indirect Costs:

- License fees
- Storage
- Utilities
- Insurances – fire, theft, accident, liability
- Property taxes
- Jobsite and storage security
- Inspection fees
- Record keeping
- Operator's training
- Regulatory permits
- Administrative overhead
- Accounting and audit fees
- Construct temporary placement sites
- Land spread, close and grade placement sites
- Engineering
- Land rights
- Legal and professional fees
- Contingency

Equipment Downtime – Planned and Unplanned:

- Refueling
- Equipment breakdown and repair
- Weather and lake conditions
- Mobilization and demobilization
- Holidays

There are several methods of estimating costs of ownership and operation including the Caterpillar method, the Association of General Contractor's method, the US Army Corps of Engineer's method, the University of Florida method and others. I selected the Caterpillar method, the US Army Corps' method (of which there are two different worksheets) and the University of Florida method as illustrations to develop cost estimates of ownership and operation; the methods are available on-line. [Work sheet forms and instructions for the US Army Corps and Florida methods are in the Cost Schedules section.] These methods do not include estimates of personnel costs and indirect costs, which have to be added to the ownership and operating cost estimates. Equipment downtime does not influence direct or indirect costs, but is a significant factor in determining production rates and thereby influences total operating cost per hour and cost per CY of sediment dredged.

(Note: I found another reference on costing: "Estimating dredging costs". Appendix 9 in Handbook of Dredging Engineering, 2nd ed by John Herbich, 2000, McGraw-Hill, New York. I was unable to access the appendix on-line, so we would need to locate the book in a library or order a copy.)

The Cost Analyses section includes worksheets of the costing methods:
Schedules A – D are worksheets of the four costing methods for IMS Model 7012 HP (12 in).
Schedules E – H are worksheets of the four costing methods for IMS Model 5012 LP (10 in).

I've estimated personnel costs by assuming two technicians to operate the dredge, as specified by the manufacturer. I used $15 per hour to include the wage and labor burden expenses per technician. There are other considerations regarding personnel that I cover in a later section.

Indirect costs will add up quickly, I suspect. The costs of sediment placement activities could be significant -- perhaps $20,000 per year (engineering to design placement berms, construction and closure of berms, possible land rental, monitoring, etc). I received a quotation from our insurance broker that property and liability coverage on equipment valued at $500,000 will run at least $2,500 per year. Lake District financial activities will also expand dramatically, moving us away from handling the bookkeeping internally with a volunteer financial review committee. With much larger sums of money involved, we will more than likely be advised to hire a part-time bookkeeper/accountant and have a formal independent audit of the annual financial records. This alone would probably add another $2,000 per year in expenses. For costing purposes I assumed an additional $30,000 per year in indirect costs.

The table below summarizes results of the four costing methods for Model 7012 HP and reports costs per hour using 1,260 hours per year as time available for work (USACE factor).

Model 7012 HP

Costs/hr	CAT	USACE 1	USACE 2	FLORIDA
Ownership Cost	$ 66.59	$ 42.52	$ 65.28	$ 61.22
Operating Cost	87.34	86.87	106.21	79.41
Total Ownership and Operating Costs	$ 153.93	$ 129.39	$ 171.49	$ 140.63
Personnel Cost	30.00	30.00	30.00	30.00
Indirect Cost	24.00	24.00	25.00	24.00
Total Cost/hr	$ 207.93	$ 183.39	$ 225.49	$ 194.63

The table below summarizes results of the costing methods for Model 5012 LP and reports costs per hour using 1,260 hours per year as time available for work.

Model 5012LP

Costs/hr	CAT	USACE 1	USACE 2	FLORIDA
Ownership Cost	$ 47.92	$ 30.59	$ 46.97	$ 44.05
Operating Cost	65.29	64.97	79.58	59.57
Total Ownership and Operating Costs	$ 113.21	$ 95.56	$ 126.55	$ 103.62
Personnel Cost	30.00	30.00	30.00	30.00
Indirect Cost	24.00	24.00	24.00	24.00
Total Cost/hr	$ 167.21	$ 149.56	$ 180.55	$ 157.62

The cost analysis methods above are instructive, in as much as they attempt to quantify various cost parameters. These methods would be used by commercial firms to budget a pro forma profit and loss statement for a proposed dredging project. These numbers don't present projected cash flow, however, which would be the main interest for the Lake District. Depreciation is a P&L cost for commercial firms; however, depreciation would not be charged against income for a governmental unit. Also, the four methods of cost analysis do not include repayment of principal, which would be a major cash outflow for the Lake District.

With this in mind, I prepared several cash flow statements using different values for the parameters of interest rate and maturity. In these examples, the ownership cost consists of the annual amortized payments (principal repayment and interest) expressed as cost per hour (based on 1,260 hours of work time per year). To those ownership costs, I added the average values of operating costs given in the four methods above and the same amounts for personnel and indirect costs.

The four cash-flow examples use current interest rates and maturities: (1) Conventional bank loan at 6.5% for 10 years, (2) Municipal note at 3.75% for 10 years, (3) Municipal bond at 4.5% for 20 years, and (4) State trust fund loan program at 5.5% for 20 years.

Model 7012 HP Principal amount $596,070, fully amortized

Costs/hr	6.5% Loan 10 yr	3.75% Note 10 yr	4.5% Bond 20 yr	5.5% Loan 20 yr
Ownership Cost (P&I)	$ 64.46	$ 56.80	$ 35.91	$ 39.05
Operating Cost	89.96	89.96	89.96	89.96
Total Ownership and Operating Costs	$ 154.42	$ 146.76	$ 125.87	$ 129.01
Personnel Cost	30.00	30.00	30.00	30.00
Indirect Cost	24.00	24.00	24.00	24.00
Total Cost/hr	$ 208.42	$ 200.76	$ 179.87	$ 183.01

Model 5012 LP Principal amount $428,881, fully amortized

Costs/hr	6.5% Loan 10 yr	3.75% Note 10 yr	4.5% Bond 20 yr	5.5% Loan 20 yr
Ownership Cost (P&I)	$ 46.38	$ 40.87	$ 25.84	$ 28.10
Operating Cost	67.35	67.35	67.35	67.35
Total Ownership and Operating Costs	$ 113.73	$ 108.22	$ 93.19	$ 95.45
Personnel Cost	30.00	30.00	30.00	30.00
Indirect Cost	24.00	24.00	24.00	24.00
Total Cost/hr	$ 167.73	$ 162.22	$ 147.19	$ 149.45

Note: Used dredge equipment is available at lower cost than that of new equipment, of course. However, there are other factors to be evaluated with used equipment, such as unknown prior use, equipment condition, anticipated equipment life, repair and maintenance requirements, uncertain salvage value, lack of warranty and service and whether financing is available. The cost analyses done with new equipment can be done with used equipment based on different assumptions. The capital cost and investment cost will be lower with less expensive machinery, although many of the operating, personnel and indirect costs will likely be unchanged. A reference stated: "Due diligence is a must if you are considering a used dredge."

Financing

Section 33.31, Wis. Stats., gives lake districts the power to finance. Section 33.30(4)(a) limits the annual tax that lake districts can levy to a rate not to exceed 2.5 mills of equalized value. The 2009 equalized value for the Lake District is $109,253,353, which equates to a tax levy maximum of $273,133.

Conventional Loan

January 22nd I spoke with representatives of M&I Bank for information on conventional bank loans, secured by the dredging equipment as collateral, and on leasing options for the equipment. In the case of a conventional loan, the Lake District would own the equipment and would be obligated for repayment of principal plus interest. The bank quoted a current rate and maturity of 6.5% for 10 years, fully amortized.

Equipment Lease

An equipment lease is a financial lease that is written for a term not to exceed the economic life of the equipment. Normally, an equipment lease is noncancellable and the lessee must maintain the equipment. A discounted cash flow analysis can be done to analyze the costs of lease versus purchase.

I provided information on Lake District finances to the leasing arm of M&I in order to obtain lease pricing. The bank has advised that it is unable to offer a lease proposal at this time due to continued credit challenges in the public financing arena. The bank advised that lease options will become available as the municipal lease markets stabilize and improve.

Municipal Financing

On January 27th Jim Gronowski and I spoke with a representative of Ehlers and Associates, Inc., the largest municipal finance broker in the state. Public financing generally includes municipal notes issued for public purpose projects with maturities of 10 years or less, and general obligation bonds and revenue bonds (for specifically identified revenue enhancement project) issued with maturities of 11 – 20 years. Current rates vary from 3.75% to 4.5%.

There is considerable flexibility in structuring the bond amounts, maturities and repayment schedules, although the normal repayment schedule is one principal payment and two interest payments per year.

An option recommended by the representative would be for the Lake District and Village of Hustisford to enter into an intergovernmental agreement that would provide for the village to issue general obligation bonds in the amount of a note from the Lake District to the village. The village would be able to obtain better pricing on public financing than would be available to the Lake District as a first-time borrower. The pricing differential to the Lake District would be about 0.5% and the underwriting issuance costs, including bond counsel fees, would be higher.

The representative also mentioned the possibility of borrowing from the Wisconsin State Trust Fund Loan Program, under the Board of Commissioners of Public Lands. Current rates are 5.5% for a 20-year maturity. Information on the program is in the Funding and Grants section. Also included in the same section is information on the Wisconsin Waterways Commission financial assistance program.

Our attorney has also arranged a number of financing packages for lake districts. One package that has been used periodically is for a lake district to sell promissory notes funded by a special charge or special assessment, and simultaneously approve an annual, irrepealable tax secured by a mill levy in the amount of the notes. The approved mill levy is to provide credit enhancement to the promissory notes. Each year that funds raised by special charge/assessment are paid to the note holders the levy tax is then abated, and so on each year until the note is paid off.

Included in the References section are capital project forms used by Dodge County for its budgeting and capital approval process.

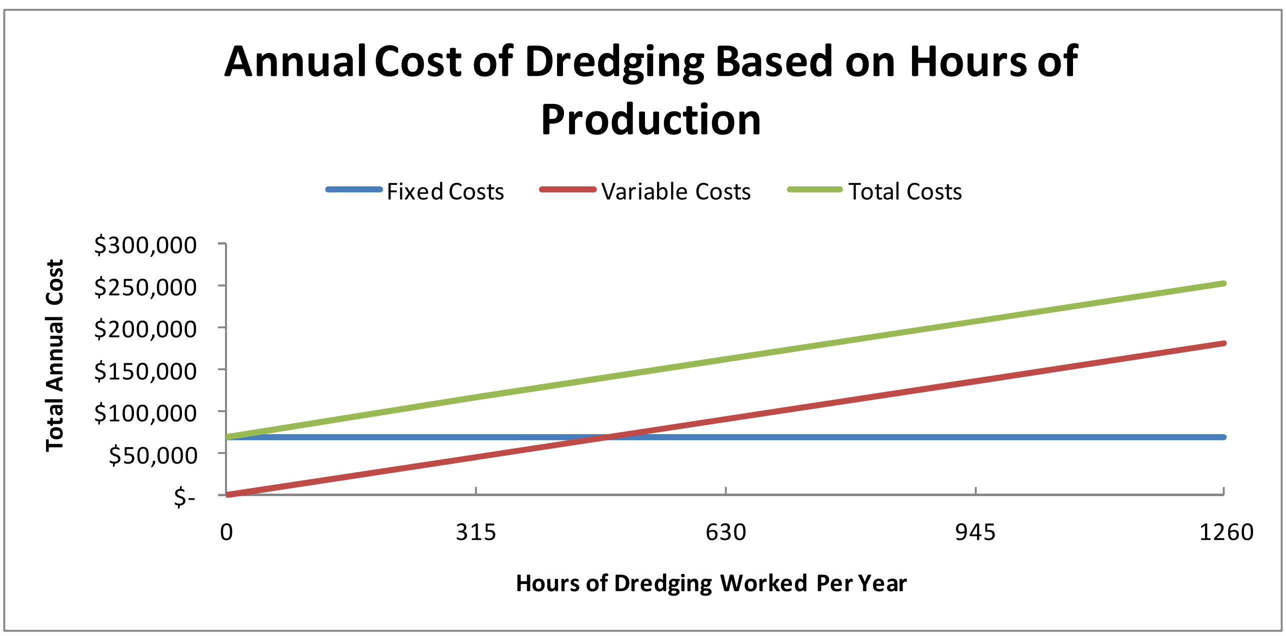
<u>Cost to the Taxpayer</u>

It is tempting to look at the total cost per hour to run a dredge, for example $200/hr for the 7012 HP and $160/hr for the smaller 5012 LP, and conclude that purchasing or leasing a dredge for such an operation is quite doable. As I indicated earlier, however, the devil is in the details; the cost impact to the Lake District and ultimately to the taxpayer lies in the aggregate of fixed costs plus variable costs, rather than simply cost per hour for dredging.

The per hour dredging costs given in the previous section are based on full absorption of capital and investment costs spread over 1,260 hours of work each year. Capital and investment costs have to be paid regardless of the number of hours worked, however. Under full cost absorption, if only 630 hours are worked in one year, the hourly cost of ownership will double. If no dredging is done, the fixed costs to the Lake District and taxpayer remain in any case.

Total fixed costs per year to the Lake District include annual repayment of amortized principal and interest on any loan, note or bond, or the annual payments under a lease, plus certain personnel and indirect costs, such as insurance and accounting fees. That is, with purchase or lease of dredge equipment the Lake District assumes a long-term financial obligation with high fixed costs, whether or not the dredge is operated.

As an example, I used the data for purchase of the Model 7012 HP dredge financed by a municipal note at 3.75% for 10 years. The quarterly amortized payments would be $17,893, or $71,572 annually. Thus the fixed cost to the Lake District to own the dredge would be well over $70,000 annually, including some of the indirect costs, without any production. As dredging production begins, the variable costs kick in and total costs increase linearly with an increase in variable costs. The graph below from Economics 101 shows the relationship among fixed costs, variable costs of production and total costs to the Lake District and, ultimately, to the taxpayer.



The taxpayers would pay for the dredging work by special charge, special assessment, general mill rate tax levy or a combination of these. If we assume a full year's production at 1,260 hours with the Model 7012 HP in the example above, then the costs of dredging will be $252,957. If we add to that amount the Lake District's current operating budget of $45,000, the total becomes $297,957, an amount that exceeds the legal maximum for tax levy ($273,133).

With 520 taxable parcels and an equal value of special charge, a budget at the tax levy limit of $273,133 would translate to $525.26 per parcel each year. On a mill rate basis, the tax on a $100,000 property would be $250 per year; on a $200,000 property the tax would be $500 per year; $750 on a $300,000 property; and, the tax on a $400,000 property would be $1,000 per year.

Operating Parameters and Costs of Placement

The interplay of operating efficiency, economical production and the ability to handle the quantities of dredged sediment poses some interesting constraints.

To maximize operating efficiency and minimize cost per CY of sediment dredged, we would want to pump as much sediment as possible in any given time period; that is, we would aim for a high production rate. Economical production suggests that we operate the dredge at a high production rate for the maximum number of hours available during the season (1,260 hours), so as to reduce the percentage that fixed costs represent out of total cost of production. Doing both of these activities well will result in a maximum volume of sediment to be handled, placed, dewatered, disposed or otherwise utilized. This quickly becomes its own limiting factor, as the sediment volume that has to be handled builds dramatically at high rates of production.

To use two examples, the first with Model 5012 LP that has a nominal production rate of 150 CY of silt sediment per hour at 20% solids over a pumping distance of 1,000 feet. Given downtime at 25% of available work time, the actual production rate would be 75% of 150 CY, or 112.5 CY of sediment per hour.

Using a total cost per hour of $160 to pump 112.5 CY, the cost per CY pumped would be $1.42 per CY.

To maximize economical production, we would run at that rate for the working season of 1,260 hours. The total sediment pumped during that time would be 141,750 CY!

$$Q_1 \text{ x } .90 = Q_2 \text{ x } .20$$
$$141{,}750 \text{ CY x } .90 = Q_2 \text{ x } .20$$

Thus Q_2, the volume of sediment slurry to be placed at upland sites or used in-lake, would be 637,875 CY in just one year!

The same scenario with the larger dredge Model 7012 HP is even more dramatic. The nominal production rate with silt at 20% solids over 1,000 feet is 350 CY per hour. Assuming an actual running rate of 75%, the production rate would be 262.5 CY per hour at a cost of only $0.76 per CY.

However, running the 7012 HP for 1,260 hours a year would move 330,750 CY of sediment. This would equate to a total volume of sediment slurry of 1,488,375 CY for a year. To hold this quantity for dewatering would require constructing the equivalent of a 5-ft earthen berm with side dimensions of 2,800 ft by 2,800 ft, which is about one third of a square mile! In actual practice, the berm volume could be less since water would be removed from the contained slurry on a continuous basis. Nevertheless, the quantities of pumped sediment that we would likely need to handle at high production rates are huge!

The limiting factor becomes the availability of upland placement sites and in-lake placement sites and the manpower and costs to handle sediment placement and re-use activities.

The costs for placement activities and site post-restoration, as listed in indirect costs in a previous section, could be significant. These costs would likely include:

- Land rental or acquisition cost for upland placement sites
- Engineering cost to design placement berms and obtain regulatory permits
- Contractor's cost for constructing temporary placement sites
- Costs of personnel and equipment to monitor pumping of sediment into berms and flow of return water
- Contractor's cost to grade, close and re-seed sediment placement sites
- Transportation cost if dried sediment must be moved to a final placement site
- Cost of possible on-going monitoring of groundwater and surface water

I used $16 an hour in indirect costs to cover the expense of such placement activities. Depending on the design details, size and complexity of a dredging project, $16 an hour ($20,000 for a year) might be a low estimate.

Note: References indicate quite a range of dredging costs per CY. For example, data from the US Army Corps for total dredging during 2008 show a range of costs from $2.37 per CY to $14.06 per CY, with an average of $4.67 per CY. This wide range of production costs demonstrates the inherent variability of values for the various parameters of ownership, operation, personnel and indirect costs.

<u>Regulatory Permits</u>

The Lake District has completed three dredging projects (Geotube® breakwater at Wildcat Road, Marban agriculture ditch and Dead Creek) and has one in process (Butternut Island Causeway). Each of these projects involved removal of a quantity of sediment not in excess of 3,000 CY. As such, the regulatory permits were issued by Wisconsin Department of Natural Resources, US Army Corps of Engineers and Dodge County Land Resources Department without the requirement of an environmental assessment (EA).

The dredging projects that are contemplated going forward will be larger projects, removing more than 3,000 CY of sediment, and will require the preparation and review of an EA by the WDNR. This means that considerable time will likely be involved in developing detailed construction plans, preparing the EA and review by WDNR staff. Additional expenses associated with permit applications may include obtaining sediment chemistry data, special engineering studies, evaluating methods to protect water quality and aquatic habitat, determining suitability of upland sediment placement sites and plans for handling return water.

If in-lake placement projects are envisioned, such as use of geotextile containment berms and island restoration, then other engineering and consulting studies will be required.

There is no assurance that permits will be issued in a timely manner nor that they will be issued at all. Obviously, the Lake District would be advised to not purchase dredge equipment without permits in hand!

This poses another planning constraint. If the Lake District plans on utilizing dredging equipment for a 10- to 20-year period, then what might be the regulatory position on issuing multiple permits or issuing a blanket permit for maintenance dredging? If the WDNR will only issue permits on a project basis, then how could the Lake District justify a long-term financial commitment to dredging with uncertainty about future permits? I've not talked with the WDNR about this issue, but obviously this is a critical part of the entire equation.

<u>Personnel</u>

For purposes of cost exercises, I assumed two technicians would be hired to operate the dredge equipment (IMS Dredge specifies two operators each for the Model 7012 and 5012. The dredging work done on the 2006 Geotube project on Lake Sinissippi used two technicians and one supervisor). On the surface this seems to be quite easy, but again, it becomes a Pandora's Box when you consider issues such as:

- Finding suitable individuals – this would not be a simple task for which we could hire high school kids for the summer!
- Training
- Who will be the employer?
- Costs of employment
- Will the individuals remain with the project during the 8-month work period?
- Since this would be limited term employment, what happens during off season?
- Is it reasonable to assume that the same individuals would be available year after year, or would the Lake District be faced with high turnover and annual recruitment of technicians?
- The same technicians on the dredge cannot simultaneously take care of activities on shore, such as arranging for refueling, monitoring sediment discharge at the placement site, etc.
- Supervision

The last bullet point leads directly to the concluding section of this report.

<u>Supervision and Management</u>

The Lake District board of commissioners comprises seven volunteers and most of the work is done by a handful of commissioners. It is unrealistic in my view to assume that the existing board can also take on ownership of equipment, management of major dredging projects and supervision of two or more technicians and placement site activities. I don't believe the board is presently constituted to handle such direct and continuous responsibilities.

If the board concurs with this assessment, then we are faced with establishing a structure that could handle the dredging work. This might include hiring a staff person for the Lake

District with sole responsibilities to supervise and manage the dredging projects, which of course would add to the indirect costs. We might investigate entering into a collaborative agreement with a commercial firm that would hire operators and do the actual dredging work – the Lake District might do a sale-leaseback of the dredge equipment or continue to own the dredge and provide it to the commercial firm for use. Perhaps there is another lake group or governmental agency that would partner with the Lake District and share personnel, costs, etc.

We might consider conducting a medium-sized dredging project with a rental dredge to gain experience. Alternatively, we might partner with a commercial firm to do a dredging project with Lake District personnel providing assistance. Our best decisions will likely be made with some direct experience under our collective belts; it may be premature to reach any decision on dredge ownership without hands-on experience.

In many ways, the issue of supervision and management may be the sine qua non for the Lake District as it considers how best to handle large-scale dredging projects.

Note: Bill Graham, Dredging Coordinator for the Illinois Waterway, Operations Division, US Army Corps of Engineers-Rock Island District, and Ron Barker, Deputy Director-Operations, Fox Waterway Agency, Fox Lake, IL, have reviewed this memorandum.

Caterpillar Method of Calculating Ownership and Operating Cost: Schedule A

IMS Hydraulic Dredge Model 7012 HP with auger excavator head, stern drive self-propulsion, 300' of floating hose, 1,000' of 12" discharge pipe with floats, GPS and training. Commercial transport trailer extra.

Engine HP 425	
Average Condition of Use	Estimated Annual Use in Hours 1,260
Total Expected Use in Hours 16,000	Useful Life 16,000/ 1,260 = 12.7 yrs
Fuel Cost $3.00 per gallon	Factors from Reference

CALCULATION OF DEPRECIATION VALUE

1. Delivered Price (including taxes, freight and installation	
List Price	$571,071
Trailer	$ 20,000
Discount	0
Sales Tax	0
Freight	$ 4,999
2. Net Value for Depreciation	$596,070

OWNERSHIP COST

3. Depreciation (Net Value)/ (Depreciation Period in Hours)	
($596,070)/ (16,000)	$ 37.25
4. Interest, Insurance, Taxes: interest 6.5%; insurance 3%; taxes 2%	
Interest: {[(12.7 + 1)/ 2(12.7)] [(596,070) (0.065)}/ (1260)	$ 16.59
Insurance: {[(12.7 + 1)/ 2(12.7)] [(596,070) (0.03)}/ (1260)	$ 7.65
Taxes: {[(12.7 + 1)/ 2(12.7)] [(596,070) (0.02)}/ (1260)	$ 5.10
5. TOTAL HOURLY OWNERSHIP COST	**$ 66.59/hr**

OPERATING COST

6. Equipment Fuel (Factor) (HP) (Fuel Cost per Gallon)	
(0.038)(425)($3.00/gal)	$ 48.45
7. Filter, Oil and Grease (Factor) (Fuel Cost)	
(0.119)(48.45)	$ 5.77
8. Tires	0
9. Repair [(Factor) (Net Value)]/ (1260)	
[(0.07) (596,070)]/ (1260)	$ 33.12
10. TOTAL HOURLY OPERATING COST	**$ 87.34/hr**
11. TOTAL HOURLY OWNERSHIP AND OPERATING COST	**$ 153.93/hr**

NOT INCLUDING PERSONNEL COST AND INDIRECT COST

US Army Corps of Engineers 1 Construction Equipment Ownership and Operating Expense: Schedule B

1. **EQUIPMENT INFORMATION AND EXPENSE FACTORS**

   a. Equipment Specification Data:

   (1) Equipment Description: IMS Hydraulic Dredge with auger excavator head, stern drive self-propulsion, 300' of floating hose, 1,000' of 12" pipe with floats, GPS and training. Commercial transport trailer extra.

   (2) Model and Series: **IMS Model 7012 HP Versi-Dredge**

   (3) Year of Use: 2010

   (4) Year Manufactured: 2010

   (5) Horsepower: John Deere Diesel 425 HP

   (6) Fuel Type: Diesel, 400gal capacity

   (7) Shipping Weight: 47,700 lbs (477 cwt)

   b. Category and Subcategory Number: M10 0.23

   c. Hourly Expense Calculation Factors:

   (1) Economic Key (EK): 105

   (2) Condition (C): Average

   (3) Discount Code (DC): B = 7.5%

   (4) Federal Cost of Money Rate: 3.25%

   (5) Life in Hours (LIFE): 16,000

   (6) Salvage Value Percentage (SLV): 0.10

   (7) Fuel Factor (D): 0.038

   (8) Filter, Oil and Grease (FOG) Factor: 0.119

   (9) Repair Cost Factor (RCF): 0.80

2. **EQUIPMENT VALUE**

   a. List Price + Accessories: $571,071

   Trailer $ 20,000

   (1) Discount: (List Price + Accessories) X (Discount Code)

   ($571,071) X (0) Less: 0

   (2) Subtotal: $591,071

   (3) Sales Tax: (Subtotal) X (Tax Rate)

   ($528,241) X (0.0) $ 0

   (4) Total Discounted Price: $591,071

   b. Freight: (Shipping Weight) X (Freight Weight per CWT)

   (477 cwt) X ($10.48): $ 4,999

   c. **Total Equipment Value (TEV)**: **$596,070**

3. **DEPRECIATION PERIOD (N)**

   (LIFE hours)/ (Working Hours Per Year (WHPY)) = N

   (16,000 hr)/ (1260 hr/yr) 12.7 years

4. **OWNERSHIP COST**

   a. Depreciation: [(TEV) X [1.0 – (SLV)]]/(LIFE)

   [$596,070 X (1.0 – 0.1)]/ (16,000 hrs) $ 33.53/hr

   b. Facilities Capital Cost of Money (FCCM):

   (1) [[(N) – 1.0] X [1.0 + (SLV)] + 2.0]/[2.0 X (N)] = Average Value Factor (AVF)

   [[(12.7 – 1) X [1.0 + 0.1] + 2.0]/[2.0 X (12.7)] = AVF 0.585

   (2) [(TEV) X (AVF) X (Cost of Money)]/ (WHPY)

   [($596,070) X (0.585) X (0.0325)]/ (1260 hrs) $ 8.99/hr

c. **TOTAL HOURLY OWNERSHIP COST (1260 hrs/yr):** **$ 42.52/hr**

5. **OPERATING COST**

a. Fuel Cost:
[Fuel Factor X Horsepower (HP)] X [Fuel Cost Per Gallon (gal)]
(0.038) X (425 HP) X $3.00/gal $ 48.45/hr

b. FOG Cost:
(FOG Factor) X (Equipment Fuel Cost) X [Labor Adjustment Factor (LAF)]
(0.119) X ($48.45)/hr X (1.08) $ 6.23/hr

c. Repair Cost:
(1) Economic Adjustment Factor (EAF) 1.0
(2) Repair Factor (RF):
(RCF) X (EAF) X (LAF) = 0.80 X 1.0 X 1.08 = 0.864
(3) Repair Cost:
[(TEV) X (RF)]/ (LIFE)
[($596,070) X (0.864)]/ (16,000 hrs) $ 32.19`/hr

d. **TOTAL HOURLY OPERATING COST:** **$ 86.87/hr**

6. **TOTAL HOURLY OWNERSHIP AND OPERATING COST:** **$ 129.39/hr**

NOT INCLUDING PERSONNEL COST AND INDIRECT COST

1. **MARINE AND DREDGING PLANT INFORMATION AND EXPENSE FACTORS**

a. Plant Pertinent Data:

(1) Equipment Description: IMS Hydraulic Dredge with auger excavator head, stern drive self-propulsion, 300’ of floating hose, 1,000’ of 12” pipe with floats, GPS and training. Commercial transport trailer extra.

(2) Model and Series: **IMS Model 7012 HP Versi-Dredge**

(3) Year of Use: 2010

(4) Year Manufactured: 2010

(5) Horsepower: John Deere Diesel 425 HP

(6) Fuel Type: Diesel, 400gal capacity

(7) Hours Worked Per Year: 1,260

(8) Life in Hours (LIFE): 16,000

(9) Plant Value:

(a) Acquisition Cost $571,071

(b) Trailer $ 20,000

(c) Freight $ 4,999

Total Plant Value **$596,070**

b. Appendix B, Area Factors Data:

(1) Labor Adjustment Factor (LAF): 1.08

(2) Fuel Type: Diesel

(3) Federal Cost of Money Rate: 3.25%

c. Available Time to Dredge: 8 months/yr

d. Dredging Plant Cost Factors Data:

(1) Useful Life (in Years) for Ownership (N): 8 yrs

(2) Salvage Value Factor: 0.05

(3) Engine Fuel Factor (gal/bhp-hr): 0.045

(4) WLS (Water, Lube & Supplies Factor): 22%

(5) RPR (Repair Cost Factor): 0.90

(6) Economic Adjustment Factor (EAF): 1.0

2. **ANNUAL OWNERSHIP PERCENTAGE FACTORS**

a. Depreciation Percent Per Year (DEPR)

(1.0 – SLV)/N

(1.0 – 0.05)/8 yrs 11.9%/yr

b. Facilities Capital Cost of Money Percent Per Year (FCCM)

[[(N – 1) X (1 + SLV) + 2] X Rate]/2N

[[(7 X 1.05) + 2] X 0.0325]/16 1.9%/yr

b. Total Ownership Percent Per Year (DEPR + FCCM) 13.8%/yr

3. **OWNERSHIP COST**

a. Ownership per Year

[Plant Value X (DEPR + FCCM)]

($596,070 X 13.8%) $82,258/yr

b. Monthly Ownership Expense (for 8 months) $ 10,282/mo

c. TOTAL HOURLY OWNERSHIP COST (1260 hrs/yr) **$ 65.28/hr**

4. **<u>OPERATING COST</u>**

a. Fuel Cost

(Fuel Factor) X (HP) X (Fuel Cost per Gallon)

(0.045 gal/bhp-hr) X (425 hp) X ($3.00/gal) $ 57.38/hr

b. Water, Lube and Supply (WLS) Cost

(WLS Factor) X (Hourly Fuel Cost)

(0.22) X ($57.38/hr) $ 12.62/hr

c. Repair Cost

(Total Plant Value) X (RPR) X (EAF) X (LAF)/ (LIFE)

($596,070) X (0.90) X (1.0) X (1.08)/ (16,000) $ 36.21/hr

d. TOTAL HOURLY OPERATING COST (Fuel + WLS + Repair) $ 106.21/hr

5. **<u>TOTAL HOURLY OWNERSHIP AND OPERATING COST</u> $ 171.49/hr**

NOT INCLUDING PERSONNEL COST AND INDIRECT COST

Equipment Description: IMS Hydraulic Dredge, **Model 7012 HP Versi-Dredge**, with auger excavator head, stern drive self-propulsion, 300' of floating hose, 1,000' of 12" pipe with floats, GPS and training. Commercial transport trailer extra.

List Price:	$571,071
Trailer:	$ 20,000
Freight:	$ 4,999
Total Cost of Equipment (COE):	$596,070
Salvage Value (10%) (SLV):	$ 59,607
Expected Life (N):	12.7 yrs
Hours Worked Per Year:	1,260 hrs

Average Book Value: [COE (N + 1) + SLV (N – 1)] / 2N
[($596,070) (13.7) + $ 59,607 (11.7)] / 25.4 — $348,959

OWNERSHIP COST

Straight Line Depreciation: (COE - SLV)/ (N X 1260)
($596,070 - $ 59,607) / (12.7 X 1260) — $ 33.52/hr

Annual Investment Cost (10% of Average Book Value):
(0.10 X $348,959) / 1260 hrs — $ 27.70/hr

TOTAL HOURLY OWNERSHIP COST (1260 hrs/yr): $ 61.22/hr

OPERATING COST

Fuel:
Total Fuel Consumed (gal/hr) =
(Operating Factor) X (fwhp) X (gal/fwhp-hr) X (Cost/gal)
(1.0) X (425 fwhp) X (0.04 gal/fwhp-hr) X ($3.00/gal) — $ 51.00/hr

Lube Oil:
[(fwhp) X (Operating Factor) X (lb/fwhp-hr)] /(7.4 lb/gal) + (Crankcase Capacity) / (Hrs Per Change)
{[(425 fwhp) X (1.0) X (0.006 lb/fwhp-hr)] / (7.4 lb/gal) + (8 gal) / (150 hrs)} x $4.00/gal
$ 1.59/hr

Maintenance and Repair:
(Repair Factor 80%) X (Depreciation Per Hour)
(0.80 X $33.52/hr) — $ 26.82/hr

TOTAL HOURLY OPERATING COST: $ 79.41/hr

TOTAL HOURLY OWNERSHIP AND OPERATING COST: $ 140.63/hr

NOT INCLUDING PERSONNEL COST AND INDIRECT COST

IMS Hydraulic Dredge Model 5012 LP with auger excavator head, stern drive self-propulsion, 300' of floating hose, 1,000' of 10" discharge pipe with floats, GPS and training. Commercial transport trailer extra.

Engine HP 325	
Average Condition of Use	Estimated Annual Use in Hours 1,260
Total Expected Use in Hours 16,000	Useful Life 16,000/ 1,260 = 12.7 yrs
Fuel Cost $3.00 per gallon	Factors from Reference

CALCULATION OF DEPRECIATION VALUE

1. Delivered Price (including taxes, freight and installation)	
List Price	$405,821
Trailer	$ 20,000
Discount	0
Sales Tax	0
Freight	$ 3,060
2. Net Value for Depreciation	$428,881

OWNERSHIP COST

3. Depreciation (Net Value)/ (Depreciation Period in Hours)	
($428,881)/ (16,000)	$ 26.81
4. Interest, Insurance, Taxes: interest 6.5%; insurance 3%; taxes 2%	
Interest: {[(12.7 + 1)/ 2(12.7)] [(428,881) (0.065)}/ (1260)	$ 11.93
Insurance: {[(12.7 + 1)/ 2(12.7)] [(428,881) (0.03)}/ (1260)	$ 5.51
Taxes: {[(12.7 + 1)/ 2(12.7)] [(428,881) (0.02)}/ (1260)	$ 3.67
5. TOTAL HOURLY OWNERSHIP COST	**$ 47.92/hr**

OPERATING COST

6. Equipment Fuel (Factor) (HP) (Fuel Cost per Gallon)	
(0.038)(325)($3.00/gal)	$ 37.05
7. Filter, Oil and Grease (Factor) (Fuel Cost)	
(0.119)(37.05)	$ 4.41
8. Tires	0
9. Repair [(Factor) (Net Value)]/ (1260)	
[(0.07) (428,881)]/ (1260)	$ 23.83
10. TOTAL HOURLY OPERATING COST	**$ 65.29/hr**
11. TOTAL HOURLY OWNERSHIP AND OPERATING COST	**$ 113.21/hr**

NOT INCLUDING PERSONNEL COST AND INDIRECT COST

7. **EQUIPMENT INFORMATION AND EXPENSE FACTORS**

b. Equipment Specification Data:

(1) Equipment Description: IMS Hydraulic Dredge with auger excavator head, stern drive self-propulsion, 300' of floating hose, 1,000' of 10" pipe with floats, GPS and training. Commercial transport trailer extra.

(2) Model and Series: **IMS Model 5012 LP Versi-Dredge**

(3) Year of Use: 2010

(4) Year Manufactured: 2010

(5) Horsepower: John Deere Diesel 325 HP

(6) Fuel Type: Diesel, 300gal capacity

(7) Shipping Weight: 29,200 lbs (292 cwt)

b. Category and Subcategory Number: M10 0.23

c. Hourly Expense Calculation Factors:

(10)Economic Key (EK): 105

(11)Condition (C): Average

(12)Discount Code (DC): B = 7.5%

(13)Federal Cost of Money Rate: 3.25%

(14)Life in Hours (LIFE): 16,000

(15)Salvage Value Percentage (SLV): 0.10

(16)Fuel Factor (D): 0.038

(17)Filter, Oil and Grease (FOG) Factor: 0.119

(18)Repair Cost Factor (RCF): 0.80

8. **EQUIPMENT VALUE**

a.	List Price + Accessories:	$405,821
	Trailer	$ 20,000
	(1) Discount: (List Price + Accessories) X (Discount Code)	
	($571,071) X (0) Less:	0
	(2) Subtotal:	$425,821
	(3) Sales Tax: (Subtotal) X (Tax Rate)	
	($528,241) X (0.0)	$ 0
	(4) Total Discounted Price:	$425,821
b.	Freight: (Shipping Weight) X (Freight Weight per CWT)	
	(477 cwt) X ($10.48):	$ 3,060
c.	**Total Equipment Value (TEV)**:	**$428,881**

9. **DEPRECIATION PERIOD (N)**

(LIFE hours)/ (Working Hours Per Year (WHPY)) = N

(16,000 hr)/ (1260 hr/yr) 12.7 years

10. **OWNERSHIP COST**

a. Depreciation: [(TEV) X [1.0 – (SLV)]]/(LIFE)

[$428,881 X (1.0 – 0.1)]/ (16,000 hrs) $ 24.12/hr

b. Facilities Capital Cost of Money (FCCM):

(1) [[(N) – 1.0] X [1.0 + (SLV)] + 2.0]/[2.0 X (N)] = Average Value Factor (AVF)

[[(12.7 – 1) X [1.0 + 0.1] + 2.0]/[2.0 X (12.7)] = AVF 0.585

(2) [(TEV) X (AVF) X (Cost of Money)]/ (WHPY)

[($428,881) X (0.585) X (0.0325)]/ (1260 hrs) $ 6.47/hr

c. **TOTAL HOURLY OWNERSHIP COST (1260 hrs/yr):** **$ 30.59/hr**

11. **<u>OPERATING COST</u>**

a. Fuel Cost:
[Fuel Factor X Horsepower (HP)] X [Fuel Cost Per Gallon (gal)]
(0.038) X (325 HP) X $3.00/gal $ 37.05/hr

b. FOG Cost:
(FOG Factor) X (Equipment Fuel Cost) X [Labor Adjustment Factor (LAF)]
(0.119) X ($37.05)/hr X (1.08) $ 4.76/hr

c. Repair Cost:
(1) Economic Adjustment Factor (EAF) 1.0
(2) Repair Factor (RF):
(RCF) X (EAF) X (LAF) = 0.80 X 1.0 X 1.08 = 0.864
(3) Repair Cost:
[(TEV) X (RF)]/ (LIFE)
[($428,881) X (0.864)]/ (16,000 hrs) $ 23.16`/hr

d. **TOTAL HOURLY OPERATING COST:** **$ 64.97/hr**

12. **<u>TOTAL HOURLY OWNERSHIP AND OPERATING COST</u>:** **$ 95.56/hr**

NOT INCLUDING PERSONNEL COST AND INDIRECT COST

2. MARINE AND DREDGING PLANT INFORMATION AND EXPENSE FACTORS

b. Plant Pertinent Data:

(1) Equipment Description: IMS Hydraulic Dredge with auger excavator head, stern drive self-propulsion, 300’ of floating hose, 1,000’ of 12” pipe with floats, GPS and training. Commercial transport trailer extra.

(2) Model and Series:	**IMS Model 5012 LP Versi-Dredge**
(3) Year of Use:	2010
(4) Year Manufactured:	2010
(5) Horsepower:	John Deere Diesel 325 HP
(6) Fuel Type:	Diesel, 300gal capacity
(7) Hours Worked Per Year:	1,260
(8) Life in Hours (LIFE):	16,000
(9) Plant Value:	
(a) Acquisition Cost	$405,821
(b) Trailer	$ 20,000
(c) Freight	$ 3,060
Total Plant Value	**$428,881**

b. Appendix B, Area Factors Data:

(1) Labor Adjustment Factor (LAF):	1.08
(2) Fuel Type:	Diesel
(3) Federal Cost of Money Rate:	3.25%

c. Available Time to Dredge: 8 months/yr

d. Dredging Plant Cost Factors Data:

(1) Useful Life (in Years) for Ownership (N):	8 yrs
(2) Salvage Value Factor:	0.05
(3) Engine Fuel Factor (gal/bhp-hr):	0.045
(4) WLS (Water, Lube & Supplies Factor):	22%
(5) RPR (Repair Cost Factor):	0.90
(6) Economic Adjustment Factor (EAF):	1.0

2. ANNUAL OWNERSHIP PERCENTAGE FACTORS

a. Depreciation Percent Per Year (DEPR)

(1.0 – SLV)/N

(1.0 – 0.05)/8 yrs 11.9%/yr

b. Facilities Capital Cost of Money Percent Per Year (FCCM)

[[(N – 1) X (1 + SLV) + 2] X Rate]/2N

[[(7 X 1.05) + 2] X 0.0325]/16 1.9%/yr

b. Total Ownership Percent Per Year (DEPR + FCCM) 13.8%/yr

3. OWNERSHIP COST

a. Ownership per Year

[Plant Value X (DEPR + FCCM)]

($428,881 X 13.8%) $59,186/yr

b. Monthly Ownership Expense (for 8 months) $ 7,398/mo

c. TOTAL HOURLY OWNERSHIP COST (1260 hrs/yr) $ 46.97/hr

4. <u>OPERATING COST</u>

a. Fuel Cost

(Fuel Factor) X (HP) X (Fuel Cost per Gallon)

(0.045 gal/bhp-hr) X (325 hp) X ($3.00/gal) $ 43.88/hr

b. Water, Lube and Supply (WLS) Cost

(WLS Factor) X (Hourly Fuel Cost)

(0.22) X ($43.88/hr) $ 9.65/hr

c. Repair Cost

(Total Plant Value) X (RPR) X (EAF) X (LAF)/ (LIFE)

($428,881) X (0.90) X (1.0) X (1.08)/ (16,000) $ 26.05/hr

e. TOTAL HOURLY OPERATING COST (Fuel + WLS + Repair) $ 79.58/hr

5. <u>TOTAL HOURLY OWNERSHIP AND OPERATING COST</u> $ 126.55/hr

NOT INCLUDING PERSONNEL COST AND INDIRECT COST

Equipment Description: IMS Hydraulic Dredge, **Model 5012 LP Versi-Dredge**, with auger excavator head, stern drive self-propulsion, 300' of floating hose, 1,000' of 10" pipe with floats, GPS and training. Commercial transport trailer extra.

List Price:	$405,821
Trailer:	$ 20,000
Freight:	$ 3,060
Total Cost of Equipment (COE):	$428,881
Salvage Value (10%) (SLV):	$ 42,888
Expected Life (N):	12.7 yrs
Hours Worked Per Year:	1,260 hrs

Average Book Value: [COE (N + 1) + SLV (N – 1)] / 2N
[($428,881) (13.7) + $ 42,888 (11.7)] / 25.4 — $251,081

OWNERSHIP COST

Straight Line Depreciation: (COE - SLV)/ (N X 1260)
($428,881 - $ 42,888) / (12.7 X 1260) — $ 24.12/hr

Annual Investment Cost (10% of Average Book Value):
(0.10 X $251,081) / 1260 hrs — $ 19.93/hr

TOTAL HOURLY OWNERSHIP COST (1260 hrs/yr): $ 44.05/hr

OPERATING COST

Fuel:
Total Fuel Consumed (gal/hr) =
(Operating Factor) X (fwhp) X (gal/fwhp-hr) X (Cost/gal)
(1.0) X (325 fwhp) X (0.04 gal/fwhp-hr) X ($3.00/gal) — $ 39.00/hr

Lube Oil:
[(fwhp) X (Operating Factor) X (lb/fwhp-hr)] /(7.4 lb/gal) + (Crankcase Capacity) / (Hrs Per Change)
{[(325 fwhp) X (1.0) X (0.006 lb/fwhp-hr)] / (7.4 lb/gal) + (8 gal) / (150 hrs)} x $4.00/gal
— $ 1.27/hr

Maintenance and Repair:
(Repair Factor 80%) X (Depreciation Per Hour)
(0.80 X $24.12/hr) — $ 19.30/hr

TOTAL HOURLY OPERATING COST: $ 59.57/hr

TOTAL HOURLY OWNERSHIP AND OPERATING COST: $ 103.62/hr

NOT INCLUDING PERSONNEL COST AND INDIRECT COST